PARLIAMENT OF AUSTRALIA

Interim report for the inquiry into nuclear power generation in Australia

House of Representatives

Select Committee on Nuclear Energy

February 2025

CANBERRA

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Terms of reference

Role of the Committee

(1) a House Select Committee on Nuclear Energy be appointed to specifically inquire into and report on the consideration of nuclear power generation, including deployment of small modular reactors, in Australia, including:

a. deployment timeframes;

b. fuel supply, and transport of fuel;

c. uranium enrichment capability;

d. waste management, transport and storage;

e. water use and impacts on other water uses;

f. relevant energy infrastructure capability, including brownfield sites and transmission lines;

g. Federal, state, territory and local government legal and policy frameworks;

h. risk management for natural disasters or any other safety concerns;

i. potential share of total energy system mix;

j. necessary land acquisition;

k. costs of deploying, operating and maintaining nuclear power stations;

l. the impact of the deployment, operation and maintenance of nuclear power stations on electricity affordability; and

m. any other relevant matter.

(2) the committee presents its final report by no later than 30 April 2025;

(3) the committee may choose to table an interim report at any time;

(4) the committee consist of:

a. seven voting members, four Members of the House of Representatives to be nominated by the Government Whip or Whips, two Members of the House of Representatives to be nominated by the Opposition Whip or Whips, and one crossbench member to be nominated by the Opposition Whip; and

b. two supplementary (non-voting) members (one Government, one non-Government) who may be substituted from time to time as advised by the Government Whip or Whips (in the case of a supplementary Government member) and the Opposition Whip or Whips (in the case of a supplementary non-Government member);

(5) every nomination of a member of the committee be notified in writing to the Speaker of the House of Representatives;

(6) the members of the committee hold office as a House select committee until presentation of the committee's final report or the House of Representatives is dissolved or expires by effluxion of time, whichever is the earlier;

(7) the committee elect a:

a. Government member as its chair; and

b. non-Government member as its deputy chair who shall act as chair of the committee at any time when the chair is not present at a meeting of the committee;

(8) at any time when the chair and deputy chair are not present at a meeting of the committee the members present shall elect another Government member to act as chair at that meeting;

(9) in the event of an equally divided vote, the chair, or the deputy chair when acting as chair, shall have a casting vote;

(10) three members of the committee including at least one Government member constitute a quorum of the committee;

(11) the committee:

a. have power to appoint subcommittees consisting of three or more of its members and to refer to any subcommittee any matter which the committee is empowered to examine or conduct public hearings; and

b. appoint the chair of each subcommittee who shall have a casting vote only;

(12) at any time when the chair of a subcommittee is not present at a meeting of the subcommittee, the members of the subcommittee present shall elect another member of that subcommittee to act as chair at that meeting;

(13) two members of a subcommittee constitute a quorum of that subcommittee including at least one government member;

(14) members of the committee who are not members of a subcommittee may participate in the proceedings of that subcommittee but shall not vote, move any motion or be counted for the purpose of a quorum;

(15) the committee or any subcommittee have power to:

a. call for witnesses to attend and for documents to be produced;

b. conduct proceedings at any place it sees fit;

c. sit in public or in private;

d. report from time to time; and

e. adjourn from time to time and sit during any adjournment of the House of Representatives; and

(16) the provisions of this resolution, so far as they are inconsistent with the standing orders, have effect notwithstanding anything contained in the standing orders.

Members

Chair

Mr Dan Repacholi MP	Hunter, NSW

Deputy Chair

Mr Ted O'Brien MP	Fairfax, QLD

Members

Mr Matt Burnell MP	Spence, SA
Hon Darren Chester MP (from 14 October 2024)	Gippsland, VIC
Ms Zaneta Mascarenhas MP	Swan, WA
Dr Daniel Mulino MP (from 18 November 2024)	Fraser, VIC
Mr Keith Pitt (to 14 October 2024)	Hinkler, QLD
Mr Graham Perrett MP (to 18 November 2024)	Moreton, QLD
Dr Monique Ryan MP	Kooyong, VIC

Supplementary Members

Mr Simon Kennedy MP (from 14 October 2024)	Cook, NSW
Dr Daniel Mulino MP (from 7 November 2024 to 18 November 2024)	Fraser, VIC
Mr Graham Perrett MP (from 18 November 2024)	Moreton, QLD

1. Introduction

1.1 On 10 October 2024, the House Select Committee on Nuclear Energy (the Committee) was established by a resolution of appointment that passed the House of Representatives.

1.2 The Committee was appointed to inquire into and report on the consideration of nuclear power generation, including the deployment of small modular reactors, in Australia.

1.3 This interim report provides an overview of the evidence received on two significant issues about the viability of nuclear power generation in Australia that have dominated the evidence the Committee has received:

1 The timeframes for the deployment of nuclear power generation in Australia; and

2 The cost of the deployment of nuclear power generation in Australia.

1.4 This report does not seek to debate the merits of nuclear power as a source of energy. This report does not present the Committee's final views or recommendations on the above matters, nor does it consider in detail all the evidence provided to the Committee.

1.5 Consideration of the viability of nuclear power generation in Australia's future energy mix requires more detailed examination of technical, economic, and social licence considerations regarding:

- waste and water management options and risks;
- safety and risk management for nuclear plants and communities particularly with regard to natural disasters and climate change;
- the health risks for nuclear power reactor communities and workforce;
- land acquisition for nuclear power plant and nuclear waste siting, and the feasibility of transitioning existing energy infrastructure for nuclear power generation and transmission; and
- management options for nuclear fallout in the event of a disaster.

1.6 The Committee is due to table its final report by 30 April 2025.

Context of the inquiry

Key issues

1.7 Some of the key issues informing the context of this inquiry are summarised below.

Changes in energy demand, use and supply

1.8 Electricity demand around the world is rising due to the electrification of heating, cooling, and transportation and a rise in energy-intensive data centres.[1]

1.9 In 2024, the Australian Energy Market Operator (AEMO) released the Integrated System Plan (ISP), outlining a roadmap for the National Electricity Market (NEM) over the next 20 years.[2] The ISP projects that electricity consumption in Australia will nearly double by 2050.[3]

1.10 The ISP proposes an Optimal Development Path (ODP) for the 'Step Change' scenario for the future of the NEM of, 'Renewable energy connected by transmission and distribution, firmed with storage and backed up by gas-powered generation [as] the lowest-cost way to supply electricity to homes and businesses as Australia transitions to a net zero economy'.[4] The ODP has an annualised capital cost of $122 billion to 2050.[5]

1.11 Under the ISP's 'Step Change' scenario, coal generation will be reduced by 46% by 2030 and phased out by 2038 (see Figure 1.1).[6] The ISP states 'Australia's energy system is rapidly changing, and the transition is well underway,' but that 'investment is needed urgently'.[7]

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1 Nuclear Energy Institute, Submission 360, p. 2.

2 The NEM is comprised of five physically connected regions on Australia's east coast: Queensland, New South Wales (including the Australian Capital Territory), Victoria, Tasmania and South Australia. Western Australia and the Northern Territory have their own electricity systems and regulatory arrangements and, as such, are not connected to the NEM. Source: Australian Energy Market Commission, *National Electricity Market,* www.aemc.gov.au/energy-system/electricity/electricity-system/NEM (accessed 5 February 2025).

3 Australian Energy Market Operator (AEMO), *AEMO's 2024 Integrated System Plan*, 6 June 2024, pages 22 and 26-27, https://aemo.com.au/energy-systems/major-publications/integrated-system-plan-isp/2024-integrated-system-plan-isp (accessed 30 January 2025).

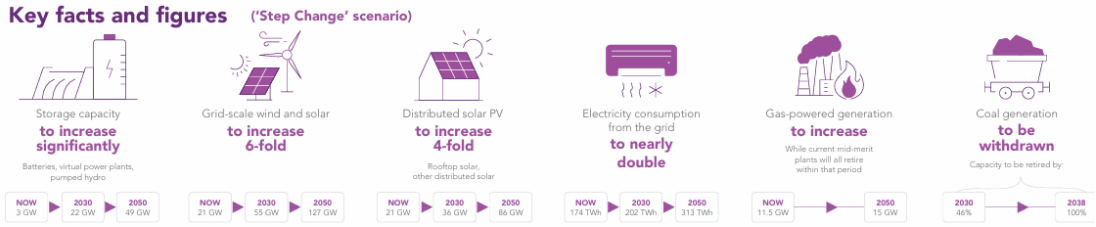
4 AEMO, *AEMO's 2024 Integrated System Plan*, 6 June 2024, pages 47 and 73, https://aemo.com.au/energy-systems/major-publications/integrated-system-plan-isp/2024-integrated-system-plan-isp (accessed 30 January 2025).

5 AEMO, *AEMO's 2024 Integrated System Plan*, 6 June 2024, p. 73, https://aemo.com.au/energy-systems/major-publications/integrated-system-plan-isp/2024-integrated-system-plan-isp (accessed 30 January 2025).

6 AEMO, *AEMO's 2024 Integrated System Plan*, 6 June 2024, pages 49-50, https://aemo.com.au/energy-systems/major-publications/integrated-system-plan-isp/2024-integrated-system-plan-isp (accessed 30 January 2025).

7 AEMO, *AEMO's 2024 Integrated System Plan*, 6 June 2024, pages [3] and 6-7, https://aemo.com.au/energy-systems/major-publications/integrated-system-plan-isp/2024-integrated-system-plan-isp (accessed 30 January 2025).

Figure 1.1 Key facts and figures for the 'Step Change' scenario



Source: AEMO 2024 Integrated System Plan Overview p. [3].

Climate change and the pursuit of Australia's climate commitments

1.12 Australia's weather and climate are changing due to a warming global climate caused by greenhouse gas emissions.[8] To address this threat, Australia has signed the Paris Agreement, which aims to limit further global warming.[9]

1.13 Emissions reduction is a key strategy to mitigate environmental, health, and economic risks from climate change.[10] The Australian Government has committed to reducing net greenhouse gas emissions to 43% below 2005 levels by 2030 and to zero by 2050 through the *Climate Change Act 2022* (Cth).[11]

1.14 Supporting this commitment is the transformation of Australia's energy market under the ISP, including the decommissioning of coal plants by 2038 and the rollout of renewables and supporting infrastructure.[12] The Australian Government has pledged an 82% renewable energy mix by 2030, with significant investments in green energy projects.[13] Additionally, a guiding 'Net Zero Plan' is being developed, alongside setting an ambitious and achievable 2035 emissions reduction target.[14]

Cost of living pressures

1.15 Many Australians are feeling the strain from cost of living pressures.[15] From September 2022 to November 2024 a Senate Select Committee inquired into the

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8 Department of Climate Change, Energy, the Environment and Water (DCCEEW), *Understanding climate change,* 3 January 2025, www.dcceew.gov.au/climate-change/policy/climate-science/understanding-climate-change (accessed 30 January 2025).

9 DCCEEW, *Net Zero*, 6 January 2025, https://www.dcceew.gov.au/climate-change/emissions-reduction/net-zero (accessed 30 January 2025).

10 DCCEEW, *Net Zero*, 6 January 2025, https://www.dcceew.gov.au/climate-change/emissions-reduction/net-zero (accessed 30 January 2025).

11 *Climate Change Act 2022* (Cth) Section 10.

12 AEMO, *AEMO's 2024 Integrated System Plan*, https://aemo.com.au/-/media/files/major-publications/isp/2024/2024-integrated-system-plan-overview.pdf?la=en (accessed 31 January 2025).

13 AEMO, *AEMO's 2024 Integrated System Plan*, 6 June 2024, p. 31, https://aemo.com.au/energy-systems/major-publications/integrated-system-plan-isp/2024-integrated-system-plan-isp (accessed 30 January 2025).

14 DCCEEW, Australia's climate change strategies, 28 November 2024, https://www.dcceew.gov.au/climate-change/strategies (accessed 29 January 2025).

15 Australian Government, Budget 2024–25, *Easing cost-of-living pressures*, https://budget.gov.au/content/factsheets/download/factsheet-col.pdf.

cost of living, noting that temporary economic shocks from COVID-19, the invasion of Ukraine, and 2022 weather events exacerbated the situation.[16]

1.16 The Committee noted high inflation[17] and the housing crisis have created further strain.[18] The inquiry also explored energy costs, noting significant price rises affecting both households and businesses.[19]

1.17 Prime Minister the Hon Anthony Albanese MP has stated that delivering cost of living relief is the Australian Government's 'number one priority',[20] with commitments to reduce taxes, provide energy bill relief, and increase wages.[21]

Recent announcements about nuclear energy

1.18 Nuclear power has gained attention from recent international and Australian announcements. As of 31 December 2023, the International Atomic Energy Agency reported that 413 nuclear reactors were operating in 31 countries and Taiwan, providing about 10% of the world's electricity.[22] At COP28, 25 countries pledged to triple global nuclear capacity by 2050.[23]

1.19 In 2024, major technology companies including Microsoft, Google, and Amazon announced plans to explore or invest in nuclear energy, including small modular reactors, for their data centres.[24] The Electric Power Research Institute projects data centres could consume up to 9% of US electricity by 2030, up from 4% in 2023'.[25]

1.20 On 19 June 2024, the Federal Coalition (the Coalition) announced a proposal to build nuclear reactors on retiring or retired coal sites across several states were they to win the 2025 federal election.[26] They proposed to develop two initial projects using

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16 Commonwealth of Australia, Senate Select Committee on the Cost of Living, *Paying the Price: The Cost of a Crisis on Australians' Standards of Living, Final Report*, November 2024, pages 2 and 3.

17 Commonwealth of Australia, Senate Select Committee on the Cost of Living, *Paying the Price: The Cost of a Crisis on Australians' Standards of Living, Final Report*, November 2024, p. 2.

18 Commonwealth of Australia, Senate Select Committee on the Cost of Living, *Paying the Price: The Cost of a Crisis on Australians' Standards of Living, Final Report,* November 2024, p. 6.

19 Commonwealth of Australia, Senate Select Committee on the Cost of Living, *Interim report*, May 2023, p. 35.

20 The Hon Mr Anthony Albanese PM, *Cost of Living*, https://anthonyalbanese.com.au/our-work/cost-of-living (accessed 31 January 2025).

21 The Hon Mr Anthony Albanese PM, *Cost of Living*, https://anthonyalbanese.com.au/our-work/cost-of-living (accessed 31 January 2025).

22 International Atomic Energy Agency (IAEA), *Annual Report 2023, 2024*, referenced in ANSTO, Submission 823, p. 1.

23 US Department of Energy, *At COP28, Countries Launch Declaration to Triple Nuclear Energy Capacity by 2050, Recognizing the Key Role of Nuclear Energy in Reaching Net Zero*, December 1, 2023, https://www.energy.gov/articles/cop28-countries-launch-declaration-triple-nuclear-energy-capacity-2050-recognizing-key, referenced in Australian Nuclear Science and Technology Organisation (ANSTO), Submission 823, p. 2.

24 ANSTO, Submission 823, p. 2.

25 ANSTO, submission 823, p. 2.

26 The Hon Mr Peter Dutton MP, The Hon Mr David Littleproud MP, Mr Ted O'Brien MP, *Media Release*, 'Australia's Energy Future', 19 June 2024, https://www.peterdutton.com.au/dutton-littleproud-obrien-media-release-australias-energy-future/ (accessed 31 January 2025).

small modular or modern larger reactors, expected to produce electricity by 2035 or 2037 respectively.[27]

1.21 The Coalition proposed that the reactors would be government-owned but built and operated in partnership with experienced nuclear companies. The stated objective of the proposal is to reduce electricity prices and emissions while complementing renewable energy and gas.[28]

Current legal status and previous inquiries into nuclear power generation in Australia

1.22 Australia has a longstanding bipartisan moratorium on nuclear power, with legislated prohibitions in place at state and federal levels. The Commonwealth *Australian Radiation Protection and Nuclear Safety Act 1998* (ARPANS Act) and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) prohibit approval being granted for the construction or operation of nuclear power plants. These laws 'effectively preclude the implementation of any nuclear power program in Australia'.[29]

1.23 Prohibitions are also in effect across the Australian states and territories. New South Wales, Victoria and Queensland have similar prohibitions to the Commonwealth. In Western Australia and South Australia, there are prohibitions against the 'construction and operation of nuclear waste storage and disposal facilities, including the importation and transportation of nuclear waste'.[30]

1.24 This inquiry follows a number of previous state and federal inquiries into nuclear power in the last decade, including:

- South Australian state government Nuclear Fuel Cycle Royal Commission 2015-2016.
- Federal Standing Committee on Environment and Energy Inquiry into the prerequisites for nuclear energy in Australia 2019.
- Victorian state government Environment and Planning Committee Inquiry into nuclear prohibition in 2019-2020.
- Federal Environment and Communications Legislation Committee Environment and Other Legislation Amendment (Removing Nuclear Energy Prohibitions) Bill 2022, 2022.

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27 The Hon Mr Peter Dutton MP, The Hon Mr David Littleproud MP, Mr Ted O'Brien MP, *Media Release*, 'Australia's Energy Future', 19 June 2024, https://www.peterdutton.com.au/dutton-littleproud-obrien-media-release-australias-energy-future/ (accessed 31 January 2025).

28 The Hon Peter Dutton MP, The Hon David Littleproud MP, Mr Ted O'Brien MP, *Media Release*, 'Australia's Energy Future', 19 June 2024, https://www.peterdutton.com.au/dutton-littleproud-obrien-media-release-australias-energy-future/ (accessed 31 January 2025).

29 Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), Submission 284, p. [2].

30 ARPANSA, Submission 284, p. [2].

Conduct of the inquiry

1.25 A media release announcing the inquiry was issued on 17 October 2024, calling for submissions that addressed the terms of the resolution of appointment by 15 November 2024.

1.26 At the time of publication of this report, the Committee has received 858 submissions and 58 supplementary submissions. A list of submissions published to date is available at Appendix A.

1.27 In addition, the Committee received 142 form letters and campaign emails in favour of the deployment of nuclear power generation in Australia, and 5250 form letter and campaign emails that were critical of nuclear power generation in Australia. Samples of the form letters were published as submission to the inquiry. The Committee' process for managing them is outlined below.

1.28 The Committee also received 94 short statements under 250 words relating to the inquiry.

1.29 To date, the Committee has held 19 public hearings in capital cities and in locations identified in the Coalition's nuclear energy policy proposal. A list of hearing locations and witnesses who gave evidence at public hearings is available at Appendix B. Submissions and transcripts of the public hearings can be found on the inquiry website.

1.30 In this report, references to *Committee Hansard* are to both proof and official transcripts. Page numbers may vary between proof and official transcripts.

1.31 The Committee also conducted two site visits:

- Callide Power Station and Mount Murchison on Tuesday, 12 November 2024.
- Tarong Power Station on Thursday, 14 November 2024.

Processing the evidence

1.32 The Committee received a significant volume of contributions related to the inquiry. The Committee resolved to manage the submissions as follows.

1.33 **Short statements:** Separate to form letters and campaign emails, the Committee received 54 contributions to the inquiry comprising of 250 words or less. The Committee resolved to note these contributions but not publish them individually as submissions. While the Committee did not set a word limit for its submissions, a review of the short statements showed that they generally echoed concerns already raised or submitted.

1.34 **Form letters and campaign emails**: refer to submissions that largely use the same template or wording, save for some paragraphs or free text areas that can be personalised by the submitter. Form letters are usually distributed by interest groups

or organisations for people to copy, edit, and submit, or prepare according to writing instructions provided by the interest group.

1.35 The inquiry received form letters and campaign emails from the following groups:

- Do Gooder (2838 received)
- GetUp (1879 received), in addition to a submission that contained 8,936 signatories
- Environment Victoria (533 received); and
- WePlanet (142 received).

1.36 The Committee resolved to publish samples of the form letter templates. Form letters that had more than 250 words of unique text and met the other requirements for being considered a submission were published as submissions to the inquiry and are included in the total number of submissions.

Acknowledgements

1.37 The Committee thanks the individuals and organisations who have provided evidence to the inquiry to date. The Committee heard from a range of stakeholders including government agencies; climate and environment groups; nuclear advocacy groups; energy experts; industry and union representatives; First Nations organisations and peoples; and local councils, businesses and community members.

Structure of report

1.38 This interim report comprises three chapters:

- Chapter 1 provides information relating to the Committee and its inquiry, the context of the inquiry, and the purpose and structure of this interim report.
- Chapter 2 provides an overview of the key issues raised in evidence considered by the Committee to date regarding the milestones and timeframes for the deployment of nuclear power in Australia and explores factors that would affect the Australian deployment timeframe that were consistently raised by witnesses and in submissions. It then considers views provided by participants in the inquiry about the implications of the likely timeframes for nuclear deployment in Australia.
- Chapter 3 sets out the key issues raised in evidence regarding the potential cost for deploying nuclear power in Australia, the history of blowouts in cost for nuclear energy projects globally, and the appetite for private investment in nuclear energy in Australia and globally.

2. Timeframes for nuclear power generation in Australia

2.1 This chapter considers evidence received throughout the inquiry regarding the potential timeframes for deploying nuclear power technology in Australia.

2.2 For the purposes of this chapter, the 'deployment timeframe' is the period '… from the initial consideration of the nuclear power option by a country to the operation of its first nuclear power plant',[1] as defined by the International Atomic Energy Agency (IAEA).

2.3 This definition excludes the timeframes for other critical components of nuclear power generation, such as the planning and development of emergency and waste management facilities and processes, which will require further consideration.

2.4 This chapter discusses:

- the milestones for a nuclear build and a range of estimates for the deployment of nuclear power in Australia as presented in the evidence;
- some of the key challenges associated with pre-construction and construction deployment timeframes in Australia that were raised by witnesses and submitters;
- commentary on the history of construction delays in the nuclear power generation sector; and
- the views expressed by inquiry participants about the implications of the deployment timeframe for achieving Australia's decarbonisation agenda and climate commitments, as well as the redeployment of the coal power workforce.

2.5 The chapter concludes with Committee comment on the issue of deployment timeframes for nuclear power generation in Australia.

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1 International Atomic Energy Agency (IAEA), *Milestones in the Development of a National Infrastructure for Nuclear Power*, IAEA Nuclear Energy Series No. NG-G-3.1 (Rev. 2), 2024, p. 2, Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), Submission 284.1, p. [2].

Deployment timeframe milestones and estimates

End-to-end estimates

2.6 The Committee heard the timeframe for the generation of nuclear power in Australia would depend on the time taken to complete 'deployment timeline milestones'.[2]

2.7 The IAEA report, *Milestones in the Development of a National Infrastructure for Nuclear Power*, provides 'guidelines and assistance with regard to deployment timeline milestones', and 'outlines both the 'hard' infrastructure (i.e., electrical grid, siting, etc.) and 'soft' infrastructure (i.e., nuclear law, training, etc.) necessary for a nuclear power program'.[3]

2.8 The IAEA report states 'experience suggests' a 10-15 year timeframe for the deployment of nuclear power plants, noting the timeframe depends 'on the resources devoted to the programme and the type of technology chosen, whether a large NPP [nuclear power plant] or an SMR [small modular reactor]'.[4] The Committee heard other factors impacting on timeframe include 'licensing, financing, fuel, the supply chain and social licence and engagement'.[5]

2.9 The Committee reviewed proposals ranging up to 50 years[6] concerning the likely end-to-end timeframes for the deployment of nuclear power in Australia, contingent upon the lifting of the current moratorium on nuclear power. As Australia has no nuclear power construction or generation experience,[7] timeframe estimates and issues were largely proposed with reference to the deployment of nuclear power reactors internationally.

2.10 Ms Helen Cook, a nuclear consultant who gave evidence in a private capacity, proposed a 10-to-12-year deployment timeframe, suggesting, 'Australia is one of the best-positioned countries in the world to move ahead with a nuclear energy programme and to do so expeditiously and responsibly'.[8]

2.11 However, the majority of submitters and witnesses pointed to a timeframe of at least 15 years for nuclear deployment in Australia.[9] This aligns with the '15-year-plus

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2 IAEA, *Milestones in the Development of a National Infrastructure for Nuclear Power*, IAEA Nuclear Energy Series No.NG-G-3.1 (Rev. 2), 2024, referred to in Australian Nuclear Science and Technology Organisation (ANSTO), Submission 824, p. 5.

3 IAEA, *Milestones in the Development of a National Infrastructure for Nuclear Power*, IAEA Nuclear Energy Series No.NG-G-3.1 (Rev. 2), 2024, referred to in ANSTO, Submission 824, p. 5.

4 IAEA, *Milestones in the Development of a National Infrastructure for Nuclear Power*, IAEA Nuclear Energy Series No. NG-G-3.1 (Rev. 2), 2024, p. 2, ARPANSA, Submission 218.1, p. [2].

5 Mr Shaun Jenkinson, Chief Executive Officer (CEO), ANSTO, *Committee Hansard*, Canberra, 24 October 2024, p. 25.

6 Professor Mark S. Winfield, Submission 627, p. [1].

7 Mr John Grimes, CEO, Smart Energy Council, *Committee Hansard*, Canberra, 28 October 2024, p. 14.

8 Ms Helen Cook, Submission 206, p. 4. See also: Mr Ian Grant, private capacity, *Committee Hansard*, Canberra, 28 November 2024, pages 2 and 4.

9 See, for example: Boundless Earth Limited, Submission 399, p. 1; Mr Simon Duggan, Deputy Secretary, Department of Climate Change, Energy, the Environment and Water (DCCEEW), *Committee Hansard*,

timeline',[10] proposed in the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the Australian Energy Market Operator's (AEMO) *GenCost 2023–24: Final Report* (GenCost) (see Box 2.1).

Box 2.1 GenCost 2023-24 timeframes

The 2023-24 GenCost report by CSIRO and AEMO provides detailed cost estimates for nuclear power in Australia and considers the timeline for deploying nuclear energy generation in Australia.

The report found that nuclear power would take at least 15 years to deploy in Australia, considering the absence of a development 'pipeline' for the sector in Australia, and the need for extensive regulatory approvals.[11]

2.12 In its submission, SMR Technology Pty Ltd explained deployment time can be broken into two parts – pre-construction preparations and construction – with the construction period commencing '… when the first nuclear concrete is laid'.[12]

2.13 Evidence received about specific aspects of the pre-construction and construction milestones for the deployment of nuclear power that may affect timeframes for the deployment of nuclear power generation in Australia is detailed in the sections below.

Pre-construction timeframe challenges for Australia

2.14 SMR Nuclear Technology Pty Ltd submitted pre-construction would require '… around 5 years for community consultation, site selection, feasibility studies, environmental and development approvals and arranging financial facilities'.[13]

2.15 However, the Committee heard that the pre-construction period is 'typically lengthy'.[14] Mr Jim Scott, the Chief Regulatory Officer and Head of Regulatory Services of Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) told the Committee that '… seven years for construction might pale',[15] compared to pre-construction activities, including siting, obtaining approval and social licence.[16]

2.16 The section below considers some of the key pre-construction milestones that will impact on timeframes for nuclear deployment in Australia, including:

Canberra, 24 October 2024 p. 1; Dr Gillian Hirth, CEO, Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), *Committee Hansard*, Canberra, 24 October 2024, p. 18; Mrs Louisa Kinnear, Chief Executive Officer, Australian Energy Council, *Committee Hansard*, Sydney, 12 December 2024, p. 34.

10 Dr Peter Mayfield, Executive Director, Environment, Energy and Resources, Commonwealth Scientific and Industrial Research Organisation (CSIRO), *Committee Hansard*, Canberra, 24 October 2024, p. 45.

11 Paul Graham; Jenny Hayward, James Foster, *GenCost 2023–24: Final Report,* May 2024, pages 18, 35-36.

12 SMR Nuclear Technology Pty Ltd, Submission 272, p. 11.

13 SMR Nuclear Technology Pty Ltd, Submission 272, p. 11.

14 Professor Winfield, Submission 627, p. 1.

15 Mr Jim Scott, Chief Regulatory Officer and Head of Regulatory Services, ARPANSA, *Committee Hansard*, Canberra, 24 October 2024, p. 22.

16 Mr Scott, ARPANSA, *Committee Hansard*, Canberra, 24 October 2024, p. 22.

- establishing social licence for nuclear power in Australia, and locations of nuclear power facilities including plants and waste facilities;
- the current legal and regulatory framework; and
- developing a nuclear workforce.

Social licence for civil nuclear power generation in Australia

Community perceptions and concerns about nuclear power

2.17 This section considers evidence the Committee received on social licence as a key early and ongoing milestone – and challenge – for the deployment of nuclear facilities.

2.18 The Ethics Centre defines 'Social licence' as the acceptance granted by the community to a company or organisation to operate, and explains it 'is made up of three components: legitimacy, credibility, and trust'.[17] Ms Tania Constable, Chief Executive Officer (CEO) of the Minerals Council of Australia (MCA) told the Committee that '… if you don't start with community consultation, there is no social licence to operate'.[18]

2.19 The issue of social licence for the nuclear sector appears to be complicated and polarised. While some submitters pointed to overseas countries successfully utilising proven nuclear power technology[19] and changing sentiment regarding nuclear power,[20] other submissions expressed concerns about nuclear power due to perceptions it 'poses significant risks to both the environment and communities'.[21]

2.20 Some of the key concerns raised in the evidence included nuclear power water demand and the risk of contamination,[22] as well as nuclear waste management,[23] including consideration of intergenerational equity.[24] Health and safety, in particular the health of workers and communities living near nuclear facilities,[25] and risk and

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17 The Ethics Centre, 'Social License To Operate - Ethics Explainer', https://ethics.org.au/ethics-explainer-social-license-to-operate/, viewed 15 January 2025.

18 Ms Tania Constable, CEO, Minerals Council of Australia (MCA), *Committee Hansard*, Perth, 17 December 2024, p. 6.

19 Australian Nuclear Association, Submission 180, p. 2.

20 MCA, Submission 430, p. [3].

21 Queensland Conservation Councils, Submission 190, p. 6.

22 See, for example: Josephite Justice Office, Submission 838, p. [4]; Ms Peta May, private capacity, *Committee Hansard*, Nanango, 14 November 2024, p. 28; Farmers for Climate Action, Submission 103, p. [1]; and Cairns and Far North Environment Centre, Submission 310, p. [3].

23 See, for example: Greenpeace Australia, Submission 335, p. 3; Mrs Suzanne Mungall, Core Member, South Burnett Sustainable Future Network, *Committee Hansard*, Nanango, 14 November 2024, p. 29; Cairns and Far North Environment Centre, Submission 310, p. [2]; Josephite Justice Office, Submission 838, p. [3]; and Professor Maria Rost Rublee, private capacity, *Proof Hansard*, Melbourne, 4 December 2024, p. 10

24 See, for example: Mr Nick Holliday, private capacity, *Committee Hansard*, Nanango, 14 November 2024, p. 21; and Mrs Rosemary Hadaway, Chairperson, Mudgee District Environment Group, *Committee Hansard*, Muswellbrook, 10 December 2024, p. 2.

25 See, for example: Medical Association for the Prevention of War, Submission 306, pages 7-8; Alexander H Doull Submission 820 p. [1]; Mr Daniel Sherrell, Senior Climate and Energy Policy Officer, Australian Council

safety in the event of accidents or catastrophic events were also raised,[26] with some submissions also pointing to recent global attacks on nuclear plants.[27]

2.21 The Clean Energy Investor Group stated:

> Currently, there is no social licence for nuclear power operations in the country. A minority of Australians support nuclear energy, while the majority oppose it.[28]

2.22 A joint submission from Queensland Conservation Councils put forward the comparison that 'Queensland communities have also shown little support for nuclear energy, with 76% of Australians preferring to live near wind or solar farms over nuclear power stations'.[29]

2.23 The Committee also received evidence that reflected on the history of First Nations experiences with nuclear activities carried out on their lands,[30] and expressed concerns that future nuclear activities 'may continue to disproportionately affect First Nations people'.[31]

2.24 Multiple First Nations representatives across the country expressed their opposition to nuclear activities in Australia during testimony to the Committee.[32] For example, in his testimony in Collie, Western Australia (WA), Mr Karim Kahn, Land and Heritage Manager at Gnaala Karla Booja Aboriginal Corporation, and a Traditional Owner representing the Noongar people, expressed concern about the 'devastation of that utilisation of nuclear' and the risk nuclear accidents could impact Country and access to Country compared to accidents with non-nuclear projects on traditional lands.[33]

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of Trade Unions (ACTU), *Committee Hansard,* Sydney, 12 December 2024, p. 2; and Queensland Conservation Councils, submission 190, p. 5..

26 See for example: Mr Nick Holliday, private capacity, *Committee Hansard*, Nanango, 14 November 2024, p. 24; Independent and Peaceful Australia Network (IPAN), submission 384, p. [6]; and Josephite Justice Office, Submission 838, p. [3].

27 See, for example: Kerin Booth, Submission 166, p. 2; Mrs Suzanne Mungall, Core Member, South Burnett Sustainable Future Network, *Committee Hansard*, Nanango, 14 November 2024, p. 29; and IPAN, Submission 384, p. [6].

28 Clean Energy Investor Group, Submission 229, p. 4.

29 Queensland Conservation Councils, Submission 190, p. 5.

30 See, for example: First Nations of South Australia Aboriginal Corporation, Submission 214 and Ms Karina Joan Lester, private capacity, *Proof Hansard*, Adelaide, 5 December 2024, pages 1-2.

31 Dr Genevieve Cowie, Chair, Research, Education and Advocacy Committee, Doctors for the Environment Australia, *Proof Hansard*, Melbourne, 4 December 2024, p. 28; see also p. 34.

32 See: Uncle Laurie Perry, CEO, Wonnarua Nation Aboriginal Corporation, *Committee Hansard*, Muswellbrook,10 December 2024, p. 28; Ms Peta May, private capacity, *Committee Hansard*, Nanango, 14 November 2024, p. 28; Auntie Janine (Taabinga) Smith, private capacity, *Committee Hansard*, Nanango, 14 November 2024, p. 31; and Ms Karina Joan Lester, private capacity, *Proof Hansard*, Adelaide, 5 December 2024, p. 2. Opposition from First Nations groups also noted in Queensland Conservation Councils, Submission 190, p. 3 and Cairns and Far North Environment Centre, Submission 310, p. [1].

33 Mr Karim Kahn, Land and Heritage Manager, Gnaala Karla Booja Aboriginal Corporation, *Committee Hansard*, Collie, 16 December 2024, p. 12.

2.25 Evidence received by the Committee reflected on gaining First Nations peoples consent for projects on traditional lands for nuclear projects.[34] For example, the First Nations of South Australia Aboriginal Corporation criticised the 'lack of consultation and consent from the First Nations and the broader community before making announcements'.[35]

Timeframes and key considerations for obtaining social licence for nuclear site locations

2.26 In its submission, the Clean Energy Investor Group noted the 'likely obstacles in securing social licence for plant locations and nuclear waste management'.[36] It submitted, 'most people are unwilling to reside near a nuclear power plant'.[37] It referred to the recent example of 'clear opposition to nuclear waste management sites, as demonstrated in June 2023 when efforts to construct a low-level nuclear waste site in South Australia were successfully blocked'.[38]

2.27 Professor Maria Rost Rublee from the University of Melbourne and Executive Committee member of Women in Nuclear-Australia gave evidence to the Committee in a private capacity and commented that because so many nuclear projects have not succeeded due to lack of community consent, the social licence process in this context has '… acquired its own acronym. The acronym is DADA. You 'decide' on the site for a nuclear project, you 'announce' it, you 'defend' it and you 'abandon' it'.[39]

2.28 On timeframes for consultation, Mr Shaun Jenkinson, CEO of the Australian Nuclear Science and Technology Organisation (ANSTO) which operates Australia's only nuclear reactor, the Open Pool Australian Light-water (OPAL) research reactor, advised that:

> …when you are looking to site a [nuclear] facility anywhere, engaging with the community would be one of the most important things you'd do. You'd start early and you'd engage long.[40]

2.29 Mr Jenkinson also highlighted the time needed to obtain social licence and explained that building social licence 'can take longer in some communities than others', and is dependent on the 'local area, their current level of knowledge around nuclear and what their acceptance of nuclear is as a baseline'.[41]

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34 See, for example: Bushfire Survivors for Climate Action, Submission 152, p. 7; Mr Luke Hilakari, Secretary, Victorian Trades Hall Council, *Committee Hansard*, Melbourne, 4 December 2024, pages 19 and 25; and Dr Genevieve Cowie, *Committee Hansard*, Melbourne, 4 December 2024, p. 28.

35 First Nations of South Australia Aboriginal Corporation, Submission 214, p. [1].

36 Clean Energy Investor Group, Submission 229, p. 2.

37 Clean Energy Investor Group, Submission 229, p. 4. See also: Queensland Conservation Councils, Submission 190, p. 5.

38 Clean Energy Investor Group, Submission 229, p. 4.

39 Professor Maria Rost Rublee, private capacity, *Committee Hansard*, Melbourne, 4 December 2024, p. 9.

40 Mr Shaun Jenkinson, CEO, ANSTO, *Committee Hansard*, Canberra, 24 October 2024, p. 25.

41 Mr Jenkinson, ANSTO, *Committee Hansard*, Canberra, 24 October 2024, p. 26.

2.30 Mr Nate Smith, Managing Director and CEO, Tellus Holdings which operates 'Australia's first and only facility for the disposal of low-level-radioactive waste',[42] reflected that 'building social licence is the foundation of our approach and success'.[43]

2.31 The Australian Nuclear Association recommended 'follow[ing] the best practice international siting standard developed by the International Atomic Energy Agency', noting:

> … the siting of nuclear plants is a rigorous process involving multiple stakeholders and assessment of social licence and technical suitability of sites. It includes outreach programs involving local communities in the decision-making process so as to gain support near potential sites.[44]

2.32 Mr Smith advised that Tellus Holdings had reviewed past nuclear waste projects to learn how best to obtain social licence. He summarised that 'one of the biggest things that we saw was that they [overseas governments] announced [site locations] and then did consultation'.[45] Mr Smith advised the Committee that the process they follow, is to 'create trust first, bring people on the journey and then announce'.[46]

2.33 Professor Rublee advised the Committee that due to the risks associated with nuclear power, 'social licence, community consent, has to be non-negotiable, particularly for our First Nations communities'.[47] She explained that 'consultation is very different from social licence', and clarified:

> For it to be a genuine social licence, communities have to be able to say no. If a community cannot say no, it is not a genuine social licence.[48]

2.34 Ms Karina Lester, a Yankunytjatjara Anangu woman from north-west South Australia, repeatedly pointed to the United Nations (UN) Declaration on the Rights of Indigenous Peoples,[49] which states in Article 29 that:

> States shall take effective measures to ensure that no storage or disposal of hazardous materials shall take place in the lands or territories of indigenous peoples without their free, prior and informed consent.[50]

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42 Mr Nate Smith, Managing Director and CEO, Tellus Holdings, *Committee Hansard*, Perth, 17 December 2024, p. 56.

43 Mr Smith, Tellus Holdings, *Committee Hansard,* Perth, 17 December 2024, p. 56.

44 Australian Nuclear Association, Submission 180, p. 4.

45 Mr Smith, Tellus Holdings, *Committee Hansard*, Perth, 17 December 2024, p. 59.

46 Mr Smith, Tellus Holdings, *Committee Hansard*, Perth, 17 December 2024, p. 60.

47 Professor Maria Rost Rublee, private capacity, *Proof Hansard*, Melbourne, 4 December 2024, p. 9.

48 Professor Maria Rost Rublee, private capacity, *Proof Hansard*, Melbourne, 4 December 2024, p. 10. See also: Associate Professor Naomi Godden, Associate Director, Centre for People, Place and Planet, Edith Cowan University, *Committee Hansard*, Collie, 16 December 2024, pages 8 - 9.

49 Ms Karina Joan Lester, private capacity, *Committee Hansard,* Adelaide, 5 December 2024, pages 2, 3 and 6. See also IPAN, Submission 384, p. [5] and Bushfire Survivors for Climate Action, Submission 152, p. 7.

50 United Nations Declaration on the Rights of Indigenous Peoples, 2007, Article 29.

2.35 Mr Smith also explained that while Tellus has 'received Traditional Owner approval for three separate radioactive waste disposal projects in the last 10 years', an achievement which he said was 'unprecedented globally',[51] some of Tellus' waste projects have taken eight and 13 years to get approval.[52]

2.36 Reflecting on Tellus Holdings' successful approval from Traditional Owners for low-level radioactive waste facilities in Australia, Mr Smith highlighted the importance of being open to changing site locations based on consultation with community and First Nations peoples, and reflected it may be more challenging for a government to 'make that decision on the spot and say, "If you're not happy, if you don't want it on your land, there's no way it's ever going to happen"'.[53]

2.37 Professor John Quiggin, appearing in a private capacity, speculated on the risk of losing social licence during the construction of nuclear power plant. He cautioned:

> … there's a further possibility that we could go three to five years down the track with those types and then discover that, once people find out about the exclusion zones and forth, the emergency evacuation zones, the project will run into social licence issues.[54]

2.38 On the timeframes to obtain and maintain social licence, Mr Jenkinson of ANSTO told the Committee about its experience building social licence at the Lucas Heights reactor in New South Wales and explained this was 'built … up over 70 years, not just for 10 years of construction of the building'.[55]

Timeframe for lifting the moratorium and establishing a robust nuclear power generation and safety regulatory framework

2.39 As raised in Chapter 1, Australia has a long standing, bipartisan moratorium on nuclear power, and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) prohibits the Minister for the Environment from approving the construction or operation of nuclear power plants. The lifting of prohibitions on nuclear activities at federal, state and territory levels is required to commence construction of a nuclear power facility in Australia.[56]

2.40 A robust regulatory framework for nuclear power generation in Australia would then be needed, noting, as submitted by ARPANSA, 'lifting prohibitions will only eliminate an obstacle, not make the system fit-for-purpose'.[57]

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51 Mr Smith, Tellus Holdings, *Committee Hansard*, Perth, 17 December 2024, p. 56.
52 Mr Smith, Tellus Holdings, *Committee Hansard*, Perth, 17 December 2024, p. 61.
53 Mr Smith, Tellus Holdings, *Committee Hansard*, Perth, 17 December 2024, p. 60.
54 Professor Quiggin, private capacity, *Committee Hansard*, Brisbane, 15 November 2024, p. 28.
55 Mr Jenkinson, ANSTO, *Committee Hansard,* Canberra, 24 October 2024, p. 32.
56 ARPANSA, Submission 284, p. [2].
57 ARPANSA, Submission 284, p. [2].

2.41 Ms Claire McLaughlin, Head, Energy Performance and Security Division, Department of Climate Change, Energy, the Environment and Water (DCCEEW), touched on some of the pre-construction steps, if the moratorium were to be lifted:

- developing 'governance, legal and other frameworks to ensure the safety and security of any plants, as well as any environmental impacts'; and
- establishing the 'regulatory structures that would be required to operate a civil nuclear industry'.[58]

2.42 The Committee received evidence on the preparedness and suitability of Australia's existing regulatory framework and institutions of Australia's current nuclear activities, which include medicine and research, were the moratorium were to be lifted.

2.43 While one submitter alleged that 'Australia has no such [regulatory] experience, and would have to develop it from scratch',[59] some nuclear experts expressed confidence that adopting nuclear power in Australia would be 'both feasible and straightforward' and require 'only minimal' regulatory adjustments.[60]

2.44 Mr Ian Grant, a nuclear expert appearing in a private capacity, proposed that ARPANSA, the current regulator for Australia's nuclear activities, would be well positioned to regulate nuclear power generation in Australia. In his view:

> … [ARPANSA] has in place a legal framework. It has in place regulations that do not, in our view, need to be changed. The only requirement would be to adopt the relevant IAEA standards, which exist today, in place of the standards that they use for the research reactor.[61]

2.45 Dr Gillian Hirth, CEO at ARPANSA, also posited that 'ARPANSA would be well based to grow,' were a civil nuclear power sector to be established in Australia, and acknowledged some of its 'existing regulatory guidance' would be 'applicable'.[62]

2.46 Energy specialist, Dr Adrian Paterson, founder and principle of Siyeva Consulting suggested, 'You would have to increase the number of people at ARPANZA (sic). … You could beef up that regulatory structure in six months'.[63]

2.47 In her testimony, Ms Helen Cook, appearing in a private capacity, disagreed with proposals that 'the entire regulatory framework is needed on day one'.[64] She told the Committee the regulatory framework and necessary human resources can be developed over time.[65] In her submission, Ms Cook suggested ARPANSA 'could be

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58 Ms Clare McLaughlin, Head, Energy Performance and Security Division, DCCEEW, *Committee Hansard*, Canberra, 24 October 2024, p. 1.
59 Climate Action Burwood/Canada Bay, Submission 210, p. 2.
60 Macquarie University Transforming Energy Markets Research Centre (TEM), Submission 782, p. 7.
61 Mr Ian Grant, private capacity, *Committee Hansard*, Canberra, 28 November 2024, p. 3.
62 Dr Hirth, ARPANSA, *Committee Hansard,* Canberra, 24 October 2024, p. 21.
63 Dr Adrian Paterson, Founder and Principal, Siyeva Consulting, Canberra, 28 October 2024, pages 27–28.
64 Ms Helen Cook, private capacity, *Committee Hansard*, Sydney, 12 December 2024, p. 46.
65 Ms Cook, *Committee Hansard*, Sydney, 12 December 2024, p. 46.

ready to receive a construction license application for nuclear reactors within three years of a policy decision to start a civil nuclear energy program'.[66]

2.48 However, Dr Hirth of ARPANSA reflected that while 'Australia does have many things in place, but we would still require significant review of our regulatory framework and the development of a clear national position'.[67] She concluded that 'Even if you have those things in place, I still think it is in the 10-to-15-years range'.[68]

2.49 On the time needed to review the regulatory framework, Ms Clare Savage, Chair of the Australian Energy Regulator, advised the Committee it would take eight to 10 years for 'the removal of the prohibition and getting the agreements of the various states and territories'.[69]

2.50 To estimate that timeframe, Ms Savage reflected on analogous experience 'developing lots of different types of policy and regulation in Australia'.[70] In her experience, the long timeframe would come from the requirement for the 'underwriting of new generation investment work',[71] and obtaining 'agreement between levels of government on technical detail with sufficient consultation of industry stakeholders, consumer stakeholders and the general public'.[72]

2.51 Dr Hirth advised the Committee that ARPANSA's regulatory capacity to oversee nuclear power generation would depend on the location and ownership of nuclear facilities, noting ARPANSA's 'remit is to regulate Commonwealth entities'.[73] Ms Savage also touched on this issue in her evidence to the Committee, reiterating:

> My understanding is that ARPANSA has Commonwealth functions and that there would still need to be state based safety, environmental and technical frameworks, and to do the combination of those things would take eight to 10 years.[74]

2.52 On the timeframe implications of undertaking this work, Ms Savage speculated that creating the enabling regulatory environment 'would take you to 2035 before you commence building'.[75] Looking further ahead, Mr John Grimes, CEO, Smart Energy Council, reflected that factoring in the required regulatory reforms, nuclear deployment by 2045 was, in his view, 'deeply ambitious'.[76]

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66 Ms Helen Cook, Submission 206, p. 5.
67 Dr Hirth, ARPANSA, *Committee Hansard*, Canberra, 24 October 2024, p. 20.
68 Dr Hirth, ARPANSA, *Committee Hansard*, Canberra, 24 October 2024, p. 20.
69 Ms Clare Savage, Chair, Australian Energy Regulator (AER), *Committee Hansard,* Canberra, 24 October 2024, p. 39.
70 Ms Savage, AER, *Committee Hansard,* Canberra, 24 October 2024, p. 39.
71 Ms Savage, AER, *Committee Hansard,* Canberra, 24 October 2024, p. 38.
72 Ms Savage, AER, *Committee Hansard,* Canberra, 24 October 2024, p. 38.
73 Dr Hirth, ARPANSA, *Committee Hansard*, Canberra, 24 October 2024, p. 21.
74 Ms Savage, AER, *Committee Hansard,* Canberra, 24 October 2024, p. 43.
75 Ms Savage, AER, *Committee Hansard,* Canberra, 24 October 2024, p. 34.
76 Mr Grimes, Smart Energy Council, *Committee Hansard*, Canberra, 28 October 2024, p. 14.

Workforce preparedness for a new nuclear power industry

2.53 The Committee received evidence about the workforce requirements and preparedness to support the deployment of nuclear power generation in Australia noting it has 'no existing nuclear power generation industry'.[77]

2.54 The Australian Nuclear Association submitted Australia can scale up existing expertise it has in key fields including nuclear engineering, management, and regulation to establish and manage a civil nuclear power industry.[78] Ms Heather Hoff, founder of Mothers for Nuclear, also highlighted that engineers and electricians would be able to transition to jobs in nuclear plants, and noted her plant also hires people for various positions without requiring a degree.[79]

2.55 However, the Australian Nuclear Research and Education Network (ANREN) advised that a nuclear workforce would 'cover a diverse range of professions', and noted, 'The European Human Resources Observatory for the Nuclear Sector defines 50 different roles essential for the nuclear sector, many of which require postgraduate-level nuclear training'.[80]

2.56 There may also be limited to the transferability of skills and experience from existing nuclear operations in Australia. Regarding the nuclear research reactor at Lucas Heights, Mr Scott from ARPANSA explained there:

> …is quite a significant difference between the research reactor and a nuclear power reactor operating at pressures, and the complexities of engineering that may be involved.[81]

2.57 Dr Hirth from ARPANSA reflected that:

> Across safety, security and safeguards, we do have excellent expertise in place for the nuclear industry…. It's just about the scale that would be required for a nuclear program, and the experts and the lead time to develop that capacity within the system.[82]

2.58 Mr Jenkinson from ANSTO advised the Committee of the need to 'make sure that there is an available workforce',[83] for a new nuclear power industry. He reflected that Australia currently has a 'small sophisticated nuclear workforce',[84] of 'about 1,400 employees', including 550 staff in 'scientific and technical' roles and 'about 250 people with PhDs'.[85]

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77 Clean Energy Investor Group, Submission 229, p. 1.
78 Australian Nuclear Association, Submission 180, p. 1. See also Dr Barry Green, private capacity, *Committee Hansard*, Perth, 17 December 2024, p. 22.
79 Ms Heather Hoff, Mothers for Nuclear, *Committee Hansard*, Canberra, 21 November 2024, p. 3.
80 Australian Nuclear Research and Education Network (ANREN), Submission 295, p. [1].
81 Mr Scott, ARPANSA, *Committee Hansard*, Canberra, 24 October 2024, p. 21.
82 Dr Hirth, ARPANSA, *Committee Hansard*, Canberra, 24 October 2024, p. 23.
83 Mr Jenkinson, ANSTO, *Committee Hansard*, Canberra, 24 October 2024, p. 26.
84 Mr Jenkinson, ANSTO, *Proof Hansard*, Canberra, 24 October 2024, p. 26.
85 Mr Jenkinson, ANSTO, *Proof Hansard*, Canberra, 24 October 2024, p. 30.

2.59 In comparison, ANREN referred to workforce capacity in the US of approximately 100,000 people, and the UK which estimates it will require 'inflows' of 14,300 to 21,500 full time staff per year for the civil and defence nuclear sectors.[86] ANREN stated that:

> …. given the international demand for nuclear expertise, Australia cannot rely on other nations to provide suitably qualified and experienced workers; we will need to train our own to ensure sovereign capability.[87]

2.60 Dr Hirth further reflected that with the AUKUS program, which also requires a workforce with nuclear capacity, running concurrently, 'the workforce would present challenges for Australia in the current landscape'.[88]

Construction timeframe challenges for Australia

2.61 In its submission, ANSTO notes the IAEA's *Commissioning Guidelines for Nuclear Power Plants,* states the construction period goes 'from the first pouring of structural concrete to grid connection'.[89] ANSTO referred to the Guideline's advice that the construction schedule '"can range from less than five years to longer than twenty years"'.[90]

2.62 This section considers evidence received about two factors that may increase the deployment timeframes for nuclear power generation in Australia:

1 Jurisdictional factors about Australia, including its democratic political ideology and its lack of previous nuclear power generation build experience; and

2 The design and availability of the reactor chosen, and scale of the program.

Jurisdictional factors influencing construction times

2.63 ANSTO submitted that construction timeframes are 'dependent on multiple factors specific to the jurisdictions in which they operate'.[91]

2.64 Professor Andrew Whittaker, Director, Institute of Sustainable Transportation and Logistics, University of Buffalo proposed it 'should' take five to 10 years to build a plant with two-gigawatt scale reactors in Australia, 'taking advantage of the lessons learned' from the recent construction in the United States of America (USA) with

86 ANREN, Submission 295, p. [1].
87 ANREN, Submission 295, p. [1].
88 Dr Hirth, ARPANSA, *Committee Hansard*, Canberra, 24 October 2024, p. 18.
89 IAEA, *Commissioning Guidelines for Nuclear Power Plants,* IAEA Nuclear Energy Series No. NP-T-2.10, 2018. See: ANSTO, Submission 823, p. 5.
90 IAEA, *Commissioning Guidelines for Nuclear Power Plants,* IAEA Nuclear Energy Series No. NP-T-2.10, 2018. See: ANSTO, Submission 823, p. 5.
91 ANSTO, Submission 823, p. 5.

Plant Vogtle and the United Arab Emirates' (UAE) construction of four units at the Barakah Nuclear Energy Plant.[92]

2.65 However, Mr Grimes from the Smart Energy Council cautioned estimating timeframes using comparisons with countries 'where there's existing nuclear energy'.[93] He pointed to comparisons with the USA, and explained:

> California has the advantage of having done nuclear since it was invented in World War II, with an industry and a whole ecosystem around that. Australia has no such experience.[94]

2.66 ANSTO also pointed to the impact on timeframes of the immaturity of Australia's nuclear power industry compared to other jurisdictions, submitting:

> The design and construction of a nuclear power plant in Australia and the associated regulatory approvals would be more complex and time-consuming. Even in jurisdictions with comparable regulatory settings, environmental laws and community expectations the deployment time would be dependent on factors such as the existence of an already established nuclear energy capability.[95]

2.67 Various witnesses referred to the example of the UAE where another 'nuclear newcomer country' went from 'zero experience and zero expertise in nuclear to what now amounts to 20 or 25 per cent of their electric grid being nuclear in 12 years'.[96]

2.68 Professor Whittaker suggested 'Australia could do much better than 12 years because it has a nuclear regulator and operating research reactor'.[97]

2.69 SMR Nuclear Technology Pty Ltd also pointed to Australia's previous nuclear research reactor experience, noting 'the deployment time of the complex OPAL research reactor at Lucas Heights from the initial announcement … in 1997 to full power operation in 2006 was less than 9 years'.[98]

2.70 However, the Committee heard that even where a jurisdiction has nuclear experience, the recency of that experience can also impact on the timeframe for construction of new reactors. ANSTO referred to the blowout of the construction

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92 Professor Andrew Whittaker, Director, Institute of Sustainable Transportation and Logistics, University of Buffalo, *Committee Hansard*, Canberra, 18 November 2024, p. 3.

93 Mr Grimes, Smart Energy Council, *Committee Hansard*, Canberra, 28 October 2024, p. 14.

94 Mr Grimes, Smart Energy Council, *Committee Hansard*, Canberra, 28 October 2024, p. 14.

95 ANSTO, Submission 823, p. 6.

96 Professor Jacopo Buongiorno, Director, Science and Technology, Nuclear Reactor Laboratory, Massachusetts Institute of Technology (MIT); and Director, Center for Advanced Nuclear Energy Systems, MIT, *Committee Hansard*, Canberra, 18 November 2024, p. 3. See also: Professor Whittaker, Institute of Sustainable Transportation and Logistics, University of Buffalo, *Committee Hansard*, Canberra, 18 November 2024, p. 3 and Adrian Morrison, *How to Build Low Cost Nuclear, Lessons from the world*, Analysis Paper 65, The Centre for Independent Studies, p. 7, included in The Centre for Independent Studies, Submission 371.

97 Professor Whittaker, Institute of Sustainable Transportation and Logistics, University of Buffalo, *Committee Hansard*, Canberra, 18 November 2024, p. 3

98 SMR Nuclear Technology Pty Ltd, Submission 272, p. 11.

timeframe for the UK Hinkley Point C reactor from a 6-year expected timeframe to a projected 10-12 year timeframe.[99] ANSTO submitted:

> Delays are attributed to an initial 15-month delay due to the COVID-19 Pandemic, and difficulties with uplifting the country's nuclear workforce and supply chain after a 20-year pause in nuclear construction.[100]

2.71 On differences between jurisdictions and how that can impact on timeframes, Mr Paul Graham, Chief Economist, Energy, CSIRO and Professor Quiggin, appearing in a private capacity, both reflected on the different political ideology and 'labour markets'[101] between Australia and the UAE. Professor Quiggin expanded,

> The United Arab Emirates mentioned 13 years, but of course they don't have to worry about social licence or anything of that kind whatsoever; the guy in charge says, 'We're building it here,' and it happens. Those difficulties of the time scales have been massively glossed over.[102]

2.72 The Australian Nuclear Association reported shorter reactor construction times in China,[103] another non-democratic country.

2.73 Mr Graham of CSCIRO advised the Committee that Australia's lack of experience and political ideology were factors in the CSIRO's 15-year timeframe estimate. He summarised:

> … we're talking about [Australia's] first nuclear build here. Some of those countries also have the advantage of not being democracies, so they don't have to consult as much. So that speeds things up as well. We couldn't really find a solid example where someone had achieved better than 15 years that was a democracy, and that was their first time. So I think it would be at least 15 years, with the risk that it would be longer than that.[104]

2.74 Professor Mark S. Winfield, a nuclear expert from Canada, posited a longer timeframe for Australia. He reflected that:

> … from start to completion the timeline for the Canadian nuclear program from a standing start, analogous to Australia's current situation, exceeds half a century.[105]

Choice of reactor design

2.75 The Australian Nuclear Association explained a key factor influencing construction timeframes comes from the 'type and size' of the reactor selected and, 'whether the

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99 ANSTO, Submission 823, pages 5-6.
100 ANSTO, Submission 823, pages 5-6.
101 Mr Paul Graham, Chief Economist, Energy, CSIRO, *Committee Hansard*, Canberra, 24 October 2024, p. 45.
102 Professor Quiggin, private capacity, *Committee Hansard*, Brisbane, 15 November 2024, p. 28.
103 Australian Nuclear Association, Submission 180, p. 2.
104 Mr Graham, CSIRO, *Committee Hansard*, Canberra, 24 October 2024, p. 46.
105 Professor Winfield, Submission 627, p. [1].

design is a first-of-a-kind or nth-of-a-kind and whether the design is finalised before construction starts'.[106]

2.76 On developments in large nuclear reactor design, ANSTO submitted that:

> The current generation of nuclear power reactors known as Generation III+ have operated reliably for several decades. Advances in materials science, engineering and numerical modelling are driving the development of next-generation (Generation IV) reactor systems.[107]

2.77 In its submission, the Australian Nuclear Association mentioned recent delays and cost overruns in 'construction of some first-of-a-kind power reactors in Finland, France and the USA'.[108]

2.78 Professor Quiggin reflected on recent large reactor designs and observed:

> When we look at the current generation designs, generation III and generation III plus, only a handful have been constructed, all running over time and over budget, and we only have a tiny amount of operating experience.[109]

2.79 Professor Quiggin commented that 'we really are taking a leap in the dark to the extent that we say, "Let's build one of these"'.[110]

2.80 SMR Nuclear Technology Pty Ltd submitted an end-to-end timeframe for construction of a large nuclear power plant would be 'up to 10 years', including five years of construction time for a 'proven design'.[111]

2.81 Mr John Hallam, a nuclear disarmament campaigner, referred to the 2019 report of the Australian House of Representatives' Standing Committee on Environment and Energy - *Not without your approval: a way forward for nuclear technology in Australia* in his submission. He noted the report, 'in its most prominent finding, wisely said Australia should acquire NOT a 'FOAK' (First of a Kind) technology but 'NOAK' (Nth of a kind)'. He cautioned that '…even "Nth of a kind", "evolutionary" reactors … seem to suffer from similar woes to other reactors'.[112]

2.82 Potential construction time efficiencies arising from repurposing existing energy infrastructure and coal power plant sites depending on the choice of reactor were raised by some witnesses.[113] Ms Constable of the MCA suggested that the

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106 Australian Nuclear Association, Submission 180, p. 2.
107 ANSTO, Submission 823, p. 2.
108 Australian Nuclear Association, Submission 180, p. 2.
109 Professor Quiggin, private capacity, *Committee Hansard*, Brisbane, 15 November 2024, p. 21.
110 Professor Quiggin, private capacity, *Committee Hansard*, Brisbane, 15 November 2024, p. 21.
111 SMR Nuclear Technology Pty Ltd, Submission 272, p. 11.
112 John Hallam, Submission 386, p. 3.
113 See, for example: Dr Barry Green, private capacity, Committee Hansard, Perth, 17 December 2024, p. 23; Mr Robert Parker, Founder, Nuclear for Climate Australia, *Committee Hansard*, Sydney, 12 December 2024, p. 50; Ms Cook, private capacity, *Committee Hansard*, Sydney, 12 December 2024, p. 50; Professor Whittaker, Institute of Sustainable Transportation and Logistics, University of Buffalo, *Committee Hansard*,

'decommissioning of a coal-fired power station can happen alongside the planning and building of SMRs [small modular reactors] or bigger facilities'.[114] Mr Nowakowski from Rainforest Reserves Australia, suggested, 'Nuclear facilities could go alongside retiring coal plants and we can utilise all of their existing infrastructure'.[115]

2.83 Dr Geoffrey Bongers, Director, Gamma Energy Technology acknowledged grid and transmission upgrades would be required if 'nuclear was placed that was larger than the current facility'.[116]

2.84 However, on reusing existing infrastructure Mr Scott of ARPANSA cautioned making assumptions about compatibility and transferability:

> You have to look at external events: floods and other natural events that could occur. That is part of the siting process. Yes, building around existing transmission infrastructure can save time, but the potential issue is that the site of a current coal-fired plant may not be adequate for a nuclear plant.[117]

2.85 Dr Hirth of ARPANSA also noted the construction timeframe 'depends on the scale of the program you are rolling out and the technologies that you choose'.[118] She contended that the benefit of using 'proven technology that was running effectively', is that it 'bring[s] efficiency in technologies which have been constructed multiple times and which are effective and well understood in their use, as well as with their regulation'.[119]

2.86 Regarding scale, Professor Whittaker referred to time efficiencies from multiple builds in Barakah in the UAE where it took eight years to construct one unit, with four units constructed in 'less than 12 years'.[120]

2.87 The Nuclear Energy Institute submitted 'the increased economies of scale and growing expertise [from global nuclear projects] are expected to drive down the cost curve and improve project delivery timelines'.[121]

2.88 Mr Graham of CSIRO also acknowledged 'there were a lot of countries that can do below 15 years. But they're often countries that have continuous building programs'.[122]

Canberra, 18 November 2024, pages 2 and 8; and Professor Buongiorno, Massachusetts Institute of Technology, *Committee Hansard*, Canberra, 18 November 2024, pages 7 and 8.

114 Ms Constable, MCA, *Committee Hansard*, Perth, 17 December 2024, p. 3.

115 Mr Nowakowski, Rainforest Reserves Australia, *Committee Hansard,* Brisbane, 15 November 2024, p. 11.

116 Dr Geoffrey Bongers, Director, Gamma Energy Technology, *Committee Hansard*, Brisbane, 15 November 2024, p. 27.

117 Mr Scott, ARPANSA, *Committee Hansard*, Canberra, 24 October 2024, p. 24.

118 Dr Hirth, ARPANSA, *Committee Hansard*, Canberra, 24 October 2024, p. 19.

119 Dr Hirth, ARPANSA, *Committee Hansard*, Canberra, 24 October 2024, p. 19.

120 Professor Whittaker, Institute of Sustainable Transportation and Logistics, University of Buffalo, *Committee Hansard*, Canberra, 18 November 2024, p. 3.

121 Nuclear Energy Institute, Submission 360 p. 4.

122 Mr Graham, CSIRO, *Committee Hansard*, Canberra, 24 October 2024, p. 46.

Design and availability impacts on timeframes for Small Modular Reactors

2.89 On the choice of design, the Committee received evidence specifically about the potential timeframe for deployment of Small Modular Reactors (SMRs) in Australia.

2.90 SMRs are 'nuclear power reactors designed to generate less than 300 MWe, regardless of the underlying technology (e.g., Gen III+ or Gen IV)'.[123] SMRs are seen by some to 'present a compelling alternative to ensure a consistent, reliable, and sustainable energy supply'.[124] For example, the Committee heard there is increasing interest from US companies in 'pursuing plans are centered on reactor[s] that are smaller and more modular'.[125]

2.91 On timeframes, SMR Nuclear Technology Pty Ltd noted GenCost 'lists the construction time of an SMR as 4.4 years'.[126] ANSTO similarly submitted that 'SMR units … have expected deployment timeframes of around 5-years from construction start to electricity (or heat) generation'.[127] ANSTO also acknowledged 'deployment timeframes are less certain for SMR modules in their current state'.[128]

2.92 The 'current state' of SMRs, and its impact on timeframes, received significant comment from submitters and witnesses. Professor Lachlan Blackhall, a Fellow with Engineers Australia, noted that while large scale 'conventional nuclear is proven internationally':

> Small modular reactors are still effectively in a research and development experimental phase. You can't go out today and buy one of those.[129]

2.93 In its submission, the Blueprint Institute stated, 'Contrary to the claims of some overly enthusiastic public commentators, SMRs also have a technology-readiness problem. Most SMRs are currently in conceptual design phases'.[130] It stated, '92% of the SMR projects globally remain in elementary, prototypical stages of design'.[131] In his submission, Professor John Quiggin noted, 'It will be unclear for some years which, if any, of these designs are technically feasible'.[132]

2.94 ANSTO advised the Committee that while there are SMRs 'planned or currently under construction',[133] the only operational SMRs are in China and Russia.[134] However, the joint submission from the 16 national and state/territory environment

123 ANSTO, Submission 823, p. 4.
124 See, for example: Geoffrey Stubbs, Submission 385, p. [1].
125 Nuclear Energy Institute, Submission 360, p. 4.
126 SMR Nuclear Technology Pty Ltd, Submission 272, p. 11.
127 ANSTO, Submission 823, p. 6.
128 ANSTO, Submission 823, p. 6.
129 Professor Lachlan Blackhall, Fellow, Engineers Australia, *Committee Hansard*, Perth, 17 December 2024, p. 53.
130 Blueprint Institute, Submission 369, p. 20.
131 Blueprint Institute, Submission 369, p. 20.
132 Professor John Quiggin, Submission 3, p. [5].
133 ANSTO, Submission 823, p. 6. See also: Ms Cook, private capacity, *Committee Hansard*, Sydney, 12 December 2024, p. 52.
134 ANSTO, Submission 823, p. 4.

groups was critical of those examples, noting 'Small modular reactors (SMRs) do not exist. The so-called operating SMRs in Russia and China were not built using serial factory production methods'.[135]

2.95 On deployment timelines specifically, the joint submission from 16 national and state/territory environment groups summarised:

> Construction timelines for the so-called SMRs in Russia and China were protracted: 9 years in China and 12 years in Russia. In both countries, planning plus construction took 20 years or more.[136]

2.96 The Blueprint Institute also noted the timeframe blowouts in the development of the Chinese and Russian SMRs, stating, 'Russian modules were completed nine years later than originally scheduled, and their performance has been described as "mediocre"'.[137]

2.97 Various submitters pointed to the lack of recent progress in SMR commercialisation In his submission, Mr Steve Gates put forward that while SMRs are being identified as a '"new generation" of nuclear reactors', they 'have been promised for over 20 years and yet nothing "commercial" exists'.[138] Mr Simon Holmes à Court, Australian businessperson and political activist, also submitted that 'SMRs are barely any closer to commercialisation than they were claimed to be five years ago'.[139]

2.98 The joint submission from 16 national and state/territory environment groups referred to above summarised that, 'the SMR sector is littered with failed and abandoned projects, false claims and false dawns'.[140] Greenpeace Australia pointed out that as the 'technology…doesn't even exist yet', it would be 'unrealistic' to imagine them being deployed in Australia 'by 2037'.[141] Similarly on timeframes, Mr Geoffrey Miell told the Committee, 'Currently [SMRs] are vapourware, and there are unlikely to be any until at least the 2030s, if ever'.[142]

A history of delays

2.99 The Committee also heard that construction schedules for nuclear power generation projects are susceptible to 'extensive delays and cost blowouts'.[143] The Independent and Peaceful Australia Network directed the Committee to note the *World Nuclear Industry 2024 Status Report*, which they submitted found:

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135 Joint submission from 16 national and state/territory environment groups, Submission 318, p. 3.
136 Joint submission from 16 national and state/territory environment groups, Submission 318, p. 3.
137 Blueprint Institute, Submission 369, p. 20.
138 Mr Steve M Gates, Submission 269, p. [1].
139 Mr Simon Holmes à Court, Submission 478, p. 2.
140 Joint submission from 16 national and state/territory environment groups, Submission 318, p. 3.
141 Greenpeace Australia Pacific, Submission 335, p. 2.
142 Mr Geoffrey Miell, private capacity, *Committee Hansard*, Lithgow, 11 December 2024, p. 9.
143 IPAN, Submission 384, p. [3] See also Clean Energy Council, Submission 230, p. 4 and Climate Council of Australia, Submission 428, p. 6.

> … every reactor currently under construction has exceeded the five year construction estimate. Many have suffered significant delays. Of those operational in recent years, time from construction to grid connection is 7 to 15 years.[144]

2.100 Ms Jennifer Brown, Climate Lead, Queensland Conservation Council, stated the Council 'does not think nuclear is the way forward'.[145] Ms Brown pointed to:

> … international examples where the UAE has taken 18 years to build one nuclear power plant. The UK has taken 16 years just for construction and over eight years for contracting and policy—and that's in a country that already has nuclear facilities.[146]

2.101 Mr Holmes à Court suggested the recently completed UAE build was not without delays. He stated in his submission that 'the first unit was expected to reach commercial operation in 2017 but that milestone was not achieved until 2021, a delay of four years'.[147] Regarding the UAE example, Dr Hirth of ARPANSA told the Committee, 'there was about an 18-month delay in actually switching on, and that was associated with workforce demands'.[148]

Implications of nuclear deployment timeframes on critical climate and industrial reforms

2.102 AEMO's Integrated System Plan (ISP) 'step change' scenario sets out key timelines for Australia's energy grid transition out to 2050, including the staged decommissioning of all coal power plants by 2038. It also addresses investment in renewable power generation and infrastructure as part of meeting emissions reductions targets to meet the goals of the Paris Agreement.

2.103 Many inquiry participants shared their views about the tension between the likely timeframes for nuclear power deployment in Australia and the timeframes for Australia's decarbonisation and climate commitments.

Nuclear 'not a timely or practical solution' for emissions reduction in Australia

2.104 Ms Constable from the MCA told the Committee, 'in the age of climate change there is persistent and growing net public support for the legitimate consideration of

144 IPAN, Submission 384, p. [3].
145 Ms Jennifer Brown, Climate Lead, Queensland Conservation Council, *Committee Hansard*, Brisbane, 15 November 2024, p. 9.
146 Ms Brown, Queensland Conservation Council, *Committee Hansard*, Brisbane, 15 November 2024, p. 9.
147 Mr Simon Holmes à Court, Submission 478, p. 5.
148 Dr Hirth, ARPANSA, *Committee Hansard*, Canberra, 24 October 2024, p. 19. See also: Geoffrey Miell, Submission 66, p. 3.

nuclear energy in Australia'.[149] She continued, 'Nuclear power has been operating safely for over 60 years, almost 70 years. Nuclear power is needed to completely decarbonise the economy by 2050'.[150]

2.105 Similarly, Dr Barry Green, a nuclear expert appearing in a private capacity, told the Committee:

> Many Western countries have had sporadic nuclear-power-building programs and are now in the process of restarting and ramping up those programs as part of their climate change mitigation strategies.[151]

2.106 Submitters and witnesses also drew the Committee's attention to international commitments to nuclear power in the context of reducing emissions at recent United Nations Climate Change Conferences.[152]

2.107 However, the Australian Nuclear Free Alliance was critical of attempts to 'promote nuclear power as a response to the climate emergency'.[153] The Climate Change Authority similarly submitted:

> It is simply not feasible that nuclear energy could be brought online fast enough to replace Australia's retiring coal-fired power stations and contribute to cutting emissions in the next two decades – the critical window for limiting climate harm while also maintaining grid reliability and security.[154]

2.108 The Cairns and Far North Environment Centre stated 'nuclear power is not a practical or timely solution',[155] because the Far North Queensland (FNQ) region is:

> …already experiencing the impacts of climate change, highlighting the urgent need for rapid emissions reductions by 2035 to protect the Great Barrier Reef, Wet Tropics Rainforest and our other unique ecosystems across FNQ.[156]

2.109 Noting the expected long deployment timeframe for nuclear power generation in Australia, Solutions for Climate Australia submitted that delays in emissions reductions until the late 2040s would mean 'catastrophic impacts would be almost certain' and, cautioned that it 'would take Australia out of international agreements on climate, likely triggering future trade restrictions and costs on Australia'.[157]

2.110 Climate Tasmania submitted 'developing nuclear power stations in Australia is way too slow to address climate change,'[158] and cautioned:

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149 Ms Constable, MCA, *Committee Hansard*, Perth, 17 December 2024, p. 1.
150 Ms Constable, MCA, *Committee Hansard*, Perth, 17 December 2024, p. 1.
151 Dr Barry Green, private capacity, *Committee Hansard*, Perth, 17 December 2024, p. 23.
152 See Ms Kirsty Braybon, private capacity, *Committee Hansard*, Adelaide, 5 December 2024, p. 12 and ANSTO, submission 823, p. 2.
153 Australian Nuclear Free Alliance, submission 332, p. [2].
154 Climate Change Authority, Submission 286, p. 2.
155 Cairns and Far North Environment Centre, Submission 310, p. [1].
156 Cairns and Far North Environment Centre, Submission 310, p. [1].
157 Solutions for Climate Australia, Submission 343, p. 7.
158 Climate Tasmania, Submission 282, p. 2.

> Selling nuclear power as a solution to climate change is really a recipe for greater greenhouse gas emissions by requiring continued coal, oil and gas burning rather than rapid deployment of renewables over the critical next few decades.[159]

2.111 The Climate Council of Australia submitted it would not be feasible to 'extend the life of Australia's ageing coal-fired' plants and ramp up the use of gas powered stations, to fill the transition time to the point where nuclear power is being successfully generated in Australia.[160]

2.112 On that topic, the Electrical Trades Union of Australia (ETU) noted the 'declining reliability of [coal power stations] as they reach the end of their life'.[161] It submitted that 'many power stations would require a complete rebuild to keep them open long enough for even the first nuclear reactor to be opened'.[162]

2.113 The Clean Energy Council submitted:

> Nuclear power would not be ready in time to substitute our aging coal-fired power fleet, creating further risks of higher energy prices, potentially supply-side shortfalls and jeopardising system reliability.[163]

2.114 The Australian Council of Trade Unions (ACTU) also cautioned that shifting focus to nuclear would depress overall energy investment, affecting supply and reliability.[164]

2.115 Mr Westerman, CEO, AEMO, highlighted that nuclear power would not be operational soon enough to address future energy reliability risks, emphasising the need for immediate investment in generation, storage, and transmission:

> … without additional investment in generation, storage and transmission, several states in the National Energy market will breach that regulated reliability standard over the decade ahead. I'm not here to debate the time line of nuclear. I don't think anyone is suggesting it would be here within the next couple of years for the first state to breach that reliability standard, and probably not in the 10-year period either.[165]

2.116 The Australian Marine Conservation Society expressed similar sentiments in its submission:

> Diverting investment and focus on building a nuclear industry, with its expense, extensive water demands, and long timelines, would delay the rollout of renewable energy that is already deployable and effective.[166]

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159 Climate Tasmania, Submission 282, p. 2.
160 Climate Council of Australia, Submission 428, pages 4, 8, 11 and 19.
161 Electrical Trades Union of Australia (ETU), Submission 396, p. [2].
162 ETU, Submission 396, p. [2]. See also: Australian Aluminium Council, submission 143, p. 4.
163 Clean Energy Council, submission 230, p. 2.
164 ACTU, Submission 338, p. 1.
165 Mr Daniel Westerman, CEO, AEMO, *Committee Hansard*, Canberra, 24 October 2024, p. 39.
166 Australian Marine Conservation Society, submission 184, p. [2]. See also Climate Council of Australia, Submission 428, p. 18.

Barriers to the redeployment of the coal workforce to nuclear power plants

2.117 The Committee received evidence on the feasibility of transitioning the coal power plant workforce to nuclear plants, as coal plants are decommissioned by 2038.

2.118 Professor Jacopo Buongiorno, Director, Science and Technology, Nuclear Reactor Laboratory, Massachusetts Institute of Technology; and Director, Center for Advanced Nuclear Energy Systems, Massachusetts Institute of Technology, told the Committee that in addition to the benefit of reusing infrastructure from coal plants for nuclear plants, 'you also get to rehire the workforce', although he noted retraining is necessary due to the differences between coal and nuclear plants.[167]

2.119 However, many submitters and witnesses questioned the credibility of 'big promises [that] have been made about job creation',[168] and identified critical barriers to the viability of transitioning of coal jobs to the nuclear sector, such as the changing nature and number of jobs, and the timing of the availability of jobs if nuclear plants were to be built. These issues are canvassed below.

2.120 Firstly, on the nature and number of jobs, Mr Trevor Woolley, a retired engineer with experience in the electrical supply industry, appearing in a private capacity, told the Committee that 'technology will change jobs and remove jobs',[169] and noted:

> The average job in a coal-fired plant is all about materials handling. It's about ash, dust, coal and milling. Those don't exist anymore. I don't think a lot of people really add up the number of jobs that aren't going to be there in a nuke. They're different types of jobs, but a lot of the jobs aren't going to exist.[170]

2.121 In its submission, the ETU included its 2024 *Nuclear Power Report*, which noted the declining workforce requirements of the nuclear sector over time compared to renewables:

> The average 1GW nuclear reactor needs approximately 3,500 jobs at the construction peak and approximately 400 direct jobs once its operating. However, because the regulation, building and development phases are riddled with so many problems, those jobs are not guaranteed. Even if they are built, we would not see the first nuclear reactor job until at least 2040.[171]

2.122 The ETU's report stated that, in comparison, 'By 2030 there will be more than 1.8 million people employed in renewable energy jobs, growing to over 2.2 million by 2050'.[172] The ACTU's submission also stated:

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167 Professor Jacopo Buongiorno, Director, Science and Technology, Nuclear Reactor Laboratory, Massachusetts Institute of Technology (MIT); and Director, Center for Advanced Nuclear Energy Systems, MIT, *Committee Hansard*, Canberra, 18 November 2024, p. 7.

168 Mr Sherrell, ACTU, *Committee Hansard*, Sydney, 12 December 2024, p. 1.

169 Mr Trevor Woolley, private capacity, *Committee Hansard*, Muswellbrook, 10 December 2024, p. 3.

170 Mr Woolley, *Committee Hansard*, Muswellbrook, 10 December 2024, p. 2.

171 *World Nuclear Report*, p. 12, included in ETU submission 396, p. [17].

172 *World Nuclear Report*, p. 12, included in ETU submission 396, p. [17].

> … the jobs created [in nuclear power plants] … would represent only a fraction of the jobs that would have been created through equivalent investment in renewables, and would pose dangerous, long-term health risks for workers.[173]

2.123 Secondly, on the timing of the availability of jobs in nuclear plants, Mr Robin Williams, District President, Northern Mining and NSW Energy District, Mining and Energy Union stated:

> Our members won't have a nuclear industry to go to. My understanding is that it'll take in excess of 15 years. We have people who are losing their jobs in 2027. Bayswater Power Station closes in 2033, if not before, and we've got the Mount Arthur coal mine closing in 2030. Their nuclear jobs are not there; there are no jobs.[174]

2.124 Finally, on the risk jobs may never eventuate, Mr Daniel Sherrell, Senior Climate and Energy Policy Officer, ACTU, stated:

> … the reality is that nuclear power is unlikely to ever create a single job in Australia, for the simple fact that the economics don't stack up. Every single nuclear project that has commenced construction in a comparable economy over the past 20 years has been subject to massive cost blowouts and long delays.[175]

Committee comment

2.125 It is clear to the Committee from the evidence it received that there would be significant challenges associated with establishing a nuclear power generation sector in Australia before the mid-2040s, at the earliest.

2.126 While the Committee received evidence from some submitters about the shifting nature of the public's perception of nuclear power in Australia and globally, it observed that overall, there continues to be a lack of broad support for nuclear power generation in Australia. The Committee also received compelling evidence about the historic challenges and potentially long timeframes to obtain social licence for siting nuclear facilities, including power plants and waste facilities, and the need to consult and gain consent prior to making announcements about locations.

2.127 The Committee heard it could take up to a decade to lift the moratorium on nuclear power generation and establish an enabling regulatory environment for a new nuclear power industry, even recognising the skills and expertise of Australia's existing nuclear industry. Australia's lack of nuclear power generation construction supply chain, experience and workforce capacity undermine its capacity to quickly deploy a new civil nuclear power sector. Further, SMRs do not yet exist at a level of commercial readiness suitable for contemplating their deployment.

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173 ACTU, Submission 338, p. 1.

174 Mr Robin Williams, District President, Northern Mining and NSW Energy District, Mining and Energy Union, *Committee Hansard*, Muswellbrook, 10 December 2024, p. 19.

175 Mr Sherrell, ACTU, *Committee Hansard*, Sydney, 12 December 2024, p. 1.

2.128 Many submitters and witnesses also drew the Committee’s attention to the frequent history of delays in nuclear power builds internationally, particularly for countries commencing a new nuclear power program.

2.129 Based on these timeframes, the Committee has formed an interim view that there is limited utility in pursuing nuclear power at this point as it cannot be deployed in time to support Australia's critical energy transition targets and climate commitments, or to assist the coal workforce and communities in their transition away from the coal industry.

3. Cost of nuclear power generation in Australia

3.1 This chapter explores evidence the Committee received on the potential cost of deploying nuclear power generation in Australia.

3.2 Specifically, this chapter considers evidence on:

- cost estimates for the deployment of nuclear power in Australia in light of factors determining deployment cost estimates applicable to the Australian context;
- the risk of cost blowouts during construction and various critical costs not factored into current estimates that would need to be further interrogated to understand the full cost of nuclear power generation in Australia; and
- the appetite for private investment in the nuclear power industry.

3.3 The chapter concludes with Committee comment on the issue of costs for the deployment of nuclear power generation in Australia.

Cost estimates and influencing factors

Deployment cost estimates

3.4 The Committee received evidence on cost estimates for nuclear power deployment in Australia, much of which included comparisons to the cost of other power generation technologies.

3.5 In its submission, SMR Nuclear Technology Pty Ltd listed various capital costs for recent nuclear builds:

> The capital cost of a nuclear power plant built since 2000 varies between A$4,323/kW in South Korea to A$20,883 in the UK [United Kingdom], average cost A$9,574/kW. For comparison, the GenCost 2023-24 report Table B.9 lists the 2023 cost of a large reactor as A$8,655/kW.[1]

3.6 SMR Nuclear Technology Pty Ltd also pointed to:

1 SMR Nuclear Technology Pty Ltd, Submission 272, p. 10.

> Modelling by the Australian consultancy Electric Power Consulting of Kiama in 2018 showed that the cost of a system with 100% renewables would be more than 4 times the cost of a system where coal was replaced by nuclear.[2]

3.7 However, comparing the cost of renewables with nuclear power, Mr Kane Thornton, Chief Executive Officer (CEO) at the Clean Energy Council also told the Committee that 'nuclear power has a materially higher cost than the alternatives here in Australia'.[3] Similarly, Australian Council of Trade Unions (ACTU) submitted nuclear power 'is at least twice and up to six times more expensive than the cheapest sources, wind and solar'.[4]

3.8 When he appeared before the Committee, Dr Peter Mayfield, Executive Director, Environment, Energy and Resources at Commonwealth Scientific and Industrial Research Organisation's (CSIRO) referred to the *GenCost 2023-2024: Final Report's* (GenCost) cost estimates for nuclear deployment.[5] He explained the report does two things:

> One is that we provide updated estimates and projections on the capital cost, and then we also do a fairly simple levelised cost electricity analysis, which is looking at what it costs to recover your capital—the cost of selling electricity to recover your capital. That's what's reported in *GenCost*, and that number would be higher than currently for firmed PV and solar.[6]

Box 3.1 GenCost 2023-2024 costings

The GenCost 2023-2024 report by CSIRO and Australian Energy Market Operator (AEMO), projects the cost and timeframe of different types of power generation and storage in Australia.[7] The 2023-2024 report provides detailed cost estimates for nuclear power in Australia for large scale nuclear reactors and small modular reactors.

The report found that the capital cost for nuclear power is higher than for renewable power sources. Specifically, the estimated capital cost for nuclear power is approximately A$8,600 per kW for a large scale nuclear and A$22,700 per kW for nuclear SMR in 2025, compared to approximately A$1,400 to A$2,800 per kW for some types of solar and wind power generation technology respectively.[8] The report also noted international nuclear projects have experienced cost increases.[9]

2 SMR Nuclear Technology Pty Ltd, Submission 272, p. 10.
3 Mr Kane Thornton, Chief Executive Officer (CEO), Clean Energy Council, *Committee Hansard*, Melbourne, 4 December 2024, p. 51.
4 Australian Council of Trade Unions (ACTU), Submission 338, p. 1.
5 Dr Peter Mayfield, Executive Director, Environment, Energy and Resources, Commonwealth Scientific and Industrial Research Organisation (CSIRO), *Committee Hansard,* Canberra, 24 October 2024, p. 45.
6 Dr Mayfield, CSIRO, *Committee Hansard,* Canberra, 24 October 2024, p. 48.
7 Paul Graham; Jenny Hayward, James Foster, *GenCost 2023–24: Final Report,* May 2024.
8 Paul Graham; Jenny Hayward, James Foster, *GenCost 2023–24: Final Report,* May 2024, p. 82.
9 Paul Graham; Jenny Hayward, James Foster, *GenCost 2023–24: Final Report,* May 2024, pages 27 and 31.

The report found that while nuclear power is technically feasible, it is not currently cost-competitive with renewable power sources in Australia.[10]

3.9 In their submission, the Electrical Trade Union of Australia (ETU) included their *Nuclear Energy Report*, which noted GenCost:

> … estimates that building a 1,000-megawatt nuclear reactor in Australia would cost up to [A]$17 billion. This is 1.5-3 times the cost per kw/h of coal and 4-8 times the cost per kw/h of solar, when considering 'first of a kind' premiums.[11]

3.10 However, Dr Adrian Paterson, Founder and Principal, Siyeva Consulting was critical that GenCost is 'based on the levelised cost of electricity' which he suggested should not be relied on.[12]

3.11 Similarly a joint submission on behalf of Macquarie University's Transforming Energy Markets Research Centre (TEM) focused on a 'total system cost' and was critical of 'The use of the Levelised Cost of Energy (LCoE) metric to compare one generation technology with another in a vacuum, rather than as parts of a system'.[13] They cautioned that in thinking about power costs, 'Discounted cash flow methods (including NPV and LCoE) must be used with great care and are neither investment-grade nor policy-level single-metric decision tools'.[14]

3.12 Mr John Grimes, CEO, Smart Energy Council also reflected on the estimates in GenCost. Referring to the Federal Coalition's (the Coalition) proposed plan, Mr Grimes advised the Committee that:

> Based on the CSIRO and AEMO's 2024 GenCost report, the capital cost for replacing those 11-gigawatt-capacity coal-fired stations with five large nuclear reactors and two small nuclear reactors in 2030, the proposed but unrealistic timeframe, would be, at a minimum, $116 billion.[15]

3.13 Mr Grimes also explained the Smart Energy Council had modelled the nuclear proposal from the Coalition and found that the cost could actually be up to '[A]$600 billion'. He added:

> In fact, we think it could probably be more than that. That is a cost that's going to go onto the power bills of everyday Australians. If the coalition is interested in the cost of living, in electricity bills and in bringing costs down for the Australian people, this is the very last thing the government would do. It's outrageous to

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10 Paul Graham; Jenny Hayward, James Foster, *GenCost 2023–24: Final Report,* May 2024, pages x, xii and 18.

11 *Nuclear Energy Report*, p. 5, included in Electrical Trades Union of Australia (ETU), Submission 396, p. [10].

12 Dr Adrian Paterson, Founder and Principal, Siyeva Consulting, *Committee Hansard*, Canberra, 28 October 2024, p. 25.

13 Macquarie University Transforming Energy Markets Research Centre (TEM), Submission 782, pages 5–6.

14 Macquarie University TEM, Submission 782, p. 6.

15 Mr John Grimes, CEO, Smart Energy Council, *Committee Hansard*, Canberra, 28 October 2024, p. 13.

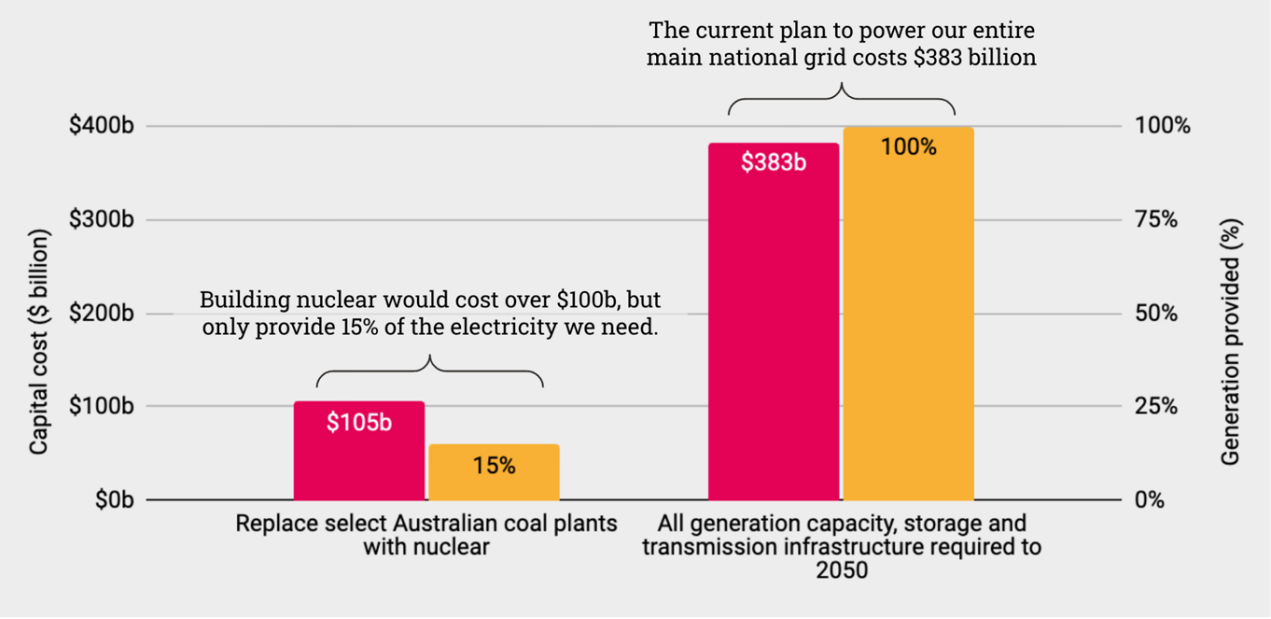
subsidise nuclear energy and to retard and hold back renewable rollout and investment.[16]

3.14 Building on the analysis by the Smart Energy Council, the Climate Council of Australia considered the cost of a nuclear build and the amount of power generated compared to other power sources in its submission. It stated:

> Across Australia, building 11 GW of nuclear capacity would cost at least $116 billion, and up to $600 billion dollars (Smart Energy Council, 2024). But despite this price tag, nuclear wouldn't provide anywhere near the amount of electricity we need. For example, nuclear reactors would only provide about 15% of the power needed in the NEM by 2050, at a minimum cost of approximately $105, and up to $540 billion. Australia's current plan can meet 100% of our electricity needs for $383 billion, while nuclear would meet less than one-sixth, for a minimum of $105 billion...[17]

3.15 The submission from the Climate Council of Australia also included a graph (see Figure 3.1) that showed, 'Building nuclear reactors would provide less than one-sixth of the generation we need, at a cost of over $100 billion'.[18]

Figure 3.1 Nuclear reactor generation and cost



Source: Climate Council of Australia, Submission 428, p. 15.

3.16 The Clean Energy Council submitted that:

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16 Mr Grimes, CEO, Smart Energy Council, *Committee Hansard*, Canberra, 28 October 2024, p. 13.

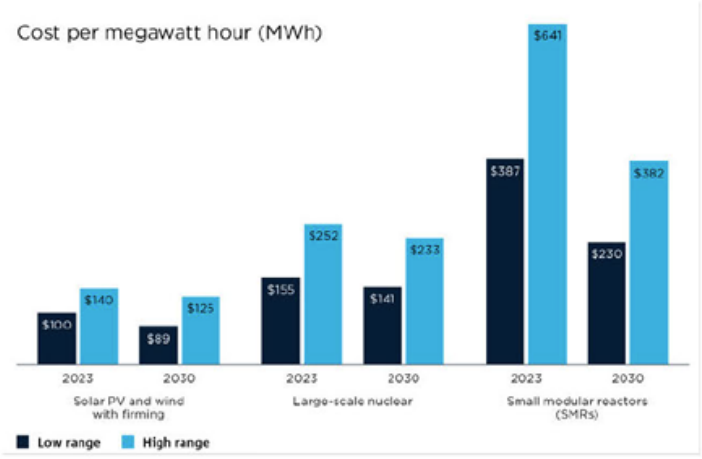
17 Quotation originally made in Climate Council of Australia, Submission 428, p. 14, corrected in Climate Council of Australia, Submission 428.1, p. 14.

18 Climate Council of Australia, Submission 428, p. 15.

> … nuclear power represents the highest cost electricity generation option for Australia across several factors including levelized (sic) cost of electricity (LCOE) and total cost of technology deployment.[19]

3.17 The submission included the below graph (Figure 3.2) showing the difference in costs between different sources of power:

Figure 3.2. Comparative cost per megawatt hour of different energy technologies



Source: CSIRO, GenCost 2023-24 Report[4]

Clean Energy Council, Submission 230, p. 4.

3.18 The Committee received further evidence on the impact of the cost of the deployment of nuclear power on power bills.

3.19 Ms Johanna Bowyer, Lead Analyst, Australian Electricity, Institute for Energy Economics and Financial Analysis (IEFFA) told the Committee that 'Nuclear is one of the most expensive forms of electricity generation',[20] and pointed to analysis published in IEFFA's September 2024 report, *Nuclear in Australia would increase household power bills,* that showed the deployment of nuclear power would increase 'household electricity bills an average of [A]$665 per year'.[21]

3.20 IEFFA's submission also referred to its report's other finding that 'The cost of electricity generated from nuclear plants would likely be 1.5 to 3.8 times the current cost of electricity generation in eastern Australia'.[22] It included graphical analysis of the impact on household electricity bills in countries that have adopted nuclear power (see Figure 3.3).

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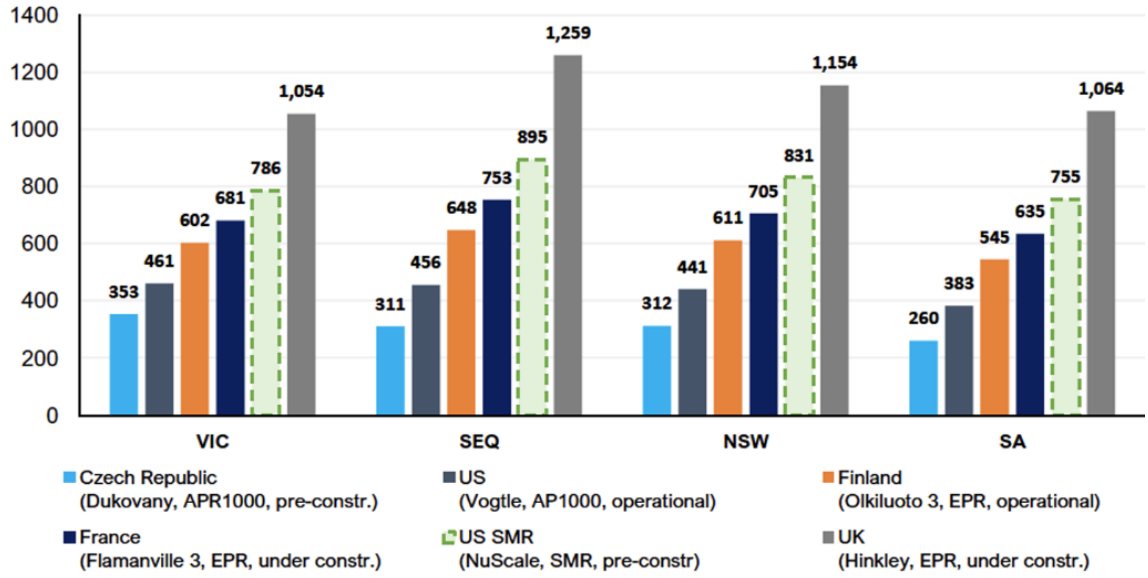
19 Clean Energy Council, Submission 230, p. 3.

20 Ms Johanna Bowyer, Lead Analyst, Australian Electricity, Institute for Energy Economics and Financial Analysis (IEFFA), *Committee Hansard*, Melbourne, 4 December 2024, p. 40.

21 Ms Bowyer, IEEFA, *Committee Hansard*, Melbourne, 4 December 2024, p. 35.

22 IEFFA, Submission 7, p. 2.

Figure 3.3 Increase in typical household electricity bill to recover cost of nuclear plants based on different countries' experience (AUD/year)



Source: IEEFA, Submission 7, p. 4.

3.21 The Committee received evidence on the cost feasibility of integrating nuclear power into a firmed 'high-VRE [variable renewable energy] grid'.[23] Ms Bowyer of IEFFA advised the Committee:

> One of the challenges with nuclear is that it needs to run almost all the time in order for its financials to work out. If it runs at a lower capacity factor, then the average cost of electricity from those plants is extremely high. So it doesn't actually complement a renewables based grid very well because renewables are variable. We want more dynamic energy resources to complement those renewables and bring the overall system cost down.[24]

3.22 The Climate Council of Australia noted 'the federal Coalition has indicated that nuclear reactors would run on a continuous basis close to their maximum capacity'.[25] Further, it speculated that to recoup on the 'operational and capital costs [of nuclear deployment], the government may need to force renewables to be turned off to accommodate nuclear generation, and/or guarantee a particular price for nuclear generation'.[26]

3.23 The ACTU posited that nuclear power generation could 'forc[e] millions of Australians to turn off their cheap rooftop solar, a double blow during a cost-of-living crisis'.[27]

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23 Clean Energy Investor Group, Submission 229, p. 2.

24 Ms Bowyer, IEEFA, *Committee Hansard*, Melbourne, 4 December 2024, p. 40. See also: Clean Energy Investor Group, Submission 229, p. 6.

25 Climate Council of Australia, Submission 428, p. 16.

26 Climate Council of Australia, Submission 428, p. 16.

27 ACTU, Submission 338, p. 1.

Factors impacting on cost estimates for Australia

3.24 This section canvasses evidence from submitters and witnesses on some of the key factors that would impact on timeframes for Australia, including:

1 Jurisdictional factors such as Australia's democratic political ideology and lack of 'experience in building or operating nuclear power plants';[28]

2 The reactor design chosen and its build history; and

3 The scale of a potential nuclear program in Australia.

Jurisdictional factors

3.25 In its submission, the Australian Nuclear Science and Technology Organisation (ANSTO) noted the International Atomic Energy Agency's (IAEA) guidance that, 'the costs of new nuclear power plants are highly specific and vary across countries'.[29]

3.26 SMR Nuclear Technology Pty Ltd's submission explained nuclear build costs are influenced by country specific factors, including labour and material costs and the efficiency of the country's regulators.[30]

3.27 During his appearance, Mr Gerard Holland, CEO at the Page Research Centre stated that costs of nuclear builds in the United Arab Emirates and South Korea were 'cheaper than what *GenCost* predicts'.[31] As noted in Chapter 2, some witnesses suggested that countries that have different political ideologies and labour conditions to Australia may not be directly applicable for making estimates for the Australian context.[32]

3.28 On the impact on cost from the nuclear maturity of a jurisdiction, ANSTO submitted 'the IAEA advises that the costs of new nuclear power … will reduce with the maturity of a country's nuclear industry'.[33] The Australian Energy Council noted 'International experience indicates nuclear project costs can escalate significantly, especially when building for the first time'.[34]

3.29 Mr Paul Graham from CSIRO informed the Committee that GenCost found countries like Australia, which lack recent experience in nuclear power, may face higher costs due to a 'first-of-a-kind premium,' that 'can be up to 100 per cent'.[35]

3.30 Mr Simon Holmes à Court, an Australian businessperson and political activist, also advised the Committee that 'Even with a mature design, the first [reactor] built in

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28 Australian Energy Council, Submission 317, p. [1].
29 Australian Nuclear Science and Technology Organisation (ANTSO), Submission 823, p. 13.
30 SMR Nuclear Technology Pty Ltd, Submission 272, p. 11.
31 Mr Gerard Holland, CEO, Page Research Centre, *Committee Hansard*, Sydney, 12 December 2024, p. 22.
32 See: Mr Graham, Chief Economist, Energy, CSIRO, *Committee Hansard*, Canberra, 24 October 2024, p. 46; Professor John Quiggin, private capacity, *Committee Hansard*, Brisbane, 15 November 2024, p. 28.
33 ANSTO, Submission 823, p. 13.
34 Australian Energy Council, Submission 317, p. [1].
35 Mr Graham, CSIRO, *Committee Hansard*, Canberra, 24 October 2024, p. 52.

Australia would encounter significant first-of-a-kind costs. A 100 per cent premium would not be unusual'.[36]

3.31 Professor John Quiggin, appearing in a private capacity, told the Committee that currently, 'the economics simply don't favour new nuclear power plants'.[37] On small modular reactors specifically, he advised, 'the economic risk is that no project of this kind has ever been constructed [in Australia]. First-of-a-kind projects have a huge range of issues'.[38]

Choice of design

3.32 SMR Nuclear Technology Pty Ltd stated that nuclear build costs vary based on design factors including supply chain efficiency, reactor type and modularisation, if the design is completed prior to construction, and whether the reactor is a First of a Kind (FOAK).[39]

3.33 On choice of design, the Australian Nuclear Association compared the costs of recent international projects. It stated in its submission that while there had been 'cost overruns' in 'recent construction of some first-of-a-kind power reactors in Finland, France and the USA [United States of America]. … Nuclear power reactors built in China, South Korea and United Arab Emirates [UAE] have been built on time and at much lower costs'.[40]

3.34 In his testimony, Mr Shaun Jenkinson, CEO of ANSTO noted, 'first-of-a-kind of anything is always subject to a bit of variability. As these things become developed, they come down in cost'.[41]

3.35 The Australian Nuclear Association recommended:

> Nuclear power plants for Australia should have identical reactors built in sequence and of a design already built and licensed overseas. It will be important for the Australian nuclear regulator to approve the design before construction starts.[42]

3.36 Ms Patty Durand, President, Cool Planet Solutions expressed scepticism about the claim that nuclear costs will be reduced following FOAK builds:

> I hear a lot of people saying that this [Vogtle] was a FOAK—a first-of-a-kind—and that future AP1000s [large reactors] would be less expensive because we've learnt how to do it now and we have the design completed. None of that is true.

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36 Mr Simon Holmes à Court, private capacity, *Committee Hansard*, Sydney, 12 December 2024, p. 19.
37 Professor John Quiggin, private capacity, *Committee Hansard*, Brisbane, 15 November 2024, p. 24.
38 Professor Quiggin, private capacity, *Committee Hansard*, Brisbane, 15 November 2024, p. 28.
39 SMR Nuclear Technology Pty Ltd, Submission 272, p. 11. See also: Australian Nuclear Association, Submission 180, p. 3.
40 Australian Nuclear Association, Submission 180, pages 2–3.
41 Mr Shaun Jenkinson, CEO, ANSTO, *Committee Hansard*, Canberra, 24 October 2024, p. 31.
42 Australian Nuclear Association, Submission 180, p. 3.

> Nuclear energy is the only technology that has never gone down in cost. It has always gone up, unlike renewables like wind and solar, which have dropped 90 per cent in the last 10 years; storage, which has also dropped precipitously and the technology has improved tremendously; and other programs that are part of the modern grid now...[43]

3.37 Mr Graham of CSIRO similarly noted that 'the cost of solar has dropped by about 90 per cent since 2010, and the cost of wind by about 75 per cent'.[44] In contrast, Mr Rod Campbell, Research Director at The Australia Institute, testified that 'Nuclear energy has not declined in cost or utility'.[45]

3.38 In his testimony, Mr Holmes à Court reflected on the design assumptions behind costings for the deployment of nuclear in Australia from the *GenCost 2024-25 Consultation Draft* published in December 2024, which 'listed a nuclear nth-of-a-kind cost of nearly [A]$9,000 a kilowatt'.[46]

3.39 Mr Holmes à Court referred to speculation that the nearly A$9,000 figure was 'too high and we should be using costs that are 60 per cent lower'.[47] In his view, the GenCost estimates underestimate the potential cost of nuclear deployment in Australia because, 'CSIRO is not presenting next-of-a-kind but rather nth-of-a-kind'.[48]

3.40 Mr Holmes à Court explained 'Nth-of-a-kind is the cost you pay when there is a warm supply chain—one that has built a number of units without delays between, one after the other after the other'.[49] He observed:

> CSIRO's modelling [in the *GenCost* report] is very simplistically based on the experience of South Korea, which has enjoyed a well-established nuclear industry that has constructed 30 reactors over almost 50 years.[50]

3.41 To support his view, Mr Holmes à Court cited 'a recent MIT study [that] confirms that CSIRO is in the ballpark of NOAK, or nth-of-a-kind, but they estimate the next-of-a-kind units would cost between A$13,000 and A$16,000 per kilowatt, and that's with a warm supply chain'.[51] Factoring in the potential '100 per cent premium' FOAK cost for new countries commencing a nuclear program, he concluded:

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43 Ms Patty Durand, President, Cool Planet Solutions, *Committee Hansard*, Canberra, 25 November 2024, p. 2.
44 Mr Graham, CSIRO, *Committee Hansard*, Canberra, 24 October 2024, p. 49.
45 Mr Rod Campbell, Research Director, The Australia Institute, *Committee Hansard*, Canberra, 28 October 2024, p. 49.
46 Mr Holmes à Court, private capacity, *Committee Hansard*, Sydney, 12 December 2024, p. 19.
47 Mr Holmes à Court, private capacity, *Committee Hansard*, Sydney, 12 December 2024, p. 19.
48 Mr Holmes à Court, private capacity, *Committee Hansard*, Sydney, 12 December 2024, p. 19.
49 Mr Holmes à Court, private capacity, *Committee Hansard*, Sydney, 12 December 2024, p. 19.
50 Mr Holmes à Court, private capacity, *Committee Hansard*, Sydney, 12 December 2024, p. 19. See also: IEFFA, Submission 7, pages 6–7.
51 Mr Holmes à Court, private capacity, *Committee Hansard*, Sydney, 12 December 2024, p. 19.

> … if the cost of [Australia's] first unit were double CSIRO's nth-of-a-kind [estimate], it would be the cheapest nuclear built in the Western world this century.[52]

Small Modular Reactor designs are not yet commercially viable and costs are uncertain

3.42 The Committee also received evidence on the estimated cost to build Small Modular Reactors (SMRs) in Australia specifically.

3.43 The Committee heard there is increasing private sector interest in SMRs. Nuclear Energy Institute submitted:

> … U.S. companies are pursuing plans [that] are centered on reactor[s] that are smaller and more modular. These simpler designs should enable shorter construction and enable projects to come online more quickly, reducing capital costs.[53]

3.44 Rolls Royce SMR Limited submitted that their 'factory-built' designed SMRs are 'more affordable, can be co located closer to infrastructure or demand centres, have shorter build times and reduced financing costs'.[54] However, in their submission, the Blueprint Institute stated that:

> In 2019, the Rolls-Royce SMR prototype was estimated to cost £1.5 billion—but this number has blown out to £4.37 billion in 2022. The NuScale reactor has faced similar cost blowouts.[55]

3.45 Mr Gerard Holland of the Page Research Centre also acknowledged that, 'whilst SMRs are exciting, they aren't necessarily the cheapest pathway for Australia'.[56] He advised that large nuclear reactors 'seems to be the most cost-effective way to do it'.[57]

3.46 The Blueprint Institute criticised claims that SMRs could be 'much less expensive to build than traditional nuclear power plants', noting:

> … in energy production what matters is not the cost per plant, but the cost per megawatt of generation capacity. Thus while it may be cheaper to build one SMRs than a traditional reactor, they also produce less energy, thus, the per unit cost of producing energy for SMRs as measured by LCOE for SMRs is higher, approximately $387/MWh-641/MWh than for large-scale nuclear power which was $155/MWh-252/MWh in 2023.[58]

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52 Mr Holmes à Court, private capacity, *Committee Hansard*, Sydney, 12 December 2024, p. 19.
53 Nuclear Energy Institute, Submission 360, p. 4.
54 Rolls-Royce SMR, Submission 355, p. [2].
55 Blueprint Institute, Submission 369, p. 20.
56 Mr Holland, Page Research Centre, *Committee Hansard*, Sydney, 12 December 2024, p. 22.
57 Mr Holland, Page Research Centre, *Committee Hansard*, Sydney, 12 December 2024, p. 22.
58 Blueprint Institute, Submission 369, pages 19–20.

3.47 In their submission, the ETU included their *Nuclear Power Report* which stated that the cost of energy produced by SMRs is 'forecast to be vastly more expensive than energy produced through any other means, with the CSIRO estimating that it would cost [A]$28,581 per kilowatt'.[59] The report explained this cost is:

> … nearly eighteen times more expensive than energy produced by large-scale solar, and more than double that of energy produced by coal - that is, assuming Small Modular Reactors ever become commercially viable in the first place.[60]

3.48 The Clean Energy Council pointed to the GenCost report finding that SMRs 'would be the highest cost solution for supplying Australia's electricity needs'.[61] They elaborated:

> We acknowledge it is difficult to estimate the final LCOE produced by theoretical SMR technology however, CSIRO acknowledged it is likely that Australia would experience higher costs due to the absence of an existing nuclear industry.[62]

3.49 The Clean Energy Investor Group also noted SMRs are not 'commercially viable in any Western country'.[63] They submitted:

> The lack of SMR development in Western nations means there is no proven evidence of their secure, reliable operation or feasibility. Additionally, there is no data available to support claims about SMR operating costs when used as operating power stations.[64]

3.50 In his submission, Professor Quiggin also noted that the 'profusion' of SMRs designs means there are not yet cost efficiencies from the large-scale production of specific SMR designs that 'capture the entire market'.[65]

3.51 Boundless Earth submitted that as SMR technology 'remains largely theoretical and unproven at scale' it is an 'unreliable solution for Australia's immediate power needs'.[66] It summarised, 'The promise of SMRs delivering quick, cost-effective nuclear power is not supported by real-world evidence'.[67]

Scale of program and potential for efficiencies

3.52 The Committee received evidence contemplating whether the cost of nuclear power deployment may reduce over time or over different project scales.

3.53 Appearing in a private capacity, Ms Helen Cook, a nuclear power consultant, posited that time and cost efficiencies can be achieved from a 'fleet approach' where if by

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59 *Nuclear Power Report*, p. 19, included in ETU Submission 396, p. [24].
60 *Nuclear Power Report*, p. 19, included in ETU Submission 396, p. [24].
61 Clean Energy Council, Submission 230, p. 4.
62 Clean Energy Council, Submission 230, p. 4.
63 Clean Energy Investor Group, Submission 229, p. 6.
64 Clean Energy Investor Group, Submission 229, p. 7.
65 Professor John Quiggin, Submission 3, p. [5].
66 Boundless Earth Limited, Submission 399, p. [1].
67 Boundless Earth Limited, Submission 399, p. [1].

'build[ing] the same technology over and over and over again, time to build comes down and cost comes down'.[68]

3.54 Similarly, the Nuclear Energy Institute submitted that 'The experience in countries that have had sustained programs of new construction, such as Japan and South Korea, have seen much lower deployment costs'.[69]

3.55 Offering an opposing view, in its submission, IEFFA stated, 'there will be limited scope to achieve learning-based cost reductions like those seen in a large continuous build program' due to the 'small size of any potential Australian nuclear build out program'.[70]

3.56 Further, the Josephite Justice Office submitted that while there may be some cost savings from reusing coal power infrastructure, 'no coal power plants have been repurposed as have nuclear plants in the US or the UK, so purported synergies and cost savings are speculative'.[71]

History of cost blowouts for nuclear builds

3.57 Various submitters raised the history of 'cost blowouts',[72] in the nuclear power sector. Mr Graham of CSIRO advised that while cost blowouts 'can happen to any technology':

> The nuclear industry is maybe just a little bit more susceptible because it's such a long lead time and long construction period that circumstances can change during the construction...[73]

3.58 Mr Holmes à Court referred to analysis by Danish megaproject expert Bent Flyvbjerg, which showed, 'billion-dollar projects habitually blow out in cost and schedule. In [the] list of 25 project types, nuclear power comes in as the third worst, with an average cost overrun of 120 per cent'.[74]

3.59 In its submission, IEFFA stated the 'capital costs (excluding financing costs) of recent nuclear power builds have tended to blow out by a factor of between 1.7 and 3.4'.[75]

3.60 Mr Grimes of the Smart Energy Council detailed time and cost blowouts in recent nuclear builds in experienced nuclear countries overseas:

> In the UK, the cost of the Hinkley C nuclear plant currently under construction has now blown out to $92 billion for a single nuclear reactor. It was originally

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68 Ms Helen Cook, private capacity, *Committee Hansard*, Sydney, 12 December 2024, p. 48.
69 Nuclear Energy Institute, Submission 360 p. 4.
70 IEFFA, Submission 7, p. 6.
71 Josephite Justice Office, Submission 838, p. [4].
72 Independent and Peaceful Australia Network, Submission 384, p. [3]. See also: Ms Bowyer, IEEFA, *Committee Hansard*, Melbourne, 4 December 2024, p. 35; Mr Theo Theophanous, private capacity, *Committee Hansard*, Melbourne, 4 December 2024, p. 56.
73 Mr Graham, CSIRO, *Committee Hansard,* Canberra, 24 October 2024, p. 52.
74 Mr Holmes à Court, private capacity, *Committee Hansard*, Sydney, 12 December 2024, p. 19.
75 IEFFA, Submission 7, p. 6.

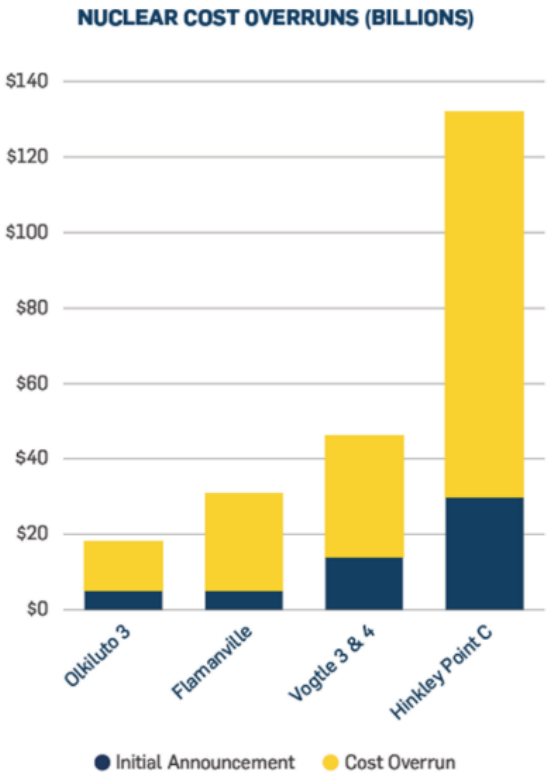
promised in 2007. Britons were told that they would be cooking Christmas turkey with nuclear energy by 2017. It's now hoped that that project will come online not in 2017 but in 2031. This is a country that has done nuclear for a very long time. In the US, the Vogtle nuclear power station had a $45 billion cost for a single reactor. It was seven years late and $17 billion over budget.[76]

3.61 Reflecting on the nuclear build in the UAE, Mr Holmes à Court remarked:

> … there is no reliable, verifiable and complete information on the project finances in the public domain, but it is hard to believe that a project can be four years late and yet come in on budget.[77]

3.62 In the *Nuclear Energy Report*, included in their submission, the ETU showed the cost blowouts from recent overseas nuclear builds in the below graph (see Figure 3.4).[78]

Figure 3.4 Nuclear cost overruns (billions)



Source: Electrical Trade Unions of Australia, Submission 396, p. [14].

3.63 Factoring in the impact of cost blowouts on estimates, Mr Grimes of the Smart Energy Council cautioned:

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76 Mr Grimes, Smart Energy Council, *Committee Hansard*, Canberra, 28 October 2024, p. 13.
77 Mr Holmes à Court, Submission 478, p. 5.
78 *Nuclear Energy Report*, p. 9, included in Electrical Trades Union of Australia (ETU), Submission 396, p. [14]].

> So what we see right around the world is that the costs are enormous, the engineering risks are extreme and the timeframes blow out. In the Australian context, we actually think that closer to a trillion dollars is an absolutely defensible estimate based on what we're learning more and more.[79]

3.64 Using the Smart Energy Council's 'cost estimates of [A]$116 billion and [A]$600 billion respectively', the Climate Council of Australia calculated:

> If funded through tax, nuclear reactors would cost Australia's 13.6 million taxpayers at least [A]$8,562 each, and up to [A]$44,118, if Australia saw the cost blowouts common in other countries.[80]

3.65 The Clean Energy Council noted recent cost blowouts in 'countries with established nuclear industries'.[81] They cautioned:

> Even though it is difficult to estimate the capital cost to deploy technologies that we do not have in Australia, we can observe the current risk and costs of large-scale nuclear generation deployed overseas.[82]

3.66 Professor Quiggin flagged the risk that Australia will, 'repeat the experience of other countries that have attempted this and the projects [Australia will] engage in will have massive cost overruns and perhaps be abandoned altogether'.[83]

Estimates do not account for other critical costs

3.67 Appearing in a private capacity, Mr Theo Theophanous, former energy and industry minister for the state of Victoria between 2002 and 2009, told the Committee that he did not think nuclear 'can be justified even on a cost basis right now'.[84] He speculated that 'some of the costs that have been put up by the CSIRO and other bodies don't take into account the full costs'.[85]

3.68 Mr Graham of CSIRO confirmed that 'Anyone who reads *GenCost* and looks at the levelised costs of electricity needs to know that there may be additional costs, such as decommissioning, that aren't included'.[86]

3.69 In its submission, the Clean Energy Council referred to analysis it had commissioned from Egis comparing the levelised cost of power across different technologies that:

> … confirmed large-scale nuclear energy is up to six times more expensive than renewable energy and that nuclear may be even higher cost than currently

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79 Mr Grimes, Smart Energy Council, *Committee Hansard*, Canberra, 28 October 2024, p. 13.
80 Climate Council of Australia, Submission 428, p. 15.
81 Clean Energy Council, Submission 230, p. 4.
82 Clean Energy Council, Submission 230, p. 4.
83 Professor Quiggin, private capacity, *Committee Hansard*, Brisbane, 15 November 2024, p. 28.
84 Mr Theophanous, private capacity, *Committee Hansard*, Melbourne, 4 December 2024, p. 54.
85 Mr Theophanous, private capacity, *Committee Hansard*, Melbourne, 4 December 2024, p. 54.
86 Mr Graham, CSIRO, *Committee Hansard*, Canberra, 24 October 2024, p. 50.

> forecast as waste management and plant decommissioning have been omitted by previous cost calculation research.[87]

3.70 On the cost of managing nuclear waste, Dr Jim Green, National Committee Member, Australian Nuclear Free Alliance, told the Committee that 'The South Australian royal commission estimated a cost of about [A]$140 billion for the establishment and long-term operation of a deep underground repository for high level nuclear waste'.[88] He put forward that for waste, 'Around the world, in countries like France and the UK, they've made very little progress, and their cost estimates double and double again'.[89]

3.71 Emergency Leaders for Climate Action also submitted that cost estimates likely do not include 'nuclear power station emergency planning and management', and noted:

> … States and Territories would be faced with significant costs purchasing land, building new fire stations, purchasing specialised fire engines and hazardous materials response equipment, then staffing the new stations with a minimum of four highly trained firefighters...[90]

3.72 On the topic of operation costs, a joint submission on behalf of Macquarie University's TEM Research Centre similarly submitted the 'High upfront capital costs of nuclear generation are more than offset by low operating costs and very long operating lives in the order of 60-80 years'.[91]

3.73 However, Dr Mayfield of CSIRO noted 'if you look at the recent retirements of nuclear reactors, most of them have gone about 41 years. I don't believe there's one that's gone for 80 years yet'.[92] His colleague Mr Graham expanded:

> For every extra 20 years… after the 40-year life, you've got to reinvest, so you've got to spend more money. So it's not spend the money now and then no more capital to spend for 80 years or 60 years. You've got to keep spending more capital on the life extensions… [I]f you're thinking about it from a consumer's perspective, and if it takes 15 years to build and then 30 years after that there's this supposedly low-cost running period for nuclear, that's 45 years into the future. How do we value that kind of thing for a customer now, if we're going to take a customer perspective?[93]

3.74 Ms Durand of Cool Planet Solutions contemplated ongoing maintenance costs during the life of a nuclear power plant and similarly raised the view that:

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87 Clean Energy Council, Submission 230, p. 3.

88 Dr Jim Green, National Committee Member, Australian Nuclear Free Alliance, *Committee Hansard*, Adelaide, 5 December 2024, p. 24.

89 Dr Green, Australian Nuclear Free Alliance, *Committee Hansard,* Adelaide, 5 December 2024, p. 24.

90 Emergency Leaders for Climate Action, Submission 431, p. 7.

91 Macquarie University TEM, Submission 782, p. 7. See also Professor Andrew Whittaker, Director, Institute of Sustainable Transportation and Logistics, University of Buffalo, *Committee Hansard*, Canberra, 18 November 2024, p. 2.

92 Dr Mayfield, CSIRO, *Committee Hansard*, Canberra, 24 October 2024, p. 49.

93 Mr Graham, CSIRO, *Committee Hansard*, Canberra, 24 October 2024, p. 50.

> … nuclear does not last 60 years, that the reactors need a tremendous amount of repair parts, and that to say that they last so much longer than renewables, because renewables last 20, is not counting the repair cost for the nuclear.[94]

3.75 Additional costs to establish a robust nuclear workforce and regulatory framework were raised in submissions. The Josephite Justice Office speculated that the 'introduction of nuclear power to Australia would require the education and training of thousands of nuclear scientists, engineers etc., presumably at taxpayers' expense',[95] and the cost of establishing 'comprehensive safety regulations and enforcement bodies,' was raised by the Clean Energy Investor Group in its submission.[96]

Private sector investment in nuclear power generation

3.76 Various witnesses and submitters reflected on the cost implications of public or private ownership and funding of nuclear reactors, and investment interest in nuclear power in Australia and internationally.

3.77 Professor Quiggin noted on the question of government investment of capital in nuclear power that, in general, there has been a 'substantial state component'.[97]

3.78 Similarly, Mr Tristan Edis, appearing in a private capacity, advised the Committee that when it comes to nuclear projects 'In the Western world, it's almost always taxpayers picking up the tab'.[98] He explained:

> The only people who have the financial wherewithal to bear such large risks are sovereign governments, because it sinks very large corporations—$90 billion, for example, on Hinkley Point C. For most private entities, that is a huge impact on their balance sheet. That's why private sector are reluctant to get involved in these things.[99]

3.79 Mr Matt Rennie, Co-CEO, Rennie Advisory, when asked about private sector interest in investing in nuclear power in Australia, replied in the negative, explaining there is a 'role for government' due to the 'need for very long-term power purchase agreements' often 'can't be written by the private sector' and the 'very long build time … [has] a long financing obligation'.[100]

3.80 Ms Bowyer of IEFFA also told the Committee that 'We are not seeing any investors lining up to invest in nuclear in Australia',[101] and suggested:

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94 Ms Durand, Cool Planet Solutions, *Committee Hansard*, Canberra, 25 November 2024, p. 7.
95 Josephite Justice Office, Submission 838, p. [7].
96 Clean Energy Investor Group, Submission 229, p. 2.
97 Professor Quiggin, private capacity, *Proof Hansard*, Brisbane, 15 November 2024, p. 24.
98 Mr Tristan Edis, private capacity, *Committee Hansard*, Melbourne, 4 December 2024, p. 39.
99 Mr Edis, private capacity, *Committee Hansard*, Melbourne, 4 December 2024, p. 39.
100 Mr Matt Rennie, Co-CEO, Rennie Advisory, *Committee Hansard*, Brisbane, 15 November 2024, p. 31.
101 Ms Bowyer, IEEFA, *Committee Hansard*, Melbourne, 4 December 2024, p. 38. See also: Mr Campbell, The Australia Institute, *Committee Hansard*, Canberra, 28 October 2024, p. 49.

> Investors would definitely have second thoughts once they look at the recent experience with extremely high construction costs, blowouts of up to three times or even more—and that's excluding the financing cost. When financing cost is included, it looks even worse.[102]

3.81 Mr Campbell from the Australia Institute told the Committee:

> All the modelling trickery in the world can't change the fact that no-one wants to build nuclear in Australia. No-one wants to build nuclear in Australia because of its upfront costs, its inability to compete in the national electricity market as it's currently set up and the huge decommissioning costs.[103]

3.82 A joint submission from various church groups expressed concern that advocacy for SMRs 'appears to be another way the nuclear corporations are seeking government funding for something that will be expensive and slow to develop'.[104]

3.83 While the moratorium on nuclear power was posited as a barrier to investment in Australia,[105] taking a global perspective, various witnesses observed that around the world there has been little successful private sector investment in nuclear power, particularly compared to renewables. Professor Quiggin provided US examples:

> Westinghouse, the main constructor, went bankrupt and almost took Toshiba with it. Certainly it was a disaster for the investors and a significant cost to the ratepayers. As I mentioned in the case of VC Summer, something like $10 billion was spent and the project was 75 per cent complete and they still decided that it would be better to abandon it than to finish the project.[106]

3.84 Looking to the United Kingdom (UK), Climate Councillor Mr Greg Bourne reflected on his experience as a special advisor on energy during the UK's transition to electricity market privatisation. He noted they 'could not get rid of the nuclear fleet,' thus 'it was kept in government hands and a nuclear levy was put on all suppliers and consumers in order to keep it running'.[107] He summarised:

> It was not commercial then. Thirty-five years later, little has changed. It's not commercial now and cannot compete with renewables and storage.
>
> Since that privatisation, the UK has transitioned from 60 per cent coal and 20 per cent nuclear down to zero per cent coal, 30 per cent nuclear and 45 per cent renewable energy—and renewable energy is continuing to grow.[108]

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102 Ms Bowyer, IEEFA, *Committee Hansard*, Melbourne, 4 December 2024, p. 38. See also: Mr Campbell, The Australia Institute, *Committee Hansard*, Canberra, 28 October 2024, p. 49.

103 Mr Campbell, The Australia Institute, *Committee Hansard*, Canberra, 28 October 2024, p. 47.

104 Uniting Church in Australia, Synod of Victoria and Tasmania, Synod of Queensland and U Ethical, Submission 215, p. 8.

105 See Minerals Council of Australia, submission 430, p. [6] and Dr Barry Green, private capacity, Committee Hansard, Perth, 17 December 2024, p. 23.

106 Professor Quiggin, private capacity, *Committee Hansard*, Brisbane, 15 November 2024, p. 24.

107 Mr Greg Bourne, Councillor, Climate Council of Australia, *Committee Hansard*, Sydney, 12 December 2024, p. 10.

108 Mr Bourne, Climate Council of Australia, *Committee Hansard*, Sydney, 12 December 2024, p. 10.

3.85 Mr Grimes of the Smart Energy Council gave the example of the government subsidies paid in relation to the nuclear build in Ontario, Canada:

> … the nuclear build bankrupted Ontario Hydro. It actually led to provincial government subsidies of more than $8 billion to artificially push power prices down. The public were paying. They were paying not through their power bills but through their taxes, because the price has to be paid.[109]

Committee Comment

3.86 The Committee has received a large volume of evidence speculating about the potential cost for deploying nuclear power in Australia.

3.87 The Committee heard that nuclear power is costlier to build than the readily available alternatives in Australia, with experts observing that while the cost of deploying renewables is continuing to reduce, they have not seen an equivalent decrease in the cost of nuclear power. The Committee also received compelling evidence nuclear power would cost consumers more to use. The Committee believes the evidence strongly indicated SMR technology is not yet commercially available and so is not a viable option for Australia's energy needs.

3.88 International experience demonstrates frequent significant cost overruns for nuclear power projects, and that countries like Australia without prior nuclear experience, may face a 100 per cent cost premium for initial builds. Evidence received about the private sector's lack of interest in investing in nuclear power in Australia and the history of issues with private investment in nuclear power internationally highlights the financial challenges for this source of power, making taxpayer funding of an uncertain nuclear venture during a cost-of-living crisis a significant risk.

3.89 While the Committee is aware it does not yet have a full picture of the costs beyond deployment – such as ongoing costs, waste management, decommissioning and emergency management, it is clear from the evidence considered that the deployment of nuclear power generation in the Australian context is currently not a viable investment of taxpayer money.

Mr Dan Repacholi MP
Chair
Member for Hunter

[109] Mr Grimes, Smart Energy Council, *Committee Hansard*, Canberra, 28 October 2024, p. 13.

A. Submissions and additional information

1 Australian Renewable Energy Agency (ARENA)

2 Greg Peak

3 Professor John Quiggin

4 Property Rights Australia Inc

- 4.1 Supplementary to submission 4
- 4.2 Supplementary to submission 4

5 Gamma Energy Technology

6 Justice and Peace Office Catholic Archdiocese

7 Institute for Energy Economics and Financial Analysis (IEEFA)

- 7.1 Supplementary to submission 7
- 7.2 Supplementary to submission 7

8 The Hon. Dr Steve Thomas

9 Dr Roderick Hill

- 9.1 Supplementary to submission 9

10 Dr Oscar Archer

11 Per Nystrom

12 Dr Roderick Sinclair

13 Darling Downs Environmental Council

14 Andrew Williams

15 Norvan Vogt

16 Kenneth Higgs

17 Emeritus Professor G. B Fincher AO FAA FTSE DSc AO FAA FTSE DSc

- 17.1 Supplementary to submission 17

18 Richard Weatherley

19 Graham Chauvin

20 Nicole Pietsch

21 Brian Wilkinson

22 Colin Boyce MP

23 John & Kay Burman

24 *Name Withheld*

25 *Name Withheld*

26 Les and Kellie Wilkie

27 *Name Withheld*

28 Dr Tony Webb

29 Des O'Shaughnessy

30 Dr Clare Smith

31 *Name Withheld*

32 Derek Manoy

33 Rabbi Paul Steinberg

34 Mark Walter

35 *Name Withheld*

36 Ian Childs

37 Jonathan Fisher

38 Ian Fraser

39 David Wilson

40 John Seddon

41 Brendon Patrick

42 Dr Gregory Au

43 *Name Withheld*

44 Danny Nowlan

45 Bill Fisher

46 *Name Withheld*

47 Dr Hiram Baddeley

48 Parsec Communications

49 *Name Withheld*

50 Phil Warwick

51 Dominic Wild

52 Barry Healy

53 George Papadopoulos

54 *Name Withheld*

55 *Name Withheld*

56 Mark Walker

58 Les Johnston

59 *Name Withheld*

60 Grahame Smith

61 Alison Scott

62 Dubbo Environment Group Inc.

63 *Name Withheld*

64 Phung-Thien Bui

65 Jack Garside

66 Geoffrey Miell

- 66.1 Supplementary to submission 66
- 66.2 Supplementary to submission 66
- 66.3 Supplementary to submission 66

- Attachment 1

67 James Brown

- Attachment 1
- Attachment 2
- Attachment 3
- Attachment 4
- Attachment 5

68 Fred Diacci

69 *Name Withheld*

70 *Name Withheld*

71 Dr Peter Hick

72 Pathfinder Exploration Pty Ltd

73 Sustainable Energy Now

- Attachment 1

74 *Name Withheld*

75 Walter Ashton

- Attachment 1
- Attachment 2
- Attachment 3

76 Paul Bockman

77 Peter Jans

78 Latrobe Valley Sustainability Group

- 78.1 Supplementary to submission 78

79 *Name Withheld*

80 Whitsunday Conservation Council

81 Trevor Crane

82 Noel Davidson

83 Cameron McDonald

84 Ian Mowat

85 Gippsland Climate Change Network

86 Climate Change Balmain Rozelle

87 Jane Sultana

88 Friends of the Earth Adelaide

89 Isaac Shields

90 Melcom Browne

91 Jonathan Benyei

92 WePlanet Australia

93 Tom Bond

94 Tasmanian Climate Collective

95 Peter Zazlin

96 Dermot Daley

97 Felecia and Shaun Heirdsfield Heirdsfield

98 Ron Camier

99 Mary Wilkinson

100 Sunshine Hydro Pty Ltd

101 Patsy Lisle

102 *Name Withheld*

103 Farmers for Climate Action

104 Chris Glennen

105 Stephen Hood

106 *Name Withheld*

107 Gorur Srinivasan

108 Dr Claire Gronow

109 *Name Withheld*

110 *Name Withheld*

111 John Andre AM

112 Bruce Thompson

113 Don Tylee

114 Michael de Mol

115 Liam Sultana

116 Dr Brian Lovell

117 Greg Chapman

118 Boyd Baker

119 Louise Taylor

120 Top End Peace Alliance

121 Malcolm Ritter

122 Steven Nowakowski

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123 Rainforest Reserves Australia

124 Jack Davidson Spira

125 David Brown

126 Regenesis Lawyers

127 Julie Favell

128 Darren Randall

129 *Name Withheld*

130 Greg North

131 Lyn Hovey

132 Richard Bennet

133 WESFORT PTY LTD

135 Sebastian Tops

136 Michael Ives

137 *Name Withheld*

138 *Name Withheld*

139 Dominic Case

140 *Name Withheld*

141 Voices of the Valley

- 141.1 Supplementary to submission 141

142 Dawn Stubbs

143 Australian Aluminium Council

144 John Hopman

145 Ross Robson

146 Graeme Mccormack

147 Bruce George

148 Pax Christi Victoria Inc

149 Ian Grant and Dr Robert Ion

- 149.1 Supplementary to submission 149

150 The Clarence Environment Centre

151 Dr Craig Cooper

152 Bushfire Survivors for Climate Action

- 152.1 Supplementary to submission 152
- Attachment 1

153 Leon Gross

154 Russell Candy

155 Alan Riseley

156 Wendy Tapscott

157 Patsy Molloy

- 157.1 Supplementary to submission 157

158 Jim Bain

159 The Page Research Centre

- 159.1 Supplementary to submission 159
- Attachment 1
- Attachment 2
- Attachment 3
- Attachment 4
- Attachment 5
- Attachment 6

160 *Name Withheld*

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162 Cathy Merchant

163 Katherine McKenzie

164 Dr Jasper Lee

165 Hunter Environment Lobby Inc

166 Kerin Booth

167 East Gippsland Climate Action Network

168 Tony Peck

169 David Spong

170 *Name Withheld*

171 Stephen Kolera

172 *Name Withheld*

173 Peter Anusas

174 Tom Coster

175 South Australian Chamber of Mines & Energy

176 Serena Kipling

177 *Name Withheld*

178 Kripan Poovathingal

179 Coalition for Conservation

180 Australian Nuclear Association

- 180.1 Supplementary to submission 180

181 Eric Smith

182 Diana Traversi

183 Gary Blaschke OAM

184 Australian Marine Conservation Society (AMCS)

185 Doreen Coster

186 Dr Janine Conway

187 Peter Curtin

188 Marley Prunean

189 Bob Phelps

190 Queensland Conservation Councils

191 Dr Anne Smith

192 Bathurst Community Climate Action Network

193 Deborah Pergolotti

194 Peter Cunningham

195 Nigel Wood

- Attachment 1

196 Graeme Jorgensen

197 Garry Smith

198 Bronwyn and Alan Kirkegard

199 David McNeice

- Attachment 1

200 Steven Timms

201 Rob Firth

202 *Name Withheld*

203 Karen Anders

204 David Rossiter

205 Caring for SA

206 Helen Cook

207 *Name Withheld*

208 Simon Thompson

209 Gary Worthington

210 Climate Action Burwood/Canada Bay

211 *Name Withheld*

212 Robert Andrew

213 Grattan Institute

214 First Nations of South Australia Aboriginal Corporation

215 Uniting Church in Australia, Synod of Victoria and Tasmania, Synod of Queensland and U Ethical

216 Solar Citizens

217 Doctors for the Environment Australia

- 217.1 Supplementary to submission 217

218 Frank Hooke

219 Jacob Louis de Villiers

220 Climate Action Merribek Inc

221 Greg Dyer

- 221.1 Supplementary to submission 221
- 221.2 Supplementary to submission 221
- 221.3 Supplementary to submission 221
- 221.4 Supplementary to submission 221

- 221.5 Supplementary to submission 221
- 221.6 Supplementary to submission 221
- 221.7 Supplementary to submission 221

222 *Name Withheld*

223 Lindsay Egan

224 Thomas Ebersoll

225 *Name Withheld*

226 Greig Ebeling

227 Nuclear Energy and National Security Coalition

228 Graham Williams

229 Clean Energy Investor Group

- 229.1 Supplementary to submission 229

230 Clean Energy Council

231 John Kite

232 Silex Systems Limited

233 Barrie Hill

234 Dr David Jones

235 Dr Alexander Fullarton

236 Steven Holmes

237 Malcolm Robins

238 Angus Cummings

239 Jonathan Shaw

240 *Name Withheld*

241 Daryll Bellingham

242 Randall Starling

243 Chris Groom

244 *Name Withheld*

245 Robert Vose

246 Trevor Woolley

247 Robert Heron

248 Wellington Climate Action Network

249 John L Gwyther

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250 Luke Glover

251 *Name Withheld*

252 *Name Withheld*

253 Dr Thomas Biegler

254 *Name Withheld*

255 Trevor Robotham

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258 Central West Environment Council

259 Environment Victoria

260 David Packham OAM

261 David Noonan B.Sc., M.Env.St

262 Electrical Trades Union Queensland and Northern Territory

263 United Workers Union

264 Logan Smith

265 Oleg Bose

266 Prof Wade Allison

267 *Name Withheld*

268 Barry Hadaway

269 Steve M Gates

270 *Name Withheld*

271 Andrew Gunner

272 SMR Nuclear Technology Pty Ltd

- 272.1 Supplementary to submission 272
- 272.2 Supplementary to submission 272
- Attachment 1

273 Dave Brown

274 Adjunct Associate Professor Richard Leaver

275 Christians for Peace Newcastle

276 Harry Creamer

277 Christopher Merridew

- Attachment 1

278 John Derrick

279 Joshua Gerschwitz

280 Nature Conservation Council of NSW

281 Terje Petersen

282 Climate Tasmania

283 Christine Bennett

284 Australian Radiation Protection and Nuclear Safety Agency (ARPANSA)

- 284.1 Supplementary to submission 284
- 284.2 Supplementary to submission 284

285 *Name Withheld*

286 Climate Change Authority

- 286.1 Supplementary to submission 286

287 Peter Murphy

288 Mark Hungerford

289 *Name Withheld*

290 Australian Nuclear Power

291 *Name Withheld*

292 Social Responsibilities Committee, Anglican Church Southern Queensland

293 Alan Lawrenson

294 Nicole Davies

- 294.1 Supplementary to submission 294

295 Australian Nuclear Research and Education Network

296 Climate Justice Union

- 296.1 Supplementary to submission 296

297 Chamber of Minerals and Energy Western Australia

298 Lisa Mariah

299 Business Council of Australia

300 Amy Hiller, PhD

301 David Arthur

302 Peoples Climate Assembly

303 Peter Hanley

304 Hydrostor

305 Dr Chris Johansen

306 Medical Association for the Prevention of War

- 306.1 Supplementary to submission 306
- 306.2 Supplementary to submission 306

307 Asian Australians For Climate Solutions

308 *Name Withheld*

309 Parents for Climate

310 Cairns and Far North Environment Centre

311 Mining and Energy Union

312 Susan Thompson

313 Moira Etheridge

314 Tania Papalia

315 Lithgow Environment Group Inc.

316 Save the Mary River Coordinating Group

317 Australian Energy Council (AEC)

318 Joint submission from 16 national and state/territory environment groups

319 Australian Workers' Union

320 Darebin Climate Action Now

321 Lighter Footprints inc

322 Climate Action Maribyrnong

323 Victorian Trades Hall Council

324 Australian Industry Group

325 John Woodward

326 Dr Roger Clifton

327 Lex Stewart

328 Ken and Michelle Park

329 Peta May

330 Friends of Latrobe Water

331 Public Health Association Australia (PHAA)

332 Australian Nuclear Free Alliance

333 Nuclear Free WA

- 333.1 Supplementary to submission 333

334 Rylstone District Environment Society

335 Greenpeace Australia Pacific

336 Brendan Fitzgerald

337 Viola Temple-Watts

338 Australian Council of Trade Unions

- 338.1 Supplementary to submission 338
- 338.2 Supplementary to submission 338
- 338.3 Supplementary to submission 338

339 Denman, Aberdeen, Muswellbrook and Scone Healthy Environment Group Inc (DAMSHEG)

340 1 Million Women

341 Responsible Energy Development for New England

342 *Name Withheld*

343 Solutions for Climate Australia

344 Australian Safeguards and Non-Proliferation Office (ASNO)

345 South Burnett Sustainable Future Network (SBSFN)

346 Mark Lynch

- Attachment 1

347 Women in Nuclear Australia

348 Global Nuclear Security Partners

- 348.1 Supplementary to submission 348

349 Dr David Harries

350 Professor Jacopo Buongiorno

351 Newtown Climate

352 William McKeand

353 Sai Ruthwick

354 Alice Springs Peace Action Think Tank (ASPATT)

355 Rolls-Royce SMR

356 *Name Withheld*

357 Rob Gulley

358 Worley

359 John Boyle

360 Nuclear Energy Institute

361 Ed Wilks

362 Security Capital Australia

363 Michael Asten

- 363.1 Supplementary to submission 363

364 Brenda Conochie

365 Professor Andrew Whittaker, Ph.D., P.E., S.E

366 Murray Hogarth

367 Tellus

368 Chris Jonkers

369 Blueprint Institute

370 *Name Withheld*

371 Centre for Independent Studies

- 371.1 Supplementary to submission 371

372 Geoff Russell

373 Julie Marlow

374 Steve Reynolds

375 Dr Brendan Jones

376 Julie Marlow

377 Louis Rozman

378 Valley Alliance

379 Gary Rowbottom

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380 Nuclear For Climate Australia

- 380.1 Supplementary to submission 380

381 Business Council for Sustainable Development Australia (BCSD Australia)

382 Australian ITER Forum

383 *Name Withheld*

384 Independent and Peaceful Australia Network

385 Geoffrey Stubbs

386 John Hallam

387 Christina Wilcox

388 Smart Energy Council

- 388.1 Supplementary to submission 388

389 Roy Currie

390 Darren & Tanya Jensen

391 Standards Australia

392 Mudgee District Environment Group

393 Dr Dave Collins BE(Hons) MBA PhD FIEAust FAIE CIH MAIOH CPEng (National) RPEQ (Qld) RBP (Vic) NER AP

- 393.1 Supplementary to submission 393

394 Georgina Stubbs

395 Jo-Anne Grant

396 Electrical Trades Union of Australia

397 *Name Withheld*

398 Wendy Farmer

399 Boundless Earth Limited

400 Rosamund Krivanek

- Attachment 1

401 Dr Mark McDonell

402 Greg Phillips

403 *Name Withheld*

404 *Name Withheld*

405 Peter Reay

406 Brian Halstead

407 Derrick Sutcliffe

408 Ben O'Shannessy

409 *Name Withheld*

410 Ronald McGuiness

411 Carole Stanford

412 Ronald James AFSM

413 David Roden

414 Margaret Cooper

415 Rosemary Walters

416 Nadja Osterstock

417 Merilyn Fairskye

418 Maritime Union of Australia

419 Michael McKeon

420 Una Sandeman

421 Josephine Grieve

422 Anne Hugo

423 Susanne Godden

424 Ken F

425 Robert Day

426 Wellington Shire Council

427 Engineers Australia

428 Climate Council of Australia

- 428.1 Supplementary to submission 428

429 Environmental Defenders Office

430 Minerals Council of Australia

431 Emergency Leaders for Climate Action

432 Paul Casbolt

433 Dominic Case

434 Roger Loughbrough

435 Annie Boutland

436 Raymond Keefe

437 Marion Helwig

438 Dr Stephen Healy

439 Glenn Brennan

440 Josh Tabrety

441 Terry McBride

442 Warren Holder

443 George Alex Mortensen

444 Ian Matthews

445 Michelle Cairns

446 Gabrielle Pether

447 Cooper King

448 Bob Tulloch

449 Flinders Local Action Group

450 Father Jim Monaghan

451 Liz Olle

452 Kevin Sweeney

453 Richard Staples

454 Cedric Creed

- 454.1 Supplementary to submission 454

- Attachment 1
- Attachment 2
- Attachment 3
- Attachment 4

455 Bernadette Young

456 Gabrielle Scanlon

457 Hunter Peace Group

458 Sue Bradbury

459 Denise Sweetman

460 Hazel Grass

461 Edward Kent

462 Shaun Heirdsfield

463 Elizabeth Robinson

464 Chantelle Rodrigues

465 Jennifer Farrer

466 Sue Tulloch

467 Conservation Council of Western Australia

468 Kevin Blake

469 Kerry Ridgley

470 Inez Hamilton-Smith

471 Mr Stephen Akers

- Attachment 1

472 Lisa Forward

473 Grant Donohue CPA

474 Elena Schak

475 Timothy Clifford

476 Meredith Bryce

477 Margaret Whittle

478 Simon Holmes à Court

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479 Helen Drury

480 Marie Jamieson

481 David Nolan

482 Lachlan Waters

483 Teya Wilson

484 Barbara Lyle

485 Andrea Findlay

486 Grace Impala

487 Riley Richardson

488 Derek To

489 Linda Marks

490 Frank Hodgkinson

491 Phoebe Corke

492 Mary Rizk

493 Fiona Colin

494 Peter Sutton

495 Trudy Whitcombe

496 Zoe Beckett

497 Leigh Newton

498 Andre Fazio

499 Steven Wilson-Todd

500 Oddur Tom Augustsson

501 Melanie-Amelia Neofitou

502 Paul Jackson

503 Brendan O'Neill

504 Heidi Bone

505 Allan Evans

506 Bernadette O'Leary

507 Robyn Byrne

508 Melissa Norman

509 Christopher Andrews

510 Chris Ellen Amie-Fong

511 Jennifer Gray

512 Ashleigh Fairchild

513 Nigel Fleming

514 Phil Dench

515 Dr Peter Sobey

516 Maria Brown

517 Cheryl Mathews

518 Viraf Bhavnagri

519 Dr Mina Roberts

520 Jane Glover

521 Vivienne Litson

522 Malcolm Allison

523 Jane Sertori

524 Phil Wakeling

525 Andy Breaden

526 Gail Elliott

527 Noel Baxendell

528 Leonie Stubbs

529 Evelyn Newman

530 David Lee

531 Linda Bell

532 Kay Schieren

533 David Mackay

534 Christina Wilcox

535 Graham Shepherd

536 Gordon Young

537 Otto Ruettinger

538 Anne Robinson

539 Anne Ammann

540 Dean Goddard

541 Eugene Chattelle

542 Thomas Driftwood

543 Colin Davies

544 Kathy Palaski

545 Stephen Horn

546 Neville Cowland

547 Jenn McMahon

548 Rod Fuller

549 Miles Protter

550 Christine Bennett

551 Dr Thomas Wilson

552 David Bray

553 David Hope

554 Peter Fell

555 T Corbett

556 Anna Kell

557 Martin Derby

558 Ann Callen

559 Dorothy Steane

560 Nancye Miles-Tweedie

561 Peter Gardner

562 Victor Komarovsky

563 Christina Virgona

564 Benny Heath

565 Michael Skelton

566 Robert Randall

567 Nicholas Gribble

568 Chris Simpson

569 Tass Holmes

570 Department of Industry, Science and Resources (DISR)

- 570.1 Supplementary to submission 570

571 Graham McLean

572 Debbie Liu

573 John Simmons

574 Daniel O'Sullivan

575 Jasper Lee

576 Alex McPherson

577 Linda Westphalen

578 Josephine Mellick

579 Isabel Graham

580 Kevin Bailey

581 Jason MacQuarrie

582 Jamnes Danenberg

583 Rodney Botica

584 Richard Best

585 Nanette Kerrison

586 Raymond Keefe

587 Julianne Skinner

588 Genevieve Hopkins

589 Mike Patterson

590 Karen Redhead

591 Cheryl North

592 Kay Williams

593 Janet Foote

594 Mark Ellis

595 Laura Robinson

596 Lyn Rushby

597 Ross Butcher

598 Paul Richards

599 Kristin Dawson

600 Bill Boyd

601 Oliver Raymond

602 Miles Protter

603 Chris Rees

604 Peter Fairlamb

605 Young, Green, et al

606 Hugh Vaughan

607 F J Hoekstra

608 Robert Greig

609 Patty Durand

- Attachment 1
- Attachment 2
- Attachment 3
- Attachment 4
- Attachment 5
- Attachment 6

610 Alan Corne

611 Sharon Bondy

612 John Caldwell

613 Jann Mehmet

614 Paul Gabbert

615 Cheryl Mathews

617 Kathy Duff, Mayor, South Burnett Regional Council

- 617.1 Supplementary to submission 617

618 Michelle Ransom-Hughes

619 Anne Brown

620 Sylvia Kinder

621 CSIRO

622 Georgina Gartland

623 Savannah Baker

624 Patrick Buckley

625 Helen Luxor

626 Australian Energy Market Operator (AEMO)

- 626.1 Supplementary to submission 626

627 Professor Mark Winfield

- 627.1 Supplementary to submission 627
- Attachment 1
- Attachment 2

628 Mary Barry

629 Dr Anne Marshall

630 Mike Kenny

631 Peter Remta

- 631.1 Supplementary to submission 631

632 Hugh Yorkston

633 Trudi Calvert

634 Greg North

635 Merelyn Saunders

636 Mardi McConnochie

637 Dawn Metcalfe

638 Rosemary Race

639 David Lindner

640 Gabrielle Raiz

641 Natalie Jozsa

642 Daniel O'Sullivan

643 Diane Cowburn

644 Dick Clarke

645 Darcy Brown

646 Paul Richards

647 Tosca Zraikat

648 Patrick Li

649 Adrian Mortimer

650 Margaret Moorhouse

651 Mike Hall

652 Anais Nedermeijer

653 Shawn Whelan

654 Carlo Gazzola

655 Alan McLean

656 Robert Ellison

657 Nigel Haskins

658 Dean Corcoran

659 Thomas Schild

660 Dr Gina Wood

661 Nathan Williams

662 Samara Pitt

663 Cora Mayer

664 Sarah Chambers

666 Katinka Smit

667 Yoon Ooi

668 Stephen Morris

669 Ingrida Matulis

670 Michaela Boelling

671 Mark Aarons

672 Maxine Andrews

673 Gayle Russell

674 Kenneth Gillett

675 David Booth

676 Kathleen Bentley

677 Clare McKay

678 Jo McCubbin

679 Louise Brogan

680 Paul Brittan

681 Steve Smallwood

682 Roger Morris

683 John Chapman

684 Dr Simon Strauss

685 Tajender Singh Virk

686 Steve Douglas

687 Ben Tredinnick

688 William Spiers

689 Ben Hermann

690 Ali Pountney

691 Amanda Yeoman

692 Ann Ellis

693 Michael Dowling

694 Dr Richard Smart

695 Yvonne Hartman

696 Alan Wilson

697 Sally Doherty

698 Janet McKeon

699 Sallie Saunders

700 Jan Cox

702 Cathy Cox

703 Alex Robertson

704 Margaret Nay

705 Steele Grffiths

706 Peter Shuttleworth

707 Una Sandeman

708 Pauline Jones

709 Russell Cox

710 Jon Othitis

711 Gitanjali Dunbar

712 Angela Rossen

713 Max Pouwer

714 Cognizant Citizen

715 Dr Richard Barnes

716 Michael Doherty

717 Rebecca Dominquez

718 Michael Surwald

719 Tash Hughes

720 Dr Rita Seethaler, OAM

721 James Emmet

722 Dorothy Carroll

723 Hans-Joerg Kraus

724 Sean McSharry

725 Rita Richter

726 Roz Williamson

727 Julie Swinburne

728 Jodie Catherine

729 Michael Crowley

730 Bob Ehrlich

731 Gil Swadling

732 Neil Champion

733 Evatt Kyriacou

734 John Schultz

735 Ian Perdrisat

736 Sandy Pulsford

737 Elizabeth van Werwaarden

738 Reg Went

739 Les Kobylinski

740 Peter Whitehead

741 Lorena Wright

742 John Holt

743 Pauline Ferguson

744 Lydia Finlayson

745 Lilly Fitzgerald

746 Andrew Grosse

747 Malcolm Holz

748 Jane Cleverley

749 Kathryn Crissman

750 Deborah Knott

751 Sandra Hand

752 Heather Jones

753 Gayle Garbutt

754 Maggie Travers

755 Carly Vause

756 Geraldine Mitchell

757 Leah Dent

758 Daryl Mann

759 Sabine Rist

760 Judy Buss

761 Sylvie Constantine

762 Kajol Eagle

763 Bruce Druery

764 H Wright

765 Stephen Kelly

766 Jeremy Klitzing

767 Daniel Marek

768 Bernice Brown

769 Kasrynne Huolohan

770 Andrew Alcock

771 RJohn Carter

772 Justine Dodd

773 Helen Kajewski

774 Marco Setiawan

775 Christine Morgan

776 Wanda Grabowski

777 Robyn Adams

778 Susan Hinckley

779 Amy-Beth Seeley

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783 Daniel Bray

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786 Peter Hunt

787 David Munro

788 Cate Moss

789 Gabriel Fuller

790 Jill Johnson

791 Sharon Sargent

792 Glenn Gale

793 Jeff Hunter

794 Rainier Verlaan

795 Richard Jones

796 Roz Reynolds

797 Leith Maddock

798 Fusion Energy Industry

799 Michelle Rower

800 Heather Middleton

801 Rob Stevens

802 Sue Dennis

803 Ben Tan

- 803.1 Supplementary to submission 803

804 Kenneth Moore

805 Jim Angel

806 Climate Action Network Australia (CANA)

807 Carol-Ann Fletcher

- Attachment 1
- Attachment 2
- Attachment 3
- Attachment 4
- Attachment 5
- Attachment 6

808 Tesla

809 Gillian Blair

810 Public Health Association of Australia

811 Dr Arthur Chesterfield-Evans

812 Professor Alex Coram

813 Lynette LaBlack

- Attachment 1
- Attachment 2
- Attachment 3
- Attachment 4

814 Judith Blyth OAM

815 Nick Pastalatzis

816 Barry Murphy

- Attachment 1

817 M.A. Wilson

818 Ronald Eric Matthews

819 Ivan Quail

- Attachment 1

820 Alexander H Doull

- Attachment 1
- Attachment 2

821 *Name Withheld*

822 Steven Leuver

823 Australian Nuclear Science and Technology Organisation (ANSTO)

824 Hunter Lakes Corporation

- 824.1 Supplementary to submission 824
- 824.2 Supplementary to submission 824
- 824.3 Supplementary to submission 824
- 824.4 Supplementary to submission 824
- 824.5 Supplementary to submission 824

825 Peter Hennessy

826 Associate Professor Edward Obbard

827 Paul Miskelly

828 *Name Withheld*

829 Dr Graham Mahony

- Attachment 1
- Attachment 2

830 James O'Halloran

- Attachment 1

831 Philip Haynes

832 *Name Withheld*

833 RW Rands

834 Braybon Advisory

835 Dr Michael Seebeck

836 Mark Schneider

837 Andrew Dyer

838 Josephite Justice Office

839 Benn Thexton, Macalister Customer Consultative Committee

840 GetUp Australia

841 Geoscience Australia

842 Australian Submarine Agency

843 Australian Conservation Foundation

844 Department of Climate Change, Energy, the Environment and Water (DCCEEW)

- 844.1 Supplementary to submission 844

845 Responsible Future (Illawarra Chapter) Inc

846 Port Stephens Recreation Game Fishing Club

847 National Rational Energy Network (NREN) Incorporated

848 Dr Sarah Lawley

849 Mayor Nev Ferrier

850 Dr Marie Little

851 Hallett Group

852 Environment Victoria campaign submission: 1 of 553 received

853 WePlanet campaign submission: 1 of 142 received

854 Do Gooder campaign submission type A: 1 of 425 received

855 Do Gooder campaign submission type B: 1 of 313 received

856 Do Gooder campaign submission type C: 1 of 324 received

857 GetUp campaign submission: 1 of 22 received

858 Robert (Bob) McCosker

B. Hearings and witnesses

Thursday 24 October 2024 – Canberra, ACT

Department of Climate Change, Energy, the Environment and Water

- Mr Lachlan Bickley, Acting Head, Energy Security, Crisis Response and GEMS Branch
- Mr Simon Duggan, Deputy Secretary
- Mr Adam McKissack, Chief Energy Economist, Office of Energy Economics,
- Mrs Clare McLaughlin, Head, Energy Performance and Security Division

Department of Industry, Science and Resources

- Mr Mark Weaver, General Manager, Policy, Governance and Strategy, Australian Radioactive Waste Agency

Department of Foreign Affairs and Trade

- Mr Lloyd Broderick, Acting First Assistant Secretary, International Security Division
- Ms Vanessa Wood, Ambassador for Arms Control and Counter Proliferation

Australian Safeguards and Non-Proliferation Office

- Dr Geoffrey Shaw, Director General
- Dr Craig Verton, Assistant Secretary, Non-Proliferation, Technology and Partnership Branch

Australian Radiation Protection and Nuclear Safety Agency

- Dr Gillian Hirth, Chief Executive Officer (by videoconference)
- Mr Martin Reynolds, General Counsel (by videoconference)
- Mr Jim Scott, Chief Regulatory Officer and Head of Regulatory Services (by videoconference)

Australian Nuclear Science and Technology Organisation

- Mr Hefin Griffiths, Chief Nuclear Officer (by videoconference)
- Mr Shaun Jenkinson, Chief Executive Officer (by videoconference)

Australian Energy Market Operator

- Ms Rebecca Irwin, Executive General Manager, Government and Stakeholder

- Mr Daniel Westerman, Chief Executive Officer
- Ms Merryn York, Executive General Manager, System Design

Australian Energy Regulator

- Ms Stephanie Jolly, Executive General Manager, Consumers Policy and Market
- Ms Clare Savage, Chair

Australian Energy Market Commission

- Mr Benn Barr, Chief Executive
- Ms Anna Collyer, Chair

Commonwealth Scientific and Industrial Research Organisation

- Mr Paul Graham, Chief Economist, Energy (by videoconference)
- Dr Peter Mayfield, Executive Director, Environment, Energy and Resources
- Dr Dietmar Tourbier, Director, Energy Research Unit (by videoconference)

Monday 28 October 2024 – Canberra, ACT

Geoscience Australia

- Mrs Kristina Anastasi, Branch Head, Advice, Investment Attraction and Analysis Branch
- Mrs Marina Costelloe, Branch Head, Mineral Systems Branch
- Dr John Dawson, Branch Head, Community Safety Branch, Place and Communities Division
- Ms Maree Wilson, Chief, Place and Communities Division

Smart Energy Council

- Mr John Grimes, Chief Executive Officer
- Mr Leigh Heaney, Government Relations Manager (by videoconference)
- Mr Tim Lamacraft, Media Relations Manager

Electrical Trades Union

- Mr Michael Wright, National Secretary (by videoconference)

Siyeva Consulting

- Dr Adrian (Adi) Paterson, Founder and Principal

Dr Sarah Lawley, Private capacity

Institute of Public Affairs

- Mr Daniel Wild, Deputy Executive Director
- Adjunct Professor Stephen Wilson, Visiting Fellow

The Australia Institute

- Mr Rod Campbell, Research Director

Dr David Collins, Private capacity

SMR Nuclear Technology Pty Ltd

- Mr Tony Irwin, Technical Director (by videoconference)

Centre for Independent Studies

- Ms Zoe Hilton, Senior Policy Analyst
- Mr Aidan Morrison, Director, Energy Research

Australian Nuclear Association

- Dr John Harries, Secretary

Department of Defence, including the Australian Submarine Agency

- Ms Sophia Blix, Head, Stewardship & Security, Australian Submarine Agency
- Mr Matthew Buckley, Head, Nuclear Submarine Capability, Australian Submarine Agency
- Mr Tim Hodgson, Deputy-Director-General, Technical, Australian Submarine Agency
- Ms Alexandra Kelton, Head, Policy Strategy & Engagement, Australian Submarine Agency
- Mr Jason Walk, Commander, Joint Logistics, Joint Capabilities Group, Department of Defence

Thursday 7 November 2024 – Canberra, ACT

Professor Mark Winfield, Private capacity (by videoconference)

Dr Chris Greig, Private capacity (by videoconference)

Wednesday 13 November 2024 – Bileola, Qld

Banana Shire Council

- Mr Neville Ferrier, Mayor

Mr Cedric Creed, Private capacity

Ms Therese Creed, Private capacity

Gladstone Regional Council

- Mr Kahn Goodluck, Councillor

High Risk Solutions Gladstone

- Mr David Nunn, Managing Director

McCosker Contracting

- Mr Robert (Bob) McCosker, Director

Gladstone Area Water Board

- Mrs Angela Moody, Chief Financial Officer

Thursday 14 November 2024 – Nanango, Qld

South Burnett Regional Council

- Ms Deb Dennien, Councillor, Division 4
- Ms Kathy Duff, Mayor
- Mrs Jane Erkens, Councillor, Division 1
- Mrs Linda Little, Councillor, Division 2

Property Rights Australia

- Mr Jim Willmott, Board Member

Kilkivan Action Group

- Mrs Katy McCallum, Primary Representative

Mr Nick Holliday, Private capacity

Auntie Jannine Smith (Taabinga), Private capacity

Ms Peta May, Private capacity

South Burnett Sustainable Future Network

- Mrs Suzanne Mungall, Core Member

Friday 15 November 2024 – Brisbane, Qld

Sunshine Hydro Pty Ltd

- Mr Chris Baker, Director and Chief Technology Officer
- Mr Michael Myer, Executive Chairman

Queensland Conservation Council

- Ms Jennifer Brown, Climate Lead

WePlanet

- Mr Tyrone D'Lisle, Lead Australian Campaigner

Rainforest Reserves Australia

- Mr Steven Nowakowski, Board member

Gamma Energy Technology

- Dr Geoffrey Bongers, Director (by videoconference)

Professor John Quiggin, Private capacity (by videoconference)

Rennie Advisory

- Mr Matt Rennie, Co-Chief Executive Officer

Nuclear for Australia

- Mr William Shackel, Founder

Monday 18 November 2024 – Canberra, ACT

Professor Jacopo Buongiorno, Director, Science and Technology, Nuclear Reactor Laboratory, Massachusetts Institute of Technology; and Director, Center for Advanced Nuclear Energy Systems, Massachusetts Institute of Technology (by videoconference)

Professor Andrew Whittaker, Director, Institute of Sustainable Transportation and Logistics, University at Buffalo (by videoconference)

Thursday 21 November 2024 – Canberra, ACT

Mothers for Nuclear

- Ms Heather Hoff, Co-founder and Chief Financial Officer (by videoconference)

Dr Chris Keefer, President, Canadians for Nuclear Energy; and Director, Doctors for Nuclear Energy (by videoconference)

Monday 25 November 2024 – Canberra, ACT

Cool Planet Solutions

- Ms Patty Durand, President (by videoconference)

Thursday 28 November 2024 – Canberra, ACT

Mr Ian Grant, Private capacity (by videoconference)

Dr Robert Ion, Private capacity (by videoconference)

Tuesday 3 December 2024 – Traralgon, Vic

Latrobe City Council

- Councillor Dale Harriman, Mayor
- Mr Steven Piasente, Chief Executive Officer

Wellington Shire Council

- Mr Andrew Pomeroy, General Manager, Development

Friends of Latrobe Water

- Mrs Tracey Anton, Secretary

Latrobe Valley Sustainability Group

- Mr Daniel Caffrey, President
- Mrs Jane Sultana, Secretary

Voices of the Valley

- Mrs Wendy Farmer, President
- Ms Marianne Robinson, Secretary

Gippsland Climate Change Network

- Mr Darren McCubbin, Chief Executive Officer

Yes 2 Renewables, Friends of the Earth

- Mr Patrick (Pat) Simons, Campaign Coordinator

Latrobe City Business Chamber

- Mr Peter Ceeney, President

Mr Thomas Patrick Dwyer, Board Member, Macalister Customer Consultative Committee, Southern Rural Water

Mr David Packham OAM, Private capacity

Mr Gregory Dyer, Private capacity

Wednesday 4 December 2024 – Melbourne, Vic

Mine Land Rehabilitation Authority

- Dr jenny Brereton, Chief Executive Officer

Federation University

- Dr Jess Reeves, Sustainability Science Researcher, Future Regions Research Centre

Professor Maria Rost Rublee, Private capacity

Victorian Trades Hall Council

- Ms Danae Bosler, Assistant Secretary (Appointed)
- Mr Luke Hilakari, Secretary

Medical Association for Prevention of War

- Dr Margaret Beavis, Vice-President

Doctors for the Environment Australia

- Dr Genevieve Cowie, Chair, Research, Education and Advocacy Committee
- Dr George Crisp, Member (by audio link)
- Dr Katriona Wylie, Executive Director (by audio link)

Institute for Energy, Economics and Financial Analysis

- Ms Johanna Bowyer, Lead Analyst, Australian Electricity

Mr Tristan Edis, Private capacity

Clean Energy Council

- Mr Kane Thornton, Chief Executive Officer

Mr Theo Theophanous, Private capacity

Clean Energy Investor Group

- Ms Marilyne Crestias, Head of Policy and Advocacy

Australian Industry Group

- Mr Tennant Reed, Director, Climate Change and Energy

Seeley International

- Mr Jon Seeley, Group Managing Director (by audio link)

Environment Victoria

- Mr Jonathan (Jono) La Nauze, Chief Executive Officer

Darebin Climate Action Now

- Mr Karen Large, Secretary

Climate Action Maribyrnong

- Ms Georgia Marrett, Member

Lighter Footprints Inc

- Mr David Strang, Convenor, Energy Transition Group

Australian Conservation Foundation

- Mr Dave Sweeney, Nuclear Policy Analyst

Thursday 5 December 2024 – Adelaide, SA

South Australian Native Title Services

- Ms Bianca Lena, Senior Legal Officer

Ms Karina Joan Lester, Private capacity

Ms Kirsty Braybon, Private capacity

Boss Energy Limited

- Mr Duncan Craib, CEO and Managing Director

Global Power Energy

- Mr Greg Elkins, Chief Executive Officer

Australian Nuclear Free Alliance

- Mrs Trish Frail, National Committee Member (by audio link)
- Dr Jim Green, National Committee Member

Friends of the Earth Adelaide

- Dr Philip White, Administration and Strategy Collective Member (by audio link)

Dr Leanna Read, Private capacity

SA Chamber of Mines and Energy

- Ms Rebecca Knol, Chief Executive Officer

Friday 6 December 2024 – Port Augusta, SA

Hallett Group

- Mr Craig Cresp, General Manager Operations, Upper Spencer Gulf

Flinders Local Action Group

- Mr Greg Bannon, Member and Spokesperson
- Mr Bob Tulloch, Member
- Ms Sue Tulloch, Spokesperson

Mr John Naisbitt, Private capacity

Nukunu Wapma Thura (Aboriginal Corporation) RNTBC

- Mr Darryn Petry, Director
- Mr Travis Thomas, Chair (by audio link)

Mr Glen Wingfield, Private capacity (by audio link)

Mrs Karen Ballard, Private capacity

Mr Gary Rowbottom, Private capacity

Mr Peter Taylor, Private capacity

Tuesday 10 December 2024 – Muswellbrook, NSW

Mudgee District Environment Group

- Mrs Rosemary Hadaway, Chairperson

Denman Aberdeen Muswellbrook Scone Healthy Environment Group Inc

- Mr Anthony (Tony) Lonergan, Committee Member and Treasurer

Mr Trevor Woolley, Private capacity

Mr Malcolm Ritter, Private capacity

Mr Steven Reynolds, Private capacity

Valley Alliance

- Mr Tim White, President (by audio link)

Mr Nigel Wood, Private capacity

Mining and Energy Union

- Mr Scott King, Delegate, Northern Mining and NSW Energy District
- Mr Robin Williams, District President, Northern Mining and NSW Energy District

Hunter Lakes Corporation

- Mr John Colvin, Consultant
- Mr Gregory Story, Director (by audio link)

Blackrock Industries

- Mr Steven Fordham, Managing Director

Wonnarua Nation Aboriginal Corporation

- Uncle Laurie Perry, Chief Executive Officer

Wednesday 11 December 2024 – Lithgow, NSW

Mr Peter Hennessy, Private capacity

NSW Farmers

- Mr Reg Kidd, Chair, Energy Transition Taskforce

Mr Peter Pain, Private capacity

Ms Sarah Elliott, Private capacity

Mr Tom Evangelidis, Private capacity

Mr Geoffrey Miell, Private capacity

Bathurst Community Climate Action Network

- Dr Jim Blackwood, Vice President

Lithgow Environment Group Inc

- Mr Thomas Ebersoll, Secretary

Central West Environment Council

- Mr Nick King, President

Mingaan Wiradjuri Aboriginal Corporation

- Aunty Sharon Riley, Traditional Owner; and Senior Cultural Heritage Officer and Program Coordinator
- Ms Patsy Wolfenden, Traditional Owner; and Cultural Heritage Officer and Community Member

Barrinang Lithgow Wiradjuri Corporation

- Mr Rick Slaven, Vice Chair

Thursday 12 December 2024 – Sydney, NSW

Maritime Union of Australia

- Mr Jamie Newlyn, Assistant National Secretary (by audio link)

Union Services Union

- Ms Narelle Rich, Manager Energy, Utilities, Private Sector Clerical and Administration, and Airlines

Australian Council of Trade Unions

- Mr Daniel Sherrell, Senior Climate and Energy Policy Officer

Climate Council of Australia

- Mr Greg Bourne, Councillor
- Ms Amanda McKenzie, Chief Executive Officer

Climate Action Network Australia

- Dr Barry Traill, Director, Solutions for Climate Program

Blueprint Institute

- Ms Liana Downey, Chief Executive Officer

Page Research Centre

- Mr Gerard Holland, Chief Executive Officer

Simon Holmes à Court, Private capacity

Australian Energy Council

- Mr David Feeney, General Manager, Wholesale and Environment
- Mrs Louisa Kinnear, Chief Executive Officer

Cauldron Energy Ltd

- Mr Jonathan Fisher, Chief Executive Officer

Squadron Energy

- Mr Jason Willoughby, Chairman

Climate Change Balmain Rozelle Inc

- Mr Derek Bolton, Treasurer

Bushfire Survivors for Climate Action

- Dr Angela Frimberger, Government Relations Adviser

Climate Action Burwood/Canada Bay

- Mr Ken Enderby, President

Newtown Climate

- Ms Amanda Dawkins, Committee Member
- Ms Madeline Parker, Committee Member

Ms Helen Cook, Private capacity

Dr Edward Obbard, Private capacity

Nuclear For Climate Australia

- Mr Robert Parker, Founder

Rewiring Australia

- Dr Saul Griffith, Chief Scientist and Co-founder

Monday 16 December 2024 – Collie, WA

Edith Cowan University

- Associate Professor Naomi Joy Godden, Associate Director, Centre for People, Place and Planet

Climate Justice Union

- Miss Jayla Parkin, Member and Collie resident
- Ms Jaime Yallup Farrant, Co-convenor and Project Lead, First and Last

Ms Stevie Anderson, Private capacity

Gnaala Karla Booja Aboriginal Corporation

- Mr Bruce Jorgensen, Chief Executive Officer
- Mr Karim Khan, Land and Heritage Manager

Mr Phillip Ugle, Private capacity

Electrical Trades Union WA

- Mr Simon Brezovnik, Organiser, Kwinana and South West

Australian Manufacturing Works Union WA Branch

- Mr Daniel Graham, Delegate, Just Transition
- Mr Steven McCartney, State Secretary

Mr Brenda Conochie, Private capacity

Ms Nicole Davies, Private capacity

Mr Rob Gulley, Private capacity

Mrs Wendy Tapscott, Private capacity

Tuesday 17 December 2024 – Perth, WA

Minerals Council of Australia

- Ms Tania Constable, Chief Executive Officer
- Mr Daniel Zavattiero, General Manager, Climate and Energy

Chamber of Minerals and Energy WA

- Mrs Anita Logiudice, Assistant Director, Policy and Advocacy
- Mr Steven Mills, Manager, Climate and Energy

Nuclear Free WA

- Ms Kerrie-Ann Garlick, Co-Chair
- Mr Liam Lilly, Co-Chair

Sustainable Energy Now

- Mr Fraser Maywood, Chair

Conservation Council of WA

- Ms Mia Pepper, Campaign Director
- The Hon. Giz Watson, Vice President

Dr Barry Green, Private capacity

Ms Jasmin Diab, President, Women in Nuclear Australia; and Managing Director, Global Nuclear

Mr Mark Schneider, Private capacity

Mr Randall Starling, Private capacity

Ms Phoebe Corke, Private capacity

Dr Alexander Fullarton, Private capacity (by videoconference)

Mr Mark Hungerford, Private capacity

Ms Patsy Molloy, Private capacity

Engineers Australia

- Professor Lachlan Blackhall, Fellow
- Ms Bernadette (Bernie) Foley, Acting Chief Engineer

Tellus Holdings

- Mr Nate Smith, Managing Director and Chief Executive Officer

Coalition Members' Dissenting Report

Deputy Chair's Introduction

1.1 This inquiry has been a politically motivated attempt on the part of the Albanese Labor Government and a misuse of resources of the Australian parliament to try and discredit the Coalition's nuclear energy plan.

1.2 The government's refusal to accept a broader scope of inquiry as proposed by the Coalition resulted in the formal Terms of Reference not accounting for important issues which should be inquired into such as:

a. the impact on energy affordability;

b. the impact on energy reliability;

c. the impact on emissions reduction;

d. the impact on energy security;

e. the impact on the environment including geographic footprint;

f. the impact on regional communities, especially coal communities;

g. the potential for employment and broader economic impact;

h. the potential to leverage and expand the uranium sector;

i. ability to leverage existing nuclear institutions and capabilities including ANSTO, ASNO, ARPANSA and ARWA;

j. synergy with AUKUS;

k. potential to replace coal as a source of 24/7 baseload power;

l. global trends and lessons to be applied in the Australian context;

m. market design options to facilitate lowest cost electricity supply; and

n. a cost comparison between alternate pathways to achieving a net-zero electricity grid including nuclear energy and the 2024 Integrated System Plan of the Australian Energy Market Operator.

1.3 Despite an already narrowed scope of inquiry in the Terms of Reference, the interim report covers an even narrower scope by focusing on only two issues of inquiry – cost and timing – both of which are the Labor Party's main areas of political attack against the Coalition's nuclear energy plan, and their summation of these issues do not reflect the balance of evidence received.

1.4 With respect to cost, Labor's interim report wrongly promotes the figure of $600 billion as the capital cost of the Coalition's nuclear plan to 2050 despite that being five times more expensive than the real cost which is up to $120 billion. It is notable that, elsewhere, Labor promotes a figure of $122 billion as the capital cost of its renewables-only plan which is five times cheaper than its real cost of over $640 billion.

1.5 Australians currently pay among the highest electricity prices in the world and it will only get worse under Labor's renewables-only plan, and yet the Australian Energy Market Operator was incapable of advising the committee on the real total system cost of Labor's plan to reach a net-zero grid by 2050.

1.6 The committee heard that nations with nuclear as part of a balanced energy mix pay far cheaper electricity prices than Australia, and independent modelling by Frontier Economics demonstrates that adding nuclear to the energy mix in Australia's National Electricity Market would deliver a net-zero electricity grid 44% cheaper than Labor's renewables-only plan.

1.7 In summary on the topic of costs, the deliberate omission of the above points is a sad reflection of the government's lack of any intellectual argument against nuclear energy; instead it has resorted to untruths to promote its renewables-only plan and disparage the Coalition's plan for a balanced energy mix including nuclear. This should alarm every household and business which is currently struggling to pay their energy bills.

1.8 With respect to timing, Labor members of the committee drafted and passed an interim report which confirms the government's plan to force all 24/7 baseload power stations – that is, coal plants – out of the electricity grid by 2038, as per the Integrated System Plan which has 90% of coal generation out of the grid by 2035 and 100% gone by 2038. It is notable that Labor members of the committee denied several times in public hearings that this was their plan. The Committee Chair argued at hearings held in regional communities which host coal plants that Labor was not planning coal plant closures according to this timeline, and yet his own interim report confirms this very timeline.

1.9 The committee heard that four of the five fastest decarbonisations of electricity grids in history were due to nuclear energy, and yet Labor members of the committee decided to ignore this fact along with evidence from Australian and global energy experts that Australia is well placed to introduce nuclear energy consistent with the timeline outlined in the Coalition's nuclear plan.

1.10 The committee heard about the slow rollout of renewable energy projects in Australia and this has also been independently modelled by Frontier Economics, showing the

slow pace and associated cost blow outs of Labor's renewables rollout, and yet this was ignored by Labor members in its interim report.

1.11 In summary on the topic of timing, the deliberate omission of the above points is a sad reflection of the government's lack of any intellectual argument against nuclear energy; instead it has resorted to untruths to promote its renewables-only plan and disparage the Coalition's plan for a balanced energy mix including nuclear. This should alarm every Australian who is concerned about the pace and plan for decarbonising our economy.

1.12 The government's refusal to balance the numbers of members on the committee to allow fairer representation, as proposed by the Coalition, resulted in an unbalanced interim report being passed. The Coalition's amendments to the interim report were voted down, various and contested views heard by the committee were not reported on, and evidence provided by some of the world's most qualified experts in the field of nuclear energy were ignored.

1.13 The political bias of the interim report, as drafted and passed by Labor members of the committee, brings shame on the parliament and on the committee process.

1.14 Lastly, not only does the interim report fail to provide a balanced perspective on the two topics of cost and timing, but it also ignores evidence which demonstrated that:

a. Australia already is a nuclear nation and is well placed to adopt nuclear energy;

b. Australians know nuclear technology saves lives due to the work of our existing nuclear reactor in Sydney which provided medical isotopes;

c. Australians know nuclear technology protects lives due to the bipartisan decision to adopt nuclear propelled nuclear submarines;

d. Australians know nuclear technology underpins livelihoods because we have the world's largest reserves of uranium which not only produces income here in Australia, but guarantees economic prosperity for other nations which use our uranium to power their nuclear plants;

e. Australia already has a world class nuclear reactor, regulator and is party to international treaties required for a civil nuclear energy industry;

f. Modern nuclear power plants are being built on time and on budget, and there is no plausible reason why Australia is not capable of doing the same;

g. Modern nuclear power plants not only have the capability to provide 24/7 always-on baseload power, but they can also ramp up and ramp down to load-follow renewables, making nuclear and renewables complementary zero-emissions clean energy champions;

h. Management of nuclear waste — including spent fuel — has proven to be safe and subject to a well regulated international regime, and the Coalition's plan is consistent with international best practice in this regard;

i. Locating modern nuclear power plants at the site of retiring coal plants is a sensible strategy given access to existing infrastructure such as water and transmission lines, and the various cooling technologies mitigate risks of water shortages at times of drought;

j. Residents in communities which host nuclear power plants are typically most in favour of nuclear technology because they understand the benefits of a multi-billion dollar facility underpinning the local economy for 60 to 80 years, maybe 100 years; and the fact that around 77% of workers from a coal plant can transition to work in a nuclear plant; and

k. All advanced economies around are either using nuclear energy today or seeking to do so, and Australia has the opportunity to join with them by adopting nuclear as part of a balanced energy mix to keep prices down and the the lights on as we decarbonise.

Executive Summary

1.15 Based on the weight of evidence provided to the Committee, the signatories to this dissenting report firmly believe Labor's plan to reach net zero is unrealistic, and a different approach is required. In short, their plan will lead to higher energy prices, rolling blackouts and environmental damage.

1.16 Higher household energy bills will arise from Labor's plan. The actual independently modeled cost of Labor's plan is estimated at $642 billion, compared to the previously claimed $122B, which the government now does not dispute. However, even this $642 billion cost is understated given it excludes costs of many major projects (e.g., Snowy Hydro 2.0), operating costs and consumer energy resources such as batteries and solar. These higher costs are why Australians are seeing their energy bills rise by up to $1,000 since Labor has come into government.

1.17 Labor's plan is not realistic, nor fit for purpose; it is a plan for intermittent energy and higher prices. The plan's projections for onshore wind energy are particularly concerning. Taking onshore wind as an example, AEMO's projections are wildly optimistic. To meet the 2030 target for onshore wind, construction will need to increase to ~5GW per year on average. This is despite the average annual increase since 2010 being <1GW. This almost 500% projected increase is simply not realistic. Further, Labor assumes hydrogen power will become available to contribute significant capacity, despite serious question about whether this technology will ever be commercially viable. Labor's plan also predates the recent explosion in artificial intelligence and data centres, which require consistent baseload power. Consequently, it is unsurprising the Minerals Council of Australia told the Committee Labor's plan was "supply driven" and "negligent".

1.18 Labor’s plan relies on 96% of total capacity provided by intermittent energy projects. The committee heard evidence from many experts that this could put Australia’s energy reliability and security at risk. The committee also heard evidence this could have extremely detrimental impacts on the environment. The Committee heard evidence from environmental groups showing that the impact on biodiversity from not including nuclear or other similar baseload power would devastate bushland, flora and fauna. The scale of land clearance required to erect 12,000 wind turbines was quoted as 114,000 hectares and alarmed local Queensland environment groups who testified strongly against it.

1.19 Australia's continued prohibition on nuclear energy stands in stark contrast to growing global momentum for nuclear power. At COP28, twenty-five countries, including the US and UK, pledged to triple global nuclear energy capacity by 2050, with six additional countries joining at COP29.

1.20 Australia possesses unique advantages for developing nuclear power efficiently and safely, making our current prohibition particularly counterproductive. Our nation maintains world-class nuclear capabilities, possesses established regulatory frameworks through ARPANSA and ASNO, and is developing advanced nuclear expertise through the AUKUS submarine program. These existing capabilities, combined with the Coalition's strategy to utilize transmission infrastructure at former coal sites, provide a practical pathway to reliable, clean energy while minimizing costs and environmental impact.

1.21 The evidence presented to the Committee demonstrates conclusively that nuclear power, as part of a balanced energy mix, represents the most pragmatic solution for Australia's energy future, and:

- Will bring energy prices down as part of a balanced energy mix;
- Is amongst the world’s safest technologies to generate electricity;
- Can be delivered in Australia on time and on budget;
- Can usher in a new era of economic prosperity for regional communities; and
- Is essential if Australia is to replace coal and reach net zero by 2050.

1.22 Frontier Economics' modeling found that AEMO's Progressive scenario including nuclear power is 44% cheaper than the Step Change model without nuclear. Based on this evidence, Coalition members of the committee support the lifting of Australia's prohibition on nuclear energy, mandating transparent cost modeling of alternate energy pathways, and leveraging our existing nuclear capabilities to deliver reliable, affordable, and clean energy for all Australians

Australians are paying among the world's most expensive power bills for increasingly unreliable energy.

1.23 Keeping electricity prices low and the grid reliable should be the core focus of any energy system plan. While decarbonising the electricity system is also key as part of global efforts to reach net zero by 2050, cost and reliability cannot be overlooked. Yet, Australia's energy grid is becoming more expensive and less reliable while overall national emissions have flatlined.

1.24 Electricity bills paid by Australians are made up of a range of costs, of which wholesale electricity is just one. Additional costs include environmental policy costs, retail costs and the network costs, the latter of which is often the most significant.

1.25 Coalition members believe that Australians deserve transparency in energy planning. As such it's critical that any methodology used for energy system planning works backwards from the outcome of low electricity prices and selects the optimum energy mix accordingly. Decisions about Australia's electricity mix should be underpinned by a 'total system cost' approach, and while 'net-present value' is an appropriate tool for comparing options, it was clear throughout this inquiry that its misuse has seriously misled the public.

1.26 Total system costs analysis is not occurring in Australia today, as was revealed throughout the inquiry by a range of expert witnesses. While both CSIRO's GenCost and AEMO's ISP were repeatedly referred to throughout the inquiry, it was clear that neither presented a real total system cost clearly and in an up-front way.

Keeping electricity bills low requires a 'total system cost' approach

1.27 The Committee received extensive evidence from written submissions and expert witnesses[1] advocating for a total system cost approach to transparently reflect the delivered price of electricity to consumers. The Blueprint Institute, emphasised the need for a total-system approach to energy planning, stating:

> The modelling for a decarbonised energy grid should take a total-system approach to costs (including iterated costs for generator assets, transmission, distribution, ancillary grid services, and storage), treat energy reliability as a constraint, and reflect a clear set of expectations and standards around biodiversity and waste management—at every life stage from development, production to end-of-life recycling. This approach would support a fair economic

[1] Liana Downey, Chief Executive Officer, Blueprint Institute, *Committee Hansard*, 12 December 2024, p. 21.

> assessment of clean generating technologies and the optimal investment sequencing pathway for transmission, free of political or ideological bias. [2]

1.28 However, this comprehensive view of system costs is absent from key planning documents, including CSIRO's GenCost report and AEMO's Integrated System Plan (ISP), resulting in an incomplete and misleading picture of the true burden of the government's planned transition on energy consumers.

GenCost and the misuse of LCOE

1.29 The GenCost report is often cited as definitive evidence that a renewables-dominant energy system is the cheapest option. This claim is based on levelised cost of energy (LCOE) estimates, which suggest that nuclear — and even coal — are more expensive than renewables. However, experts have consistently pointed out that LCOE is a flawed and incomplete metric that fails to capture the real costs of building and operating a functional energy system.

1.30 During Committee hearings, Dr Peter Mayfield, Executive Director of CSIRO, clarified that GenCost does not model total system costs but instead provides a "fairly simple levelised cost of electricity analysis", which only represents capital recovery costs from an investor's standpoint. Dr Mayfield admitted:

> We haven't done total systems analysis on the system, which would look at the whole cost all the way through.[3]

1.31 This was further confirmed by Dr Sarah Lawley, who explained that LCOE is not an appropriate tool for evaluating the costs of an entire electricity system:

> Levelised cost of energy for a form of generation is useful for particular tasks but doesn't tell you anything about the costs of different systems. In effect, how much something costs depends on the overall system, not just adding up the individual sources.[4]

AEMO endorsed total system cost but fails to capture it in the ISP

1.32 While GenCost relies on LCOE estimates that fail to capture system-wide costs, the Integrated System Plan (ISP) is often touted as providing a true total system cost. In a 7 August 2023 media release AEMO claimed that the ISP "reflects whole-of-system costs",[5] and the Labor government has used it as the basis for asserting that a renewables-dominant system is the lowest-cost pathway.

1.33 AEMO itself previously recognised total system cost as the correct metric for long-term energy planning. In testimony before the House of Representatives Standing

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2 Blueprint Institute, Submission 369, p. 5.
3 Dr Peter Mayfield, Executive Director, CSIRO, *Committee Hansard*, 24 October 2024, p. 48.
4 Dr Sarah Lawley, Private capacity,*Committee Hansard*, 28 October 2024, p. 33.
5 Australian Energy Market Operator, Media Release, "Integrated System Plan reflects whole of system costs", 7 August 2023.

Committee on the Environment and Energy for the inquiry into the prerequisites for nuclear energy in Australia (2019), Dr. Alex Wonhas, then Chief System Design and Engineering Officer at AEMO, stated:

> …the best metric to look at in the long run is what we call 'total system cost' that takes into account the capital investment and the operating cost of a plant, and that is actually the metric that we are looking at when we do the analysis for the integrated system plan.[6]

1.34 So, Australians are led to believe that the ISP is a total system cost assessment. However, evidence presented to the Committee contradicts this claim. The Committee heard from AEMO representatives that the ISP excludes several key cost components essential to understanding the full financial impact of the transition.[7][8] These omissions include the costs of consumer energy resources (CER) and distribution network upgrades to accommodate these resources, as well as the costs of committed or anticipated projects, including Snowy 2.0, CopperString, Central West Orana, and the Waratah Super Battery.

1.35 AEMO chief executive Daniel Westerman conceded that the ISP does not account for all key expenses associated with the transition, despite being framed as the "least-cost pathway" for the transition. When asked whether the ISP's cost estimates represent a true total system cost, Mr Westerman admitted:

> What the integrated system plan is the least cost pathway to meet reliability standards and system security standards through a series of government emissions targets to net zero by 2050. It is the least cost pathway. It's not a modelling of all the costs.[9]

1.36 The ISP's failure to reflect total system cost raises serious doubts about the credibility of Labor's renewables-only plan as the least-cost transition. By excluding key expenditures and failing to capture the full financial impact on end users, the ISP does not provide Australians any confidence that Labor's renewables-only plan will bring down power bills.

Labor's 'renewables-only' plan is a road to ruin

1.37 The weight of evidence from credible experts with relevant experience highlighted factual inaccuracies of claims that Labor's renewables-only plan is the lowest-cost pathway to emissions-free electricity, which is an assumption based on CSIRO and AEMO modelling that, as already established, excludes key cost components and significantly understates the true financial burden of Labor's energy plan. It is also clear that the evidence pointing to these documents, used to attack the prospect of

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6 Dr Alex Wonhas, *Proof Committee Hansard*, 29 August 2019, p. 25.

7 Merryn York, Executive General Manager, Australian Energy Market Operator, *Committee Hansard*, 24 October 2024, pages. 35-36.

8 Australian Energy Market Operator, Submission 626.1, p. 1.

9 Mr Daniel Westerman, Chief Executive Officer, Australian Energy Market Operator. *Committee Hansard,* 24 October 2024, p. 36.

nuclear, are misguided in assuming that the ISP itself assesses nuclear power. It does not.

Net present value is not the real cost paid by consumers

1.38 Energy Minister Chris Bowen and the Labor government have repeatedly cited $122 billion as the total cost of the Integrated System Plan (ISP) without clearly stating that this figure represents a net present value (NPV) estimate rather than the actual, undiscounted cost that consumers will pay over time. This misrepresentation distorts public understanding of the true financial burden of Labor's renewables-only transition.

1.39 When questioned in the Committee, AEMO chief executive Daniel Westerman confirmed that the ISP's cost figure is an NPV estimate:

> The total system cost of the step-change scenario as modelled in the integrated system plan is $122 billion in annualised cost terms.[10]

1.40 Ms York Executive General Manager, System Design, AEMO stated:

> It is the annualised capital cost between 2025 and 2050 of all the elements that you've just mentioned, discounted back to today's dollars.[11]

1.41 However, when asked about the undiscounted, real total system cost, including committed projects, AEMO was unable to provide an answer from a total system cost perspective. Coalition Members were surprised that the market operator could not disclose the real cost of its preferred model for the energy transition and requested a formal response via Questions on Notice.

1.42 Coalition Members are disappointed that AEMO once again failed to provide a clear response in their formal reply. When asked to disclose the aggregate cost from 2025 to 2051, AEMO claimed that the "2024 ISP does not provide a forecast of the needed investment to 2051".[12] This assertion is demonstrably false, as AEMO's own 2024 ISP Generation and Storage Outlook workbook contains cost projections spanning from 2024-25 to 2051-52.

1.43 In any case, AEMO continued to withhold the real total system cost out to 2050, despite being in a position to provide this figure. The Coalition Members are concerned the market operator's lack of transparency prevents policymakers and the public from understanding the full cost of Labor's renewables-only plan.

1.44 This is why independent work, such as that conducted by Frontier Economics, is critical in informing public debate. Frontier Economics calculated the actual undiscounted cost of the ISP at $642 billion, using the same assumptions as

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10 Daniel Westerman, Chief Executive Officer, Australian Energy Market Operator, *Committee Hansard*, 24 October 2024, p. 35.

11 Merryn York, Executive General Manager, System Design, Australian Energy Market Operator, *Committee Hansard*, 24 October 2024, p. 35.

12 Australian Energy Market Operator, Submission 626.1, p. 1.

AEMO.[13] This real cost is more than five times the $122 billion figure that Labor and renewables-only advocates frequently cite.

1.45 Yet, misleading cost comparisons continue to be made—particularly with nuclear. Mr. Grimes of the Smart Energy Council claimed that the Coalition's nuclear policy "would be, at a minimum, $116 billion."[14] However, the Smart Energy Council's estimate reflects total capital build cost,[15] whereas the ISP's $122 billion figure is an NPV estimate. As another expert witness pointed out, this "is not even close to an apples-to-oranges comparison."[16]

1.46 Coalition Members are deeply concerned that accounting tricks are being used to understate the cost of Labor's renewables-only plan while making unfair and invalid comparisons with nuclear grid estimates. By relying on NPV figures — which themselves omit key expenditures — to give the impression of lower costs, the government fails to provide an honest assessment of the true price of their energy transition—a cost that will ultimately be paid by Australian households and businesses.

Infrastructure overbuild will lead to higher costs

1.47 The Committee received evidence warning that a renewables-only system will require excessive infrastructure expansion, driving up costs for consumers. Experts point out that variable renewable energy (VRE) relies on widely dispersed, intermittent resources, necessitating significant generation, storage, and transmission to maintain reliability.

1.48 The Centre for Independent Studies has noted that AEMO's own ISP modelling demonstrates the inefficiencies inherent in a renewables-dominant system, requiring vast amounts of underutilised infrastructure:

> …building an energy system almost entirely dependent on sources of energy that are dispersed, intermittent and uncontrollable is an expensive and difficult exercise. The ISP demonstrates that such a system will require vast amounts of machinery used inconsistently; with most being used at less than half their full capacity, and some barely used at all. This is a recipe for an expensive system.[17]

1.49 The United States Department of Energy's Pathway's Report[18], referenced by Michael Asten, has found, using a total system cost analysis, that a renewables and storage based grid is 37% cheaper with nuclear power:

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13 Frontier Economics, Report 1 – Developing a base case to assess the relative costs of nuclear power in the NEM, 14 November 2024.
14 John Grimes. Chief Executive Officer, Smart Energy Council, Committee Hansard, 28 October 2024, p. 13.
15 Smart Energy Council, Press Release, Nuclear Fallout: $116-$600 billion to build 7 nuclear reactors, June 22 2024.
16 Aidan Morrison, Director, Energy Research, Committee Hansard, 28 October 2024, p. 72.
17 Centre for Independent Studies, Submission 371.1, p. 1.
18 US Department of Energy, "Pathways to Commercial Liftoff", September 2024, p. 10.

> The study concludes there would be a 37% lower cost of power from renewables and storage combined with nuclear power, when compared with power from renewables and storage only.[19]

1.50 This finding was consistent with work referenced by submissions to the inquiry from the Nuclear Energy Institute:

> Including nuclear energy results in the lowest cost system and translates to the lowest bills for electricity users. An energy system with 43% of its power drawn from nuclear energy would be significantly more cost effective than an energy system with just 13% from nuclear energy, with savings in excess of U.S.$400 billion[20].

1.51 Professor Stephen Wilson further explained that low-energy-density, part-time energy sources require extensive infrastructure buildout, often located far from demand centres, compounding costs:

> The root cause of the very high cost of systems that are trying to rely just on wind, solar power and storage are the intermittencies, the part-time nature of the primary resource at the input side and also the very low-energy density of that energy and its location. It's not near the load, it's further and further away from the load, it's very low density and it's part time. What that means is you end up building assets that have a very low utilisation factor.[21]

1.52 He cautioned that while moderate renewables penetration can be integrated economically, forcing a renewables-only system leads to escalating costs and infrastructure bloat:

> You can accommodate, economically, a small proportion of these resources but once you get to about the level we're at now, if you keep forcing them in, you see a dramatic escalation and bloating of physical assets and costs, and you end up doubling and doubling again and probably going up to five and six times the cost of where we used to be.[22]

1.53 The Committee also heard evidence that incorporating nuclear power would significantly reduce overbuild requirements. Nuclear's high-capacity factor and dispatchability reduce the need for excessive backup storage, transmission expansion, and redundant generation capacity.

1.54 Professor Jacopo Buongiorno emphasised that nuclear serves to stabilise the grid, preventing excessive spending on renewables-supporting infrastructure:

> ...a 100 per cent renewables—or frankly, 100 per cent nuclear—grid would not be the least cost option… the role of nuclear is not that it has the lowest cost

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19 Michael Asten, Submission 363, p. 4.
20 Nuclear Energy Institute, Submission 360, p. 3.
21 Stephen Wilson, Visiting Fellow, Institute of Public Affairs, *Committee Hansard*, 28 October 2024, p. 36.
22 Stephen Wilson, Visiting Fellow, Institute of Public Affairs, *Committee Hansard*, 28 October 2024, p. 36.

> megawatt hour, kilowatt hour produced; it's that by keeping nuclear in the mix, it allows you not to have to build or overbuild the capacity of solar or wind storage and transmission lines that go with a 100 per cent fully renewable grid. So, in the end, it helps bring down the average cost.[23]

1.55 The evidence presented to the Committee demonstrates that a renewables-only system is not the least-cost energy pathway. The ISP's modelling confirms that an ultra-high renewables grid requires substantial overbuild, yet this systemic inefficiency is downplayed by the Labor government. The massive investment required for generation, transmission, and storage expansion will inevitably drive up electricity prices, while alternative pathways, such as a mix including nuclear, would reduce unnecessary infrastructure spending.

Consumer energy resource costs are excluded.

1.56 The Committee received evidence warning that several key assumptions in the ISP understate the true cost of Labor's renewables-only transition. The ISP excludes costs associated with consumer energy resources (CER), which are borne by households.

1.57 Dr. Dave Collins estimated that the capital cost of distributed energy resources—rooftop solar, behind-the-meter batteries, and the necessary low-voltage network upgrades—adds at least another $240 billion to the total system cost.[24] Similarly, the Centre for Independent Studies estimated that the total capital cost for rooftop solar and home batteries alone would amount to approximately $347.5 billion by 2050.[25]

1.58 The Committee heard concerns that the ISP relies on CER uptake to artificially reduce the planned utility-scale investments in renewables, transmission, and storage—thereby decreasing the reported system cost.

1.59 Coalition Members have already noted that if CER uptake does not materialise as forecasted, additional utility-scale investments will be required—raising system costs. The same concern applies to projected hydrogen production; should it fail to develop as expected, the system will need greater reliance on gas and storage to firm renewables or will suffer increased energy spillage.

1.60 Former Victorian Energy and Industry Minister Theo Theophanous described green hydrogen as potentially difficult solution, noting that:

> …it's become clear that [green hydrogen] is an extremely costly process. Hydrogen is difficult to use, it's hard to ship and it's very expensive, and so getting that last 20 per cent is a real challenge… you cannot ignore the fact that you've got to build double the capacity. That's a huge expense to the system.

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23 Jacopo Buongiorno, Director at Nuclear Reactor Laboratory, *Committee Hansard*, 18 November 2024, p. 4
24 David Collins, Submission 393.1, p. 8.
25 Centre for Independent Studies, Submission 371.1, p. 5.

> You can't ignore the fact that you've got to build massive transmission lines. All of these are subsidies to the renewable energy sector.[26]

1.61 These assumptions, while favourable to renewables on paper, mask the true cost of the transition. If they were removed from ISP modelling, the financial burden on consumers could be significantly higher than currently acknowledged.

The 82% renewable target by 2030 unnecessarily increases cost

1.62 The Committee received evidence demonstrating that Labor's renewables-only energy transition is optimised to hit Labor's targets first, and not the best cost outcomes for electricity consumers. Perversely, this means that arbitrary political targets are the primary focus of Labor's current "least-cost" modelling, whilst Australian households and businesses and the electricity prices they pay are put last. This includes the Federal target of 82% renewable energy by 2030 amongst various State targets. These constraints increase total system costs by limiting technology choices, imposing arbitrary renewable energy and emissions targets, and preventing transparent cost comparisons.

1.63 Coalition Members recognise that a constrained system is necessarily more expensive than an unconstrained one — a principle well supported by expert testimony and submissions.[27] [28] [29] The evidence presented suggests that by mandating a particular energy mix rather than allowing the market to determine the lowest-cost decarbonisation pathway, Labor's plan is artificially inflating costs.

Automatically excluding technology increases total system cost

1.64 The Committee has consistently heard the need for energy planning that is technology-neutral in identifying the least-cost, low-emission electricity generation options.[30] [31] [32] [33]

1.65 Despite AEMO describing itself as "technology agnostic", the Integrated System Plan (ISP) does not model a scenario that includes nuclear energy. This omission is not due to technical or economic constraints, as AEMO chief executive Daniel Westerman confirmed:

> …the Integrated System Plan does not consider nuclear as a component of that plan, and that is because nuclear is not currently permitted under Australia's current laws and policies.

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26 Theo Theophanous, Private capacity, *Committee Hansard*, 4 December 2024, p. 56.
27 Centre for Independent Studies, Submission 371.1, p. 1.
28 Gamma Energy Technology, Submission 5, p. 2.
29 Geoff Bongers, Director, Gamma Energy Technology, *Committee Hansard*, 15 November 2024, p. 22.
30 Minerals Council of Australia, Submission 430, p. 3.
31 Chamber of Minerals and Energy, Submission 298, p. 2.
32 Gamma Energy Technology, Submission 5, p. 3.
33 Silex Systems Limited, Submission 232, p. 3.

1.66 This policy-driven exclusion inherently biases the ISP in favour of a renewables-only transition, rather than allowing an objective evaluation of all viable pathways. Will Shackel, Founder of Nuclear for Australia, stated:

> In terms of the ISP and AEMO, as this committee has heard, they're framed by government policy, and the government policy, at the moment, is a renewables target without any nuclear, so they're not able to actually consider what impacts nuclear energy could have. Therefore, I think it's very difficult to make the comparison between an approach which has a balanced energy mix with nuclear as compared to a renewable one.[34]

1.67 By outright excluding nuclear energy—a proven, reliable source of zero-emissions electricity—Australians are denied the opportunity to consider its role as a cost-effective solution for decarbonising the grid.

1.68 Gamma Energy Technology warned that constraining viable low-emissions firm technologies like nuclear and CCS will necessarily increase total system cost:

> Constraining technologies increases the total system cost at deep decarbonisation levels… If no low emissions, firm generation such as CCS and nuclear, are available, very deep decarbonisation will become a significant system cost issue. Without BECCS or fossil CCS, nuclear power is required for deep decarbonisation, will be more than necessary. Constraints to the deployment of technologies, when applied, limit the possible 2050 decarbonisation transformation options, will result in a less than optimum total system cost.[35]

1.69 The economic consequences of these constraints were also highlighted by Dr. Bongers, who emphasised that limiting technology choices will reduce Australia's competitiveness and increase cost-of-living pressures:

> If we are disproportionately increasing our cost compared to others who are using a mix to get a lowest total system cost, if we choose to eliminate a technology or two and that results in a higher overall cost…[36]

Emissions and renewables targets are driving up costs

1.70 The ISP does not determine the most cost-effective energy transition; instead, it is designed to comply with pre-set government emissions and renewable energy targets. This policy constraint locks in a renewables-only pathway, regardless of feasibility or cost.

1.71 AEMO CEO Daniel Westerman confirmed that all three ISP scenarios assume the 82% renewables-by-2030 target, alongside other government-imposed policy constraints:

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34 Will Shackel, Founder, Nuclear for Australia, *Committee Hansard*, 15 November 2024, p. 44.
35 Gamma Energy Technology, Submission 5, p. 3.
36 Geoff Bongers, Director, Gamma Energy Technology, *Committee Hansard*, 15 November 2024, p. 22.

> Yes, it is. And, while we're clarifying, I might just add that it also has the constraint of several other government policies that are included. Offshore wind targets is an example, and there are a number of other targets in there, including the 82 per cent by 2030.[37]

1.72 The Centre for Independent Studies warned that binding the ISP to these political targets results in higher costs:

> AEMO has constrained the ISP model so it must reach state and federal renewables targets, carbon budgets, and other policy targets regardless of their feasibility or cost. The 82% renewable energy target is currently the most significant constraint… The ISP's flaws mean it not only fails to find a least-cost system but also seriously understates the cost of the system it proposes.[38]

1.73 Dr Sarah Lawley reinforced this concern, stating that the ISP's scenarios were unrealistic from the outset due to the political targets imposed on them:

> …the ISP scenarios themselves were not realistic in the first place, due to the unrealistic government targets that were imposed on them… A consequence of the coal closure schedule not being realistic is that the ongoing need for the coal units has not been adequately considered or planned for. Hence, we are now observing ad hoc state government-initiated interventions, in the form of bespoke piecemeal coal extensions.[39]

1.74 Labor's renewables-only plan is not the result of an open, technology-neutral cost-benefit analysis, but rather a constrained model designed to comply with pre-determined political objectives. These constraints inflate total system costs, leading to higher electricity prices, increased infrastructure requirements, and reduced flexibility in responding to future energy needs.

There are a number of reasons to believe electricity bills will rise under the current plan

1.75 Experts warned power bills go up. When asked whether consumer prices were likely to decrease to meet the government's $275 reduction target, Dr. Sarah Lawley responded:

> No, I don't think that's likely… There are different components to it [electricity bill]—the wholesale cost, the poles and wires and the green costs.… even if the prices are negative during the middle of the day, if they are very, very high in the evening, you need to scale that up accordingly, as a retailer, because you're going to be charged that by the operator… in lots of different ways, retailers have to ensure that they're charging enough to recover those different increasing costs

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37 Daniel Westerman, Chief Executive Officer, Australian Energy Market Operator, *Committee Hansard*, 24 October 2024, p. 41.

38 Centre for Independent Studies, Submission 371, p. 3.

39 Sarah Lawley, Submission 848, p. 3.

> in the wholesale part. In the poles and wires part, if you're building vast amounts of transmission, it's pretty obvious that those costs are going to go up as well.[40]

1.76 Aidan Morrison of the Centre for Independent Studies:

> I think there is no chance that power prices will fall in the medium to long term under this plan. The degree of effort that's required in expending on capital expenditure, particularly in the transmission and distribution network in the next few years, is utterly incompatible with any fall in retail or commercial electricity prices in the next few years.

1.77 Macquarie University's Transforming Energy Markets Research Centre:

> When all electricity costs are considered, modelling by Electric Power Consulting shows that development of the NEM in accordance with the Step Change scenario of the Integrated System plan leads to ongoing large electricity costs for customers... If the ISP is implemented in its present form, high electricity costs will likely lead to accelerated de-industrialisation of the Australian economy and increasing energy poverty.[41]

1.78 In the absence of genuine counterfactual modelling that considers alternative technologies such as nuclear, there is no valid basis to claim that a renewables-dominant system represents the cheapest clean energy option. On the contrary, multiple factors indicate that if Labor's renewables-only plan proceeds, the overall cost of Australia's energy system will rise significantly.

1.79 The Committee heard evidence that when all system costs are properly accounted for, Labor's renewables-only energy transition would prove more expensive than widely perceived, with costs escalating as further renewables penetration is integrated into the grid.

1.80 In its submission to the Inquiry, Gamma Energy Technology found that emissions reduction in the NEM leads to increased total system costs:

> When examining the impact of the constrained access to a technology, or suite of technologies on the lowest total system cost it has again and again been demonstrated that reducing the carbon emissions from the NEM comes at an increased cost.[42]

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40 Sarah Lawley, Private capacity, *Committee Hansard*, Monday, 28 October 2024, p. 33.
41 Macquarie University, Submission 782, p. 7.
42 Gamma Energy Technology, Submission 5, p. 3.

Australia's nuclear ban is out of step with the rest of the world

1.81 The Committee heard extensive evidence suggesting Australia's moratorium on nuclear is out of line with the rest of the world, with many countries recognising nuclear as a critical solution to decarbonisation in the energy sector.

> Other countries are turning to nuclear as they seek to ensure reliability and cost affordability. Australia is one of the few developed countries that is opposed to nuclear energy – the only large scale zero emission power source capable of operating 24/7, 365 days a year. Australia is it at odds with most other developed countries who are again focusing on nuclear energy as a way of providing affordable, reliable and, importantly, zero emission power.[43]

1.82 The global momentum for nuclear energy has permeated both policy and financial domains.

> At COP28, 25 countries, including the US and UK, pledged to triple global nuclear energy generating capacity by 2050. On 13 November 2024 at COP29, six additional countries joined the pledge, taking the total to 31 countries… In September 2024, 14 major financial institutions (including Bank of America, Citi, Goldman Sachs, Morgan Stanley and Rothschild & Co) declared support for the pledge to triple global nuclear energy generating capacity by 2050.[44]

1.83 During testimony, Ms Cook declared nuclear as the backbone of the global decarbonised energy system, and expressed concern over Australia's inexplicable departure from global trends.

> I firmly believe that the backbone of the world's future decarbonised energy system will need to be nuclear energy. In addition to the 32 countries utilising nuclear energy today, more than 50 countries are at various stages of actively considering nuclear or implementing new programs… All other countries in the G20 utilise nuclear energy, are able to access it from neighbours or are actively developing nuclear power programs… Since coming home to Australia, and in the context of my day-to-day work overseas, I'm concerned that our country is increasingly out of step with other industrialised countries and countries in our region. However, in my professional opinion, Australia is one of the best placed countries, if not the best placed, in the world to move ahead expeditiously and responsibly to implement a nuclear energy program.[45]

1.84 This was reiterated by Dr Edward Obbard:

> In a context of very high risks, uncertainties and probable loss of life and livelihoods, it is unconscionable that a developed country like Australia should

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43 Coalition for Conservation, Submission 179, p. 3.
44 Helen Cook, GNE Advisory, Submission 206, p. 2.
45 Helen Cook, Private capacity, *Committee Hansard*, 12 December 2024, p. 45.

> rule out a whole class of the most powerful zero-emissions energy technology. We must take all possible steps to use nuclear energy and continue to develop renewables. Nuclear energy is expensive. Building nuclear power plants takes years—this is not contested. We should have started 20 years ago. It does not mean we can't start now.[46]

1.85 Coalition Members identify Australia's position on nuclear as wholly inconsistent with other industrialised and developed countries who are depending on nuclear energy as a critical technology for decarbonisation.

1.86 The Committee heard evidence global momentum for nuclear is also underscored by significant investment from Big Tech, recognising that nuclear is critical to delivering the energy density and scale required for the next generation of data centres and AI technologies. Crucially the ISP was developed before the advent of commercial AI and data centres, meaning the energy load intensity is not currently factored into AEMO's demand profile forecasts.

> In addition to Government based initiatives, the "Big Tech" sector has recently significantly increased its support of nuclear energy; recognising that nuclear is critical to delivering the energy density and scale required for the next generation of data centres and AI technologies. This has included support from and commercial deals from many of the world's largest technology companies such as Microsoft, Google, Amazon, Oracle and OpenAI amongst others.[47]

> Microsoft are the ones that just fired up the Three Mile Island nuclear plant. They've just done a deal with the owners of that. It was shut down about four or five years ago, and it's now getting refired. All your big companies—Amazon, Google and all of those—are setting up deals with nuclear power to have green power to power their data centres. In Australia, we need to be doing the same. We've got data centres right across this country. They're not going to be green powered.[48]

A balanced grid with nuclear will cost 44% less than a renewables-only grid

1.87 Frontier's modelling found that AEMO's Progressive scenario including nuclear power is 44% cheaper than the Step Change model without nuclear, and that using a Step Change model with nuclear will garner a 25% cheaper solution than using renewable and storage alone.[49] Frontier and other independent modelling shows including nuclear will lead to lower total system cost than renewables-only grid.

> The lowest total system cost solutions always have a mix of nuclear, CCS, storage, biomass, renewables, and peaking plant.[50]

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46 Dr Edward Obbard, Private capacity, *Committee Hansard*, 12 December 2024, p. 45.
47 Jonathan Fisher, Submission 37, p. 3.
48 Robert McCosker, Director, McCosker Contracting, *Committee Hansard*, 13 November 2024, p. 30.
49 Danny Price, Economic Analysis of Including Nuclear Power in the NEM, Frontier Economics Insight, 13 December 2024.
50 Gamma Energy Technology, Submission 5, p. 1.

1.88 Nuclear Energy Institute cite studies:

> Vibrant Clean Energy analyzed the role of nuclear energy in decarbonizing the U.S. energy system and found that when taking into account the need to match demand with generation in the same geographic area at the same time, including more nuclear energy results in the lowest cost system and translates to the lowest bills for electricity users. The study also found that an energy system with 43 percent of its power drawn from nuclear energy would be significantly more cost effective than an energy system with just 13 percent from nuclear energy – with savings in excess of U.S.$400 billion. An analysis by E3 found similar effects when it modeled the Pacific Northwest 10 and other studies have reinforced these findings.[51]

1.89 Prof. Buongiorno in his opening statement:

> …when integrated in a balanced mix with renewables and storage, nuclear actually reduces the average cost of electricity for consumers. This is primarily because nuclear reactors generate carbon-free electricity 24/7 365 days per year with no intermittency. If only intermittent energy sources such as wind, solar and the energy storage that goes with them are used to deeply decarbonise the power grid, then an enormous overcapacity of solar panels, wind turbines, electric batteries and transmission lines must be built to meet the electricity demand throughout every hour of the day and every day of the year.[52]

1.90 Ronald James AFSM refers to Finland's reactor reducing prices:

> When a new reactor came online, reports state the price of electricity in Finland fell by 75%.[53]

1.91 The Coalition members note that the Chair's report relies on IEEFA assessments of cost, which has been found by other industry analysts to be a deeply flawed analysis on a number of grounds. Firstly, it is not a comparison of Labor's plan against the Coalition's plan. Secondly, it makes a major technical error as outlined by Mr Danny Price of Frontier Economics in his first report:[54]

> When comparing the costs of alternative states of the world it is important to establish the base against which an alternate world is being compared. Unless the base case is appropriately established the comparison could result in an incorrect conclusion about the relative costs of the alternative world.
>
> An excellent example of the error that can occur from this mistake can be seen in the recent analysis conducted by the Institute for Energy Economics and Financial Analysis (IEEFA). The authors compared the wholesale electricity costs

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51 Nuclear Energy Institute, Submission 360, p. 3.

52 Jacopo Buongiorno, Director at Nuclear Reactor Laboratory, *Committee Hansard*, 18 November 2024, p. 1.

53 Ronald James AFSM, Submission 412, p. 10.

54 Frontier Economics, "Report 1 – Developing a base case to assess the relative costs of nuclear power in the NEM", 14 November 2024.

> of current electricity bills, which reflects a combination of coal, gas, oil, wind, solar, hydro and storages and substituted this plant mix with their estimate of nuclear power, implicitly assuming that consumers are suddenly only supplied by one form of electricity. Clearly this approach is wrong as it is not reflective of how any power system works and would not be what would happen in the NEM if nuclear formed part of the plant mix used to economically and reliably meet demand.

1.92 Coalition members recognise the critical importance of including nuclear energy to reduce the total system cost of the energy system itself. The lowest total system cost grid will always include nuclear in some capacity.

Nuclear can be delivered cost effectively

1.93 The Coalition members believe that nuclear power is worth investing in because it provides low-cost, clean, and reliable energy for 60 to 100 years. While the up-front capital costs of nuclear power stations are significant, these can be minimised through a well-planned rollout.

1.94 The Coalition members were disappointed to read that the Chair's report cites the claim from the Smart Energy Council, a peak body for the renewable energy industry, that Nuclear power could cost up to $600 billion. The committee also received 8 submissions citing this claim.[55] However, the Coalition Members note that Oscar Archer, engineer, provided evidence which revealed that the methodology behind this assumption were not credible. In fact, the Smart Energy Council assumed an overnight capital cost for building nuclear power that was 442% larger than CSIRO and AEMO's testimony regarding their GenCost report.

1.95 Dr Oscar Archer explained in his submission that:[56]

> $600 billion AUD corresponds to a rudimentary calculation assuming 11 GW worth of capacity at the same cost as the Hinkley Point C twin EPR 3.2 GW plant in Somerset, UK, at AUD$87 billion (11 ÷ 3.2 = 4.4375, 87 x 4.4375 = 299), and doubled.

1.96 Coalition members argue the Smart Energy Council's assumptions and lack of a credible methodology for its work has resulted in a grossly different cost outcome from the GenCost report and other credible estimates and concludes this figure is completely unintelligible and should be dismissed.

1.97 The committee also received submissions which found that building a number of reactors sequentially has achieved significant cost savings and provides significant insurance against the risk of cost blowouts for reactors:[57]

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55 Submissions 216, 431, 335, 388, 88, 328, 819, and 474.
56 Dr Oscar Archer, Submission 10, p. 6.
57 Centre for Independent Studies, Submission 371, p. 4.

> [building] more reactors at fewer sites [allows] for 'learning by doing' and economies of scale at each site. It allows for economies of scale because a substantial portion of the costs for nuclear energy are on a 'per-site' basis, and include civil works, establishing water access, transmission corridors, attaining social license, and various safety and regulatory overheads. Australia should focus on building larger nuclear plants at a limited number of sites.

1.98 This is in line with the Coalition's energy policy, which confirms that Australia would only build first-of-a-kind reactors in line with international best practice and would significantly reduce the cost of a nuclear buildout.

1.99 The Nuclear Energy Institute submitted that:

> A strategy that embraces nuclear deployment alongside wind and solar provides more options to ensure that the transition to carbon-free energy sources can be accomplished in a manner that maintains reliability and affordability … Recent civil nuclear power projects have created learning lessons for the U.S. nuclear industry that are being incorporated into new and ongoing nuclear power projects to drive down the cost curve and improve project delivery. Earlier this year, the U.S. brought online Vogtle Unit 4, which was reportedly 30 percent more efficient and 20 percent cheaper than Unit 3, which began commercial operations in 2023.[58]

No nuclear means no net zero

1.100 The Committee heard extensive evidence from a wide range of witnesses and submissions that Australia is not on track to meet its emissions reduction and renewable energy targets under Labor's plan, and yet a wide array of witnesses supported the deployment of nuclear energy as a climate solution to drive emissions reductions in the energy sector.[59] [60] [61]

> The renewable rollout has slowed in Australia. Committed investment into grid-scale renewable generation capacity fell from $6.5 billion in 2022 to just $1.5 billion in 2023…[62]
>
> The reality is Australia will not meet its 82 per cent by 2030 renewable energy target. As the Australian Energy Market Operator has admitted, it is getting harder each year to ensure lights stay on. There is no reason to expect this will get better anytime soon. Snowy 2.0, the centre-piece of the energy transition, is already five years behind schedule, and more than A$10 billion over budget. But this is symptomatic of a broader problem for the government's energy agenda – the need for additional government assistance to support the roll-out of

58 Nuclear Energy Institute, Submission 360, p. 4.
59 Australian Nuclear Association, Submission 180, p. 1.
60 Rainforest Reserves Alliance, Submission 123, p. 5.
61 Dr Geoff Bongers, Gamma Energy Technology, *Committee Hansard*, 15 November 2024, p. 27.
62 Blueprint Institute, Submission 369, p. 8.

> renewable energy, despite it being promised to bring down energy prices. The government is already assuming even greater market risk for new large-scale renewables and storage projects by guaranteeing minimum payments under the Capacity Investment Scheme.[63]

1.101 Evidence was also heard that nuclear was the most preferable generation technology for environmental outcomes beyond emissions reduction. Rainforest Reserves Australia found that nuclear's minimal comparable land use compared to utility-scale renewables meant nuclear was clearly preferable to minimise adverse biodiversity impacts.

> In stark contrast, nuclear power does not require extensive land use. When considering biodiversity, the inclusion of nuclear energy in our nation's energy portfolio appears to be a responsible choice and any hesitance toward this option raises questions about underlying motives.[64]

1.102 Further, Dr David Collins testified that when considering overall health effects, nuclear was superior to renewables, including that nuclear produces less greenhouse gas emissions than wind and solar.

> The United Nations looked at health effects, and they looked at a number of other parameters, like environmental effects, water consumption et cetera. In every case, with the exception of water, nuclear was much better than wind and solar—in every case. And, on average, nuclear facilities used less water than coal facilities. That's the only parameter where nuclear doesn't do as well as wind and solar—but everything else. By the way, on greenhouse gas emissions, nuclear is much less than wind and solar. The embodied energies in nuclear energy are much less than wind and solar.[65]

1.103 The committee also heard from Dr Keefer and Ms Hoff about the successful 'coal to nuclear' transition in Canada which saw the deployment of around 20 nuclear reactors in less than three decades. This resulted in one of the world's fastest efforts to decarbonise an electricity grid. Ms Hoff noted that history shows that countries which decarbonise do so "primarily with a combination of nuclear and naturally occurring hydro"[66]

> And the health consequences—I'm also a medical doctor—have been truly tremendous. It's estimated that a thousand premature deaths have been avoided every year. The majority of the power required to phase out coal came from nuclear. So I think this is a really remarkable success story and one that should be celebrated, particularly by environmentalists. [67]

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63 Coalition for Conservation, Submission 179, p. 2.
64 Rainforest Reserves Alliance, Submission 123, p. 21.
65 Dr David Collins, Private capacity, *Committee Hansard*, 28 October 2024, p. 59.
66 Heather Hoff, Mothers of Nuclear, *Committee Hansard*, 21 November 2024, p. 1.
67 Chris Keefer, Canadians for Nuclear Energy, *Committee Hansard,* 21 November 2024, p. 4.

Australia is Already a Nuclear Nation and Can Develop a Nuclear Energy Industry at Pace

1.104 The overwhelming bulk of evidence from experts with relevant nuclear experience confirmed that Australia is well-positioned to deploy a nuclear energy industry, in large part due to the fact that Australia already is a nuclear nation.

1.105 Renowned nuclear Law professional, Helen Cook stated that Australia was one of the best positioned countries in the world.

> Australia is one of the best-positioned countries in the world to move ahead with a nuclear energy programme and to do so expeditiously and responsibly"

1.106 The Coalition Members believe that Australia's existing capability, and the trust we have built internationally as a result of our work in non-proliferation and other treaty development places us in an excellent position to undertake the development of a Nuclear Power program. Such a program would also clearly lift Australia's capability in science and engineering.

1.107 The committee also heard evidence that developing a Nuclear Power program would significantly improve Australia's technical and engineering capability and work hand-in-hand with our University sector.

1.108 The Committee heard from DFAT that Australia has established a comprehensive framework for nuclear non-proliferation, safety, security, and liability through nine international agreements, having ratified: [68]

a. The Treaty on the Non-Proliferation of Nuclear Weapons (1973)

b. the Comprehensive Safeguards Agreement (1974)

c. the Additional Protocol to CSA (1997)

d. The Convention on Nuclear Safety (1997)

e. the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (2003)

f. the Convention on Early Notification of a Nuclear Accident (1987)

g. the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (1987).

h. The Convention on the Physical Protection of Nuclear Material (1987) and the CPPNM Amendment (2016).

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[68] Vanessa Wood, Department of Foreign Affairs and Trade, *Committee Hansard*, Thursday 24 October 2024, p. 13.

i. The Vienna Convention on Supplementary Compensation for Nuclear Damage (1997).

1.109 The Committee heard evidence that Australia is already a nuclear nation, with world class capabilities in research and regulation. Helen Cook, an expert in nuclear law and regulation, submitted that:

> Australia's nuclear credentials are well-established through decades of experience – Australia has been a nuclear nation since the 1950s, when our first research reactor was commissioned. Australia is one of the original member states of the IAEA. Australia has de facto permanent membership of the IAEA's Board of Governors as the sole designated representative from the South-East Asia and Pacific Region, reflecting our nuclear leadership position in the region to date.[69]

1.110 Similarly, several witnesses (including the former head of legal for the Australian Radioactive Waste Agency) provided evidence supporting Australia's existing regulatory capacity as a starting point to develop a comprehensive regulatory landscape for nuclear energy in Australia.

> [ARPANSA] is working to upskill the Department of Defence to establish the new naval regulator for AUKUS. They're actually providing all that expertise and support to the Department of Defence, and that is a new regulator that is regulating nuclear activities. As you know, with the small modular reactors that will be inside the submarines. So it's not leaps and bounds for ARPANSA to start regulating a nuclear power industry. They would just need to be resourced to do so.[70]

1.111 Other witnesses lauded Australia's nuclear scientists and lawyers among the best in the world.

> We have an established nuclear industry in Australia. We have the OPAL reactor in Sydney that is providing nuclear science. We have a regulatory regime that is already being stood up that supports nuclear energy. We have the best scientists and lawyers working on systems. In South Australia, we have the very best lawyer that has helped seven countries across the world, Dr Helen Cook. We have the University of New South Wales and the University of Sydney. I would say that this is a furphy. It is a convenient untruth that we don't have a regulatory regime that could support nuclear immediately.[71]

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69 Helen Cook, GNE Advisory, Submission 206, p. 5.

70 Kirsty Braybon, Private capacity, *Committee Hansard,* 5 December 2024, p. 9.

71 Tania Constable, Minerals Council of Australia, *Committee Hansard*, 17 December 2024, p. 5.

1.112 Ms Constable gave evidence that we possess both a "world-class skilled workforce" and that ARPANSA and ASNO "can be added to in terms of their skill set and stood up immediately. So I don't accept that it will take 15 or 20 years…"[72]

1.113 Further, Ms Cook recognised Australia's well-established existing regulatory capacity for nuclear.

> Australia has existing, world-class nuclear regulatory agencies in the Australian Radiation Protection and Nuclear Safety Agency ("ARPANSA") and the Australian Safeguards and Non-Proliferation Office ("ASNO") which implement Australia's current international obligations in nuclear non-proliferation, nuclear security and nuclear safety.[73]

1.114 Based on the evidence from multiple witnesses, Coalition Members reject the notion that the development of an appropriate regulatory capacity for nuclear would take 15-20 years.

Nuclear Energy Is Australia's Next Jobs Opportunity

A 'Coal to Nuclear' transition can underwrite a new era of prosperity for regional communities'

1.115 Communities which currently host a coal fired power station have helped keep the lights on, prices down and businesses powering for generations. The operation of a coal fired power station in these communities is not only critical for Australia's economy, but also the livelihoods of local people. The coal fired power station is not only one of the largest direct employers in these regions, but also indirectly contributes to local businesses. This includes industries which service the coal plant specifically as well as those that service and maintain the local community such as local restaurants and cafes.

1.116 As outlined on page three of the Chair's report, the Albanese Labor Government's energy plan will result in the premature closure of Australia's entire fleet of coal fired power stations by 2038 with no like for like alternative in place. The premature closure of these power stations will devastate local economies through the loss of thousands of direct and indirect jobs. The premature closure of these plants has created immense uncertainty for residents in these regional communities, some of which have experienced the fallout before.

1.117 When the former Hazlewood power station was shuttered prematurely in 2017, the impacts were severe for local people and the economy. The memory of this incident and the employment prospects on offer through the development of a nuclear

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72 Tania Constable, Chief Executive Officer of the Minerals Council of Australia, *Committee Hansard,* 17 December 2024, p. 5.

73 Helen Cook, GNE Advisory, Submission 206, p. 1.

industry were discussed by the Latrobe City Council Mayor Dale Harriman in public community hearing where he stated:

> I know I talk regularly to a number of coal power station workers. They're excited by this idea that they're actually going to have a future. When Hazelwood closed, the thought of 'no future and nowhere to work' was palpable in the area and had a depressive effect on the community. The discussion now that nuclear is there and it gives an option to our coal-fired power station workers—that there is a future that pays like- for-like jobs—they're very, very supportive of it. I think, as a community, that's something we've been asking for: those jobs that are like for like.[74]

1.118 A number of international experts outlined the lived experience around the world of how a 'coal to nuclear' transition can not only provide a lifeline to impacted communities but underwrite a new era of economic prosperity.

1.119 For the seven communities the Coalition has announced as locations to host a nuclear power plant this will be a once in a generation opportunity to not only maintain the standard of living they enjoyed today, but improve their position.

1.120 When asked about how nuclear jobs have been found to pay 14% more than an equivalent job in a coal fired power station and 50% more than a job in wind and solar, and that 77% of coal plant workers could transition seamlessly to work in a nuclear power plant, Mr Peter Ceeney, President, Latrobe City Business Chamber representing local businesses and employees suggested that the jobs opportunity provided by nuclear power would be welcomed by locals.[75]

> First of all, I wasn't aware of that study. Yes, of course it would be. If a local worker can stay locally at another form of employment that they want to do, of course it'd be welcome.

1.121 Dr Buongiorno explained that Nuclear power plants have demonstrated the ability to support and expand upon the existing workforce for coal power station in the United States:

> Essentially all the workers could be rehired and retrained, depending on their skillsets, but there would be a need for additional hires. Not all of them need to be nuclear engineers. In fact, nuclear-specific expertise is razor thin, and primarily the folks that work in the control room are licensed operators. first reactor in Wyoming at a coal-fired plant site, where the coal plant is going out of business. They basically rehired the whole workforce. They're hiring more people; they're retraining them. As I said earlier, the synergies are around transmission lines, cooling, infrastructure, access roads, administrative buildings—there is a lot that you can reuse. The other positive aspect is that the

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74 Councillor Dale Harriman, Mayor, Latrobe City Council, *Committee Hansard,* 3 December 2024, p. 6.

75 Peter Ceeney, Latrobe City Business Chamber, *Committee* Hansard, Tuesday, 3 December 2024, p. 25.

peak of support for nuclear in the US is typically in counties and towns where there are nuclear plants." [76]

1.122 Dr Chris Keefer told the committee that Australia could expect considerable job creation in coal communities that would facilitate a transition to nuclear. Keefer noted not only the opportunity for job creation, but also the quality of employment opportunities – nuclear would replace intergenerational coal jobs like-for-like, unlike the temporal nature of employment opportunities in wind and solar generation:

> I think there would be a lot of jobs available, particularly in craft labour, in the construction phase… the jobs available in the kinds of communities that, I think, coal has probably sustained in terms of local investment—intergenerational jobs passed down from father to son or mother to daughter over many generations—are available again in nuclear. One thing that is fairly evident from our experience of renewables industry jobs, certainly in North America, is that they're largely construction jobs. There are no parking lots outside of a wind or solar farm. There are very sparse labour requirements after that point. They're transient jobs, moving from construction site to construction site, rather than jobs that are anchored in communities with healthy tax revenues and the kinds of community centres and things that can be supported by that.[77]

1.123 Ms Hoff also testified that her experience of the nuclear industry supported the possibility of transitioning coal workers:[78]

> … when I graduated from college with my degree in engineering, I didn't know anything about nuclear generation either. I got a job as an operator and went through a lot of training to become a field operator initially and then more training again, back to licencing class for a couple of years, before I got my licence to operate the reactor. We hire all kinds of people into those positions. You don't have to have a degree. They're very good jobs and people come from all areas to do them.

1.124 Steve Reynolds, a local business owner from Muswellbrook, NSW, submitted that a significant portion of the community would be supportive of a new power station project, including nuclear:[79]

> In any community you will find those to speak in opposition to a topic. I have had the opportunity to speak face to face with a significant number of community members, and when it comes to the construction of a nuclear fired power station, overwhelmingly the majority have been supportive of the need for a new modernised coal power station, or for a small nuclear power station. Beyond the conversation of electricity, our community knows we need the jobs and whilst we

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76 Dr Buongiorno, *Committee Hansard*, Monday 18 November 2024, p. 8.

77 Dr Chris Keefer, President, Canadians for Nuclear Energy; and Director, Doctors for Nuclear Energy, Committee, Committee Hansard, 21 November 2024, p. 11.

78 Ms Hoff, Committee Hansard, 21 November 2024, p. 3.

79 Steve Reynolds, Submission 374, p. 1.

> diversify to other manufacturing, agricultural etc jobs in the future, a replacement of a power station here would see jobs being transferred into a familiar role whilst retaining the permanent well-paying jobs.[80]

The Chair provided several explanations for the ultimate closure of Australia's coal fired power stations which contradict the Chair's own report.

1.125 Throughout the inquiry, the Chair repeatedly told public hearings that the premature closure of Australia's coal fired power stations was not a part of the Government's plan.

1.126 The Chair referred to one of his positions on the topic at the Lithgow Public hearing on 11 Dec 2024. On this occasion the Chair suggested that it wasn't the Government's plan to close coal fired power stations early, saying "It is not the Albanese Labor government's plan to close coal-fired power stations early."

1.127 On another occasion on 3 Dec 2024, the Chair stated that the Government wasn't seeking to close down the Loy Yang B Coal fired power station in an attempt to assure local people deeply concerned about their future that their jobs were safe.

> The federal government isn't looking at closing down Loy Yang B. It's going to close in 2047. That will be up to the owner of that plant as to whether they close before then or in 2047

1.128 Yet, the Chair's report makes it abundantly clear that the premature closure of Australia's coal fired power stations is central to the Australian Government's plan to reduce emissions by 43%.

> 1.13 The Australian Government has committed to reducing net greenhouse gas emissions to 43% below 2005 levels by 2030 and to zero by 2050…
>
> 1.14 Supporting this commitment is the transformation of Australia's energy market under the ISP, including the decommissioning of coal plants by 2038…

1.129 Regardless of the Government's excuse that the closure of coal fired power stations is a private decision made by the operators, it is abundantly clear that the Government's energy plan assumes their premature closure. Labor members are telling regional communities one thing while they tell a national audience another.

Nuclear energy can unlock and sustain a higher level of education and employment opportunity for Australians

1.130 Dr Green also provided evidence on the benefits of enriching Australia's tertiary education and research sectors in nuclear technology.

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[80] Steve Reynolds, Private Capacity, Submission 374, p. 1.

> There is an appetite in Australia for developing educational opportunities in nuclear related areas in the educational space. This will not only benefit domestic students but could contribute to our world-class international student education system. Government-supported Australian scientists have been contributing to nuclear fusion research for several decades. At some point in the future, nuclear fusion will become both a viable and a cost-competitive power source. If Australia is to take agile advantage of this revolution by rapidly developing a nuclear fusion power industry, it will require nuclear engineers and scientists. Developing a nuclear fission power industry now is the only way of ensuring we will have an appropriately skilled workforce in place when commercial fusion power becomes a reality.[81]

1.131 The Committee heard evidence of significant employment opportunities for the nuclear sector, particularly given the advent of nuclear submarines established by AUKUS. Dr Barry Green stated:

> With the introduction of nuclear submarines for the Australian Navy, there exist far greater job opportunities for nuclear engineers than before. While these jobs will primarily be submarine-reactor oriented, many engineers will be required for remote maintenance and for the handling of radioactive waste. All of these skills will be transferable to land based reactors, of course…the training and advice for building a nuclear industry has a non-negligible basis. Of course, increased training will be necessary, and this will be a positive in making Australia a clever country.[82]

Nuclear will support baseload while renewables risk de-industrialisation

1.132 The Committee heard evidence of the significant risk that a high VRE grid poses to system reliability. This will have pronounced impacts on the industrial sector and threaten Australia's economic industrial capacity. Witnesses were sceptical that a high penetration of renewables could support and heavy industry, and some noted that a system of this magnitude does not exist anywhere else in the world.

1.133 Dr Chris Keefer testified:

> …to run a grid, and particularly to run electricity required for heavy industry, there's a lot of additional systems cost. Those include things like transmission, distribution and the firming costs you mentioned in terms of gas turbines and batteries. There are no examples around the world of heavy industry operating off of mostly wind and solar.[83]

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81 Dr Barry Green, Private capacity, *Committee Hansard,* 17 December 2024, p. 22.
82 Dr Barry Green, Private capacity, *Committee Hansard,* 17 December 2024, p. 22.
83 Dr Chris Keefer, President, Canadians for Nuclear Energy; and Director, Doctors for Nuclear Energy, Committee, *Committee Hansard*, Thursday 21 November 2024, p. 5.

> That's actually one of my major concerns for Australia, as I mentioned—the declining economic complexity and the closure of coal plants and that stable baseload power, which up until this very moment have proven to be essential for running electricity-intensive heavy industry. This is a major gamble. We have a well established history of nuclear plants providing reliable power to heavy industry. That's the reason why I think it would be a very astute thing to diversify the decarbonisation portfolio…

1.134 And as base-load energy is removed from the system and is replaced with variable renewables, what happens to reliability? Further to that, what then happens to costs and therefore prices?"

1.135 Professor Stephen Wilson:

> The risk is you see a collapse in reliability. We have to look at the detail of what's actually happening, but I think the Broken Hill islanding and the inability to keep that system alive while the transmission line is not able to support it is a microcosm of what I expect we'll see on a larger scale. If you're trying to deliver 99.98 per cent reliability to the consumer and you're trying to do it only with assets that are available 20, 25, 30, 35 per cent of the time, bridging that probability gap just becomes harder and harder as you increase the share of those resources on the system. As you try to fight it by throwing more and more batteries and more and more pumped hydro, and this, that and the other at it—and, by the way, the ISP seems to still have a lot of gas in the system, even in the outyears in 2050. Is it natural gas? Is it hydrogen? But that's the get-out-of-jail-free card. You see the costs escalate and all of your assets on this system end up having lower and lower and lower utilisation, but those fixed capital costs have to be recovered somehow.[84]

1.136 Mr Craig Cresp, General Manager Operations, Upper Spencer Gulf, Hallett Group:

> I think the true risk ends up being whether, as we add more renewable assets like wind and solar to the grid, that will increase our power prices going forward, which then impacts the viability of our business. If we had cheaper fuel or a cheaper energy supply, like a nuclear source, for example, and that ended up being a viable commercial solution, then that would benefit everyone.[85]

1.137 Minerals Council of Australia submitted that:

> No large, industrialised economy without large hydroelectric resources is planning to decarbonise its electricity systems using just intermittent solar and wind resources.[86]

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84 Professor Stephen Wilson, Private Capacity, *Committee* Hansard, Monday, 28 October 2024, p. 40.
85 Craig Cresp, Hallett Group, *Committee Hansard*, Friday, 6 December 2024, p. 2.
86 Minerals Council of Australia, Submission 430, p. 3.

1.138 Brendan Fitzgerald, Chartered Chemical Engineer:

> Without reliable, constant baseload power generation, power systems become inherently unreliable. As has been demonstrated around the world, wherever renewable power sources provide a significant proportion of the generation capacity, power prices to the consumer vary massively on a daily basis. In addition, there is increased potential for outages due to the instability introduced to the grid by variable power sources which do not maintain a steady synchronised supply. This is on top of the inherent intermittency of renewable power sources. Asynchronous supply, i.e. that provided by wind and solar, requires significant additional infrastructure such as capacitors and transformers. Provision of batteries for firming and supply back-up on a grid scale has never been achieved and is currently beyond available battery technology. At a grid level, during an outage of wind or solar power generation, a battery system would only provide power for tens of minutes, whereas such a wind and solar outage could last for days. The experience in Europe in the last couple of years is that such outages persisted for weeks.[87]

Nuclear complements renewables and storage

1.139 While the committee heard evidence from some renewable energy lobby organisations that nuclear is not a flexible energy source and would be incompatible on a grid with renewables,[88] [89] significant and more detailed evidence was submitted finding modern nuclear plants to be capable of load-following, and possible to run in a grid alongside both storage, utility-scale renewable generation, and consumer energy resources.

1.140 The Committee also heard extensive concerns around how nuclear reactors would affect existing rooftop solar which seemed to be underpinned by a misunderstanding of how the Australian grid operates, and ignores the important role of storage in any future grid, including one with baseload Nuclear power in it. The committee notes that this claim was heard multiple times.

1.141 The submission from the Queensland Conservation Council, referred to by the ACTU[90] was that “equivalent 45,000 rooftop solar systems to be turned off on an average day to accommodate the nuclear power station.”[91]

1.142 But most of the concerns submitted to the committee around rooftop solar curtailment were either directly from, or referred to, analysis from the Smart Energy Council. They submitted that “nuclear reactors at the seven proposed sites put forward by the

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87 Brendan Fitzgerald, Submission 336, p.1.

88 Smart Energy Council, Submission 388, p. 5.

89 Johanna Bower, Lead Analyst, Australian Electricity, Institute for Energy Economics and Financial Analysis, *Committee Hansard,* December 4 2024, p. 41.

90 Australian Council of Trade Unions, Submission 338.

91 Queensland Conservation Council, Submission 190, p. 4.

coalition will shut down solar at millions of Australian homes. This is because nuclear power is inflexible, and must always push power into the grid, with solar to be the first casualty due to its ability to be switched off."[92]

1.143 These analyses rested on the premises that at times of excess supply, rooftop solar would be curtailed, and that nuclear power would be inflexible, leading to excess supply. The committee evidence strongly suggested that both of these premises were incorrect.

1.144 The committee heard from Dr Sarah Lawley that "If you look at what's happening on the weekends now—and this is largely an implication of rooftop solar—we're actually curtailing utility-scale wind and solar to the order of eight gigawatts across the NEM during solar hours."[93] which showed utility scale energy was curtailed, not rooftop solar, at times of excess supply occurring on the grid today.

1.145 This was reinforced by Dan Caffrey of the Latrobe Valley Sustainability Group, whose testimony recognised that it is in fact rooftop solar which causes utility-scale generation to be switched off, including partially inflexible coal power stations:

> Already, it is common to see wind farms on a windy and sunny day between the hours of 10 am to 4 pm where not a blade is turning. This is because as the morning progresses an increasing amount of rooftop solar is being put into the National electricity grid. As the coal fired power stations in the Latrobe Valley and elsewhere cannot be switched off and can only wind back production to about 40% of capacity at present, then wind and solar farms are forced to switch off. This is known as curtailment.[94]

1.146 This was reiterated by Nicole Davies:

> It was said earlier in the previous panel that nuclear didn't follow load, had to be maintained at levels and didn't work well with renewables. I know for a fact that's not correct. I would again have to take it on notice to give you the evidence if you want it. Yes, I'm absolutely happy to do that. Nuclear actually is load-following and it does complement renewables.[95]

1.147 Mr Mark Schneider, speaking of his experience operating the Surry Nuclear Power Station in the US:

> The turbines at Surry Power Station can ramp from 100 per cent power down to five per cent power in 90 minutes and ramp back up in 90 minutes. That's 1,600 megawatts of power that can be ramped within 90 minutes that can support the load following of renewables.[96]
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> …

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92 Smart Energy Council, Submission 388, p. 5.
93 Monday, 28 November 2024, p. 31.
94 Latrobe Valley Sustainability Group, Submission 078, p. 5.
95 Nicole Davies, Private capacity, Committee Hansard, 16 December 2024, p. 28.
96 Tuesday, 17 December 2024, p. 32.

> With wind and solar that's already existing and is producing, for all intents and purposes, zero-cost power, as that's peaking out and you have to have your nuclear to ramp up and down, you're actually extending your fuel, and your fuel is going to remain longer. Are you paying a little bit more for it upfront? Yes. But, overall, the lifespan of the nuclear reactor is being extended. Right now in the United States, they're talking about licensing to 120 years now. You're going to build a power plant that could last you for well over a century.[97]

1.148 Coalition Members reject the notion that nuclear is inflexible and cannot play a complementary role with renewables, but instead recognise the benefits of nuclear flexibility to ramp up and down to smooth the generation of variable sources. Coalition Members also found there were no credible grounds for the claim that introducing nuclear energy would force rooftop solar to be shutdown.

Nuclear Energy Among the World's Safest Forms of Electricity Generation

1.149 Zero-emissions nuclear energy is amongst the world's safest forms of electricity generation. According to an ongoing report from Our World In Data which utilises MIT data, Nuclear is as safe as solar and safer than wind energy. This safety record is not only in regard to accidents but also air pollution for which nuclear energy is the least harmful source of electricity generation.

1.150 Mothers for Nuclear's submission to the inquiry spoke to the health benefits of nuclear, in particular the role it plays in improving air quality:

> The World Health Organisation estimates that at least 7 million people die annually from air pollution, and that 9 out of 10 people breathe air containing high levels of pollutants. Nuclear energy does play a major role in reducing these statistics. Nuclear power currently reduces 471 million metric tons of carbon dioxide from our atmosphere (equivalent of 100 million cars). A study by NASA in 2013 (post Fukushima) calculated that nuclear power has prevented an average of 1.84 million air pollution related deaths.[98]

1.151 She goes on to cite that "Nuclear power causes the lowest number of fatalities of any major electricity source" and that the "global nuclear power industry has a strong safety and reliability culture promoted through the World Association of Nuclear Operators (WANO) where best practice is exchanged globally."[99]

1.152 The committee also heard Mr Schneider, that in his 25 years experience in the US Nuclear industry, far more of his own personal total exposure to radiation was from

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97 Tuesday, 17 December 2024, p. 36.
98 Women in Nuclear, Submission 347, p. 16.
99 Women in Nuclear, Submission 347, p. 16.

background sources and medical exposure than from his work in nuclear power plants, and that:[100]

> I will talk about the US's worst accident, Three Mile Island. Three Mile Island had a meltdown that destroyed the unit and then exposed the public to radiation. The amount that the public was exposed to was less than that of a flight from Perth to basically anywhere.

1.153 On the matter of earthquake risk, the Coalition Members were satisfied that Australia's relative geological stability meant that Australia is extremely well placed, and reactors here would face a much lower risk of earthquakes than reactors that have operated safely for decades elsewhere in the world. The committee heard from Geoscience Australia that:[101]

> Based on a global compilation of national-scale seismic hazard assessments by the Global Earthquake Model, the estimated seismic hazard for Taiwan, Japan and California is higher than that of Australia at higher probabilities of exceedance

1.154 The committee also heard from Prof Whittaker, a licensed civil and structural engineer that:[102]

> Nuclear power plants are the most robust of all civilian infrastructure, designed to resist the effects of extreme natural hazards … Firstly, nuclear power plants are built and operated in regions of high seismic hazard, such as coastal California and Japan. Secondly, the seismic hazard in Australia is low because the mainland is far from the boundaries of the Indo-Australian tectonic plate. Thirdly, processes and procedures to characterise the effects of earthquake shaking on mission-critical infrastructure are both mature and mandated in the United States and elsewhere.

1.155 The committee also heard that credible estimates put the water consumption of nuclear reactors on par with coal plants:[103]

> The United Nations Economic Commission for Europe examined the Life Cycle water use of all generators…shows that nuclear energy uses similar or slightly less water than coal generators such as pulverised and supercritical coal plants.

1.156 The committee also heard about alternate solutions for water cooling using coal pits. With respect to nuclear generating capacity being introduced in the Latrobe valley, Robert Parker from Nuclear for Climate Australia submitted that: [104]

> Water stored in the brown coal pits can enable cooling via surface convection and slower evaporation. Alternatively, if traditional evaporative cooling towers

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100 Tuesday, 17 December 2024, p. 34.
101 Geoscience Australia, Submission 841, p. 3.
102 Monday, 18 November 2024, p. 3.
103 Nuclear for Climate Australia, Submission 380, p. 20.
104 Nuclear for Climate Australia, Submission 380.1. pages 1-4.

used, the massive stored volumes would drought proof the nuclear power plants and avoid competition with existing domestic and commercial uses.

1.157 The Coalition Members of the committee heard a significant volume of evidence beyond what has been provided in this section on the matter of safety, the overwhelming majority of which showed that nuclear power was clean, safe, and relied upon around the world, and could be relied upon in Australia's environment as well.

Mr Ted O'Brien MP
Deputy Chair
Member for Fairfax

Mr Darren Chester MP
Member for Gippsland

Mr Simon Kennedy MP
Member for Cook

Additional Comments from Dr Monique Ryan MP

1.1 Australia is already experiencing the economic and social impact of the climate crisis.

1.2 Globally, the IPCC has noted that we have already surpassed the 1.5° mark of planetary warming relative to pre-industrial times. It's a tipping point for accelerated warming of our planet. The acceleration of climate change is reflected in recent increases in the global mean surface temperature and in atmospheric carbon dioxide levels.

1.3 Climate pollution, caused by the burning of fossil fuels such as coal, oil and gas, is already causing increasingly severe bushfires, floods and heat waves in Australia. Australians have lost homes, farms and livelihoods, and are paying higher prices for food and insurance, because of extreme weather events and decreased agricultural productivity caused by climate change.

1.4 In response to these changes, the Australian government has committed to reduce net greenhouse gas emissions to 43% below 2005 levels by 2030, and to zero by 2050, having legislated this target in the Climate Change Act of 2022, the first legislation passed by the 47th Parliament of Australia. Additionally, the federal government has pledged to an 82% renewable energy mix by 2030, having committed significantly to investment in green energy projects to that end. The government has also worked with industry in fostering and facilitating the energy transition.

1.5 Australia's energy production has historically been largely dependent on coal and gas, but the last few decades have seen a marked expansion in our renewables capacity.

1.6 Electricity generation from coal is anticipated to decrease by 46% by 2030, and to cease by 2038, under the Australian Energy Market Operator's integrated system plan (ISP) for our national electricity market (NEM).

1.7 Australia's energy requirements are forecast to almost double by 2050, with AEMO identifying energy-intensive data centres, cryptocurrency, and AI as necessitating a marked increase in our energy requirements in the coming decades.

1.8 Renewable energy sources like wind and solar, backed by storage, are already providing about 40% of the electricity in our national electricity market, up from only 20% six years ago. More than 4 million Australian homes - one in three households in Australia – have already committed to renewable energy through purchase of rooftop solar.

1.9 Industry has made the commitment to the renewable energy transition, having already built more than 20 GW of wind, solar and storage projects in the NEM, with a further 284 GW in planning or preparation.

1.10 This Inquiry into nuclear power generation in Australia was prompted by release of the federal Coalition's proposal to build nuclear reactors on seven retiring or retired coal sites across several states of Australia. The proposal released on 19 June 2024 was for two initial projects using small modular, or larger reactors, expected to produce electricity by 2035 or 2037, respectively. The proposal was that the reactors should be government-owned, but built and operated in partnership with companies (presumably international companies) with experience in building and running nuclear reactors.

1.11 The Inquiry was short but intensive. The committee received more than 900 individual submissions, and thousands of letters and emails. It held 19 public meetings and undertook several site visits.

1.12 The conclusions of the Inquiry are clear:

- **There are considerable roadblocks to nuclear energy in this country.**
    - Even were all state, territory, and federal governments in policy alignment, it would take some time to overturn existing legislated bans on nuclear energy, and transport and management of nuclear waste. Several state governments have previously ruled out such legislation.
    - Necessary regulatory framework for health, safety, security, environmental impacts, and transport of fuels and waste would likely take some years to develop.
    - Australia currently lacks the workforce and technical capability required for building multiple large-scale nuclear reactors.
- Independent experts (including from the CSIRO and Australian Energy Regulator) repeatedly told the Inquiry that **it would take at least 15 years to build a single nuclear reactor** – possibly as long as 25 years. Australia's coal power stations will all shut down well before nuclear energy could come online. In the interim, the Coalition has indicated that it plans to delay closure of the existing coal-fired power plants and increase our (currently declining) use of gas.
- **The Coalition's proposal would provide only 15% of the country's electricity requirements by 2050.** Assuming the five locations within the NEM nominated by the Coalition hosted 2GW of nuclear generation capacity by 2050, this would provide only ~78GWh of electricity annually. This is less than the electricity currently provided to the NEM by renewables.
- **Under current projections, by 2030 more than 84% of the main national electricity grid will be powered by renewables; 96% by 2035.** A balanced mix of wind, solar, batteries, pumped hydro and very small amounts of gas peaking will provide reliable, renewable electricity around the clock- including times when electricity demand is high, and wind and sun resources are low.

- **Nuclear power is the most expensive form of energy.** AEMO's 2024 ISP estimates that the capital cost of all required transmission, utility-scale generation, storage and firming required in the NEM until 2050 is about $383 billion. Across Australia, building 11 GW of nuclear capacity - to give 15% of our energy needs - would cost at least $116 billion, and up to $600 billion dollars (Smart Energy Council, 2024). The current energy transition is significantly underwritten by investors using private capital. Under nuclear, Australian taxpayers would bear all of these costs.
- **Nuclear power does not compete economically.** Several of Australia's largest energy companies - including AGL, Alinta, EnergyAustralia, and Origin – have indicated that they will not invest in nuclear energy.
- **Australians would pay more for electricity generated from nuclear plants.** Wholesale electricity prices have dropped as the amount of low-cost wind and solar in the grid has increased. This has left inflexible generators, like coal, struggling to compete. Nuclear power is also inflexible. For it to generate enough revenue in the market to recover its operational and capital costs, the government will have to turn renewables off, and/or guarantee a price for nuclear generation. The cost of electricity would have to rise to nuclear power's levelized cost of electricity. This would increase power prices by over $665/ year on average, or $972 per year for a four-person household.
- **Nuclear energy lacks social licence in many parts of Australia.** There are persisting and appropriate concerns regarding the absence of any plan for permanent disposal of waste produced by nuclear power plants.
- Australia is an increasingly arid continent. CSIRO data shows that the annual water inflow to the Murray-Darling Basin alone has almost halved over the last 20 years. The **impact of nuclear power generation on Australia's water supplies** has been inadequately considered by the Coalition in its proposal.

1.13 Australia's energy policy should be based on science and on evidence. Independent experts have repeatedly advised the government that the fastest and most economic route to net zero in this country is via commitment to and investment in renewable forms of energy. Those experts include the Australian Energy Market Operator, the Climate Change Authority, the Climate Council of Australia, and energy regulators. All agree that nuclear is not an economically viable or appropriate energy solution for Australia.

1.14 Many who testified to this committee expressed the concern that the Coalition is proposing nuclear power as a means of distracting the Australian population from the urgent task of replacing diminishing coal power, and increasingly expensive gas stores, with renewable power from wind, solar, hydro, and other sources.

1.15 An ongoing pursuit of nuclear energy options will only perpetuate and increase Australia's reliance on coal and gas, while undermining policy and investment certainty in clean energy technologies and increasing climate pollution, thereby exposing Australians to accelerated climate harm.

1.16 This Inquiry followed a large number of previous state and federal inquiries into nuclear power; there have been four in the last decade alone. It should be the last.

1.17 We must draw a line under nuclear in this country. We must commit to the net zero transition at speed and at scale. We must trust the markets, the investors, and the scientists, not politicians pushed by the fossil fuel companies who are often their major donors.

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