

October 2019



Power Play

How governments can better
direct Australia's electricity markets

Tony Wood, Guy Dundas, and Lucy Percival

Grattan Institute Support

Founding members



Australian Government



Endowment Supporters

The Myer Foundation
National Australia Bank
Susan McKinnon Foundation

Affiliate Partners

Medibank Private
Susan McKinnon Foundation
Veitch Lister Consulting

Senior Affiliates

Cuffe Family Foundation
Maddocks
The Myer Foundation
PwC
Scanlon Foundation
Trawalla Foundation
Wesfarmers
Westpac

Affiliates

Allens
Ashurst
Corrs
Flagstaff Partners
Jemena
McKinsey & Company
Silver Chain
Urbis
Woodside

Grattan Institute Report No. 2019-09, October 2019

This report was written by Tony Wood, Guy Dundas, and Lucy Percival.

We would like to thank the members of Grattan Institute's Energy Reference Group for their helpful comments, as well as numerous government and industry participants and officials for their input.

The opinions in this report are those of the authors and do not necessarily represent the views of Grattan Institute's founding members, affiliates, individual board members, reference group members, or reviewers. Any remaining errors or omissions are the responsibility of the authors.

Grattan Institute is an independent think tank focused on Australian public policy. Our work is independent, practical, and rigorous. We aim to improve policy outcomes by engaging with decision makers and the community.

For further information on the Institute's programs, or to join our mailing list, please go to: grattan.edu.au.

This report may be cited as: Wood, T., Dundas, G., and Percival, L. (2019). *Power play*. Grattan Institute.

ISBN: 978-0-9876359-5-2

All material published or otherwise created by Grattan Institute is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 3.0 Unported License

Overview

Governments feel compelled to respond when electricity supply is lost or when prices are too high. But ad hoc and uncoordinated actions, which may provide short-term relief, usually makes things worse in the long run. Recent and current government actions imperil the success of Australia's great energy transition. This report shows that there are better ways to respond.

Intervention in the energy market by the Commonwealth, state, and territory governments has become de rigeur in recent years. Governments have increasingly responded to price shocks or reliability problems by building or subsidising new generation assets.

The South Australian Government started the trend with its rushed and expensive investment in diesel generation. The Federal Government has followed suit with its Snowy 2.0 pumped hydro project, and its program to underwrite new generation investment. This approach of 'picking winners' ultimately just crowds out other investments, many of which are better able to deliver what the market needs.

A range of other policies further chill investment. The Federal Government's Liddell closure taskforce deters the investment needed to replace this ageing coal power station. Retail price caps, state and federal, and the Federal Government's 'big stick' policy increase risks for investors, causing them to hesitate.

If governments show restraint and pull back from these ad hoc interventions, investors can deliver new generation capacity. Governments can encourage investment through the current transition phase by implementing transparent and rule-based policies.

Transmission investment is slow, often taking six or seven years. Governments can help by allowing networks to recover the cost of early planning works, even if the project does not ultimately proceed.

Managing coal closures is also critical – consumers cannot afford another sudden closure as occurred with the Hazelwood power station in 2017. But existing rules to prevent this are likely to be ineffective. We propose that coal generators be required to put funds into escrow to ensure they comply with closure dates that they nominate in advance, to protect consumers and drive timely replacement investment.

More than 20 years ago, Australian governments created an electricity market and established market agencies to deliver reliable, affordable power. Like any other tool, markets need to be maintained to make sure they still work well. Governments are appropriately reviewing the design of the National Electricity Market to assess whether it remains fit-for-purpose. Governments should similarly review the roles of the market agencies, particularly that of the Energy Security Board.

Governments must fix up the climate policy mess they have created. The Federal Government has considered and rejected five potential climate policies over the past decade, and state governments have filled the resulting vacuum with uncoordinated and chaotic renewable energy targets. If the Federal Government is unwilling to provide clarity, the states should do so through a state-based, but nationally-consistent, emissions reduction policy.

If the private sector is second-guessing possible government intervention, the outcome will be higher prices and lower reliability. It is in governments' interests to ensure a well-regulated market delivers efficient investment and robust competition.

The ultimate beneficiaries will be consumers, who will get what they expect, want, and deserve – affordable, reliable, and cleaner power.

Table of contents

Overview	3
1 Australia is transitioning to clean energy the hard way	6
2 Knee-jerk policies have real costs	12
3 Getting back on the right track	21
A Grattan's coal closure model	34
B Renewables committed since the start of 2017	37

List of Figures

1.1	Electricity prices rose sharply in 2017, building on earlier price increases	6
1.2	Market events prompted policy responses over late 2016 and early 2017	7
1.3	Prices have increased since the NEG was scrapped	10
2.1	There's been significant renewable investment in the NEM since Hazelwood closed	14
2.2	Wholesale prices are expected to fall	14
2.3	Increased profits explain only a small component of increasing electricity market prices	16
2.4	The reliability outlook for NSW is improving rapidly	20
3.1	Wind farms are getting bigger	28
3.2	Announced closure dates imply a steady transition away from coal, particularly during the 2030s	29
3.3	Funds in escrow would grow to almost \$4 billion before declining as coal plant closes	33

1 Australia is transitioning to clean energy the hard way

Australia’s electricity sector is at the beginning of a period of rapid and profound change. Solar and wind generation are now the cheapest sources of new energy.¹ Australia’s coal power stations are still needed, but they are breaking down more often as they age.² Significant investment is needed to transition from old and dirty to new and clean, while keeping the lights on. But we are currently doing this the hard way – and Australia’s governments, state and federal, are not helping.

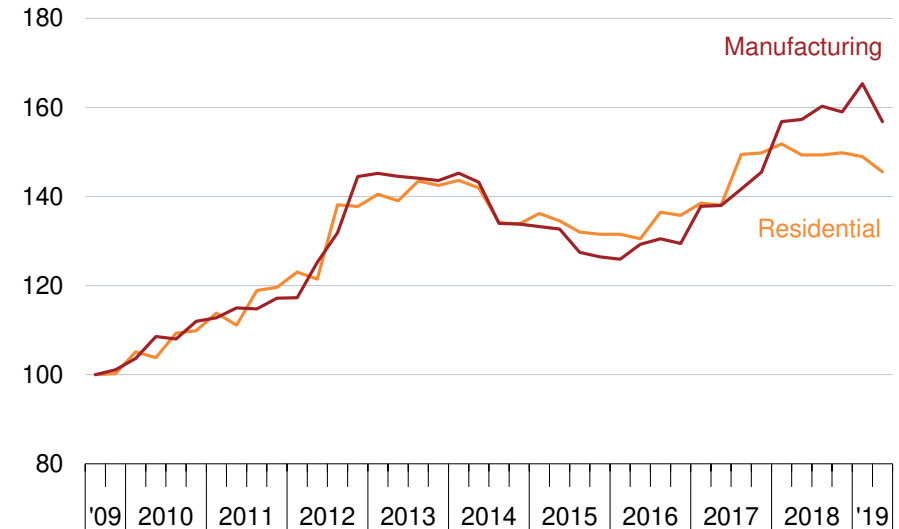
Australia’s energy transition has hit a few speed bumps. Prices have increased (Figure 1.1) and consumers are unhappy. And some high-profile blackouts have prompted a national debate about electricity reliability.³

It is hardly surprising that governments have felt compelled to act in response to this pressure. But government responses have been ad hoc and uncoordinated, rather than clear and comprehensive. These knee-jerk reactions have created uncertainty and discouraged the very investment that is needed.

Governments should act in ways that promote good long-term outcomes despite short-term political pressures. In many cases they are not presently passing that test. This report proposes alternative actions that will help investment rather than hinder it. The ultimate beneficiaries of this shift will be consumers, who expect and deserve affordable, reliable, and cleaner power.

Figure 1.1: Electricity prices rose sharply in 2017, building on earlier price increases

Inflation-adjusted electricity prices, indexed June 2009 = 100



Notes: Price indices cover the whole of Australia. ABS residential electricity prices are sampled from electricity providers in capital cities. ABS manufacturing producer prices are collected from suppliers.

Sources: Grattan analysis of ABS (2019a) and ABS (2019b).

1. Graham et al (2018, p. 28).

2. AEMO (2019a, p. 9).

3. Wood et al (2019).

1.1 Crisis and response

1.1.1 September 2016 to June 2017: rising panic

The South Australian state-wide blackout on 28 September 2016 marked the start of a turbulent period for Australia's electricity system. The blackout precipitated unprecedented media reporting and political debate about power reliability.⁴ In response, the COAG Energy Council commissioned a review by Chief Scientist Alan Finkel on the future security of the electricity market.⁵ But while Finkel did his work, events continued to turn sour.

Pressure mounted over the summer of 2016-17 (Figure 1.2). In November 2016 Engie announced that it would close the Hazelwood power station in Victoria the following March, giving only five months notice.⁶ The Australian Energy Market Operator (AEMO) reassessed the level of supply in the market and found a heightened risk of power shortfalls in the summer of 2017-18.⁷

Then in December 2016 a combination of planned and unplanned transmission outages cut power to Alcoa's Portland aluminium smelter in Victoria for more than three hours.⁸ Metal in the smelter's potlines froze, requiring extensive repairs and greatly reducing its output for more than six months.⁹ Even before this, the smelter had relied heavily on substantial Victorian Government subsidies which exceeded \$100 million in some years.¹⁰ The Victorian and Federal Governments provided \$230 million to keep the smelter operating for another four

4. Ibid.

5. COAG Energy Council (2016).

6. Engie (2016).

7. AEMO (2016).

8. AEMO (2017a).

9. Alcoa Australia (2017); and Judd (2017).

10. Gordon (2017).

Figure 1.2: Market events prompted policy responses over late 2016 and early 2017



Notes: Market events marked in red. Policy responses marked in orange.

Source: Grattan analysis.

years.¹¹ This decision has probably harmed electricity consumers, because Alcoa's closure would have helped to lower prices and maintain reliability after Hazelwood's closure.

The summer finished with a heatwave in South Australia and NSW. Demand was high. Several power stations failed. About 85,000 households lost power for about half an hour in SA on 8 February 2017, and supply to the Tomago aluminium smelter in NSW was restricted

11. Macdonald-Smith (2017a), Andrews (2017) and Hunt (2017). The Portland smelter employs 580 staff and contractors (Alcoa Australia (2019)), and so this subsidy represents about \$100,000 per worker per year.

for about an hour on 10 February.¹² Meanwhile Queensland's two government-owned generation businesses were using their dominant market position to drive that state's summer electricity prices to unprecedented highs.¹³

The South Australian Government cracked first. Its Energy Plan,¹⁴ announced on 14 March 2017, included some good elements – the Hornsdale battery has saved SA consumers money and improved reliability¹⁵ – but also a number of bad ones. The SA Government deployed some very expensive diesel generators at short notice, which ultimately were used for only four hours – at a cost of \$111 million.¹⁶ And after a change of government in March 2018, its plans to build a permanent gas-fired generator were abandoned – but not before the government's plans had delayed AGL's own plans to do the same.¹⁷ SA Treasurer Tom Koutsantonis' view that the National Electricity Market was 'broken'¹⁸ was fast becoming a self-fulfilling prophecy.

The Federal Government quickly followed the SA Government's example. Despite federal energy minister Josh Frydenberg describing the SA plan as a \$550 million admission of failure,¹⁹ the very next

day prime minister Malcolm Turnbull announced a 'game changing' intervention in the market – the so-called Snowy 2.0 pumped hydro project.²⁰ Such a large government-funded project crowds out projects that are smaller, cheaper, and quicker to build, increasing reliability risks in NSW after the closure of the Liddell power station in 2023.²¹

In April 2017 the federal and SA governments combined forces to back an ill-fated solar thermal power station in Port Augusta.²² Cross-bench SA senator Nick Xenophon secured a low-interest loan for the Aurora solar thermal project from the Federal Government through negotiations on unrelated tax changes,²³ and this project subsequently won an electricity supply tender with the SA Government.²⁴ But, even with this support, the project did not stack up financially and it was later abandoned before construction started.²⁵

To cap off this eventful period, consumers' electricity prices rose sharply during 2017. The closure of Hazelwood, a sudden increase in east-coast gas prices as gas exports ramped up, and an increase in coal prices all pushed wholesale electricity prices higher. As Figure 1.1 shows, this flowed through to higher retail prices, especially for manufacturing customers (wholesale costs make up a larger portion of manufacturers' bills than households' bills).

12. AEMO (2017b); AEMO (2017c); and Wood et al (2019, p. 14).

13. Wood et al (2018); Grattan analysis of AEMO (2019b). Queensland's excessive wholesale market prices fell only after the State Government issued a directive to Stanwell to 'put as much downward pressure on wholesale prices as possible': Stanwell (2017, p. 17). As a result of this directive, Queensland's wholesale prices generally fell in the year after Hazelwood closed, whereas prices increased elsewhere in the National Electricity Market.

14. Weatherill and Koutsantonis (2017a).

15. Aurecon (2018).

16. Wood et al (2019, p. 27). The quoted cost covers the initial two-year lease of the generators. The SA Government spent a further \$227 million to purchase the generators at the end of the lease period, and subsequently recouped most of the purchase cost by leasing the generators to the private sector (Harmsen (2019)).

17. Macdonald-Smith (2017b).

18. Weatherill and Koutsantonis (2017a).

19. Frydenberg (2017).

20. Turnbull (2017).

21. Wood et al (2019).

22. All operating utility-scale solar power stations in Australia use photovoltaic technology, more commonly known as solar panels. By contrast, solar thermal power stations concentrate sunlight to create steam and drive a turbine.

23. Xenophon (2017).

24. Weatherill and Koutsantonis (2017b).

25. Fedorowytch (2019).

1.1.2 July 2017 to August 2018: false hope

The Finkel Review reported to the COAG Energy Council in June 2017²⁶ and was generally well received. The Federal Government rejected its most controversial recommendation – a Clean Energy Target to drive emissions reductions and reduce market uncertainty – but accepted the other 49 recommendations in principle.²⁷ The Clean Energy Target was quickly replaced by an alternative policy known as the National Energy Guarantee (NEG). The NEG was to have two limbs. An emissions limb would guarantee that retailers purchased sufficiently clean electricity to ensure the sector reduced its emissions in line with government targets. And a reliability limb would ensure those same retailers purchased enough dispatchable electricity to maintain reliability.²⁸

So far so good. The NEG was developed by the Energy Security Board (a body created in response to another Finkel recommendation) with general support from the COAG Energy Council, industry, and consumer groups. Though not perfect, the NEG had created a sense of progress and the prospect of a framework that the key players could work with and understand.

That was until August 2018. Responding to political disagreements within his government, prime minister Turnbull abandoned the emissions component of the NEG.²⁹ But the move failed to placate his internal critics. Turnbull was dumped and the new Prime Minister, Scott Morrison, made clear that his focus was on prices and reliability, not emissions.³⁰

26. Finkel et al (2017).

27. Elton-Pym (2017).

28. Dispatchable generation sources can increase or reduce their output as required.

29. Yaxley (2018a).

30. Yaxley (2018b).

Even though the reliability component of the NEG was retained and has now been legislated, the energy industry was disappointed and frustrated. The peak body representing generators and retailers argued that ‘the NEG and policy stability remain the long-term solution to bringing down prices’.³¹ The NEG was the fifth iteration of climate policy proposed and rejected by the Federal Government since 2007.³² Investors were left wondering when they would have a framework to guide Australia’s long-term emissions reductions in the electricity sector.

1.1.3 September 2018 to today: adding insult to injury

Having abandoned its centrepiece energy policy, the Federal Government moved quickly to replace it. But its new policies made it harder for established suppliers to invest, entrenching the problems in the electricity market. In the October 2018 ‘Fair Deal on Energy’ package, the Government pledged to underwrite new generation assets to improve competition through the Underwriting New Generation Investments (UNGI) program, give the competition regulator new powers to ‘crack down on dodgy, anti-competitive practices’ (the so-called ‘big stick’ policy), and introduce a retail price safety net.³³

Wholesale electricity prices had decreased while the NEG was developed, but began increasing after it was scrapped. This trend became entrenched after the ‘Fair Deal on Energy’ package was announced (Figure 1.3 on the following page). Policy uncertainty

31. Australian Energy Council (2018).

32. The Carbon Pollution Reduction Scheme failed to pass the Senate in 2009 and was abandoned. The Carbon Pricing Mechanism operated from July 2012 to June 2014 before being repealed. In 2016 the Climate Change Authority proposed an Emissions Intensity Scheme; the government considered and then rejected it (Climate Change Authority (2016)). In 2017 Finkel’s Clean Energy Target was proposed and rejected.

33. Morrison et al (2018). The Government also confirmed its intention to implement the reliability component of the NEG, and other minor measures.

is likely to have contributed to this increase, alongside market factors such as low hydro storages and delays to renewable project connections. By early 2019, expected prices for power in 2020 were at levels similar to those seen in the troubled months of early 2017.

The Victorian Government’s retail pricing policies have also complicated the investment environment. Retailers became increasingly concerned about the effect of the Victorian Default Offer policy as it was developed during 2018 and 2019, particularly whether it would allow them to recover the cost of supplying electricity.³⁴

During 2019 reliability concerns returned to the fore, with political responses not far behind. Coal plants failed in hot weather. The Portland aluminium smelter was forced to reduce its power use for about an hour on the evening of 24 January, and the next day about 200,000 Victorian households were hit by rolling blackouts.³⁵ And plant breakdowns in Victoria at the Loy Yang A (coal) and Mortlake (gas) power stations in May and July respectively have heightened concerns about a repeat during the coming summer.³⁶ The Federal Government linked the challenges in Victoria with Hazelwood’s closure and announced yet another intervention in the market, this time a taskforce to ‘deal with’ the 2023 closure of the Liddell power station, including options to extend its life or replace it ‘like for like’.³⁷

1.2 Where are we today?

Bashing big companies may be good politics, but it is bad policy. The energy sector is likely to need in the order of \$150 billion in new utility-scale generation assets over the next 30 years.³⁸ A functioning

34. Potter (2019).

35. AEMO (2019c); and AEMO (2019d).

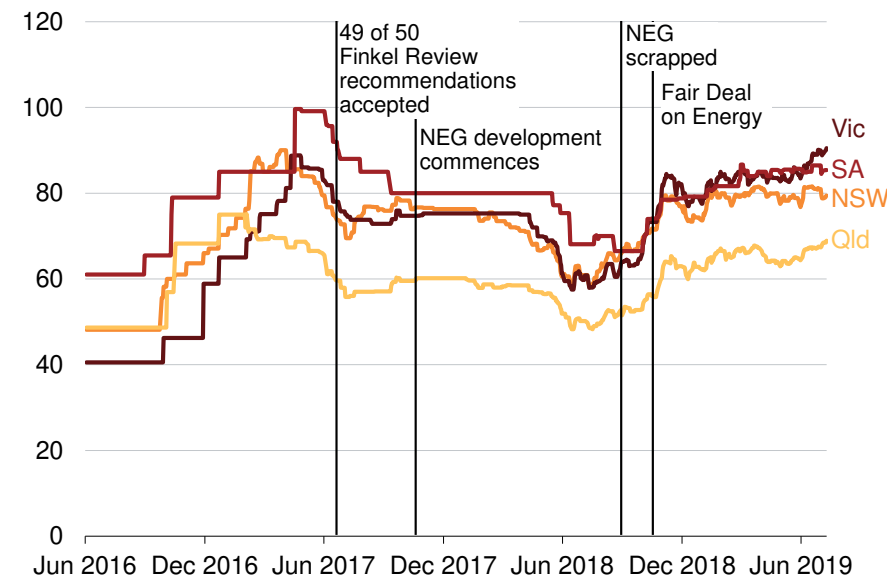
36. AEMO (2019a).

37. Taylor (2019a).

38. CSIRO (unpublished data from CSIRO and Energy Networks Association (2017)), personal communication with the authors, 9 October 2019.

Figure 1.3: Prices have increased since the NEG was scrapped

June 2020 quarter base futures price, \$/MWh



Notes: Only the emissions component of the NEG was scrapped in August 2018. The reliability component of the NEG is now in place and called the Retailer Reliability Obligation.

Source: Grattan analysis of Thomson Reuters Datastream (2019).

market will draw this capital from private investors, rather than requiring governments to increase debt or taxes, or to divert capital away from transport, education, and health projects. And a functioning market means that private energy investors – not governments – bear the financial risk of navigating a period of rapid change.

Unless governments seek to abandon the market and re-nationalise the sector, it is in their interest to ensure that the market delivers. But this requires a change of direction. Private investors will build less often and later if they must constantly second-guess what governments will do next. As a consequence, prices will be higher and reliability lower. And this uncertainty is compounded by a chaotic approach to climate policy. These government interventions and failures could become a vicious cycle: government-created uncertainty worsens market outcomes, leading to further government intervention.

This report points to a way out of this mess. Chapter 2 examines the pressures on governments to *do* something. It shows that many of the arguments in favour of government action are exaggerated, and many of the proposed actions are likely to prove counterproductive.

But governments can help the electricity market at this time of rapid change. Chapter 3 identifies how governments can guide Australia's energy transition using established institutions and transparent, rule-based processes.

2 Knee-jerk policies have real costs

Governments do face pressure to implement policies that give them a semblance of control over the rapid and complex energy transition. But many of the arguments to act are exaggerated, and often governments have only limited power to address the perceived problems. Investment is occurring in response to high prices and this, not government policy, will bring prices down. The Federal Government's approach of 'picking winners' through direct involvement in new generation investments crowds out other projects that could be delivered sooner and would be more likely to lower prices and increase reliability. And the 'big stick' policy and ongoing political pressure over the planned closure of the Liddell power station only make investment harder. These interventions ultimately harm both governments and consumers.

2.1 The pressure on governments is real

2.1.1 Consumers are unhappy about power prices

Consumers were unhappy about power prices even before the challenges of late-2016 and 2017. Excessive investment in electricity networks, generous consumer-funded environmental subsidies, and high retail margins had all forced retail prices to historically high levels, well before coal closures and fuel price increases pushed wholesale prices dramatically higher.³⁹ Consumers consistently ranked electricity as their top cost-of-living concern over the two years to July 2016.⁴⁰

Only half of households and small businesses are satisfied with the power prices they pay, a slight improvement since July 2016.⁴¹ And consumers rate the value for money of electricity below that of

comparable services, such as gas, water, mobile phones, the internet, insurance, and banking.⁴²

Large business customers are also concerned about energy prices.⁴³ Electricity prices for larger energy consumers have increased faster than for households in recent years (Figure 1.1 on page 6), and this has been compounded by sharp increases in gas prices.⁴⁴

2.1.2 Blackouts stoked a media debate about reliability

High-profile blackouts in 2016 and 2017 – notably the SA state-wide blackout of September 2016 but also load-shedding in SA and NSW during February 2017 – increased public debate on the reliability of Australia's power system.

Events in Victoria in 2019 have re-stoked the debate. Rolling blackouts in January 2019 affected 200,000 customers,⁴⁵ and generator breakdowns have led to alarming predictions by AEMO of up to 1.3 million households being without power over the coming summer under a worst-case scenario.⁴⁶

These high-profile events have caused a dramatic increase in media reporting on electricity reliability. Media reporting on 'blackouts' has increased tenfold since 2016 compared to the decade beforehand.⁴⁷

39. ACCC (2018).

40. CHOICE Australia (2016).

41. Energy Consumers Australia (2019a).

42. Ibid.

43. Australian Industry Group (2019).

44. ACCC (2019).

45. AEMO (2019d).

46. AEMO (2019a).

47. Wood et al (2019, p. 6).

2.2 Sometimes the medicine is worse than the disease

When faced with public concern, the obvious political solution is to do something, anything – irrespective of its cost or effectiveness. But doing nothing is sometimes the right thing to do.

A well-functioning market allows governments to do nothing, or at least very little, to manage the day-to-day activities of the electricity sector. Private investors, not governments, can invest the billions of dollars required to keep the electricity sector operating. And independent experts immune from the pressures of politics make the complex technical judgements needed to administer and regulate the system.

Governments, particularly the Federal Government, appear to have formed a view that the market is not functioning, and that intervention is necessary. Far from simply setting the rules and appointing the referees, the Federal Government has become one of the key players in the electricity market game.

But many of these interventions will be ineffective at best, or counterproductive at worst. By seeking to pick winners and directly supporting specific generation investments, governments crowds out other investments. And brandishing a ‘big stick’ and pressuring companies over coal closures make it harder for the market to deliver the price and reliability outcomes politicians and consumers want.

2.2.1 High prices bring on investment...

Consumers (and politicians) feel like the market is failing when prices rise. And both wholesale and retail electricity prices have increased significantly over recent years. But these increases don’t signal a broken market or policy failure – they largely reflect fundamental shifts in the cost of supplying power. Supply has tightened since the closure

of the Hazelwood coal power station in March 2017,⁴⁸ and higher gas and coal prices have increased the cost of generating electricity.⁴⁹

Consumers don’t like high prices, but fortunately high prices tend to bring about their own solution. High prices motivate new investment, which in turn works to reduce prices. The short notice given before the closure of Hazelwood in early-2017 caused a delayed response, but there are clear signs that this response is now happening.

About 9 GW of solar and wind generation has been committed to be built in the National Electricity Market (NEM) since the start of 2017, and more than a third of this capacity is already operating (Figure 2.1 on the following page). The amount of new generation committed is well above the amount needed to comply with the national renewable energy target, indicating that investment is occurring in response not only to subsidies but also high market prices.⁵⁰

The NEM is likely to follow the laws of supply and demand – as supply increases, prices will fall. Figure 2.2 on the next page compares the price of futures contracts for the four mainland NEM regions for the next three financial years with average spot market prices for 2017-18 and 2018-19. Prices are expected to trend down in all regions, and by 2021-22 will be about \$70 per megawatt-hour, which is federal Energy Minister Angus Taylor’s 2021 price target.⁵¹

This expected price reduction comes from investment, not policy interventions – by 2021, Snowy 2.0 and any projects backed by the

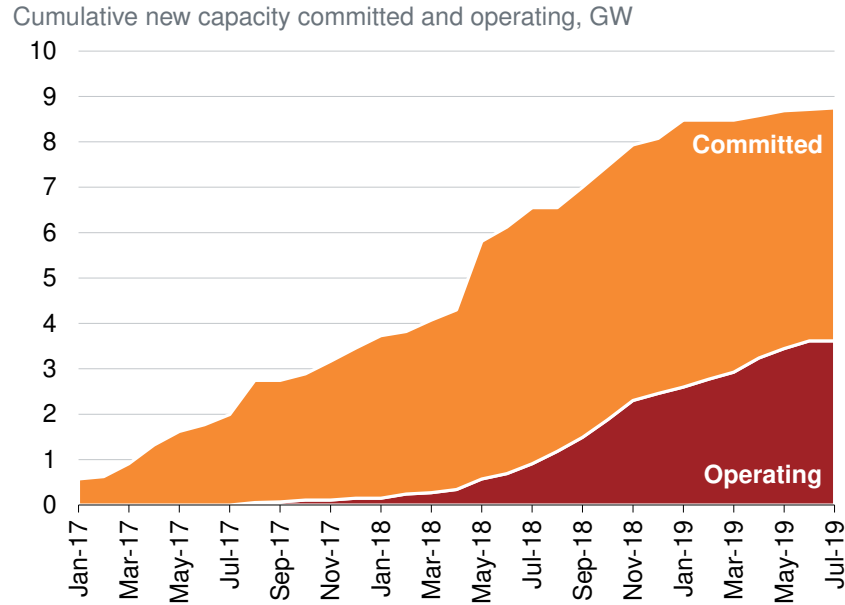
48. The closure of the Northern coal power station in SA in May 2016 also contributed.

49. Wood et al (2018).

50. Clean Energy Regulator (2019, p. 5). State government contracts have supported about 17 per cent of the renewable capacity committed since the start of 2017. If Victorian contracts awarded to projects that are not yet formally committed are included, this share increases to 21 per cent (Table B.6).

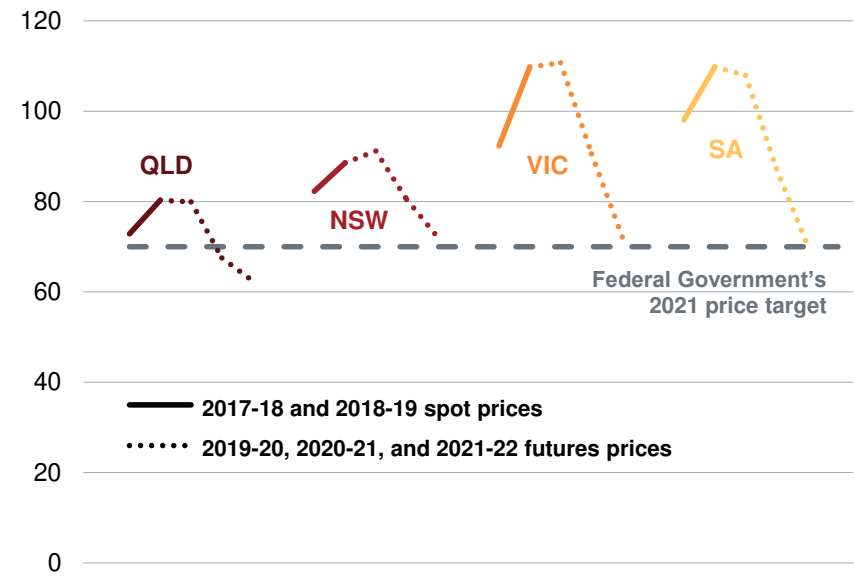
51. Taylor (2019b). This target appears broadly consistent with the ACCC’s expectations for 2021: ACCC (2018, p. 48).

Figure 2.1: There's been significant renewable investment in the NEM since Hazelwood closed



Notes: Renewable generation only. Hazelwood closed in March 2017.
 Source: Grattan analysis as summarised in Appendix B.

Figure 2.2: Wholesale prices are expected to fall
 Spot market and futures contract prices, \$/MWh



Notes: Prices are time-weighted averages. 2017-18 and 2018-19 data are actual market prices based on AEMO data. 2019-20 data are futures contracts as of 28 June 2019 (the last trading day before the 2019-20 year began). 2020-21 and 2021-22 data are futures contracts prices based on ASX Energy data as of 1 October 2019.
 Sources: AEMO (2019b), Thomson Reuters Datastream (2019) and ASX Energy (2019).

Government's 'Underwriting New Generation Investments' program will still be years from connecting to the grid.

2.2.2 ... unless governments try to pick winners and in doing so scare investors away

Significant amounts of renewable generation are being built in response to the closure of coal power stations and higher prices, but this has not been accompanied by new dispatchable generation, such as gas or pumped hydro.⁵² In turn, the shift from dispatchable generation to variable renewable energy has driven political concerns about prices and reliability, and motivated policies such as Snowy 2.0 and the Underwriting New Generation Investments (UNGI) program (Box 1).

But by trying to pick winners through the UNGI program and Snowy 2.0, the Government has made it harder for investors to deliver new dispatchable capacity, exacerbating the very price and reliability concerns that motivated these interventions. The impending entry of Snowy 2.0 and an unknown number of the 12 short-listed UNGI projects is very likely to have dissuaded and delayed other investments. This level of government intervention was not present between 2005 and 2009 when the market last needed substantial new dispatchable capacity – and at that time private investors delivered 4 GW of new dispatchable capacity.⁵³

Investors face a number of market risks and uncertainties such as demand, gas prices, changing technology costs, and the high rate of change in the generation mix. These are complicating and delaying investment decisions. But investors consider the unpredictability of what governments will or won't do far harder to manage.

52. AEMO (2017d, p. 1); Finkel et al (2017, p. 76); and ESB (2018a, p. 15).

53. Wood et al (2019, p. 13).

Box 1: The Federal Government is trying to pick winners to ease price and reliability concerns

'The Turnbull Government will start work on an electricity game-changer: the plan for the Snowy Mountains Scheme 2.0... The unprecedented expansion will help make renewables reliable, filling in holes caused by intermittent supply and generator outages... This will ultimately mean cheaper power prices' – Malcolm Turnbull, 15 March 2017^a

'Underwriting new electricity generation will attract investment in the electricity market, increasing supply and reducing wholesale prices' – Scott Morrison, Josh Frydenberg, and Angus Taylor, 23 October 2018^b

'When we go for periods where we don't have sunshine or wind that's needed to power our electricity market, Snowy can step in at a scale that it hasn't been able to in the past. That will put downward pressure on prices and it will keep the lights on' – Scott Morrison, 26 February 2019^c

'The Government is focused on the real challenge of ensuring enough reliable affordable generation to meet demand post-2023. More dispatchable generation is the only way to bring prices down and keep the lights on' – Angus Taylor, 2 August 2019^d

a. Turnbull (2017).

b. Morrison et al (2018).

c. Morrison (2019).

d. Taylor (2019c).

The 'Big 3' integrated generator-retailers – AGL, Origin, and EnergyAustralia – are planning investments that, in most cases, can

be delivered faster than competing projects seeking government assistance through the UNGI program (Table 2.1 on the next page).

Only three UNGI projects (the Vales Point upgrade in NSW, Reeves Plains in SA, and Gatton in Queensland) appear likely to be able to be ready quickly. Of these, one (Gatton) does not appear to meet a pressing market need, and another (Vales Point) is very small. So they are unlikely to materially improve market outcomes even if they are delivered. The long lead times of other UNGI-shortlisted projects, and the program’s uncertain scope will discourage other, more prospective, investments for many years. Similarly the long lead time of Snowy 2.0 will dissuade other investments before its scheduled start date of 2025.

2.2.3 Company bashing won’t achieve anything

As prices have increased, public criticism of energy companies ‘gouging’ customers has increased.⁵⁴ This concern appears to have motivated the Federal Government to develop its ‘big stick’ legislation, which was loosely based on, but went well beyond, the recommendations of an ACCC report.⁵⁵

But the perception of gouging doesn’t match the reality. Profits have not increased anywhere near as much as prices. NEM turnover for the past three financial years is about \$8 billion higher than in the two preceding years, but annual operating profits of the ‘Big 3’ energy generator-retailers targeted by the big stick legislation – AGL, Origin, and EnergyAustralia – have increased by only about \$1 billion over the same time. The profits of generators owned by the Queensland,

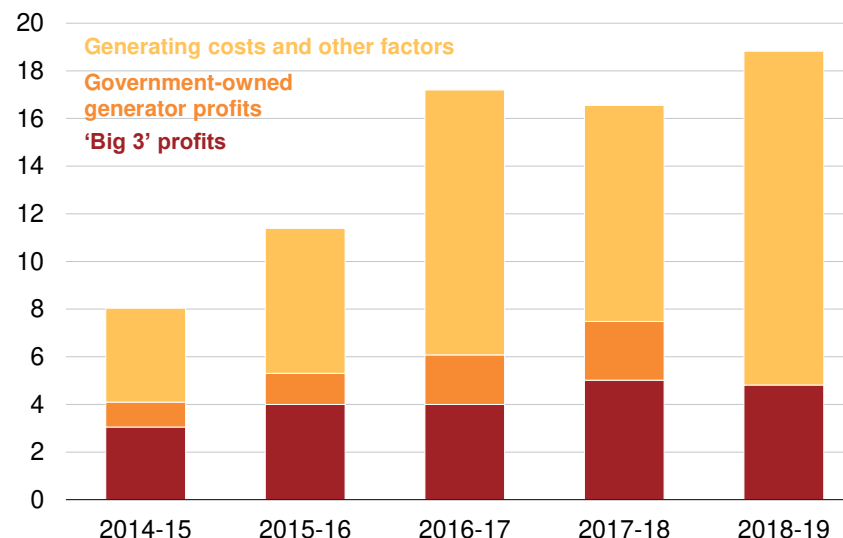
54. Chung (2018); Mountain and Percy (2019); Hobday et al (2019); and Macdonald-Smith (2019).

55. Recommendations 3, 7, 41, and 43 of ACCC (2018) bear some resemblance to the provisions covered in the *Treasury Laws Amendment (Prohibiting Energy Market Misconduct) Bill 2018*. Wood and Dundas (2019a) analysed the proposed energy market misconduct legislation and found that it did not accurately target the true sources of higher prices, and was likely to be ineffective.

Tasmanian, and federal governments have also increased by about \$1 billion per year, but off a much smaller base (Figure 2.3).

Figure 2.3: Increased profits explain only a small component of increasing electricity market prices

Total NEM wholesale market revenue by component, billions of dollars (nominal)



Notes: The ‘Big 3’ are AGL, Origin, and EnergyAustralia. The government generators analysed are CS Energy, Stanwell, Snowy Hydro, and Hydro Tasmania. 2018-19 data are not available for Snowy Hydro and Hydro Tasmania at the time of writing, and so government generator profits are not presented. Profits are measured using EBITDA, an underlying measure of profit. EBITDA is earnings before interest, tax, depreciation, and amortisation. These estimates exclude revaluations of financial instruments, and other exceptional items that affect comparability. The final return to shareholders is substantially lower because this excludes finance and tax payments. Profits for the Big 3 companies are overstated in this context because they include retail margins for both gas and electricity. Other factors include profits for other generating companies, that collectively comprise around 20 per cent of the market.

Sources: Grattan analysis of company financial reports and AEMO (2019e).

Table 2.1: Several projects excluded from the Underwriting New Generation Investments program can be built quicker than comparable UNGI projects

Major proposed dispatchable capacity additions, ordered by speed to market

Speed to market	Proponent	Project	State	Technology	Project size	Planning approval status	Market need	Clear need for project?
Very fast	EnergyAustralia	Mt Piper upgrade	NSW	Coal upgrade	Small	Minor plant upgrade	NSW energy	Yes
	Delta Electricity	Vales Point upgrade	NSW	Coal upgrade	Small	Minor plant upgrade	NSW energy	Yes
	EnergyAustralia	Tallawarra B	NSW	Gas (OCGT)	Medium	Approved, brownfields	NSW capacity	Yes
	Origin	Quarantine upgrade	SA	Gas (OCGT)	Medium	Approved, brownfields	SA capacity	Yes
	EnergyAustralia	Hallett upgrade	SA	Gas (OCGT)	Small	Approved, brownfields	SA capacity	Yes
Fast	Alinta	Reeves Plains	SA	Gas (OCGT)	Medium	Approved	SA capacity	Yes
	Quinbrook Partners	Gatton	QLD	Gas (OCGT)	Large	Approved	QLD capacity	No
Moderate	AGL	Newcastle	NSW	Gas (reciprocating engine)	Medium	Not yet approved, but brownfields	NSW capacity	Yes
	Alinta	Bairnsdale	VIC	Gas (OCGT)	Unknown	Not yet approved, but brownfields	VIC capacity	Yes
	APA	Dandenong	VIC	Gas (OCGT)	Medium	Not yet approved, but brownfields	VIC capacity	Yes
	Sunset Power / Delta Electricity	Goat Hill / Lincoln Gap	SA	Pumped hydro	Medium	Approved	SA arbitrage	Maybe
	Rise Renewables	Baroota	SA	Pumped hydro	Medium	Approved	SA arbitrage	Maybe
	Origin	Shoalhaven expansion	NSW	Pumped hydro	Medium	Not yet approved, but brownfields	NSW arbitrage	Maybe
Slow	Australian Industrial Energy	Pt Kembla	NSW	Gas (CCGT)	Large	Not yet approved	NSW energy	Maybe
	EnergyAustralia	Cultana	SA	Pumped hydro	Medium	Not yet approved	SA arbitrage	Maybe
	AGL	Kanmantoo	SA	Pumped hydro	Medium	Not yet approved	SA arbitrage	Maybe
	SIMEC Zen	Middleback Ranges / Eyre Peninsula	SA	Pumped hydro	Small	Not yet approved	SA arbitrage	Maybe
	BE Power	Cressbrook Reservoir	QLD	Pumped hydro	Unknown	Not yet approved	QLD arbitrage	Maybe
	Hydro Tasmania	Battery of the Nation	TAS	Pumped hydro	Unknown	Not yet approved	TAS arbitrage	Maybe
	AGL	Bells Mountain	NSW	Pumped hydro	Medium	Not yet approved	NSW arbitrage	Maybe
	UPC Renewables	Armidale	NSW	Pumped hydro	Unknown	Not yet approved	NSW arbitrage	Maybe

Notes: Grey rows identify projects not shortlisted for assistance through the UNGI program. OCGT = open-cycle gas turbine. CCGT = combined-cycle gas turbine. Small: less than 100 MW; Medium: 100-500 MW; Large: more than 500 MW.

Sources: Grattan analysis of company documents, planning approvals, and Department of the Environment and Energy (2019).

About two thirds of the increase in wholesale electricity prices are driven by higher supply costs.⁵⁶ Increased profits of large companies explains only 25 per cent of the total increase in wholesale electricity prices, and profits for the large energy companies targeted by the big stick legislation explain only half of this.

Profits appear to have peaked, and look set to decline further as new investment comes online. Big 3 profits were lower in 2018-19 than in 2017-18, as higher coal and gas prices begin to reduce margins. In their most recent results, both AGL and EnergyAustralia noted expected falls in wholesale prices, which will squeeze future profits.⁵⁷ In competitive markets high profits, like high prices, tend to be temporary.

Investment, not squeezing profit margins, is likely to have the biggest effect on prices. But the Federal Government has spent much of the past year directly threatening those companies best-placed to make those investments. This is likely to prove counterproductive.

Governments, particularly the federal and Victorian governments, have also targeted retail profits. To be clear, Australia's retail electricity markets have not operated perfectly – as has been highlighted in numerous studies.⁵⁸ But capping retail prices is dangerous when the cost of reliably supplying electricity has been increasing for many reasons other than retail margins.

The Federal Government gave the Australian Energy Regulator (AER) significant discretion in establishing a 'default market offer'. The AER appears to have struck a reasonable balance between providing a

safety net for disengaged consumers, without preventing companies from recovering the true cost of supplying electricity.⁵⁹

By contrast the Victorian Government specifically requested its Essential Services Commission (ESC) to allow only 'a modest allowance for customer acquisition and retention costs'.⁶⁰ This reflects the recommendations of an earlier review to establish a 'no frills' regulated retail offer.⁶¹ This prescription has led to the ESC establishing a price cap at about the level of the average market offer.⁶² This price level leaves little margin for error for retailers – even small changes in market conditions could prevent retailers from recovering their costs, including the cost of new generation investments. In the longer-term, the regulatory risk such a policy creates could reduce competition and increase prices.

2.2.4 Fighting to stop coal closures is futile

The fall-out of the sudden closure of Hazelwood has turned coal closure into a political and policy battleground. Predictably, a fight has flared over the next planned coal closure – the Liddell power station in NSW.

The two cases are quite different. Engie gave only five months' notice of Hazelwood's closure, whereas AGL gave about seven years' notice of its originally intended 2022 closure of Liddell.⁶³ AGL's decision to give long notice of Liddell's closure is entirely positive for consumers – with such lead time investors, including AGL's competitors, can plan and deliver new capacity to fill the gap in supply, and regulators and network businesses can consider transmission upgrades that take a long time to build.

56. Together AGL, Origin, EnergyAustralia, CS Energy, Stanwell, Snowy Hydro, and Hydro Tasmania supply more than 80 per cent of power in the NEM (Grattan analysis of ACCC (2018)). This calculation assumes that smaller generators comprising the rest of NEM supply increase profits in proportion with the large private and government generators analysed directly.

57. AGL (2019a, p. 28); and CLP Holdings (2019, p. 50).

58. Wood et al (2017b); Thwaites et al (2017); and ACCC (2018).

59. Wood and Dundas (2019b).

60. Victorian Government (2018).

61. Thwaites et al (2017).

62. Essential Services Commission (2019, p. 4).

63. AGL (2017). In August 2019 AGL delayed Liddell's full closure to April 2023.

Early notice of closure may be good for consumers, but the political effects have not been particularly good for AGL. The Federal Government has criticised the announced closure, accusing AGL of seeking to increase prices and profits.⁶⁴ In September 2017, AGL's CEO personally assured the Prime Minister that AGL would develop a plan to replace Liddell. But when AGL affirmed its plan to replace Liddell with a mix of renewables, gas, and storage, the Federal Government continued to pressure the company to extend Liddell's life or sell it to another operator.⁶⁵ Even when AGL delayed the full closure of Liddell by a year,⁶⁶ the Federal Government was not appeased. A week later it announced a joint Commonwealth-NSW taskforce to examine options to manage the Liddell closure, including how to extend its life or replace it 'like for like'.⁶⁷

The Federal Government's fight to avoid Liddell's closure makes it harder for Australia to achieve its emissions reduction targets. It is also likely to prove futile, because the underlying economics of the plant are poor. NSW has too much 'base load' plant that needs to run constantly to remain profitable,⁶⁸ and needs more flexible plant, likely gas, that can run less frequently and turn on and off in response to market conditions. Liddell's retirement will lead to a generation mix that better suits NSW's needs.

By resisting Liddell's closure, the Federal Government has created uncertainty for potential investors seeking to replace it. Despite the policy uncertainty, a substantial amount of new renewables – about 2.3 GW (Table B.1) – has been committed in NSW since AGL first announced Liddell's closure. This is a good start, but it is likely that more will be needed, alongside gas plants such as those being

planned by both AGL and EnergyAustralia. If the Liddell taskforce delays investment, it will increase prices and reduce reliability for NSW consumers. The best thing the Federal Government can do is get out of the way and give investors a clear signal to replace Liddell.

The level of concern about reliability after Liddell's closure is not justified. AEMO's 2019 Electricity Statement of Opportunities (ESOO) shows the risk of power outages increasing significantly in the first summer after Liddell's closure (2023-24). But that projection is already significantly better than in AEMO's 2018 ES00, in part because new renewable generation has increased supply (Figure 2.4 on the following page).

AEMO's analysis indicates that potential transmission upgrades will further improve reliability in NSW – and this is likely to improve still further with gas and renewable investment over the next four years. By the time Liddell is finally closed, electricity supplies in NSW are likely to be about as reliable as they are today.

2.2.5 Interventions to improve reliability are poorly targeted and go against consumer preferences

Government interventions to support reliability overwhelmingly focus on new generation capacity. Power outages caused by a lack of generation affect a large number of customers at any one time, and so grab headlines. But this approach ignores the fact that only about 0.1 per cent of all power outages (weighted by the number of customers affected and the length of outages) are caused by a lack of generation capacity.⁶⁹

Reliability interventions that target only 0.1 per cent of all outages are likely to provide poor value to the customers or taxpayers who pay for them. And it does not appear that electricity consumers want these

64. Chambers and White (2018).

65. Turnbull (2018).

66. AGL (2019b).

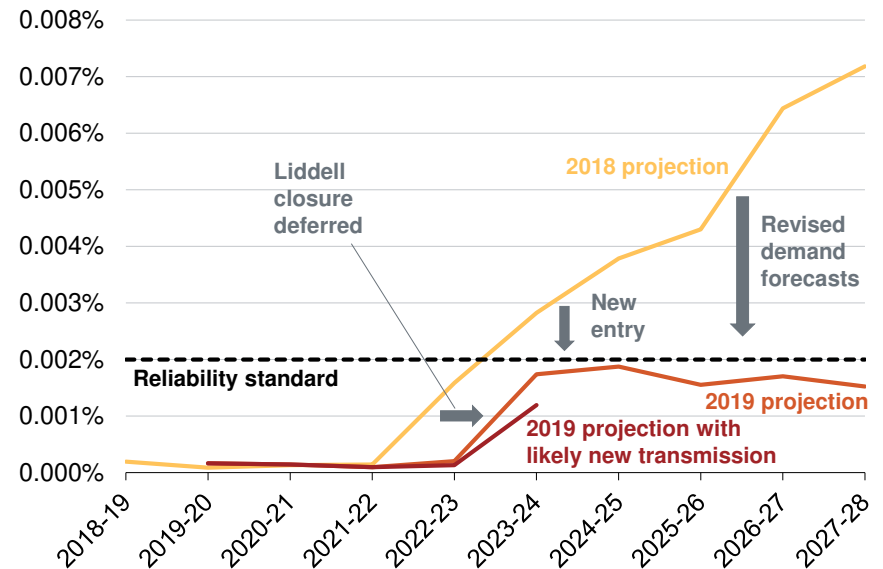
67. Taylor (2019a).

68. Nelson (2018).

69. Wood et al (2019, p. 9).

interventions – they are generally more concerned about affordability than reliability. About 70 per cent of households nationwide are satisfied with the reliability of their power, but less than half are satisfied with the value for money they receive.⁷⁰ There was a noticeable drop in satisfaction with power reliability in South Australia after the state-wide blackout, but consumers are only slightly less satisfied with reliability today than they were in August 2016, just before the blackout.

Figure 2.4: The reliability outlook for NSW is improving rapidly
 Projected unserved energy in NSW, percentage of annual electricity consumption



Notes: Likely transmission projects are minor upgrades between NSW and Victoria, and NSW and Queensland. A major NSW-South Australia transmission upgrade is not included because it is awaiting regulatory approval by late 2019. If approved, this project would further improve the reliability outlook.

Sources: Grattan analysis of AEMO (2018a) and AEMO (2019a).

70. Grattan analysis of Energy Consumers Australia (2019b) from June 2017 to June 2019 inclusive. State sample sizes are not available for the June 2016 and December 2016 surveys to calculate a national figure, but state-level results indicate that national results would be similar to those in later surveys.

3 Getting back on the right track

Rather than ad hoc interventions to directly support generation, governments should focus on clarifying the big issues shaping the electricity market. Much-needed investment in transmission needs to be accelerated by giving networks confidence that they can recover the cost of early planning works. And strengthening rules around coal closures is critical. Coal generators should put funds into escrow to ensure orderly closure, to protect consumers and drive timely replacement investment.

Having designed a market and created regulatory agencies to administer it, the onus is on governments to ensure that regulatory frameworks are sound and that the market's design supports investment in new generation. Clear climate policy is also critical to support this investment. Together these actions will help get the electricity market back on the right track.

3.1 Monitor and refine institutional and regulatory frameworks

Far from a 'deregulated' electricity market, the NEM is managed through an extensive and carefully crafted regulatory and institutional framework.⁷¹ During the 1990s and 2000s, governments established this framework recognising that clear rules are needed to attract billions of dollars of private investment.

Independent agencies manage the day-to-day activities of the market. AEMO operates the market, and the AER assesses whether entities (including AEMO and market participants) have complied with the rules.

Governments also recognised that the market rules could not be set in stone but would need to be adapted to changing circumstances. To

71. The National Electricity Rules that set down the detailed operation of the market currently run to about 1600 pages.

retain the confidence of investors, this process needed to be robust, transparent, and free of political interference. And so governments created the independent Australian Energy Market Commission (AEMC) to manage the NEM's rule-change process. Any entity, including governments, consumers groups, and market participants, can request a rule change, and the AEMC must assess whether implementing it (or an alternative rule) will be in the long-run interests of consumers.

This framework worked well while the pace of change was modest and politicians were generally happy with market outcomes. A 2015 review of market governance led by Michael Vertigan found that the NEM framework was 'fundamentally sound . . . and amongst best practice internationally'.⁷² But this review was critical of the contribution of governments and officials to a 'strategic policy deficit'. While the Vertigan Review recommended that the AEMC work more closely with the COAG Energy Council to formulate strategic policy, the more recent Finkel Review emphasised the need for the COAG Energy Council to itself focus more on strategic issues, and recommended the creation of the Energy Security Board (ESB) to help achieve this focus.

But the world has changed. Facing a period of rapid change, the agencies have tended to be reactive rather than proactive. They have struggled to work collaboratively when broader strategic issues have emerged. And governments have not helped by second-guessing the agencies' work, adding policy uncertainty to underlying market and technological changes.⁷³

Both the Vertigan and Finkel reviews acknowledged a lack of strategic focus by the COAG Energy Council itself. Changing membership and

72. Vertigan et al (2015, p. 7).

73. Wood (2019).

conflicting political objectives have made it difficult for the Council to drive coherent long-term policy. The answer lies in ensuring that the agencies are resourced and empowered to tackle emerging issues and challenges, as well as managing day-to-day issues.

Only governments can fix any weaknesses in institutional arrangements. Guided by expert and independent advice, governments should strengthen the agencies so they can guide the sector through the period of rapid change ahead. The ESB's current mandate finishes after three years in 2020. If the ESB is part of the answer to addressing the sector's need for strategic advice, its role should be formalised. And the three formal market agencies – the AEMC, the AER, and AEMO – should be given a joint statutory obligation to collaborate on common objectives.⁷⁴

3.2 Ensure the NEM's design remains appropriate

The design of the NEM is crucial if prices are to be as low as possible and reliability maintained. Reliability concerns in particular have driven debate for many years about whether the NEM's 'energy only' market design remains suitable. There are legitimate views on both sides (Box 2).

The NEM's design supports reliability by allowing the market prices to rise to very high levels (currently \$14,700 per megawatt-hour, which is well over 100 times the average market price). This places a premium on reliable supply when demand and prices are high. The Reliability and Emergency Reserve Trader mechanism provides further insurance by allowing AEMO to purchase back-up reserves to increase supply or reduce demand when the market is particularly stretched.

Despite these protections, reliability concerns remain. In response, the COAG Energy Council implemented the Retailer Reliability Obligation

74. Ibid.

Box 2: The NEM's 'energy only' market design is a matter of debate

The NEM is an energy only market, which means that generators are only paid for energy delivered. This contrasts with 'capacity markets', where generators are paid for making capacity available which may or may not be used. In a capacity market, the energy market operator typically determines the amount of capacity needed to maintain reliability, procures this through a centralised auction, and passes the cost on to consumers. Variants of this approach are used, for example, in Western Australia, Great Britain, Ireland, and parts of the US.

One argument for a capacity market is that it is more politically sustainable, because politicians tend to be unwilling to wait for prices to increase to levels necessary to motivate new investment. Another argument is that a centralised capacity auction gives regulators and politicians a more direct mechanism to purchase the degree of reliability they seek.

But this certainty would be likely to come at a cost. Given the acute political pressure that arises from even small power outages, it is likely that both politicians and regulators would buy too much capacity – and this cost would ultimately be passed on to either energy consumers or taxpayers.

in July 2019. This mechanism complements the NEM's intrinsic reliability incentives. But the fundamental question of whether the energy only market will deliver the desired level of reliability remains open. If there is clear evidence that the current market design is not adequate, it should be changed.⁷⁵

Governments need to be involved in this process. Balancing reliability and price involves difficult judgements about society's preferences, and elected politicians can help make these judgements. But politicians' judgements can differ from the interests of their constituents – for example, today's heightened political concerns about electricity reliability are not consistent with the fact that consumers are more concerned about affordability (Section 2.2.5 on page 19). And politicians' desire for increased reliability should be balanced against the cost of achieving this, which requires careful analysis of different policy settings and market designs.

So far governments appear to be managing this process well. The COAG Energy Council has appropriately sought expert advice from the ESB on the need for changes to the NEM's post-2025 design.⁷⁶ But having sponsored a review, governments should not pre-judge its outcome. If governments act as though the current market design is flawed and continue to intervene, outcomes will continue to be poor. These outcomes would probably be blamed, incorrectly, on market design, in turn leading to poorly-targeted changes. This would simply add to the already high level of uncertainty for investors, who need to make important commercial decisions well before the post-2025 market review can be completed.

75. Wood et al (2017a).

76. COAG Energy Council (2019).

3.3 Governments must take charge of climate policy

Climate policy is a key factor affecting the energy sector. It has a major impact on investments. Only elected governments can make emissions reduction commitments as part of international negotiations, and set policies across the economy to fulfil these commitments. Yet governments have singularly failed to clarify this issue for the energy sector.

As was discussed in Chapter 1, five emissions policies have been proposed and rejected by the Federal Government since 2007, with the most recent being the NEG. The Federal Government's 2030 emissions reduction target for the electricity sector is likely to be met, but it, along with other countries' commitments, remains insufficient to achieve the Paris Agreement's long-term objective of keeping global warming to well below 2 degrees Celsius.⁷⁷ The process by which this target will be increased and the mechanism by which it will be achieved both remain unclear.

State governments have filled the vacuum created by the Federal Government's unambitious targets and lack of a policy mechanism. But the states' actions have been uncoordinated and chaotic, using different mechanisms and adopting different targets. The overall effect has frustrated investors and driven up costs for consumers.

The states should abandon their uncoordinated policies and instead implement a nationwide emissions reduction policy through state-based legislation.⁷⁸ While a national policy led by the Federal Government would be ideal, a state-based policy would be far superior to no policy at all. It would resolve a key element of uncertainty that has held back investment in both renewable and dispatchable generation. This would underpin lower prices and increased reliability.

77. IPCC (2018).

78. Daley et al (2018, p. 76).

3.4 Governments can facilitate market-shaping transmission investments

More transmission is likely to be needed to maintain a cost-effective and reliable grid as the share of renewable generation increases.⁷⁹ And transmission investments are delivered through a centralised planning and regulatory process (Box 3) that can better accommodate government involvement than the generation market, where decentralised competition determines investment.

Major investments in the shared transmission network take a long time, often in the order of six or seven years. The challenge for governments and market agencies is to ensure that transmission investment can 'keep up' with rapid changes in the generation mix.

The Finkel Review recommended that AEMO develop an 'integrated grid plan' to examine the least-cost combination of generation and transmission investments.⁸⁰ This led to AEMO's Integrated System Plan (ISP), which is now a key planning tool for the NEM.

The ISP is an efficient way of identifying prospective new links, but is not sufficient on its own to ensure that this occurs in a timely manner. Transmission networks are reluctant to spend significant time and money planning these links until the AER has confirmed that they can recover the cost from consumers.⁸¹ This means that the key steps involved in a new transmission investment typically occur sequentially, rather than in parallel. This causes a six- or seven-year process, starting with a two- or three-year regulatory investment test for transmission (RiT-T) process, then about two years of detailed planning, and finally a further two or three years for construction.⁸²

79. Finkel et al (2017, p. 121).

80. Ibid.

81. ESB (2018b, p. 10).

82. NSW Government (2018, p. 14).

Box 3: Transmission planning requires a number of steps

Planning and delivering investments in the shared transmission network involves three key steps. First, because consumers will pay for these assets, the need for investment must be established – for example because it would improve reliability or bring down costs. Second, the most efficient way of delivering that need must be found, and confirmed to be worthwhile based on cost-benefit analysis. Third, worthwhile investments must be approved by planning authorities and built.

The Integrated System Plan assesses the need for new transmission across the NEM. Transmission network companies each assess more localised needs through their annual planning reports.

The 'regulatory investment test for transmission' (RiT-T) assesses whether the benefits of specific investments justify their costs. This test is performed by transmission networks,^a and assessed independently by the AER. The ISP also assesses some costs and benefits at a high-level, and so can be used to inform subsequent RiT-T processes.

Once an investment has passed the RiT-T, the AER confirms that transmission networks can recover this cost from energy consumers through network charges. The networks then plan and build the link.

The process for investments to connect new generators is quite different. Unlike shared transmission assets, generators pay for 'connection assets', and so there is no need for a cost-benefit test through the RiT-T.

a. AEMO acts as regional transmission planner in Victoria, and undertakes the RiT-T on behalf of the Victorian transmission network, AusNet Services.

But governments can accelerate this process. The ESB has considered several ways to speed-up investments proposed in the ISP.⁸³ Governments, through the COAG Energy Council, should make several changes to streamline these processes. The key policy options are discussed further below, and their merits are compared in Table 3.1.

3.4.1 Governments should streamline regulatory processes

The ESB has proposed allowing transmission networks to skip the initial (needs assessment) stage of the RiT-T process if the same need has already been examined in the ISP.⁸⁴ The ESB has also proposed allowing the AER to assess whether a project passes the RiT-T and what revenue that project can recover at the same time, rather than sequentially. Together these steps could reduce the time take for a RiT-T by as much as 18 months,⁸⁵ without risking the integrity of the RiT-T.

The AEMC is considering other reforms to help coordinate generation and transmission investment (Box 4). These reforms are likely to complement the ESB's proposals, but are not intended to significantly hasten delivery of new transmission.

3.4.2 Governments should accelerate early planning work

Starting early planning work before a RiT-T is completed can also greatly speed-up transmission projects. Governments can fund or underwrite early planning work, and so overcome the concerns of transmission companies that they will not be able to recover these costs from consumers.

Allowing early planning work to proceed alongside, rather than after, the RiT-T could reduce the time needed for a transmission investment

83. ESB (2018b).

84. Ibid (p. 17).

85. AEMC (2018a, p. 31).

Box 4: The AEMC's proposed reforms are likely to complement RiT-T improvements

A recent AEMC review has recommended a system of financial rights to clarify transmission access, to encourage generators to manage their impact on the grid.^a These so-called 'coordination of generation and transmission investment', or COGATI, reforms are likely to complement the enhancements listed above. The streamlined ISP, RiT-T, and early planning processes are still the key processes that determine what gets built. But the AEMC's proposed transmission rights would help ensure that the assets are used efficiently once built, and help generators plan their investments to take advantage of planned transmission links.

a. AEMC (ibid).

by 12 to 18 months,⁸⁶ while still using the RiT-T to protect consumers from paying for inefficient investments.

Several governments have already adopted this approach. The SA Government is funding early work on the proposed NSW-SA 'EnergyConnect' interconnector, which is currently going through the RiT-T.⁸⁷ The NSW Government is also supporting early work on EnergyConnect, and has committed to do the same for small upgrades to interconnectors with Victoria and Queensland.⁸⁸ And the Federal Government has provided funding for feasibility studies of the 'MarinusLink' interconnector between Tasmania and Victoria.⁸⁹

86. ESB (2018b, p. 3).

87. Marshall and van Holst Pellekaan (2018).

88. NSW Government (2018).

89. Morrison and Taylor (2019).

Table 3.1: Rating transmission policies relative to the status quo

Criteria	Refinements to the RiT-T process	Governments de-risk early works	Governments fund shared network	Governments fund assets to connect new renewable energy zones
Clarity	No change: transmission investments are still primarily shaped by the ISP.	No change: transmission investments are still primarily shaped by the ISP.	Worse: reliance on government budget funding will create uncertainty and could delay investment in response to fiscal pressure.	Worse: coordination processes between governments and multiple generators, and reliance on budget funding, creates new sources of uncertainty.
Flexibility	Improved: significant time savings through streamlining regulatory processes.	Improved: significant time savings through running early works and regulatory processes in parallel.	Improved: by abandoning regulatory checks and balances, projects can move more quickly.	Worse: coordination processes between governments and multiple generators could slow the connection process.
Efficiency	No change: protections of regulatory investment test remain and guard against inefficient investment.	No change: protections of regulatory investment test remain and guard against inefficient investment.	Worse: politicised project selections may increase system costs. Moving costs from consumers to taxpayers artificially encourages electricity consumption.	Worse: risk of politicised project selection, with generators seeking to pass costs on to taxpayers. This appears insufficient to offset the low risk of sub-scale connection assets under current arrangements.
Political viability	No change: limited scope for governments to claim credit for driving investments.	No change: limited scope for governments to claim credit for driving investments.	Improved: governments directly drive key investments, and so can manage their political need to have viable policies.	Improved: governments directly drive new links, and so can manage their political need to have viable policies.
Practicality	Improved: retains (but streamlines) key elements of existing processes.	No change: retains key elements of existing processes and works within rule-based processes.	Worse: changes how shared transmission assets are paid for, shifting costs from consumers to taxpayers.	Worse: changes how connection assets are paid for, shifting costs from generators to taxpayers.
Overall performance	Improved	Improved	Worse	Worse

Notes: Yellow = improved. Orange = worse. No colour = no change.

Source: Grattan analysis.

But these approaches have been somewhat piecemeal. The ESB has recommended a dedicated fund to underwrite these activities for high-priority projects identified in the ISP.⁹⁰

This approach is likely to be beneficial where it is currently being employed. But relying on government funding leaves these important investments subject to the uncertainties of budget processes. Even if a dedicated fund is created, this itself will rely on sustained government commitment and involve complex inter-governmental negotiations.

A superior approach is to amend the market rules so that the AER can approve funding for transmission companies to undertake early works and recover the cost from consumers. This should be limited to important investments that are very likely to pass the RiT-T. For example, it should include projects that have been scrutinised and given priority through the ISP, such as EnergyConnect and MarinusLink, and the ‘KerangLink’ and ‘HumeLink’ interconnectors that would greatly strengthen the connection between NSW and Victoria.⁹¹ Links not scrutinised in this way should be excluded unless a strong case can be made for early works funding.

Policies to accelerate early work can be implemented alongside efforts to streamline the broader regulatory process (Section 3.4.1).

3.4.3 Governments do not need to fund shared network investments

With these enhancements, governments do not need to directly fund transmission investments as was proposed by, for example, the Labor opposition during the 2019 federal election.⁹² To do so would risk politicising project selection. And while consumers would not bear the risk of poor projects, taxpayers would.

90. ESB (2018b).

91. AEMO (2018b); and AEMO (2019f).

92. Shorten and Butler (2018).

3.4.4 Governments need not fund renewable energy zone connections

The ESB has also proposed a fund to underwrite investment in transmission to connect remote renewable resources (so-called ‘renewable energy zones’) to the existing grid.⁹³ This seeks to avoid a situation where generators build connections that are only large enough to accommodate their own capacity, meaning other generators have to duplicate this investment and significant scale economies are lost. It is also possible that generation investors will ignore good renewable resources because they are so far from the transmission grid that the cost of connecting them is prohibitive.

Connecting new renewables is important, but does not necessarily require governments to fund dedicated connections to designated renewable energy zones. Though some areas of the grid are becoming congested, and project proponents affected by these constraints are unhappy, about 14 GW of new connection capacity remains available.⁹⁴ The cost differences between congested and less-congested areas do not always justify significant network investment. Many of the lowest-cost resource areas have spare capacity. Where the cost of building new transmission to congested areas is justified by the benefit of accessing better resources, this can generally be justified through the standard RiT-T process – for example, AEMO has found that investment to strengthen the network to western Victoria is justified, largely on the basis of unlocking additional renewable resources.⁹⁵ Though this will take time, the best approach is to streamline the general RiT-T process, not direct government funding of investments.

Many investments in the shared network will unlock additional renewable investment. All the major interconnectors proposed in the

93. ESB (2018b).

94. Grattan analysis of AEMO (2019g).

95. AEMO (2019h).

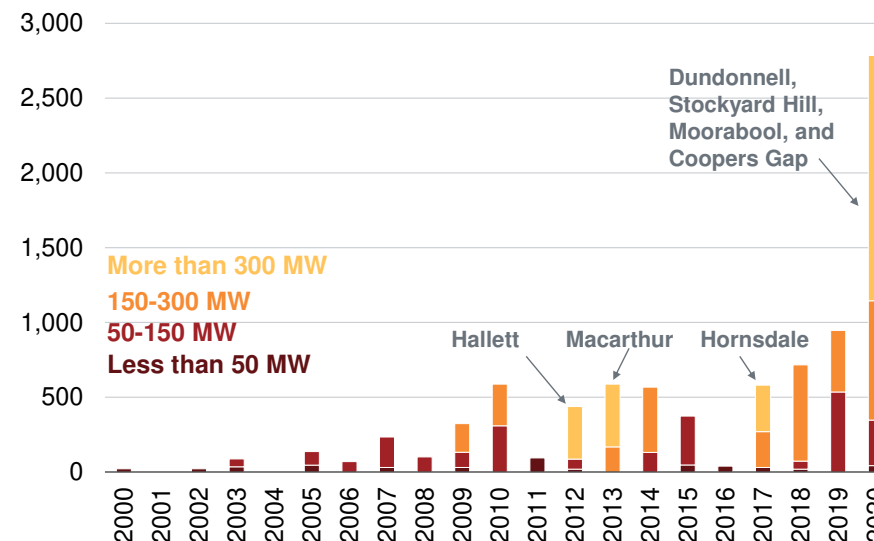
ISP facilitate additional renewable connection alongside their broader market benefits. For example, the EnergyConnect interconnector would unlock solar resources in south-west NSW, KerangLink and HumeLink would unlock solar, wind, and hydro resources in north-west Victoria and southern NSW, and an expanded interconnector between NSW and Queensland ('QNI2') would unlock solar and wind resources in New England and the Darling Downs. These links, if built, would allow the NEM to accommodate a further 7 GW of utility-scale renewable generation on top of the 14 GW available today – 21 GW in total.

Dedicated connections to renewable energy zones may be needed one day, but are not likely to be needed any time soon. 21 GW of connection capacity represents around 16 years of renewable investment projected under the 2018 ISP's neutral scenario.⁹⁶ AEMO analysis also indicates that dedicated lines to remote renewable energy zones are not likely to be needed until the early 2030s.⁹⁷

The risk of sub-scale connections is a key argument in favour of dedicated renewable energy zone connections. But this risk is declining as renewable energy projects, particularly wind farms, get bigger. There are currently only three wind farms that generate more than 300 MW. Four more such farms will be built in 2020 alone (Figure 3.1), and much larger projects are planned.⁹⁸

Figure 3.1: Wind farms are getting bigger

Wind capacity built, MW, by size category



Notes: Calendar years. 2020 capacity is expected based on AEMO's predicted commissioning dates. The following multi-stage wind farms are treated as a single wind farm because there is a gap of three years or less between stages: Woolnorth (Tasmania), Portland Cape Bridgewater and Cape Nelson South (Victoria), Lake Bonney (SA), Hallett (SA), Hornsdale (SA), and Lal Lal (Victoria). The two stages of Snowtown (SA), Crookwell (NSW), and Waterloo (SA) are treated as separate wind farms because of the long period between the phases. Portland Cape Nelson North wind farm is treated as separate to the other two stages of the Portland wind farm. Of these, only Snowtown would be in a larger category if treated as a single wind farm.

Sources: Grattan analysis of AEMO (2019i) and company websites.

96. Grattan analysis of AEMO (2018b) and AEMO (2019g). AEMO's 2018 ISP neutral scenario forecast about 21 GW of utility-scale renewable investment between 2019-20 and 2034-35. Additional renewable capacity unlocked is based on estimates for QNI Option 3C and VIC-NSW Option 9 in AEMO (ibid).

97. AEMO (2018b).

98. Large wind projects at advanced stages of planning include Golden Plains (Victoria, 800 MW), Clarke Creek (Queensland, 800 MW), Yorke Peninsula (SA, 630 MW), Liverpool Range (NSW, 1000 MW), and Walcha (NSW, 1400 MW).

Increasingly, proposed projects are co-locating solar and wind generation to achieve economies of scale and better utilise available transmission capacity.⁹⁹

Given these factors, the current approach is likely to be sufficient for renewable connections for the foreseeable future. The current approach has the benefit that generators bear their own costs of grid connection, helping to ensure that connection assets are not over-sized and are built at the same time as new generation assets. Generators bearing their own connection costs also avoids the risk that generators will lobby government to fund network connections to benefit their own projects, but at the cost of taxpayers.

3.5 Australia needs clarity on coal closures

Australia’s coal fleet is ageing and will progressively be retired over coming decades (Figure 3.2). But the timing of individual plant closures is highly uncertain and the large size of many coal power stations makes it hard for the market to manage sudden retirements. The abrupt closures of the Northern and Hazelwood power stations in 2016 and 2017 respectively have heightened political concerns that future closures will increase price and reduce reliability.

In response to these concerns, the Finkel Review recommended all generators be required to give three years’ notice of their intention to close.¹⁰⁰ This proposal was implemented as a market rule in November 2018.¹⁰¹

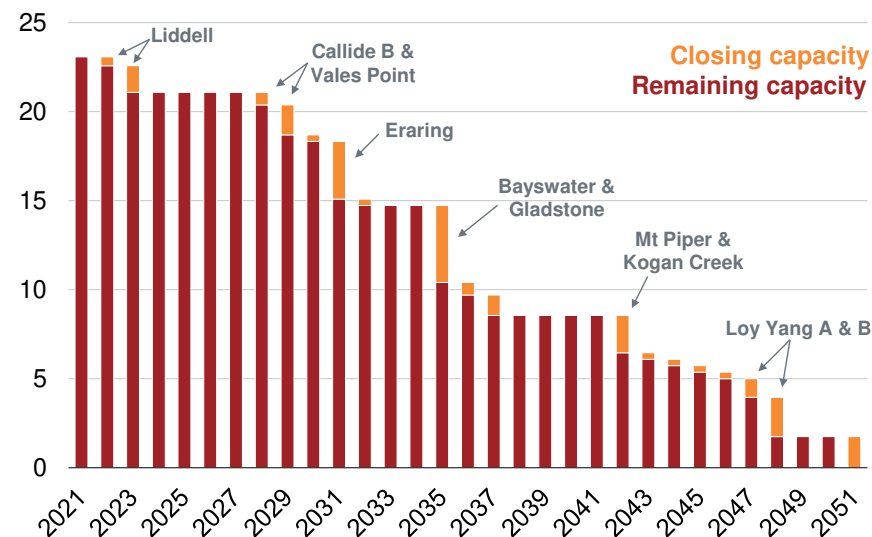
99. For example, the Walcha project proposes 1400 MW of wind and 700 MW of solar. The Goyder South project (SA), which is at an earlier stage of development, could involve 1200 MW of wind and 600 MW of solar.

100. Finkel et al (2017).

101. AEMC (2018b) The initial rule specified a three-year notice period. The notice period was subsequently increased to 42 months (three-and-a-half years) to better align with reporting requirements under the Retailer Reliability Obligation.

Figure 3.2: Announced closure dates imply a steady transition away from coal, particularly during the 2030s

Projected NEM coal generation capacity, GW



Notes: One unit of Yallourn power station is scheduled to close in 2031, as well as Eraring.

Sources: Grattan analysis of AEMO (2019j) and AEMO (2019g).

The rule was a positive step, but the penalties for not complying are too small to be effective: up to \$100,000 for a body corporate, plus \$10,000 per day for an ongoing breach. It would be rational for a generator that is operating at a loss, or that suffers a technical failure, to breach the rule and incur these penalties rather than pay the costs of complying.

Governments should strengthen the rules on notice of closure. The current policy provides only weak protection against an early and unexpected closure, and no protection against *late* closure. Generators can extend their life beyond their notified closure date, creating risk for investors anticipating that closure. Even if penalties were increased, the mechanism could be 'gamed'. If a generator nominates a relatively early closure date, nothing prevents it from closing any time after that date.

Unlike the three-year notice rule, strengthened closure rules should only apply to coal power stations. Coal power stations are more likely than other types of plant to close suddenly and unexpectedly in response to rapid changes in market circumstances. This is because they may struggle to pay their high overhead costs if they only operate infrequently – for example, during summer only to meet demand peaks. Coal plant also are less flexible than other dispatchable plants, and cannot be turned on and off frequently if that is what market circumstances require.

Potential options to better manage coal closure are considered below, and their merits are compared in Table 3.2.

3.5.1 Legislating a hard coal closure date is too inflexible

The UK and Canada have legislated for coal closure by specified dates – 2025 and 2030 respectively.¹⁰² Their policies allow coal plant to continue operating if they retrofit carbon capture and storage (CCS)

102. UK Government (2018); and Government of Canada (2018a).

technology. But CCS is not generally cost-effective – and so these policies effectively legislate a hard coal closure date.

When the UK and Canada implemented these policies they had a substantially lower share of coal generation than Australia.¹⁰³ Given Australia's continuing coal dependence, a more flexible process allowing a staged exit is necessary here.

One possibility is an earlier Canadian policy, which required coal generators to close, or retrofit CCS, once they reached 45-to-50 years of age.¹⁰⁴ This policy would provide some protection against late closure and encourage new entry. But it would not protect against the risk of early closure.

3.5.2 Negotiated exit is not credible in Australia

In 2018 the German Government created a multi-sector commission to negotiate a coal exit policy. Industry, unions, environmental groups, and regional governments negotiated a package involving coal exit by 2038, compensation for generators, and assistance for affected regions and workers. The German Government has supported the commission's key recommendations.¹⁰⁵

But such an approach is not credible in Australia because the required high level of cooperation between business, unions, and government is generally not present here.¹⁰⁶

103. Grattan analysis of International Energy Agency (2019). In 2016 coal provided less than 10 per cent of power in both the UK and Canada, but more than 60 per cent in Australia.

104. Government of Canada (2018b).

105. Deutsche Welle (2019).

106. Jotzo et al (2018, p. 25).

Table 3.2: Rating coal closure policies relative to the status quo

Criteria	Independently negotiated exit	Legislated exit at a nominated age	Government payments to manage exit	Grattan’s coal closure model
Clarity	Worse: a negotiated exit may not be credible and could create new sources of uncertainty about closure.	Improved: each generator would have to close by a clear date, assisting replacement investment.	Improved: a negotiated schedule, underpinned by government payments, would give greater clarity on coal exit and when new generation is required.	Improved: generator-nominated closures would have a high degree of credibility, given the penalties for non-compliance.
Flexibility	No change: given a lack of enforcement mechanisms, a negotiated closure schedule would probably remain flexible.	Worse: a slight reduction in flexibility, but generators are unlikely to operate far beyond 50 years of age in any case.	Worse: once negotiated, an exit schedule would reduce flexibility to respond to changing circumstances.	Worse: generators would retain the flexibility to nominate closure windows that suit them, and to tighten them closer to closure. But the policy would reduce flexibility relative to the status quo.
Efficiency	No change: this rule would not guard against market shocks arising from early closure.	No change: this rule would not guard against market shocks arising from early closure.	Worse: governments do not have good information on which to negotiate an exit schedule, so this policy would be likely to result in significant fiscal cost and potentially an inefficient closure sequence.	Improved: generators could nominate closure windows that best reflect their circumstances, while giving consumers protection against the negative effects of early closure and encouraging new entry.
Political viability	Improved: an independently negotiated closure schedule may help governments manage the politics of closure.	Worse: by legislating for closure, governments would face criticism for difficult issues associated with closure (such as worker displacement and the effect on communities).	Worse: by paying for closure, governments would face criticism for difficult issues associated with closure (such as worker displacement and the effect on communities).	Improved: governments would be seen to neither accelerate nor delay closure, but have greater means to manage the market effects of closure, retrain workers, and provide regional assistance.
Practicality	Worse: Australia’s adversarial climate politics, and lack of cooperation between governments, businesses, and unions, makes this impractical.	No change: appears feasible.	No change: appears feasible.	No change: could be delivered through existing market structures and institutions.
Overall performance	No change	No change	Worse	Improved

Notes: Yellow = improved. Orange = worse. No colour = no change.

Source: Grattan analysis.

3.5.3 Governments should not pay generators to change their exit decisions

The Gillard government made a major policy blunder by proposing to pay coal generators to close. Fortunately the Contract for Closure policy was abandoned in 2012 because of the high cost of bids.¹⁰⁷ This saved taxpayers from paying hundreds of millions of dollars – four of the five shortlisted generators have since closed without any government involvement.

The policy concerns that motivated the Contract for Closure policy were quite different to today's. Policy makers were concerned that so-called 'barriers to exit' would delay closure and desired emissions reductions. Post-Hazelwood, they are more concerned about early closure.

But the lessons from the Contract for Closure policy are still relevant today. Paying generators to close, or not close, risks paying for something that would have happened anyway. Taxpayers are unlikely to get a good deal. This is likely to be true of any policy ideas that come out of the federal Energy Minister's current taskforce to examine options to manage the closure of Liddell, particularly if the Government offers funds to extend its life. Governments should be more concerned about managing the effects of closure on workers, communities, and energy consumers, not on the generators themselves.

'Reliability must run' policies are used in some international power markets, particularly in the US, and involve the market operator paying generators to not exit.¹⁰⁸ This occurs only when a retiring generator is needed to maintain reliability, and so the market operator can justify passing these costs on to consumers. Market operators are in a better position than governments to negotiate such outcomes, but still have less information than the generators they seek to negotiate with. And

107. Ferguson (2012).

108. For example, New York (Chorazy (2018)), California (California Independent System Operator (2019)), and Texas (Walton (2016)).

such policies create incentives for generators to withhold new supply to increase the likelihood of receiving regulated payments to continue to operate.

3.5.4 Grattan's coal closure model to promote orderly retirement

A transparent and rules-based approach is needed to promote orderly retirement. We recommend requiring generators to place funds into escrow to ensure they comply with nominated closure dates. If the generator closes within the nominated window it would have these funds returned, but not if it failed to comply. This financial incentive would be much stronger than compliance incentives under the existing three-year notice rule.

An orderly closure requires a plant to retire neither too early nor too late. This can be achieved by requiring coal plants to nominate a closure window. This would protect against early closure, but also encourage new entrants to invest with greater certainty that coal generators will not operate longer than expected.

To balance flexibility and certainty, generators should be allowed to nominate their own window. But circumstances change and generators cannot reasonably fix their closure dates decades in advance. Younger generators should be able to nominate longer windows, or initially no window at all. Older generators closer to retirement should be more precise about their closure plans. As generators age they would need to tighten the window in which they plan to close.

These closure windows should be consistent with the existing three-year notice of closure requirements. To ensure that investors had sufficient time to build new capacity before the closure, generators could not nominate a window that started less than three years into the future.¹⁰⁹ If a generator wished to close within three years, it would not

109. Transitional provisions would be needed to translate notice given under existing requirements into the new policy.

have its escrow funds returned unless it had already given three years’ notice of a one-year closure window.

The amount of funds held in escrow would need to be large enough to materially affect closure decisions – in the order of hundreds of millions of dollars. Where a generator closed early, escrowed funds could be made available to the market operator to deal with any resulting reliability problems.

Requiring generators to hold funds in escrow would have a cost. Generators’ cost of capital is likely to be higher than the interest rate that would be earned on escrowed funds, and generators would try to pass some of this cost on to consumers. In practice some of this cost would probably be borne by consumers in the form of higher electricity prices, and some by generators through lower profits.

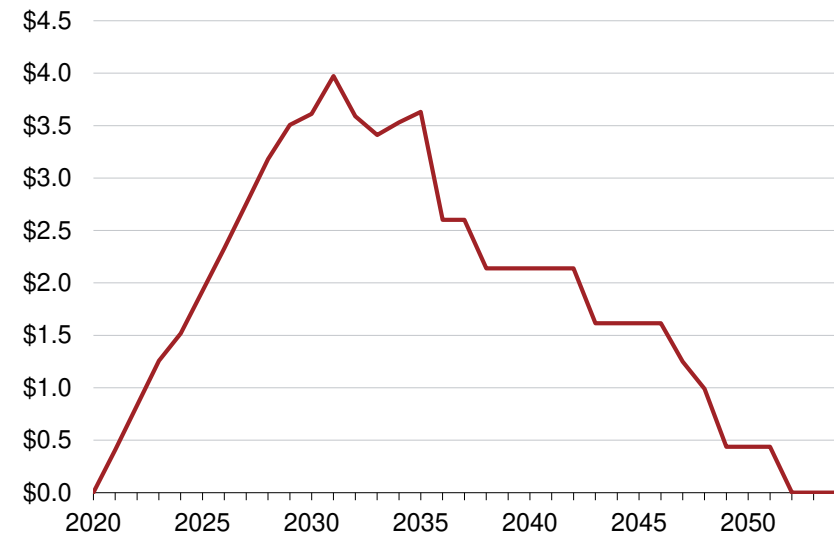
Despite its cost, such a scheme is likely to prove cost-effective insurance against the significant negative effects of poorly managed coal closures. The overall cost of the scheme would depend on its detailed design, but is likely to be modest. Based on a potential scheme design set out in Appendix A, the total amount of funds held in escrow would reach a maximum of just less than \$4 billion in the early 2030s, and then decline as coal plant closes (Figure 3.3). The cost of the policy would be the total holding in escrow, multiplied by the difference between coal generators’ cost of capital and the interest rate earned on escrowed funds – indicatively several hundred million dollars a year. This cost is modest when compared to the NEM’s total turnover, currently about \$18 billion per year.

Governments should ask the ESB to develop this model in further detail. The ESB or COAG Energy Council could then put a rule change to the AEMC. A viable model that adequately balances flexibility and certainty would give governments, agencies, and investors better information to manage the overall process of coal closure, ranging from new investment (in both generation and transmission) to managing

impacts on employees and communities. Appendix A provides an indicative design for Grattan’s coal closure model.

Figure 3.3: Funds in escrow would grow to almost \$4 billion before declining as coal plant closes

Total escrow balance, billions of dollars (nominal)



Source: Grattan analysis based on parameters and retirement dates detailed in Appendix A.

Appendix A: Grattan's coal closure model

A.1 High-level design

The essential design elements of Grattan's proposed coal closure model are:

- Generators nominate their own closure windows.
- Generators make ongoing payments for each megawatt-hour of electricity generated, which are held in escrow against compliance with their nominated closure window.
- Older generators would be required to nominate shorter ('tighter') closure windows than younger generators. This means that each generator would need to tighten its nominated window as it gets older.
- In the event that a generator closes before its nominated window, the funds would be made available to AEMO to manage any reliability problems caused by the early closure.
- In the event that a generator closed after its nominated window, the funds could be returned to consumers.
- The total amount of funds held in escrow would be capped, to limit the risk to each generator.
- Closure windows would be specific to each generating unit, rather than to entire power stations – this would give generators flexibility to stagger closures 'unit-by-unit'.
- The policy should not include exemptions for closure due to technical failure, to ensure that generators have an incentive to manage this risk.

Table A.1: Indicative parameters for Grattan's coal closure model

Age of generator	Escrow payment	Length of nominated closure window
35 years or younger	\$2.5/MWh	No nomination required
36-40 years	\$3/MWh	7 years
41-45 years	\$3.5/MWh	3 years
46 years or older	\$4/MWh	1 year

A.2 Detailed design features

A.2.1 Parameters for payments and closure windows

Setting the rate of escrow payment and the length of windows that generators nominate will determine how difficult the policy is to comply with, and therefore how much generators' decisions are affected. Potential parameters are summarised in Table A.1. If these parameters are applied to each coal plant, and these plants are assumed to close in the year nominated by generators as required under the three year notice of closure rule, the results are summarised in Table A.2.

A.2.2 Cap on total funds

The cap on total funds could be set per unit of generating capacity. For example, a cap of \$0.25 million per megawatt would ensure that funds reach a level proportionate to the size of the generator and large enough to materially affect closure decisions.

A.2.3 Managing escrow funds

The simplest way to collect escrow funds would be for AEMO to do so via its existing market settlement process.

Table A.2: Closure windows and funds held in escrow under Grattan's indicative coal closure model

Generator	AEMO closure date	Plant age in 2021	2021 closure window length	2021 window	First window tightening	Updated window	Second window tightening	Updated window	Third window tightening	Updated window	Funds in escrow at closure (\$m)
Liddell	2023	48	1	2022-23							135
Vales Point	2029	43	3	2026-29	2024	2028-29	N/A				259
Yallourn	2032	41	3	2029-32	2026	2031-32	N/A				363
Gladstone	2035	39	7	2028-35	2023	2032-35	2028	2034-35	N/A		420
Eraring	2031	37	7	2024-31	2025	2028-31	2027	2030-31	N/A		615
Bayswater	2035	35	N/A	N/A	2022	2028-35	2027	2032-35	2032	2034-35	660
Tarong	2037	35	N/A	N/A	2022	2030-37	2027	2034-37	2032	2036-37	350
Loy Yang A	2048	33	N/A	N/A	2024	2041-48	2029	2045-48	2034	2047-48	553
Callide B	2028	33	N/A	N/A	2024	2027-28	N/A	N/A	N/A	N/A	100
Mt Piper	2042	28	N/A	N/A	2029	2035-42	2034	2039-42	2039	2041-42	338
Loy Yang B	2047	25	N/A	N/A	2032	2040-47	2037	2044-47	2042	2046-47	260
Stanwell	2046	25	N/A	N/A	2032	2039-46	2037	2043-46	2042	2045-46	365
Callide C	2051	20	N/A	N/A	2037	2044-51	2042	2048-51	2047	2050-51	225
Millmerran	2051	18	N/A	N/A	2039	2044-51	2044	2048-51	2049	2050-51	213
Tarong North	2037	18	N/A	N/A	2033	2036-37	N/A	N/A	N/A	N/A	113
Kogan Creek	2042	14	N/A	N/A	2038	2041-42	N/A	N/A	N/A	N/A	186

Notes: Callide C has not yet nominated a closure year under the three year notice of closure rule – its closure date is taken from AEMO ISP assumptions. Plant age is based on the construction date of the last unit of each power station. Grey cells indicate that closure notifications are driven by the requirement to notify closure at least three years in advance, and so the notifications are earlier or the windows shorter than would be required based only on the parameters in Table A.1 on the previous page. Funds in escrow are calculated using average state-level coal capacity factors for 2018-19 – 65 per cent in NSW, 72 per cent in Queensland, and 84 per cent in Victoria.

Source: Grattan analysis of AEMO (2019j).

These funds should be placed in interest-bearing accounts, to partially offset the holding cost of these funds for generators. Interest earned on the account should be returned to the relevant generator once its escrow holding has reached its cap.

A.2.4 Technical definitions

Closure must be defined in a way that ensures generators do not mothball a generating unit but keep it registered purely for compliance purposes. If a generator was unavailable to the market and not able to respond to AEMO directions for an extended period, it should be defined as being mothballed. If such a generator never returned to commercial service, its date of closure would be defined as the start of its mothballed period. If the generator did return to service, the date of closure would be that of any future mothballing or closure. This approach would ensure that generators could carry out major maintenance without triggering the definition of closure and forfeiting their escrowed funds.

A.2.5 Updating closure windows

Closure windows must be updated and tightened as a generator reaches a new age category (indicatively every five years after 36 years of age, as set out in Table A.1). To ensure that windows provide useful information to the market, and that updates do not create significant uncertainty, each subsequent window must be within the earlier nominated window.

For example, when a generator reaches 41 years of age, it must nominate a three-year closure window that is entirely within the seven-year window it nominated when it reached 36 years of age. Similarly, at 46 years of age it must nominate a one-year window entirely within the previously nominated three-year window.

In addition to the general requirement on generators to tighten closure windows as they age, generators would also have to do so if necessary to comply with the three-year notice requirement. For example, if a generator nominated a seven-year window starting in three years' time, a year later it would need to tighten this to a six-year window starting one year later. This would ensure that the window did not start in less than three years' time. But if the generator did want to shut in three years' time, it would instead need to nominate a one-year window starting in no less than three years' time.

A.2.6 Exemptions

Exemptions for events such as unexpected technical failures would undermine the intent of the policy. It would transfer the risk of such events from generators (who are best placed to manage them through their maintenance regimes) to AEMO and consumers.

But some exemptions should be allowed to ensure the policy is sufficiently flexible. If a generator could close without causing the market to breach the reliability standard, it should be allowed to do so. This would allow generators that are struggling to remain viable to close, and would ensure the policy did not 'lock in' coal generation and emissions. It would also give a generator seeking to close a coal generator an incentive to build replacement plant to maintain overall market reliability.

Conversely, if closing a plant in line with its nominated window would cause the market to breach the reliability standard, the plant should be allowed to continue to operate if it chooses to do so. But it should not be required to do so.

Appendix B: Renewables committed since the start of 2017

Table B.1: Renewable projects committed in NSW since January 2017

Project	Technology	Project status	Month committed	Capacity (MW)	Government contract awarded?	Capacity with gov't contract (MW)	First production	Full production
Sapphire	Wind	Operational	Jan 2017	270	ACT Govt (37%)	100	Feb 2018	Nov 2018
Silverton	Wind	Commissioning	Jan 2017	200			May 2018	–
Dubbo	Solar	Operational	Jan 2017	24	NSW Govt (LGCs only)	12	Unknown	Unknown
Griffith	Solar	Operational	Jan 2017	28			Apr 2018	May 2018
Parkes	Solar	Operational	Jan 2017	53			Feb 2018	Mar 2018
Manildra	Solar	Operational	Mar 2017	47			May 2018	Sept 2018
White Rock	Solar	Operational	May 2017	20			Oct 2018	Dec 2018
Crookwell II	Wind	Operational	Jun 2017	93	ACT Govt	93	Aug 2018	Nov 2018
Bodangora	Wind	Operational	Jul 2017	113			Aug 2018	Dec 2018
Coleambally	Solar	Operational	Jan 2018	150			Sep 2018	Oct 2018
Crudine Ridge	Wind	Committed	May 2018	134			–	–
Beryl	Solar	Operational	May 2018	87	NSW Govt (rail use)	87	Apr 2019	Jun 2019
Nevertire	Solar	Committed	May 2018	105			–	–
Limondale	Solar	Committed	Sep 2018	249			–	–
Sunraysia	Solar	Committed	Oct 2018	200			–	–
Finley	Solar	Committed	Nov 2018	133			–	–
Darlington Point	Solar	Committed	Jan 2019	275			–	–
Bomen	Solar	Committed	Apr 2019	100			–	–
Molong	Solar	Committed	Jun 2019	30			–	–
NSW				2,321		292		–

Notes: Operational plant has reached full capacity. Commissioning plant is sending power to the grid but has not yet reached full capacity. Committed plant is committed to be built, but is not yet sending power to the grid. LGCs = Large-scale Generation Certificates. Government contracts for LGCs only are assumed to support half the project's capacity.

Sources: Grattan analysis of AEMO (2019i), company and market announcements, and AEMO market data.

Table B.2: Renewable projects committed in Victoria since January 2017

Project	Technology	Project status	Month committed	Capacity (MW)	Government contract awarded?	Capacity with gov't contract (MW)	First production	Full production
Gannawarra	Solar	Operational	Apr 2017	51			Apr 2018	Aug 2018
Mt Gellibrand	Wind	Commissioning	Apr 2017	132	Victorian Govt (LGCs only)	66	Jun 2018	–
Salt Creek	Wind	Operational	Jun 2017	54			Jun 2018	Jul 2018
Bannerton	Solar	Operational	Oct 2017	89			Jul 2018	Jan 2019
Bulgana	Wind	Committed	Mar 2018	194	Victorian Govt (90%)	175	–	–
Murra Warra	Wind	Commissioning	Apr 2018	226			Apr 2019	–
Crowlands	Wind	Operational	May 2018	80			Dec 2018	Jun 2019
Moorabool	Wind	Committed	May 2018	321			–	–
Stockyard Hill	Wind	Committed	May 2018	530			–	–
Lal Lal (Elaine end)	Wind	Committed	Jun 2018	84			–	–
Lal Lal (Yendon end)	Wind	Commissioning	Jun 2018	144			Jun 2019	–
Wemen	Solar	Operational	Jun 2018	88			Nov 2018	Feb 2019
Karadoc	Solar	Operational	Jul 2018	114			Oct 2018	Dec 2018
Kiamal	Solar	Committed	Sep 2018	200			–	–
Numurkah	Solar	Commissioning	Oct 2018	100			May 2019	–
Dundonnell	Wind	Committed	Nov 2018	336	Victorian Govt (37%)	124	–	–
Cherry Tree	Wind	Committed	Dec 2018	58			–	–
Cohuna	Solar	Committed	Jan 2019	27			–	–
Yatpool	Solar	Committed	May 2019	106			–	–
Victoria (committed plant)				2,934		392		–
Berrybank	Wind	CFD awarded	Sep 2018	180			–	–
Carwarp	Solar	CFD awarded	Sep 2018	100			–	–
Mortlake South	Wind	CFD awarded	Sep 2018	158			–	–
Winton	Solar	CFD awarded	Sep 2018	85			–	–
Victoria (plant with CFD awarded)				523		523		–
Victoria (total)				3,456		914		–

Notes: Operational plant has reached full capacity. Commissioning plant is sending power to the grid but has not yet reached full capacity. Committed plant is committed to be built, but is not yet sending power to the grid. CFD = Contract for Difference. Projects marked as 'CFD awarded' have had CFDs awarded by the Victorian Government, but do not yet meet AEMO's commitment criteria. The month committed (Sept 2018) is the month the CFD was awarded. LGCs = Large-scale Generation Certificates. Government contracts for LGCs only are assumed to support half the project's capacity.

Sources: Grattan analysis of AEMO (2019i), company and market announcements, and AEMO market data.

Table B.3: Renewable projects committed in Queensland since January 2017

Project	Technology	Project status	Month committed	Capacity (MW)	Government contract awarded?	Capacity with gov't contract (MW)	First production	Full production
Kidston	Solar	Operational	Feb 2017	50	Queensland Govt	50	Nov 2017	Mar 2018
Ross River	Solar	Operational	Mar 2017	128			Sep 2018	Nov 2018
Hamilton	Solar	Operational	Apr 2017	58			Jul 2018	Oct 2018
Whitsunday	Solar	Operational	Apr 2017	58	Queensland Govt	58	Jul 2018	Nov 2018
Clare	Solar	Operational	May 2017	100			Apr 2018	Dec 2018
Mt Emerald	Wind	Operational	May 2017	181			Aug 2018	Dec 2018
Coopers Gap	Wind	Commissioning	Aug 2017	453			June 2019	Aug 2017
Darling Downs	Solar	Operational	Jul 2018	110			Jul 2018	Jan 2019
Hayman	Solar	Operational	Aug 2017	50			Jan 2019	Apr 2019
Hughenden	Solar	Operational	Aug 2017	19			Jan 2018	Sep 2018
Kennedy	Solar/Wind	Committed	Oct 2017	58			–	–
Daydream	Solar	Operational	Nov 2017	134			Oct 2018	Mar 2019
Collinsville	Solar	Operational	Dec 2017	42			Jul 2018	Jan 2019
Lilyvale	Solar	Operational	Dec 2017	100			March 2019	May 2019
Longreach	Solar	Operational	Dec 2017	15	Queensland Govt	15	Apr 2018	Aug 2018
Oakey I	Solar	Operational	Dec 2017	25	Queensland Govt	25	Mar 2019	Apr 2019
Sun Metals	Solar	Operational	Dec 2017	108			May 2018	May 2018
Childers	Solar	Operational	Jan 2018	46			Feb 2019	Feb 2019
Susan River	Solar	Operational	Jan 2018	75			Dec 2018	Apr 2019
Oakey II	Solar	Committed	Mar 2018	25			–	–
Yarranlea	Solar	Committed	May 2018	103			–	–
Clermont	Solar	Commissioning	Jul 2018	75			Jun 2019	–
Emerald	Solar	Operational	Jul 2018	72			Sep 2018	Nov 2019
Teebar	Solar	Committed	Jul 2018	53			–	–
Haughton	Solar	Commissioning	Oct 2018	100			May 2019	–
Rugby Run	Solar	Commissioning	Oct 2018	65			May 2019	–
Brigalow	Solar	Committed	Jan 2019	35			–	–
Warwick	Solar	Committed	Jan 2019	64			–	–
Maryborough	Solar	Committed	Jul 2019	34			–	–
Queensland				2,481		148		–

Notes: Operational plant has reached full capacity. Commissioning plant is sending power to the grid but has not yet reached full capacity. Committed plant is committed to be built, but is not yet sending power to the grid.

Sources: Grattan analysis of AEMO (2019i), company and market announcements, and AEMO market data.

Table B.4: Renewable projects committed in South Australia since January 2017

Project	Technology	Project status	Month committed	Capacity (MW)	Government contract awarded?	Capacity with gov't contract (MW)	First production	Full production
Hornsedale III	Wind	Operational	Mar 2017	110	ACT Govt	110	Aug 2017	Nov 2017
Bungala I	Solar	Operational	Apr 2017	113			May 2018	Aug 2018
Bungala II	Solar	Commissioning	Jul 2017	110			Oct 2018	–
Willogoleche	Wind	Operational	Aug 2017	119			Aug 2018	Jun 2019
Lincoln Gap I	Wind	Commissioning	Nov 2017	126			May 2019	–
Tailem Bend	Solar	Operational	Feb 2018	95			Feb 2019	Apr 2019
Lincoln Gap II	Wind	Committed	Dec 2018	86			–	–
South Australia				760		110		–

Notes: Operational plant has reached full capacity. Commissioning plant is sending power to the grid but has not yet reached full capacity. Committed plant is committed to be built, but is not yet sending power to the grid.

Sources: Grattan analysis of AEMO (2019i), company and market announcements, and AEMO market data.

Table B.5: Renewable projects committed in Tasmania since January 2017

Project	Technology	Project status	Month committed	Capacity (MW)	Government contract awarded?	Capacity with gov't contract (MW)	First production	Full production
Cattle Hill	Wind	Committed	May 2018	150			–	–
Granville Harbour	Wind	Committed	Jul 2018	112			–	–
Tasmania				262		0		–

Notes: Committed plant is committed to be built, but is not yet sending power to the grid.

Sources: Grattan analysis of AEMO (ibid), company and market announcements, and AEMO market data.

Table B.6: Summary of renewable capacity committed since January 2017

State	Technology	Operational	Commissioning	Committed	Total committed since Jan 2017	Committed capacity with gov't contract	Share of committed capacity with gov't contract	CFD awarded but not committed	Total (committed and CFD awarded)	Share of total capacity with CFD
NSW	Solar	419	0	1,092	1,511	99				
	Wind	477	200	134	811	193				
	Total	895	200	1,226	2,321	292	13%			
Victoria	Solar	342	100	333	775	212		185	960	
	Wind	134	502	1,523	2,159	702		338	2,497	
	Total	476	602	1,856	2,934	914	31%	523	3,456	41%
Queensland	Solar	1,206	240	359	1,805	148				
	Wind	181	453	43	677	0				
	Total	1,387	693	402	2,481	148	6%			
SA	Solar	209	110	0	319	0				
	Wind	229	126	86	441	110				
	Total	438	236	86	760	110	14%			
Tasmania	Solar	0	0	0	0	0				
	Wind	0	0	262	262	0				
	Total	0	0	262	262	0	0%			
NEM	Solar	2,175	450	1,784	4,409	459		185	4,594	
	Wind	1,020	1,281	2,048	4,349	1,006		338	4,687	
	Total	3,195	1,731	3,822	8,758	1,465	17%	523	9,290	21%

Notes: Operational plant has reached full capacity. Commissioning plant is sending power to the grid but has not yet reached full capacity. Committed plant is committed to be built, but is not yet sending power to the grid. CFD = Contracts for Difference. Projects marked as 'CFD awarded' have had CFDs awarded by the Victorian Government, but do not yet meet AEMO's commitment criteria.

Sources: Grattan analysis of AEMO (2019i), company and market announcements, and AEMO market data.

Bibliography

- ABS (2019a). *6401.0 - Consumer Price Index, Australia*. Accessed August 2019. <https://www.abs.gov.au/ausstats/abs@.nsf/mf/6401.0>.
- _____ (2019b). *6427.0 - Producer Price Indexes, Australia*. Accessed August 2019. <https://www.abs.gov.au/ausstats/abs@.nsf/mf/6427.0>.
- ACCC (2018). *Restoring electricity affordability and Australia's competitive advantage: Retail Electricity Pricing Inquiry – Final Report*. Australian Competition and Consumer Commission. <https://www.accc.gov.au/publications/restoring-electricity-affordability-australias-competitive-advantage>.
- _____ (2019). *Gas inquiry 2017-20: July 2019 interim report*. Australian Competition and Consumer Commission. <https://www.accc.gov.au/publications/serial-publications/gas-inquiry-2017-2020/gas-inquiry-july-2019-interim-report>.
- AEMC (2018a). *Coordination of generation and transmission investment: final report*. Australian Energy Market Commission. <https://www.aemc.gov.au/markets-reviews-advice/reporting-on-drivers-of-change-that-impact-transmi>.
- _____ (2018b). *Rule Determination - National Electricity Amendment (Generator Three Year Notice of Closure) Rule 2019*. Australian Energy Market Commission. <https://www.aemc.gov.au/rule-changes/generator-three-year-notice-closure>.
- AEMO (2016). *Update: 2016 Electricity Statement of Opportunities*. Australian Energy Market Operator. https://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/NEM_ESOO/2016/update/2016-ESOO-Update---Hazelwood-Retirement.pdf.
- _____ (2017a). *Final report - South Australia separation event, 1 December 2016*. Australian Energy Market Operator. https://www.aemo.com.au/-/media/Files/Electricity/NEM/Market_Notices_and_Events/Power_System_Incident_Reports/2017/Final-report---SA-separation-event-1-December-2016.pdf.
- _____ (2017b). *System Event Report: South Australia, 8 February 2017*. Australian Energy Market Operator. https://www.aemo.com.au/-/media/Files/Electricity/NEM/Market_Notices_and_Events/Power_System_Incident_Reports/2017/System-Event-Report-South-Australia-8-February-2017.pdf.
- _____ (2017c). *System Event Report: New South Wales, 10 February 2017*. Australian Energy Market Operator. https://www.aemo.com.au/-/media/Files/Electricity/NEM/Market_Notices_and_Events/Power_System_Incident_Reports/2017/Incident-report-NSW-10-February-2017.pdf.
- _____ (2017d). *Advice to Commonwealth Government on dispatchable capability*. Australian Energy Market Operator. https://www.aemo.com.au/-/media/Files/Media_Centre/2017/Advice-To-Commonwealth-Government-On-Dispatchable-Capability.PDF.
- _____ (2018a). *2018 Electricity Statement of Opportunities*. Australian Energy Market Operator. https://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/NEM_ESOO/2018/2018-Electricity-Statement-of-Opportunities.pdf.
- _____ (2018b). *2018 Integrated System Plan*. Australian Energy Market Operator. https://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/ISP/2018/Integrated-System-Plan-2018_final.pdf.
- _____ (2019a). *2019 Electricity Statement of Opportunities*. Australian Energy Market Operator. https://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/NEM_ESOO/2019/2019-Electricity-Statement-of-Opportunities.pdf.
- _____ (2019b). *Data Dashboard - Average Price Tables*. Accessed September 2019. Australian Energy Market Operator. <https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Data-dashboard#average-price-table>.

- AEMO (2019c). *Load-shedding in Victoria on 24 and 25 January 2019*. Australian Energy Market Operator. https://www.aemo.com.au/-/media/Files/Electricity/NEM/Market_Notices_and_Events/Power_System_Incident_Reports/2019/Load-Shedding-in-VIC-on-24-and-25-January-2019.pdf.
- _____ (2019d). *Victorian energy supply - 4pm update*. Accessed January 2019. Australian Energy Market Operator. <http://energylive.aemo.com.au/News/Victorian-energy-supply---4PM-update>.
- _____ (2019e). *Data Dashboard - Aggregated Data Files*. Accessed August 2019. Australian Energy Market Operator. <https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Data-dashboard#aggregated-data>.
- _____ (2019f). *Building power system resilience through pumped hydro energy storage*. Australian Energy Market Operator. https://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/ISP/2019/ISP-Insights---Building-power-system-resilience-with-pumped-hydro-energy-storage.pdf.
- _____ (2019g). *2019 Integrated System Plan: inputs and assumptions workbook*. Australian Energy Market Operator. <https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Integrated-System-Plan>.
- _____ (2019h). *Western Victoria renewable integration: project assessment conclusions report*. Australian Energy Market Operator. <https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Victorian-transmission-network-service-provider-role/RITT/Reports-and-project-updates>.
- _____ (2019i). *Generation information*. Accessed September 2019. Australian Energy Market Operator. <https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Generation-information>.
- _____ (2019j). *Generating unit expected closure year: 2 September 2019*. Accessed September 2019. Australian Energy Market Operator. <https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Generation-information>.
- AGL (2017). *AGL announces plans for Liddell power station*. <https://www.agl.com.au/about-agl/media-centre/asx-and-media-releases/2017/december/agl-announces-plans-for-liddell-power-station>.
- _____ (2019a). *FY19 Full-year results: presentation*. Accessed August 2019. <https://www.agl.com.au/-/media/aglmedia/documents/about-agl/asx-and-media-releases/2019/1956284.pdf>.
- _____ (2019b). *Schedule for the closure of AGL plants in NSW and SA*. Accessed September 2019. <https://www.agl.com.au/about-agl/media-centre/asx-and-media-releases/2019/august/schedule-for-the-closure-of-agl-plants-in-nsw-and-sa>.
- Alcoa Australia (2017). *Portland aluminium smelter in Victoria, Australia to restart capacity lost after power outage*. <https://www.alcoa.com/australia/en/news/releases.asp?id=2017/01/portland-aluminium-smelter-in-victoria-australia-to-restart-capacity-lost-after-power-outage&year=y2017>.
- _____ (2019). *Fact sheet: Portland aluminium smelter*. Accessed September 2019. <https://www.alcoa.com/australia/en/pdf/smelting-portland-aluminum-smelter-fact-sheet.pdf/>.
- Andrews, D. (2017). *Landmark agreement secures Alcoa jobs*. Accessed August 2019. <https://www.premier.vic.gov.au/landmark-agreement-secures-alcoa-jobs/>.
- ASX Energy (2019). *Futures*. Accessed October 2019. https://www.asxenergy.com.au/futures_au.
- Aurecon (2018). *Hornsedale Power Reserve: Year 1 Technical and Market Impact Case Study*. <https://www.aurecongroup.com/markets/energy/hornsedale-power-reserve-impact-study>.

- Australian Energy Council (2018). *Energy industry concerned by policy shift*. Accessed August 2019. <https://www.energycouncil.com.au/news/energy-industry-concerned-by-policy-shift/>.
- Australian Industry Group (2019). *National CEO survey: business prospects for 2019*. https://cdn.aigroup.com.au/Reports/2019/CEO_Business_Prospects_2019.pdf.
- California Independent System Operator (2019). *Reliability must-run and capacity procurement enhancements*. Accessed August 2019. http://www.caiso.com/informed/Pages/StakeholderProcesses/ReliabilityMust-Run_CapacityProcurementMechanismEnhancements.aspx.
- Chambers, M. and White, A. (2018). "AGL's Liddell shutdown smacks of 'gouging'". *The Australian*. Accessed August 2019. <https://www.theaustralian.com.au/business/mining-energy/agls-liddell-shutdown-smacks-of-gouging/news-story/59bad63b16c5ed95dc1bfbff748375de>.
- CHOICE Australia (2016). *Consumer pulse: Australians' attitudes to cost of living, 2015-16*. <https://www.choice.com.au/money/budget/consumer-pulse/articles/electricity-costs-biggest-concern-july-2016>.
- Chorazy, P. (2018). *Update on NYISO's comprehensive system planning process*. Accessed August 2019. <https://pjm.com/-/media/committees-groups/stakeholder-meetings/ipsac/20181210/20181210-a03-3-nyiso-updates-on-comprehensive-system-planning-process.ashx>.
- Chung, F. (2018). *Former energy exec slams power price gouging*. Accessed August 2019. <https://www.qt.com.au/news/these-games-have-got-to-stop-former-energy-exec-sl/3493724/>.
- Clean Energy Regulator (2019). *The Renewable Energy Target 2018 administrative report: the acceleration in renewables investment*. <http://www.cleanenergyregulator.gov.au/About/Pages/Accountability%20and%20reporting/Administrative%20Reports/The%20Renewable%20Energy%20Target%202018%20Administrative%20Report/The-Renewable-Energy-Target-2018-Administrative-Report.aspx>.
- Climate Change Authority (2016). *Towards a climate policy toolkit: Special Review of Australia's climate goals and policies*. <http://climatechangeauthority.gov.au/special-review/towards-climate-policy-toolkit-special-review-australias-climate-goals-and>.
- CLP Holdings (2019). *2019 interim results: analyst briefing*. Accessed August 2019. https://www.clpgroup.com/en/Investors-Information-site/Analyst%20Brief%20Document/2019%20CLP%20Interim%20Results_Final.pdf.
- COAG Energy Council (2016). *Expert panel to review security of National Electricity Market*. <http://www.coagenergycouncil.gov.au/publications/expert-panel-review-security-national-electricity-market>.
- _____ (2019). *Post 2025 market design for the National Electricity Market*. Accessed August 2019. <http://coagenergycouncil.gov.au/publications/post-2025-market-design-national-electricity-market-nem>.
- CSIRO and Energy Networks Association (2017). *Electricity Network Transformation Roadmap: Final Report*. <https://www.energynetworks.com.au/electricity-network-transformation-roadmap>.
- Daley et al (2018). Daley, J., Duckett, S., Goss, P., Terrill, M., Wood, D., Wood, T. and Coates, B. *State Orange Book 2018*. Report No. 2018-16. Grattan Institute. <https://grattan.edu.au/report/state-orange-book-2018/>.
- Department of the Environment and Energy (2019). *Underwriting New Generation Investments program shortlist*. Accessed August 2019. https://www.energy.gov.au/sites/default/files/underwriting_new_generation_investment_program_shortlist.pdf.
- Deutsche Welle (2019). *Germany to join alliance to phase out coal*. Accessed September 2019. <https://www.dw.com/en/germany-to-join-alliance-to-phase-out-coal/a-50532921>.

- Elton-Pym, J. (2017). "Coalition to adopt 49 of 50 Finkel energy suggestions but undecided on clean energy target". *SBS News*. Accessed August 2019. <https://www.sbs.com.au/news/coalition-to-adopt-49-of-50-finkel-energy-suggestions-but-undecided-on-clean-energy-target>.
- Energy Consumers Australia (2019a). *Energy Consumer Sentiment Survey, June 2019*. <https://energyconsumersaustralia.com.au/publication/energy-consumer-sentiment-survey-findings-june-2019>.
- (2019b). *Energy Consumer Sentiment Survey, July 2016 to June 2019*. <https://energyconsumersaustralia.com.au/projects/consumer-sentiment-survey/>.
- Engie (2016). *Hazelwood to close in March 2017*. Accessed January 2019. <https://webarchive.nla.gov.au/awa/20170225070101/http://www.ipplc.com.au/media/newsitem/Hazelwood-to-close-in-March-2017>.
- ESB (2018a). *National Energy Guarantee: Final Detailed Design*. Energy Security Board. <http://www.coagenergycouncil.gov.au/publications/energy-security-board-%E2%80%93-final-detailed-design-national-energy-guarantee>.
- (2018b). *Integrated System Plan: action plan*. Energy Security Board. <http://www.coagenergycouncil.gov.au/publications/integrated-system-plan-action-plan>.
- Essential Services Commission (2019). *Victorian Default Offer to apply from 1 July 2019: advice to Victorian Government*. <https://www.esc.vic.gov.au/sites/default/files/documents/Victorian%20Default%20Offer%20to%20apply%20from%201%20July%202019.pdf>.
- Fedorowysch, T. (2019). "The future of solar thermal power once promised so much, but has the shine worn off?" *ABC*. Accessed August 2019. <https://www.abc.net.au/news/2019-04-09/has-the-shine-worn-off-solar-thermal-power/10983180>.
- Ferguson, M. (2012). *Contract for Closure negotiations cease*. <https://webarchive.nla.gov.au/awa/20130329000537/http://minister.ret.gov.au/MediaCentre/MediaReleases/Pages/cfc-cease.aspx>.
- Finkel et al (2017). Finkel, A., Moses, K., Munro, C., Effene, T. and O'Kane, M. *Independent review into the future security of the National Electricity Market: Blueprint for the future*. <https://www.energy.gov.au/government-priorities/energy-markets/independent-review-future-security-national-electricity-market>.
- Frydenberg, J. (2017). *Weatherill's costly admission of failure*. Accessed August 2019. <https://joshfrydenberg.com.au/latest-news/weatherills-costly-admission-of-failure/>.
- Gordon, J. (2017). "Letting Alcoa's Portland smelter go under no longer a political option". *The Age*. Accessed August 2019. <https://www.theage.com.au/national/victoria/letting-alcoas-portland-smelter-go-under-no-longer-a-political-option-20170116-gtsibl.html>.
- Government of Canada (2018a). *Canada's coal power phase-out reaches another milestone*. Accessed August 2019. <https://www.canada.ca/en/environment-climate-change/news/2018/12/canadas-coal-power-phase-out-reaches-another-milestone.html>.
- (2018b). *Regulations amending the reduction of carbon dioxide emissions from coal-fired generation of electricity: regulatory impact statement*. Accessed August 2019. <http://gazette.gc.ca/rp-pr/p1/2018/2018-02-17/html/reg3-eng.html>.
- Graham et al (2018). Graham, P., Hayward, J., Foster, J., Story, O. and Havas, L. *GenCost 2018: updated projections of electricity generation and technology costs*. <https://www.csiro.au/en/News/News-releases/2018/Annual-update-finds-renewables-are-cheapest-new-build-power>.

- Harmsen, N. (2019). "Back-up power stations to prevent SA black outs privatised but will contribute more to the grid". *ABC*. Accessed August 2019. <https://www.abc.net.au/news/2019-08-28/back-up-power-generators-leased-to-private-companies/11457824>.
- Hobday et al (2019). Hobday, L., Gillett, C. and Tran, D. "Australian energy giant AGL 'gouged' customers after Hazelwood closure, new research shows". Accessed August 2019. <https://www.abc.net.au/news/2019-03-25/energy-companies-gouge-customers-hazelwood-electricity-bill/10910948>.
- Hunt, G. (2017). *Turnbull Government secures jobs for Alcoa workers*. Accessed August 2019. <https://www.greghunt.com.au/turnbull-government-secures-jobs-for-alcoa-workers/>.
- International Energy Agency (2019). *Statistics data browser: electricity generation by fuel*. Accessed August 2019. <https://www.iea.org/statistics/?country=UK&year=2016&category=Electricity&indicator=ElecGenByFuel&mode=chart&dataTable=ELECTRICITYANDHEAT>.
- IPCC (2018). *Global warming of 1.5 degrees: summary for policymakers*. Intergovernmental panel on climate change. <https://www.ipcc.ch/2018/10/08/summary-for-policymakers-of-ipcc-special-report-on-global-warming-of-1-5c-approved-by-governments/>.
- Jotzo et al (2018). Jotzo, F., Mazouz, S. and Wiseman, J. *Coal transitions in Australia: preparing for the looming domestic coal phase-out and falling export demand*. https://coaltransitions.files.wordpress.com/2018/09/coal_australia_final.pdf.
- Judd, B. (2017). "Alcoa's Portland smelter rebuilding after unprecedented power failure". *ABC*. Accessed October 2019. <https://www.abc.net.au/news/2017-06-09/portland-smelter-rebuilding-after-unprecedented-power-failure/8604792>.
- Macdonald-Smith, A. (2017a). "AGL Energy seals power deal for Alcoa's Portland smelter". *Australian Financial Review*. Accessed October 2019. <https://www.afr.com/companies/energy/agl-energy-seals-power-deal-for-alcoas-portland-smelter-20170120-gtv2ug>.
- _____ (2017b). "Power project plans shaken by government push into energy". *Australian Financial Review*. Accessed September 2019. <https://www.afr.com/business/energy/electricity/power-project-plans-shaken-by-government-push-into-energy-20170405-gvej1>.
- _____ (2019). "How AGL profited from Hazelwood closure". *Australian Financial Review*. Accessed August 2019. <https://www.afr.com/companies/energy/agl-saw-60pc-lift-in-gross-profit-after-hazelwood-closed-study-finds-20190325-p5177n>.
- Marshall, S. and van Holst Pellekaan, D. (2018). *\$14 million to spark electricity interconnector*. Accessed August 2019. <https://premier.sa.gov.au/news/14-million-to-spark-electricity-interconnector>.
- Morrison, S. (2019). *Doorstop: Talbingo, NSW*. Accessed September 2019. <https://www.pm.gov.au/media/doorstop-talbingo-nsw>.
- Morrison et al (2018). Morrison, S., Frydenberg, J. and Taylor, A. *A fair deal on energy*. Accessed August 2019. <https://www.pm.gov.au/media/fair-deal-energy>.
- Morrison, S. and Taylor, A. (2019). *Accelerating a second Bass Strait interconnector*. Accessed August 2019. <https://www.pm.gov.au/media/accelerating-second-bass-strait-interconnector>.
- Mountain, B. and Percy, S. (2019). *The exercise of market power in Australia's National Electricity Market following the closure of the Hazelwood power station*. Victoria Energy Policy Centre. <https://www.vepc.org.au/working-papers>.
- Nelson, T. (2018). "The future of electricity generation in Australia: a case study of New South Wales". *The Electricity Journal*.
- NSW Government (2018). *NSW transmission infrastructure strategy: supporting a more modern energy system*. <https://energy.nsw.gov.au/renewables/clean-energy-initiatives/transmission-infrastructure-strategy>.

- Potter, B. (2019). "This plan could save Victorians \$520 on power bills, but may harm competition". *Australian Financial Review*. Accessed August 2019. <https://www.afr.com/politics/this-plan-could-save-victorians-520-on-power-bills-but-may-harm-competition-20190308-h1c5bf>.
- Shorten, B. and Butler, M. (2018). *Labor's plan for more renewable energy plan and cheaper power*. Accessed August 2019. https://www.billshorten.com.au/_labor_s_plan_for_more_renewable_energy_and_cheaper_power_thursday_22_november_2018.
- Stanwell (2017). *Annual report 2016-17*. Accessed August 2019. <https://www.stanwell.com/story/annual-reports/>.
- Taylor, A. (2019a). *Liddell Taskforce to address reliability and power prices*. Accessed August 2019. <https://minister.environment.gov.au/taylor/news/2019/liddell-taskforce-address-reliability-and-power-prices>.
- _____ (2019b). *Support for pumped hydro energy storage in South Australia*. Accessed August 2019. <https://minister.environment.gov.au/taylor/news/2019/support-pumped-hydro-energy-storage-south-australia>.
- _____ (2019c). *Extension of Liddell power station*. Accessed August 2019. <https://minister.environment.gov.au/taylor/news/2019/extension-liddell-power-station>.
- Thomson Reuters Datastream (2019). *Datastream*. Accessed July 2019.
- Thwaites et al (2017). Thwaites, J., Faulkner, P. and Mulder, T. *Independent review into the retail electricity and gas markets in Victoria*. https://www.energy.vic.gov.au/__data/assets/pdf_file/0030/79266/Retail-Energy-Review-Final-Report.pdf.
- Turnbull, M. (2017). *Securing Australia's energy future with Snowy Mountains 2.0*. Accessed August 2019. <https://www.malcolmturnbull.com.au/media/securing-australias-energy-future-with-snowy-mountains-2.0>.
- _____ (2018). *Doorstop: Rockhampton, Queensland*. Accessed August 2019. <https://www.malcolmturnbull.com.au/media/doorstop-rockhampton-queensland>.
- UK Government (2018). *Implementing the end of unabated coal by 2025*. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/672137/Government_Response_to_unabated_coal_consultation_and_statement_of_policy.pdf.
- Vertigan et al (2015). Vertigan, M., Yarrow, G. and Morton, E. *Review of governance arrangements for Australian energy markets*. <http://www.coagenergycouncil.gov.au/publications/review-governance-arrangements-australian-energy-markets-final-report>.
- Victorian Government (2018). *Fair pricing in the energy market: terms of reference for the Essential Services Commission*. Accessed August 2019. <https://www.esc.vic.gov.au/sites/default/files/documents/retail-market-review-victorian-default-offer-terms-of-reference-20181221.pdf>.
- Walton, R. (2016). *Texas grid operator continues debate over pricey reliability agreement*. Accessed August 2019. <https://www.utilitydive.com/news/texas-grid-operator-continues-debate-over-pricey-reliability-agreement/432545/>.
- Weatherill, J. and Koutsantonis, T. (2017a). *South Australia is taking charge of its energy future*. <https://webarchive.nla.gov.au/awa/20170604191837/http://pandora.nla.gov.au/pan/86202/20170605-0000/www.premier.sa.gov.au/index.php/jay-weatherill-news-releases/7198-south-australia-is-taking-charge-of-its-energy-future.html>.
- _____ (2017b). *Port Augusta solar thermal to boost competition and create jobs*. <https://webarchive.nla.gov.au/awa/20171211120149/http://pandora.nla.gov.au/pan/86202/20171211-1631/www.premier.sa.gov.au/index.php/jay-weatherill-news-releases/7896-port-augusta-solar-thermal-to-boost-competition-and-create-jobs.html>.

- Wood, T. (2019). *Energy transition: a blueprint for success*. Grattan Institute. <https://grattan.edu.au/submissions/australias-energy-transition-a-blueprint-for-success/>.
- Wood et al (2017a). Wood, T., Blowers, D. and Griffiths, K. *Next generation: the long-term future of the National Electricity Market*. Report No. 2017-9. Grattan Institute. <https://grattan.edu.au/report/next-generation-the-long-term-future-of-the-national-electricity-market/>.
- Wood et al (2017b). Wood, T., Blowers, D. and Moran, G. *Price shock: is the retail electricity market failing consumers?* Report No. 2017-04. Grattan Institute. <https://grattan.edu.au/report/price-shock/>.
- Wood et al (2018). Wood, T., Blowers, D. and Percival, L. *Mostly working: Australia's wholesale electricity market*. Report No. 2018-8. Grattan Institute. <https://grattan.edu.au/report/mostly-working/>.
- Wood, T. and Dundas, G. (2019a). *Poorly considered market interventions: an inefficient path to lower power prices*. Grattan Institute. <https://grattan.edu.au/submissions/poorly-considered-market-interventions-an-inefficient-path-to-lower-power-prices/>.
- _____ (2019b). *Default market offer draft determination: a pragmatic approach to a delicate balancing act*. Grattan Institute. <https://grattan.edu.au/submissions/the-risks-in-setting-a-default-market-offer-price-for-electricity-retailers/>.
- Wood et al (2019). Wood, T., Dundas, G. and Percival, L. *Keep calm and carry on: maintaining electricity reliability*. Report No. 2019-1. Grattan Institute. <https://grattan.edu.au/report/keep-calm-and-carry-on/>.
- Xenophon, N. (2017). *Summary of media conference at Ainslie IGA (ACT) on tax cuts, power prices and solar thermal plant at Port Augusta*. Accessed August 2019. <https://sabest.org.au/media/older-releases/summary-of-media-conference-at-ainslie-iga-act-on-tax-cuts-power-prices-and-solar-thermal-plant-at-port-augusta/>.
- Yaxley, L. (2018a). "Malcolm Turnbull abandons emissions guarantee as he fends of speculation about Peter Dutton challenge". *ABC*. Accessed August 2019. <https://www.abc.net.au/news/2018-08-20/cabinet-ministers-admit-disunity-amid-turnbull-dutton-spill-talk/10138850>.
- _____ (2018b). "Scott Morrison announces new ministry with Julie Bishop replaced by Marise Payne as foreign affairs minister". *ABC*. Accessed August 2019. <https://www.abc.net.au/news/2018-08-26/scott-morrison-announces-new-cabinet-after-julie-bishop-quits/10166300>.