

Spot prices greater than \$5000/MWh



AUSTRALIAN ENERGY
REGULATOR

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Introduction

The AER is required to publish a report covering the circumstances in which the spot price exceeded \$5000/MWh, pursuant to clause 3.13.7 (d) of the Rules. That report should:

- describe significant factors contributing to the spot price exceeding \$5000/MWh, including withdrawal of generation capacity and network availability;
- assess whether rebidding pursuant to clause 3.8.22 contributed to the spot price exceeding \$5000/MWh;
- identify the marginal scheduled generating units; and
- identify all units with offers for the trading interval equal to or greater than \$5000/MWh and compare these dispatch offers to relevant dispatch offers in previous trading intervals.

This report examines the factors that can contribute to the spot price exceeding \$5000/MWh including; changes in demand (compared to that forecast by NEMMCO); generator offers and rebidding (including changes to generation capacity); and changes to network availability.

Summary

At 4 pm on January 11 the spot price in New South Wales peaked at \$5092/MWh. At the time, prices were generally aligned with Victoria and Queensland with spot prices of \$3147/MWh and \$3383/MWh respectively. South Australia and Tasmania were exporting at their nominal limits. The national demand was close to record levels and significantly higher than forecast.

The combination of higher than forecast demand, a step change in network capability and generator rebidding led to prices significantly greater than forecast for the trading interval.

Actual and forecast demand

NEMMCO is responsible for forecasting demand as part of the dispatch process. Changes between forecast and actual demand can have significant impacts on market outcomes. An increase in demand tends to push generation dispatch further up the supply curve leading to an increase in price.

One input to the demand forecast is the temperature forecasts for the capital cities of each state. Figure one below shows the temperature forecast for each capital city published the previous evening, and the actual maximum temperature.

Figure 1: Actual and forecast temperature

Temperature (°C)	Sydney	Brisbane	Melbourne	Adelaide	Hobart
Forecast 6pm	33	30	38	30	32
Actual	34	31	33	27	30

On 11 January demand in New South Wales reached 12 333 MW at 4 pm, 800 MW higher than forecast four and twelve hours ahead. This was the third highest demand this summer, but around 1000 MW lower than the record set during the previous summer¹. The actual demand was 350 MW higher than the last forecast for the trading interval, which is published at 3.30 pm. Figure 2 compares the actual demand in New South Wales with that forecast by NEMMCO four and twelve hours ahead of dispatch. A comparison of actual and forecast spot price is also included.

Figure 2: Actual and forecast demand and spot price in New South Wales

Thursday 4:00 pm	Actual	4 hr forecast	12 hr forecast
Demand (MW)	12 333	11 565	11 556
Spot Price (\$/MWh)	5091.95	109.44	327.05

Over the course of the day, prices were generally forecast to align across New South Wales, Snowy, Victoria and Queensland. Significant changes to the demand forecast in Victoria during the day led to changes in price and generator and interconnector dispatch forecasts in Victoria, Queensland and New South Wales. Early in the morning, demand in Victoria was forecast to peak at 8550 MW by 4 pm, whilst the actual demand reached 7717 MW, (800 MW lower than forecast). A revision to the demand forecast at 6 am reduced the forecast for the peak, (improving the accuracy) but resulted in under forecasting demand for the rest of the morning, (by as much as 1000 MW). Further revisions saw an increase to the peak forecast to 8300 MW. At 10 am, another significant revision was made, with forecast peak demand dropping by 1200 MW to 7150 MW. **Appendix A** details the demand forecasts in Victoria and New South Wales together with the price forecasts for Victoria, Queensland and New South Wales

Generator offers and rebidding

The summer capability of installed generating capacity in New South Wales is 12 414 MW². At 4 pm on 11 January, 10 537 MW of this capacity was presented to the market. Figure 3 details the significant generation capacity that was not presented on that day.

Figure 3: New South Wales generation capacity not presented at 4 pm

Participant	Capacity	Comment
Macquarie Generation	(MW)	
Hunter Valley GT	44	Two 25 MW open cycle turbines fuelled by diesel, generally operated only in extreme circumstances.
Liddell unit 3	145	Milling limit, reduced availability for much of the day.
Liddell unit 4	513	Unit tripped on 2 January and remained out of service on this day.
Bayswater	220	Units 1, 3 and 4 slightly reduced from nominal capacity.
Delta Electricity		
Munmorah unit 4	300	Shutdown on 11 December, returned to service on 27 January.
Vales Point unit 6	660	Shutdown on 15 December, returned to service on 14 January.
Capacity not presented	1882	(15 per cent of installed capacity)

¹ The peak demand was around 2400 MW lower than the extreme 10% probability of exceedance summer forecast of 14 750 MW published in the 2006 Statement of Opportunities.

² Based on the 2006 Statement of Opportunities summer forecast of aggregate generation capability for 2006 with an additional 3500 MW available from the Snowy region.

NEMMCO produce a forecast of market outcomes for each 30-minute trading interval of the trading day, including forecast price. This report focuses on two forecasting horizons, namely four and twelve hours ahead of dispatch and endeavours to compare and explain actual outcomes with reference to these timeframes. These forecasts are based on information compiled by NEMMCO and submitted by participants. 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 predictions; network capability; and participant bids and rebids. This information helps participants to make informed commercial decisions.

Macquarie Generation made three rebids during the day, all either shifted capacity into higher prices or reduced capacity at low prices. At 7.47 am, 680 MW of capacity across Bayswater and Liddell, which was priced at less than \$250/MWh, was shifted into prices of more than \$5000/MWh. The rebid reason given was “Manage Snowy CSC/CSP constraints”. At 10.25 am, the available capacity at Liddell unit three was reduced by 165 MW, (with 135 MW of that capacity priced above \$9000/MWh and 30 MW priced at less than \$20/MWh). The rebid reason given was “Milling limit”, which suggests a physical limitation with the plant. At 12.47 pm a further 160 MW of capacity was shifted from prices of less than \$20/MWh to prices above \$9000/MWh across the Bayswater units. The rebid reason given was “NSW Demand higher than forecast”. At around this time, actual demand had begun to track higher than the forecast.

Rebidding by Delta Electricity and Eraring Energy, on the other hand, had little impact on the dispatch of their units or on the amount of capacity offered at lower prices.

Throughout the day, rebidding in Queensland saw a number of participants rebid capacity into prices greater than \$5000/MWh. Callide Power Trader shifted 140 MW of capacity at Callide C from prices of less than \$20/MWh into prices of more than \$9000/MWh. The rebid reason given was “Optimisation decision::adjust MW dist” and “Price dif from PD::Adjust MW dist”. At 3.02pm, Stanwell Corporation shifted 160 MW of capacity from prices of less than \$60/MWh to above \$9000/MWh. The rebid reason given was “Manage transmission constraint”. Millmerran Energy Trader shifted 80 MW of capacity from prices below \$10/MWh into prices above \$9000/MWh. The rebid reason given was “Optimisation decision::Adjust MW dist”.

Origin Energy shifted 288 MW of capacity at Mt Stuart from prices of above \$9000/MWh with 90 MW priced at less than \$10/MWh, 100 MW at less than \$200/MWh and the remainder at less than \$500/MWh. The rebid reasons given were “Change in PDS” and “Volume adjustment band shift down”.

Plant problems at TRUenergy’s Yallourn power station in Victoria saw 90 MW of capacity removed during the morning, with 140 MW of capacity subsequently shifted from prices above \$9000/MWh to below \$10/MWh. When the capacity was returned, it was priced at more than \$9000/MWh. From around 2.30pm, LYMMCO shifted 150 MW of capacity at Loy Yang A, priced above \$9000/MWh, into prices of less than \$100/MWh. A further 560 MW on Loy Yang A unit 1 was bid at a fixed loading level due to boiler stability issues.

Also from midday, Snowy Hydro rebid 1300 MW of capacity priced between \$450/MWh and \$7500/MWh to less than \$200/MWh. The rebid reasons given related to the higher than forecast demand and resulting changes in dispatch and network constraints and included “Disp higher fcst:Re-allocate gen”, “Manage unexp Snowy NSW constraint bnd down”, “Manage unexp Snow-Vic constraint bnd up”, “Manage

Sno-NSW constraint bnd dwn” and “NSW price high Snowy1 constraint not in CSP list:Bnd D”. At 3.50 pm, following a step reduction in import capability into New South Wales at 3.45 pm, Snowy Hydro shifted 300 MW of capacity from \$450/MWh to greater than \$9000/MWh. The rebid reason given was “Manage unexp Snowy-NSW constraint Band up”.

Figure 4 lists the five-minute dispatch prices for all regions and shows that apart from the 3.45 pm dispatch interval, prices were aligned for the 4 pm trading interval across the New South Wales, Queensland, Victoria and Snowy regions.

Figure 4: Five-minute dispatch prices for all regions for the 4 pm trading interval

Time	NSW	Queensland	Victoria	Snowy	SA	Tasmania
3:35 pm	\$274.34	\$263.59	\$241.57	\$235.93	\$34.00	\$206.85
3:40 pm	\$526.94	\$506.32	\$458.52	\$450.00	\$34.00	\$280.14
3:45 pm	\$9,350.01	\$80.75	\$458.51	\$450.00	\$34.00	\$280.22
3:50 pm	\$7,350.01	\$7,011.51	\$6,409.76	\$6,322.18	\$34.00	\$280.22
3:55 pm	\$7,350.01	\$6,960.29	\$6,410.80	\$6,322.93	\$36.71	\$280.22
4:00 pm	\$5,700.41	\$5,475.34	\$4,900.07	\$4,833.20	\$46.00	\$280.06

Figure 5 compares the actual capacity presented in New South Wales with that forecast four and twelve hours ahead of the 4 pm trading interval. It highlights the change in capacity presented below the four hour ahead forecast price of \$109/MWh compared to that at the time of dispatch, which contributed to the higher than forecast price.

Figure 5: Actual and forecast capacity and spot price for New South Wales

Thursday 4:00 pm	Actual	4 hr forecast	12 hr forecast
Capacity (MW)			
available	10537	10568	10735
priced at less than \$109.44	9047	9218	
Spot price (\$/MWh)	5091.95	109.44	

The generators involved in setting the spot price during the 4 pm trading interval, and how that price was determined by the market systems are detailed in **Appendix B**.

The supply curve and spot price in each region for the 4 pm trading interval compared with the forecast produced four hours ahead is presented in **Appendix C**.

The closing bids for all participants in New South Wales and Snowy with capacity priced at or above \$5000/MWh during this period are presented in **Appendix D**.

Changes to network availability

Total imports into New South Wales were around 1600 MW and 900 MW higher than forecast twelve hours and four hours ahead respectively. Flows across the Snowy and Queensland interconnectors were unconstrained for all but one dispatch interval during the trading interval.

At 3.45 pm, a combined reduction of more than 600 MW in import capability across the Queensland to New South Wales interconnectors occurred. This step change was driven by a very short unplanned outage³ of the Kempsey to Nambucca 132kV line in northern New South Wales. This rapid reduction in the limit led to a reduction in flow south into New South Wales by 250 MW. This saw step changes in prices from

³ The duration of the outage was only a few seconds, but this was long enough for the change in network status to be incorporated into the limit equations to reduce import capability.

\$527/MWh in New South Wales and \$506/MWh in Queensland at 3.40 pm to \$9350/MWh in New South Wales and \$81/MWh in Queensland at 3.45 pm. The limit returned to its previous levels at 3.50 pm. The dispatch price remained above \$5000/MWh in New South Wales, Queensland, Snowy and Victoria for the remainder of the trading interval.

Figure 6 compares the average combined flows and interconnector limits into New South Wales, for the 4 pm trading interval, with those forecast four and twelve hours ahead of dispatch.

Figure 6: Combined actual and forecast flow and limits into New South Wales

Thursday 4:00 pm	Actual	4 hr forecast	12 hr forecast
Import limit	3693	3331	3998
Flows into NSW	3266	2347	1626

A planned outage of the number 66 transmission line between Murray and Lower Tumut occurred between 7 am and 5.30 pm. This line is one of two between Murray and Tumut. This outage limited flows north and south out of the Snowy region for around six hours on the day. Notice of the outage first appeared in the market systems on 29 December, with NEMMCO approving the outage on 8 January.

Assessment

A number of factors contributed to the \$5092/MWh spot price in New South Wales at 4 pm on January 11.

Demand was high in New South Wales and across the NEM. National demand peaked at 30 960 MW, the highest level since last winter.

The demand forecasts fluctuated through the day and in a number of cases varied significantly from actual outcomes. Demand in New South Wales reached 12 333 MW, which was 800 MW higher than forecast four hours ahead and 350 MW higher than forecast at the beginning of the trading interval. Across the NEM demand was around 1360 MW higher than forecast four hours ahead.

In New South Wales 1490 MW (or 14 per cent) of capacity was priced above \$5000/MWh. Of this capacity, up to 870 MW resulted from rebidding by Macquarie Generation from relatively low prices during the day. A further 1882 MW (or 15 per cent) of installed capacity in New South Wales was not offered to the market on the day.

An unplanned transmission outage caused a significant step reduction in imports from Queensland into New South Wales at around 3.45 pm, increasing prices in New South Wales. During the 4.00 pm trading interval (which covers the half hour from 3.30 pm to 4.00 pm) five minute dispatch prices were aligned with Victoria and Queensland at less than \$600/MWh until 3.45 pm, when the transmission outage occurred. The New South Wales dispatch price then diverged from the other regions to \$9350/MWh. While the outage was rectified within five minutes, a rebid into higher prices by Snowy Hydro, saw the prices across the regions realign at more than \$4800/MWh for the remainder of the trading interval.

The AER reviewed compliance with the National Electricity Rules including the ‘good faith’ rebidding provisions in clause 3.8.22A but did not identify any breaches.

Australian Energy Regulator

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Appendix A – actual and forecast price and demand for the 4 pm trading interval

The following table shows the actual demand and spot price for New South Wales, Queensland and Victoria for the 4 pm trading interval, together with each predispach forecast price and demand for that same trading interval. The price in the Snowy region is also included.

The table shows the actual demand is significantly higher than forecast in New South Wales. The impacts of changes to the Victorian demand forecasts on New South Wales price forecasts are highlighted along with the price forecast following the rebid by Macquarie Generation.

	Demand				Spot price			
	<i>Actual</i>	<i>12333</i>	<i>7579</i>	<i>7718</i>	<i>\$5,092</i>	<i>\$3,383</i>	<i>\$3,102</i>	<i>\$3,147</i>
Predispach run	NSW	Queensland	Victoria		NSW	Queensland	Snowy	Victoria
2007011124 at around 15:30	11993	7604	7563		\$176	\$179	\$151	\$152
2007011123 at around 15:00	11988	7604	7313		\$174	\$176	\$69	\$72
2007011122 at around 14:30	11863	7604	7314		\$171	\$168	\$151	\$149
2007011121 at around 14:00	11858	7604	7316		\$173	\$174	\$150	\$146
2007011120 at around 13:30	11732	7495	7315		\$169	\$166	\$151	\$148
2007011119 at around 13:00	11732	7495	7150		\$169	\$167	\$150	\$146
2007011118 at around 12:30	11565	7495	7147		\$110	\$109	\$101	\$100
2007011117 at around 12:00	11565	7495	7145		\$109	\$107	\$101	\$100
2007011116 at around 11:30	11565	7508	7145		\$109	\$107	\$101	\$100
2007011115 at around 11:00	11565	7508	7145		\$141	\$138	\$130	\$130
2007011114 at around 10:30	11569	7507	7147		\$311	\$299	\$289	\$285
2007011113 at around 10:00	11568	7507	7146		\$311	\$299	\$291	\$289
2007011112 at around 09:30	11566	7508	8326		\$473	\$442	\$450	\$489
2007011111 at around 09:00	11567	7508	8103		\$473	\$439	\$450	\$479
2007011110 at around 08:30	11559	7508	8122		\$9,350	\$4,832	\$9,298	\$145
2007011109 at around 08:00	11563	7454	7951		\$9,350	\$300	\$9,118	\$147
2007011108 at around 07:30	11559	7452	7956		\$214	\$200	\$216	\$233
2007011107 at around 07:00	11563	7453	7962		\$325	\$299	\$329	\$359
2007011106 at around 06:30	11567	7438	7966		\$351	\$299	\$355	\$390
2007011105 at around 06:00	11572	7440	7959		\$257	\$237	\$259	\$286
2007011104 at around 05:30	11567	7438	8548		\$443	\$299	\$450	\$9,501
2007011103 at around 05:00	11557	7436	8548		\$327	\$299	\$450	\$9,501
2007011102 at around 04:30	11557	7436	8548		\$327	\$299	\$450	\$9,501

Appendix B – price setters for the 4 pm trading interval

The following table identifies the trading interval in which the spot price exceeded \$5000/MWh. Each five minute dispatch interval price and the generating units involved in setting the energy price, as published in the market systems are shown. This information is published by NEMMCO⁴. Also shown is the energy or ancillary service offer price involved in determining the dispatch price together with the quantity of that service and the contribution to the total energy price. The 30-minute spot price is the time weighted average of the six dispatch interval prices.

Thursday 11 January – New South Wales 4 pm

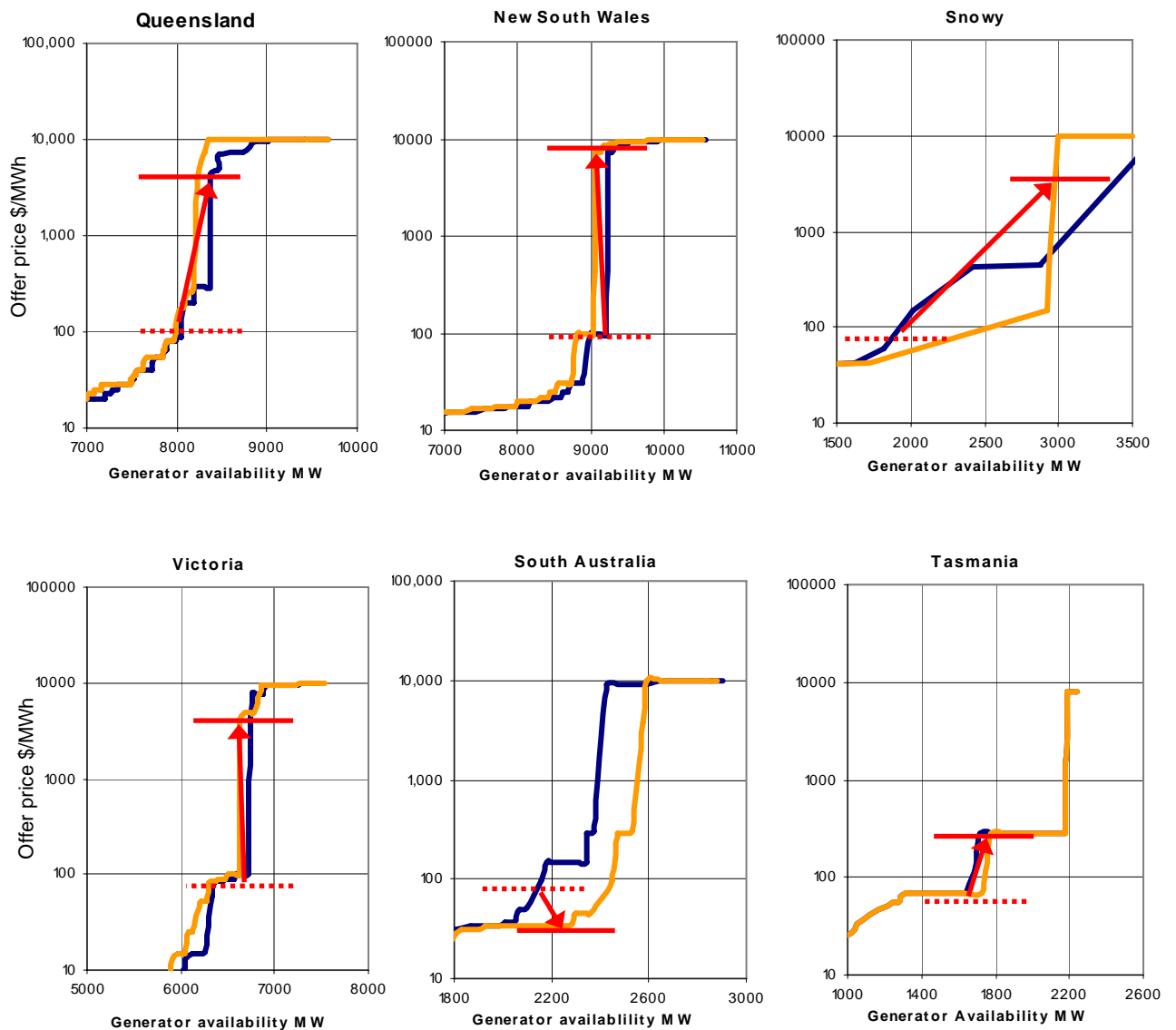
Time	Dispatch price (\$/MWh)	Participant	Unit	Service	Offer price	Marginal change	Contribution (\$/MWh)
15:35	\$274.34	Enertrade	MSTUART2	Energy	\$263.59	1.04	\$274.34
15:40	\$526.94	Snowy Hydro	MURRAY	Energy	\$450.00	1.17	\$526.94
15:45	\$9,350.01	Eraring Energy	ER01	Energy	\$9,350.01	0.14	\$1,335.71
		Eraring Energy	ER02	Energy	\$9,350.01	0.14	\$1,335.71
		Eraring Energy	ER03	Energy	\$9,350.01	0.14	\$1,335.71
		Eraring Energy	ER04	Energy	\$9,350.01	0.14	\$1,335.71
		Eraring Energy	SHGEN	Energy	\$9,350.01	0.43	\$4,007.14
15:50	\$7,350.01	Eraring Energy	ER01	Energy	\$7,350.01	0.25	\$1,837.50
		Eraring Energy	ER02	Energy	\$7,350.01	0.25	\$1,837.50
		Eraring Energy	ER03	Energy	\$7,350.01	0.25	\$1,837.50
		Eraring Energy	ER04	Energy	\$7,350.01	0.25	\$1,837.50
15:55	\$7,350.01	Eraring Energy	ER01	Energy	\$7,350.01	0.25	\$1,837.50
		Eraring Energy	ER02	Energy	\$7,350.01	0.25	\$1,837.50
		Eraring Energy	ER03	Energy	\$7,350.01	0.25	\$1,837.50
		Eraring Energy	ER04	Energy	\$7,350.01	0.25	\$1,837.50
16:00	\$5,700.41	Tru Energy	YWPS3	Energy	\$4,900.07	1.16	\$5,700.41
Spot price	\$5091.95/MWh						

⁴ NEMMCO first published details on how the price is determined, for every dispatch interval, in June 2004. Documentation of this process can be found at <http://www.nemmco.com.au/dispatchandpricing/140-0036.htm>

Appendix C – Supply curves for each region for the 4 pm trading interval

The following figures show the supply curve and spot price in each region for the 4 pm trading interval compared with the forecast produced four hours ahead. The supply curve is the sum of all generation offered within a region at various offer prices. It highlights for a given level of demand, the movement in the amount of capacity offered at a given price in predispach compared to dispatch. A shift in the supply curve left tends to increase spot price for the same level of generation dispatch, while a shift right tends to decrease spot price.

The figures show that there were minimal changes to the supply curve in the four hours ahead of dispatch apart from the Snowy and South Australian regions. The actual demand, however, was significantly higher than forecast.



Supply curve: forecast 4hr ahead Actual

Spot price: forecast 4hr ahead Actual

Appendix D highlights the half hour closing bids for all participants in New South Wales and Snowy with capacity priced at or above \$5000/MWh for each trading interval of the day. It also shows the generation output of that participant and the spot price exceeding \$5000/MWh.

Figure D1: Macquarie Generation closing bid prices, dispatch and region price.

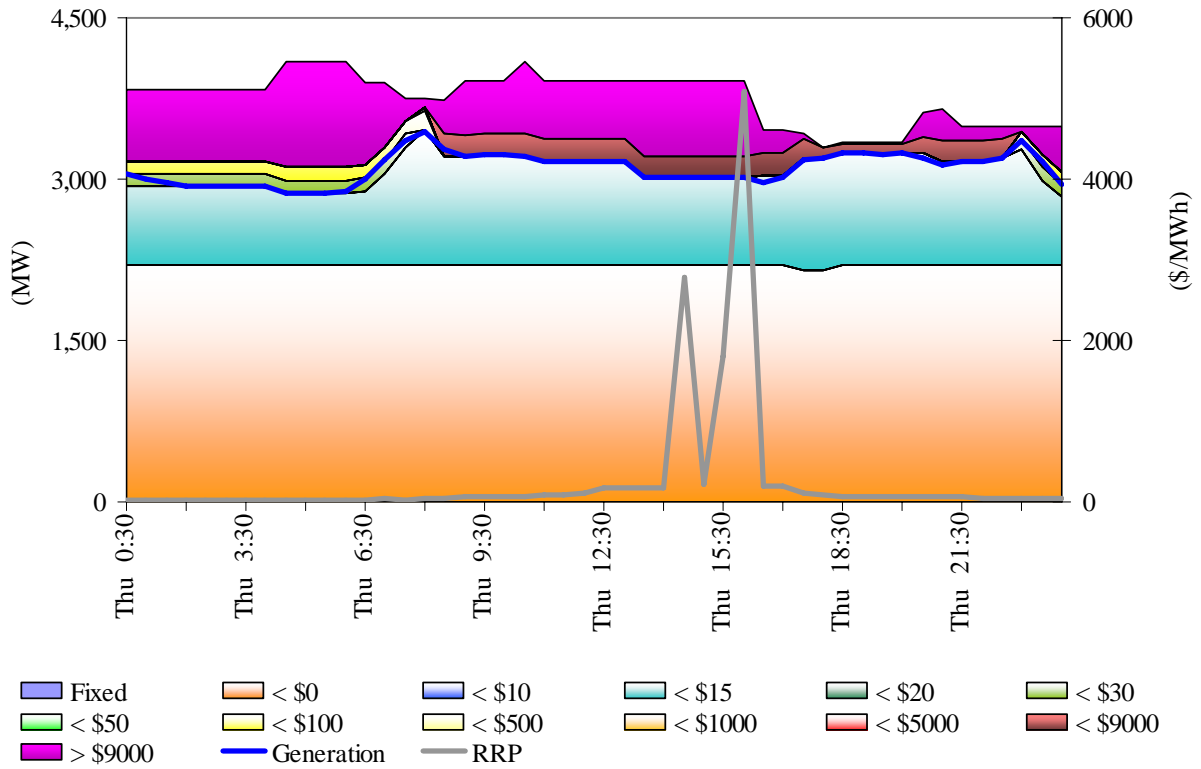


Figure D2: Delta Electricity closing bid prices, dispatch and spot price.

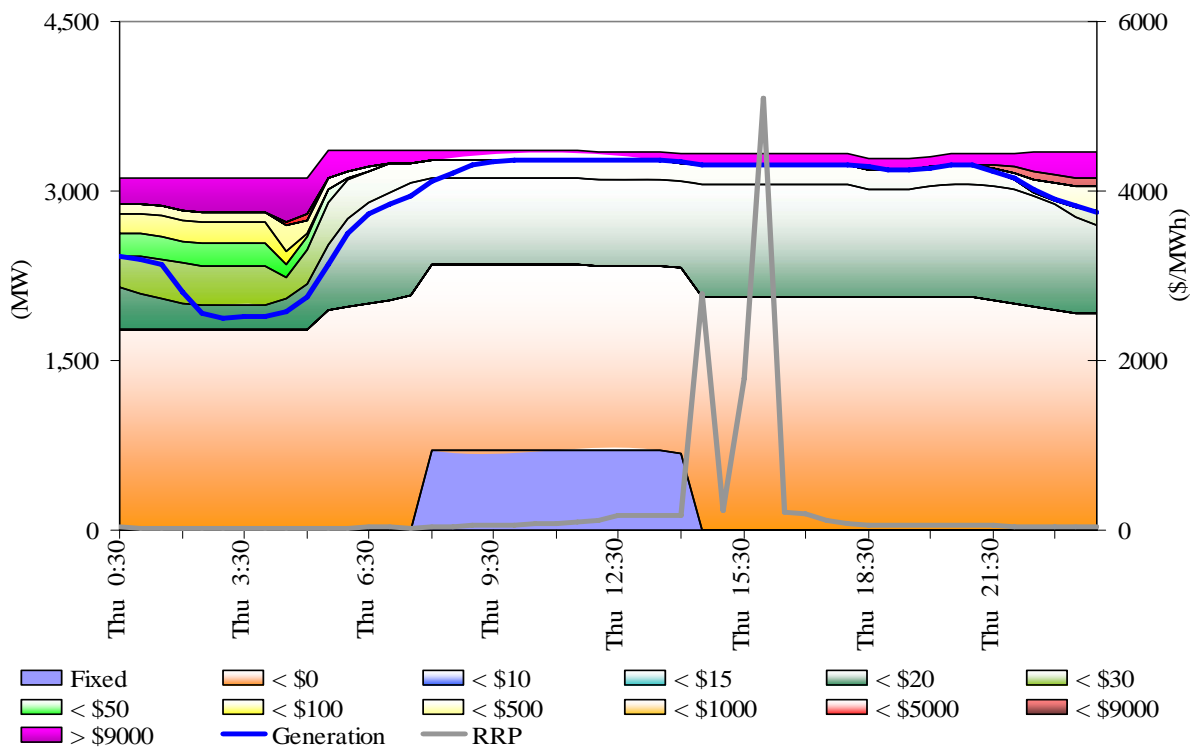


Figure D3: Eraring Energy closing bid prices, dispatch and spot price.

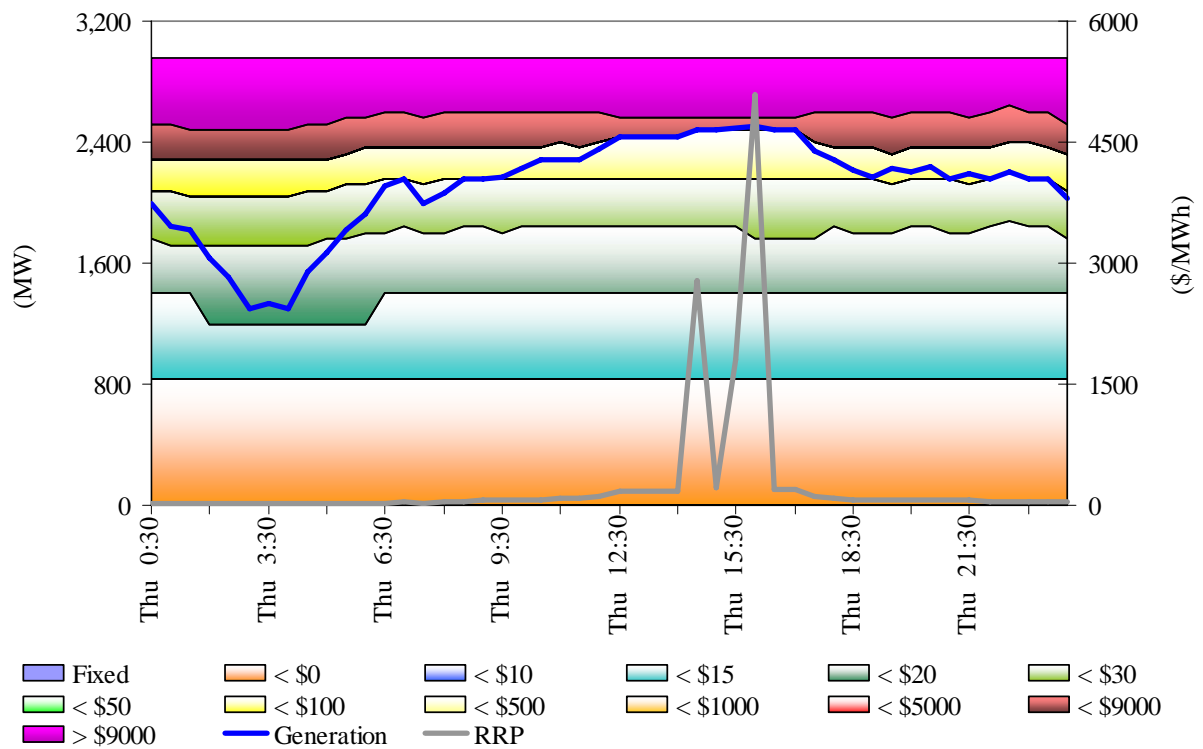


Figure D4: Snowy Hydro closing bid prices, dispatch and spot price.

