



Electricity spot prices above \$5000/MWh

**New South Wales,
9 February 2017**

27 April 2017

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AER Reference: 61695-D17/19772

Amendment Record

Version	Date	Pages
1 version for publication	27 April 2017	21

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1 Obligation

The Australian Energy Regulator regulates energy markets and networks under national legislation and rules in eastern and southern Australia, as well as networks in the Northern Territory. Its functions include:

- monitoring wholesale electricity and gas markets to ensure energy businesses comply with the legislation and rules, and taking enforcement action where necessary;
- setting the amount of revenue that network businesses can recover from customers for using networks (electricity poles and wires and gas pipelines) that transport energy;
- regulating retail energy markets in Queensland, New South Wales, South Australia, Tasmania (electricity only), and the ACT;
- operating the Energy Made Easy website, which provides a retail price comparator and other information for energy consumers;
- publishing information on energy markets, including the annual State of the energy market report, to assist participants and the wider community.

The AER is required to publish a report whenever the electricity spot price exceeds \$5000/MWh in accordance with clause 3.13.7 (d) the National Electricity Rules.

The report:

- describes the significant factors contributing to the spot price exceeding \$5000/MWh, including withdrawal of generation capacity and network availability;
- assesses whether rebidding contributed to the spot price exceeding \$5000/MWh;
- identifies the marginal scheduled generating units; and
- identifies all units with offers for the trading interval equal to or greater than \$5000/MWh and compares these dispatch offers to relevant dispatch offers in previous trading intervals.

These reports are designed to examine market events and circumstances that contributed to wholesale market price outcomes and are not an indicator of potential enforcement action.

2 Summary

On 9 February 2017, the spot price in New South Wales exceeded \$5000/MWh for the 5 pm trading interval, reaching \$7822/MWh. Pricing outcomes in New South Wales were directly related to intervention by the market operator (AEMO) for events in South Australia. This action triggered special pricing arrangements across the National Electricity Market (NEM). The AER has separately reported on the events in South Australia.¹

AEMO intervened in the market by directing Engie to start and run extra generation at Pelican Point Power Station in South Australia to manage power system security in that State. The market design includes special pricing arrangements that apply when the market operator intervenes in this way (known as “What-if” pricing). These arrangements affect prices for all electricity services across all regions in the NEM. “What-if” pricing determines the price that would have applied had Pelican Point not been directed to increase its output. This price preserves signals to market participants regarding the value of generator availability and long term investment in new capacity.

The “What-if” pricing process determined that electricity prices in New South Wales would have been high had Pelican Point in South Australia not been directed by AEMO.

¹ https://www.aer.gov.au/wholesale-markets/market-performance?ff01=field_accr_aer_report_type%3A310

3 Analysis

To calculate the amount of electricity that must be supplied, or generated, AEMO collects information about: network capability and offers from market generators and calculates expected (forecast) demand from customers. Generator offers comprise the mega-watt (MW) capacities generators are willing to supply at a price point and the amount the generator can generate in total (generator availability). AEMO publishes regular forecasts of its assessment of the demand for electricity in each region of the market based on a range of external inputs such as temperature.

Market conditions are dynamic and to inform market participants AEMO balances generator offers compiled by AEMO against forecast demand, and publishes aggregated expected and actual dispatch information, price and network loadings at five minute and 30 minute intervals for the remainder of the day. These forecasts also form the basis for AEMO’s recommendations with respect to interconnector capacity, transfers between regions, reserves and conditions that relate to power system security.

The first forecast, or pre-dispatch run, for a trading day is prepared at around 1 pm the previous day and is updated every half hour, taking into account: changes in demand; network capability; and participant bids and rebids. AEMO also produces a more granular, 5 minute, pre-dispatch forecast for the next hour. The accuracy and timeliness of this information is critical to allow participants to make informed commercial decisions

Table 1 shows, the actual and forecast wholesale price, known as the spot price, electricity demand and generator availability for the 4.30 - 5.30 pm trading periods. The spot price exceeded \$5000/MWh for the 5 pm trading interval. The analysis extends to other trading intervals as they are relevant to the conditions that occurred in the afternoon of 9 February 2017.

Network availability has not been included in the analysis as it shows what actually happened on the network once the direction was issued. “What-if” pricing is calculated as if the direction did not occur so the two cannot be related.

Table 1: New South Wales actual and forecast spot price, demand and availability

Trading interval	Spot Price (\$/MWh)			Demand (MW)			Generator Availability (MW)		
	Actual	4 hr forecast	12 hr forecast	Actual	4 hr forecast	12 hr forecast	Actual	4 hr forecast	12 hr forecast
4.30 pm	2559	300	11 077	12 516	11 715	11 755	13 173	13 087	12 999
5 pm	7822	300	11 697	12 601	11 797	11 765	12 573	13 130	12 968
5.30 pm	2830	190	300	12 452	11 638	11 565	13 025	13 187	12 962

Spot prices above \$5000/MWh were forecast 12 hours prior to the 4.30 pm and 5 pm trading intervals but high prices were not forecast four hours ahead.

Events in South Australia at this time are also relevant to price outcomes in New South Wales. AEMO directed Engie to start another unit at Pelican Point Power Station in South Australia. Under these circumstances AEMO must declare an Intervention Pricing event, which affects prices in all regions (pricing during an intervention is explained in Appendix D).

For the 5 pm trading interval, New South Wales forecasts, four and twelve hours ahead, under-estimated demand by around 800 MW and generator availability was around 560 MW lower than forecast four hours ahead. This meant that forecast conditions four hours ahead were in error by around 1360 MW, or close to the reserve margin, of around 1400 MW, that would trigger AEMO to issue a lack of reserve notice.² We note that price forecasts four hours ahead were materially lower, primarily because of higher declared generator availability at that time.

“What-if” pricing occurred from 3.50 pm until 7 pm, the same as it was in South Australia. AEMO’s intervention in South Australia triggers “what-if” pricing in all regions and as shown in Table 1, three spot prices in New South Wales were materially higher than forecast four hours ahead. Other spot prices, in the period were also affected but not materially.

Table 2 below shows both “Intervention” and “What-if” pricing outcomes for New South Wales during the 5 pm trading interval in which the spot price reached \$7822/MWh.

Table 2: “What-if” and Intervention pricing outcomes

Dispatch period ending time	What-if pricing (\$/MWh)	Intervention pricing (\$/MWh)
4.35 pm	1227	120
4.40 pm	345	214
4.45 pm	3905	213
4.50 pm	13 999	300
4.55 pm	13 999	221
5 pm	13 458	148

3.1 AEMO intervention in South Australia

On 9 February AEMO chose to intervene in South Australia by directing Pelican Point Power Station to provide additional generation. This was based on predicted shortfalls in spare capacity, from generators within South Australia and from neighbouring regions across the interconnectors, to maintain for system security if an unplanned failure were to occur. The AER has separately reported on the events in South Australia.

Special pricing arrangements apply following an intervention in the market. In this case, because no customer load in New South Wales was interrupted, “What-if” pricing was applied to maintain market price signal by determining prices as if no action had been taken. Under the Rules when this occurs all regions in the National Electricity

² Appendix E: includes a discussion of Lack of Reserves

Market (NEM) are covered by the special pricing arrangements. These arrangements are explained in Appendix D.

Relevant market notices issued by AEMO on the intervention are in Appendix F.

3.2 Supply and Demand

Participants in the NEM are free to choose the amount of electricity or capacity (MW) they offer for each of their generators for dispatch into the market and the price they are prepared to accept (\$/MWh) for the energy produced. A participant's offer comprises 10 price and MW pairs. AEMO aggregates all generator offers, from lowest to highest price, and network transfer capabilities and dispatches generation in order to meet its forecast of the demand for electricity in a state every 5 minutes.

This section discusses changes to the offered prices, capacity and market demand conditions relevant to the high price periods.

As a note of caution - The values included in the following section are inputs that AEMO would use for calculating dispatch targets, not necessarily those that would have been used for "what-if" pricing. For this reason the report will only highlight high level supply and demand conditions as specific changes in these variables cannot be directly attributed to movements in price.

3.2.1 Generation offers

Each generator is obliged to provide an initial offer to AEMO by midday the preceding day. Figure 1 shows the cumulative initial offers for generators in New South Wales aggregated by price against the conditions forecast at the time. Specifically, it shows the aggregated initial offers for New South Wales generators (stacked area), the total New South Wales generator dispatch (orange line) and spot price (purple line) that would have occurred to satisfy the forecast demand (blue line). It highlights the day a head forecast high prices above \$5000/MWh for the 4.30 - 5 pm trading intervals.

Figure 1: New South Wales generator opening bids

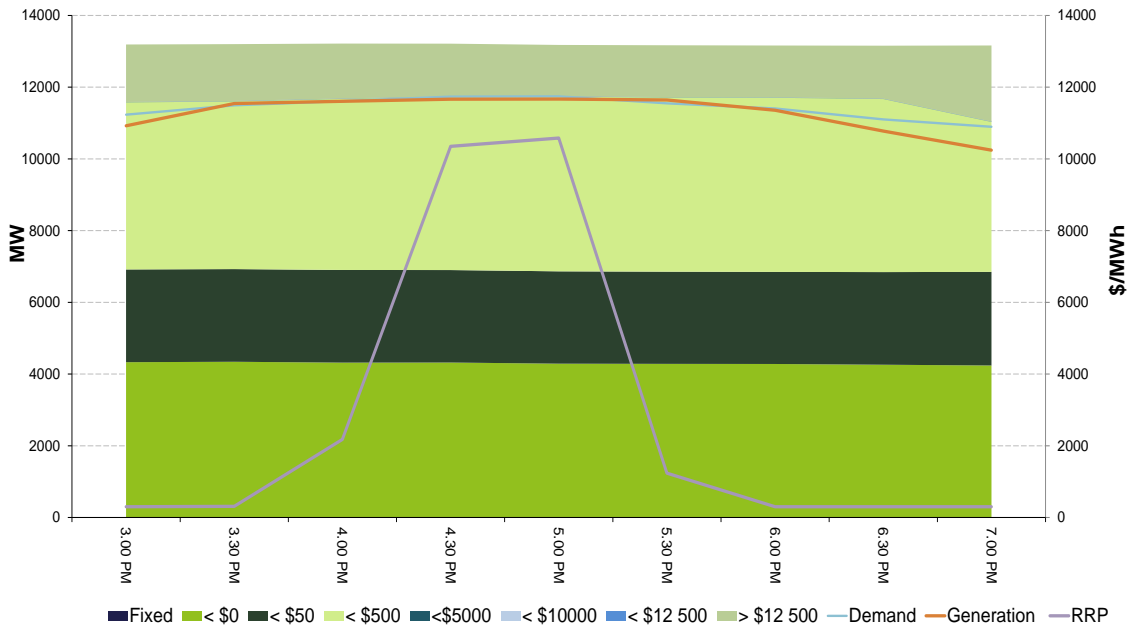


Figure 2: New South Wales generator closing bids

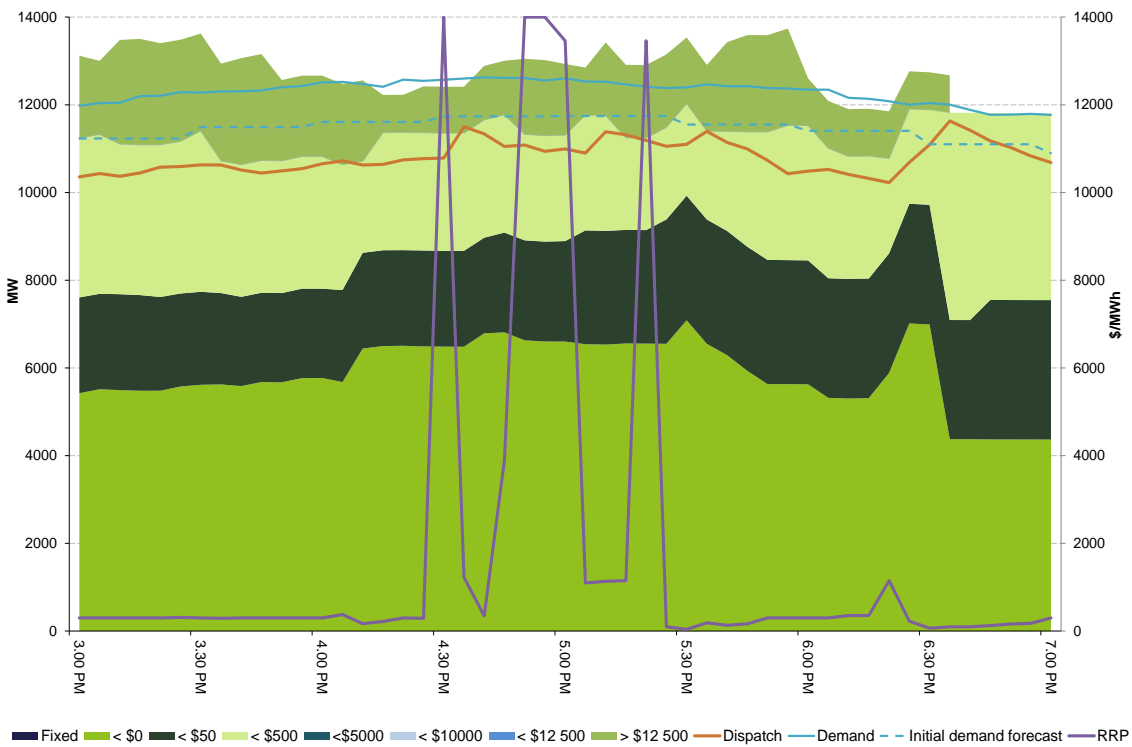


Figure 2 shows the cumulative offers for generators in New South Wales that were in place at the time of actual dispatch, also known as closing bids, at a five minute resolution. The forecast and actual demand are also shown in Figure 2.

Generators may change their offers to suit their changing economic or physical position as the day unfolds. Generators change their offers by submitting rebids. The

figure shows, the dispatch price (purple line), demand (blue line), forecast demand (dashed blue line) and total local generation dispatch (orange line).

Both figures highlight that there was no capacity available between \$500/MWh and \$12 500/MWh for both opening and closing offers. Furthermore, on the basis of closing offers for the 5 pm trading interval, only 30 MW was priced between the forecast price four hours prior (\$300/MWh) and \$13 000/MWh.

The decrease in the top green section during the 5 pm trading interval coincides with a rebid by Snowy Hydro removing 667 MW of supply from its Colongra Power Station. Snowy’s rebid included a rebid reason “avoiding an uneconomic start”. This rebid removes 667 MW of supply capacity priced at the market price cap (\$14 000/MWh).

Origin Energy also removed 270 MW of supply in a rebid for its Eraring Power Station during the 5 pm trading interval which had been priced at less than \$300/MWh. The reason given related to cooling water management.

3.2.2 Demand

In Sydney on 9 February 2017, the temperature reached 31 degrees, slightly higher than forecast.

Figure 3 shows the actual half hourly demand (blue line) and the four hour (red line) and twelve hour (green line) demand forecasts produced by AEMO for the afternoon. As shown below, demand across the day was consistently higher than forecast. During the 5 pm trading interval demand reached its peak for the day (12 601 MW).

Figure 3: New South Wales forecast vs actual demand

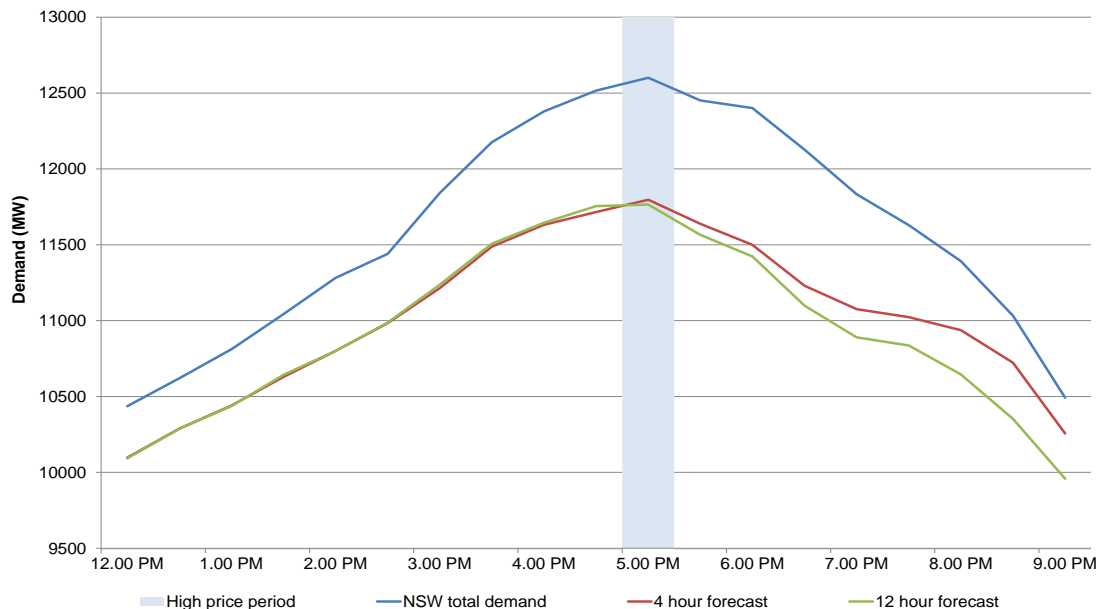
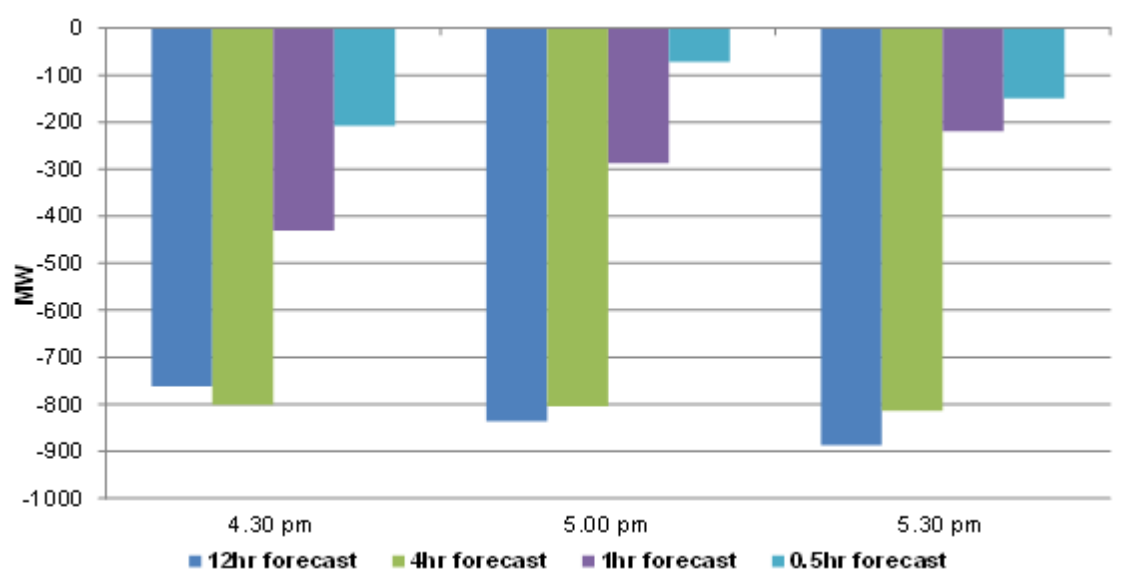


Figure 4 highlights the difference in actual and forecast demand for the high price periods. Demand, for the 5 pm trading interval, was around 800 MW higher than forecast both four and twelve hours prior. Forecasts half an hour ahead were only around 70 MW higher than actual.

Figure 4: Demand forecast error



Given the large demand forecast error it is probable, although difficult to determine with precision, that if “what if” pricing had not occurred, the actual spot price would have been higher than what had been forecast.

Australian Energy Regulator

April 2017

Appendix A: Significant Rebids

The rebidding tables highlight the relevant rebids submitted by generators that impacted on market outcomes during the time of high prices. It details the time the rebid was submitted and used by the dispatch process, the capacity involved, the change in the price of the capacity was being offered and the rebid reason.

Table 3: Significant energy rebids for 5 pm

Submit time	Time effective	Participant	Station	Capacity rebid (MW)	Price from (\$/MWh)	Price to (\$/MWh)	Rebid reason
4.29 pm	4.40 pm	Snowy Hydro	Colongra	667	14 000	N/A	16:28:48 A avoid uneconomic start - expected srmr < srmc
4.43 pm	4.50 pm	Origin Energy	Eraring	-270	<300	N/A	1641P change in avail - cw management sl

Appendix B: Price setter

The following table identifies for the trading intervals in which the spot price exceeded \$5000/MWh, each five minute dispatch interval price and the generating units involved in setting the energy price. This information is published by AEMO.³ The 30-minute spot price is the average of the six dispatch interval prices. The prices shown are a result of the “what-if” pricing calculation.

Table 5: New South Wales price setter for the 5 pm trading interval

DI	Dispatch Price (\$/MWh)	Participant	Unit	Service	Offer price (\$/MWh)	Marginal change	Contribution
16:35	\$1227.45	Origin Energy	QPS2	Energy	\$13 160.01	0.04	\$526.40
		Origin Energy	QPS4	Energy	\$13 160.01	0.04	\$526.40
		Hydro Tasmania	CETHANA	Energy	\$83.62	0.95	\$79.44
		Hydro Tasmania	CETHANA	Lower reg	\$10.00	0.95	\$9.50
		Hydro Tasmania	DEVILS_G	Lower reg	\$10.00	-0.95	-\$9.50
		Hydro Tasmania	MACKNTSH	Raise 60 sec	\$2.39	-0.92	-\$2.20
		AGL Energy	LYA1	Raise 60 sec	\$0.20	0.92	\$0.18
16:40	\$344.81	Origin Energy	MSTUART2	Energy	\$311.00	1.11	\$345.21
16:45	\$3905.43	ERM Power	OAKY2	Energy	\$3500.69	1.12	\$3920.77
16:50	\$13 999.00	Snowy Hydro	TUMUT3	Energy	\$13 999.00	1.00	\$13 999.00
16:55	\$13 999.00	Snowy Hydro	TUMUT3	Energy	\$13 999.00	1.00	\$13 999.00
17:00	\$13 457.81	EnergyAustralia	TALWA1	Energy	\$13 457.81	1.00	\$13 457.81
Spot Price \$7822/MWh							

³ Details on how the price is determined can be found at www.aemo.com.au

Appendix C: Closing bids

Figures C1 to C4 highlight the half hour closing bids for participants in New South Wales with significant capacity priced at or above \$5000/MWh during the periods in which the spot price exceeded \$5000/MWh. They also show generation output and the spot price.

Figure C1: AGL (Bayswater, Liddell, Hunter Valley) closing bid prices, dispatch and spot price

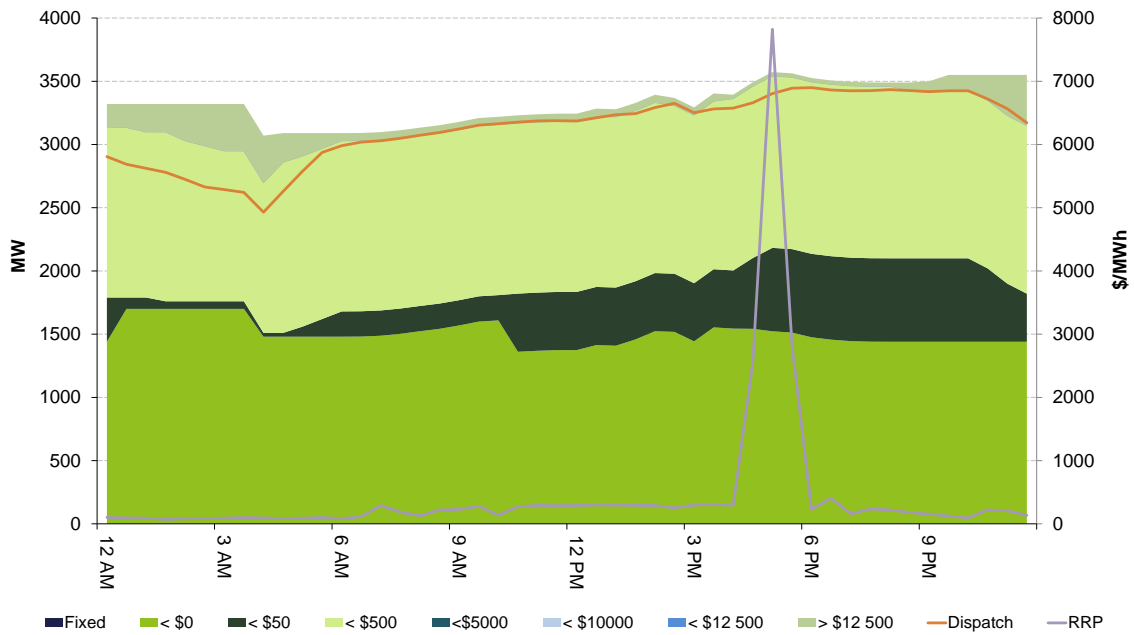


Figure C2: Delta (Vales Point) closing bid prices, dispatch and spot price

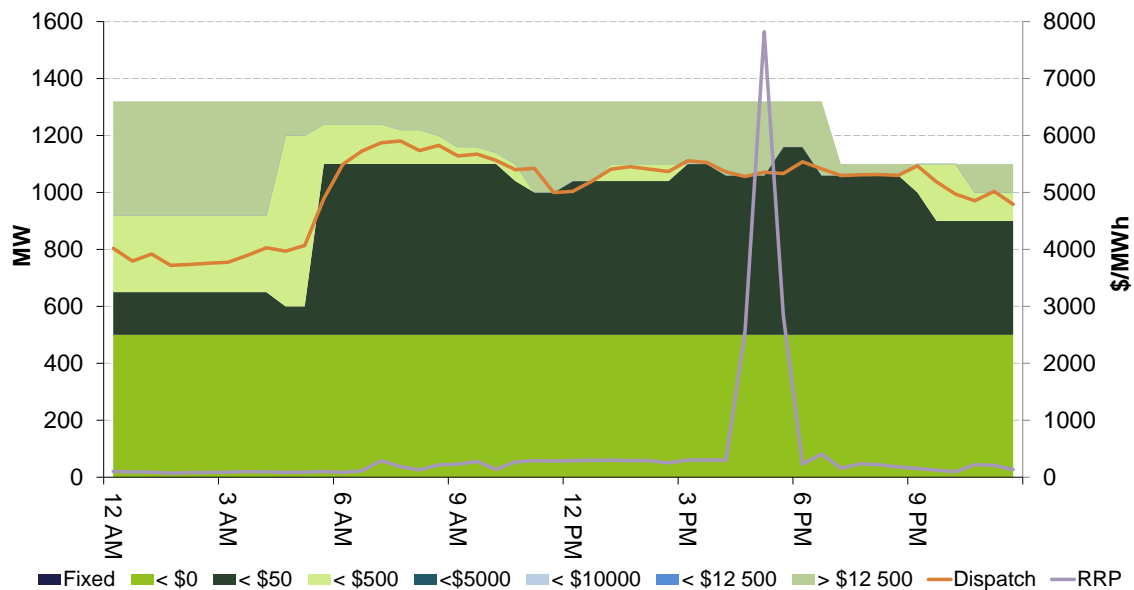


Figure C3: Energy Australia (Mt Piper, Tallawarra) closing bid prices, dispatch and spot price

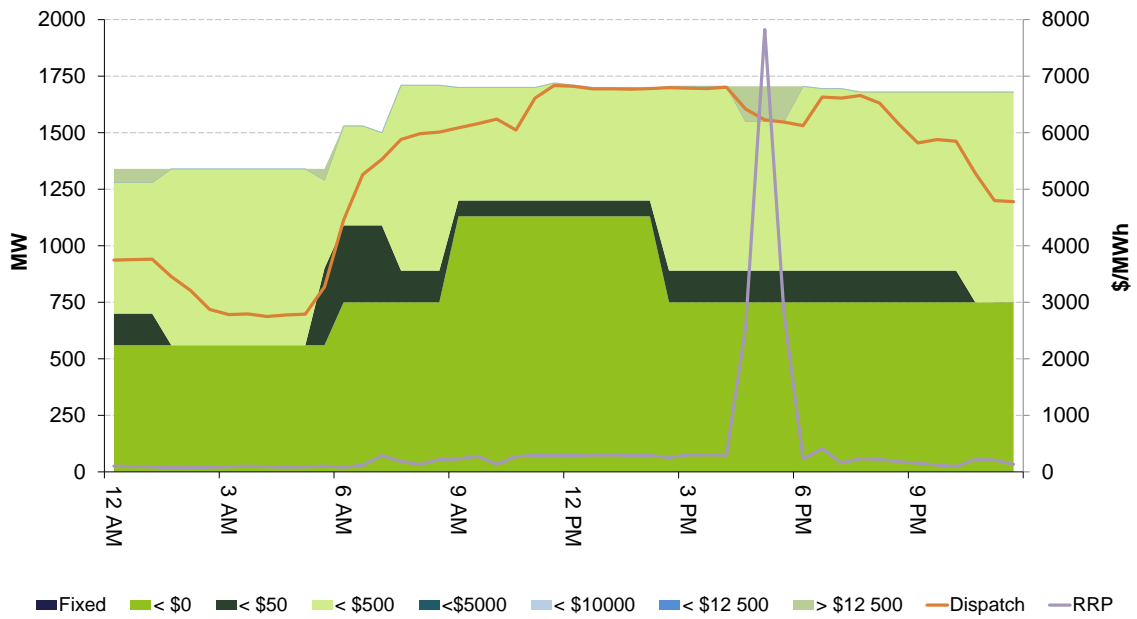
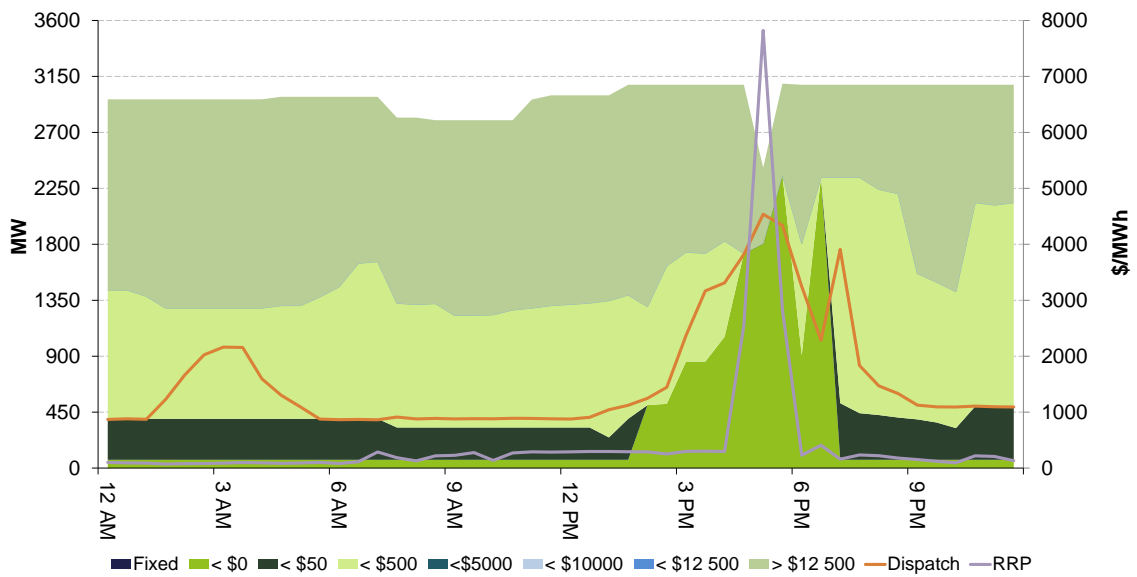


Figure C4: Snowy Hydro (Colongra, Tumut, Upper Tumut, Guthega, Blowering) closing bid prices, dispatch and spot price



Appendix D: Pricing during intervention

At times, AEMO, may need to override the normal dispatch process to maintain system security. In accordance with the National Electricity Rules (NER) a dispatch interval where an AEMO intervention event occurs, must be declared an intervention price dispatch interval and set the energy and FCAS prices for all regions as if AEMO had not intervened in the market. An intervention pricing interval is declared when AEMO directs a participant to operate plant other than in accordance with dispatch instructions, or activates a reliability and emergency reserve trader (RERT) contract.

RERT contracts refer to specific arrangements by AEMO by which additional capacity may be made available under special circumstances. AEMO may dispatch or activate a RERT contracts to address a power system security situation.

Under normal operations AEMO sets targets for generation and interconnectors and determines wholesale electricity market prices (energy and FCAS) in a single calculation for every five minute dispatch interval. Under “Intervention pricing” these are calculated twice for each dispatch interval, one taking into account the direction called “Intervention” and one that does not include the direction called “What-if”.

The “Intervention” calculation takes into account the direction by AEMO (in this case at Pelican Point) and is used to set targets for generation in order to meet demand. The pricing outcome of this calculation is not received by the generators.

The “What-If” calculation does not take the direction into account and is used to calculate the wholesale electricity market price and is received by generators. The generation targets calculated are not used to dispatch generation.

These calculations dispatch generation to meet demand (intervention calculation) while providing the pricing signal to indicate a shortage of supply (what-if calculation).

Appendix E: Lack of Reserve

AEMO is required to monitor the level of reserve, or spare capacity, within each region of the NEM. Reserves are defined as the difference between the volume of electricity that can be made available to consumers, either by local generation or through the network from other regions of the NEM, and the regional customer demand at that time.

Reserves are an indicator of the supply demand balance and an important tool to communicate with the market potential and actual shortfalls. This is achieved through the release of LOR notices by AEMO. Forecast LOR notices are designed to elicit a market response from generators to increase their declared available capacity or retailers to reduce demand to address any forecast reserve shortfalls. Actual LOR notices are also issued when the thresholds are actually triggered.

There are three reserve thresholds which relate to managing power system security following a defined number of unplanned failures of either transmission or generating equipment (credible contingencies). An example of a credible contingency would be the failure of a large generator or the failure of a transmission line that would reduce interconnector capacity.

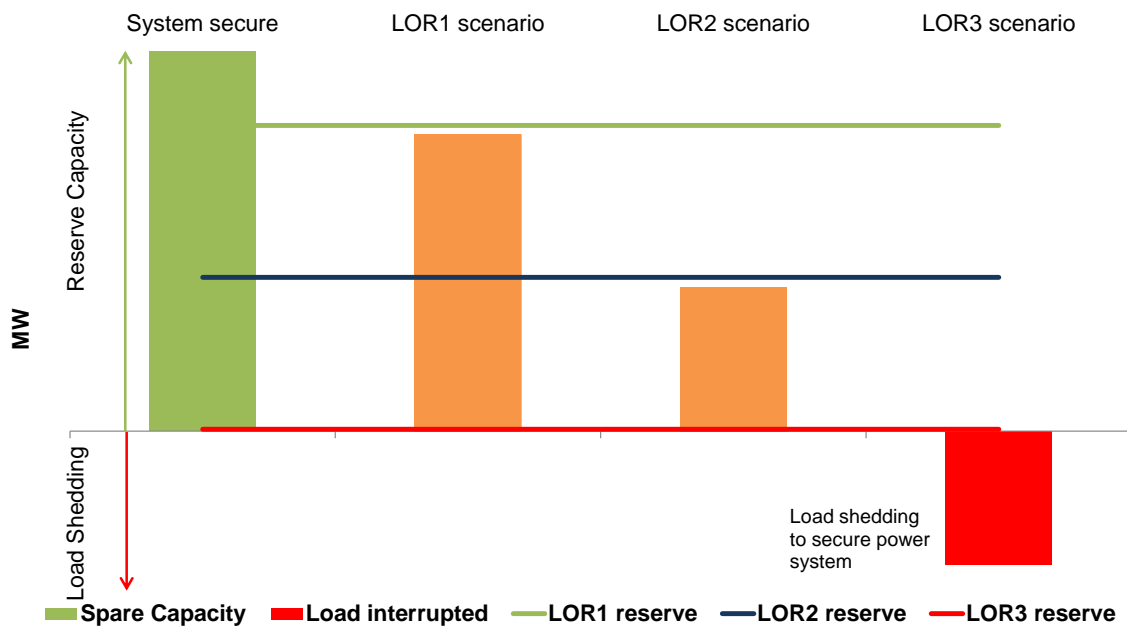
The three LOR levels are broadly categorised as follows: ⁴

- An LOR1 is declared when AEMO considers load shedding is likely to occur after two single credible contingencies.
- An LOR2 is declared when AEMO considers load shedding is likely to occur after a single credible contingency.
- An LOR3 is declared when customer(s) load would be, or is, shed in order to maintain the security of the power system.

Figure 5 shows the decrease in spare capacity and the lack of reserve thresholds.

⁴ These definitions have been simplified for the sake of readability. An interactive glossary of electricity market terms can be found on the AEMO website at: <https://www.aemo.com.au/Datasource/Archives/Archive1767#>

Figure 5: Spare capacity and lack of reserve



As the spare capacity drops below a reserve trigger level (represented as a horizontal line on the chart) either by a reduction in available spare capacity or an increase in demand, a new LOR reserve notice is issued to participants. If the region is left with insufficient reserve capacity to supply customer demand, an LOR3 is issued and load shedding occurs (as happened on 8 February 2017 in South Australia).

The solid green and amber blocks represent spare capacity. As the spare capacity drops below a reserve line (the horizontal lines) either by a reduction in available capacity or an increase in demand, a new reserve condition exists. AEMO monitors this situation continuously and issues LOR notices to inform participants.

When there is insufficient capacity to meet demand load must be shed (customers interrupted) and an LOR3 is issued.

Appendix F: Relevant Market Notices

Market Notice	Type	Date of issue	Last Changed
57310	MARKET INTERVENTION	9/02/2017 3:17:21 PM	9/02/2017 3:17:21 PM

External Reference

Direction - Pelican Point Power Limited (Pelican Point GT12) - 9/02/17

Reason

AEMO ELECTRICITY PARTICIPANT NOTICE.

Direction - Pelican Point Power Limited

In accordance with clause 4.8.9 of the National Electricity Rules AEMO is issuing a direction to Pelican Point GT 12 to take the following action.

Synchronise and dispatch to minimum load.

The direction is issued subject to the Registered Participant's best endeavours to comply with it unless compliance would be a hazard to public safety or materially risk damaging equipment or contravene any other law.

The direction is issued at 1505 hrs 9/02/17 and is expected to stay in place until 1900 hrs 9/02/17

Manager NEM Real Time Operations

Market Notice	Type	Date of issue	Last Changed
57312	MARKET INTERVENTION	9/02/2017 3:17:31 PM	9/02/2017 3:17:31 PM

External Reference

Direction - South Australia region - 9/02/17

Reason

AEMO ELECTRICITY MARKET NOTICE.

In accordance with clause 4.8.9 of the National Electricity Rules AEMO has issued a direction to a participant in the South Australia region.

The direction was necessary to maintain the power system in a reliable operating state.

The direction was issued at 1505 hrs 9/02/17 and is expected to stay in place until 1900 hrs 9/02/17.

Manager NEM Real Time Operations

Market Notice	Type	Date of issue	Last Changed
57316	MARKET INTERVENTION	9/02/2017 3:17:46 PM	9/02/2017 3:17:46 PM

External Reference

AEMO Intervention Event intervention price dispatch intervals - 9/02/17

Reason

AEMO ELECTRICITY MARKET NOTICE.

AEMO Intervention Event intervention price dispatch intervals - 9/02/17

Refer AEMO Electricity Market Notice No. 57312

An AEMO Intervention Event has been implemented by issuing a direction to maintain the power system in a reliable operating state.

AEMO declares all dispatch intervals during the AEMO Intervention Event to be intervention price dispatch intervals.

The AEMO Intervention Event commenced in the 1510 hrs dispatch interval and is forecast to apply until 1900 hrs 9/02/17

Intervention pricing may be implemented during these intervention price dispatch intervals. AEMO will provide an update market notice when intervention pricing has been implemented in dispatch.

Manager NEM Real Time Operations

Market Notice	Type	Date of issue	Last Changed
57321	MARKET INTERVENTION	9/02/2017 3:52:16 PM	9/02/2017 3:52:16 PM

External Reference

Update - AEMO Intervention Event intervention price dispatch intervals - 9/02/17

Reason

AEMO ELECTRICITY MARKET NOTICE.

Update - AEMO Intervention Event intervention price dispatch intervals - 9/02/17

Refer AEMO Electricity Market Notice No. 57312 and 57316

The AEMO Intervention Event commenced in the 1510 hrs dispatch interval and is forecast to apply until 1900 hrs 9/02/17.

Intervention pricing was implemented from the 1550 hrs dispatch interval and is forecast to apply until the end of the AEMO Intervention Event.

Manager NEM Real Time Operations

Market Notice	Type	Date of issue	Last Changed
57347	MARKET INTERVENTION	9/02/2017 7:09:55 PM	9/02/2017 7:09:55 PM

External Reference

Cancellation - Direction South Australia Region Thursday, 9 February 2017

Reason

AEMO ELECTRICITY MARKET NOTICE

Cancellation - Direction South Australia Region Thursday, 9 February 2017

Refer AEMO Electricity Market Notices 57312 and 57340

Direction cancelled at 1900 hrs Thursday, 9 February 2017

Manager NEM Real Time Operations
