



Electricity spot prices above \$5,000/MWh

**New South Wales,
20 November 2020**

29 January 2021

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1 Obligation

The Australian Energy Regulator (AER) 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 the performance of energy markets, including the annual State of the energy market report and biennial effective competition report, to assist stakeholders and the wider community.

The AER is required to publish a report whenever the electricity spot price exceeds \$5,000 per megawatt hour (\$/MWh) in accordance with clause 3.13.7 (d) of the National Electricity Rules.

The report:

- describes the significant factors contributing to the spot price exceeding \$5,000/MWh, including withdrawal of generation capacity and network availability;
- assesses whether rebidding contributed to the spot price exceeding \$5,000/MWh;
- identifies the marginal scheduled generating units; and
- identifies all units with offers for the trading interval equal to or greater than \$5,000/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 compliance issues or enforcement action.

2 Summary

On 20 November 2020, the spot price in New South Wales reached \$7,550/MWh for the 2.30 pm trading driven by three dispatch intervals at or close to the price cap. AEMO did not forecast this price.

The high spot price was a result of three main factors.

- New South Wales had limited access to capacity priced below \$5,000/MWh.
 - Planned maintenance work on a transmission line in southern New South Wales and upgrades on the Queensland to New South Wales interconnector (QNI) meant New South Wales had limited access to lower priced generation from neighbouring regions and from southern New South Wales.
 - There was around 2,400 MW of baseload generation on both planned and unplanned long-term outages, a majority of which is usually offered below \$5,000/MWh.
- Demand was 730 MW higher than forecast 4 hours ahead and 400 MW higher than forecast half an hour ahead.
- Origin rebid 570 MW of capacity at Eraring power station to the price cap. This rebid was placed in error and contributed to the price exceeding \$5,000/MWh. Origin rebid to correct the erroneous rebid which become effective after 2 dispatch intervals and the price fell to previous levels.

During the high priced period around 80% of capacity offered by participants in New South Wales was priced below \$5,000/MWh but given the increase in demand and rebidding of capacity from low to high prices a small amount of capacity priced above \$5,000/MWh was required.

3 Analysis

The following sections explore the factors that led to the high spot price in detail.

3.1 Overview of actual and expected conditions

The spot price in New South Wales reached \$7,550/MWh for the 2.30 pm trading interval. The dispatch price was close to or at the market cap price of \$15,000/MWh for the 2.15 pm, 2.20 pm and 2.25 pm dispatch intervals.

There was around 2,400 MW (out of around 9,700 MW) of base load generation unavailable for dispatch due to long term outages that were both planned and unplanned (Table 1). These were taken into account in all forecasts.

Table 1: Offline base load generators in New South Wales

Participant	Station	Unit	Fuel Type	Summer rating (MW)	Outage
AGL	Bayswater	Unit 1	Black coal	630	Unplanned – 14 days
AGL	Bayswater	Unit 4	Black coal	655	Unplanned – 22 days
AGL	Liddell	Unit 2	Black coal	450	Planned - 42 days
EnergyAustralia	Mount Piper	Unit 1	Black coal	675	Planned – 56 days
Total				2,410	

Table 2 shows the spot price was not forecast 4 or 12 hours ahead and demand was 730 MW greater than forecast, 4 hours ahead. Half an hour before dispatch the forecast demand was around 400 MW below actual demand.

Table 2 :Actual and forecast spot price, demand and available capacity

Trading interval	Price (\$/MWh)			Demand (MW)			Availability (MW)		
	Actual	4 hr forecast	12 hr forecast	Actual	4 hr forecast	12 hr forecast	Actual	4 hr forecast	12 hr forecast
2.30 pm	7,550	68	70	9,934	9,204	9,152	11,928	11,748	11,694

In New South Wales 79% of capacity was offered below \$5,000/MWh during the high priced intervals. Only a small amount of capacity priced above \$5,000/MWh was required to meet local demand.

3.2 Network, demand and rebidding

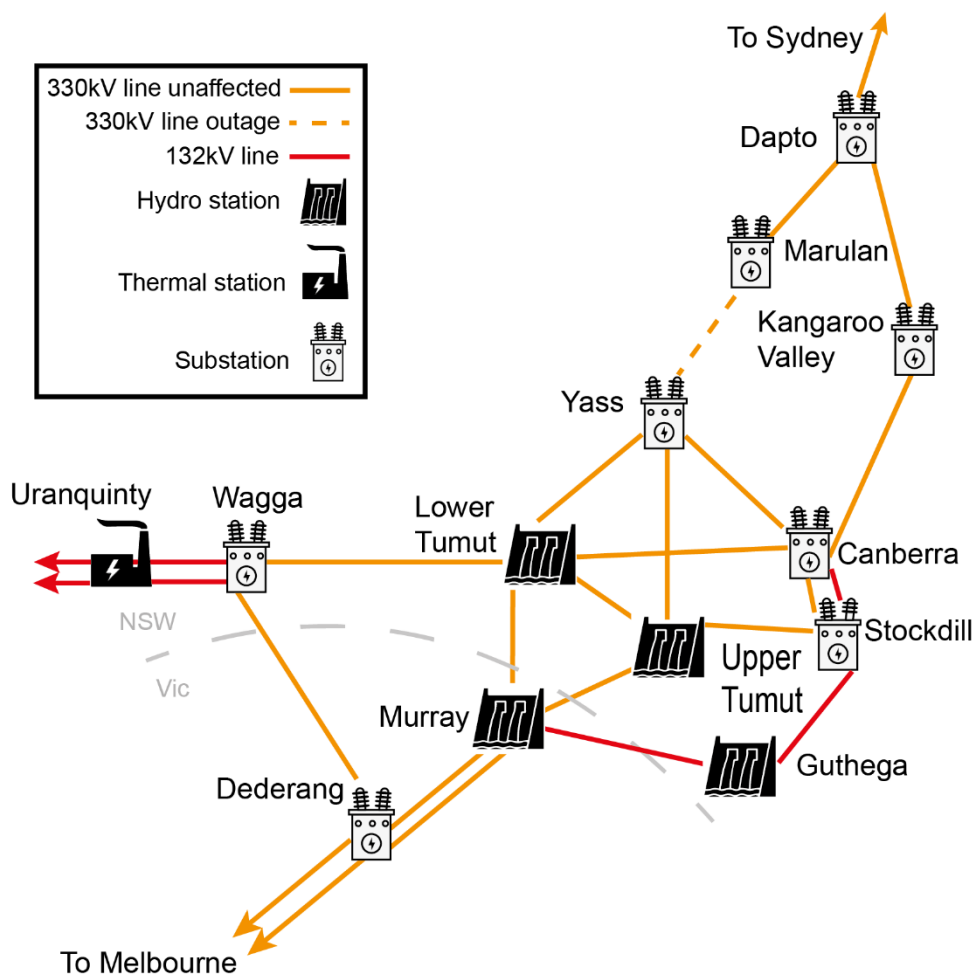
3.2.1 Network

This section examines the network capability and its contribution to price outcomes. There were network constraints that limited flows into New South Wales on each of the three interconnectors connecting New South Wales to Victoria and Queensland. This reduced access to lower priced generation in New South Wales from neighbouring regions. Network constraints also limited access to capacity priced below \$5,000/MWh from southern New South Wales.

3.2.1.1 Outages

There was a planned outage (market notified 16 November 2020) of the Yass to Marulan 5 330 kV line in New South Wales. Figure 1 shows the affected network area, the significant southern generators, substations and the line that was out of service (yellow dashed). To manage the outage, AEMO invoked a constraint (discussed in the next section) affecting generation in southern New South Wales and flows on the Vic-NSW interconnector.

Figure 1: Network diagram and constraint in effect



Line outages for the upgrade of QNI also limited exports from Queensland into New South Wales. This meant that the combined limits and flows into New South Wales from Queensland were around 600 MW lower than their nominal limits on QNI and Terranora. Flows into New South Wales from Queensland were close to forecast.

3.2.1.2 Constraints

What is a constraint?

In optimising economic generation dispatch and interconnector flows, the National Electricity Market Dispatch Engine (NEMDE) formulates the maximum network capability for every 5-minute dispatch interval. Constraints mathematically describe the capability of each network element that include generator and interconnector coefficients.

Constraints contain a Left Hand Side (LHS) and a Right Hand Side (RHS). The RHS contains all of the inputs that NEMDE cannot vary. These inputs include demand and the rating of the relevant transmission line (i.e. how much energy the line can carry without damaging the line or causing unsafe conditions). The LHS contains all of the inputs that NEMDE can vary to deliver an outcome that satisfies the requirement of the RHS. These inputs include targets from generators and flow on interconnectors. When the LHS equals the RHS then the constraint is binding.

The constraint managing outages of the Yass to Marulan line limits the amount of capacity sent towards Sydney. To minimise the dispatch price, NEMDE schedules the cheapest generation sources to meet demand and maintain interconnector flows within limits, so if generation in southern New South Wales is cheaper than the imports from Victoria, it is dispatched before imports and vice versa. In this situation, because of the location of the generators and the transmission outage, if the Vic-NSW interconnector is at its adjusted limit then any excess generation in that area is forced south across the interconnector into Victoria, possibly counter-price (from a high to low priced region).¹

The output of generators on the LHS of the constraint is co-optimised with interconnectors on the LHS. The participants with the largest generator capacity that affect these particular constraints are Snowy Hydro (2,285 MW) and Origin (600 MW).² There are also a number of wind and solar farms, ranging from 40 MW to 320 MW, that affect this constraint to a lesser degree.

At 2.05 pm, demand increased by 175 MW, imports from Victoria increased by 59 MW to 532 MW and the constraint managing the outage bound.

At 2.10 pm a rebid by Snowy Hydro became effective that shifted 560 MW of capacity at Tumut power station from \$300/MWh to the price floor. This increased its dispatch by

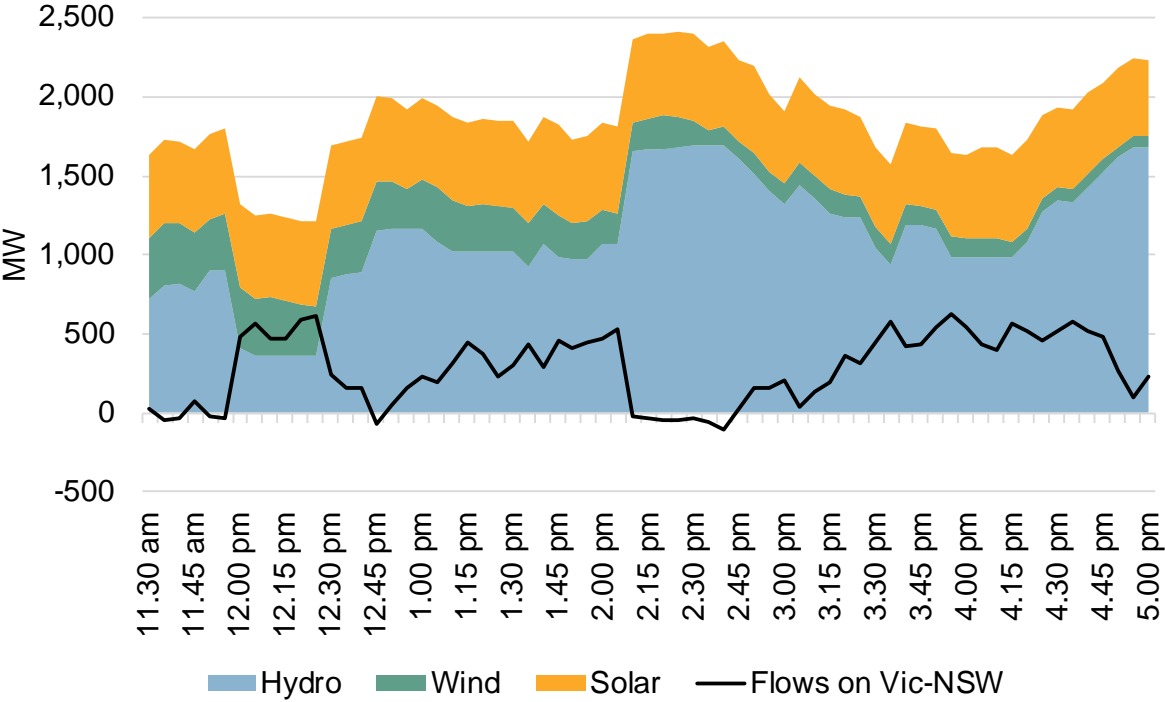
¹ <https://www.aer.gov.au/wholesale-markets/performance-reporting/special-report-the-impact-of-congestion-on-bidding-and-inter-regional-trade-in-the-nem>

² On this constraint Snowy hydro controls Tumut (1,500 MW), Upper Tumut (616 MW), Blowering (80 MW), Guthega (60 MW) and Hume (29 MW) and Origin energy controls Uranquinty (600 MW).

560 MW and as the constraint was already binding, effectively replaced imports on the Vic-NSW interconnector, as the price of electricity from Victoria was $-\$45/\text{MWh}$. As a result, flows went from 532 MW into New South Wales to 18 MW into Victoria.

Figure 2 shows the target of all the units on the constraint. At 2.10 pm, when Tumut’s rebid came into effect, hydro generation increased and flows on the Vic-NSW interconnector changed direction from importing to exporting.

Figure 2: Generation output and flow on the Vic – NSW interconnector



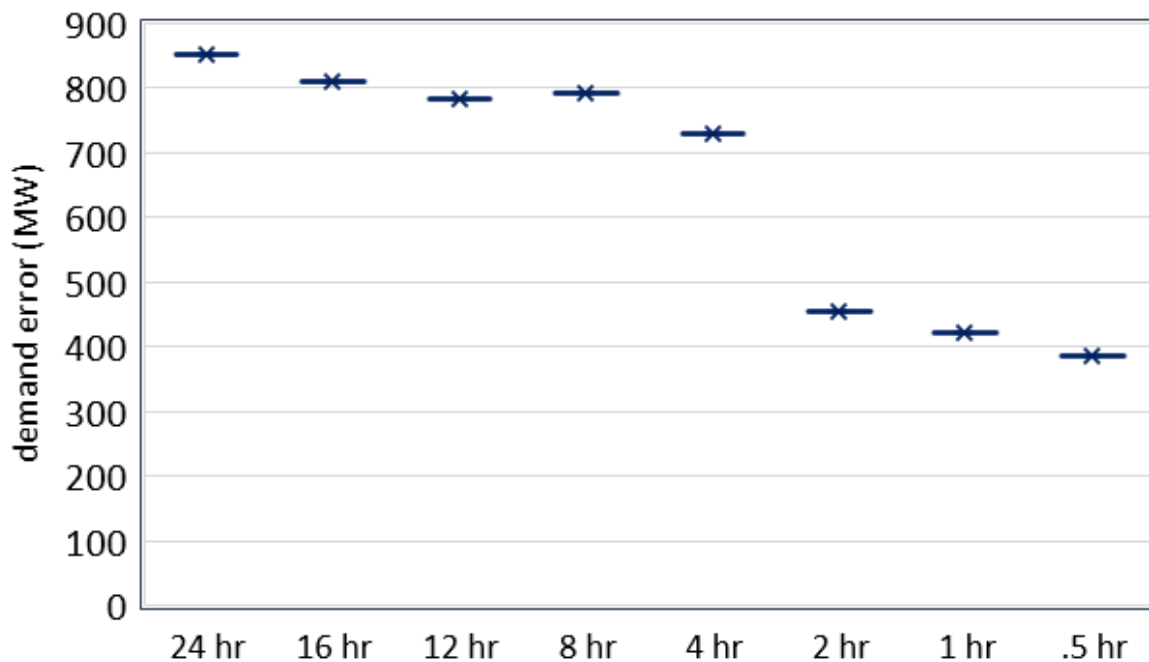
3.2.2 Demand

Demand in New South Wales was 9,934 MW for the 2.30 pm trading interval, well below record demand.

Price sensitivities published by AEMO showing changes in price given a change in demand predicted a 500 MW increase in demand or loss of supply would lead to prices above $\$5,000/\text{MWh}$. Actual demand was between 384 MW and 850 MW higher than demand forecasts published by AEMO for the 2.30 pm trading interval over the preceding hours (Figure 3). The forecasting error was due to warmer than forecast temperatures in western Sydney, an over-forecasting of rooftop PV generation (which reduces demand from the grid), as well as some underlying under-forecasting in the demand forecast model.

With all interconnectors in New South Wales at their limits, due to the network outages outlined above, the higher than forecast demand had to be met by an increase in local generation.

Figure 3: Forecast demand errors for the 2.30 pm trading interval



3.2.3 High priced dispatch intervals

3.2.3.1 2.15 pm

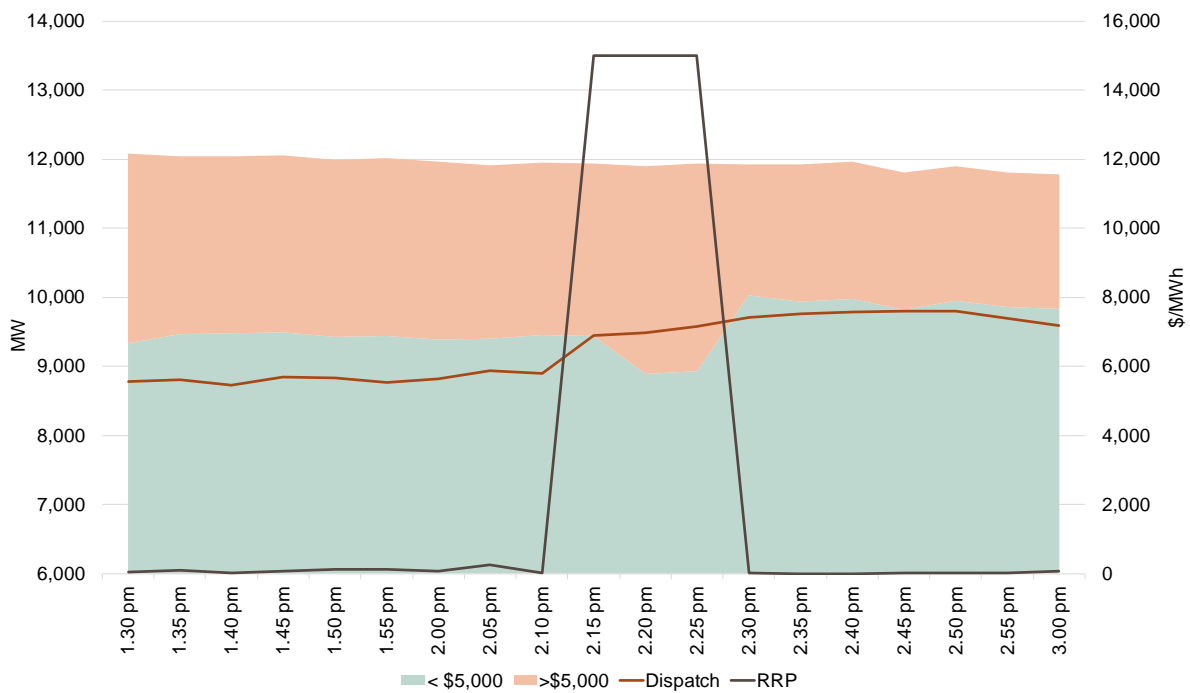
At 2.15 pm demand increased by 234 MW. There was no capacity offered between \$300/MWh and \$14,998/MWh, and the capacity offered below \$300/MWh was either ramp limited, at maximum availability or inflexible so could not set price. As a result, the 2.15 pm dispatch price reached \$14,999/MWh.

3.2.3.2 2.20 pm and 2.25 pm

At 2.09 pm, effective for the 2.20 pm dispatch interval, Origin Energy rebid 570 MW of capacity at Eraring power station from \$13/MWh to the price cap of \$15,000/MWh (Figure 4). The reason related to a material change in demand. As a result the dispatch price went close to the price cap at 2.20 pm and to the cap at 2.25 pm with Eraring setting the price.

At 2.19 pm, effective from 2.30 pm, Origin reversed this rebid, shifting 600 MW of capacity from the cap to \$13/MWh, stating the previous rebid was an error. With other low priced capacity at Snowy Hydro's Colongra power station becoming available from start-up the dispatch price fell to \$13/MWh. Origin have since contacted the AER to provide an explanation of the circumstances.

Figure 4: Available capacity offered above and below \$5,000MWh



The rebids considered to have been material to the event are listed in Appendix A.

Appendix B details the generators involved in setting the price during the high-price periods, and how that price was determined by the market systems.

The closing bids for all participants in New South Wales with capacity priced at or above \$5,000/MWh for the high-price periods are set out in Appendix C.

Australian Energy Regulator

January 2021

Appendix A: Significant Rebids

The rebidding tables highlight the relevant rebids submitted by generators that affected 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 and the rebid reason.

Table 3: Significant energy rebids for 2.30 pm

Submit time	Time effective	Participant	Station	Capacity rebid (MW)	Price from (\$/MWh)	Price to (\$/MWh)	Rebid reason
2.02 pm	2.10 pm	Snowy Hydro	Tumut	560	300	-1,000	14:01:00 A NSW 5min pd price \$2,727.00 higher than 5min pd 14:15@13:56 (\$2,739.50)
2.09 pm	2.20 pm	Origin	Eraring	570	13	15,000	1405A material change in NSW dem SL
2.11 pm	2.20 pm	Snowy Hydro	Colongra	507	15,000	-1,000	14:10:49 A unforecast change to market - reason to follow
2.19 pm	2.30 pm	Origin	Eraring	600	15,000	13	1416E correct bid - a material change in NSW dem SL

Appendix B: Price setter

The following table identifies for the trading interval in which the spot price exceeded \$5,000/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.

Table 4: Price setter for the 2.30 pm trading interval

DI	Dispatch Price (\$/MWh)	Participant	Unit	Service	Offer price (\$/MWh)	Marginal change	Contribution
2..05 p	\$264.61	CS Energy	CALL_B_1	Lower reg	\$4.99	-1.03	-\$5.14
		CS Energy	CALL_B_1	Lower 60 sec	\$60.61	1.03	\$62.43
		CS Energy	GSTONE3	Lower 6 sec	\$27.73	1.03	\$28.56
		NEON	HPRL1	Lower 6 sec	\$0.00	-1.03	\$0.00
		Engie	PPCCGT	Lower 60 sec	\$0.03	-1.03	-\$0.03
		Stanwell	STAN-1	Energy	\$25.71	0.27	\$6.94
		Stanwell	STAN-2	Energy	\$25.71	0.27	\$6.94
		Stanwell	STAN-3	Energy	\$25.71	0.27	\$6.94
		Stanwell	STAN-4	Energy	\$25.71	0.27	\$6.94
		Stanwell	TARONG#1	Lower reg	\$74.99	2.06	\$154.48
AGL (SA)	TORRB2	Lower reg	\$3.78	-1.03	-\$3.89		
2.10 pm	\$24.04	CS Energy	CALL_B_2	Lower reg	\$32.33	1.03	\$33.30
		CS Energy	CALL_B_2	Lower 60 sec	\$28.61	1.03	\$29.47
		AGL Energy	BW03	Lower reg	\$25.10	-1.03	-\$25.85
		Stanwell	TARONG#3	Lower 6 sec	\$8.68	1.03	\$8.94
		EnergyAustralia	MP2	Lower 60 sec	\$0.38	-1.03	-\$0.39
		EnergyAustralia	MP2	Lower 6 sec	\$0.03	-1.03	-\$0.03
		Edify Energy	WHITSF1	Energy	-\$20.00	1.07	-\$21.40
2.15 pm	\$14,998.89	EnergyAustralia	TALWA1	Energy	\$14,998.89	1.00	\$14,998.89
2.20 pm	\$14,999.96	EnergyAustralia	MP2	Energy	\$14,999.96	1.00	\$14,999.96
2.25 pm	\$15,000.00	Origin Energy	ER02	Energy	\$15,000.00	1.00	\$15,000.00
2.30 pm	\$12.50	Origin Energy	ER01	Energy	\$12.50	0.33	\$4.13
		Origin Energy	ER03	Energy	\$12.50	0.33	\$4.13
		Origin Energy	ER04	Energy	\$12.50	0.33	\$4.13
Spot	\$7,550/MWh						

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

Appendix C: Closing bids

Figures C1 to C2 highlight the half hour closing bids for participants in New South Wales with significant capacity priced at or above \$5,000/MWh during the periods in which the spot price exceeded \$5,000/MWh. They also show generation output and the spot price.

Figure C1 - EnergyAustralia (Mt Piper, Tallawarra) closing bid prices, dispatch and spot price

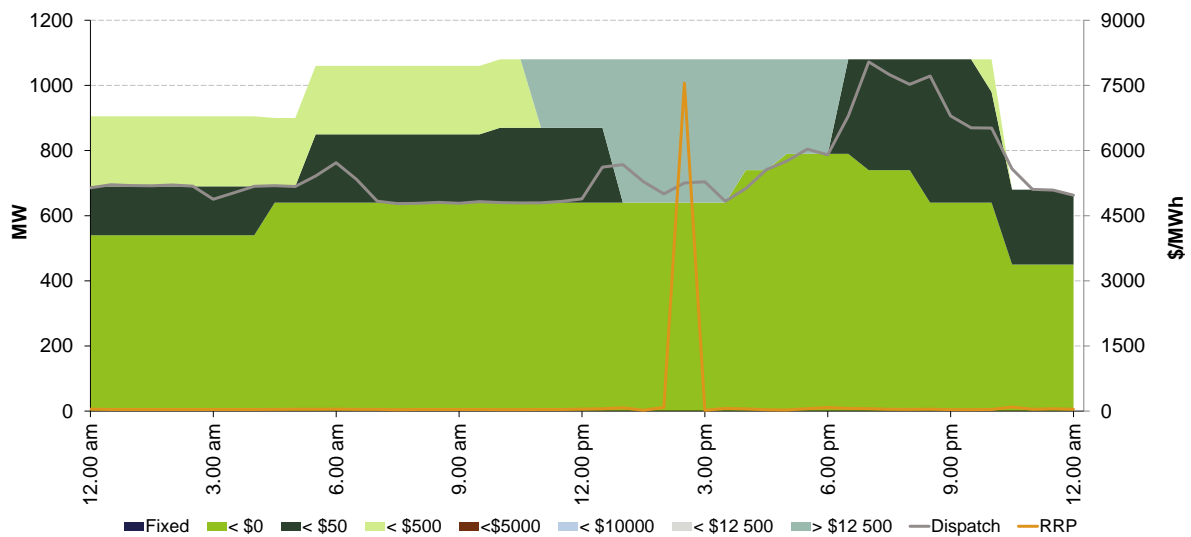


Figure C2 - Origin (Eraring, Shoalhaven, Uranquinty) closing bid prices, dispatch and spot price

