

Spot prices greater than \$5 000/MWh



AUSTRALIAN ENERGY
REGULATOR

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Introduction

The AER is required to publish a report within 20 business days of the end of a week 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.

Description of the circumstances

On Wednesday 7 December high temperatures in New South Wales and Queensland, led to record coincident demand across the two regions, reaching 20 900 MW at 4pm. The temperature in Sydney reached 38.7 degrees. Demand in New South Wales peaked at just over 12 900 MW, the highest-ever for summer and only 200 MW short of the winter record. Demand in Queensland reached 8000 MW, also around 200 MW below the record. NEMMCO reported a level one lack of reserve condition in Queensland¹ between 2pm and 4.35pm.

Half-hour spot prices exceeded \$5000/MWh on four occasions in New South Wales, three occasions in Queensland and on one occasion in the Snowy region. Figure 1 identifies those trading intervals where the spot price exceeded \$5000/MWh and the price during the trading interval. The maximum price in Victoria and South Australia during this period was around \$90/MWh.

Figure 1 - Spot prices above \$5000/MWh

Trading interval ending	NSW spot price (\$/MWh)	Queensland spot price (\$/MWh)	Snowy spot price (\$/MWh)
2:30 pm	5332	4937	42
3:00 pm	7798	7090	2058
3:30 pm	8371	7867	4881
4:00 pm	8754	7824	6113

¹ Lack of reserve level 1 (LOR1) means that NEMMCO considers that there is insufficient capacity reserves available to provide complete replacement of the contingency capacity reserve on the occurrence of a critical single credible contingency event. The largest critical single credible contingency in Queensland is generally the loss of 450 MW of generation.

The marginal scheduled generating units involved in setting spot prices above \$5000/MWh in New South Wales, Queensland and Snowy and how those prices were determined by the market systems are detailed in Appendix 1.

Prices above \$5000/MWh

The spot price was greater than \$5000/MWh in New South Wales between 2.30pm and 4pm, peaking at \$8754/MWh. In Queensland there were three spot prices greater than \$5000/MWh. These occurred between 3pm and 4pm with the spot price peaking at \$7867/MWh. The one trading interval in Snowy where the price exceeded \$5000/MWh occurred at 4pm, with price reaching \$6113/MWh.

The contributing factors to market prices can be categorised into:

- market forecasts;
- changes to network availability;
- rebidding, including changes to generation capacity; and
- offer prices.

Market forecasts. Figure 2 shows, for the trading intervals where the spot price was greater than \$5000/MWh in New South Wales, actual price, demand and available capacity in Queensland, and compares it with that forecast 4 and 12 hours ahead of dispatch. Figure 3 shows similar information for New South Wales. Figure 4 highlights price and despatched generation at Murray and Tumut 3 (Lower Tumut) in the Snowy region on the same basis.

Figure 2: Queensland actual and forecast information

2:30 pm	Actual	4 hr forecast	12 hr forecast
Price (\$/MWh)	4937.05	315.82	281.81
Demand (MW)	7974	8067	8167
Available capacity (MW)	9300	9408	9588
3:00 pm	Actual	4 hr forecast	12 hr forecast
Price (\$/MWh)	7089.57	853.56	282.89
Demand (MW)	7946	8074	8174
Available capacity (MW)	9295	9406	9588
3:30 pm	Actual	4 hr forecast	12 hr forecast
Price (\$/MWh)	7867.33	846.63	299.64
Demand (MW)	7939	7982	8184
Available capacity (MW)	9345	9411	9588
4:00 pm	Actual	4 hr forecast	12 hr forecast
Price (\$/MWh)	7824.25	412.69	299.64
Demand (MW)	7984	8009	8212
Available capacity (MW)	9286	9651	9588

Conditions in Queensland at the time saw demand within 200 MW of the record set the previous day. Forecasts prepared 12 hours ahead of dispatch were predicting demands around 200 MW higher than actual. Available capacity was between 100 MW and 400 MW lower than forecast four hours ahead. Most of the reduction in capacity was priced at less than zero.

Figure 3: New South Wales actual and forecast information

2:30 pm	Actual	4 hr forecast	12 hr forecast
Price (\$/MWh)	5331.75	334.86	267.39
Demand (MW)	12 525	12 192	11 961
Available capacity (MW)	10 886	10 762	11 047
3:00 pm	Actual	4 hr forecast	12 hr forecast
Price (\$/MWh)	7798.39	919.35	268.44
Demand (MW)	12 670	12 340	11 979
Available capacity (MW)	10 886	10 782	11 047
3:30 pm	Actual	4 hr forecast	12 hr forecast
Price (\$/MWh)	8730.82	920.30	288.40
Demand (MW)	12 844	12 397	12 021
Available capacity (MW)	10 926	10 826	11 047
4:00 pm	Actual	4 hr forecast	12 hr forecast
Price (\$/MWh)	8754.32	451.72	284.20
Demand (MW)	12 922	12 342	11 993
Available capacity (MW)	10 926	10 826	11 047

The temperature in Sydney on the day peaked at 38.7 degrees, around 4 degrees higher than forecast the previous day. Demand in New South Wales reached a new summer record and was within 200 MW of the highest ever. As a result, demand forecasts produced 12 hours to dispatch were 600 MW to 1000 MW lower than actual. Demand forecast errors four hours to dispatch varied from around 300 MW at 1.30pm to a maximum error of 870 MW at 5pm.

Figure 4: Snowy actual and forecast information

2:30 pm	Actual	4 hr forecast	12 hr forecast
Price (\$/MWh)	42.00	33.00	33.00
Murray Generation (MW)	1207	1018	1182
Tumut 3 Generation (MW)	952	753	638
3:00 pm	Actual	4 hr forecast	12 hr forecast
Price (\$/MWh)	2057.77	26.50	33.00
Murray Generation (MW)	1187	881	1172
Tumut 3 Generation (MW)	964	756	638
3:30 pm	Actual	4 hr forecast	12 hr forecast
Price (\$/MWh)	4880.92	33.00	247.93
Murray Generation (MW)	1197	1049	1200
Tumut 3 Generation (MW)	969	777	638
4:00 pm	Actual	4 hr forecast	12 hr forecast
Price (\$/MWh)	6112.56	33.00	244.27
Murray Generation (MW)	1193	1079	1200
Tumut 3 Generation (MW)	966	756	638

Throughout the period, 5-minute dispatch prices in the Snowy region oscillated between zero and above \$6000/MWh.

Changes to network availability. From 11.25am to 8pm NEMMCO invoked discretionary constraints to limit flows from Victoria to Snowy. Those constraints were designed to limit the accumulation of negative settlement residues. Prior to these constraints being implemented, forecast flows, driven by constraints within the Snowy region, were forcing flows from Victoria into Snowy at levels of up to 200 MW and at times counter-price. The discretionary constraints limited flows from Victoria to between 50 MW and 250 MW.

Flows into New South Wales from Snowy were limited to around 2900 MW throughout this period while flows south from Queensland peaked during the 5pm trading interval at more than 800 MW, short of the limit by around 100 MW.

Constraints between central and south Queensland, which limit flows to around 1900 MW, saw at times as much as 150 MW of low priced capacity in central Queensland constrained off.

Figures 5-7 show the target flows and limits on the New South Wales to Queensland (QNI), Snowy to New South Wales (Snowy1) and Victoria to Snowy interconnectors respectively between 12pm and 8pm on Wednesday 7 December.

Figure 5: QNI interconnector target flows including import and export limits

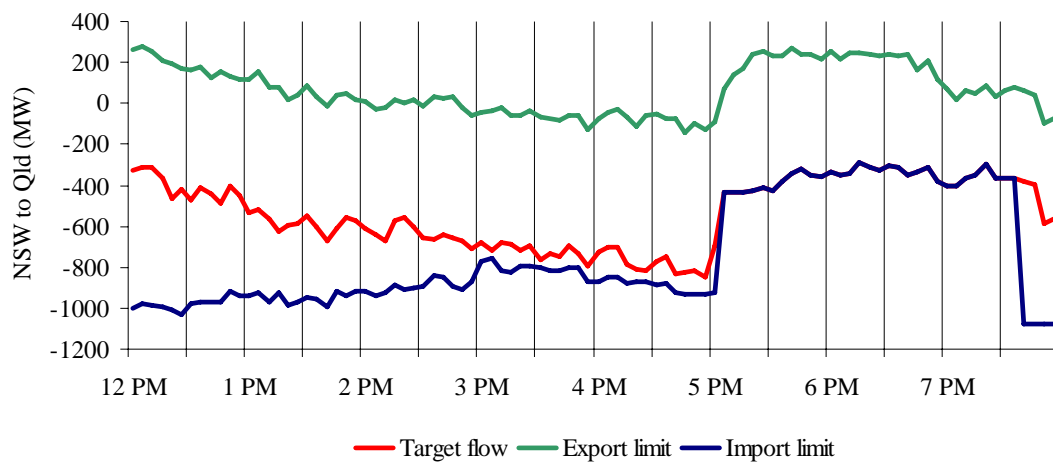


Figure 6: Snowy1 interconnector target flows including import and export limits

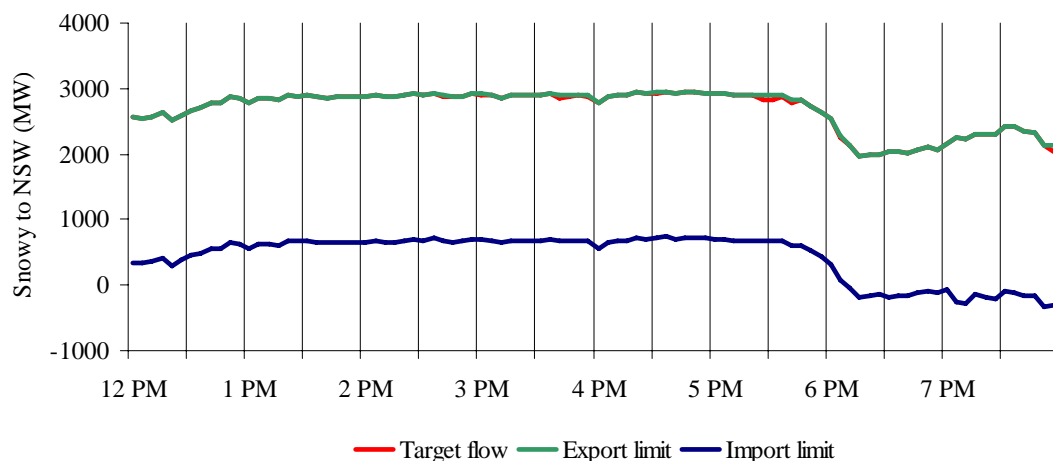
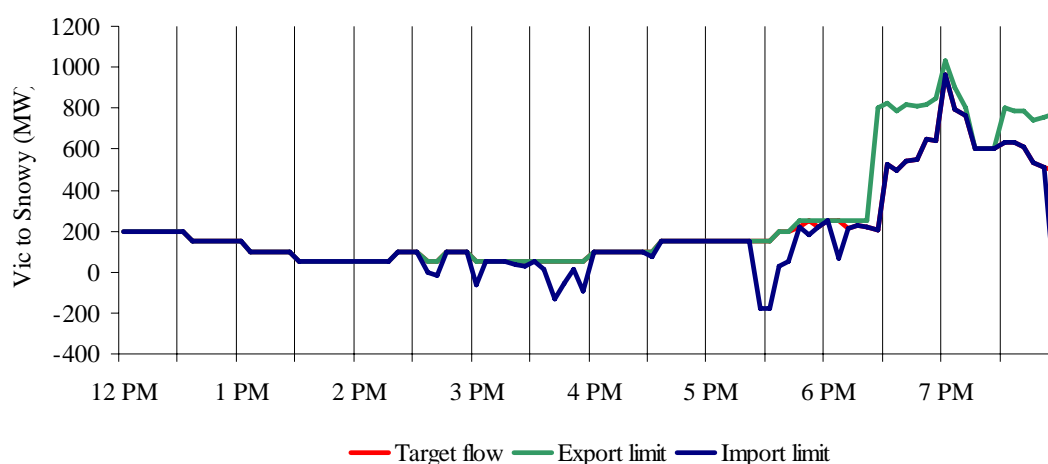


Figure 7: Vic-Snowy interconnector target flows including import and export limits



Rebidding - Queensland. Delays in the return to service of Millmerran unit 1, which had been out of service since mid November and was initially expected to return around 8am, saw as much 250 MW less available capacity than expected at 1pm. The rebid reasons given included “Revised synchronization” and “Changed plant conditions”. All of this capacity was priced at less than zero.

At 8.50am, Origin Energy committed 58 MW of capacity at Roma at prices close to zero from prices above \$9 000/MWh. The rebid reason given was “Est (N) change in PDS”.

At 11.46am, CS Energy rebid around 60 MW of capacity across Callide B and Swanbank B and E, from prices of less than \$20/MWh to prices above \$400/MWh. The rebid reason given was “Portfolio rearrangement based on latest P”. At 1.19pm, around 400 MW was rebid from prices of zero and above to the market floor across Callide B. The rebid reason given was “Callide B response to Central to south constraint”. At 1.39pm Callide B1 was rebid as fixed load. The rebid reason given was “Callide B1 unit instability”.

From midday, Enertrade rebid around 450 MW of capacity from across its portfolio from prices above \$100/MWh, to prices below zero. The rebid reasons given included “Inter/Intra connector constraint::Changed MW distrib” and “Material change in market conditions ::Changed MW distrib”.

At 1.50pm, effective 2pm, Callide Power Trading reduced the availability of Callide unit C3 by 50 MW. The rebid reason given was “Mill trip” and was effective until 3.05pm. All of this capacity was priced at less than zero.

There was no other significant rebidding within Queensland.

Rebidding - New South Wales. There was around 9200 MW of capacity in New South Wales priced below \$30/MWh presented through day-ahead bids, with around 200 MW of capacity priced between \$30/MWh and \$5000/MWh. A further 1600 MW of capacity in New South Wales was priced above \$5000/MWh.

At 9.08am, Macquarie Generation rebid as much as 400 MW of capacity from prices below \$20/MWh to prices above \$500/MWh. The reason given was “RP/Volume tradeoff – load expected to vary from forecast”.

At 2.16pm, effective from 2.25pm until 4pm, Eraring Energy rebid 100 MW of capacity from prices of less than \$30/MWh to prices above \$9 000/MWh. The rebid reason given was “F:Increased likelihood of increased profit”.

There was no other significant rebidding within New South Wales.

Rebidding – Snowy region. Between 12.40pm and 2.50pm, Snowy Hydro rebid around 100 MW of capacity at Tumut 3 from prices above \$7500/MWh to between \$270/MWh and \$760/MWh. The rebid reasons included, “M: Change in NSW RRP 5/30 mngemnt: Bandshift down” and “M: mnge const maximise flow: Bandshift down”

At 2.24pm, 1200 MW of capacity at Murray, was shifted from priced of \$42/MWh and below, to zero. The rebid reason given was “M: NEMMCO increase Vic-SN limit:Bandshift down”. Just prior at around 2.20pm, NEMMCO had increased the discretionary limit that was restricting flows north from Victoria by 50 MW to 100 MW.

There was no other significant rebidding within Snowy.

Assessment

A combination of near record demand in Queensland and New South Wales, demand forecast errors, particularly in New South Wales and rebidding contributed to the price exceeding \$5000/MWh. Based on the information available at this point in time, the rebidding requirements of 3.8.22 and 3.8.22A were satisfied.

Offer prices. Figures 8 to 14 present the capacity offered into the market within a series of price thresholds by participants with capacity at prices greater than \$5000/MWh in Queensland, New South Wales and Snowy. Those participants are: Macquarie Generation, Eraring Energy and Delta Electricity in New South Wales, Enertrade and Tarong Energy in Queensland and Snowy Hydro. These figures compare capacity offered into the market, when the spot price was above \$5000/MWh, with other periods of the day. Spot price and dispatched generation are overlaid. Figures 11 and 12 divide Snowy Hydro into generation at Murray and Lower Tumut to highlight the amount of capacity priced at zero at Murray.

Figure 8: Macquarie Generation closing bid prices, dispatch and region price.

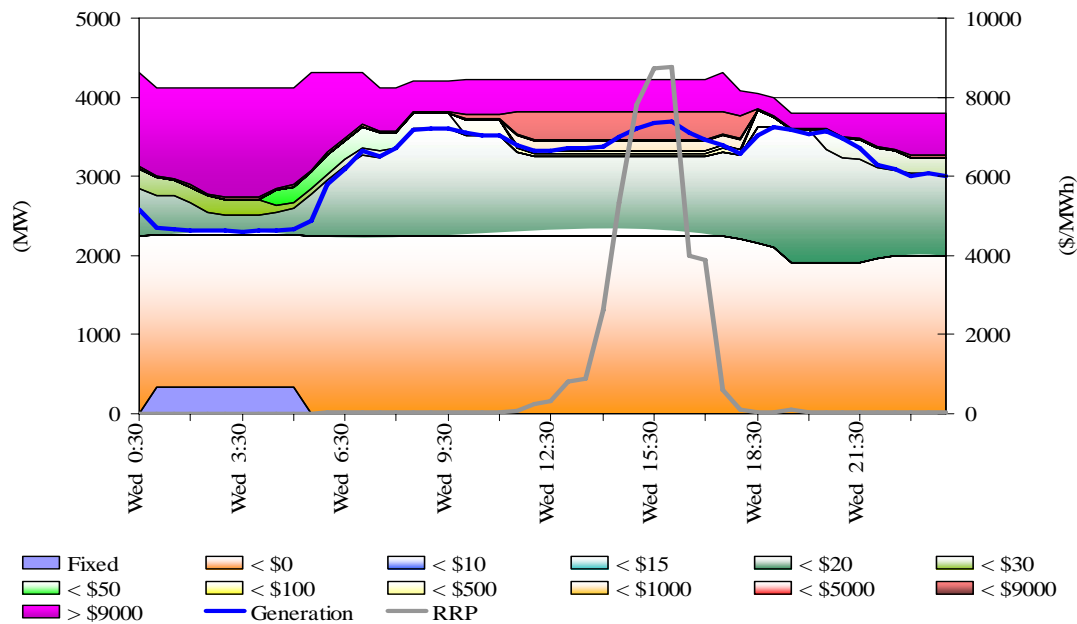


Figure 9: Eraring Energy closing bid prices, dispatch and region price.

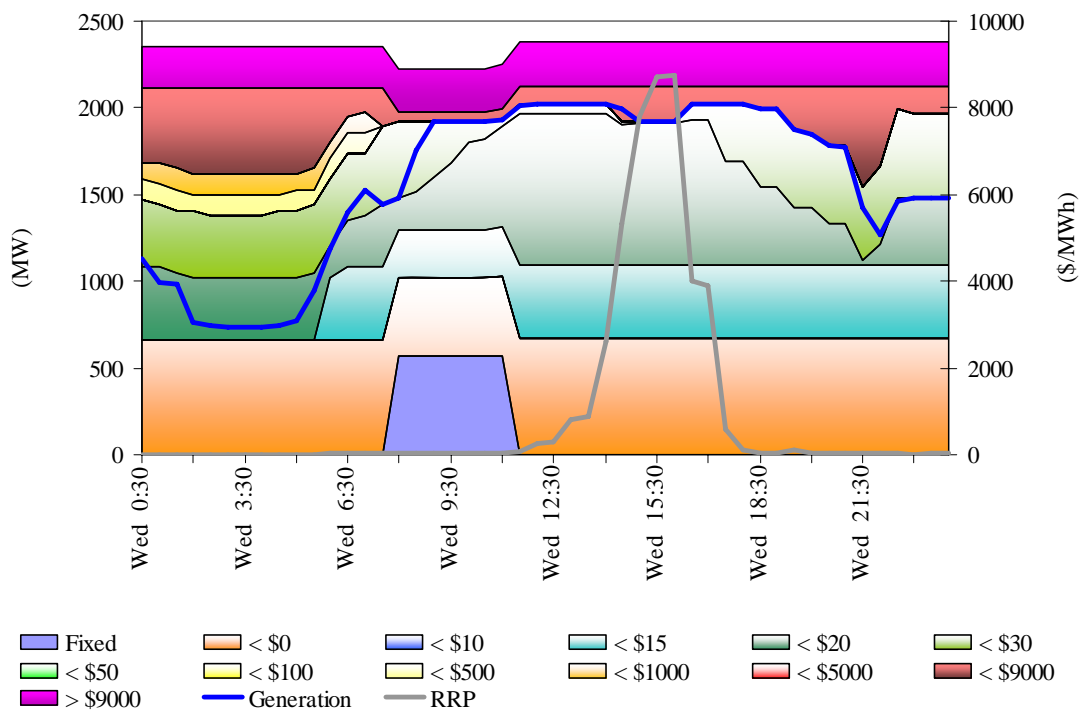


Figure 10: Delta Electricity closing bid prices, dispatch and region price.

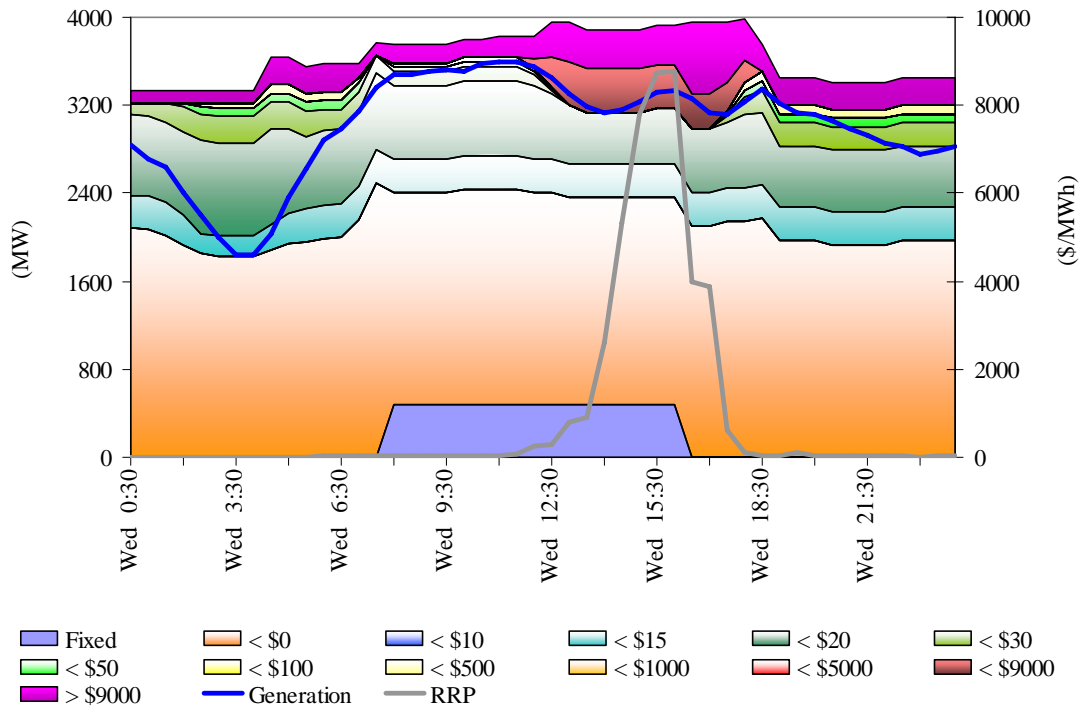


Figure 11: Snowy Hydro - Murray closing bid prices, dispatch and region price.

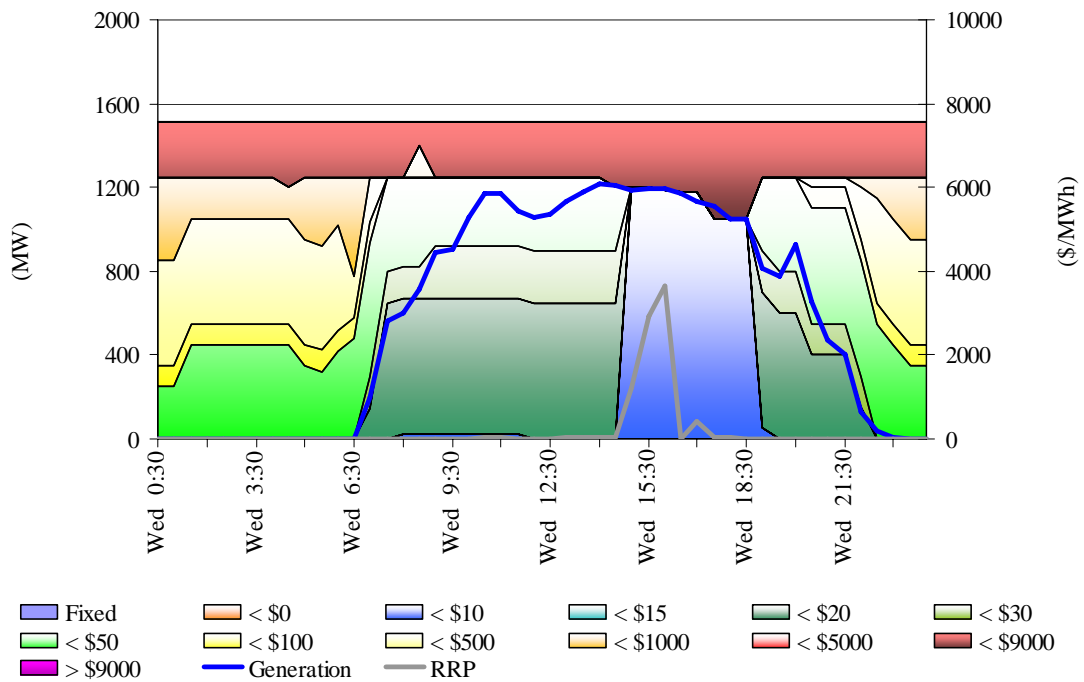


Figure 12: Snowy Hydro – Tumut 3 closing bid prices, dispatch and region price.

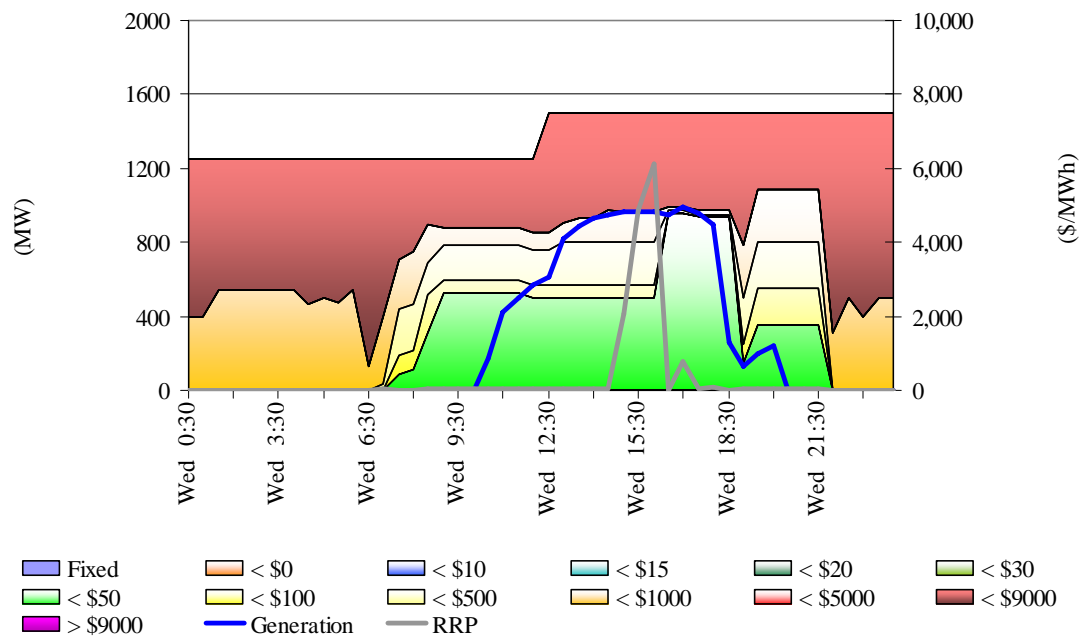


Figure 13: Enertrade closing bid prices, dispatch and region price

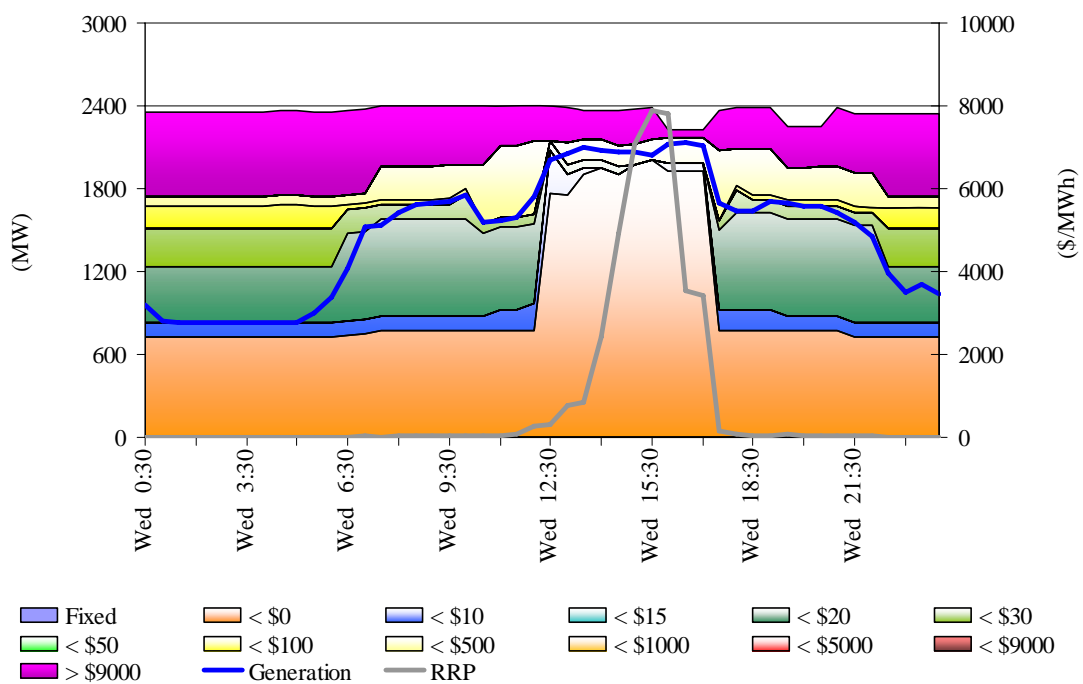
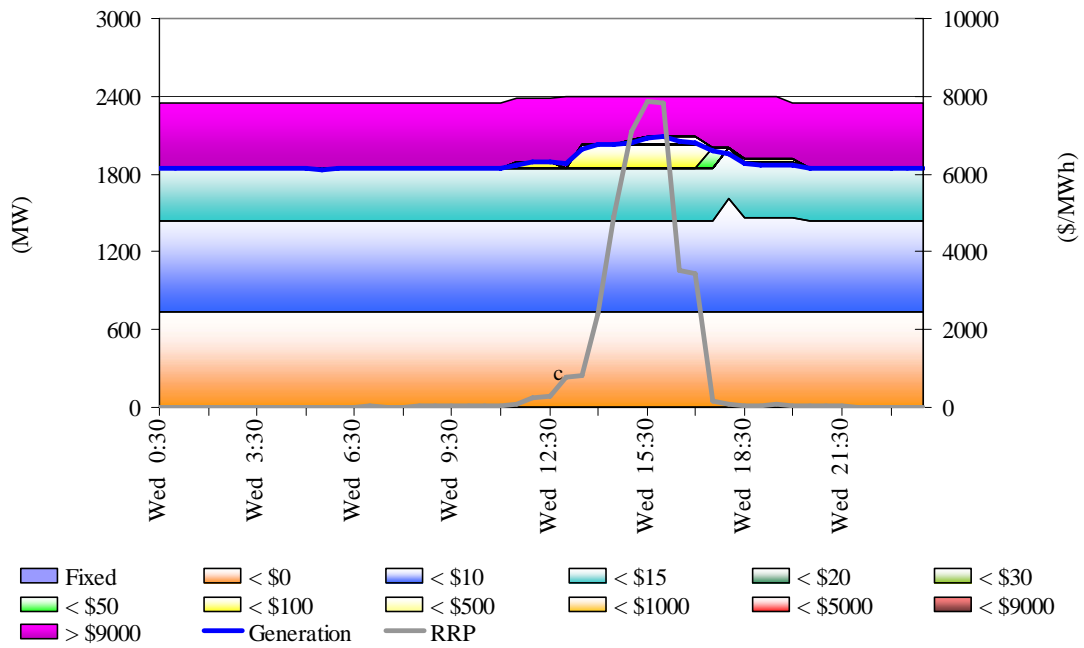


Figure 14: Tarong Energy closing bid prices, dispatch and region price



Appendix 1

The following tables identify for each trading interval in which the spot price exceeded \$5000/MWh, every five minute dispatch interval price and the generating units, as published in the market systems, involved in setting the energy price. This information is published by NEMMCO². Also shown is the energy or ancillary service offer price involved in determining the dispatch price together with the quantity and the contribution of that service to the total energy price. Dispatch prices greater than \$10 000/MWh are capped. The 30-minute spot price is the time weighted average of the six dispatch interval prices.

Wednesday 7 December – Queensland 3pm

Time	Dispatch price(\$/MWh)	Participant	Unit	Service	Offer (\$/MWh)	Marginal change	Portion (\$/MWh)
14:35	6747.50	Delta Electricity	MP1	Energy	7400.00	0.46	3373.75
			MP2	Energy	7400.00	0.46	3373.75
14:40	6702.23	Macquarie Gen	LD04	Energy	7362.45	0.91	6702.23
14:45	6745.38	Delta Electricity	MP1	Energy	7400.00	0.46	3372.69
			MP2	Energy	7400.00	0.46	3372.69
14:50	7902.32	Tarong	TARONG#1	Raise reg	1.10	0.91	1.00
		Macquarie Gen	BW02	Raise reg	0.02	-0.91	-0.02
			BW02	Energy	8666.24	0.91	7901.34
14:55	7802.32	Macquarie Gen	BW01	Energy	8560.56	0.91	7802.32
15:00	6637.70	Delta Electricity	MP2	Energy	7400.00	0.45	3318.85
			MP1	Energy	7400.00	0.45	3318.85
Spot price	\$7089.57/MWh						

Wednesday 7 December – Queensland 3.30pm

Time	Dispatch price(\$/MWh)	Participant	Unit	Service	Offer (\$/MWh)	Marginal change	Portion (\$/MWh)
15:05	7735.82	Macquarie Gen	BW01	Energy	8560.56	0.90	7735.82
15:10	7672.13	Macquarie Gen	BW01	Energy	8560.56	0.90	7672.13
15:15	8128.07	Eraring Energy	ER02	Energy	9000.00	0.22	1977.10
			ER01	Energy	9000.00	0.17	1537.74
15:20	7882.23	Delta Electricity	VP6	Energy	9000.00	0.51	4613.23
		Snowy Hydro	GUTHEGA	Energy	0.00	0.00	0.00
			TUMUT3	Energy	7539.69	1.05	7882.23
			MURRAY	Energy	0.00	0.03	0.00
15:25	7864.12	Macquarie Gen	BW03	Energy	8771.93	0.90	7864.12
15:30	7921.64	Macquarie Gen	BW03	Energy	8771.93	0.90	7921.64
Spot price	\$7867.33/MWh						

² 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>

Wednesday 7 December – Queensland 4pm

Time	Dispatch price(\$/MWh)	Participant	Unit	Service	Offer (\$/MWh)	Marginal change	Portion (\$/MWh)
15:35	7713.02	Macquarie Gen	BW02	Energy	8666.24	0.89	7713.02
15:40	7770.59	Macquarie Gen	BW02	Energy	8666.24	0.90	7770.59
15:45	7808.97	Macquarie Gen	BW03	Energy	8771.93	0.89	7808.97
15:50	8024.96	Macquarie Gen	BW04	Energy	8877.62	0.90	8024.96
15:55	7875.07	Macquarie Gen	BW03	Energy	8771.93	0.90	7875.07
16:00	7752.87	Macquarie Gen	BW03	Energy	8771.93	0.88	7752.87
Spot price	\$7824.25/MWh						

Wednesday 7 December – New South Wales 2.30pm

Time	Dispatch price(\$/MWh)	Participant	Unit	Service	Offer (\$/MWh)	Marginal change	Portion (\$/MWh)
14:05	929.40	Macquarie Gen	BW02	Energy	929.40	1.00	929.40
14:10	949.49	Macquarie Gen	BW04	Energy	949.49	1.00	949.49
14:15	5522.37	LYMMCO	LYA4	Raise 60 sec	0.40	0.42	0.17
			LYA4	Raise 6 sec	0.50	0.42	0.21
		CS Energy	SWAN_B_1	Raise 5 min	1.00	-1.10	-1.10
			SWAN_B_1	Raise 60 sec	0.01	-0.42	0.00
			SWAN_B_1	Raise 6 sec	0.01	-0.42	0.00
			SWAN_B_1	Energy	4,997.00	1.10	5521.12
		Macquarie Gen	BW04	Raise 5 min	1.80	1.10	1.99
14:20	7362.45	Macquarie Gen	LD04	Energy	7,362.45	1.00	7362.45
14:25	8666.24	Macquarie Gen	BW02	Energy	8,666.24	1.00	8666.24
14:30	8560.56	Macquarie Gen	BW01	Energy	8,560.56	1.00	8560.56
Spot price	\$5331.75/MWh						

Wednesday 7 December – New South Wales 3pm

Time	Dispatch price(\$/MWh)	Participant	Unit	Service	Offer (\$/MWh)	Marginal change	Portion (\$/MWh)
14:35	7400.00	Delta Electricity	MP1	Energy	7400.00	0.50	3700.00
			MP2	Energy	7400.00	0.50	3700.00
14:40	7362.45	Macquarie Gen	LD04	Energy	7362.45	1.00	7362.45
14:45	7400.00	Delta Electricity	MP1	Energy	7400.00	0.50	3700.00
			MP2	Energy	7400.00	0.50	3700.00
14:50	8667.32	Tarong	TARONG#1	Raise reg	1.10	1.00	1.10
		Macquarie Gen	BW02	Raise reg	0.02	-1.00	-0.02
			BW02	Energy	8666.24	1.00	8666.24
14:55	8560.56	Macquarie Gen	BW01	Energy	8560.56	1.00	8560.56
15:00	7400.00	Delta Electricity	MP2	Energy	7400.00	0.50	3700.00
Spot price	\$7798.39/MWh						

Wednesday 7 December – New South Wales 3.30pm

Time	Dispatch price(\$/MWh)	Participant	Unit	Service	Offer (\$/MWh)	Marginal change	Portion (\$/MWh)
15:05	8560.56	Macquarie Gen	BW01	Energy	8560.56	1.00	8560.56
15:10	8560.56	Macquarie Gen	BW01	Energy	8560.56	1.00	8560.56
15:15	9000.00	Eraring Energy	ER02	Energy	9000.00	0.24	2189.19
			ER01	Energy	9000.00	0.19	1702.70
		Delta Electricity	VP6	Energy	9000.00	0.57	5108.11
15:20	8719.93	Snowy Hydro	GUTHEGA	Energy	0.00	0.00	0.00
			TUMUT3	Energy	7539.69	1.16	8719.93
			MURRAY	Energy	0.00	0.04	0.00
15:25	8771.93	Macquarie Gen	BW03	Energy	8771.93	1.00	8771.93
15:30	8771.93	Macquarie Gen	BW03	Energy	8771.93	1.00	8771.93
Spot price	\$8730.82/MWh						

Wednesday 7 December – New South Wales 4pm

Time	Dispatch price(\$/MWh)	Participant	Unit	Service	Offer (\$/MWh)	Marginal change	Portion (\$/MWh)
15:35	8666.24	Macquarie Gen	BW02	Energy	8666.24	1.00	8666.24
15:40	8666.24	Macquarie Gen	BW02	Energy	8666.24	1.00	8666.24
15:45	8771.93	Macquarie Gen	BW03	Energy	8771.93	1.00	8771.93
15:50	8877.62	Macquarie Gen	BW04	Energy	8877.62	1.00	8877.62
15:55	8771.93	Macquarie Gen	BW03	Energy	8771.93	1.00	8771.93
16:00	8666.24	Macquarie Gen	BW03	Energy	8771.93	1.00	8771.93
Spot price	\$ 8754.32						

Wednesday 7 December – Snowy 4pm

Time	Dispatch price(\$/MWh)	Participant	Unit	Service	Offer (\$/MWh)	Marginal change	Portion (\$/MWh)
15:35	0.00	Snowy Hydro	GUTHEGA	Energy	0.00	0.04	0.00
			MURRAY	Energy	0.00	0.96	0.00
15:40	7249.97	Macquarie Gen	BW02	Energy	8666.24	0.84	7249.97
15:45	7339.72	Macquarie Gen	BW03	Energy	8771.93	0.84	7339.72
15:50	7426.51	Macquarie Gen	BW04	Energy	8877.62	0.84	7426.51
15:55	7330.35	Macquarie Gen	BW03	Energy	8771.93	0.84	7330.35
16:00	7328.79	Macquarie Gen	BW03	Energy	8771.93	0.84	7328.79
Spot price	\$6112.56/MWh						