



AER electricity wholesale performance monitoring

Hazelwood advice

March 2018

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Executive Summary

The Hazelwood power station was a 1600 MW generator located in the La Trobe Valley in Victoria. The station closed at the end of March 2017. It had a significant presence in the Victorian wholesale market, representing around 15 per cent of installed capacity and supplying 20 per cent of electricity in the state.

In light of the potential for the closure of Hazelwood to enable anti-competitive behaviours among remaining generators, the Treasurer and the Minister for the Environment and Energy requested that the AER monitor market developments in Victoria and South Australia and provide advice to the Council of Australian Governments (COAG) Energy Council on any factors affecting the efficient functioning of the market within one year of the station's closure.

While the scope of this advice is limited to Victoria and South Australia, we will make a more informed assessment based on longer-term data across all regions of the National Electricity Market (NEM) in our December 2018 wholesale market performance report.

Our review found the closure of the Hazelwood power station has had a significant impact. Hazelwood was powered by brown coal, a comparatively low cost fuel. It is the tenth coal-fired power station to exit the NEM since 2012, and the largest generator to exit since the NEM commenced in 1998. Its closure has further tightened supply.

Our review has found that increased output from gas generators in Victoria and South Australia and black coal generators in NSW and Queensland was required to replace the output of Hazelwood. These gas and black coal generators have higher fuel costs than Hazelwood.

The increased output of gas and black coal fired generators coincided with increased fuel costs for some of these generators. As highlighted in our NSW report¹¹, NSW generators' black coal costs increased from late 2016, particularly under short term contracts. NSW coal fired generators were also facing problems with coal supply during 2017, which drove higher offers from these generators. At the same time, there have been increases in gas prices in recent years affecting gas-fired generators.

Our review also found that brown coal plant set the electricity spot price in Victoria far less often following the closure of the Hazelwood power station. Higher fuel cost generators set the price more often, in particular gas fired and hydro generation, while NSW and Queensland black coal generation continued to set the price a significant proportion of the time, but at much higher prices.

Our key finding therefore is that the exit of Hazelwood removed a significant low fuel cost generator which was largely replaced by higher cost black coal and gas plant – at a time when the input costs of black coal and gas plant were increasing. These factors in turn drove

¹ AER, Electricity wholesale performance monitoring - NSW electricity market advice, December 2017.

significant increases in wholesale electricity prices. Annual average wholesale electricity prices in Victoria in 2017 were the highest they have been since the commencement of the NEM. South Australian average prices were also consistently high.

Our review has highlighted a number of other market trends that warrant mentioning.

There have been notable changes to flows of electricity across the NEM in 2017. Victoria changed from being a net exporter of relatively cheap brown coal generation, to being a net importer. Flows from Queensland into NSW (and then through to Victoria) increased significantly as Queensland black coal generators increased output in 2017. South Australia also became a net exporter to Victoria, where previously it was a net importer. More generally, the interconnectors between the regions were constrained less often, resulting in greater price alignment between regions.

We reviewed the offers of Victorian and South Australian generators before and after the closure of the Hazelwood power station. Offers from remaining generators in Victoria were largely unchanged, with some gas fired generators moving capacity previously priced above \$5000/MWh to lower price bands.

Our analysis did not identify instances where the opportunistic exercise of market power significantly affected average price outcomes in Victoria or South Australia since Hazelwood closed. Generators did not appear to physically withhold capacity from the market and we did not observe instances of participants shifting capacity to extremely high prices (for example at the market price cap) which could indicate economic withholding.

There are however other issues of a longer term nature that will require ongoing analysis and review. Ownership in the South Australian and Victorian markets is concentrated, with a few, largely vertically integrated participants controlling a significant proportion of capacity in both regions.

Periods of high prices are expected in the market, particularly during periods of tightening supply or increasing fuel costs. High prices can signal efficient investment in new generation capacity. Problems can arise however, if high prices are sustained but there is no new entry due to high barriers to new investment.

It is too early to tell whether the current price outcomes will be sustained, and if so the extent to which there will be new entry. We will need to monitor these developments over a longer period to make an informed assessment on the effectiveness of competition.

The AER has a new role to report on the effectiveness of wholesale market competition in the NEM, with our first report due in December 2018. We will continue to monitor the market's response to the closure of the Hazelwood power station as part of this role, but will also broaden our analysis to look at the longer-term performance of the NEM across all regions and include an in depth analysis of barriers to entry.

1 Background

Built in the 1960s, Hazelwood was over 50 years old; when on average, coal fired generators have retired at around 35 years old. Hazelwood had the highest emission intensity factor in the NEM and was responsible for around 15 per cent of Victoria's greenhouse emissions and 3 per cent of national emissions. It was jointly owned by Engie, a French multinational electric utility company (72 per cent), and Japan's Mitsui (28 per cent).

There was general speculation around the future of Hazelwood as early as May 2016.² In September 2016 there was media speculation that Engie had advised the Victorian government it would close Hazelwood as early as April 2017, rather than sell the plant.³ Engie made the official announcement in November 2016 and closed Hazelwood at the end of March 2017.⁴ Safety compliance issues may have hastened Hazelwood's closure.⁵ It was reported that the cost of repairs and plant revamp (estimated to be over \$400m) was not economically viable.⁶

1.1 The request

On 3 November 2016, the Treasurer and the Minister for Environment and Energy requested the AER provide advice to COAG EC on any factors impacting the efficient functioning of the wholesale energy markets, given the announced closure of Hazelwood. We replied that we would look at market outcomes and participant behaviour prior to and following the closure of Hazelwood, and report on any changes. The Minister and Treasurer's request, and our response are contained in Appendix A and B.

1.2 The AER's roles

The AER has a range of market monitoring functions. We are required to monitor the wholesale market on a systematic basis and report on performance at least every two years (first report due December 2018). In particular, we are required to identify whether:

- there is 'effective competition' within the wholesale market or there are features of the market that may be detrimental to effective competition
- there are features of the market that may compromise the efficient functioning of the market.

We can also advise the COAG Energy Council on the performance of the wholesale markets as issues arise.

² On 25 May 2016, the French Minister of Ecology Ségolène Royal announced on France 2 TV that Engie would "disengage" from the Hazelwood plant.

³ The Age, 'Hazelwood shutdown: Victoria's dirtiest power station set to close early next year', 24 September 2016.

⁴ Engie, 'Hazelwood power station in Australia to close at the end of March 2017' Media release, 3 November 2016.

⁵ The ABC requested a freedom of information notice. <http://www.abc.net.au/news/2016-12-01/worksafe-notices-detail-extent-of-repairs-needed-at-hazelwood/8082318> .

⁶ Environment Victoria, Hazelwood FAQs, <https://environmentvictoria.org.au/hazelwood-faqs/> .

1.3 Our approach

We have analysed market outcomes and participant behaviour before and after the closure of Hazelwood, focussing on any changes. As required under the National Electricity Law, we have based our analysis on publicly available data in the first instance,⁷ but we also met with a number of market participants and some key stakeholders during our review.

The following advice reports on the increase in prices, the changing fuel mix, the rising importance of black coal and gas, changes in regional flows and how generators have offered capacity. We have also included limited information and analysis on longer term issues including market features that could impede competition. We will continue to examine these as part of our new powers to monitor the effectiveness of competition in wholesale electricity markets.

This report focuses on the impact the closure of Hazelwood on the wholesale market, rather than on the retail market.

⁷ NEL, 18D(1)(a). We must use publically available information to carry out our wholesale market monitoring functions in the first instance. If we identify an issue, then we may use our powers under section 28 of the NEL to acquire non-public information.

2 Spot prices increased significantly

Average spot prices across the NEM increased in 2017 with average prices in Victoria around double those experienced previously, while in South Australia average prices have been consistently high in 2017. Futures prices were also much higher, with a steep rise in prices occurring in the lead up to Hazelwood's closure. Box 2.1 includes general information on how wholesale prices impact retail bills.

2.1 NEM wholesale prices were higher in 2017

Average spot prices increased across the NEM in 2017 (Table 2.1). While high prices in the NEM are not unprecedented (and have been higher than those now), the 2017 price increases differed, as they were sustained throughout the year and occurred simultaneously across the NEM. In this report we assess prices in Victoria and South Australia. Our advice on the NSW wholesale markets includes further information on prices in that state.⁸

Table 2.1 Quarterly volume weighted average spot prices (\$/MWh)

		QLD	NSW	VIC	SA	TAS
2015	Q1	108	35	28	41	39
	Q2	32	37	33	49	34
	Q3	45	46	39	71	38
	Q4	43	45	43	60	79
2015 Average		57	41	36	55	48
2016	Q1	89	46	50	55	174
	Q2	77	81	70	89	114
	Q3	54	56	53	137	56
	Q4	66	66	35	77	38
2016 Average		71	62	52	90	96
2017	Q1	194	135	86	165	99
	Q2	87	94	107	119	114
	Q3	82	96	104	104	98
	Q4	73	81	88	86	85
2017 Average		109	101	96	119	99

Source: AEMO; AER.

⁸ AER, Electricity wholesale performance monitoring - NSW electricity market advice, December 2017.
<https://www.aer.gov.au/wholesale-markets/market-performance/aer-electricity-wholesale-performance-monitoring-nsw-electricity-market-advice-december-2017>.

Box 2.1 How wholesale prices impact retail prices

While the focus of this report is on wholesale prices, the closure of Hazelwood will have an impact on retail prices and energy bills.

A typical electricity retail bill covers: the wholesale costs of buying electricity in spot and hedge markets; network costs for transporting electricity; and retailers' costs and margins.

Electricity retailers typically buy electricity in spot wholesale markets and package it with network services for sale to consumers. The electricity spot price can fluctuate from -\$1000/MWh to the market price cap of \$14 200/MWh. Generators and retailers manage their exposure to fluctuating wholesale spot prices by entering into hedge contracts. There are a range of products that are generally traded either on the ASX or negotiated directly between two parties (known as over-the-counter).

The wholesale costs of buying electricity in spot and hedge markets, and retailers' costs and margins collectively averaged around 45 per cent of an electricity bill in 2016–17.¹

It is difficult to separate the impact of wholesale and retail costs on energy bills because while spot electricity prices are transparent, there is less transparency around how retailers have hedged their wholesale exposure.

For this same reason, it is difficult to document how the impact of Hazelwood will flow into retail prices. The increase in wholesale prices will not flow through immediately through all retailers. The impact on energy bills will depend on how individual retailers were exposed to the spot market, how their portfolios were structured and when their contracts were being replaced with new forward contracts that were affected by the closure of Hazelwood.

¹ State of the Energy Market, May 2017, p. 128.

2.2 High average prices in Victoria and in South Australia

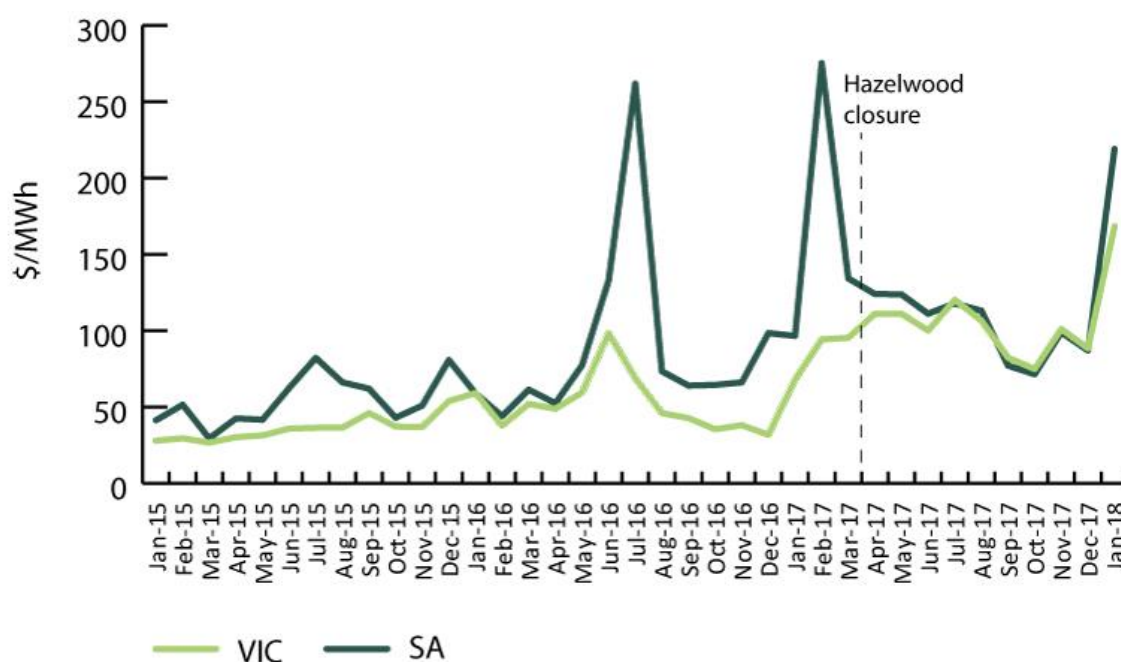
Annual average prices in Victoria in 2017 were almost double those in 2016, while average prices in South Australia were consistently high. Wholesale prices are typically higher and more volatile in South Australia than in Victoria. Figure 2.1 sets out average monthly prices in Victoria and South Australia. It shows average monthly prices in both states jumped considerably higher in January and February 2017, coinciding with the summer. A number of extreme price events (when higher than forecast regional demand and low wind output lead to load shedding) drove the significant peak in the average monthly price in South Australia in February.⁹

⁹ See "Prices above \$5000/MWh" reports from 2-12 February 2017 at www.aer.gov.au/publications.

Rather than falling after the summer peak, prices in Victoria increased further after the closure of the Hazelwood power station and remained high throughout the year. South Australian average monthly prices after the summer period remained at consistently high levels compared to historical averages. Average monthly prices in Victoria since April 2017 have ranged between \$74–111/MWh compared to \$27–54/MWh in 2015, while in South Australia they ranged between \$71–124/MWh compared to \$29–82/MWh in 2015. Prices in early 2018 peaked due to hot weather.¹⁰

Historically high average prices have been driven by a limited number of extreme price events. For example, a relatively large number of prices above \$300/MWh in South Australia contributed to high average prices in winter 2016.¹¹ In contrast to previous periods of higher prices, the higher prices in Victoria beyond the summer in 2017 (and after Hazelwood closed) occurred despite relatively little volatility. The spot price only exceeded \$300/MWh on ten occasions between April and December 2017. This was a similar number of times compared to the same period the year before, but average prices over that period were significantly lower (other than the winter 2016 peak). While still more volatile than Victoria, South Australia experienced significantly less instances of prices over \$300/MWh in 2017 than in 2016.

Figure 2.1 Monthly volume weighted average prices in Victoria and South Australia



Source: AEMO; AER.

¹⁰ There were five \$5000 trading intervals in Victoria and eight in South Australia on 18 and 19 January 2018 due to extreme heat. These prices were forecast.

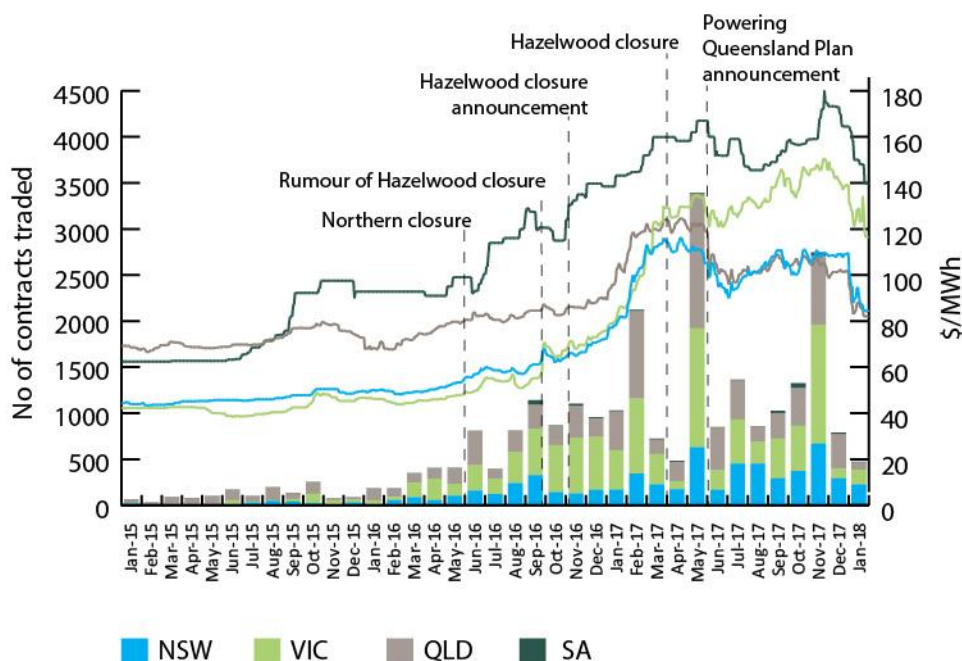
¹¹ High prices over this period were due to a range of factors including high gas prices and reduced availability of low priced coal generation capacity. These events were the subject of an AER special report in 2016. AER, <https://www.aer.gov.au/communication/winter-energy-prices-2016>.

2.3 Futures prices also increased

The closure of the Hazelwood power station had a significant impact on futures prices, not only in Victoria but also in other regions across the NEM. Figure 2.2 shows quarter one base futures prices and volumes traded on the ASX for NSW, Victoria, Queensland and South Australia. Prices for ASX traded NSW and Victorian Q1 2018 base futures jumped in September 2016 when the media reported that Engie had advised the Victorian Government it was intending to close Hazelwood. By the time Engie made an official announcement in November 2016, futures prices across all regions materially increased, and then continued to rise until Hazelwood closed in March 2017.

A number of other factors also affected futures prices over this period. Increasing fuel costs, black coal supply constraints, extreme price events in 2016 and early 2017 and Alinta closing the South Australian Northern power station put upward pressure on futures prices. At the same time, the Queensland Government's direction to Stanwell¹² to put downward pressure on wholesale prices and to return the 385 MW Swanbank E gas fired power station to service likely contributed to futures prices easing in New South Wales and Queensland from mid-2017.

Figure 2.2 Base futures prices and volumes - Q1 2018



Source: ASX Energy; AER.

¹² https://www.dnrm.qld.gov.au/data/assets/pdf_file/0008/1253825/powering-queensland-plan.pdf

3 Output replaced by more expensive gas and black coal

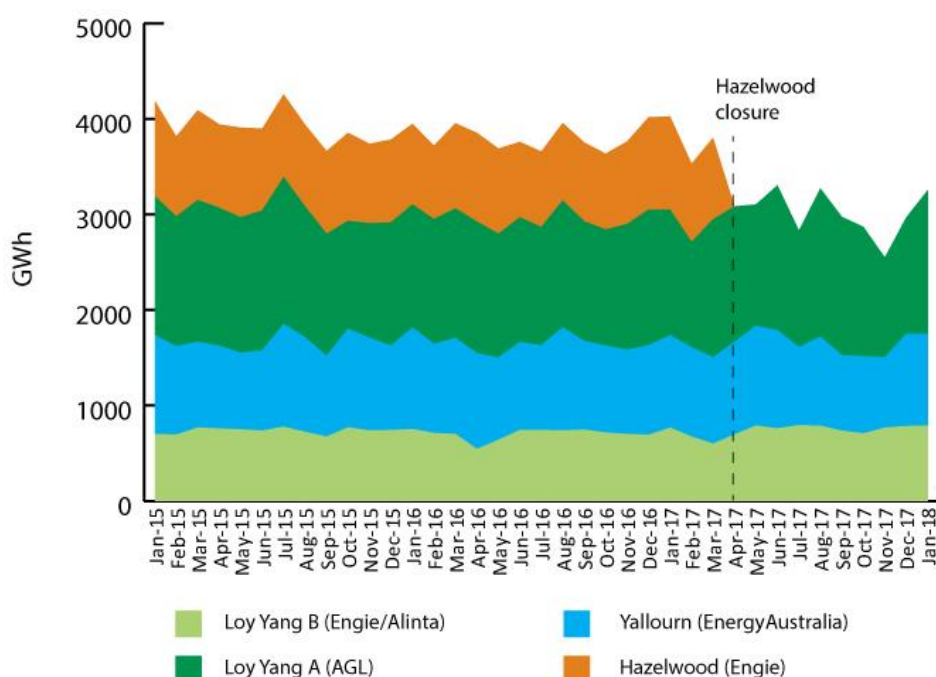
Increased output from gas generators in Victoria and South Australia and black coal generators in NSW and Queensland largely replaced Hazelwood's output.

3.1 Removal of low cost brown coal generation

Hazelwood had a significant presence in the market supplying around 20 per cent of Victoria's electricity or around 5 per cent of total NEM output. Brown coal is a comparatively low cost fuel, so the closure removed a significant amount of cheap base load electricity from the NEM.

Figure 3.1 shows the amount of energy produced by brown coal generators in Victoria before and after Hazelwood closed. Brown coal generators typically run close to their maximum capacity due to their low fuel costs and have limited ability to increase that in the short to medium term. Since Hazelwood closed, the output of the remaining brown coal generators has been relatively stable despite higher spot prices. During the course of our review market participants confirmed that their brown coal generators were generally running as hard as possible in 2017.

Figure 3.1 Victoria - brown coal generation



Note: Engie sold the Loy Yang B power station to Alinta in January 2018.

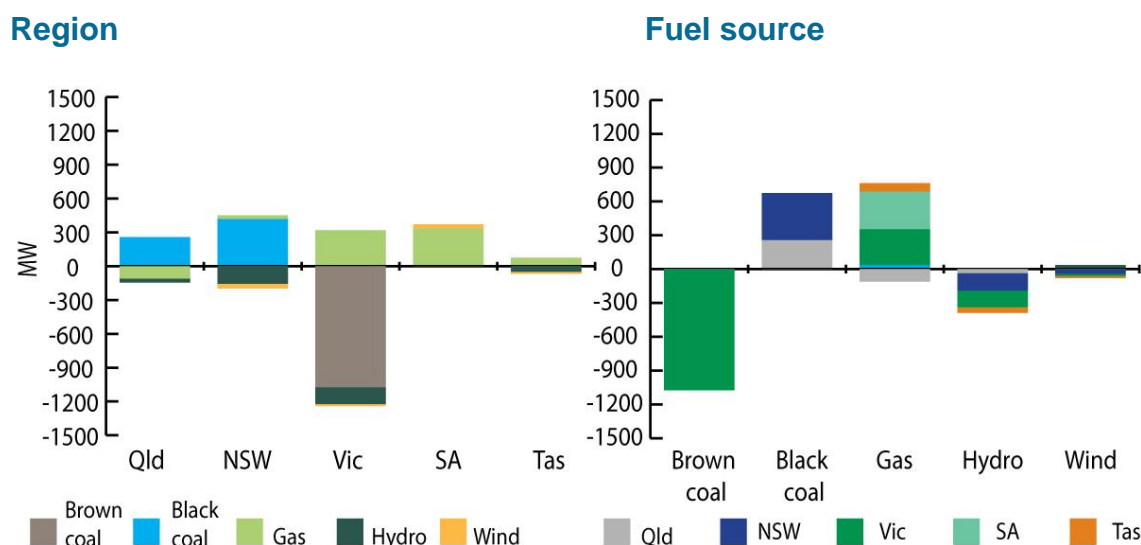
Source: AEMO; AER.

3.2 Output replaced by black coal and gas generation

Hazelwood's output was largely replaced by increased output from existing black coal generators in Queensland and NSW and gas fired generators in Victoria and South Australia. Figure 3.2 shows the average change in electricity generation by fuel source and region since Hazelwood closed compared to the same period a year earlier. In summary:

- Collectively Queensland and NSW black coal generators generated 665 MW more on average (or 6 per cent). This increase in black coal fired generation occurred despite coal supply constraints that existed in late 2016 and into 2017 (discussed in section 4 below).¹³
- Hydro generation decreased between 2016 and 2017. This likely reflects a number of factors outside the market and unrelated to the Hazelwood's closure, including high water inflows in 2016 and lower water inflows in 2017, and Snowy Hydro's possible incentives to adjust generation in response to the large scale renewable energy target scheme.¹⁴
- Gas fired generation increased on average by around 652 MW (or around 37 per cent), with the most significant increases from the Victorian and South Australian generators.

Figure 3.2 Changes in electricity generation, by fuel source



Note: Average change between 1 April 2017 to 30 Jan 2018 and 1 April 2016 to 30 Jan 2017.

Source: AEMO; AER.

¹³ AER electricity wholesale performance monitoring - NSW electricity market advice - December 2017.

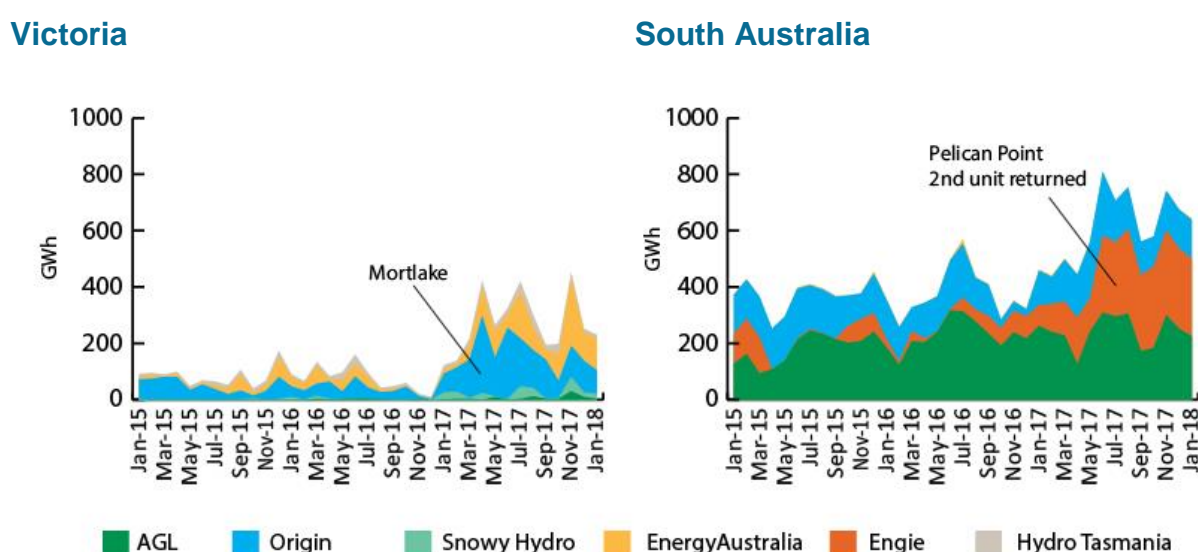
¹⁴ Snowy Hydro can create renewable energy certificates (RECs) for electricity generated above its renewable power baselines, determined by the Clean Energy Regulator (CER).
<http://www.cleanenergyregulator.gov.au/About/Accountability-and-reporting/administrative-reports/the-renewable-energy-target-2014-administrative-report/Power-station-baselines>.

A number of factors contributed to significantly higher gas output in South Australia in addition to Hazelwood closing (Figure 3.3):

- Engie returned the second unit of the gas fired Pelican Point to service in mid-2017 after withdrawing it from service in April 2015.
- AEMO required at least three gas generators in South Australia to operate at all times from July 2017, to help maintain system security, which contributed to high levels of gas fired generation through 2017 and constrained wind generation at times.¹⁵

The increase in gas output in Victoria was from Origin's Mortlake power station (Figure 3.3). While Mortlake operated as a peaking plant in recent years, it generated much more frequently in 2017.

Figure 3.3 Monthly gas generation



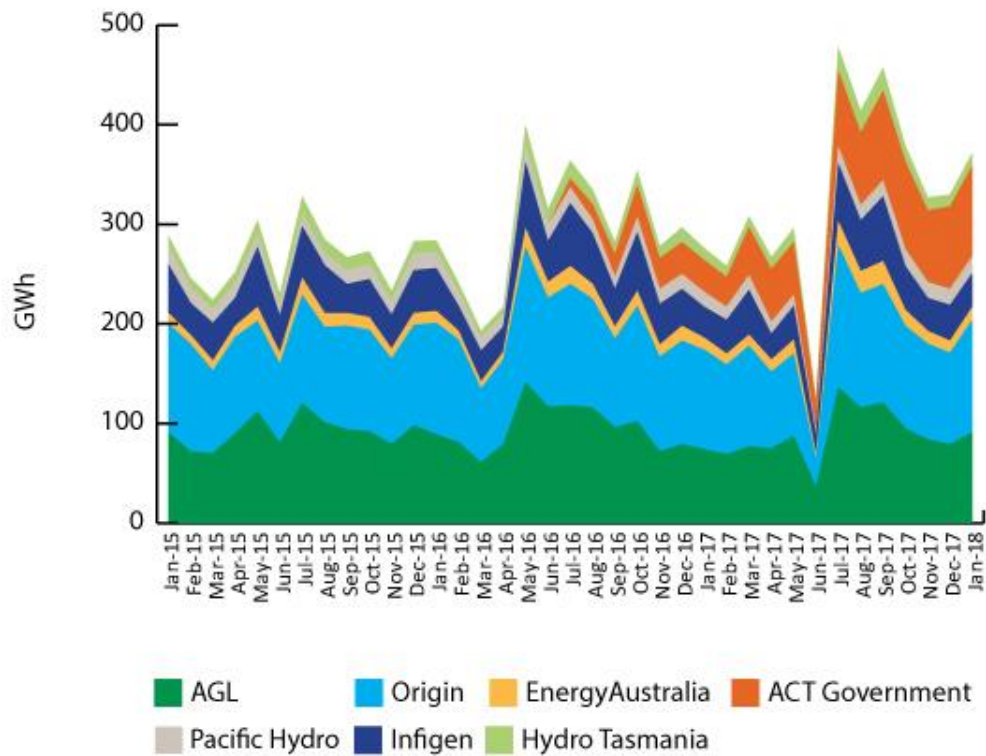
Note: Capacity that is subject to a power purchase agreement is attributed to the party with control over output.

Source: AEMO, AER.

There was also generally high wind output in South Australia through 2017 (except in June when it was particularly low). Monthly wind generation in South Australia increased by around one third in the second half of 2017 compared to the previous year (Figure 3.4).

¹⁵ From 2 July 2017 AEMO has required an increased number of large synchronous generating units to remain online, to provide adequate system strength during periods of high non-synchronous generation. These measures are expected to remain in place until other longer-term solutions can be developed to address system strength in South Australia. AEMO expects these solutions will be facilitated through amendments to the National Electricity Rules currently under consultation by the Australian Energy Market Commission.

Figure 3.4 South Australia - Wind generation



Note: Capacity that is subject to a power purchase agreement is attributed to the party with control over output.

Source: AEMO, AER.

4 Fuel costs for black coal and gas generators increasing

The increased reliance on black coal and gas since the closure of the Hazelwood coincided with increased fuel costs and fuel supply issues. Engie closed Hazelwood five months after making the announcement it would close. The relatively short notice to the market may have exacerbated fuel supply issues and contributed to price increases in 2017.

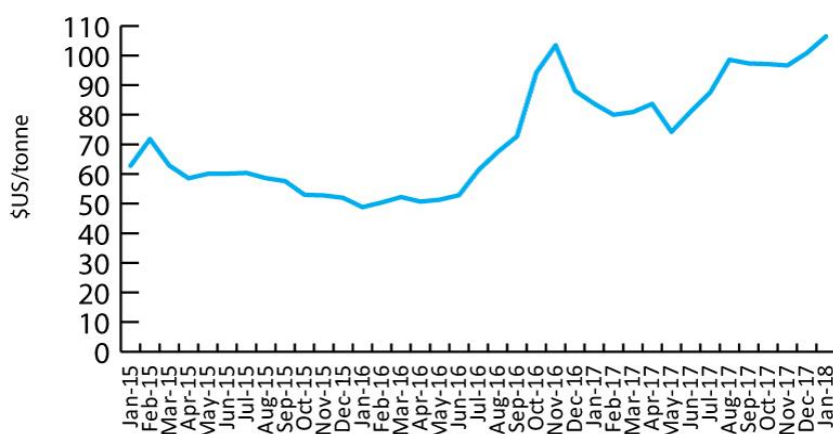
4.1 Black coal

As highlighted in our NSW report, NSW black coal generators faced increasing fuel costs and supply issues in 2017.¹⁶ In addition to higher fuel costs, generators had a range of concerns around managing fuel in 2017, which drove higher offers, including higher than expected output for some generators following the closure of the Hazelwood power station.¹⁷

Generators typically source coal under a range of short and long-term contracts. Prices negotiated under short-term contracts are likely to align more closely with the prevailing international coal spot price. Generators are also exposed to rising coal prices under long term contracts if prices under those contracts are benchmarked against international coal prices or if contract renegotiations coincide with rising fuel costs.

Figure 4.1 shows the globalCOAL Newcastle coal price for spot thermal coal at the Newcastle port in NSW.¹⁸ Coal spot prices have remained high since the publication of our NSW report with the spot price hovering around US\$105/tonne in late 2017 to early 2018.

Figure 4.1 Newcastle thermal coal index



Source: globalCOAL NEWC Index (www.globalcoal.com).

¹⁶ AER electricity wholesale performance monitoring - NSW electricity market advice - December 2017.

¹⁷ For more detail on the range of factors that contributed see AER electricity wholesale performance monitoring - NSW electricity market advice - December 2017, p. 18.

¹⁸ The globalCOAL Newcastle coal price index is a reference price for spot thermal coal at Newcastle Port in NSW. The globalCoal methodology is available at <https://www.globalcoal.com/coalprices/newcindex.cfm>.

4.2 Gas

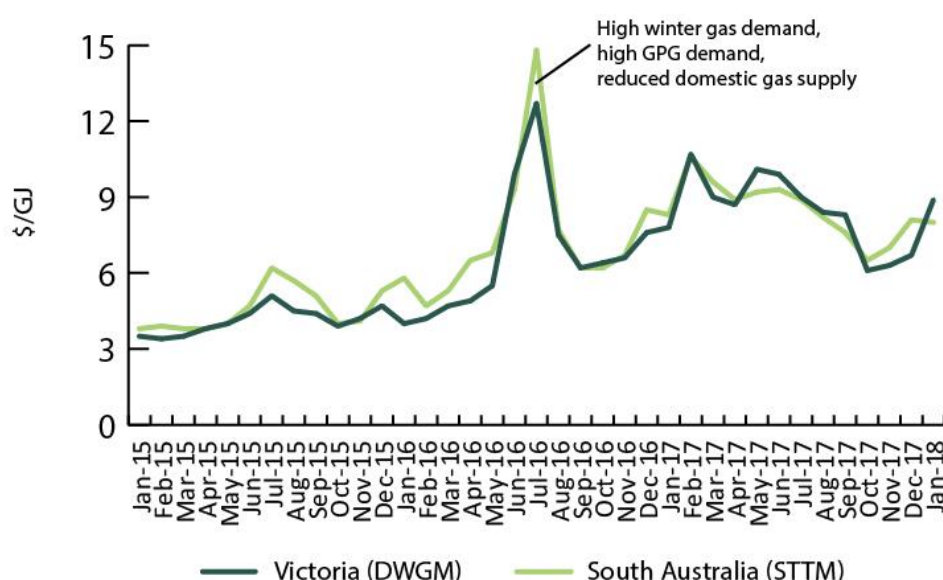
Gas prices across the east coast have risen steeply over the past few years.

While generators may not directly source their gas from the Victorian declared wholesale gas market (DWGM) or the Adelaide short-term trading market (STTM), prices on these markets are a general indicator of the extent of increases in gas costs (Figure 4.2).

Spot prices in Victoria and South Australia more than doubled between the first quarter of 2016 and the second quarter of 2017.¹⁹ The introduction of LNG exports from Queensland linked the domestic price to the international market and increased uncertainty regarding the availability of future gas supplies to the domestic market. Gas prices declined from mid-2017 and continued to fall after the Federal government reached an agreement with gas exporters to increase supply to the domestic market in October 2017.²⁰

Spot prices rose higher again in January 2018 to coincide with higher demand for electricity for the summer peak demand period. Total gas demand in Victoria increased since Hazelwood closed in part driven by increased gas fired generation.

Figure 4.2 Gas prices



Note: Victorian (DWGM) data is the monthly average of the daily imbalance weighted average price. South Australian data (STTM) is the monthly average of the daily ex ante price.

Source: AEMO; AER.

¹⁹ In addition to general doubling of gas prices, prices peaked in winter 2016. The peak was driven by seasonally high winter demand, higher demand for gas powered generation, and tightened supply due to growing LNG exports, lower southern production and reduced storage. AER, State of the Energy Market May 20127, pp. 84-85.

²⁰ <https://industry.gov.au/resource/UpstreamPetroleum/AustralianLiquefiedNaturalGas/Documents/Heads-of-Agreement-The-Australian-East-Coast-Domestic-Gas-Supply.pdf>.

4.3 The speed at which Hazelwood exited

Hazelwood's eventual closure was largely expected given its relative age and emissions intensity. However, the period between the announcement and the station closing was relatively short (at around five months) and the station shut down all eight of its generating units within a few days. This contrasted to the exit of the Northern power station in South Australia where Alinta progressively shut down the station's units in a more graduated exit from the market.

A number of industry stakeholders and market participants suggested that the speed at which Hazelwood exited the market following the announcement of its closure took the market by surprise. The significant increase in futures prices following the announcement supports the view that the timing of the closure was unexpected.

This may have exacerbated fuel supply issues to the extent that the generators did not sufficiently anticipate the increase in output and the associated need for fuel. That is, generators may have managed stockpile levels or contracted fuel earlier or differently if given additional notice.

To avoid similar circumstances in the future, the COAG Energy Council have agreed to require generators to provide three years' notice of their intention to close. This will provide time for replacement capacity to be built and for affected communities to plan for change. The Council also agreed that AEMO should publish a register of expected closures to assist long-term investor planning. These reforms were recommended by the June 2017 independent review of the NEM (Finkel review).²¹ The AEMC is now considering a rule change request from the Energy Security Board (ESB) to this effect.²²

²¹ Independent Review into the Future Security of the National Electricity Market: Blueprint for the Future, June 2017.

²² On 8 March 2018, the AEMC received a request to amend the National Electricity Rules for the three year notice of closure rule change, from Dr Kerry Schott of the ESB. <https://www.aemc.gov.au/rule-changes/generator-three-year-notice-closure>.

5 Black coal, hydro and gas now setting the price in Victoria

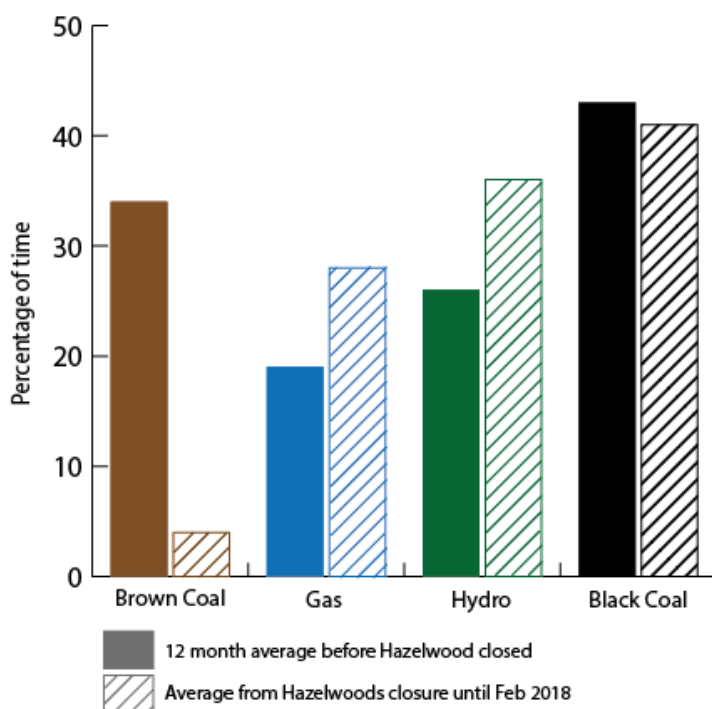
The generators that replaced the Hazelwood output are higher fuel cost generators and now gas and hydro are setting the price more often in Victoria. A greater number of different gas participants have been involved in setting the price. Even though prices are higher, this may nonetheless indicate an increasing level of competition among gas generators. Box 5.1 sets out general information on how spot prices are set in the NEM.

5.1 Price setting by fuel type

Figure 5.1 shows the percentage of time each fuel type contributed to setting the price in Victoria with their energy offer. The solid bars show the average in the 12 months before Hazelwood closed and the hashed bars show the average from its closure until February 2018. Since Hazelwood closed:

- brown coal rarely sets the price, going from 34 per cent of the time to only 4 per cent
- gas and hydro increased the amount of time they contributed to setting the price, going from 19 per cent to 28 per cent and 26 per cent to 36 per cent respectively
- black coal sets the price more often than any other fuel type, and sets the price around the same amount of time.

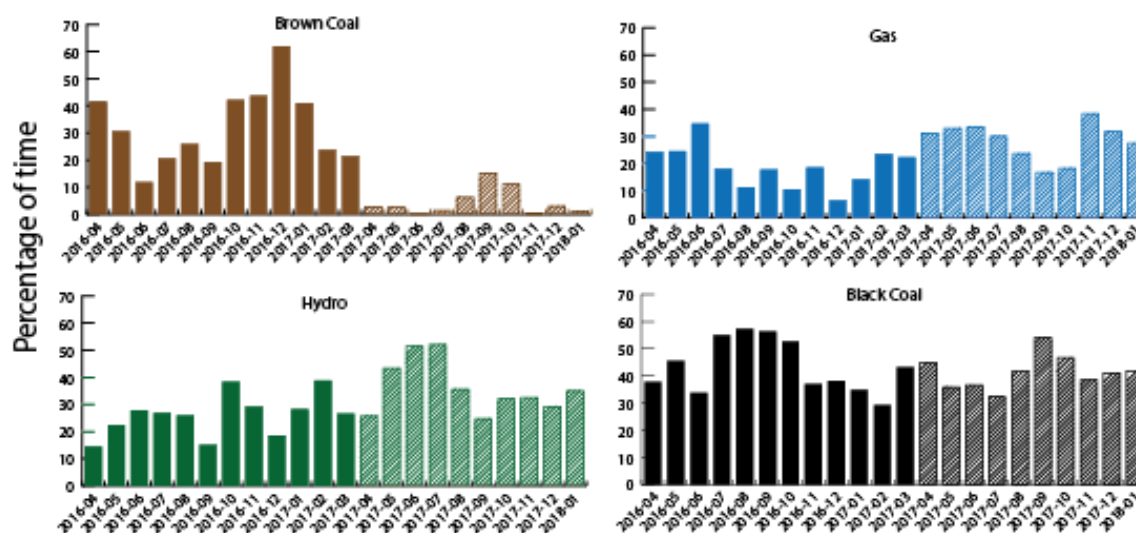
Figure 5.1 Price setting in Victoria by fuel type since Hazelwood closed



Note: The percentage of time each fuel type contributed to setting the price in Victoria. The solid bars show the average in the 12 months before Hazelwood closed and the hashed bars show the average from its closure until February 2018. Totals may add to more than 100 per cent if more than one fuel type contributed to setting the price. Source: AEMO; AER.

Figure 5.2 shows the same comparison using monthly average data. The monthly data shows that black coal consistently sets the price a significant proportion of the time throughout the year and even more so in the shoulder seasons, while hydro and gas tend to set the price more often in higher demand seasons.

Figure 5.2 Price setter in Victoria by fuel type (per cent of time)



Note: Totals may add to more than 100 per cent if more than one fuel type contributed to setting the price.

Source: AEMO; AER.

5.2 Price setting by state

We examined the amount of time individual stations were involved in setting the price in Victoria and found that as well as gas playing an increased role setting the price in Victoria, a greater number of different gas participants have been involved in setting the price. This may indicate an increasing level of competition among gas generators. We also observed power stations outside Victoria are setting the price in Victoria more often.

Three of the top four generators that set the price in Victoria are from outside Victoria. During the second half of 2017, half of the time the price in Victoria was set by one of the following: the Victorian Murray hydro power station (Snowy Hydro), the South Australian Torrens Island gas fired power station (AGL Energy), the NSW Eraring black coal power station (Origin) and Bayswater (AGL Energy) black coal power station.

Appendix C sets out additional information on how often individual stations were involved in setting the price in Victoria and the average prices at which their capacity was offered during those times.

Box 5.1 How prices are set in the NEM

AEMO schedules the generators with the lowest offers to meet demand every five minutes. The cheapest bids are selected first, and then progressively more expensive bids until enough electricity can be dispatched to meet demand every five minutes.

Participants are free to offer their capacity at any price between the price floor and the price cap. There is no requirement that participants' offers reflect their costs and participants will take into account a range of factors when offering capacity including costs, contract obligations they may have with retailers or their own retail load.

The highest priced offer needed to meet demand sets the price every 5 minutes (dispatch price) in each region. This capacity can come from any generator in the NEM and the dispatch price can be set by multiple generating units at the same time.

The settlement price (spot price) paid to generators is the average of the dispatch prices over 30 minutes for each region in the NEM. All successfully dispatched bidders are paid at this price regardless of the price at which they offered capacity. Generally participants have some control over the level they are dispatched by adjusting their offers or withdrawing capacity from the market.

The Australian Energy Market Commission (AEMC) made a final rule in November 2017 to change the settlement period for the electricity spot price from 30 minutes to five minutes, starting in 2021. This was to provide a better price signal for investment in fast response technologies, such as batteries, new generation gas peaking plant and demand response.

6 More energy is flowing into Victoria

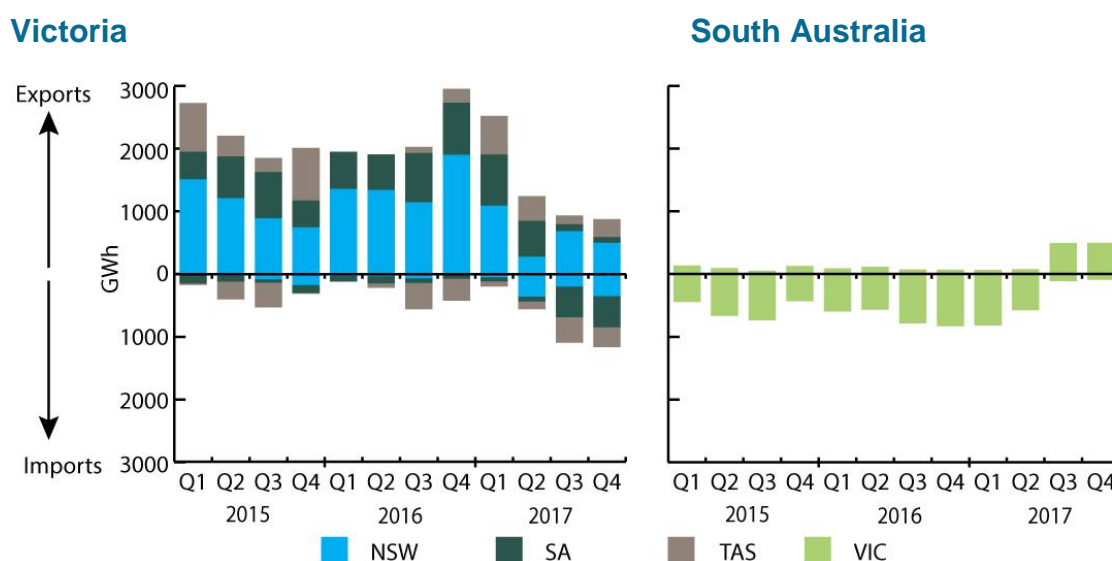
There have been notable changes to flows between regions since Hazelwood closed. Box 6.1 sets out background information on interconnectors.

6.1 Interconnector flows changed

Victoria has historically been a key exporter of cheap base load generation. It was the largest exporter in 2014–15 and 2015–16. Victoria switched to become a net importer from mid-2017 (Figure 6.1). While it remained a net exporter of electricity to NSW, the level of exports significantly reduced and imports from NSW grew as expected. Flows from Queensland into NSW (and then through to Victoria) increased significantly as the Queensland black coal generators increased output in 2017.

South Australia has traditionally been one of the highest importers in the NEM. This was largely due to its high average fuel costs and its trade dependency on Victoria during times of low wind generation.²³ This trend reversed over the second half of 2017, with South Australia becoming a net exporter to Victoria. This shift coincided with the second unit of Engie's Pelican Point power station coming back on line and high wind levels.

Figure 6.1 Interconnector flows



Source: AEMO, AER.

²³ AER, State of the Energy Market, May 2017, pp.43, 54.

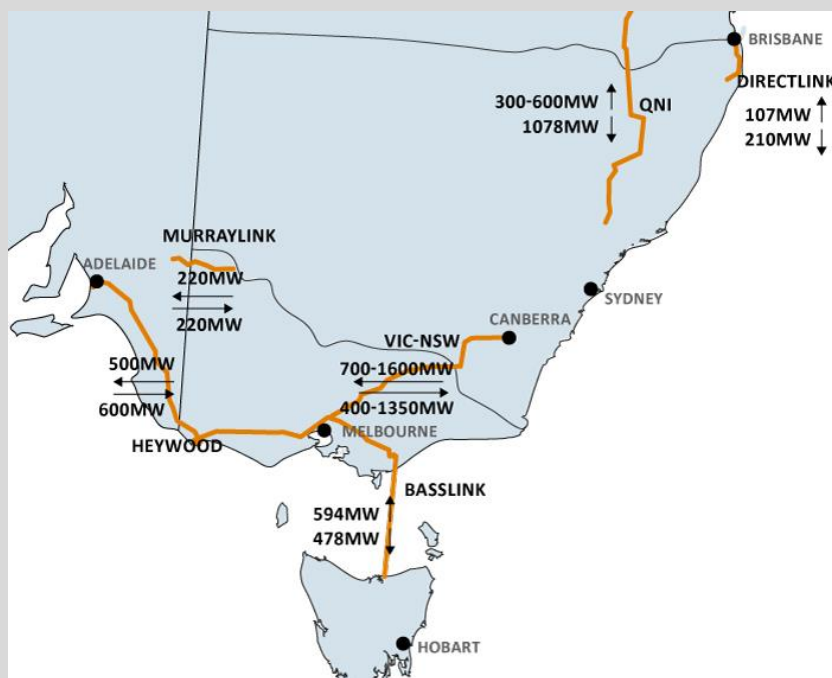
Box 6.1 Interconnectors in the NEM

Energy transfers between the NEM's five regions are enabled by the transmission interconnectors that join them (Figure 6.1). This allows high price regions to import electricity from lower price regions and increases the reliability and security of the power system.

The ability of generators to supply energy to other regions is limited by the capacity of the transmission network. This capacity can change depending on the direction of flow and any constraints both physical and to manage system security. An interconnector is said to be constrained when the flow across it reaches its technical limit. When the network is constrained cheaper sources of generation in one region are not able to replace more expensive generation in another and prices may separate.

Victoria and Queensland have traditionally been the NEM's principal electricity exporters, while South Australia and NSW typically import electricity. Tasmania shifts between being a net importer and exporter.

Figure 6.2 Interconnectors in the NEM



6.2 Interconnectors constrained less often

The transmission interconnectors between Victoria and its neighbouring regions were less constrained in 2017. For example, the Heywood interconnector which connects Victoria to South Australia was constrained 106 days less in 2017 than in the previous year. The interconnector to NSW constrained for the equivalent of 35 days less and when it did constrain it was at a higher limit allowing more flow into Victoria than before.²⁴

A number of factors have contributed:

- Historically, the Heywood interconnector was the NEM's most congested interconnector. This situation improved after it was upgraded in 2015–16.
- In 2015–16 there was a major outage on the Basslink interconnector between Victoria and Tasmania, preventing transfers between Tasmania and the rest of the NEM.
- Following the closure of Hazelwood, Victoria exported less to NSW so the interconnector between these regions did not reach its technical limit as often.

6.3 Prices across the NEM aligned more often

The market sets a separate spot price for each NEM region. When the interconnectors are not constrained these regional spot prices tend to align across the NEM. When the network in unconstrained cheaper sources of generation in one region can replace more expensive generation in another and prices across the NEM will tend to align.

Historically Queensland and NSW have had a high level of price alignment, while price alignment has occurred less often in Victoria and South Australia.²⁵

Alignment rates in mainland regions have increased significantly in 2017. Prices in Victoria and South Australia were more aligned with overall NEM prices in 2017. For example, prices between Victoria and at least one of its neighbouring regions were aligned about 90 per cent of the time in 2017, compared to 62 per cent in 2016. The increase in alignment in 2017 indicates the NEM acted as a single market more often than as a collection of regional markets and consequently generators within a region were subject to competition from generators in other regions.

²⁴ The Vic-NSW interconnector was at its technical limit around 10 000 fewer dispatch intervals.

²⁵ Price alignment is the amount of time that the region has at least one interconnector that is not constrained, and therefore, its price is aligned with at least one other region.

7 Victorian and South Australian markets are concentrated

The markets in Victoria and South Australia were relatively concentrated both before and after the closure of Hazelwood.

The number and size of participants in an electricity market affects the opportunities and incentives for generators to exercise market power. A market dominated by a small number of large participants—especially if interconnection is limited—is likely to be less competitive than a market with more participants. That said, the number and size of participants alone does not determine whether market power has been, or will be, exercised.

7.1 Four participants dominate the Victorian market

Victoria has traditionally had a high proportion of relatively cheap brown coal generation. Brown coal accounted for around 56 per cent of Victorian capacity before Hazelwood closed and 46 per cent after. Gas and hydro each account for around 22 per cent and wind accounts for around 10 per cent.

AGL Energy, EnergyAustralia and Alinta²⁶ own the three remaining brown coal power stations. Snowy Hydro controls the vast majority of the hydro generators, and Origin, EnergyAustralia and Snowy Hydro control the major gas stations.

Figure 7.1 shows the capacity market shares of participants in Victoria. Ownership in the Victorian market is concentrated with four participants controlling over 90 per cent of capacity both before and after Hazelwood closed. Overall capacity decreased when Hazelwood closed.

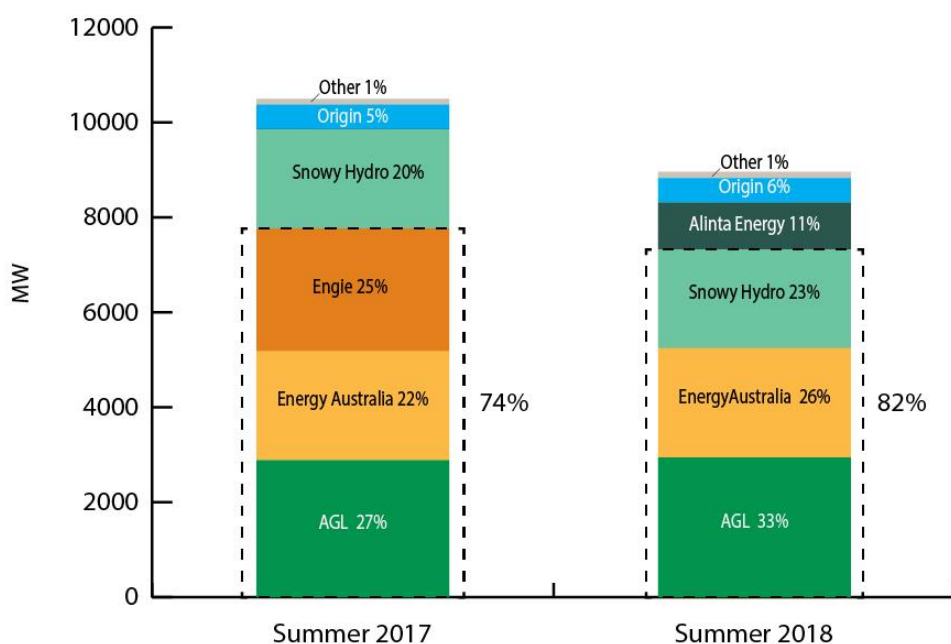
Concentration measured by capacity increased slightly with the three largest participants (EnergyAustralia, AGL Energy and Engie) controlling around 74 per cent of summer capacity in 2017, whereas the current three largest participants (EnergyAustralia, AGL Energy, and Snowy Hydro) now control 82 per cent of capacity.²⁷ The impact of Hazelwood closing on market concentration is less clear when measured using output (see Figure 7.2). This is because the remaining generators, apart from Snowy Hydro, increased their output in response to higher prices in Victoria.

We will continue to monitor the performance of the Victorian market as part of our regular assessment of wholesale market performance.

²⁶ Alinta bought Victoria's third brown coal generator from Engie in January 2018.

²⁷ A standard concentration metric, the Herfindahl-Hirschman Index (HHI), highlights the impact of large firms on the market. The HHI index for Victoria increased from 2260 in summer 2017 to 2430 in summer 2018. The HHI can range from a value of 0 in a perfectly competitive market to 10 000 with a monopoly.

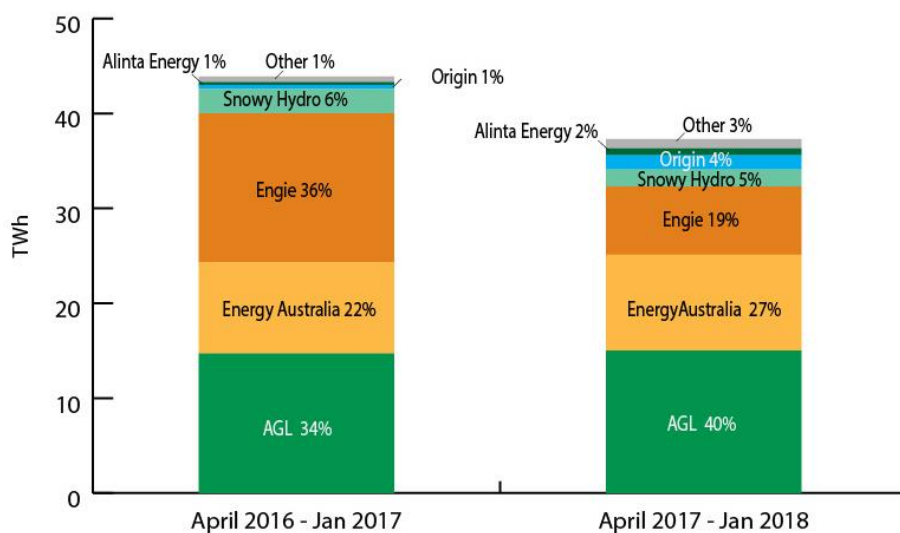
Figure 7.1 Market share by capacity, Victoria



Note: Capacity shares are based on summer availability for 31 January 2017 as reported by AEMO, except wind and solar which are adjusted for a contribution factor determined by AEMO. Capacity that is subject to a power purchase agreement is attributed to the party with control over output. Engie sold Loy Yang B to Alinta in January 2018.

Source: AEMO, AER.

Figure 7.2 Market share by output, Victoria



Note: Market share by output by trading rights. Pre-Hazelwood includes the period from April 2016 to January 2017. Post-Hazelwood includes the period April 2017 to January 2018. Interconnectors are excluded.

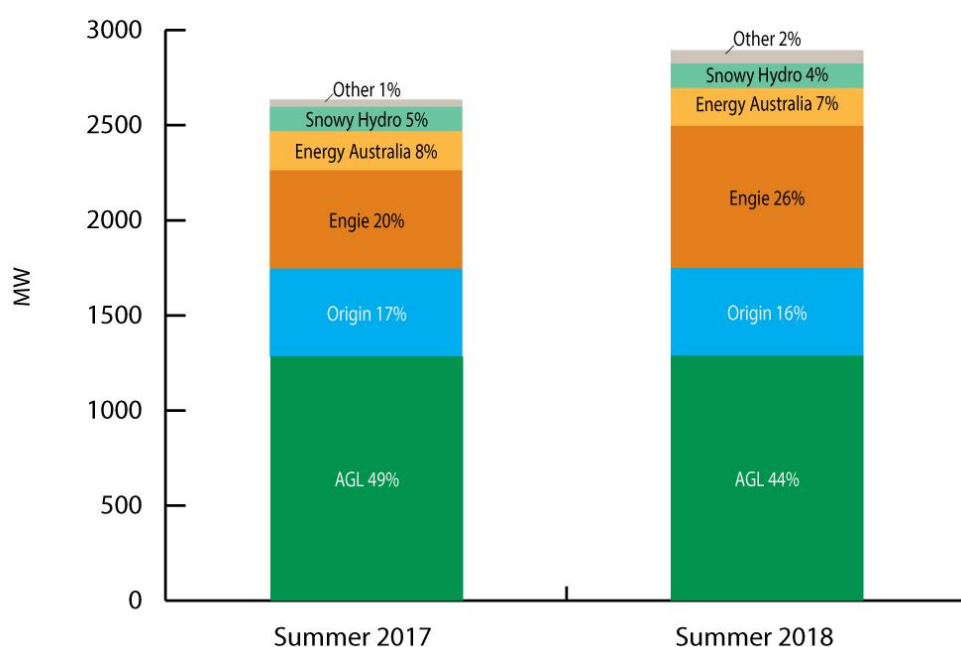
Source: AEMO, AER.

7.2 Three participants dominate the South Australian market

South Australia is dominated by gas and wind generation. Gas accounts for around 60 per cent of installed capacity and wind around 32 per cent. The closure of Alinta's Northern Power Station, in May 2016, marked the end of coal-fired generation in South Australia.

Ownership of generation capacity in South Australia is concentrated. Figure 7.3 shows the capacity market shares of participants in South Australia. Three vertically integrated participants (AGL Energy, Engie and Origin) collectively control around 86 per cent of capacity. These participants along with EnergyAustralia own all of the gas generators in South Australia and also hold power purchase agreements with a significant proportion of the remaining wind generators.

Figure 7.3 Market share by capacity, South Australia



Note: Capacity shares are based on summer availability for 31 January 2017 as reported by AEMO, except wind and solar which are adjusted for a contribution factor determined by AEMO. Capacity that is subject to a power purchase agreement is attributed to the party with control over output. The shares include 30 MW of the 100 MW battery owned by Neoen as the remaining 70 MW is only used in emergency situations.

Source: AEMO, AER.

Supply conditions in South Australia improved over 2017. The second unit of the Pelican Point power station returned to service in July 2017 after Engie withdrew it from service in April 2015.²⁸ Engie signed a three-year offtake agreement with Origin Energy to provide gas

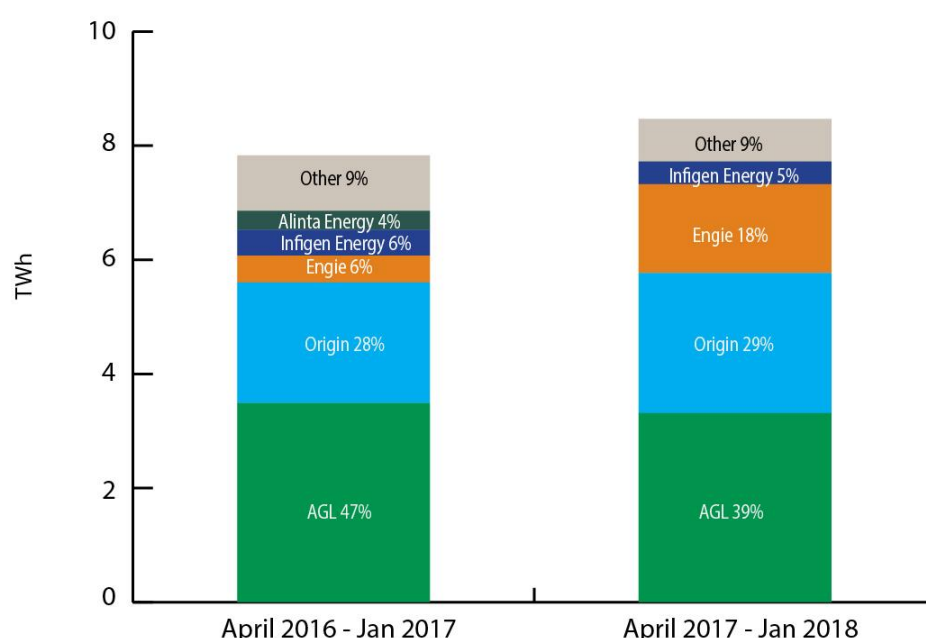
²⁸ Engie withdrew Pelican Point's second unit in 2015 as it was not profitable. Cheaper renewable energy had priced Pelican Point's second unit out of the market during windy and sunny days. Pelican Point recorded significant financial losses during 2013, 2014 and 2015.

to Pelican Point in return for access to 240 MW of fixed-price electricity. This additional firm capacity should alleviate some of the supply pressures experienced in South Australia in periods of high demand, especially when wind and solar is not available.

The South Australian government introduced its Energy Plan in March 2017 to address its concerns around system security in South Australia.²⁹ The plan includes 100 MW of battery storage, and 276 MW of temporary diesel generation. All but 30 MW of this additional capacity sits outside of the market arrangements and is expected to be used only in emergency situations.

Assessing market concentration using output confirms the market in South Australia is still concentrated. Figure 7.4 compares market share by output in the period April 2017–January 2018 to the same period a year before, April 2016–January 2017. The figure shows that output is still dominated by three participants but the share attributed to each is more even.

Figure 7.4 Market share by output, South Australia



Note: Market share by output by trading rights. Pre-Hazelwood includes the period from April 2016 to January 2017. Post-Hazelwood includes the period April 2017 to January 2018. Interconnectors are excluded.

Source: AEMO, AER.

²⁹ <http://ourenergyplan.sa.gov.au/>.

7.3 Competition from neighbouring regions

Generators in neighbouring regions can provide competitive pressure on local generation when the interconnectors are not constrained. As noted in section 6 the interconnectors constrained less in 2017 and prices aligned more frequently. While market concentration increased when Hazelwood closed, the detrimental effect on competition may have been partially offset by the interconnectors constraining less in 2017.

7.4 Recent investment activity

In the five years prior to Hazelwood closing there has been around 5000 MW of capacity withdrawn from the NEM, 3500 MW of which was coal generation. In NSW around 1900 MW was withdrawn mainly due to Wallerawang and Munmorah power stations (1600 MW combined capacity). In South Australia the Northern and Playford B power stations exited (740 MW combined capacity), while in Victoria Energy Brix and Anglesea (355 MW combined capacity).

Over the same period there has been around 2500 MW of new capacity added to the NEM, 2100 MW of wind and 240 MW of solar. Around 1600 MW of this wind capacity is in Victoria and South Australia along with a 100 MW battery.

Since Hazelwood closed there has also been around 750 MW of returned generation that had been previously withdrawn:

- Pelican Point is a combined cycle gas-plant and returning a second unit to service provided an additional 240 MW of base load capacity to the state. Engie signed a three year offtake agreement with Origin Energy to provide gas to Pelican Point in return for access to 240 MW of fixed-price electricity.
- Swanbank E (385 MW) is a gas fired power station owned by Stanwell, a Queensland government owned corporation. It was taken out of service in 2014 and returned to service in January 2018.³⁰
- Smithfield gas fired power station (176 MW) closed in July 2017 and returned to service at the end of the year.³¹

There is around 3800 MW of capacity (1800 MW of wind and solar each) that is committed to being built across the NEM, according to AEMO.³² This does not include Snowy 2.0 which would add a further 2000 MW of hydro generation.

³⁰ Queensland Government, media release 4 June 2017, Joint statement, Treasurer and Minister for Trade and Investment, Minister for Main Roads, Road Safety and Ports and Minister for Energy, Biofuels and Water Supply.

³¹ AEMO, NEM generation page, NSW summary, updated 22 December 2017.

³² <http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Generation-information>

8 Bidding behaviour relatively unchanged

Even though Hazelwood's removal heightened the potential for competition issues to arise, we did not observe generators withholding significant capacity or shifting lower priced capacity to higher priced bands. We analysed participant behaviour in Victoria and South Australia to see whether (and if so, the extent to which) participants had taken advantage of Hazelwood closing. We examined whether generators had changed the way they offered their capacity or whether there was any evidence they had withheld capacity to increase prices.

8.1 No evidence of opportunistic bidding

There are certain types of opportunistic bidding commonly associated with the exercise of market power in electricity markets. In the past year we have not identified instances where this has significantly affected Victorian or South Australian price outcomes:

- Generators did not appear to physically withhold capacity from the market.
- We did not observe instances of participants shifting capacity to extremely high prices (for example at the market price cap), which could indicate economic withholding.
- Victorian and South Australian generators did not rebid capacity from low to high prices close to dispatch. This type of behaviour can limit the ability of other generators to respond to price signals competitively.
- We did not detect false or misleading rebidding.³³ Generators are required to take into account all existing material circumstances when making a bid and, if there is a change to any of those material circumstances, to reflect those changes in rebids as soon as practicable.³⁴

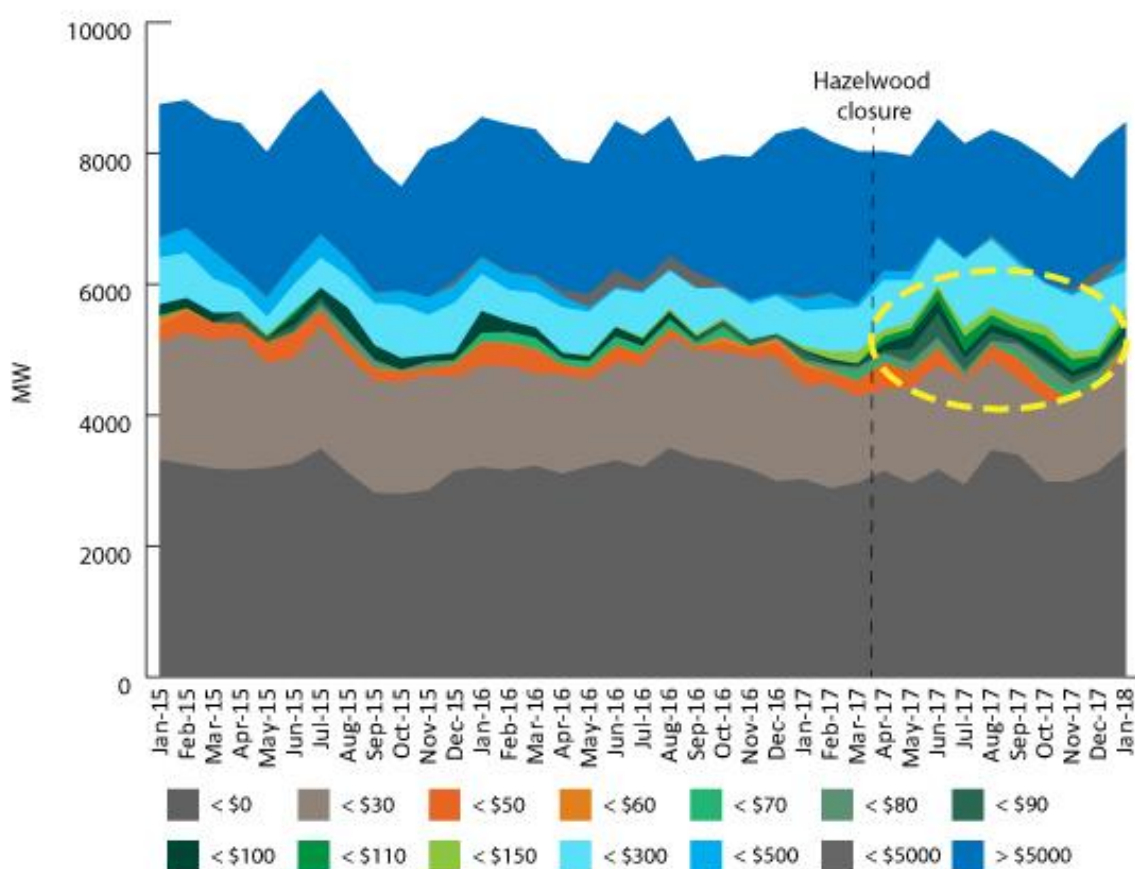
8.2 Bidding behaviour in Victoria

Figure 8.1 shows how Victorian generators offered their capacity over the last three years. It shows the monthly average volume of offers within certain price thresholds, with the lowest priced capacity at the bottom and the highest priced capacity at the top. We have excluded Hazelwood from the figure so we can see whether the remaining generators have changed their offers since the closure.

³³ This conduct is prohibited under section 3.8.22A of the National Electricity Rules.

³⁴ NER, clause 3.8.22.

Figure 8.1 Victoria - Capacity offer by price band, excluding Hazelwood



Source: AEMO, AER.

Overall, generators' offers remained largely unchanged since Hazelwood closed with some exceptions. While generators continued to offer more than half of their capacity into the market at the lowest price bands, they reduced the capacity they offered at the highest price band (shown by a narrowing of the dark blue band at the top of Figure 8.1). They shifted this capacity to middle price bands (ranging between \$50/MWh to \$150/MWh and indicated by the yellow circle in Figure 8.1).

When we examined individual bidding behaviours in Victoria we observed that, while brown coal generators' bidding behaviour remained relatively unchanged, the biggest gas fired generators, Mortlake and Newport, significantly changed their bidding behaviour. Where these two plants previously operated as peaking plants, in 2017 they both moved capacity from the highest price band to the price floor (and to a lesser extent to middle price bands) to increase how often they were dispatched.³⁵ Snowy Hydro also moved some of its capacity from a low price band to middle price bands. As noted in our New South Wales advice, this reflects the increased value it placed on water in a drier 2017.³⁶

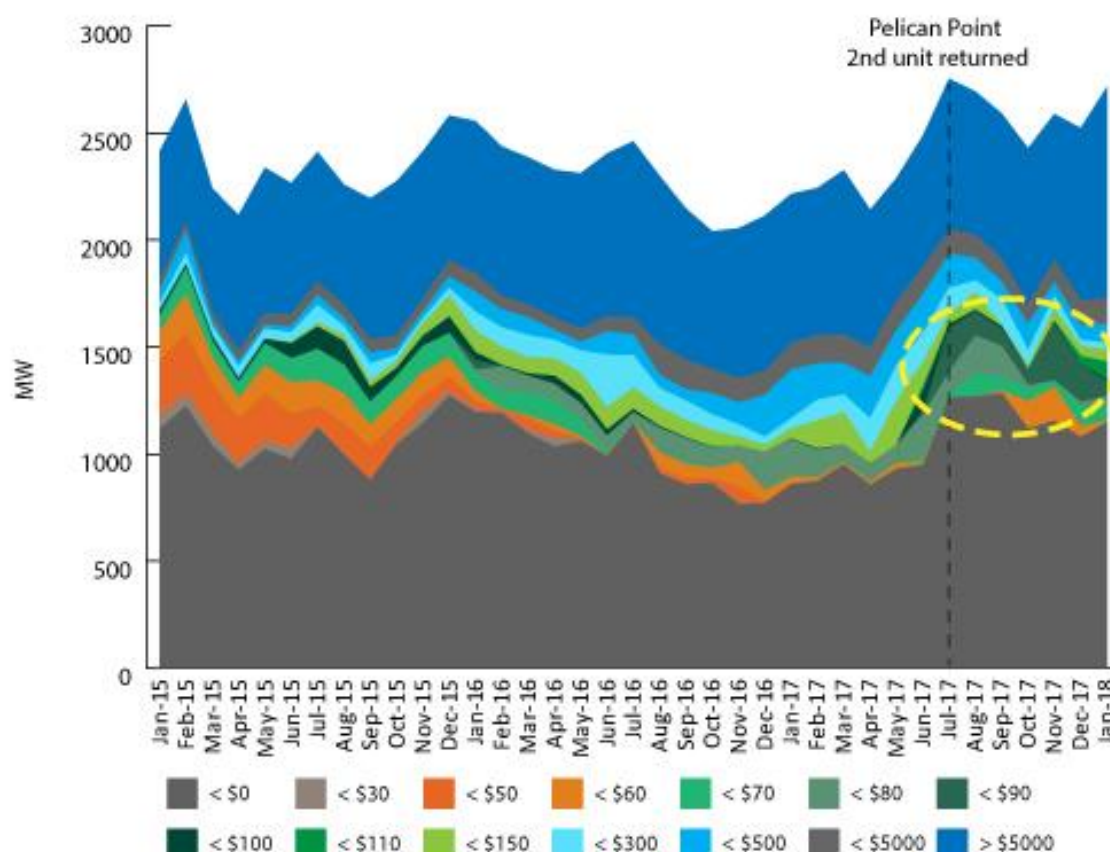
³⁵ Newport gas plant is owned by Ecogen but contracted to EnergyAustralia. EnergyAustralia proposed to buy Newport and Jeeralang from Ecogen in December 2017.

³⁶ AER, Electricity wholesale performance monitoring - NSW electricity market advice - December 2017, p. 20.

8.3 Bidding behaviour in South Australia

The only significant change in generator offers in South Australia after Hazelwood closed was an increase in capacity offered into the market by Engie at Pelican Point. Figure 8.2 shows South Australian generators' offers within certain price bands over the last three years. From mid-2017, capacity increased coinciding with the return to service of the second turbine at Pelican Point. This additional capacity was offered mainly at the price floor (the bottom brown band) and between \$50/MWh and \$150/MWh (indicated by the yellow circle below).

Figure 8.2 South Australia – Capacity offer by price band



Source: AEMO, AER.

9 Competition findings and future work

Engie's decision to close Hazelwood aligned with the firm's global policy to exit coal fired generation. The eventual exit of the power station was not unexpected given its age, condition, and increased maintenance costs. It was the tenth and largest coal-fired power station to exit the NEM in the last six years.

9.1 Short term market response

Average wholesale electricity prices increased significantly across the NEM in 2017. Prices remained high after the summer period, coinciding with Hazelwood closing. Annual average wholesale electricity prices in Victoria in 2017 were the highest they have been since the commencement of the NEM. South Australian average prices have been consistently high.

Our analysis did not identify instances where bidding behaviour we normally associate with the exercise of market power significantly affected average prices in Victoria or South Australia. Generators did not appear to physically withhold capacity from the market and we did not observe instances of participants shifting capacity to extremely high prices (for example at the market price cap), which could indicate economic withholding.

The increase in spot prices was driven by tightening supply conditions and increased fuel costs. The exit of Hazelwood removed a significant low fuel cost generator that was largely replaced by increased generation from higher cost black coal and gas plant—at a time when the input costs for these plants were increasing. Higher prices in these circumstances would be expected (at least over the short term).

The supply response from remaining market participants over the short term was also as you might expect. Not only did the output of existing generators increase, but some existing gas generators offered more capacity into the market. Some previously withdrawn gas fired capacity re-entered the market.

9.2 Longer-term issues

While the market response in the short term was as we might have expected, there are a number of longer term issues that require ongoing monitoring.

Market concentration

Ownership of the generation plant in the South Australian and Victorian markets is concentrated, with a few, largely vertically integrated participants controlling a significant proportion of capacity in both regions. Markets with high concentration are more susceptible to the exercise of market power.

While we didn't identify the transient exercise of market power as a significant feature in South Australia or Victoria as part of this review, there may have been factors that limited this opportunity in 2017:

- There were relatively few high demand days in Victoria and South Australia between Hazelwood closing and the most recent summer.

- Wind output in South Australia was also high for most of the year, which increased the contribution of low fuel cost generation.
- Victoria and South Australia were more exposed to inter-regional competition because the interconnectors between regions were less constrained.

Investment conditions

Periods of high prices are expected in the market, particularly during periods of tightening supply or increasing fuel costs. The market design allows for periods of high prices to encourage investment in new generation capacity when needed. Problems can arise however, if high prices are sustained and there is no new entry.

It is too early to tell whether the price outcomes we are currently seeing will be sustained. While there are some signs that wholesale price pressures are easing, forward prices, which reflect the market's expectations of future wholesale prices, are trending downwards but not to previous levels.

It is also too early to test whether additional new capacity will respond to higher prices, if they are sustained. We have already observed some previously withdrawn gas plant re-enter the market in response to the higher prices. There is also significant investment on the horizon in renewable generation including wind and solar.

Despite these positive signs of investment, there are also factors that have a tempering effect on commercial investment decisions. While initiatives are underway to provide greater certainty around long term emissions policy, at this stage there is still uncertainty regarding the National Energy Guarantee as well as the impact of an additional 2000 MW at Snowy³⁷ and other jurisdictional energy and climate initiatives.

9.3 Future work

We will monitor these developments over a longer period to make an informed assessment on the effectiveness of competition. The AER has a new role to report on the effectiveness of wholesale market competition in the NEM, with our first report due in December 2018.

We will continue to monitor the market's response to the closure of the Hazelwood power station as part of this role, including the effect of the high levels of ownership concentration in South Australia and Victoria. We will also broaden our analysis to look at the longer-term performance of the NEM across all regions and include an in depth analysis of the extent of any barriers to new entry.

³⁷ Media release, Snowy 2.0 declared critical state significant infrastructure, 9 March, [www.snowyhydro.com.au](http://www.snowyhydro.com.au/our-scheme/snowy20/).
<http://www.snowyhydro.com.au/our-scheme/snowy20/>.

Appendix A Letter from the Minister for the Environment and Energy and the Treasurer



**Treasurer
Minister for the Environment and Energy**

Ms Paula Conboy
Chair
Australian Energy Regulator
GPO Box 520
Melbourne VIC 3001

03 NOV 2016

Dear Ms Conboy

We are writing to you regarding the announced closure of the Hazelwood Power Station (Hazelwood).

As you will be aware, the owners of Hazelwood, Engie and Mitsui, have taken the commercial decision to close the power station by 31 March 2017.

While the closure can be expected to have some short term effects on prices in South Australia and Victoria, the Australian Government is keen to ensure that such price movements are limited and that any adverse impacts on effective competition in the wholesale market are minimised.

This is relevant to the Australian Energy Regulator (AER) under new wholesale market monitoring powers agreed by the COAG Energy Council. The National Electricity (South Australia) (Australian Energy Regulator – Wholesale Market Monitoring) Amendment Bill 2016 was recently introduced into the South Australian Parliament and the new legislation is expected to be proclaimed later this year.

As part of its new powers, the AER will be required to periodically monitor the wholesale electricity market for any features which may be detrimental to effective competition and to provide advice to the Energy Council, as appropriate, on the market's performance.

In light of the potential for the closure of Hazelwood to enable anti-competitive behaviours among remaining generators, I ask that the AER closely monitor market developments in Victoria and South Australia and provide advice to the Energy Council on any factors impacting on the efficient functioning of the market within one calendar year of the power station's closure.

Should you require any further information in regards to this request, please contact James O'Toole, Assistant Secretary, Department of the Environment and Energy on 02 6275 9023.

Yours sincerely



JOSH FRYDENBERG
Minister for the Environment and Energy



SCOTT MORRISON
Treasurer

Appendix B AER response



GPO Box 520
Melbourne VIC 3001
Telephone: (03) 9290 1444
Facsimile: (03) 9290 1457
www.aer.gov.au

11 November 2016

Hon Josh Frydenberg MP
Minister for Environment and Energy
Parliament House
CANBERRA ACT 2600

Hon Scott Morrison MP
Treasurer
Parliament House
CANBERRA ACT 2600

Dear Ministers

Thank you for your letter of 3 November 2016 requesting that the AER provide advice to the CoAG Energy Council on any factors impacting on the efficient functioning of wholesale energy markets, given the announced closure of the Hazelwood Power Station (Hazelwood).

We look forward to presenting our advice to you. We share your interest in ensuring that any adverse impacts on competition in the wholesale market following the closure of Hazelwood are minimised.

In undertaking the advice, we will look at market outcomes and participant behaviour prior to and following the closure of Hazelwood and report on any changes that we observe. We will also draw on analysis we will be developing as part of our expected new powers under the National Electricity (South Australia) (Australian Energy Regulator – Wholesale Market Monitoring) Amendment Bill 2016 in monitoring the effectiveness of competition in wholesale electricity markets.

Finally, to the extent our analysis highlights potential competition law issues, we will liaise with the ACCC given the agency's responsibility for application of competition law in the energy sector.

Should you or your staff require any further information in regards to matters raised in this letter, please do not hesitate to contact me on (03) 9290 1419.

Yours sincerely,

A handwritten signature in blue ink, appearing to read 'P. Conboy'.

Paula W. Conboy
Chair

Appendix C Price setter

The following graphs show the percentage of time power stations located in various regions of the NEM were involved in setting the 5 minute dispatch price in Victoria (vertical bars) and the average price of the offered capacity which was involved in setting that price.

Figure B.1 Loy Yang B – Brown Coal – Victoria

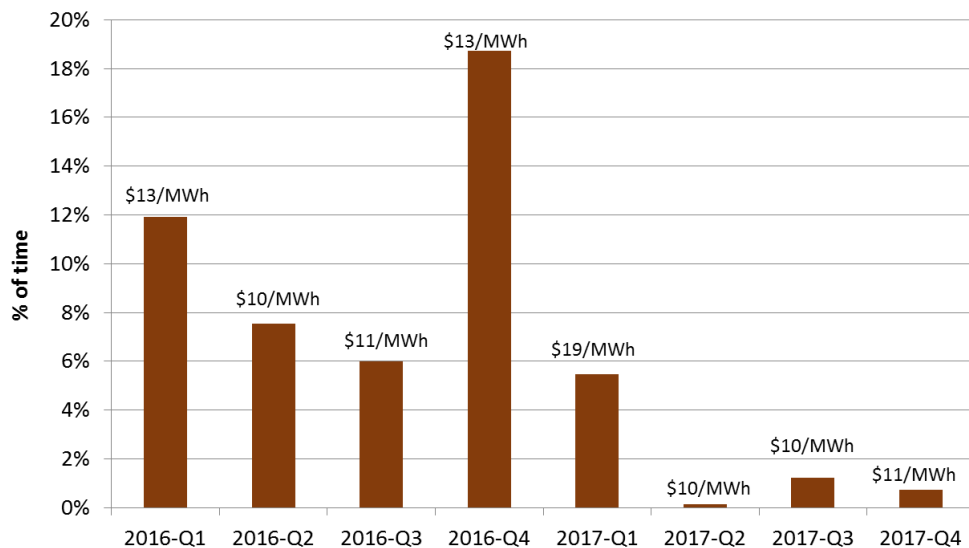


Figure B.2 Yallourn – Brown Coal – Victoria

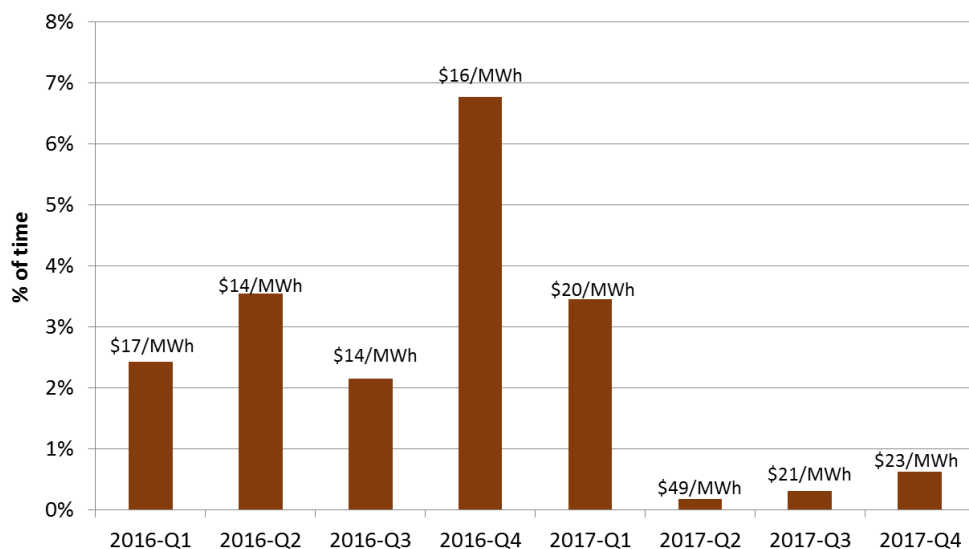


Figure B.3 Eraring – Black Coal – NSW

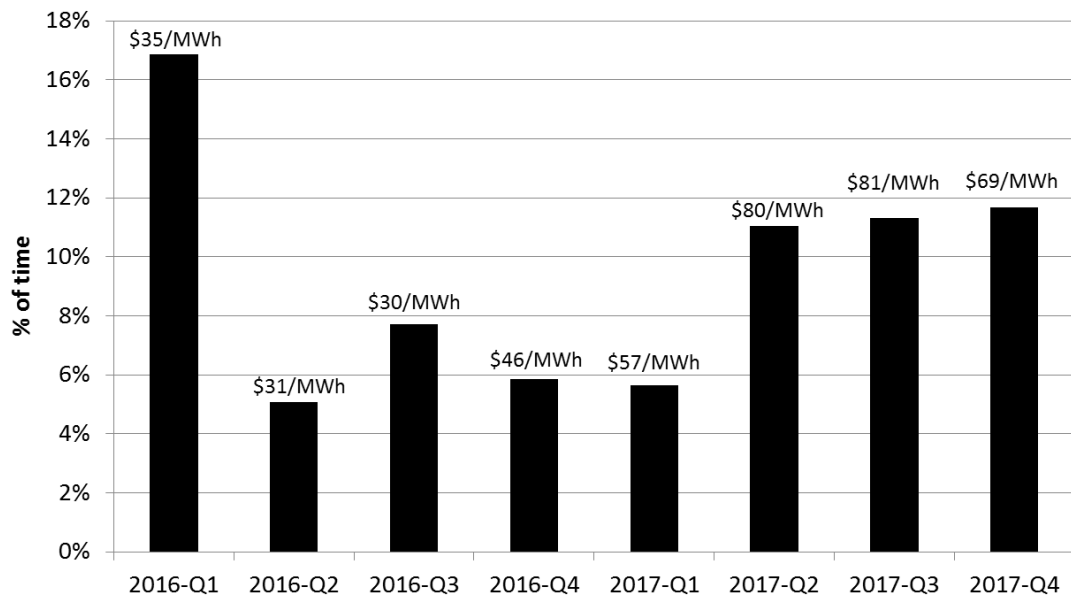


Figure B.4 Bayswater – Black Coal – NSW

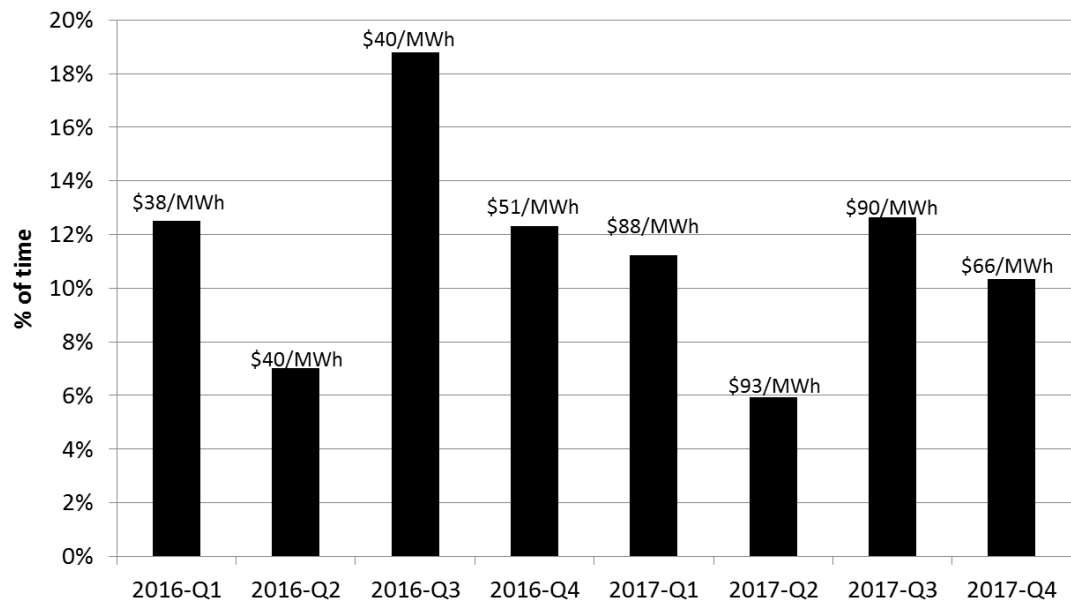


Figure B.5 Torrens Island – Gas – South Australia

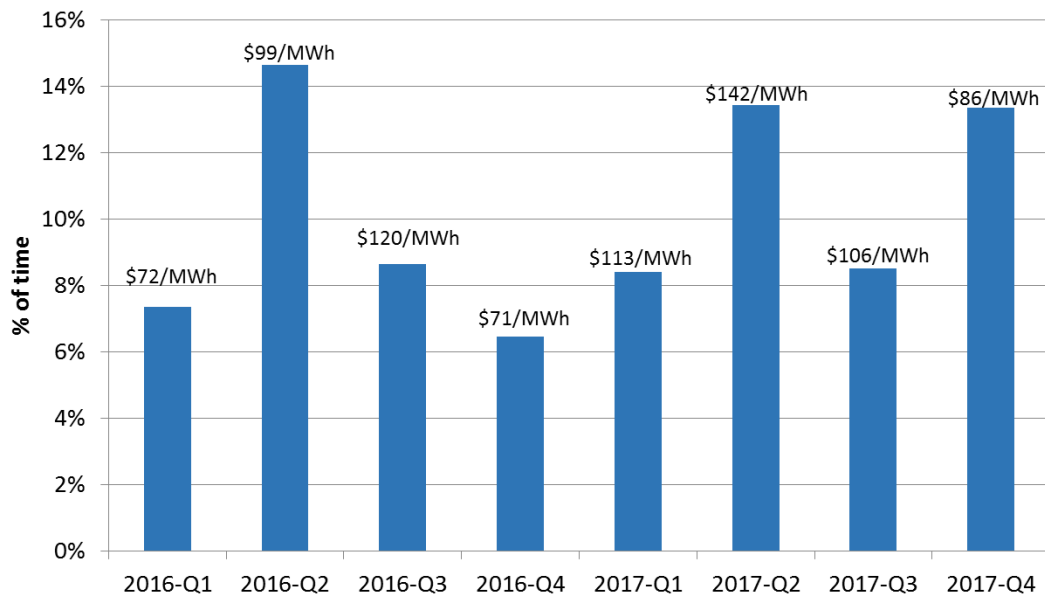


Figure B.6 Mortlake Gas – Victoria

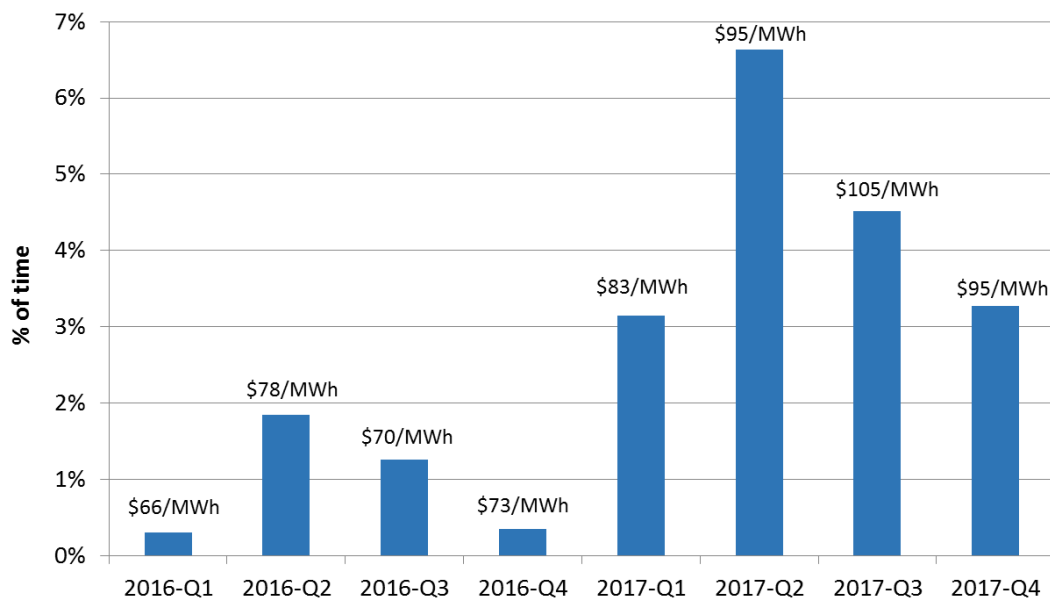


Figure B.7 Newport – Gas – Victoria

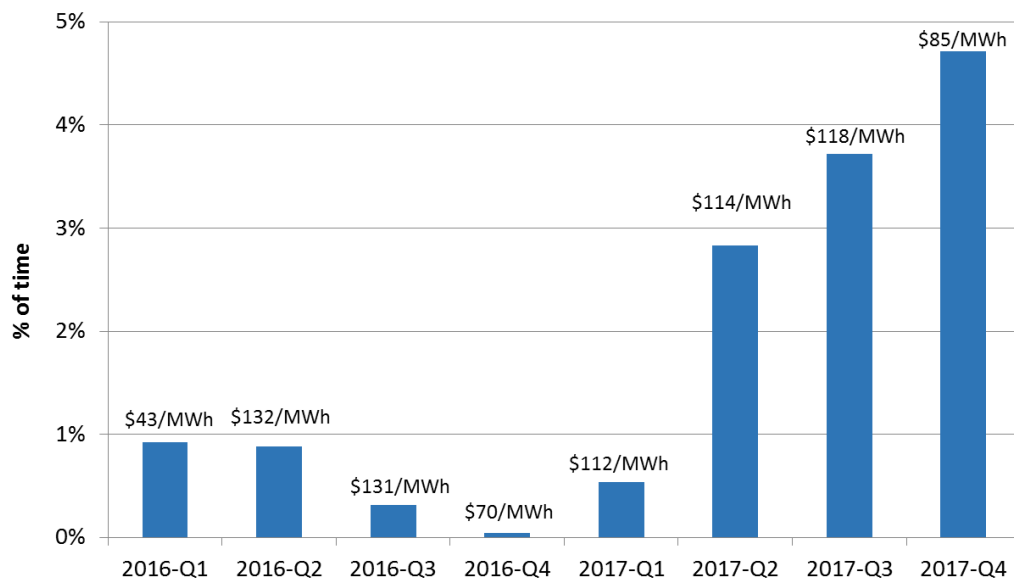
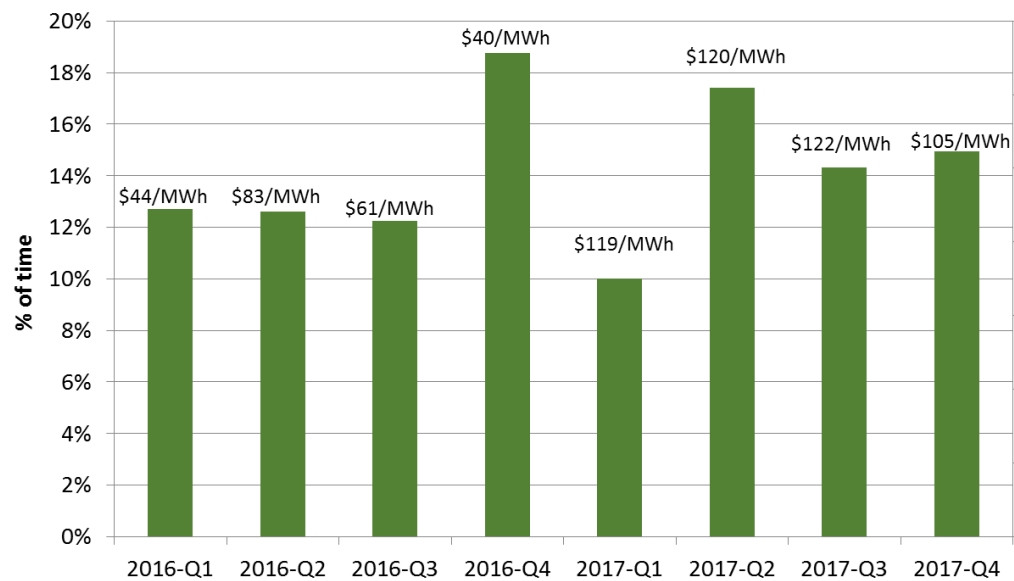


Figure B.8 Murray – Hydro – Victoria



Appendix D New and returned generation

New entry over this period has predominantly been in wind and solar.

There was also 750 MW of returned generation that had been previously withdrawn. Pelican Point in South Australia (Engie), Smithfield in New South Wales (Visy) and Swanbank E in Queensland (Stanwell).³⁸ This returned generation was at a higher cost than brown coal.

Table A.1 Generation withdrawals (and returns) in the NEM

Year	Power station	Region	Generation technology	Capacity (MW)	Status
2011-12	Swanbank B	Qld	CCGT	480	Decommissioned progressively between April 2010 and May 2012
2012-13	Munmorah	NSW	Coal	600	Retired
2012-13	Tarong	Qld	Coal	700	Closed 2012 to 2014
2012-13	Collinsville	Qld	Coal	180	Retired
2014-15	Morwell, Brix	Vic	Coal	205	Retired
2014-15	Wallerawang C	NSW	Coal	1000	Retired
2014-15	Redbank	NSW	Coal	144	Retired
2014-15	Pelican Point	SA	CCGT	249	Half capacity withdrawn. Returned to full capacity in July 2017
2014-15	Swanbank E	Qld	CCGT	385	Placed into cold storage. Returned December 2017
2015-16	Northern	SA	Coal	540	Retired
2015-16	Playford B	SA	Coal	200	Retired
2015-16	Angelsea	Vic	Coal	150	Retired
2016-17	Hazelwood	Vic	Coal	1600	Retired
2017-18	Smithfield	NSW	Gas	171	Retired. Returned to service in 2017 with 109MW available capacity

³⁸ While Swanbank E in Queensland (Stanwell) came back online, gas output in Queensland decreased in 2017 (see Figure 3.2).

Table A.2 Generation entry in the NEM

Region	Power station	Generation technology	Capacity (MW)	Year completed
Qld	Oaky Creek 2	Waste coal mine Gas	15	2016
NSW	Eraring [upgrade]	Coal	60	2013
NSW	Gullen Range Wind Farm	Wind	166	2014
NSW	Taralga Wind Farm	Wind	107	2015
NSW	Boco Rock Wind Farm	Wind	113	2015
NSW	Royalla Solar Farm	Solar	20	2015
NSW	Nyngan Solar Farm	Solar	102	2015
NSW	Broken Hill Solar Plant	Solar	53	2015
NSW	Moree Solar Farm	Solar	56	2016
NSW	Williamsdale Solar Farm	Solar	10	2017
Vic	Morton's Lane	Wind	20	2012
Vic	Macarthur	Wind	420	2013
Vic	Qenos Cogeneration Facility	CCGT	21	2013
Vic	Mount Mercer	Wind	131	2014
Vic	Bald Hills Phase 1	Wind	107	2015
Vic	Portland Wind Farm Stage 4	Wind	47	2015
Vic	Coonooer Bridge Wind Farm	Wind	20	2016
Vic	Ararat Wind Farm	Wind	240	2017
SA	Snowtown 2 North	Wind	144	2014
SA	Snowtown 2 South	Wind	126	2014
SA	Waterloo Wind Farm expansion	Wind	19.8	2016
SA	Horsndale Wind Farm Stage 1	Wind	102	2016
SA	Horsndale Wind Farm Stage 2	Wind	102	2017
SA	Horsndale Wind Farm Stage 3	Wind	109	2017
SA	Horsndale Power Reserve	Li-ion battery storage	100	2017
Tas	Musselroe Wind Farm	Wind	168	2013