

# Chapter One

## Introduction

1.1 On 12 October 2016, the Senate resolved to establish the Select Committee into the Resilience of Electricity Infrastructure in a Warming World to inquire into and report on the following matters by 10 February 2016:

- (a) the role of storage technologies and localised, distributed generation to provide Australia's electricity networks with the resilience to withstand the increasing severity and frequency of extreme weather events driven by global warming;
- (b) recommend measures that should be taken by federal, state and local governments to hasten the rollout of such technologies in order to:
  - (i) create jobs in installation, manufacture and research of storage and distribution technologies,
  - (ii) stimulate household and business demand for storage technologies,
  - (iii) anticipate the rapid deployment of localised distributed generation through changes to market rules,
  - (iv) drive the reduction in technology costs through economies of scale, and
  - (v) seize on the opportunities to be a global leader in deploying storage technologies because of Australia's high fixed electricity tariffs and significant penetration of rooftop solar; and
- (c) any other relevant matters.<sup>1</sup>

### Conduct of the inquiry

1.2 The committee would like to thank all the organisations and individuals that contributed to the inquiry.

1.3 A list of submitters to the inquiry is provided in Appendix 1. The committee has published 56 submissions. The committee advertised the inquiry on its website and wrote to organisations and individuals inviting submissions by 27 January 2017. The committee extended the closing date for submissions to 3 February 2017, and continued to accept submissions after this date.

1.4 On 29 November 2016, the Senate agreed to extend the inquiry's reporting date from 10 February 2017 to 24 March 2017.<sup>2</sup> On 22 March 2017, the Senate agreed to extend the reporting date to 7 April 2017.

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1 *Journals of the Senate*, No. 10, 12 October 2016, p. 313.

2 *Journals of the Senate*, No. 21, 29 November 2016, p. 658.

1.5 A list of witnesses who gave evidence at public hearings is provided in Appendix 2. The committee held three public hearings in:

- Canberra on 10 February 2017;
- Adelaide on 20 February 2017; and
- Melbourne on 7 March 2017.

### **Note on references**

1.6 References in this report to the Hansard for the public hearings are to the proof Hansard. Please note that page numbers may vary between the proof and the official transcripts.

### **Structure of the report**

1.7 This report comprises four chapters. The matters covered in the remaining chapters are outlined below:

- Chapter 2 provides the context on a warming world, the implications of climate change for Australia's electricity networks, the Paris Climate Agreement, the main sources of electricity generation in Australia, and the National Electricity Market including its regulatory framework and the issues that it is facing.
- Chapter 3 assesses the resilience that various storage technologies and distributed generation are able to provide to Australia's electricity infrastructure.
- Chapter 4 discusses the imperatives for policy coherence within the context of a national energy plan.

### **Terminology**

1.8 The Australian Energy Market Commission (AEMC) notes that 'Australia's energy policy objectives focus on promoting the long-term interests of consumers with respect to the price, quality, reliability and security of electricity services'.<sup>3</sup>

1.9 The AEMC define security and reliability as follows:

- Security—a secure power system is one that is being operated or managed such that all vital technical parameters such as voltage, equipment loading and power system frequency are within design limits and are stable and all persons are safe.
- Reliability—a reliable power system is one that has a high likelihood of supplying all consumer needs.<sup>4</sup>

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3 Australian Energy Market Commission, *Integration of energy and emissions reduction policy*, 9 December 2016, p. i, <http://www.aemc.gov.au/Markets-Reviews-Advice/Integration-of-energy-and-emissions-reduction-poli/Final/AEMC-documents/Final-Report.aspx> (accessed 27 March 2017).

1.10 The Energy Change Institute at the Australian National University (ANU) describe resilience as follows:

In the context of this inquiry, resilience refers to the ability of the electricity infrastructure (generation, transmission, and distribution systems) to maintain uninterrupted supply of power to customers, in the face of inputs or external factors that are changing significantly on either very short to long time scales, and/or to restore that supply in the event of an interruption.<sup>5</sup>

### **Other inquiries**

1.11 This inquiry into electricity infrastructure is not the first conducted in Australia in recent times. The committee acknowledges the work that has been and is being undertaken to explore alternative energy futures. In particular, the committee notes the following reports.

#### ***Finkel Review of Energy Security***

1.12 Following the state-wide blackout in South Australia in September 2016, on 7 October 2016 the Council of Australian Governments (COAG) Energy Council announced A National Energy Review by Australia's Chief Scientist Dr Alan Finkel AO.<sup>6</sup>

1.13 The Finkel review will enable the COAG Energy Council to:

- properly understand the causes of recent events; and
- examine and advise on the broader issues facing the system due to the increasing penetration of intermittent generation'.<sup>7</sup>

1.14 The Finkel review will consolidate work initiated by the COAG Energy Council on energy security and consider other avenues to develop a national reform blueprint to maintain energy security and reliability within the National Electricity Market (NEM). Along with domestic sources, the United Kingdom, United States and the International Energy Agency will provide international input into the review.<sup>8</sup>

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4 Australian Energy Market Commission, *Integration of energy and emissions reduction policy*, 9 December 2016, pp. i–ii.

5 ANU Energy Change Institute, *Submission 28*, p. 5.

6 COAG Energy Council, *Blueprint for Energy Security in the National Electricity Market: Independent Review*, 7 October 2016, <http://coagenergycouncil.gov.au/publications/independent-review-terms-reference> (accessed 17 November 2016).

7 COAG Energy Council, *Blueprint for Energy Security in the National Electricity Market: Independent Review*, 7 October 2016.

8 The Hon. Josh Frydenberg MP, Minister for the Environment and Energy, *UK and US Agree to Provide Input into Australian Energy Security Review*, Media Release, 16 November 2016, <http://www.joshfrydenberg.com.au/guest/mediaReleasesDetails.aspx?id=283> (accessed 17 November 2016).

1.15 A preliminary report from the Finkel review was delivered to the Commonwealth government in December 2016. Amongst other things, the preliminary report addressed issues of, and solutions to, intermittent generation:

The shift from coal-fired generators to wind and solar PV generators has implications for security and reliability. These variable renewable electricity generators do not inherently provide usable inertia to support power system security. They are also much less able to contribute to other ancillary services required to maintain a secure and reliable supply of power.

Fortunately, solutions are available to effectively integrate variable renewable electricity generators into the electricity grid, but we will have to change the way we operate. Such solutions include intelligent wind turbine controllers, batteries and synchronous condensers, all of which can contribute to system security. But the NEM does not currently encourage their adoption. Emerging markets for ancillary services, required to maintain system security, have not kept pace with the transition. New and updated frameworks, technical standards and rules may be required.<sup>9</sup>

1.16 On 17 February 2017, Dr Finkel AO addressed the COAG Energy Council on 'options to fast-track 'proof-of-concept' projects designed to increase security and reliability in Australia's physical electricity system as the generation mix continues to change into the future'.<sup>10</sup>

1.17 Dr Finkel's final report is expected in the first half of 2017.

***Senate inquiry into the retirement of coal fired power stations***

1.18 On 13 October 2016, the Senate referred the following matter to the Senate Environment and Communications References Committee for report by 1 February 2017 (since extended to 29 March 2017):

- a. the experience of closures of electricity generators and other large industrial assets on workers and communities, both in Australia and overseas;
- b. the role that alternative mechanisms can play in alleviating and minimising the economic, social and community costs of large electricity generation and other industrial asset closures, drawing on experiences in Australia and overseas;
- c. policy mechanisms to encourage the retirement of coal-fired power stations from the National Electricity Market, having regard to:
  - i. the 'Paris Agreement' to keep global warming below 2 degrees Celsius, and ideally below 1.5 degrees Celsius,

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9 Dr Alan Finkel AO, *Preliminary Report of the Independent Review into the Future Security of the National Electricity Market*, 14 December 2016, p. 3.

10 COAG Energy Council, *9<sup>th</sup> COAG Energy Council Meeting Communique*, 17 February 2017, p. 1, <http://www.coagenergycouncil.gov.au/publications/9th-coag-energy-council-meeting-communique-0> (accessed 14 March 2017).

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- ii. the state and expected life span of Australia's coal-fired power plants,
  - iii. the increasing amount of electricity generated by renewable energy and likely future electricity demand,
  - iv. maintenance of electricity supply, affordability and security, and
  - v. any other relevant matters;
- d. policy mechanisms to give effect to a just transition for affected workers and communities likely impacted by generator closures, as agreed in the 'Paris Agreement', including:
    - i. mechanisms to ensure minimal community and individual impact from closures, and
    - ii. mechanisms to attract new investment and jobs in affected regions and communities;
  - e. the appropriate role for the Federal Government in respect of the above; and
  - f. any other relevant matters.

1.19 The terms of reference for the Senate Environment and Communications inquiry are set out in full to highlight the considerable overlap with the committee's own inquiry. Where this committee's remit includes the potential of storage technologies and localised distributed generation to provide the resilience to withstand climate change, the Environment and Communications committee has a greater focus on the experiences of coal fired power station closures in terms of the economic, social and community costs. Accordingly, this committee acknowledges but will not address in detail the significant weight of evidence received on the community and individual impact of the closure of coal-fired power stations.

1.20 Rather, this inquiry has examined measures that should be taken by all levels of government to hasten the rollout of new technologies to ensure the resilience of Australia's electricity networks, including changing market rules and stimulating household and business demand. These matters were addressed to some extent in the Senate Environment and Communications References Committee's interim and final reports. The interim report, presented on 28 November 2016 contained the following relevant recommendations:

**Recommendation 1**

**The committee recommends that the Australian Government adopt a comprehensive energy transition plan, including reform of the National Electricity Market rules.**

**Recommendation 2**

**The committee recommends that the Australian Government, in consultation with industry, community, union and other stakeholders, develop a mechanism for the orderly retirement of coal fired power stations to be presented to the COAG Energy Council.**

**Recommendation 3**

**The committee recommends that the Australian Government, through representation on the COAG Energy Council, put in place a pollution reduction objective consistent with Australia's obligations under the Paris Agreement in the National Electricity Objectives.**

**Recommendation 4**

**The committee recommends that the Australian Government establish an energy transition authority with sufficient powers and resources to plan and coordinate the transition in the energy sector, including a Just Transition for workers and communities.<sup>11</sup>**

1.21 The Senate Environment and Communications References Committee's final report, presented on 29 March 2017, added five further recommendations to those contained in the interim report:

**Recommendation 5**

**The committee recommends:**

- **That the Australian Government commission a comprehensive and independent assessment of the health impacts of coal fired power stations.**
- **That the Australian Government develop a load-based licencing arrangement for coal fired power stations for adoption at COAG based on the New South Wales Load-Based Licencing scheme, with fees that reflect the health impacts and other externalities of power station emissions.**
- **That the Australian Government take additional measures to ensure compliance with the standards set in the National Environmental Protection (Air Quality) Measure and - in the case of sulphur dioxide and nitrogen dioxide - international best practice standards. In regions where these standards are exceeded such as the Hunter and Latrobe Valleys, coal fired power stations must be compelled to reduce emissions to levels below the NEPM standards.**
- **That the Australian Government ensure a more rigorous assessment of power station emissions through an independent audit of reports provided through the National Pollutant Inventory.**

**Recommendation 6**

**The committee recommends that the Commonwealth and state energy ministers should undertake a national audit of likely rehabilitation costs for existing coal mines and power stations and assess these costs against the current provisions or bond arrangements.**

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11 Senate Environment and Communications References Committee, *Retirement of coal fired power stations: Interim report*, November 2016, p. vii.

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The committee recommends that the Commonwealth and state energy ministers should also work to develop a common approach to setting rehabilitation bonds to ensure that rehabilitation costs are properly provisioned for.

#### **Recommendation 7**

The committee recommends that the Australian Government continue and expand the Renewable Energy Target beyond 2020 and consider adopting renewable energy reverse auctions such as adopted by the ACT to bring more new generation into the national electricity market.

The committee also recommends that the Australian Government support the continuing deployment grid level battery storage and of household solar and battery storage technologies, including making the necessary regulatory changes, such as aligning the settlement and bidding time periods in the National Electricity Market, to encourage the utilisation of products that promote decentralisation of electricity production while enhancing the stability of the grid.

#### **Recommendation 8**

The committee recommends that the Australian Government commit to not provide any direct funding, subsidies or other support for the construction of new coal fired power stations in Australia.

#### **Recommendation 9**

The committee recommends that the Australian Government reverse its ideological opposition to the introduction of a scheme for managing the transition in the electricity sector such as an Emissions Intensity Scheme or the setting of pollution intensity standards and commit to considering fairly all policy options presented by the forthcoming final report of the Finkel Review.<sup>12</sup>

#### ***Committee view***

1.22 These recommendations are so congruent with the committee's own findings that they are echoed in this report. Additional evidence gathered by this committee in support of those recommendations is available in later chapters.

1.23 The committee encourages all levels of government to pay close attention to its findings.

#### **Recommendation 1**

1.24 The committee recommends that the Commonwealth government adopt the recommendations made by the Senate Environment and Communications References Committee in its final report into the retirement of coal fired power stations.

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12 Senate Environment and Communications References Committee, *Retirement of coal fired power stations: Final report*, March 2017, pp. vii-viii.

### *Senate inquiry into the performance and management of electricity network companies*

1.25 On 2 October 2014, the Senate referred an inquiry into the performance and management of electricity network companies to the Senate Environment and Communications References Committee. That committee presented three reports to the Senate. An interim report on 30 April 2015 with 18 recommendations, included the following:

#### **Recommendation 15**

The committee recommends that the Australian, state and territory governments increase and prioritise efforts to ensure that networks are prepared to efficiently respond to changes in the energy market, in light of:

- the increased uptake of small-scale solar generation;
- emerging energy storage technologies;
- the anticipation of customers going 'off-grid';
- the anticipation of further disruptive technologies; and
- the certainty of value destruction as a result of current business models.<sup>13</sup>

1.26 A government response received on 27 April 2016 accepted recommendation 15, stating that the COAG Energy Council had agreed in December 2015 to a Strategic Work Program that would 'work towards successfully transitioning energy markets to a future where energy provision is more decentralised and dynamic'.<sup>14</sup>

1.27 The government response further explained that the Strategic Work Program: ...aims to ensure regulatory frameworks are ready to cope with the effects of emerging technologies such as batteries and enable consumers to benefit from innovative services while mitigating risks.<sup>15</sup>

1.28 Officials were 'due to report back to the COAG Energy Council in the first instance at its next meeting in July 2016'.<sup>16</sup> However, at its August 2016 meeting, the COAG Energy Council added 'consideration of the economic and operational impacts

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13 Senate Environment and Communications References Committee, *Performance and management of electricity network companies: interim report*, April 2015, p. xv.

14 Australian Government, *Response to the Environment and Communications References Committee report: Performance and management of electricity network companies*, April 2016, pp. 11–12.

15 Australian Government, *Response to the Environment and Communications References Committee report: Performance and management of electricity network companies*, April 2016, p. 11.

16 Australian Government, *Response to the Environment and Communications References Committee report: Performance and management of electricity network companies*, April 2016, p. 12.



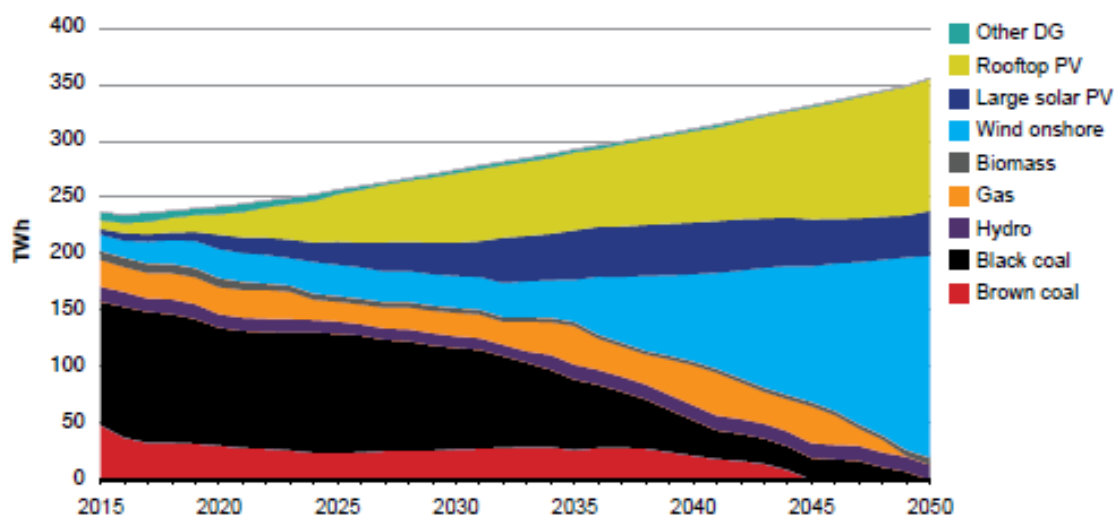
of existing state and territory emission reduction policies' to the remit of advice.<sup>17</sup> The item was not addressed in communiqués from the Council's subsequent meetings of 14 December 2016 and 17 February 2017.<sup>18</sup>

***Energy Networks Australia and CSIRO: Electricity Network Transformation Roadmap: Key Concepts Report***

1.29 In December 2016, Energy Networks Australia and the Commonwealth Scientific and Industrial Research Organisation (CSIRO) released the *Electricity Network Transformation Roadmap: Key Concepts Report*, which set out a pathway for Australia's transition to a more decentralised, clean electricity system. Energy Networks Australia is the peak national body representing gas distribution and electricity transmission as well as distribution businesses.

1.30 Modelling undertaken for the roadmap identified a mix of power generation which would allow Australia to meet wholesale energy requirements and achieve zero net emissions by 2050.<sup>19</sup>

**Figure 1: Plausible projection of Australia's changing energy mix to 2050.**



Source: Energy Networks Australia and CSIRO, *Electricity Network Transformation Roadmap: Key Concepts Report*, December 2016, p. iii.

17 COAG Energy Council, *5<sup>th</sup> COAG Energy Council Meeting Communiqué*, 19 August 2016, p. 2, <http://www.coagenergycouncil.gov.au/publications/5th-coag-energy-council-meeting-communication-19-august-2016> (accessed 21 March 2017).

18 COAG Energy Council, *Meeting Communiqué, 8<sup>th</sup> COAG Energy Council Meeting Communiqué*, 14 December 2016, <http://www.coagenergycouncil.gov.au/publications/8th-coag-energy-council-meeting-communication> (accessed 21 March 2017); COAG Energy Council, *9<sup>th</sup> COAG Energy Council Meeting Communiqué*, 17 February 2017, <http://www.coagenergycouncil.gov.au/publications/9th-coag-energy-council-meeting-communication-0> (accessed 21 March 2017).

19 Energy Networks Australia and CSIRO, *Electricity Network Transformation Roadmap: Key Concepts Report*, December 2016, p. iii.

**Committee view**

1.31 The committee encourages the government to take note of the roadmap.

***Australian Energy Market Commission: 2016 Retail Competition Review***

1.32 The third annual review of competition in electricity and gas markets across jurisdictions in the NEM was undertaken by the Australian Energy Market Commission (AEMC) at the request of the COAG Energy Council. The July 2016 report found that:

...competition continues to be effective in most jurisdictions and is delivering benefits for customers. We have also found that there is a need to make it easier for customers to access the choices available to them. New research undertaken for this year review reveals that this is particularly important for certain customer segments as new technology expands the range of options available in the market.<sup>20</sup>

1.33 The AEMC made the following recommendations:

1. Jurisdictions continue to phase out retail price regulation for electricity and natural gas where effective retail competition can be demonstrated, as agreed under the Australian Energy Market Agreement.
2. Jurisdictions coordinate the development of NEM-wide awareness and engagement programs to make it easier for customers to access the best options for their circumstances and improve customer confidence in the energy markets.
3. Jurisdictions review concession policies to assess opportunities to better target them to customers most in need and to harmonise their structure across jurisdictions, where substantive differences exist.
4. Jurisdictions continue to harmonise regulatory arrangements to reduce the long-term costs of new businesses or retailers competing across jurisdictions.<sup>21</sup>

***AEMC final report on the integration of energy and emissions reduction policy***

1.34 The AEMC released its final report into the integration of energy and emissions reduction policy on 9 December 2016. The report examined the following three emissions reduction mechanisms that could be applied to the wholesale electricity generation sector to assist in the achievement of Australia's 2030 emissions reduction target:

- an emissions intensity scheme;
- an extension of the Large-scale Renewable Energy Target; and
- government regulation (forced closure of certain generators).<sup>22</sup>

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20 Australian Energy Market Commission, *2016 Retail Competition Review: Final Report*, 30 June 2016, p. i.

21 Australian Energy Market Commission, *2016 Retail Competition Review: Final Report*, 30 June 2016, p. v.

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1.35 The report found that an emissions intensity scheme would have 'the lowest impact on wholesale prices, the lowest resource costs and the lowest cost of abatement to meet a given emissions reduction target'<sup>23</sup> where resource costs are defined as 'the costs of building new capacity (capital, fuel and labour), as well as the increase in operating costs from switching from lower cost to higher cost fuels (e.g. coal to Combined Cycle Gas Turbine (CCGT)), in order to achieve the emissions reduction target'.<sup>24</sup>

1.36 Modelling for the AEMC report has been criticised for assuming much lower gas prices than current market conditions and for projected renewable energy prices that are significantly higher than current market projections.<sup>25</sup>

1.37 The state and federal ministers acknowledged the report's release at the COAG Energy Council meeting on 14 December 2016, and the analysis was reported as being considered by Dr Finkel over the course of his review.<sup>26</sup>

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22 Australian Energy Market Commission, *Integration of energy and emissions reduction policy*, 9 December 2016, p. iii.

23 AEMC, *Integration of energy and emissions reduction policy*, 9 December 2016, p. viii.

24 AEMC, *Integration of energy and emissions reduction policy*, 9 December 2016, p. viii, fn 8.

25 Giles Parkinson, Modelling from government advisor shows high RET may be cheapest option, *Renew Economy*, 13 December 2016, <http://reneweconomy.com.au/modelling-from-government-advisor-shows-high-ret-may-be-cheapest-option-82484/> (accessed 3 April 2017).

26 COAG Energy Council, Meeting Communique, *8<sup>th</sup> COAG Energy Council Meeting Communique*, 14 December 2016; p. 1, <http://www.coagenergycouncil.gov.au/publications/8th-coag-energy-council-meeting-communique> (accessed 14 March 2017).

