

# Spot prices greater than \$5000/MWh



AUSTRALIAN ENERGY  
REGULATOR

Queensland 23 January 2007

## 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

On Tuesday 23 January, the spot price in Queensland exceeded \$5000/MWh in two trading intervals, reaching \$5920/MWh and \$7939/MWh at 3 pm and 3.30 pm respectively. Demand at the time was at near-record levels.

A planned network outage at Tarong, combined with the loss of 120 MW of generation at Swanbank, resulted in flows between Tarong and Brisbane exceeding secure limits. As shown in figure 2 there are three flow paths into Tarong. NEMMCO managed the increased flows on the Tarong to Brisbane path by invoking constraints to limit flows on the three flow paths into Tarong. The constraints restricted the dispatch of cheaper generation in South West and Central Queensland by around 1000 MW, significantly increasing the Queensland price. The constraints invoked by NEMMCO restricted flows from New South Wales by a further 425 MW.

Five-minute prices in Victoria, Snowy and New South Wales exceeded \$4000/MWh during the 3.30 pm trading interval. The constraints were withdrawn at 3.25 pm. The use of these constraints was not forecast through the market systems.

## Actual and forecast demand

On 23 January demand in Queensland reached 8129 MW<sup>1</sup> at 2 pm, within 150 MW of the highest-ever<sup>2</sup>. Demand reduced slightly over the next two hours. Forecasts on the day were predicting near record demand. Actual demand was, however, slightly lower than forecast.

Figure 1 compares the actual demand in Queensland with that forecast by NEMMCO four and twelve hours ahead of dispatch. A comparison of actual and forecast spot price is also included.

<sup>1</sup> The peak demand on the day was around 1450 MW lower than the extreme 10% probability of exceedance summer forecast of 9 675 MW published in the 2006 Statement of Opportunities.

<sup>2</sup> On the following day, demand reached a new record in Queensland of 8338 MW.

**Figure 1: Actual and forecast demand and spot price in Queensland**

<b>Tuesday 3:00 PM</b>	<b>Actual</b>	<b>4 hr forecast</b>	<b>12 hr forecast</b>
Demand (MW)	8046	8253	8229
Spot Price (\$/MWh)	5920.35	119.89	181.34

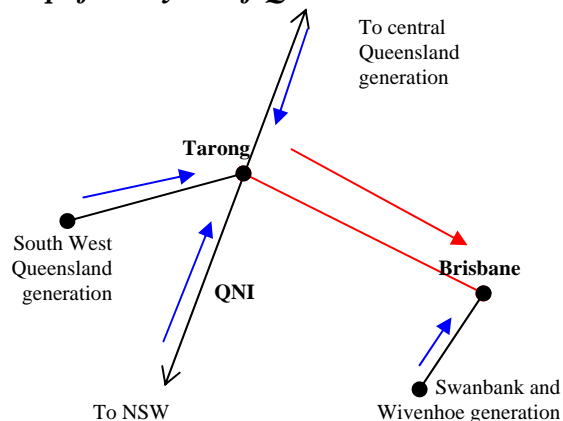
<b>Tuesday 3:30 PM</b>	<b>Actual</b>	<b>4 hr forecast</b>	<b>12 hr forecast</b>
Demand (MW)	7919	8255	8252
Spot Price	7938.97	122.73	193.97

**Changes to network availability**

Network equipment at Tarong substation was out of service on the day for planned upgrades associated with the commissioning of Kogan Creek. Advice of this outage, which was scheduled to occur from 21 January to 31 January, was first provided to NEMMCO by Powerlink on 5 January. Assessments by NEMMCO during the day concluded that there were potential system security issues for flows from Tarong towards Brisbane that led to a reconfiguration of the network.

At 1.45 pm, Swanbank unit B3 tripped, from 120 MW. This increased the impact of the network outage, as Swanbank power station is located close to the Brisbane load. Figure 2 shows a simplified layout of the transmission network in southern Queensland, highlighting the power flows that contributed to the congestion between Tarong and Brisbane.

**Figure 2: simplified layout of Queensland transmission network**



As a result of these system security issues, NEMMCO invoked a constraint from 2.30 pm that reduced flows from Central Queensland, South West Queensland and from New South Wales across QNI. The constraints forced flow south into New South Wales, which was counter-priced. The constraint also restricted the output of all generators in Queensland except for Swanbank and Wivenhoe. Around 9250 MW of the 10 500 MW of generating capacity in Queensland was affected.

At 2.30 pm, coinciding with the first use of this constraint, the limit for flows across QNI into Queensland fell by 400 MW to 25 MW, reducing imports into Queensland by 250 MW. As a result, the five-minute dispatch price in Queensland increased from \$200/MWh to \$370/MWh. By 2.45 pm the import limit had decreased further to force flows out of Queensland, by 173 MW, causing the five-minute dispatch price to increase to \$7459/MWh. The price in New South Wales at the time was \$178/MWh. From 3 pm, NEMMCO invoked further constraints, to restrict the accumulation of negative residues on the interconnector, limiting flows south to around 100 MW. This further restricted the dispatch of cheaper Queensland generation capacity, by a total of around 1000 MW.

At 3.20 pm Swanbank unit three returned to service, relieving the system security issue, and the constraints were removed. As a result, the restrictions on imports from New South Wales and the dispatch of Queensland generation ceased. The Queensland price dropped over two dispatch intervals from \$10 000/MWh to \$175/MWh. The prices in New South Wales, Snowy and Victoria also fell significantly as access to lower priced generation capacity in Queensland increased, which saw exports from Queensland of 460 MW.

Figure 3 compares the half hour average flow and limits across QNI for the 3 pm and 3.30 pm trading intervals with those forecast four and twelve hours ahead of dispatch.

**Figure 3: Actual and forecast flow and limits across QNI (MW)**

<b>Thursday 3:00 pm</b>	<b>Actual</b>	<b>4 hr forecast</b>	<b>12 hr forecast</b>
Limit into QLD	-147	400	396
Flow into QLD	-122	247	82
Limit from QLD	587	728	711

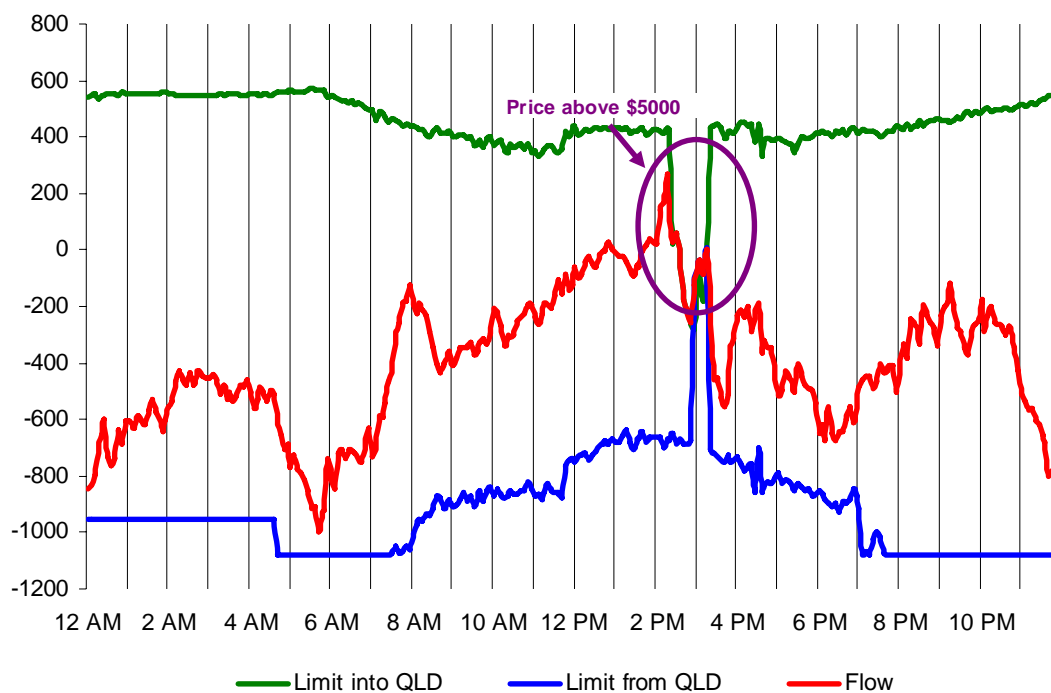
  

<b>Thursday 3:30 pm</b>	<b>Actual</b>	<b>4 hr forecast</b>	<b>12 hr forecast</b>
Limit into QLD	76	404	394
Flow into QLD	-140	253	105
Limit from QLD	268	721	716

The Terranora interconnector was also flowing counter price during this period, with a system normal constraint forcing a flow of around 110 MW south from midday to 4.30 pm. This limitation was, however, forecast from the previous day.

Figure 4 shows the 5-minute flow and limits on QNI for the day. The period where the spot price was greater than \$5000/MWh is highlighted.

**Figure 4: Actual 5-minute flow and limits across QNI (MW)**



## Generator offers and rebidding

The summer capability of the installed generation in Queensland is 10 500 MW<sup>3</sup>. On 23 January, there was up to 585 MW not presented to the market during the high priced period. Constraints invoked during the afternoon to manage the network outage around Tarong limited access to low priced generation capacity in central and south west Queensland by around 1000 MW. Figure 5 details the significant generation capacity that was not presented on that day.

*Figure 5: Queensland generation capacity not presented*

Participant	Capacity (MW)	Comment
<b>CS Energy</b>		
Swanbank	125	Swanbank unit B3 tripped from 120MW at 1.45 pm on the day.
<b>Millmerran Energy Trader</b>		
	300	The availability of Millmerran unit 1 was reduced by up to 105 MW from 2.45 pm due to plant conditions. Unit 2, which was returning to service from a one week outage, was also reduced for the day.
<b>Tarong Energy</b>		
Tarong and Wivenhoe(net change)	160	Tarong units 1 and 2 presented a combined fixed loading level of 420 MW, which is 280 MW below the summer capacity. At the same time, Wivenhoe presented as much as 120 MW more than its forecast summer capacity.
<b>Total</b>	<b>585</b>	

Figure 6 shows, for the trading intervals where the spot price was greater than \$5000/MWh, the actual generating capacity presented. The figure compares this with the amount of available capacity forecast four and twelve hours ahead of dispatch. The change in the amount of capacity offered at prices less than the forecast price calculated four hours ahead of dispatch is also included and shows a significant increase in capacity offered at less than the forecast price made four hours ahead. The network constraints within Queensland led to a series of rebids, which saw up to 1000 MW of generation capacity shifted into lower prices. There was no other significant rebidding.

*Figure 6: Actual and forecast capacity and spot price for Queensland*

<b>Tuesday 3:00 PM</b>	<b>Actual</b>	<b>4 hr forecast</b>	<b>12 hr forecast</b>
Capacity (MW)			
available	9797.83	9866	9845
priced at less than \$119.89	8555	8118	
Spot price (\$/MWh)	5920.35	119.89	
<b>Tuesday 3:30 PM</b>			
Capacity (MW)			
available	9951.5	9862	9845
priced at less than \$122.73	9242	8114	
Spot price (\$/MWh)	7938.97	122.73	

<sup>3</sup> Based on the 2006 Statement of Opportunities.

The generators involved in setting the spot price during the 3 pm and 3.30 pm trading intervals, and how that price was determined by the market systems are detailed in **Appendix A**.

The closing bids for all participants in Queensland with capacity priced at or above \$5000/MWh during this period are presented in **Appendix B**.

### **Assessment**

On Tuesday 23 January demand reached near-record levels in Queensland. A planned network outage at Tarong, combined with the unplanned loss of a 120 MW Swanbank generating unit, caused a system security issue for power flows from Tarong into Brisbane. To manage the situation, NEMMCO invoked network constraints which restricted the dispatch of generation in central and south west Queensland and reduced imports from New South Wales. Queensland prices subsequently reached \$5920/MWh and \$7939/MWh for the 3 pm and 3.30 pm trading intervals respectively.

Rebidding by generators did not contribute to the spot price exceeding \$5000/MWh.

The AER understands that the network outage was taken by Powerlink to allow maintenance of a circuit breaker, as part of an upgrade program related to Kogan Creek. The timing of the outage in the peak summer period had a major impact on prices. Powerlink has responsibilities for the timing and planning of outages. NEMMCO has the role of assessing planned network outages for their impacts on power system security.

The Rules do not specify when network outages can be taken, neither Powerlink or NEMMCO breached the Rules. However, the incident highlights the impact that planned outages can have on the market. The AER is developing a new service standards incentive scheme which aims to link the impact of outages to the transmission service providers' revenues. The AER will commence its consultation process in the second quarter of this year, with a view to finalising the new incentive scheme by the end of this year.

The AER believes that this incident also highlights the importance of effective constraints to both the management of the power system and to facilitate efficient market responses through accurate market forecasts. At the request of the AER, NEMMCO is reviewing its use of constraints, including for planned network outages. Following this incident and a similar incident on 24 January, the AER will write to NEMMCO requesting that NEMMCO assess this network outage as part of that review.

## Appendix A – 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 NEMMCO<sup>4</sup>. 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.

### Tuesday 23 January – Queensland 3 pm

Time	Dispatch price (\$/MWh)	Participant	Unit	Service	Offer price	Marginal change	Contribution (\$/MWh)
14:35	\$301.38	Tarong	W/HOE#1	Energy	\$301.38	1.00	\$301.38
14:40	\$301.38	Tarong	W/HOE#1	Energy	\$301.38	1.00	\$301.38
14:45	\$7 458.93	Tarong	W/HOE#1	Energy	\$7 458.93	1.00	\$7 458.93
14:50	\$7 460.43	Hydro Tas	DEVILS_G	Raise 5 min	\$1.50	1.00	\$1.50
		Tarong	W/HOE#1	Energy	\$7 458.93	1.00	\$7 458.93
		Tarong	W/HOE#1	Raise 5 min	\$0.00	-1.00	\$0.00
14:55	\$10 000.00	Tarong	W/HOE#2	Energy	\$10 000.00	1.00	\$10 000.00
15:00	\$10 001.00 (capped to \$10 000)	CS Energy	SWAN_B_1	Energy	\$10 000.00	1.00	\$10 000.00
		CS Energy	SWAN_B_1	Raise reg	\$0.60	-1.00	-\$0.60
		TRUenergy (SA)	TORRB4	Raise reg	\$1.60	1.00	\$1.60
<b>Spot price</b>		<b>\$5920.35/MWh</b>					

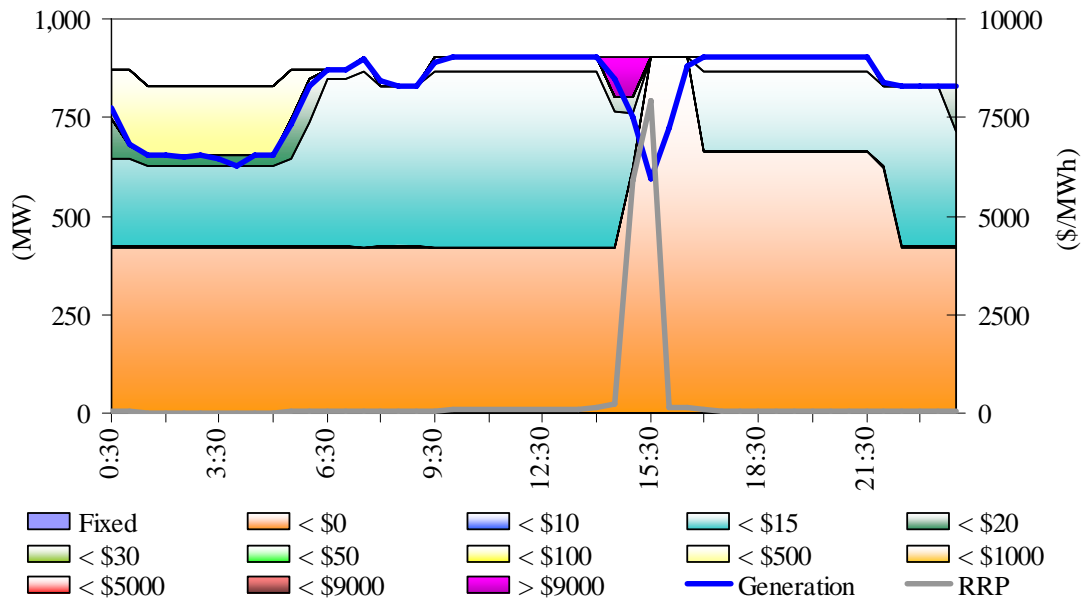
### Tuesday 23 January – Queensland 3.30 pm

Time	Dispatch price (\$/MWh)	Participant	Unit	Service	Offer price	Marginal change	Contribution (\$/MWh)
15:05	\$10 001.20 (capped to \$10 000)	CS Energy	SWAN_B_1	Raise reg	\$0.60	-1.00	-\$0.60
		CS Energy	SWAN_B_1	Energy	\$10 000.00	1.00	\$10 000.00
		Hydro Tas	CETHANA	Raise reg	\$1.50	1.00	\$1.50
		Hydro Tas	CETHANA	Raise 5 min	\$1.50	-1.00	-\$1.50
15:10	\$10 001.00 (capped to \$10 000)	Macquarie Generation	BW04	Raise 5 min	\$1.80	1.00	\$1.80
		CS Energy	SWAN_B_1	Raise reg	\$0.60	-1.00	-\$0.60
		CS Energy TRUenergy (SA)	SWAN_B_1 TORRB4	Energy Raise reg	\$10 000.00 \$1.60	1.00 1.00	\$10 000.00 \$1.60
15:15	\$10 000.98 (capped to \$10 000)	CS Energy	SWAN_B_1	Energy	\$10 000.00	1.00	\$10 000.00
		CS Energy	SWAN_B_1	Raise reg	\$0.60	-1.00	-\$0.60
		Hydro Tas	CETHANA	Raise reg	\$1.50	1.00	\$1.50
		Hydro Tas	CETHANA	Energy	-\$47.98	-1.00	-\$47.98
		Hydro Tas	JBUTTERS	Energy	-\$47.90	1.00	-\$47.90
15:20	\$10 000.85 (capped to \$10 000)	CS Energy	SWAN_B_2	Energy	\$10 000.00	1.00	\$10 000.00
		CS Energy	SWAN_B_2	Raise reg	\$0.65	-1.00	-\$0.65
		Hydro Tas	GORDON	Raise 5 min	\$1.50	1.00	\$1.50
		Hydro Tas	JBUTTERS	Raise 5 min	\$0.50	-1.00	-\$0.50
15:25	\$7 458.93	Hydro Tas	JBUTTERS	Raise reg	\$0.50	1.00	\$0.50
		Tarong	W/HOE#1	Energy	\$7 458.93	1.00	\$7 458.93
15:30	\$174.88	Snowy Hydro	TUMUT3	Energy	\$151.76	1.15	\$174.88
<b>Spot price</b>		<b>\$7938.97/MWh</b>					

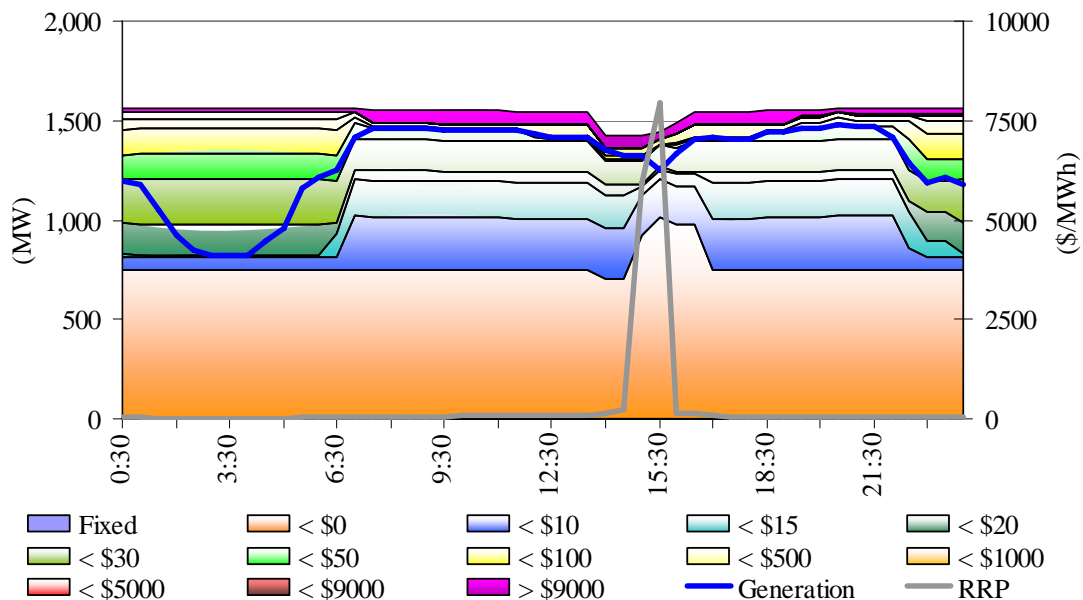
<sup>4</sup> NEMMCO first published details on how the price is determined, for every dispatch interval, in June 2004. Documentation of this process can be found at <http://www.nemmco.com.au/dispatchandpricing/140-0036.htm>

Appendix B highlights the half hour closing bids for all participants in Queensland with capacity priced at or above \$5000/MWh during the trading intervals in which the spot price exceeded \$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.

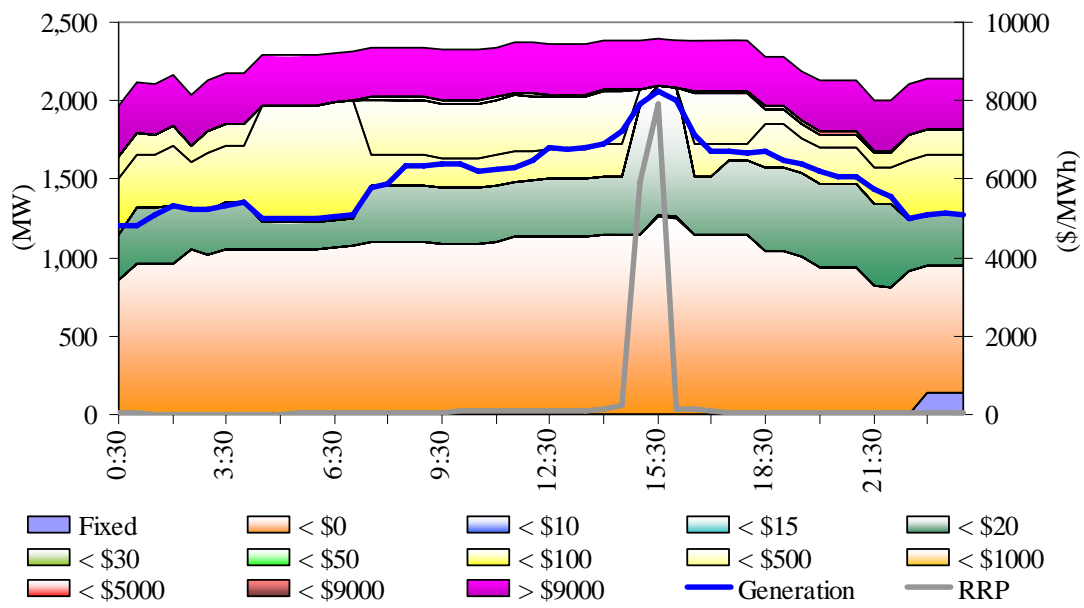
**Figure B1: Callide Power Trader bid prices, dispatch and region price.**



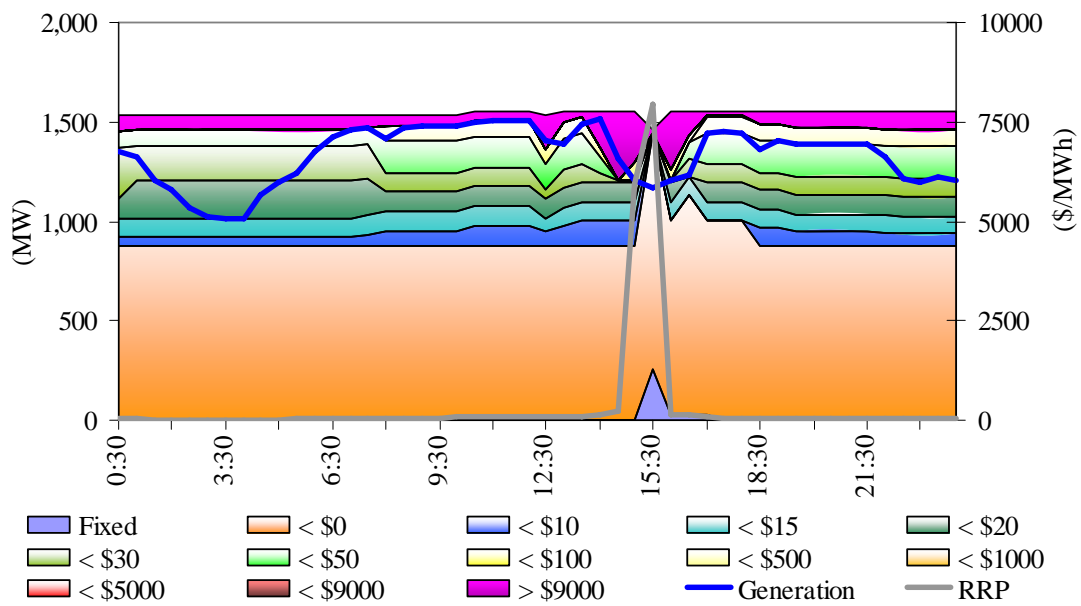
**Figure B2: CS Energy closing bid prices, dispatch and spot price.**



**Figure B3: Enertrade closing bid prices, dispatch and spot price.**



**Figure B4: Stanwell closing bid prices, dispatch and spot price.**





**Figure B4: Tarong Energy closing bid prices, dispatch and spot price.**

