

# Electricity spot prices above \$5000/MWh

7 and 8 August 2010  
Tasmania



AUSTRALIAN ENERGY  
REGULATOR

## Introduction

The AER is required to publish a report covering the circumstances in which the spot price exceeds \$5000/MWh<sup>1</sup>. 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.

## Summary

On 7 and 8 August the spot price in Tasmania exceeded \$5000/MWh on five occasions. On three of those occasions the spot price reached \$12 400/MWh, the highest spot prices ever recorded in the National Electricity Market (NEM)<sup>2</sup>.

The central cause of the high prices on both days was day-ahead offers from Hydro Tasmania, which saw significant amounts of capacity offered at high-prices on both days. Other points of interest include:

- Hydro Tasmania's non-scheduled generators (all small hydro generators) reduced output during the peak price times; and
- there was apparent demand-side response of close to 100 MW during some of the high priced times, presumably from large industrial users, which dampened the price at those times.

## Actual and forecast conditions

### *Saturday 7 August*

Figure 1 compares the actual demand and spot price in Tasmania with that forecast by AEMO 4 and 12 hours ahead of dispatch.<sup>3</sup> Conditions on the day saw demand close to forecast and available capacity as forecast. Prices, however, were very different to forecast.

For the 9 am trading interval the price reduced significantly from that forecast 12 hours ahead to that forecast four hours ahead. This was driven by an increase in the forecast import on Basslink and is explained in the "Changes to Basslink" section.

<sup>1</sup> Pursuant to clause 3.13.7 (d) of the Electricity Rules.

<sup>2</sup> The market price cap increased on 1 July 2010 from \$10 000/MWh to \$12 500/MWh.

<sup>3</sup> As part of its Weekly Market Analysis reports, the AER provides further information if the spot price exceeds three times the weekly average for a region and is above \$250/MWh. On 7 and 8 August there were four trading intervals in Tasmania each day where this occurred. As all of these high prices were caused by related events, they have been explained as part of this report.

The actual prices were in general considerably higher than forecast four hours ahead. None of these greater than \$5000/MWh spot prices were forecast in the 30-minute forecast systems. Further discussion on these forecasts is set out in the “Changes to network constraints section”.

Although high spot prices were forecast for the 10 am trading interval, they did not eventuate because of an apparent demand side response (see the “Demand side responses” section later in this paper).

**Figure 1: Actual and forecast demand, spot price and available capacity – 7 August**

<b>9 am</b>	<b>Actual</b>	<b>4 hr Forecast</b>	<b>12 hr Forecast</b>
Demand (MW)	1434	1448	1411
Spot Price (\$/MWh)	5720	2383	12 410
<b>10 am</b>	<b>Actual</b>	<b>4 hr Forecast</b>	<b>12 hr Forecast</b>
Demand (MW)	1426	1465	1427
Spot Price (\$/MWh)	833	12 410	12 410
<b>5.30 pm</b>	<b>Actual</b>	<b>4 hr Forecast</b>	<b>12 hr Forecast</b>
Demand (MW)	1443	1450	1450
Spot Price (\$/MWh)	1647	79	5283
<b>6.30 pm</b>	<b>Actual</b>	<b>4 hr Forecast</b>	<b>12 hr Forecast</b>
Demand (MW)	1502	1514	1515
Spot Price (\$/MWh)	12 400	79	260

*Sunday 8 August*

Figure 2 compares the actual demand and spot price in Tasmania with that forecast by AEMO 4 and 12 hours ahead of dispatch. Conditions on the day saw demand close to forecast and available capacity as forecast. All spot prices were significantly higher than forecast.

**Figure 2: Actual and forecast demand, spot price and available capacity – 8 August**

<b>10 am</b>	<b>Actual</b>	<b>4 hr Forecast</b>	<b>12 hr Forecast</b>
Demand (MW)	1392	1386	1387
Spot Price (\$/MWh)	2733	75	75
<b>6 pm</b>	<b>Actual</b>	<b>4 hr Forecast</b>	<b>12 hr Forecast</b>
Demand (MW)	1473	1482	1483
Spot Price (\$/MWh)	12 400	67	75
<b>6.30 pm</b>	<b>Actual</b>	<b>4 hr Forecast</b>	<b>12 hr Forecast</b>
Demand (MW)	1475	1492	1488
Spot Price (\$/MWh)	12 400	127	106
<b>7.30 pm</b>	<b>Actual</b>	<b>4 hr Forecast</b>	<b>12 hr Forecast</b>
Demand (MW)	1468	1467	1466
Spot Price (\$/MWh)	8300	68	79

## Generator offers and rebidding

*Saturday 7 August*

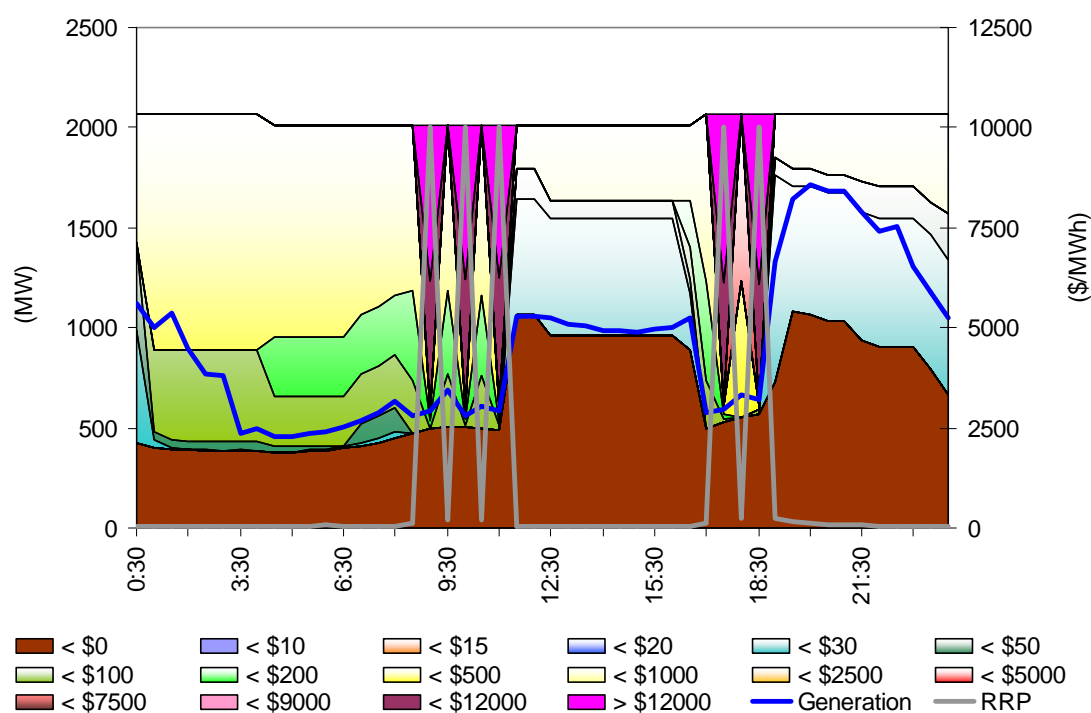
Around 2390 MW was offered through initial offers (the day before). Hydro Tasmania accounted for around 90 per cent of this capacity, while Aurora Energy offered around 180 MW.

Initial forecasts at 12.30 pm the day before, showed prices of \$10 000/MWh for the 9 am, 10 am, 11 am, 5.30 pm and 6.30 pm trading intervals. This was driven by day-ahead offers by Hydro Tasmania, which saw five step reductions-each for only a single trading interval-in the availability of low-priced capacity in Tasmania, which was replaced with high-priced capacity.

Figure 3 shows initial offers for Hydro Tasmania highlighting the capacity priced at or above \$5000/MWh and the high initial forecast prices (RRP) coincident with the high-priced offers. It also shows the initial forecast generation output for the Hydro Tasmania portfolio.

For the 6.30 pm trading interval, when the spot price reached \$12 400/MWh, the step decrease in low-priced capacity coincided with a reduction in the output of non-scheduled generation. The reduction in output from non-scheduled generation caused an increase in demand. This is explained in Appendix A.

**Figure 3: Hydro Tasmania opening bids and forecast spot prices for 7 August**



In response to the high forecast prices, at 4.16 pm the previous day, Aurora Energy rebid to commit 178 MW of open cycle gas turbines (Bell Bay Three and Tamar Valley OCGT). This rebid shifted 178 MW of capacity from prices above \$11 000/MWh to below \$80/MWh during the morning and evening periods of 7 August. The reason given was “1530 A predispatch price forecast increased”.

This increase in the availability of low priced capacity resulted in reduced forecast prices for the evening peak period to below \$300/MWh. The forecast prices for the morning period, however, remained high.

On the day, there was no available capacity priced between \$100/MWh and \$11 800/MWh for the five trading intervals, so small changes in demand or network capability led to large swings in prices.

Hydro Tasmania was the only participant with capacity priced at or above \$5000/MWh during the high priced periods. Around 1550 MW out of the 2165 MW offered by Hydro Tasmania was priced above \$11 000/MWh for the 9 am, 10 am and 11 am, 5.30 pm and 6.30 pm trading intervals, while the remainder of the day the majority of this capacity was priced below \$500/MWh.

There was no other significant rebidding.

#### *Sunday 8 August*

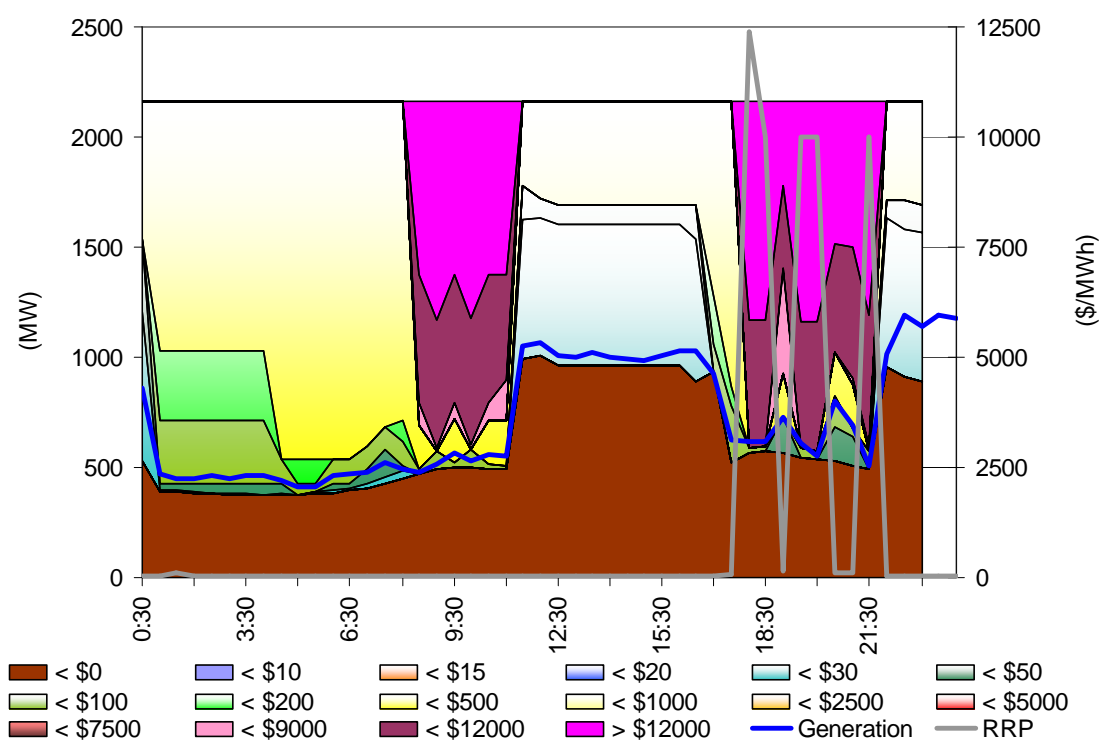
Around 2550 MW was offered through initial offers (the day before). Hydro Tasmania accounted for the majority of this capacity, while Aurora Energy offered around 180 MW.

Initial forecasts at 12.30 pm the day before, showed prices of \$12 400/MWh for 6 pm, and \$10 000/MWh for 6.30 pm, 7.30 pm, 8 pm and 9.30 pm. This was driven by day-ahead offers by Hydro Tasmania, which saw several step reductions in the availability of low-priced capacity in Tasmania, which was replaced with high-priced capacity.

Figure 4 shows opening bids for Hydro Tasmania highlighting the capacity priced at or above \$5000/MWh and the high initial forecast prices (RRP) coincident with the high-priced offers. It also shows the initial generation output for the Hydro Tasmania portfolio.

The step increases in high-priced capacity coincided with a reduction in non-scheduled generation for all of the high-priced trading intervals in the evening, and for the 10 am trading interval when the spot price reached \$2733/MWh. The reduction in output from non-scheduled generation caused an increase in demand. This is explained in Appendix A.

**Figure 4: Hydro Tasmania opening bids and forecast spot prices for 8 August**



In response to the high forecast prices, over two rebids at 3.23 pm and 7.12 pm the previous day, Aurora Energy rebid to commit 178 MW of open cycle gas turbines (Bell Bay Three and Tamar Valley OCGT). These rebids shifted 178 MW of capacity from prices above \$11 000/MWh to below \$80/MWh during the morning and evening periods of 7 August. The

reasons given related to predispach price forecast changes, leaving Hydro Tasmania as the only participant with capacity priced at or above \$5000/MWh during the high-priced periods.

This increase in the availability of low-priced capacity resulted in reduced forecast prices for the evening peak period to below \$130/MWh.

As on 7 August, there was no available capacity priced between \$100/MWh and \$11 800/MWh for the three high-priced trading intervals.

Around 1500 MW out of the 2165 MW offered by Hydro Tasmania was priced above \$11 000/MWh for the 10 am, 6 pm and 7 pm trading intervals, while the remainder of the day the majority of this capacity was priced below \$500/MWh.

There was no other significant rebidding.

All of the high prices were set by high-priced offers from Hydro Tasmania. Details on the generators that set the spot price during the time prices were above \$5000/MWh, and how that price was determined by the market systems are in **Appendix B**.

## Demand side responses

### *Saturday 7 August*

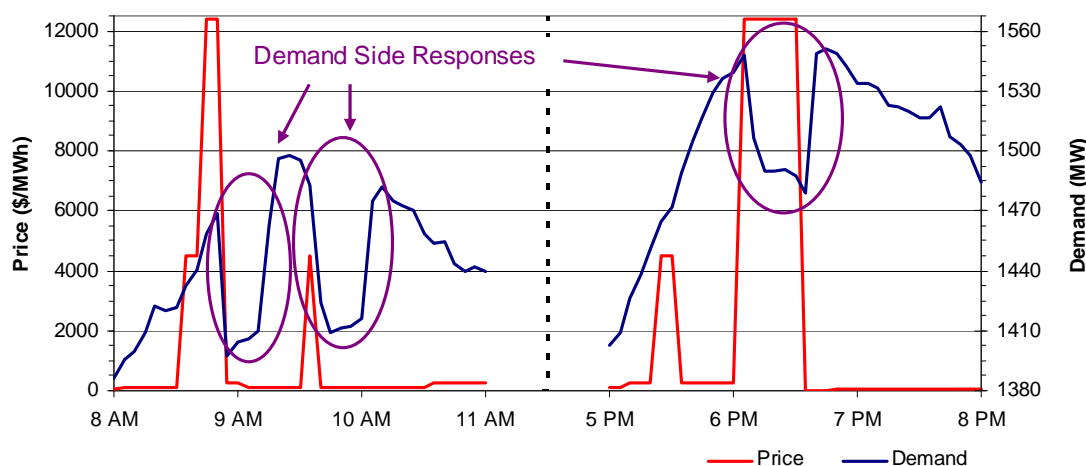
Figure 6 shows there were several apparent demand side responses on the day. Following the high 5-minute dispatch prices (\$4500/MWh at 8.35 am and \$12 400/MWh at 8.45 am and 8.50 am), demand fell from 1468 MW at 8.50 am to 1397 MW at 8.55 am. The fall in demand saw the 5-minute price fall to \$260/MWh at 8.55 am. Demand remained at below 1410 MW before rising to 1496 MW at 9.20 am.

In response to high 5-minute predispach forecast prices it appears there was a second demand side response shortly afterwards. Demand fell from 1498 MW at 9.25 am to 1409 MW at 9.45 am.

The dispatch price reached \$12 400/MWh at 6.05 pm. Following this there was another apparent demand side response, which saw demand fall from 1548 MW at 6.05 pm to 1479 MW at 6.35 pm. Despite the demand side response, the 5-minute price remained at \$12 400/MWh until 6.30 pm before falling to around \$22/MWh at 6.35 pm (the completion of the high offer price period), at which time demand increased, reaching 1549 MW at 6.40 pm.

Figure 5 shows apparent demand side responses in the morning and afternoon of 7 August.

**Figure 5: Five-minute price and demand for 7 August**



*Sunday 8 August*

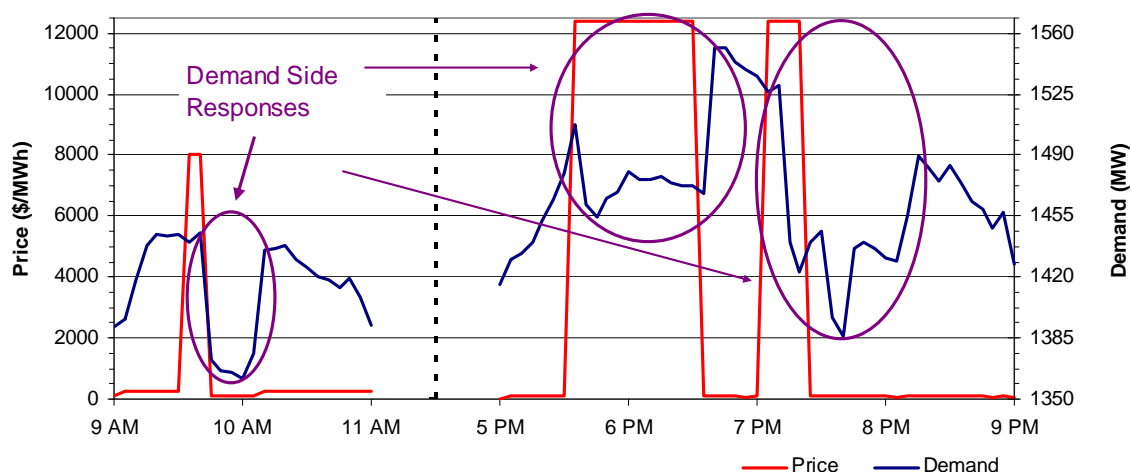
Figure 6 shows there were several apparent demand side responses on the day. Following high 5-minute dispatch prices (\$8000/MWh at 9.35 am and 9.40 am), demand fell from 1445 MW at 9.40 am to 1362 MW at 10 am. The fall in demand saw the 5-minute price fall to \$100/MWh at 9.45 am. The 5-minute price remained at relatively low levels for the remainder of the morning and early afternoon, which saw demand increase to 1438 MW by 10.20 am.

The 5-minute price reached \$12 400/MWh at 5.35 pm and remained at that level until 6.30 pm. In response, demand fell from 1507 MW at 5.35 pm to 1454 MW at 5.45 pm. A reduction in the 5-minute price to around \$115/MWh from 6.35 pm saw demand increase again.

The 5-minute price again reached \$12 400/MWh at 7.05 pm and remained at that level until 7.20 pm. In response, demand fell from 1530 MW at 7.10 pm to 1422 MW at 7.20 pm.

Figure 6 shows apparent demand side responses to the high prices on 8 August.

**Figure 6: Five-minute price and demand for 8 August**



## Changes to network constraints

On both days, for all of the high priced periods, 5-minute predispach (which forecasts 5-minute resolution prices for the next hour) generally forecast prices that closely reflected actual 5-minute price outcomes. The high prices were not, however, forecast to occur at all in the 30-minute predispach systems.<sup>4</sup>

For example, for the 6 pm trading interval on 8 August, the 30-minute predispach forecast spot prices published between 3 pm and 5.30 pm ranged from \$50/MWh to \$55/MWh. However, all of the 5-minute predispach forecasts for the 6 pm trading interval showed prices of \$12 400/MWh for each 5-minute dispatch interval in the trading interval.

The AER understands that this discrepancy was as a result of different forms of network constraints used in the 30-minute predispach systems compared to the 5-minute predispach and dispatch systems.

<sup>4</sup> The 5-minute predispach systems forecast market outcomes on a 5 minute resolution for the next hour. The 30-minute predispach systems forecast market outcomes on a 30 minute resolution for the remainder of the trading day.

## **Changes to Basslink**

As highlighted in Figure 1, for the 9 am trading interval on 7 August, the price reduced significantly from that forecast 12 hours ahead to that forecast four hours ahead. This was driven by an increase in the forecast import limit into Tasmania from 255 MW to 478 MW at around 3.30 am. Similar increases in forecast import capability for the remainder of the day occurred at the same time. This increase in import capability on Basslink resulted from an increase in the availability of raise 6-second frequency control ancillary services within Tasmania, reducing the need for capacity to be reserved for importing ancillary services.

**Australian Energy Regulator  
September 2010**

## Appendix A - Non-scheduled generation

The vast majority of installed generation in the National Electricity Market is registered as scheduled. Scheduled generators are dispatched by AEMO in accordance with their offers to meet demand. A number of smaller generators are classified as non-scheduled generation. Non-scheduled generators fall outside of the market processes and can generate electricity at their discretion. The output from non-scheduled generators is treated as negative demand, so any variation in their output is reflected in the demand that must be met by scheduled generators. For example, a 10 MW increase from a non-scheduled generator is treated as a 10 MW decrease in demand.

There is around 2400 MW of installed scheduled generation in Tasmania. There is a further 240 MW of non-scheduled generation. The non-scheduled generation includes:

- the 140 MW Woolnorth wind farm operated by Roaring 40s;
- the 28 MW Repulse hydro plant, operated by Hydro Tasmania;
- the 28 MW Paloona hydro plant, operated by Hydro Tasmania;
- the 17 MW Cluny hydro plant, operated by Hydro Tasmania;
- the 14 MW Butlers Gorge hydro plant, operated by Hydro Tasmania; and
- the 10 MW Rowallan hydro plant, operated by Hydro Tasmania.

The five non-scheduled generators operated by Hydro Tasmania are all hydro plant with a nominal capacity of less than 30 MW, and were registered as non-scheduled with AEMO<sup>5</sup>.

On Saturday 7 August, the combined output from Paloona, Rowallan and Repulse was reduced by around 30 MW in total for the 6.30 pm trading interval compared to 4 pm with half of this between 6.05 pm and 6.10 pm. The output from these stations increased again from 7.40 pm.

On Sunday 8 August, the combined output from Cluny, Paloona, Repulse and Rowallan reduced from an average of around 65 MW from 12.15 pm to 4 pm to around 13 MW from 5.35 pm to 7.25 pm (i.e. the time of high prices).

As non-scheduled generating units are not scheduled as part of the central dispatch process, there is no requirement to notify the market of the availability or output level of these units. As a result the impacts of these significant changes in output were not forecast.<sup>6</sup>

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<sup>5</sup> Note that there are a number of Hydro Tasmania's generators close to the 30 MW cut-off including the 32 MW Lake Echo plant, that are registered as scheduled generators.

<sup>6</sup> The AER has written about non-scheduled generation in Tasmania in its "Spot prices above \$5000/MWh" reports covering events in Tasmania on 22 May 2010 and 10 to 19 June 2009 and the weekly report for 16 to 22 May 2010.



## Appendix B – Price setters for 7-8 August 2009

The following tables identify 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, as published in the market systems are shown. 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.

### Saturday 7 August – 9.00 am

Time	Dispatch price	Participant	Unit	Service	Offer price	Marginal change	Contribution
08:35	\$4 500.26	Hydro Tasmania	POAT110	Energy	\$4 500.26	\$ 1.00	\$4 500.26
08:40	\$4 500.26	Hydro Tasmania	POAT110	Energy	\$4 500.26	\$ 1.00	\$4 500.26
08:45	\$12 400.26	Hydro Tasmania	POAT110	Energy	\$12 400.26	\$ 1.00	\$12 400.26
08:50	\$12 400.26	Hydro Tasmania	POAT110	Energy	\$12 400.26	\$ 1.00	\$12 400.26
08:55	\$ 260.10	Hydro Tasmania	LEM_WIL	Energy	\$ 260.10	\$ 1.00	\$ 260.10
09:00	\$ 260.10	Hydro Tasmania	LEM_WIL	Energy	\$ 260.10	\$ 1.00	\$ 260.10
<b>Spot price</b>		<b>\$5720/MWh</b>					

### Saturday 7 August – 6.30 pm

Time	Dispatch price	Participant	Unit	Service	Offer price	Marginal change	Contribution
18:05	\$12 400.28	Hydro Tasmania	POAT220	Energy	\$12 400.28	\$ 1.00	\$12 400.28
18:10	\$12 400.26	Hydro Tasmania	POAT110	Energy	\$12 400.26	\$ 1.00	\$12 400.26
18:15	\$12 400.26	Hydro Tasmania	POAT110	Energy	\$12 400.26	\$ 1.00	\$12 400.26
18:20	\$12 400.26	Hydro Tasmania	POAT110	Energy	\$12 400.26	\$ 1.00	\$12 400.26
18:25	\$12 400.26	Hydro Tasmania	POAT110	Energy	\$12 400.26	\$ 1.00	\$12 400.26
18:30	\$12 400.26	Hydro Tasmania	POAT110	Energy	\$12 400.26	\$ 1.00	\$12 400.26
<b>Spot price</b>		<b>\$12 400/MWh</b>					

### Sunday 8 August – 6.00 pm

Time	Dispatch price	Participant	Unit	Service	Offer price	Marginal change	Contribution
17:35	\$12 400.10	Hydro Tasmania	LEM_WIL	Energy	\$12 400.10	\$ 1.00	\$12 400.10
17:40	\$12 400.08	Hydro Tasmania	TUNGATIN	Energy	\$12 400.08	\$ 1.00	\$12 400.08
17:45	\$12 400.08	Hydro Tasmania	TUNGATIN	Energy	\$12 400.08	\$ 1.00	\$12 400.08
17:50	\$12 400.08	Hydro Tasmania	GORDON	Raise 6 sec	\$ 1.10	\$ 0.26	\$ 0.29
		Hydro Tasmania	TUNGATIN	Energy	\$12 400.08	\$ 1.00	\$12 400.08
		Hydro Tasmania	TUNGATIN	Raise 6 sec	\$ 1.10	-\$ 0.26	-\$ 0.29
17:55	\$12 400.08	Hydro Tasmania	GORDON	Raise 6 sec	\$ 1.10	\$ 0.26	\$ 0.29
		Hydro Tasmania	TUNGATIN	Energy	\$12 400.08	\$ 1.00	\$12 400.08
		Hydro Tasmania	TUNGATIN	Raise 6 sec	\$ 1.10	-\$ 0.26	-\$ 0.29
18:00	\$12 400.08	Hydro Tasmania	GORDON	Raise 60 sec	\$ 0.90	\$ 1.73	\$ 1.55
		Hydro Tasmania	TUNGATIN	Energy	\$12 400.08	\$ 1.00	\$12 400.08
		Hydro Tasmania	TUNGATIN	Raise 60 sec	\$ 0.90	-\$ 1.73	-\$ 1.55
<b>Spot price</b>		<b>\$12 400/MWh</b>					

### Sunday 8 August – 6.30 pm

Time	Dispatch price	Participant	Unit	Service	Offer price	Marginal change	Contribution
18:05	\$12 400.08	Hydro Tasmania	TUNGATIN	Energy	\$12 400.08	\$ 1.00	\$12 400.08
18:10	\$12 400.08	Hydro Tasmania	TUNGATIN	Energy	\$12 400.08	\$ 1.00	\$12 400.08
18:15	\$12 400.08	Hydro Tasmania	GORDON	Raise 6 sec	\$ 1.10	\$ 0.26	\$ 0.29
		Hydro Tasmania	TUNGATIN	Energy	\$12 400.08	\$ 1.00	\$12 400.08
		Hydro Tasmania	TUNGATIN	Raise 6 sec	\$ 1.10	-\$ 0.26	-\$ 0.29
18:20	\$12 400.08	Hydro Tasmania	GORDON	Raise 6 sec	\$ 1.10	\$ 0.26	\$ 0.29
		Hydro Tasmania	TUNGATIN	Energy	\$12 400.08	\$ 1.00	\$12 400.08
		Hydro Tasmania	TUNGATIN	Raise 6 sec	\$ 1.10	-\$ 0.26	-\$ 0.29
18:25	\$12 400.08	Hydro Tasmania	GORDON	Raise 60 sec	\$ 0.90	\$ 1.73	\$ 1.55
		Hydro Tasmania	TUNGATIN	Energy	\$12 400.08	\$ 1.00	\$12 400.08
		Hydro Tasmania	TUNGATIN	Raise 60 sec	\$ 0.90	-\$ 1.73	-\$ 1.55
18:30	\$12 400.08	Hydro Tasmania	TUNGATIN	Energy	\$12 400.08	\$ 1.00	\$12 400.08
<b>Spot price</b>		<b>\$12 400/MWh</b>					

**Sunday 8 August – 7.30 pm**

<b>Time</b>	<b>Dispatch price</b>	<b>Participant</b>	<b>Unit</b>	<b>Service</b>	<b>Offer price</b>	<b>Marginal change</b>	<b>Contribution</b>
19:05	\$12 400.10	Hydro Tasmania	LEM_WIL	Energy	\$12 400.10	\$ 1.00	\$12 400.10
19:10	\$12 400.12	Hydro Tasmania	DEVILS_G	Energy	\$12 400.12	\$ 1.00	\$12 400.12
19:15	\$12 400.08	Hydro Tasmania	TUNGATIN	Energy	\$12 400.08	\$ 1.00	\$12 400.08
19:20	\$12 400.08	Hydro Tasmania	TUNGATIN	Energy	\$12 400.08	\$ 1.00	\$12 400.08
19:25	\$ 100.08	Hydro Tasmania	TUNGATIN	Energy	\$ 100.08	\$ 1.00	\$ 100.08
19:30	\$ 100.08	Hydro Tasmania	TUNGATIN	Energy	\$ 100.08	\$ 1.00	\$ 100.08
<b>Spot price</b>					<b>\$8300/MWh</b>		