CLIMATE COUNCIL

THE PERFECT STORM: ANALYSING THE ROLE OF GAS IN SOUTH AUSTRALIA'S POWER PRICES

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Key Findings

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Interstate controlled power companies used the recent interconnector transmission line outage with Victoria to exploit their strong gas generation market positions in South Australia, driving up prices to extreme levels. Renewable energy was used as the scapegoat, but prime responsibility actually lies with profit maximization by the power companies.

- Power companies have used international gas export prices to increase power prices across the National Electricity Market.
- Recent power plant closures and "mothballing" in the state increased the local market power of these companies.
- The removal of the Heywood Interconnector during South Australia's peak winter demand compounded the situation, allowing two companies - AGL and Origin – to control 80% of gas power generated in South Australia.
- During the most extreme demand days, AGL made some of its Torrens Island capacity "unavailable". This amplified the market position of these few companies.
- Collectively, these events created the perfect storm for prices to increase.
- Analysis shows these power companies appeared to engage in deliberately unpredictable bidding behavior in July 2016, inflating the price of electricity on both the wholesale spot market and future hedge contracts.

2

South Australia's gas generators earned around $178 million in net margin on the spot market during the July high price events.

- Past behaviour suggests they will seek to pass these high power costs, now reflected in futures market prices, through to South Australian industrial and retail customers.
- The higher power costs could amount to triple South Australia's share of the Heywood Interconnector expansion capital cost.

3

The media focus on renewable energy enabled the parties and reasons responsible for South Australia's recent high price events to avoid public scrutiny. There is considerable cause for regulators to review the recent events in South Australia.

- A review of how the power companies exercised their market positions, specifically their bidding activities and the removal of Torrens Island capacity during the period of the Heywood interconnector outage, is warranted to determine whether any steps should be taken in respect of that conduct.
- A review of why the electricity market operator and regulators allowed the planned Heywood Interconnector outage to take place at a time when AEMO's own long term forecasts showed the state would need this interconnector during peak winter demand.

4

Increasing reliance on high-priced gas is not a viable solution to reduce power prices or to tackle climate change.

- Using more gas power in South Australia will not solve the price issue. Rather it will reinforce it and make it worse by further entrenching the market position of incumbents reducing competition.
- It will increase reliance on the state's ageing obsolete gas fuelled fleet, increasing greenhouse emissions including risks of fugitive methane emissions – a potent greenhouse gas. Both are contrary to national greenhouse gas reduction commitments.

5

South Australia needs more competition from more energy supply sources to put downward pressure on power prices. This means:

- More low cost renewable energy from a diverse range of sources, including increased solar photovoltaic and solar thermal, and more wind.
- Increased interconnector capacity by adding an interstate link to New South Wales.
- Encouraging in-state fast response energy storage and demand management (for large energy users).

6

Regulatory and governance structures of the National Energy Market (NEM) should be reviewed to ensure they are fit to manage the transformation to an energy future focused around renewables.

- The electricity transition underway to a low carbon high technology future centered on renewables is the industries' biggest change and challenge in over a century.
- The current infrastructure was not built on the back of the energy only market of the last 15 years. Market design, regulatory and governance structures should be reviewed to ensure they are fit to manage the transformation underway. They currently are not.

1. Introduction

South Australia is at the forefront of efforts (both in Australia and globally) to transition the state's power generation from fossil fuels to renewable energy sources like solar and wind (Australian Energy Council 2016).

In July this year, South Australia experienced a series of high wholesale electricity price spikes in one week, which some politicians and media commentators simplistically linked to the state's high proportion of renewable energy, particularly wind (For example, Australian Financial Review 2016; The Advertiser 2016a; The Australian 2016). This was incorrect.

The mistaken attack on renewables enabled the principal reasons and parties responsible for the high price events to slip under the radar and largely avoid public scrutiny.

This briefing paper analyses the role the "gentailers" (generator-retailers, companies owning both power plants and retail businesses) played in the high wholesale price spikes in South Australia, the lack of competition, and the conditions which enabled these companies to exercise the full force of their market power. For background, see the Climate Council's initial analysis in our report "Mythbusting: Electricity Prices in South Australia" (Climate Council 2016).

The mistaken attack on renewable energy has enabled the parties and reasons responsible for South Australia's recent high price events to largely avoid public scrutiny.

2. South Australia's Transition to Renewable Power is in Line with Climate Change Action

Last year, nations worldwide (including Australia), agreed to act to limit global warming to less than two degrees Celsius at the United Nations Framework Convention on Climate Change Conference of the Parties 21 held in Paris in December 2015 (the Paris Conference). Meeting this goal requires all countries to dramatically reduce greenhouse gas emissions like carbon dioxide.

This is critical for Australia's future given that we are highly vulnerable to the consequences of climate change, worsening bushfire conditions, extreme heat, sea level rise and damage to iconic ecosystems like the Great Barrier Reef.

Globally, the transition to renewable energy is well underway. Annual investment in renewable energy is consistently outperforming investment in new fossil fuel power, and falling prices for wind and solar are driving record-breaking installations of renewable energy capacity - last year totaling 147GW (REN21 2016). 173 countries now have renewable energy targets in place, with many of the world's largest emitters announcing plans to dramatically scale up their renewable energy efforts (Climate Council 2015).

South Australia's transition away from fossil fuels to renewable electricity is consistent with action needed to avoid catastrophic climate change.

Figure 1: South Australia's Starfish Hill Wind Farm.

Australia has one of the lowest levels of renewable electricity generation of comparable nations. Despite renewable electricity generation reaching 14.6% in 2015, Australia's electricity remains dominated by fossil fuels such as coal and gas (Australian Energy Council 2015; Clean Energy Council 2016a). Producing electricity from fossil fuels is Australia's number one source of emissions - responsible for 35% of Australia's total greenhouse gas emissions (Australian Government 2016). Research shows that Australia will need to source a minimum of 50% of its power from renewable sources by 2030 in order to achieve emissions reductions consistent with limiting global warming to less than two degrees Celsius (ClimateWorks 2015).

After more than a decade of consistent policies and targets encouraging more wind and solar power in the state, South Australia now leads the other mainland states with 41.3% renewable electricity - far ahead of the next mainland states Western Australia and Victoria at 12.1% renewable electricity (Clean Energy Council 2016a; Figure 1). The state is on track to reach its target of 50% renewable electricity by 2025 (Government of South Australia 2015).

South Australia's transition away from fossil fuels, particularly coal, is consistent with action needed to avoid catastrophic climate change.

3. The Anatomy of a Price Spike

In the week of 7 - 14 July, a number of circumstances coincided creating the "perfect storm" for South Australia's "gentailers" (generator-retailers, companies owning both power plants and retail businesses) to exercise their market positions – and raise wholesale electricity prices dramatically.

A number of factors contributed to high electricity prices in the week of 7 - 14 July 2016:

1. **Existing market position of the gentailers:** In South Australia, the electricity market is dominated by a small number of companies who control both the production (owning the in-state gas power plants) and sale (owning the major electricity retail businesses) of electricity. Energy regulators have expressed concerns about the lack of competition in South Australia's electricity market for years.

2. **Already expensive gas power prices:** The price of power generated from gas has increased around Australia underpinned by international gas prices since liquefied natural gas (LNG) exports commenced.

3. **Power plant closures or "mothballing" further concentrated the market shares of the gentailers:** The closure of Alinta's Northern and Playford coal-fired power stations and the "mothballing" (taking out of service for a period) for winter 2016 of Engie's Pelican Point gas plant collectively, reduced South Australian generating capacity by around 1250MW. This brought supply of electricity much closer to demand. When supply and demand are closer together, there is less competition to supply electricity and the pricing power of the gentailers increases.

4. **The removal of the Heywood Interconnector during peak winter demand further compounded the situation:** The main electricity line connecting South Australia with Victoria (known as the Heywood Interconnector) was in large part, removed for upgrade works. The interconnector was removed at a time of peak winter demand, which together with the generator withdrawals, took out 1700MW of supply. The removal of the Heywood Interconnector removed a key source of competition in South Australia's electricity market, giving the local gentailers more pricing power.

5. **Local gas generation capacity was made unavailable during this period:** AGL made parts of its Torrens Island capacity "unavailable" during the most extreme demand days. With even less local generation capacity, supply and demand came closer together, further increasing the pricing power of the local gentailers.

6. **Bidding behavior of the gentailers maximised their financial returns.** Based on available evidence, these companies appeared to engage in deliberately unpredictable bidding behavior to inflate the price of electricity far above cost on the wholesale spot market. The high spot prices are being reflected in future hedge contracts (which usually allow users to reduce price risk), and will likely lead to increased consumer retail prices.

In summary, the existing market position of a small number of gentailers in South Australia was increased by a series of circumstances - power plant closures and mothballing bringing supply and demand closer together. The removal of the Heywood Interconnector and some Torrens Island gas capacity compounded the pricing power of these companies.

While wind and solar provided some of South Australia's power during this period, the restricted capacity of the interconnector meant the state was more reliant than usual on gas to meet the remaining demand (Clean Energy Council 2016b).

In this situation, the gentailers exercised the full force of their market position by using unpredictable bidding patterns designed to increase the price of electricity far above cost. This led to gas power prices reaching extreme levels, and gas generators earning an estimated net margin of around $178 million in the spot market over the fortnight (RenewEconomy 2016c).

The existing market positions of a small number of gentailers in South Australia was increased by a series of circumstances, and these companies used the opportunity to maximise their financial returns.

Each of these factors is explained in more detail below.

Existing market power of the gentailers

Energy companies are able to exercise "market power" (meaning the ability to set high prices) in states where there are few companies operating, reducing competition. These companies are also "gentailers", owning both power plants and electricity retail businesses (this is sometimes referred to as vertical integration).

> *"High levels of market concentration and vertical integration between generators and retailers give rise to a market structure that may, in certain conditions, provide opportunities for the exercise of market power."*
> - Australian Energy Regulator 2014

Competition concerns have been expressed for years by regulators about the South Australia's highly concentrated market for gas fuelled power generation.

> *"The Commission's analysis has demonstrated that South Australia may have some characteristics that may make it different from other [National Electricity Market] regions and potentially more prone to inhibiting efficient investment and promoting the likelihood of substantial market power."*
> - Australian Energy Market Commission 2013

Competition concerns have long been expressed about South Australia's highly concentrated market for gas power generation.

In response to competition concerns, regulators have kept a watching brief on South Australia's situation, specifically relying on the growth of wind energy and upgrades to the Heywood Interconnector (the high voltage electricity line enabling South Australia to import and export electricity from Victoria) to dampen the market power of these gentailers (Australian Energy Market Commission 2013).

Already expensive gas power prices due to export links

Unlike Victoria, New South Wales and Queensland, which rely largely on coal for electricity generation, South Australia has historically relied mainly on gas for its power. Australian gas prices have increased and become more volatile since becoming linked to international Liquefied Natural Gas (LNG) markets (Melbourne Energy Institute 2016). The international export market for gas has also increased demand. High international LNG prices have led to some companies selling gas supplies overseas rather than using the gas for local power generation. This has led to the mothballing of gas power plants such as Pelican Point in South Australia and Swanbank E gas plant in Queensland (RenewEconomy 2016a).

Power plant closures or "mothballing" further increased the gentailers market power

The market power (and ability to set high prices) of South Australia's gentailers has increased in recent times as electricity supply and demand in the state have come closer together. This has occurred due to excess power generation capacity either being shut down (as in the case of Alinta's Northern (Figure 2) and Playford coal-fired power plants) or "mothballed" and taken out of service for a period (such as Engie's Pelican Point gas-fired power plant).

Figure 2: Northern coal-fired power station (now closed).

Heywood Interconnector removed during peak winter demand

When the interconnectors (Heywood, and a smaller line called Murraylink) between South Australia and Victoria are operating, there is still more than enough interstate and local electricity supply to meet South Australia's electricity needs (with electricity supply capacity almost double peak demand) (AEMO 2015).

However, in July this year, the Heywood Interconnector was taken out of service for up to two weeks to expand capacity, and further generating capacity removal occurred at a time of forecast winter peak demand for electricity.

With the Heywood interconnector out of service and with Pelican Point fully mothballed, South Australia's power supply (excluding wind and diesel) comes very close to its maximum demand. This means that competition to supply electricity in South Australia is even further limited.

Australia's Electricity Market Operator (AEMO) regularly predicts periods of high and low electricity demand (shown by the wiggly white line in Figure 3). AEMO (2015) forecast in October 2015 that these tight supply-demand conditions would occur in July 2016 (Figure 3) and the following summer, stating:

> *"After Northern Power Station is withdrawn, there are times when maximum daily demand is projected to exceed supply from scheduled generation in South Australia. At these times, the region will rely on imports (via interconnection) and wind generation to meet operational demand"*
> - AEMO 2015

Removing the Heywood Interconnector for upgrade works during peak winter demand, was a recipe for disastrous price outcomes.

Figure 3: AEMO South Australia electricity supply and demand - shows Heywood Interconnector outage timed for SA Winter Peak. **Source**: Adapted from AEMO 2015.

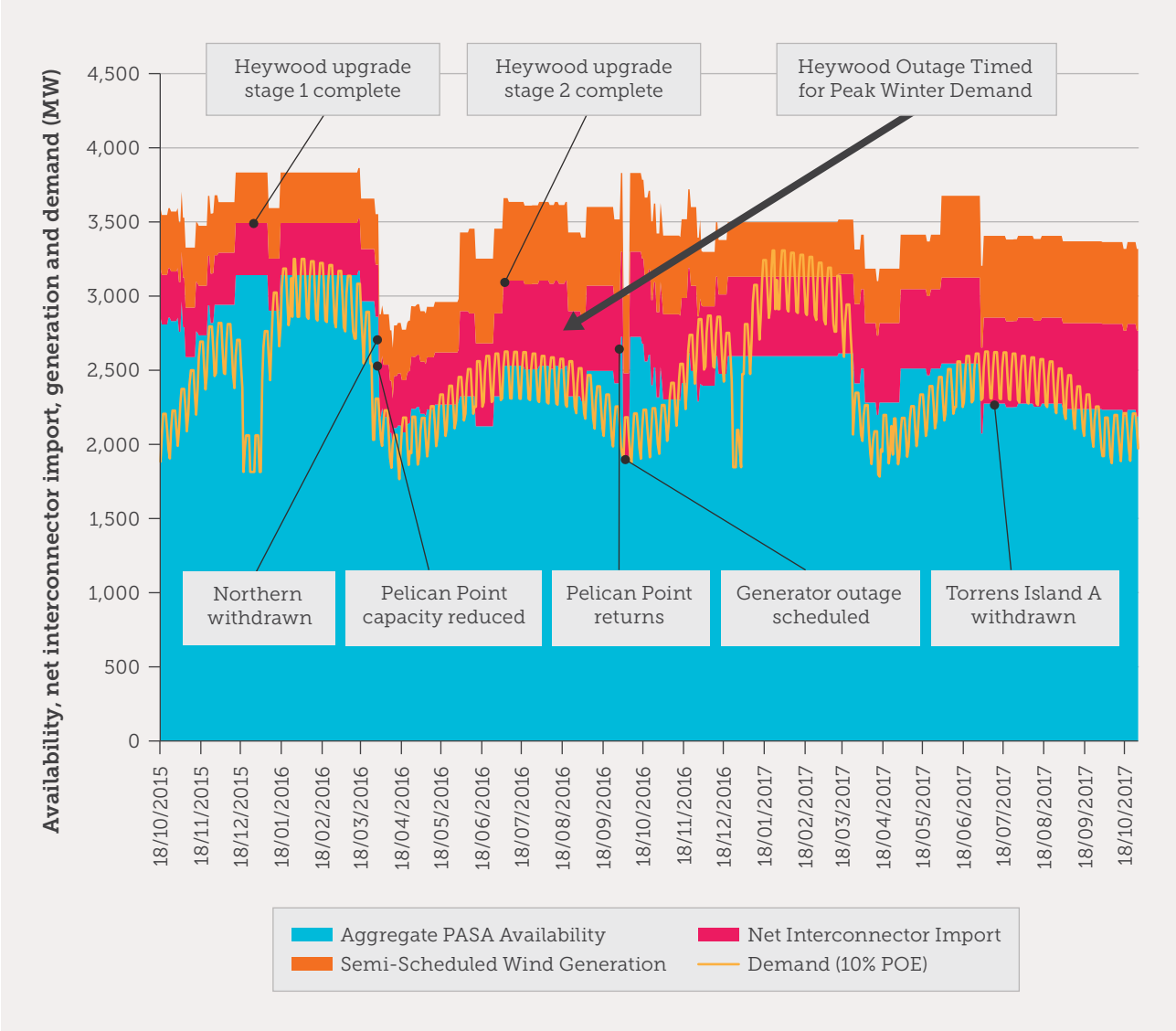


Figure 3 explained: This graph shows AEMO's forecasts for South Australian electricity supply and demand from 2015 to 2017 and highlights that Heywood Interconnector works were planned during forecast winter peak demand. The expected South Australian fossil fuel electricity supply is shown in blue ("Aggregate PASA Availability"), the forecast wind electricity supply is shown in orange, ("Semi-Scheduled Wind Generation") and the supply from interstate is shown in pink ("Net Interconnector Import"). The wiggly yellow line shows South Australia's forecast electricity demand.

Given their own analysis, it is surprising that AEMO allowed the works requiring the Heywood interconnector outage to take place at the time of its own forecast peak 2016/17 winter demand in South Australia. During this period, supply/demand, on AEMO's own forecasts, required both interconnectors to be available to moderate gas generators' competitive positions.

With South Australia's gentailers already holding significant market positions, removing competition in the form of the Heywood Interconnector for upgrade works at this time of peak winter demand, was a recipe for disastrous price outcomes.

It is concerning that lengthy regulatory reviews are undertaken to ensure capital costs of an interconnector upgrade can be justifiably passed onto consumers, but there seems to have been minimal regulatory or market operator oversight of the market conditions, and likely price outcomes, arising from the timing of the Heywood interconnector outage works. There is ample industry consultant capability to model market outcomes to have selected the best timing for the Heywood Interconnector outage to minimise the cost to South Australia consumers. This appears to not have been done.

Additional local gas generation capacity was made unavailable

During the most extreme demand days, and further exacerbating already tight supply conditions, AGL declared several of its Torrens Island gas power units, amounting to 570MW, "unavailable" for reasons that AEMO has not fully disclosed. The removal of further gas power capacity compounded already tight supply/ demand conditions in South Australia and enhanced the market position of the gentailers.

Torrens Island B Unit 3 was unavailable for the duration of 6 to 8 July, and Torrens Island A Units 1,3 and 4 were declared unavailable for periods during 6 to 7 July (AEMO 2016b; Figure 4).

Better planning and timing for the Heywood Interconnector works could have dramatically reduced the impact on electricity prices in South Australia.

Exacerbating already tight supply conditions, AGL declared several of its Torrens Island gas power units "unavailable" during the most extreme demand days.

Figure 4: Torrens Island Power Station.

4. Outcomes

Tight electricity supply and demand conditions

Putting all of these circumstances together: (i) the existing market power of the gentailers in South Australia; (ii) peak winter demand conditions; (iii) mothballing of Pelican Point; (iv) unanticipated removal of further generation capacity (parts of Torrens Island, Figure 4), and without the competition from Victorian supply through the Heywood Interconnector; South Australia's gas generators gained extraordinary pricing power (Box 1).

BOX 1: THE PERFECT STORM: A TIMELINE OF KEY EVENTS CONTRIBUTING TO HIGH PRICES IN SOUTH AUSTRALIA

2014	- Engie reduces capacity of Pelican Point power station by half
2016	- Engie mothballs all of Pelican Point for winter
May 2016	- Alinta shuts down Playford and Northern coal-fired power stations
July 2016	- Planned Heywood Interconnector outage during winter peak demand
6-8 July	- Torrens Island B unit 3 unavailable
6-7 July	- Torrens Island A units 1, 3 and 4 unavailable

Sources: Adelaide Now 2014; AEMO 2015; Alinta 2015; AEMO 2016b.

In the week of 7 - 14 July, a quarter of the capacity available under normal conditions was not available to South Australia (Table 1). There were times when up to 40% of the capacity was not available (1,498MW).

Table 1: Power capacity available in the week 7 - 14 July compared to maximum capacity. **Source:** AEMO 2016a, 2016b.

Source	Maximum capacity (excluding wind) (MW)	Capacity available in the week 7 - 14 July 2016 (MW)
Heywood interconnector	450	0
Murraylink interconnector	220	220
Gas generation	2716	2238*
Diesel generation	264	264
Total	3650	2,722

*AGL withdrew up to a further 570MW of Torrens Island capacity at times.

Without the Heywood Interconnector, two companies - AGL and Origin - control 80% of gas power generated in South Australia.

Under these conditions, four gentailers - AGL, Origin, Energy Australia and Engie - control 100% of the gas power generated in the state. Just two gentailers - AGL and Origin Energy - control 80% of the gas power generated (Figure 5).

The lack of competition in South Australia and the resultant impact on wholesale and retail electricity pricing is a recurring theme in reports from the Australian Energy Market Commission and Australian Energy Regulator over the years since early 2000's. Little appears to have changed as market analysis by Climate Council and others (eg Carnegie Mellon SACOSS 2013; SACOSS 2015 RenewEconomy 2016c; Melbourne Energy Institute 2016) demonstrates continued evidence of market power being exercised in the South Australian wholesale electricity market.

Figure 5: South Australian electricity demand and supply. **Source:** Adapted from Melbourne Energy Institute 2016 and AEMO 2016a.

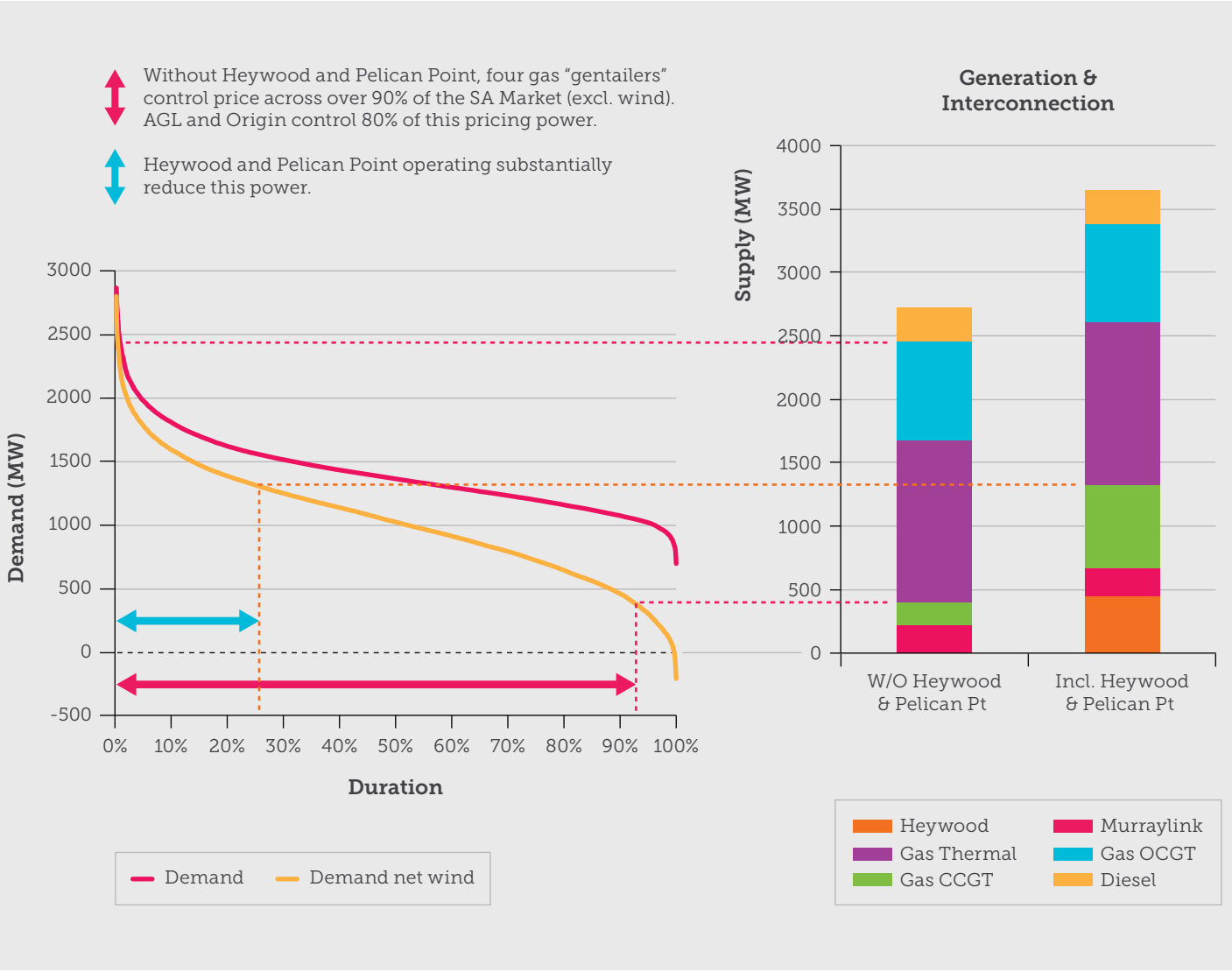


Figure 5 explained: This graph shows the range in South Australia's electricity demand and the contribution of wind power and the need for gas power and interconnection. For example, while wind makes a substantial contribution, around 10% of the time there is a need for around 1,500MW of additional gas plant capacity and interconnection to meet demand.

The lowest red dashed line shows that when the Heywood Interconnector and Pelican Point power station are unavailable, all other gas generation sources (owned by a small number of gentailers) are needed to meet South Australia's electricity demand.

There were 24 price spikes above $10,000/MWh on 7 July 2016 - this is a record for Australia.

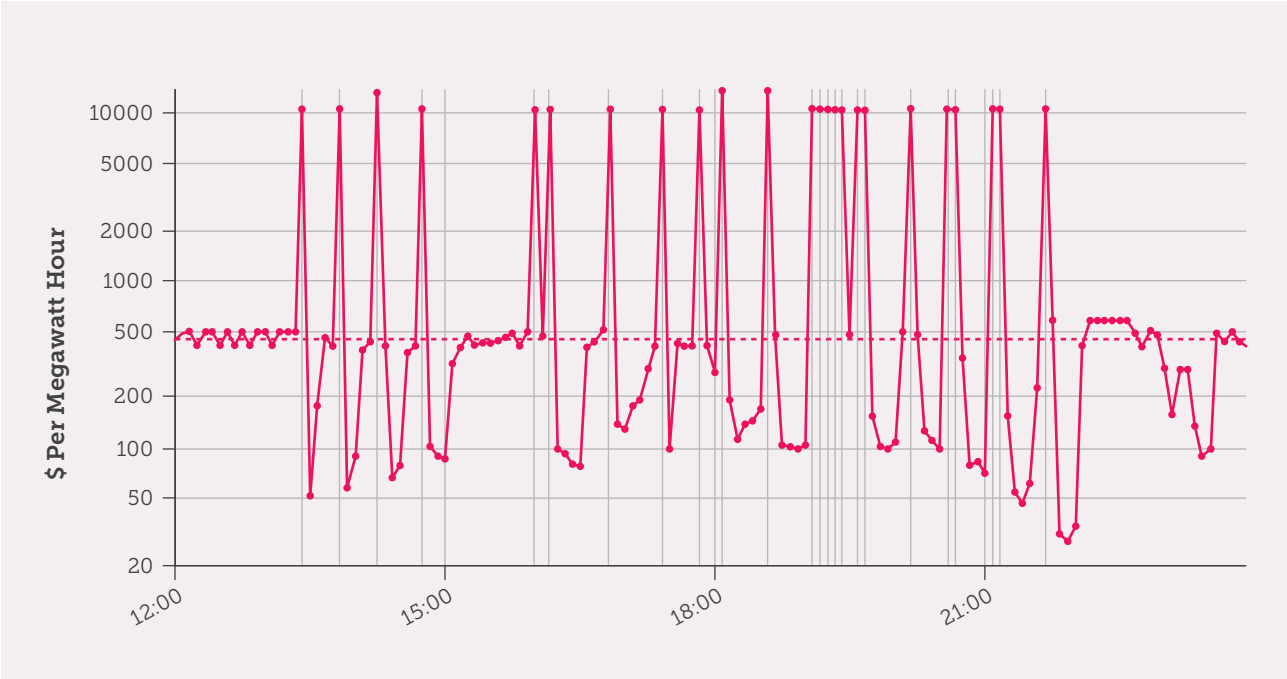
Bidding behavior of the gentailers designed to maximize profits

The week of 7 - 14 July saw frequent extreme price events and major volatility in bid prices (for example, Figure 6). Gas power generators bid prices as high as $14,000/MWh into the market, and varied their supply by several hundred MW within minutes in numerous half hour periods as Figure 6 shows.

When gas plants ramp up and down like this (as shown in Figure 7), it is usually to use the market situation to drive higher prices – that is gas generators are "price setters".

Price spikes appear to occur consistently at 5 minutes in and 10 minutes in to each half hour interval. The total number of price spikes above $10,000/MWh on 7 July 2016 was 24 - a record for Australia (RenewEconomy 2016b).

Figure 6: South Australia 5 Minute Prices ($/MWh) from Midday to Midnight on 7 July. **Source**: Adapted from Melbourne Energy Institute 2016.



Note: AEMO averages these 5 minute prices each 30 minutes to determine the settlement price.

Figure 6 explained: This graph provides a snapshot on 7 July 2016 of bidding behaviour and large price fluctuations in South Australia. The Y axis shows prices moving from >$10000 to $50 in some cases within 5 minutes, and back again to $10,000 or more within the half hour.

With peak demand conditions, limited competition from the Heywood Interconnector outage, and the removal of some Torrens Island gas capacity, South Australia's gentailers ramped their plants up and down to deliver extreme power prices.

Figure 7: Gas electricity generation from Midday to Midnight on 7 July. **Source**: Adapted from Melbourne Energy Institute 2016.

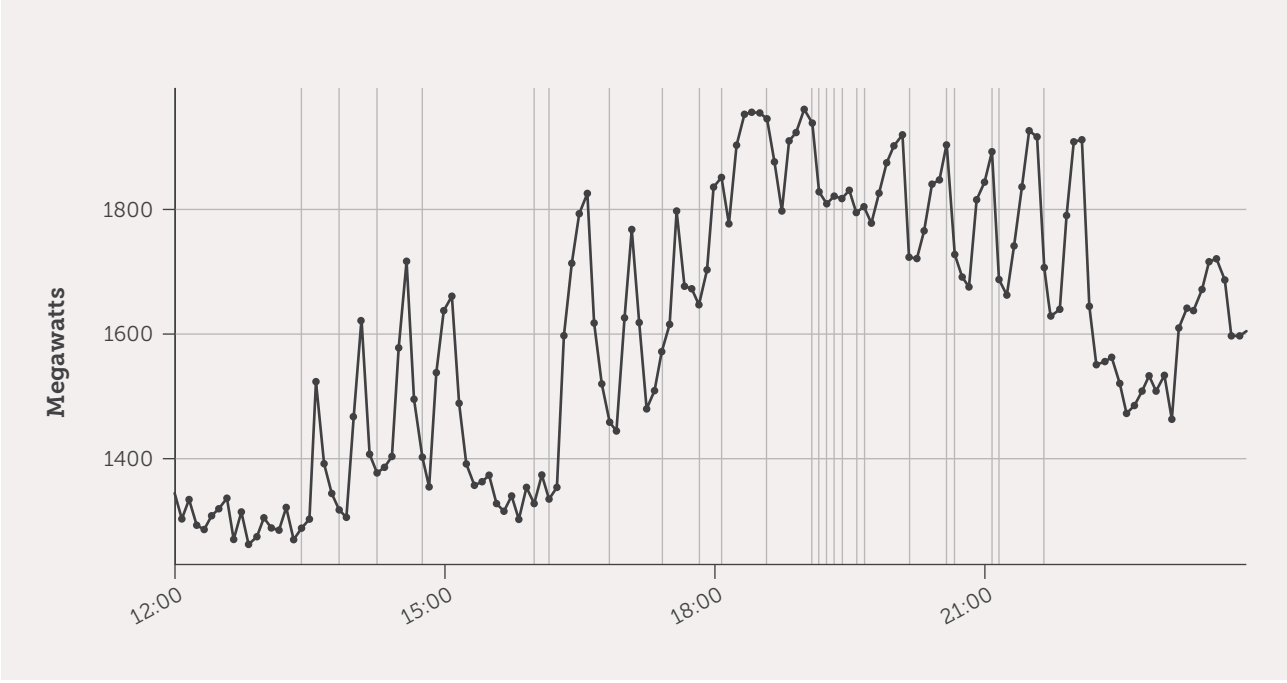


Figure 7 explained: This graph provides a snapshot on 7 July 2016 of gas power plants ramping production up and down by several hundred MW.

The Australian Energy Regulator (2016) and AEMO (2016b) have examined the reasons for prices on some of the July days (see key extracts in Appendix 1). The planned outage on the Heywood Interconnector, the "non-availability" of up to 720MW of gas generation plant over 6 to 8 July, and low wind generation created the tight supply conditions that allowed the gentailers to set such high prices. Most of the price spikes resulted from the way generators bid so that minor increases in demand would trigger price spikes.

> *"Rebidding from lower priced bands to higher priced bands occurred in 17 of the high priced DIs [dispatch intervals]. For these DIs, up to 397MW of generation capacity was re-bid from the Market Floor Price of -$1,000/MWh to bands priced at $10,580.20/MWh or above."*
> - AEMO 2016b

The theory of market design for the National Electricity Market is that generators will compete and offer prices at or close to their short run costs of generation to ensure they get dispatched while covering costs and earning a return.

In the period 7-14 July, even though gas costs were high ($15 to $20/GJ) during these days, resulting in high marginal generation costs ($200 to $300/MWh), it appears that lack of competition and capacity withdrawal by AGL and Engie created ideal conditions to maximise price margins. These typical gas generation costs in the period show that bidding strategies such as margin maximisation drove the exceedingly high gas generator prices, rather than generators competing on cost.

Regulators have long been concerned about the impact of price volatility caused by late re-bidding by electricity generators (ESCOSA 2003; QPC 2016; RenewEconomy 2016d). The AEMC (2015) observed in its 2015 review of the Bidding in Good Faith rule governing generator bidding behaviour:

> *"Price volatility caused by deliberately late rebidding has the potential to inflate the value of financial hedge contracts. Participants can be effectively compelled to buy hedges at a higher than normal price, or be exposed to wholesale prices that are also higher and less predictable than normal. They may be forced to pay more either way – through wholesale prices or contracts.*
>
> *This may result in higher costs being passed through to consumers – both households and industry."*
> - AEMC 2015

It is unclear from information publicly available whether prolific SA gas generator re-bids during the Heywood outage met the requirements of the new AEMC Bidding in Good Faith rule (which commenced on 1 July 2016). What is undeniable is that major re-bidding took place resulting in dramatic price increases at a time when SA gas generators were able to exercise substantial market power.

The bidding behaviours of the gentailers do warrant review by regulators given the major financial impact on South Australian consumers described below.

Profit margin maximisation strategies appear to have driven exceedingly high gas generator prices, rather than generators competing on cost.

Electricity price impacts

The following figure shows the stark contrast in electricity prices between the week where the Heywood Interconnector was offline (7 - 14 July) compared with the period directly after the Heywood Interconnector returned to full service (22 – 28 July) (Figure 8).

Electricity demand characteristics (average, peak and load shape), and wind generation as a percentage of supply, were very similar between these two periods. Apart from the dramatic differences in pricing, the only physical differences between the two periods are the conditions described above - the removal of the Heywood Interconnector and additional Torrens Island capacity in the week of 7 - 14 July. This demonstrates how much lower prices (and volatility) were in South Australia once the interconnector returned, bringing more competitive conditions.

Figure 8: Electricity price versus demand - when Heywood Interconnector restricted (and gentailers have limited competition) and after Heywood Interconnector operations re-established. **Source:** Adapted from AEMO 2016c.

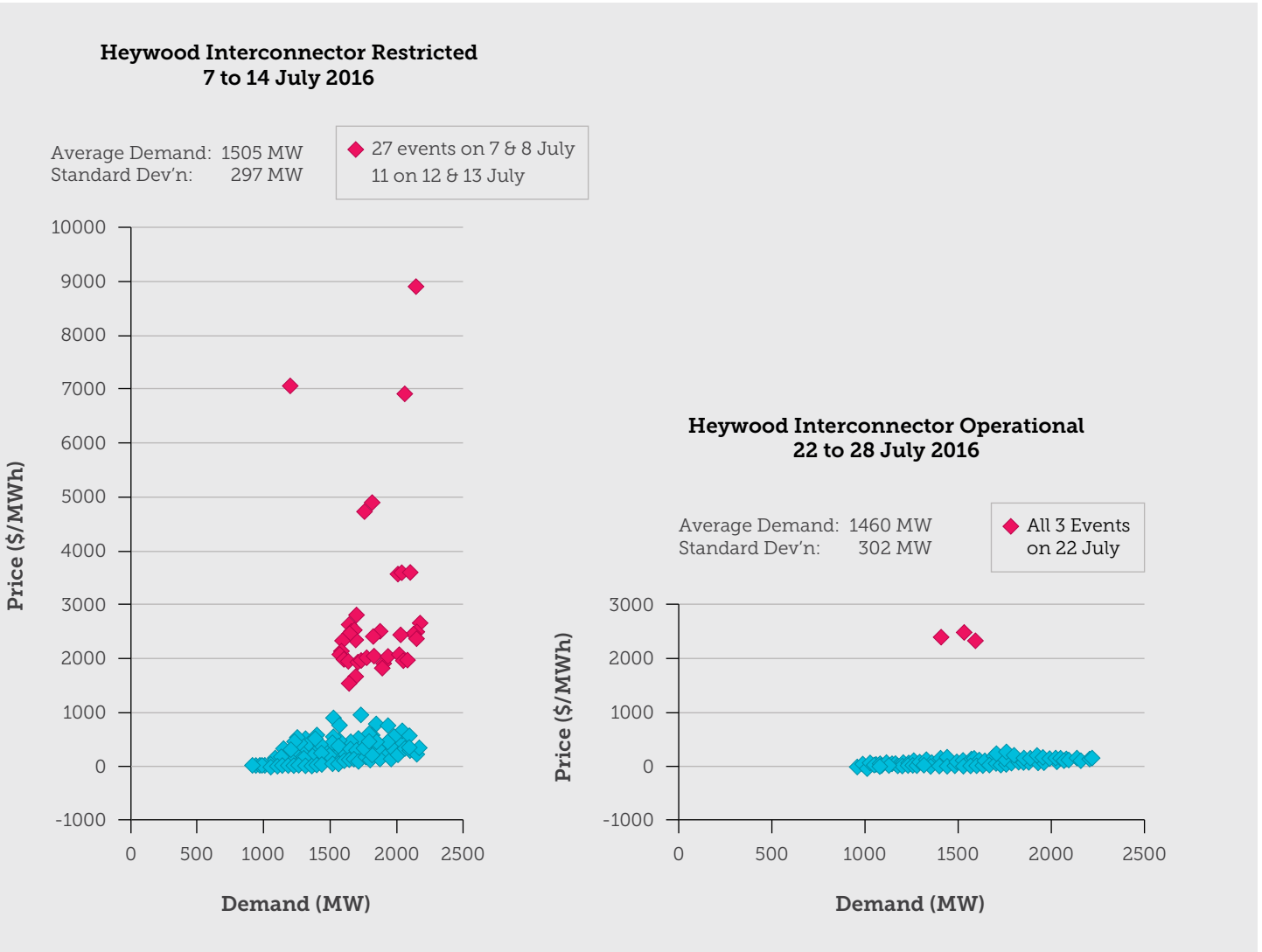


Figure 8 explained: These two graphs contrast electricity prices when the Heywood Interconnector was unavailable (7 - 14 July) and the period directly following when the Heywood Interconnector returned to service (22 - 28 July). These two graphs show the positive impact of competition from the interconnector - keeping prices lower and less volatile, and shows the volatility and high prices that occurred when the gas plants had limited competition.

Analysis shows that South Australia's gas generators earned about $178 million in net margin during the high priced events over 1 to 18 July, while part of this margin may have been offset by financial hedge contracts, smaller electricity retailers and large industrial consumers could still have been significantly exposed to these costs (Table 2).

Taking into account the original acquisition or construction costs of the power stations involved, the net (pre-hedge) margins reflect annual returns ranging from 20% to 40%+ in just eighteen days (Table 2). While it may be argued the assets are high risk, by any measure, these are very high rates of return captured in one fortnight reflecting the strong market position of owners.

Table 2: Price margins in July and asset values.

Owner	Asset	Original Cost - Purchase (P) or New (N) (**)	Estimated Written Down Value	July 1 – 18 Net Margin (*)	Estimated Return
		($ million)	($ million)	($ million)	(%)
AGL	Torrens Island	417	250	97	39%
Origin	Ladbroke Grove	65	30	8	27%
Origin	Quarantine	170	105	22	21%
Origin/ATCO	Osborne	175	70	28	40%
EA	Hallett	117	78	14	18%
Engie	Mintaro (includes Dry Creek)	39	20	9	75%

Note: The Original Costs above are undepreciated. The actual carrying value of all of these assets will be lower in company accounts as they are depreciated over their useful lives. As an estimate, tax depreciation rates assuming useful lives of 30 years have been used to calculate Estimated Written Down Values.

Net Margins are before any intra-company or third party hedges.

Data sources: (*) RenewEconomy 2016c, (**) Asset values sourced from: Boral 1999a; Boral 1999b; South Australia Department of Treasury and Finance 2000; Origin Energy 2007; SMH 2007.

South Australia's gas generators earned around $178 million in net (pre-hedge) margin during the July high price events.

If gentailers pass on these high wholesale electricity prices to consumers through future hedge contract price increases and higher retail tariffs, it could amount to triple South Australia's $63 million share of the Heywood Interconnector expansion capital cost.

Futures market price trends show the price spikes in July 2016 are now reflected in the futures market through a $15/MWh to $20/MWh increase in the strike price of a base electricity contract for 2017 (Asxenergy 2016). If these increases were to be applied across the whole South Australian market, it would add around $200 million to consumers' electricity costs next year. The gentailers, owning both generation and retail businesses will likely seek to pass these higher wholesale prices on to contract and retail electricity tariffs in South Australia.

Between them, the four gas power gentailers hold around 90% of the retail electricity consumers (SACOSS 2015) in the state.

Industrial and commercial customers, and other smaller retailers, who had not been able to purchase forward contracts to reduce their exposure to high prices were severely impacted. The very concentration of gas generation capacity in the hands of the major retailers in the state, which led to the extreme prices, also created conditions that made it difficult for large users and competing retailers to manage their electricity supply risk. Large South Australian industrial customers were significantly impacted (The Advertiser 2016b).

Other smaller retailers operating in South Australia were unable to limit the price impacts or compete by offering lower prices as they do not own in-state power plants and were not able to take out "hedge" contracts with Victorian generators to reduce their price risk given the unavailability of the Heywood Interconnector.

5. Solutions

What solutions are available to address the electricity price situation in South Australia?

The key to reducing electricity prices in South Australia is to reduce the state's reliance on expensive gas and to increase competition.

Is more gas a solution to the price problem?

Some have suggested the solution to South Australia's pricing issues is more gas-fired power. However, now that Australian gas prices are linking to export LNG markets (and oil prices), more gas generation in SA will only serve to underpin continuing higher power costs in the state and higher volatility.

New, efficient combined cycle gas plants are unlikely to offer competitive power prices given high gas export prices. Two of the most efficient combined cycle plants South Australia and Queensland have been mothballed and owners have sold their gas into LNG export markets.

Further, the parties in the best commercial position to plan for new gas power stations are the major incumbent gentailers in South Australia who already control the existing gas power plants, have major gas supply and transportation contracts, and are the major players in the power (and gas) retail markets.

It is also important to note that over 50% of South Australia's gas generation capacity is over 40 years old (Table 3). Once generators reach this age, the risk of plant failure increases through reliance on obsolete technology. One of the two major gas pipelines supplying these power stations is also nearly 50 years old, adding to supply risks.

More gas generation will only continue higher electricity prices and higher volatility in South Australia.

Table 3: Age of South Australia's Gas Power Plants.

Name	Year Commissioned	Age (Years)	Capacity (MW)	Technology
Torrens Island A	1967	49	4 x 120	Rankine
Torrens Island B	1976	40	4 x 200	Rankine
Dry Creek	1973	40	3 x 52	OCGT
Hallett	2001	35	9 x 17, 3 x 25	OCGT
Mintaro	1984	32	90	OCGT
Osborne	1999	17	1 x 118, 1 x 62	CCGT
Ladbroke Grove	2000	16	2 x 40	OCGT
Pelican Point	2001	15	2 x 239	CCGT
Quarantine	2001 -2, 2009	15, 7	4 x 24, 1 x 128	OCGT

Sources: AGL 2016; Energy Australia 2016; Industcards 2016.

Action on climate change requires South Australia (as well as the rest of Australia) to continue the transition away from fossil fuels and to renewable sources of power. This means phasing out coal and gas power.

Over 50% of South Australia's gas generation capacity is over 40 years old, with increasing risk of plant failure.

Gas power is sometimes considered a transition fuel, with lower emissions intensity than coal-fired power, and able to ramp up and down to support increased levels of intermittent renewable energy. However, methane leaks associated with natural gas production, particularly from unconventional gas sources like coal seam gas and shale gas, as well as transportation, may cancel-out emissions reductions compared with coal (methane being a more potent greenhouse gas than carbon dioxide) (SMH 2016).

More renewable energy, increased interconnection and in-state fast response energy storage in South Australia will reduce the market power of the gentailers.

Increased competition is needed for South Australia

The solution to SA's dilemma lies not on increasing reliance on yet more high priced gas, but in developing more supply competition from renewable energy sources, and increasing diversity of supply.
This means:

- More low cost renewable energy from a diverse range of sources - increased solar photovoltaic and solar thermal power have roles to play, in addition to more wind.
- Increased interconnector capacity, for example by adding a third link to New South Wales.
- Encouraging in-state fast response energy storage and demand management (for large energy users).

Collectively, these initiatives will go a long way to abating the current market power of the gas based "gentailers" in the state (provided they are not the ones who also control these new supply sources).

National Electricity Market changes are needed

South Australia is at the forefront of initiatives in Australia to reduce emissions from its electricity supply.

The nation's electricity system was not built without a great deal of coordinated planning. The relatively recent market-based system has been in place for only the last 15 years or so, and was predicated on continued growth in demand met by fossil fuel supply from centralised generation.

The world is changing rapidly and it is an appropriate time to review some of the core tenets of the current market based system. Carbon emissions control should be a key objective written into the existing National Energy Market objectives to guide future decision and rule-making for the industry.

The National Electricity Market currently only provides payment for electricity provided (that is, it is an "energy only" market). There is no alternative payment or incentive structure to support reserve generation capacity (capacity that is available and can be turned on to meet supply in conditions like those that recently occurred in South Australia). As Australian states and territories transition to greater shares of intermittent solar and wind energy, batteries and other forms of storage will play an increasingly important role in providing reserve capacity and other essential technical services, like frequency, voltage control, and inertia. These services will need to be valued in an alternative way by the market, such as a capacity payment mechanism, to avoid the price extremes that South Australia has seen. The AEMC has already ruled that retail consumers should bear more of the network capacity costs used infrequently at times of extreme demand, through fixed capacity type payments.

6. Conclusion

Gas generator market concentration, market power, and tight supply and demand during a period without interconnection to Victoria (and resulting competition) are the principal reasons for recent extreme price events in South Australia.

Some key questions need to be answered. In the near term, regulators should review:

- How the gentailers exercised their market power, specifically their bidding activities and the removal of Torrens Island capacity during the period of the Heywood interconnector outage and whether any steps should be taken in respect of such conduct, and

- Why the electricity market operator and regulators allowed the planned Heywood Interconnector outage to take place at the same time AEMO's own long term forecasts showed it was needed for peak winter demand.

Appendix 1
- Key Extracts from Australian Energy Regulator (2016) and AEMO (2016b) Reports

AEMO (2016b) 6 - 8 July:

"Rebidding from lower priced bands to higher priced bands occurred in 17 of the high priced DIs [dispatch intervals]. For these DIs, up to 397 MW of generation capacity was re-bid from the Market Floor Price of -$1,000/MWh to bands priced at $10,580.20/MWh or above."

AER on 6 July:

- 1pm $2065/MWh - *"Actual prices, however, were higher ... due to rebidding of capacity from low to high prices during a time of tight supply conditions."*
- 5pm $2375/MWh, 5.30pm $2139/MWh, 6.30pm $2229/MWh *"there was little capacity available priced between $300/MWh and $10 000/MWh. With all lower priced capacity either fully dispatched or ramp rate limited the dispatch price spiked once in each interval when there was a minor increase in demand."*

AER on 7 July:

- 9am $1917/MWh - *"Price was less than that forecast four and 12 hours ahead due to ... rebidding which increased the overall level of low priced capacity."*
- 9.30am $1819/MWh - *"there was no capacity priced between $500/MWh and $11 000/MWh. The actual price was higher ....as a result of an increase in actual demand."*

AER on 8 July:

- 7.30am $2513/MWh, 8am $2061/MWh - *"Capacity offers were such that there was only around 45MW priced between $500/MWh and $12500/MWh so small changes in market conditions could have a significant impact on price. At 7.30 am there was a 40MW increase in demand and with low-priced capacity either fully dispatched the dispatch price reached $13 330/MWh. At 7.55 am a 65MW increase in demand resulted in a $10 758/MWh price."*
- 8.30am $2062/MWh - *"price was lower than forecast due to rebidding of capacity from high to low prices by Engie, Energy Australia, AGL and Origin."*
- 6pm $2531/MWh - *"Generators bids were such that there was only around 50 MW of capacity priced between $500/MWh and $12 500/MWh meaning small changes in market conditions could have a significant impact on price. The ... rebidding and a 51MW increase in demand at 6 pm saw the dispatch price reach $13 338/MWh at 6 pm."*
- 7pm $1971/MWh, 7.30pm $1960/MWh – *"The 6.30 pm to 7.30 pm spot prices were lower than forecast due to rebidding."*

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