



# **Report into market ancillary service prices above \$5000/MW**

**South Australia,  
22 May 2017**

1 September 2017

© Commonwealth of Australia 2017

This work is copyright. In addition to any use permitted under the Copyright Act 1968, all material contained within this work is provided under a Creative Commons Attributions 3.0 Australia licence, with the exception of:

- the Commonwealth Coat of Arms
- the ACCC and AER logos
- any illustration, diagram, photograph or graphic over which the Australian Competition and Consumer Commission does not hold copyright, but which may be part of or contained within this publication. The details of the relevant licence conditions are available on the Creative Commons website, as is the full legal code for the CC BY 3.0 AU licence.

Requests and inquiries concerning reproduction and rights should be addressed to the Director, Corporate Communications,  
Australian Competition and Consumer Commission,  
GPO Box 4141,  
Canberra ACT 2601  
or [publishing.unit@acc.gov.au](mailto:publishing.unit@acc.gov.au).

Inquiries about this publication should be addressed to:

Australian Energy Regulator  
GPO Box 520  
Melbourne Vic 3001

Tel: (03) 9290 1444  
Fax: (03) 9290 1457

Email: [AERInquiry@aer.gov.au](mailto:AERInquiry@aer.gov.au)  
AER Reference: 62293 / D17/114193

#### Amendment Record

Version	Date	Pages
1 version for publication	01/09/2017	30

# Contents

<b>1</b>	<b>Obligation</b> .....	<b>4</b>
<b>2</b>	<b>Summary</b> .....	<b>5</b>
<b>3</b>	<b>Analysis</b> .....	<b>6</b>
	<b>3.1. Planned network outage</b> .....	<b>6</b>
	<b>3.2. Regulation FCAS offers, rebidding and price</b> .....	<b>7</b>
	3.2.1 Registered capacity.....	8
	3.2.2 Rebidding and effective availability.....	9
	3.2.3 Price.....	10
<b>Appendix A</b>	<b>Explanation of FCAS</b> .....	<b>13</b>
	Frequency Control Ancillary Service Settlement.....	14
<b>Appendix B</b>	<b>Local Frequency Control Ancillary Services</b> .....	<b>15</b>
<b>Appendix C</b>	<b>Significant Rebids</b> .....	<b>16</b>
<b>Appendix D</b>	<b>Closing bids</b> .....	<b>17</b>
<b>Appendix E</b>	<b>Relevant Market Notices</b> .....	<b>26</b>
<b>Appendix F</b>	<b>Price setter</b> .....	<b>28</b>

# 1 Obligation

The Australian Energy Regulator 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 energy markets, including the annual State of the energy market report, to assist participants and the wider community.

The AER is required to monitor significant variations between forecast and actual prices and publish a report where:

- prices for a market ancillary service over a period significantly exceed the relevant spot price for energy; and
- prices for a market ancillary service exceed \$5000/MW for a number of trading intervals within that period.

In accordance with the clause 3.13.7(e) of the National Electricity Rules, the report must:

- describe the significant factors that contributed to the ancillary service prices exceeding \$5000/MW;
- identify any linkages between spot prices in the energy market and ancillary service prices contributing to the occurrence; and
- assess whether rebidding pursuant to clause 3.8.22 contributed to prices exceeding \$5000/MW.

These reports examine the reasons for the high price outcomes—they are not compliance reports. We deal separately with compliance issues that come to our attention during the preparation of these reports.

## 2 Summary

Lower and raise regulation frequency control ancillary services (regulation services) are used to manage small fluctuations in supply or demand.

On 22 May 2017 the price for local regulation services in South Australia exceeded \$10 700/MW for 6 consecutive dispatch intervals, from 12.20 pm to 12.45 pm. The wholesale (or spot) price for electricity in South Australia was around \$60/MWh during this time. High prices for raise regulation services later in the day did not breach the reporting threshold.

A planned network outage on the Heywood No. 1 busbar in Victoria began at 10 am on 22 May. This outage put South Australia on a single contingency, which created the risk of South Australia becoming electrically isolated from the National Electricity Market (NEM). To manage this risk, and in line with its procedures, the market operator (AEMO) notified the market that South Australia would be required to source 35 MW of raise and lower regulation services from within the region for the duration of the outage.

From the start of the outage until 12.20 pm, 35 MW of low priced capacity was available, sufficient to meet the 35 MW requirement. However, during testing, Origin Energy removed low priced regulation services at Quarantine and replaced it with low-priced regulation services capacity at Osborne. The technical characteristics of the Osborne plant meant less effective low priced capacity was available than when Quarantine was offering regulation services. As a result, capacity priced above \$5000/MW was needed to meet the 35 MW requirement. The price returned to lower levels at 12.50 pm.

Later in the day Origin shifted capacity for both services from low prices to high prices at its Quarantine power station, which saw prices for raise and lower services reach \$7690/MW and \$3994/MW, respectively, from 5.35 pm to 6.15 pm.

The outage was completed earlier than expected at 6.20 pm and AEMO removed the 35 MW requirement for local regulation services.

## 3 Analysis

The following sections explain the reasons for the high regulation services prices. To summarise, in response to a planned network outage in Victoria, AEMO imposed the requirement that 35 MW of regulation services be sourced locally in South Australia. Rebidding by Origin at its Quarantine and Osborne power stations, effective from 12.20 pm, reduced the amount of effective capacity priced less than \$5000/MW to 33 MW, 2 MW less than the 35 MW requirement. As a result prices both services exceeded \$10 700/MW for all dispatch intervals from 12.20 pm to 12.45 pm.

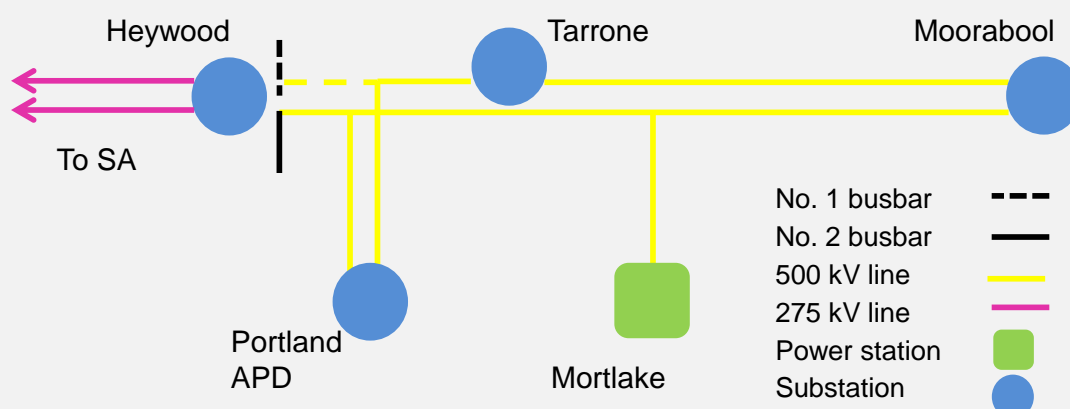
Later in the day Origin shifted capacity for both services from low prices to high prices at its Quarantine power station, which saw prices for raise and lower services reach \$7690/MW and \$3994/MW, respectively from 5.35 pm to 6.15 pm.

### 3.1 Planned network outage

Market notice 58470 (published on 4 May 2017 and replicated in Appendix E) announced to the market that there would be an outage on the Heywood No.1 500 kV busbar in Victoria from 6 am to 6 pm on 22 May 2017, putting South Australia on a single contingency. Under such conditions AEMO requires South Australia to source 35 MW of regulation services locally. The outage was postponed through another market notice (58606) on 21 May to run from 10 am to 10 pm instead. Box 1 explains how AEMO manages outages on the Heywood interconnector.

### Box 1: Heywood Interconnector and line outage management

South Australia is electrically connected to Victoria by the Heywood and Murraylink interconnectors. Murraylink is a direct current interconnector that cannot provide FCAS. The Heywood Interconnector is an alternating current high voltage transmission link which can transfer FCAS from the rest of the NEM. The figure below is a simplified representation of the network around the interconnector.



When any one of the four lines going through the Heywood substation is on an outage, the South Australian region is on a single contingency. This means that South Australia is at risk of being electrically isolated from the rest of the NEM as only one line is connecting South Australia to Victoria. When this occurs AEMO invokes constraints requiring 35 MW of local regulation services. This ensures adequate regulation services are immediately available to manage the frequency (around 50Hz) within South Australia if the remaining line trips.

Further details on the 35 MW requirement can be found in Appendix B.

## 3.2 Regulation FCAS offers, rebidding and price

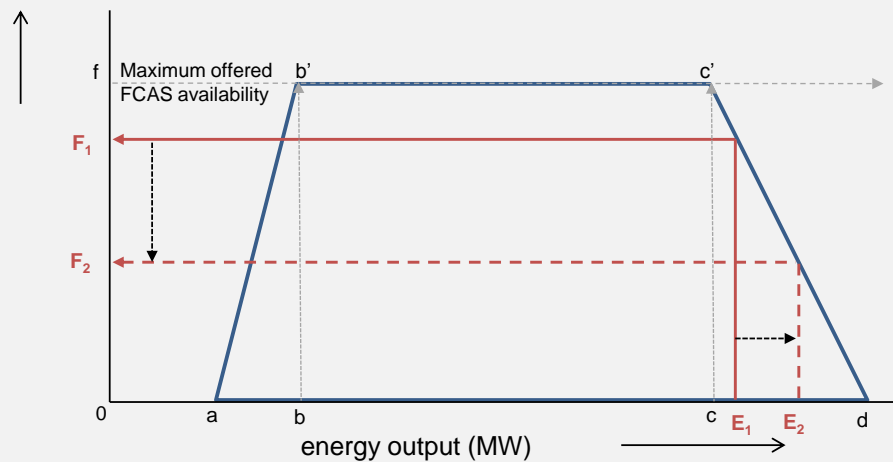
This section discusses participants' offers and resultant prices.

### Box 2: Trade-off between generator FCAS and energy offers

Generators must register with AEMO to provide FCAS and offer FCAS capacity in a similar manner to energy into the market.

Participants offer the maximum amount of FCAS (f in the diagram below) and energy, in mega-watts (MW), they are willing to supply across ten price bands, ranging between - \$1000 and \$14 000 for a trading day. A trading day starts at 4 am each day. A participant also offers the limits by which they can be dispatched in FCAS (a, b, c, d in the diagram below). There can be a trade-off between a participant's provision of FCAS and energy, impacting the effective availability of FCAS. For example in the diagram below, if a generator's energy output is at  $E_1$  then its FCAS effective availability is  $F_1$ , if its output in energy increases to  $E_2$  then its effective FCAS availability drops to  $F_2$ .

For every dispatch interval the National Electricity Market Dispatch Engine (NEMDE) co-optimises market participants FCAS and energy offers to arrive at the least cost outcome while maintaining system security.



### 3.2.1 Registered capacity

Of the 26 power stations (including wind farms) in South Australia only four are registered to provide FCAS. Table 1 shows the power stations that were registered to provide raise and lower regulation FCAS in South Australia on the day and their maximum registered capacity. Table 1 shows each power station, if fully operational, was individually capable of providing the local requirement.

**Table 1: Registered maximum regulation FCAS capacity (MW) by station**

Power Station	Registered Capacity (MW)	
	Lower regulation	Raise regulation
Osborne (Origin Energy)	36	36
Quarantine (Origin Energy)	50	50
Pelican Point (Engie)	100	100
Torrens Island (AGL)	200	260
<b>Total</b>	<b>386</b>	<b>446</b>



On the day half of Pelican Point power station and five units at Torrens Island power station were all unavailable, while no regulation services were offered by Origin at its Osborne power station for the commencement of the trading day (i.e. through initial offers). So, although the registered capacity is as show in Table 1, only around 120 MW of lower regulation and 150 MW of raise regulation was available.

### 3.2.2 Rebidding and effective availability

From 10.05 am, when the outage began, until 12.15 pm 35 MW of raise and lower services priced below \$5000/MW was available and prices for these services were around \$300/MW and \$550/MW respectively. At 12.20 pm the price in both services reached around \$10 770/MW.

At 12.05 pm, effective 12.15 pm, Origin bid in 12 MW of capacity at \$0/MW at Osborne in raise and lower services. The reason given was “CHANGE IN AVAIL - QPS5 OVERSPEED TEST SL”. At 12.11 pm, effective from 12.20 pm, Origin withdrew 12 MW of capacity priced at \$0/MW from Quarantine in raise and lower services. The reason given was “CHANGE IN AVAIL - QPS5 OVERSPEED TEST SL”. Both of these rebids were only effective until 12.30 pm.

Despite the fact that these rebids effectively netted each other out, the price for these services reached \$10 770/MW from 12.20 pm until 12.45 pm. This was because of the different technical FCAS limits of the two generators. Box 3 explains how effective FCAS availability is determined and can change according to the technical limits of the generator. The Quarantine power station was able to provide 2 MW more effective raise and lower services capacity than the Osborne power station. With Osborne offering regulation services instead of Quarantine, only 33 MW of effective regulation services remained, resulting in the need for high price capacity to meet the requirement.

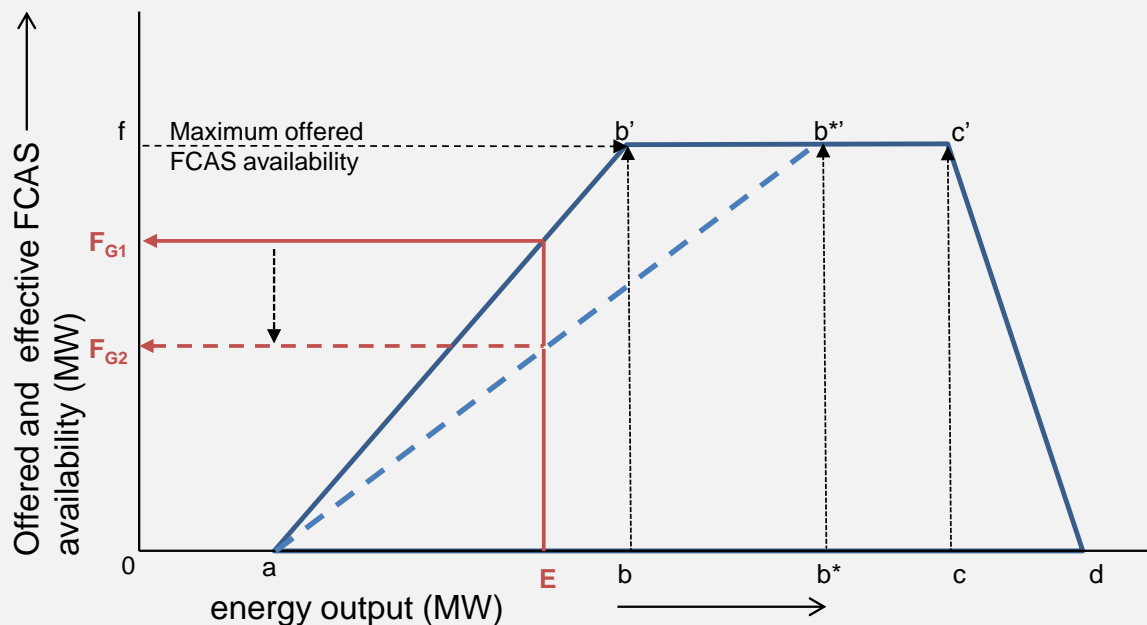
Quarantine began providing regulation services again at 12.50 pm when its energy output had reached a sufficient level (to visualise, imagine somewhere between points a and d in the figure in Box 3). The effective availability of regulation capacity priced below \$5000/MW increased to 35 MW, which saw prices fall to significantly lower levels (as shown in Figure 1 and Figure 2).

### Box 3: Changing ‘technical’ limits and effective FCAS availability

Effective FCAS availability is the amount of FCAS a generator can provide taking into account its energy output and the technical limits of the plant at the time. In effect, a generator may not be able to provide as much FCAS as submitted in its FCAS offer.

The diagram below demonstrates how effective availability is determined for a given level of FCAS offered and energy output. The shape of the figure is determined by the limits offered by the participant (represented by a, b, b\*, c, d and f in the figure). The diagram also shows how its shape, in turn, determines the amount of effective FCAS availability.

For a given level of energy output (E), the amount of effective FCAS a generator (generator 1, say) can provide is  $F_{G1}$ . The figure shows how, for the same energy output, the level of effective FCAS availability can vary. Let’s say generator 1 trips and is replaced by another generator, generator 2, which has slightly different technical limits to generator 1 (b to b\*). This changes the slope of the line ab to ab\*. For the same energy output, E, the amount of effective FCAS availability falls to  $F_{G2}$ .



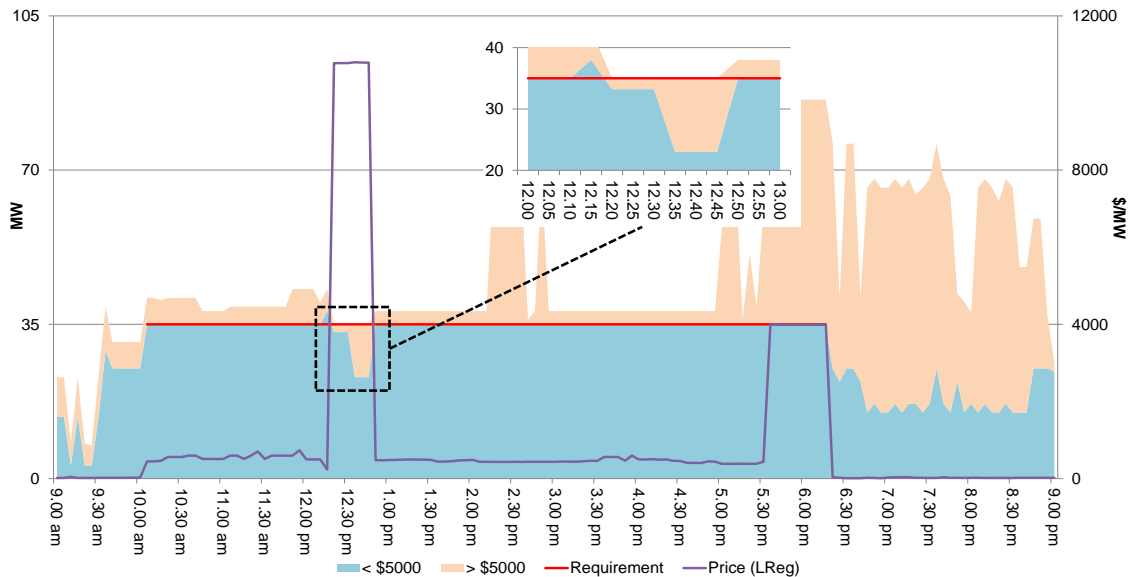
### 3.2.3 Price outcomes

Figure 1 and Figure 2 show actual price (purple line)<sup>1</sup> and effective available capacity over the high price period. The (constant) 35 MW requirement is shown as a red line. The blue shaded areas indicate effective available capacity below \$5000/MW, while effective available capacity above \$5000/MW is shaded light orange.

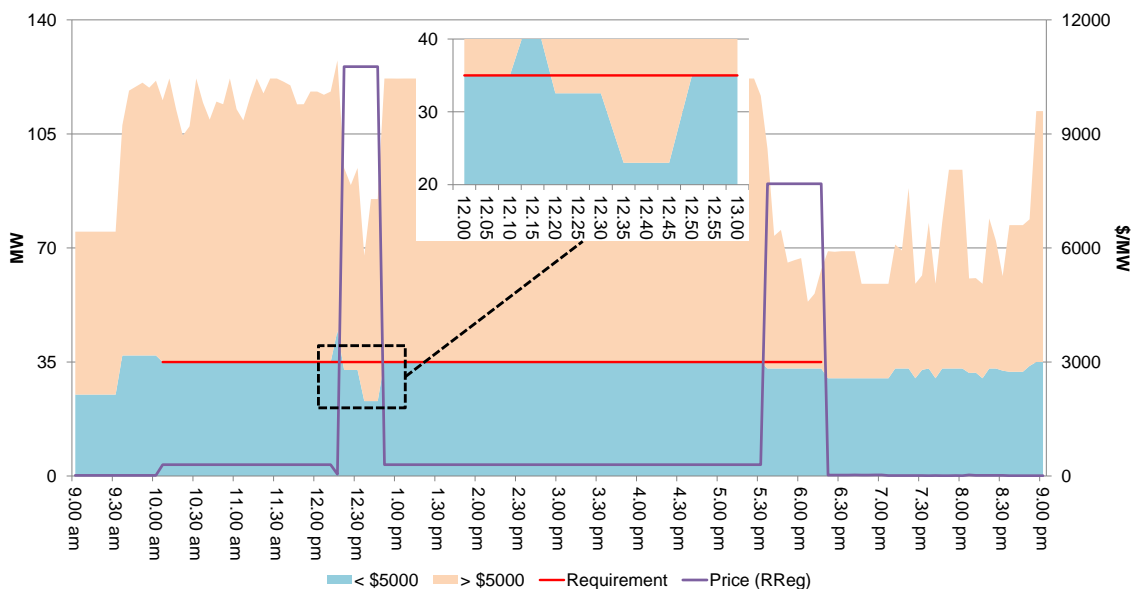
<sup>1</sup> Individual prices are contained in the Price Setter at Appendix F

The inset graphs are designed to show the reduction in low priced effective capacity from 12.20 pm. The inset graphs clearly show the red line just inside the orange shaded area, meaning that some high priced capacity was needed to meet the requirement. As a result, prices for regulation services increased from relatively low levels to around \$10 770/MW in both services at 12.20 pm. The wholesale (or spot) price for electricity was around \$60/MWh during this time.

**Figure 1 Lower regulation effective offers, requirement and price**



**Figure 2 Raise regulation effective offers, requirement and price**



### 3.2.3.1 High prices from 5.35 pm to 6.15 pm

Figure 1 and figure 2 show that prices for raise and lower services reach \$7690/MW and \$3994/MW, respectively from 5.35 pm to 6.15 pm. The reason for this was at 5.28 pm, effective 5.35 pm, Origin rebid 2 MW of raise and lower regulation services

from \$0/MW to \$7690/MW in raise and \$3994/MW in lower. The reason given was “1726A INC SA DEM 5PD 1724MW > 30PD 1572MW @HHE1800 SL”. These rebids set price until 6.20 pm when the outage was completed ahead of schedule and the 35 MW requirement was removed.

### **Australian Energy Regulator**

**September 2017**

## Appendix A Explanation of FCAS

Frequency control ancillary services (FCAS) are required to maintain the frequency of the power system within the frequency operating standards. The two general categories of FCAS are:

- Regulation services, which continuously adjust to small changes in demand or supply (changes that cause the frequency to move by only a small amount away from 50 Hz). There are regulation services to increase the frequency (raise regulation or RREG) and services to decrease the frequency (lower regulation or LREG).
- Contingency services, which manage large changes in demand or supply that occur relatively rarely and move the frequency by a large amount. There are three contingency services to increase the frequency and three contingency services to decrease the frequency. Raise contingency FCAS are required to be available to correct frequency excursions that have arisen from a credible contingency event that leads to a decrease in frequency. As these contingency events usually involve step reductions in supply side, the Electricity Rules stipulate that generators pay for these services. Lower contingency FCAS are the services required to be available to correct the frequency excursions that arise from a credible contingency event that leads to an increase in frequency. As these contingency events usually involve step reductions in customer demand, the Electricity Rules stipulate that customers pay for these services.

Participants providing regulation services receive adjusted dispatch targets every 5 minutes via their automatic generation control (AGC) signals from AEMO. Participants are paid through the FCAS markets in accordance with their offered volumes. Their energy production, which may be higher or lower depending on the AGC signals they receive, are settled in accordance with energy market prices.

There are three lower and three raise contingency services:

- fast services, which arrest a frequency deviation within the first six seconds of a contingent event (L6 and R6);
- slow services, which stabilise frequency deviations within sixty seconds of the event (L60/R60); and
- delayed services, which stabilise frequency deviations within five minutes of the event (L5/R5).

Participants offering to provide contingency services are enabled in accordance with the “trapezium” supplied in their offers. While participants will not necessarily be supplying these services until a contingency occurs they are paid in accordance with their enablement.

## Frequency Control Ancillary Service Settlement

AEMO settles the FCAS markets on a weekly basis, as follows<sup>2</sup>.

- Regulation FCAS: Cost recovery on a “causer pays” basis using the Causer Pays Procedure<sup>3</sup> developed by AEMO in accordance with the appropriate NER procedures.
- Contingency FCAS: Generators pay for Raise Services and customers pay for Lower Services.

The ‘Causer Pays’ Procedure allocates regulation FCAS costs to those market generators, customers and small generation aggregators with facilities that have the metering capable of determining their contribution to frequency deviations at any time.

Every four weeks based on historical data AEMO calculates a causer pays contribution factor for each generator. Broadly, the contribution factor is determined from historical 4 second generator output and frequency information and is a measure of how each generator contributed to managing changes in the system frequency. If a generators’ output changes such that it supports maintaining the system frequency its contribution factor is positive. Conversely, if a generators’ output changes such that it exacerbates a frequency deviation, its contribution factor will be negative. The causer pays contribution factors for a portfolio of generators effectively represent the aggregation of the individual performance of the generators in that portfolio.

Settlement is determined by allocating the FCAS costs incurred in the current period in accordance with the causer pays contribution factor for that portfolio from the preceding period. Thus cost allocation to a participant is not dependent on the amount of energy purchased or consumed in that period but by the performance of that participant in managing system frequency in the previous period.

Consequently a portfolio of generators with a negative factor in a particular period will still pay a share of FCAS costs irrespective of how much it generates in the current period.

Since not all of the costs will be recovered from generators, the residual costs are recovered from market customers (including retailers) in the relevant region, based on the amount of energy each market customer is purchasing.

---

<sup>2</sup> For a full description go to <https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Data/Ancillary-Services/Ancillary-Services-Payments-and-Recovery>

<sup>3</sup> For a full description go to <https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Security-and-reliability/Ancillary-services/Ancillary-services-causer-pays-contribution-factors>

## Appendix B Local Frequency Control Ancillary Services

AEMO sets the requirement for FCAS to ensure that the frequency standard (as set by the Reliability Panel) is maintained in the event of step changes in supply or demand that results from credible contingencies. Where a credible contingency results in the loss of an interconnector it is termed a “separation event”.

The standard states that in the event of a “separation event” the frequency must be contained within 49 to 51 Hz or a wider band notified to AEMO by a relevant JSSC. In the case of South Australia the JSSC notified AEMO that the frequency band for separation of the South Australian power system is 47 to 52 Hz and that under frequency relays will operate at frequency levels in the low end of this range.

When there is a potential separation event caused by the loss of an interconnector “local frequency control ancillary services” are usually required.

If the region was exporting at the time the interconnector fails, then as a consequence of the immediate over supply situation local contingency “lower” services are required in the islanded region to lower the frequency (typically generators offer to quickly reduce output to lower frequency). In other words, the loss of the Heywood interconnector when power is flowing from South Australia, results in an oversupply of generation, increasing the frequency in South Australia. Contingency lower services are sourced from registered suppliers in South Australia (typically generators) in proportion to the flow across the interconnector from South Australia to Victoria to quickly reduce that over frequency.

A similar situation exists for contingency “raise” services for all other regions except South Australia where, in accordance with the advice from the JSSC, the raise requirement is covered by under frequency load shedding. In other words, the loss of the Heywood interconnector when power is flowing into South Australia, results in an undersupply of generation decreasing the frequency in South Australia. Under frequency load shedding reduces demand in blocks to arrest the falling frequency until supply matches demand and the frequency is restored.

In either event, in the past, in the period immediately following the separation event AEMO would invoke local regulation services and establish a local regulation reference source to manage frequency until the region can be reconnected to the rest of the NEM. It is this aspect that has been recently changed by AEMO. AEMO will now impose a requirement for local lower and raise regulation services in South Australia prior to the failure of the interconnector so that frequency after an island is formed, and after the contingency services have operated, can be smoothly maintained.

## Appendix C Significant Rebids

The rebidding tables highlight the relevant rebids submitted by generators that impacted on 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 was being offered and the rebid reason.

**Table C 1: Significant rebids for 22 May – lower regulation**

Submit time	Time effective	Participant	Station	Capacity rebid (MW)	Price from (\$/MW)	Price to (\$/MW)	Rebid reason
12.05 pm	12.15 pm	Origin	Osborne	12*	n/a	0	1201P CHANGE IN AVAIL - QPS5 OVERSPEED TEST SL
12.11 pm	12.20 pm	Origin	Quarantine	12*	0	n/a	1201P CHANGE IN AVAIL - QPS5 OVERSPEED TEST SL
5.28 pm	5.35 pm	Origin	Quarantine	2	0	3994	1726A INC SA DEM 5PD 1724MW > 30PD 1572MW @HHE1800 SL

**Table C 2: Significant rebids for 22 May – raise regulation**

Submit time	Time effective	Participant	Station	Capacity rebid (MW)	Price from (\$/MW)	Price to (\$/MW)	Rebid reason
12.05 pm	12.15 pm	Origin	Osborne	12*	n/a	0	1201P CHANGE IN AVAIL - QPS5 OVERSPEED TEST SL
12.11 pm	12.20 pm	Origin	Quarantine	12*	0	n/a	1201P CHANGE IN AVAIL - QPS5 OVERSPEED TEST SL
5.28 pm	5.35 pm	Origin	Quarantine	2	0	7690	1726A INC SA DEM 5PD 1724MW > 30PD 1572MW @HHE1800 SL

\*As part of these rebids, capacity priced higher greater than \$13 000/MW was also added or removed from offers. As that capacity did not impact price, they have not been included.



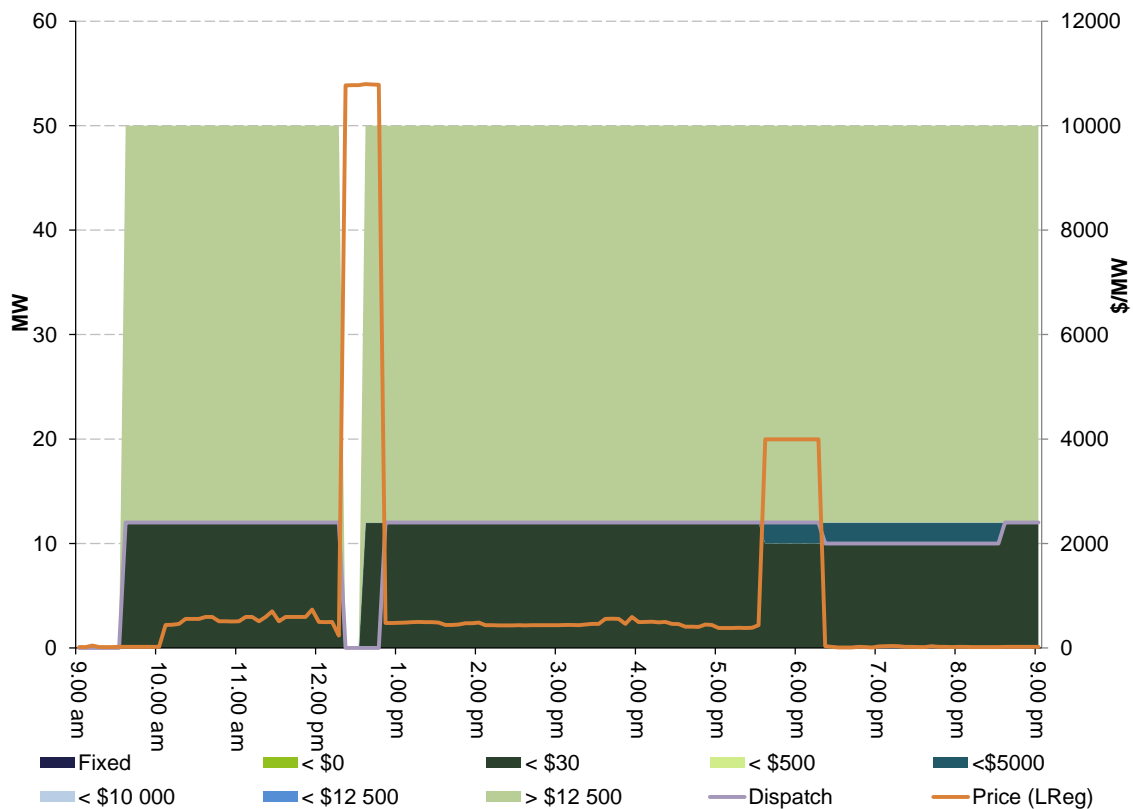
## Appendix D Closing bids

Figures D1a to D8b highlight for each dispatch interval the lower and raise regulation services closing bids for Origin, AGL and Engie (the participants in South Australia with ancillary service capability). It also shows the dispatch level of the respective services at each station and the dispatch price.

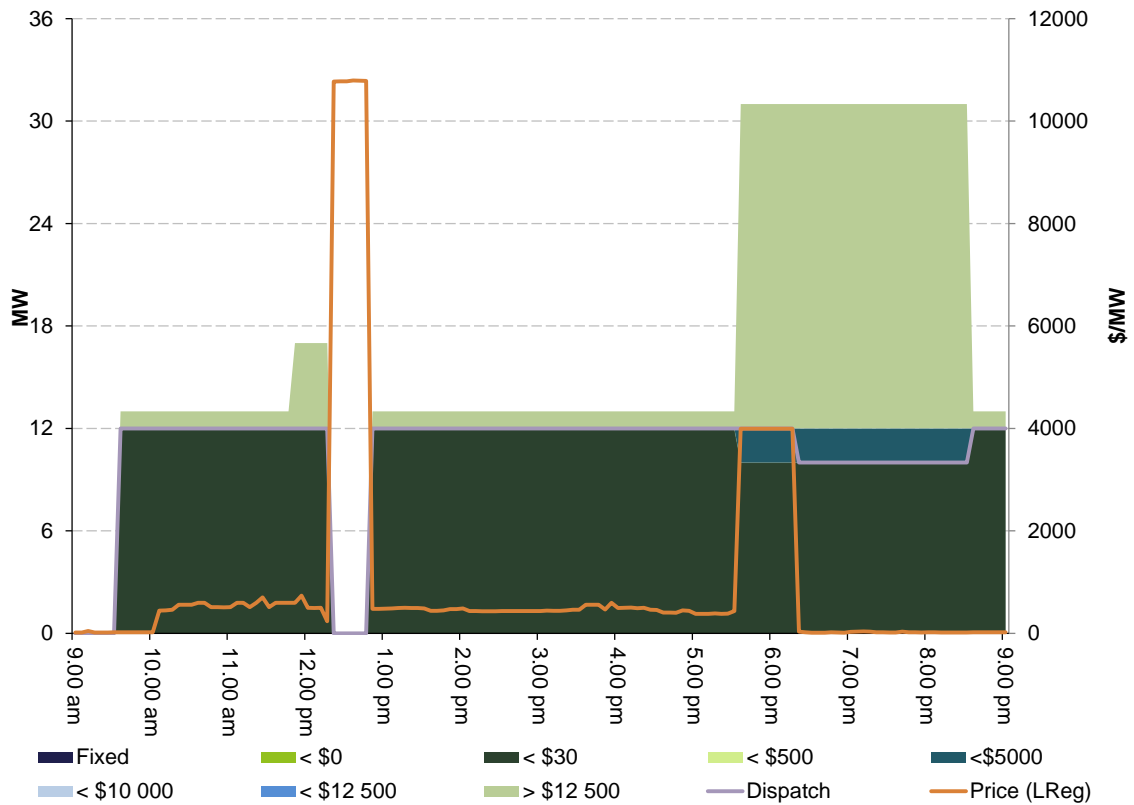
FCAS services are co-optimised with energy offers. For example a generator that is operating at its maximum capacity cannot provide raise services so their effective available capacity for raise services would be zero. Figures denoted with an “a” refer to the quantities offered while those with a “b” refer to the *effective* quantities available to the market after accounting for the interaction between energy and FCAS (“effective available capacity”).

### Lower regulation

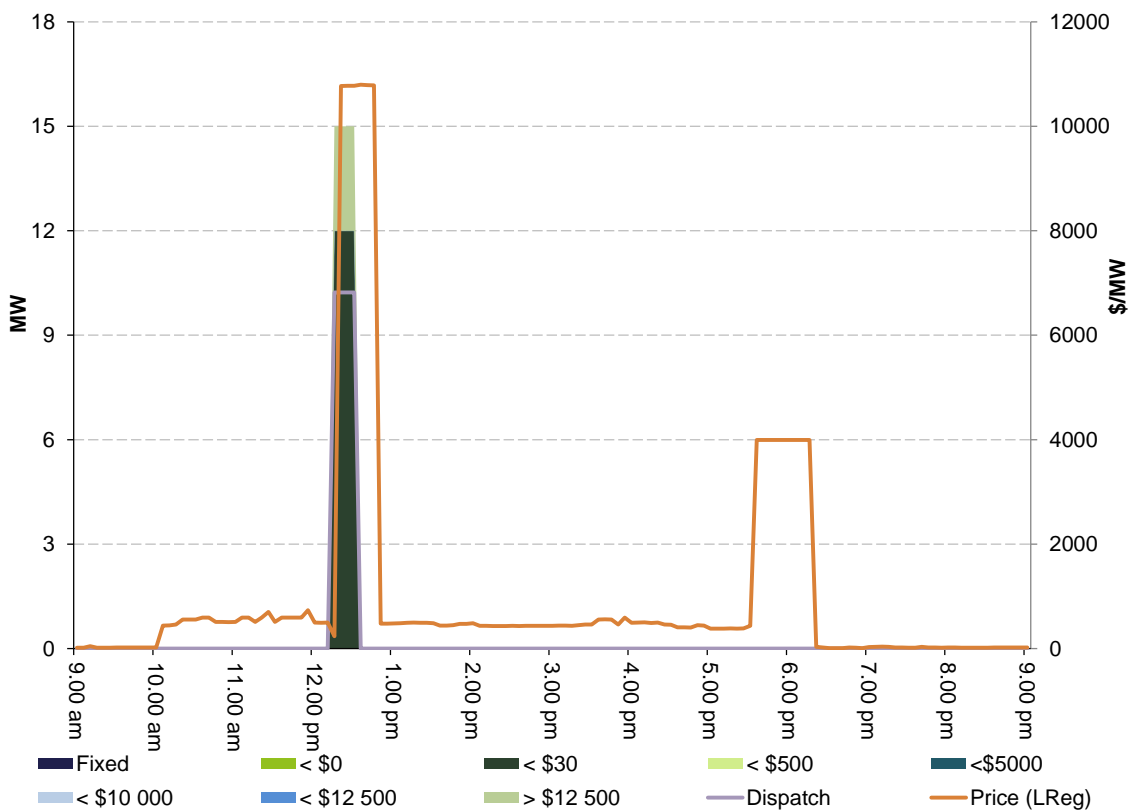
**Figure D1a: Quarantine (Origin) lower regulation service closing bid prices, dispatch and dispatch price - maximum offers**



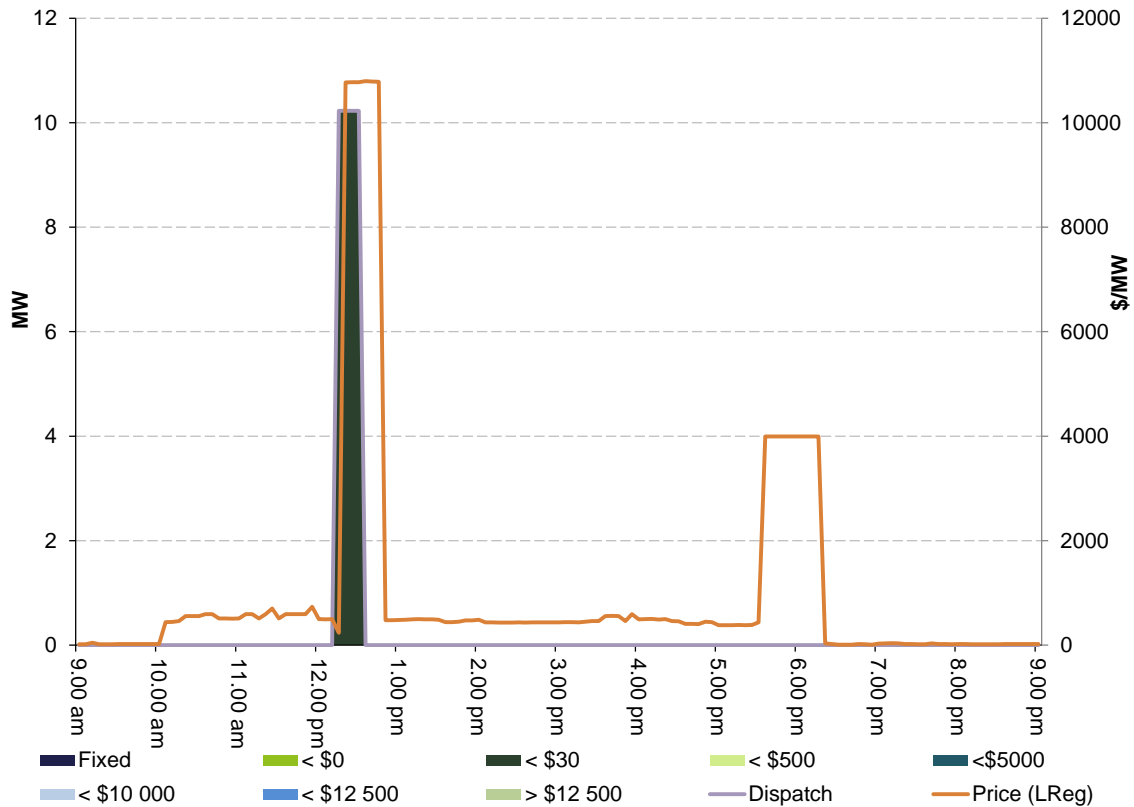
**Figure D1b: Quarantine (Origin) lower regulation service closing bid prices, dispatch and dispatch price – effective offers**



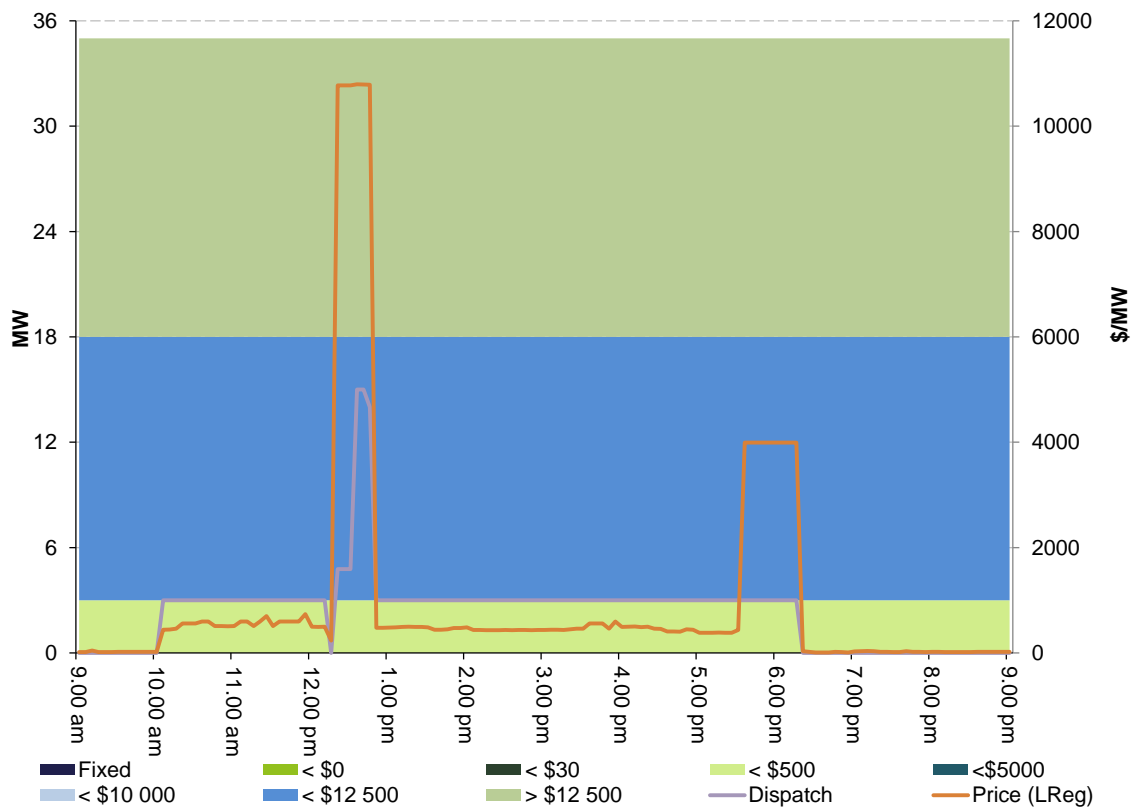
**Figure D2a: Osborne (Origin) lower regulation service closing bid prices, dispatch and dispatch price – maximum offers**



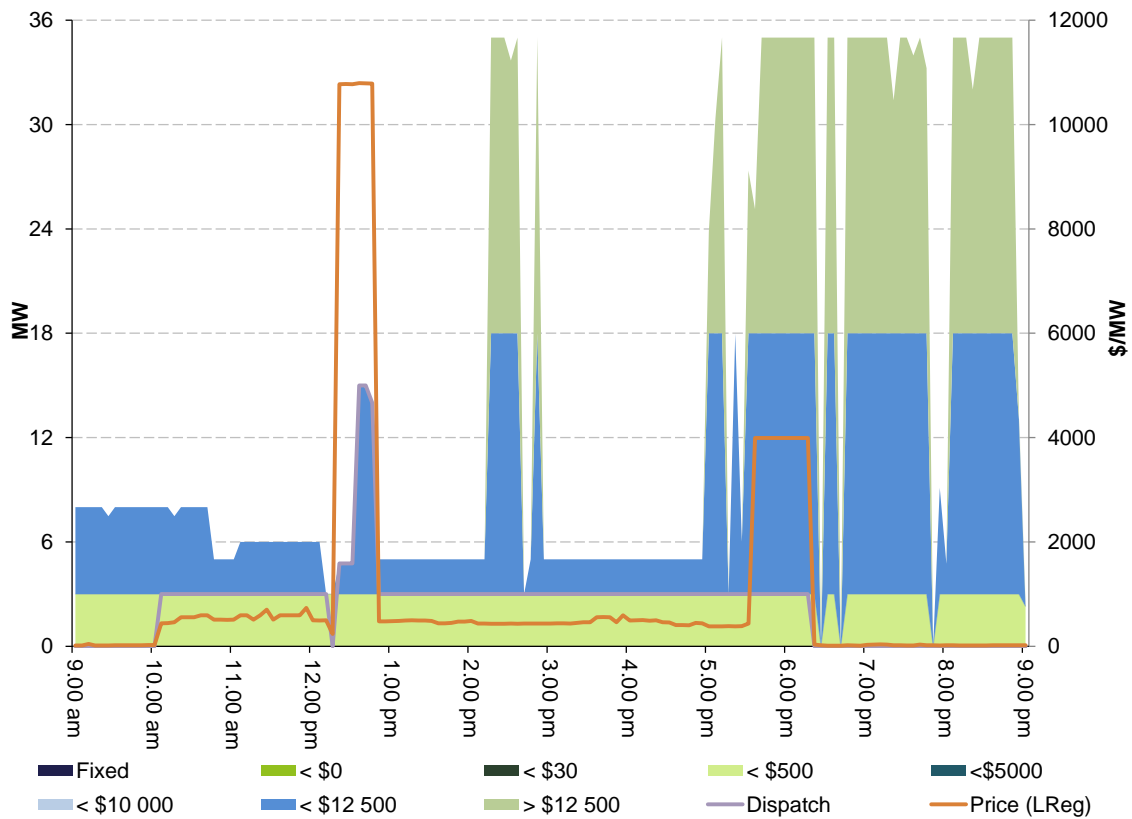
**Figure D2b: Osborne (Origin) lower regulation service closing bid prices, dispatch and dispatch price – effective offers**



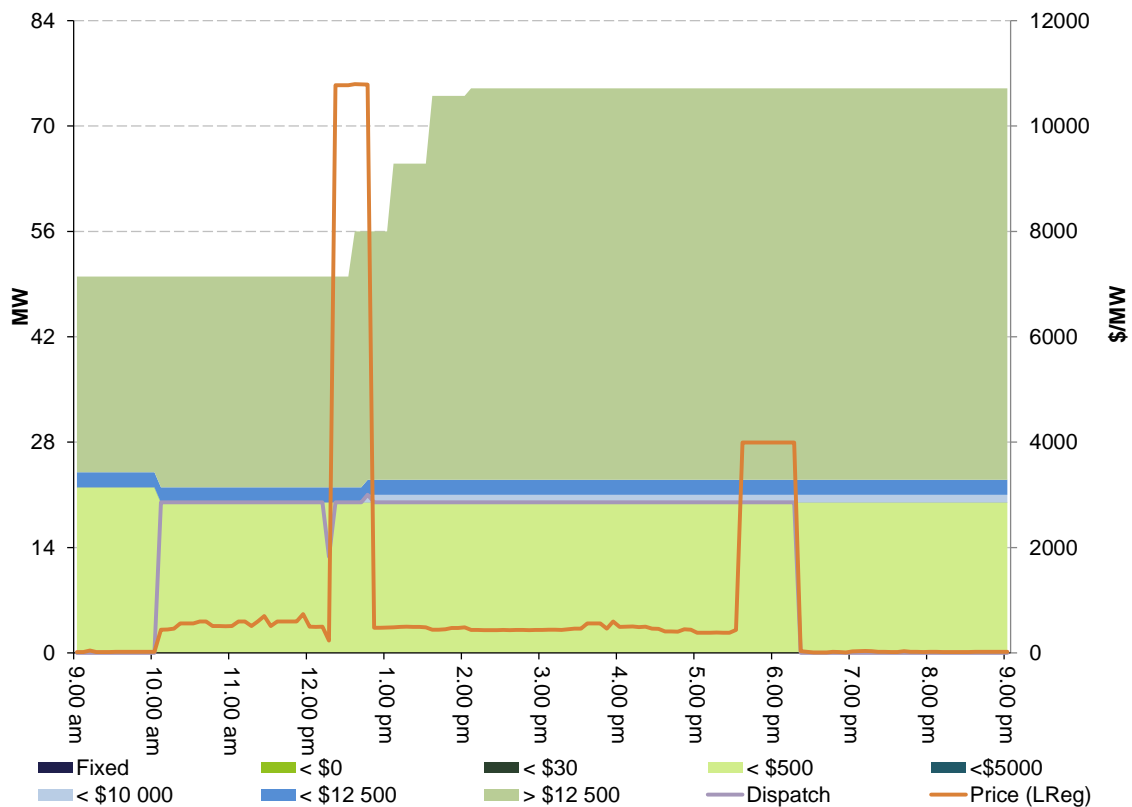
**Figure D3a: Pelican Point (Engie) lower regulation service closing bid prices, dispatch and dispatch price – maximum offers**



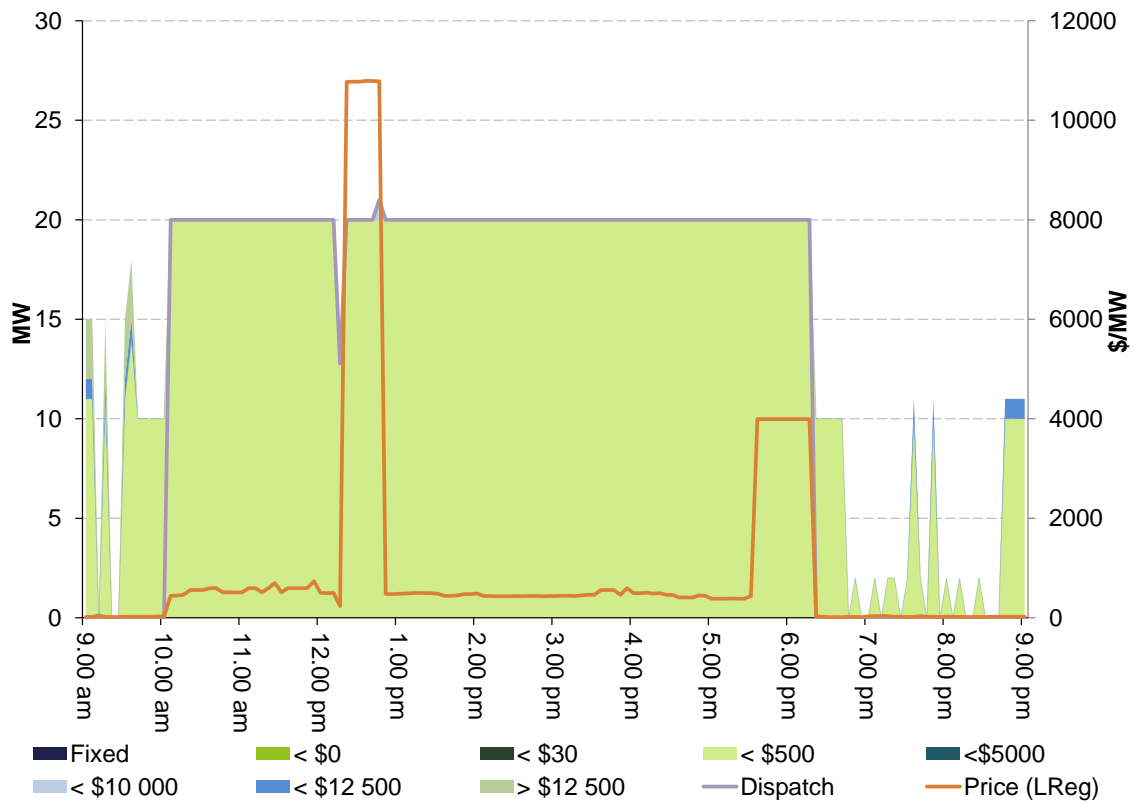
**Figure D3b: Pelican Point (Engie) lower regulation service closing bid prices, dispatch and dispatch price – effective offers**



**Figure D4a: Torrens Island (AGL) lower regulation service closing bid prices, dispatch and dispatch price – maximum offers**



**Figure D4b: Torrens Island (AGL) lower regulation service closing bid prices, dispatch and dispatch price – effective offers**



## Raise Regulation

Figure D5a: Quarantine (Origin) raise regulation service closing bid prices, dispatch and dispatch price - maximum offers

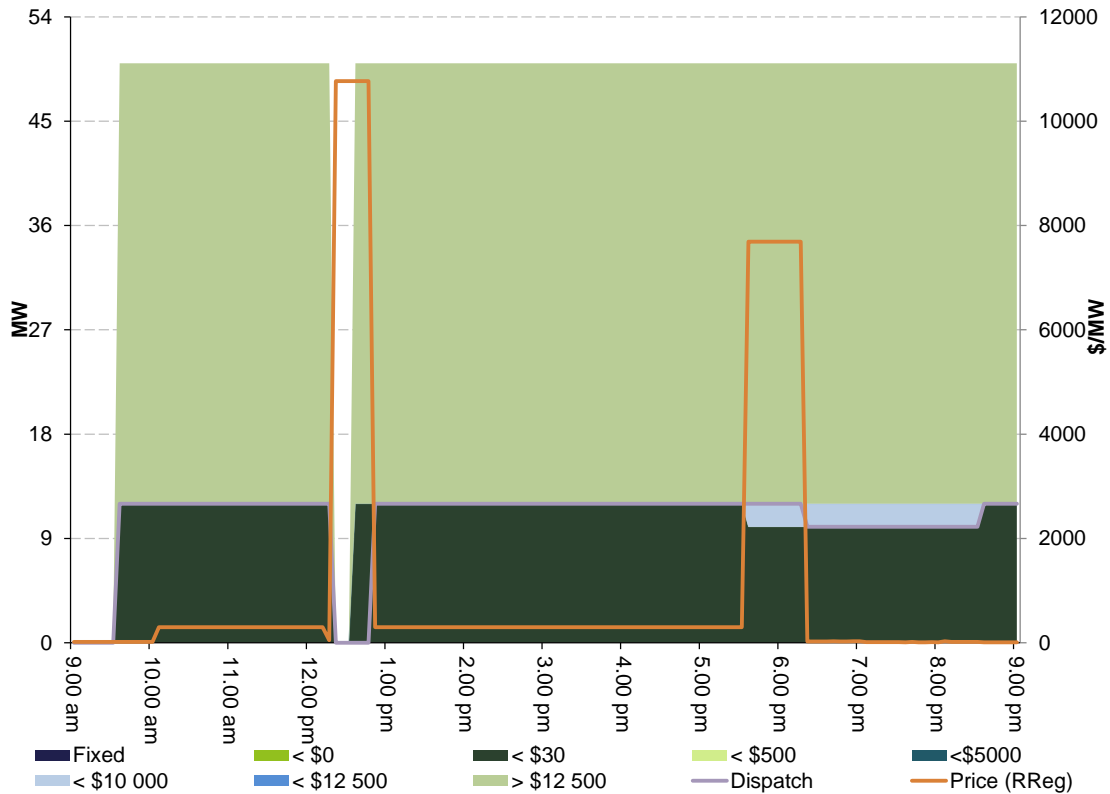
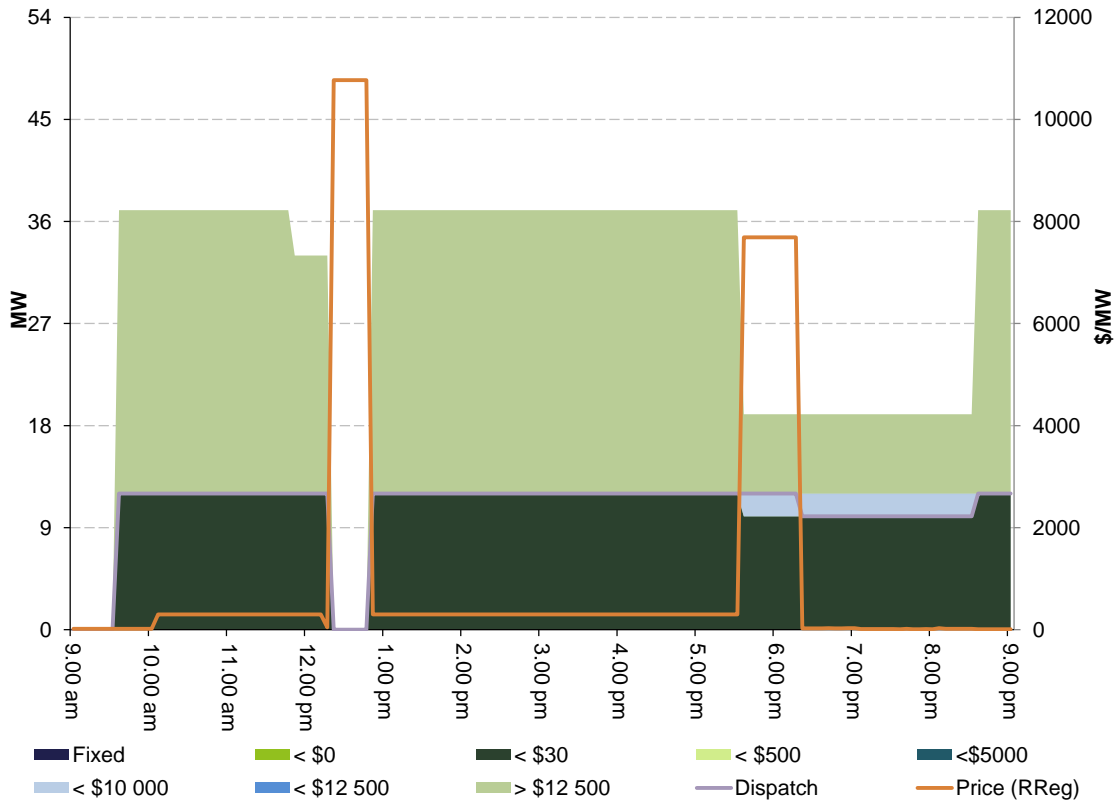
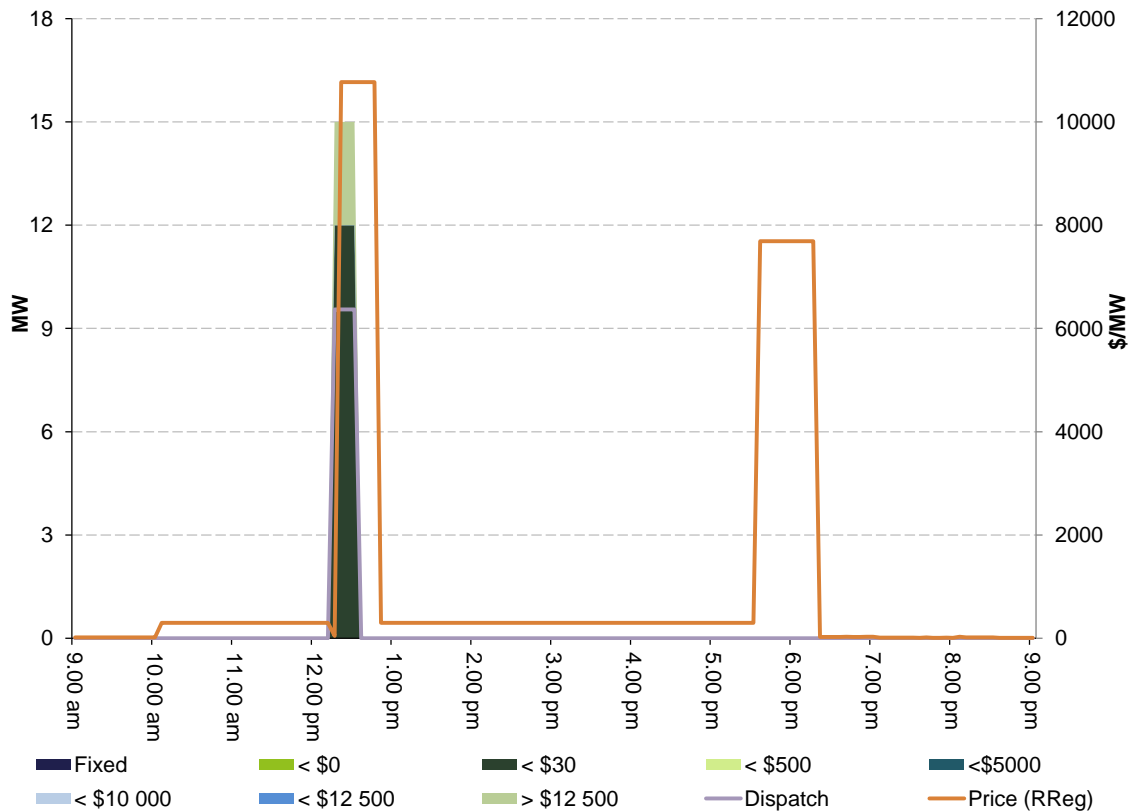


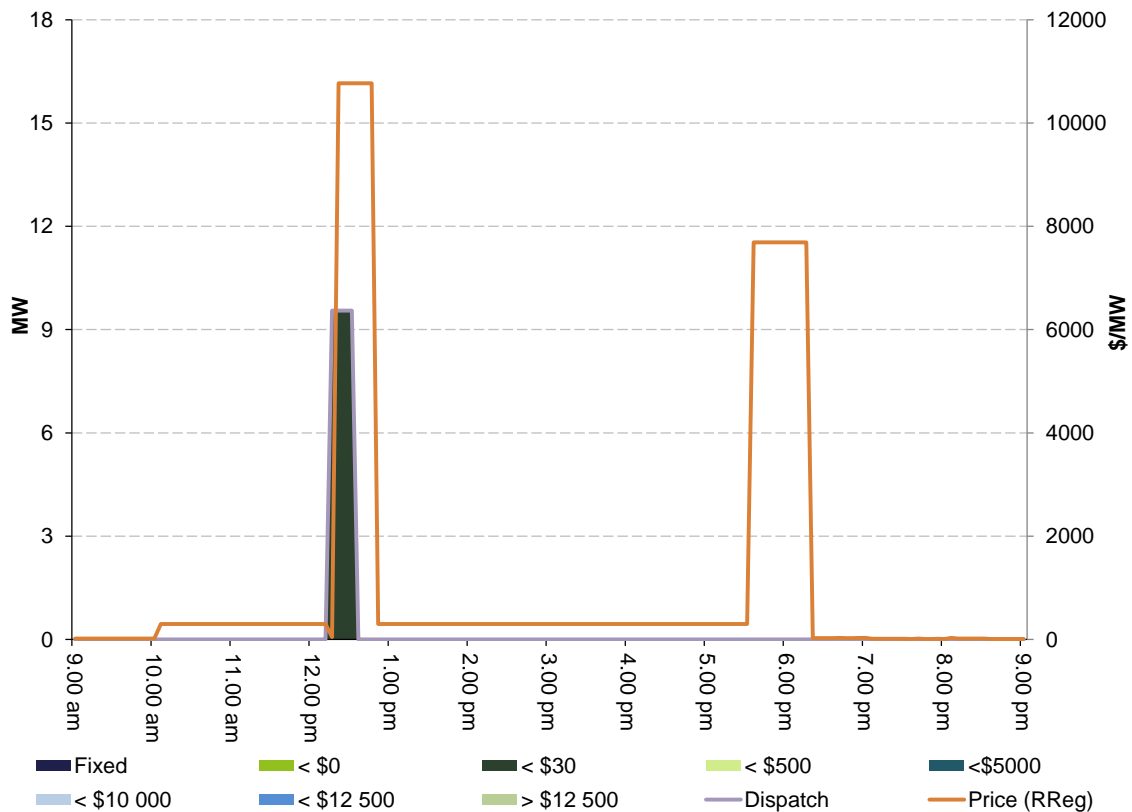
Figure D5b: Quarantine (Origin) raise regulation service closing bid prices, dispatch and dispatch price - effective offers



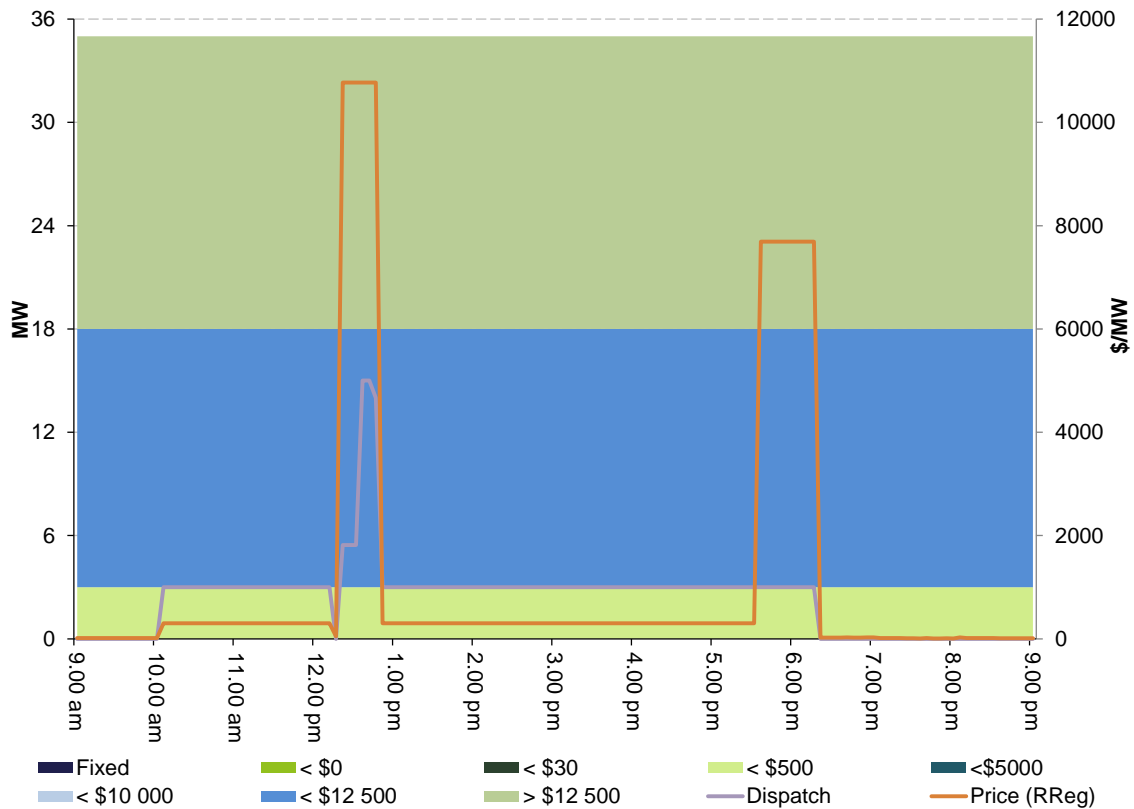
**Figure D6a: Osborne (Origin) raise regulation service closing bid prices, dispatch and dispatch price – maximum offers**



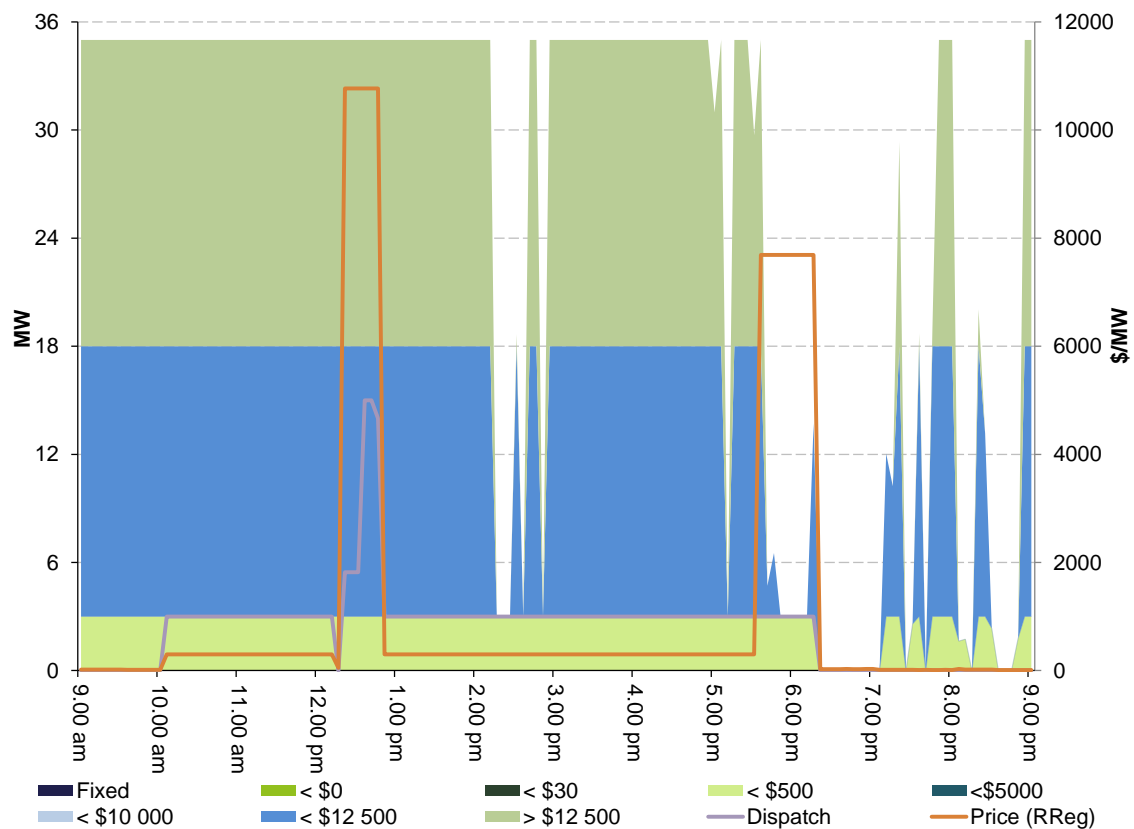
**Figure D6b: Osborne (Origin) raise regulation service closing bid prices, dispatch and dispatch price – effective offers**



**Figure D7a: Pelican Point (Engie) raise regulation service closing bid prices, dispatch and dispatch price – maximum offers**

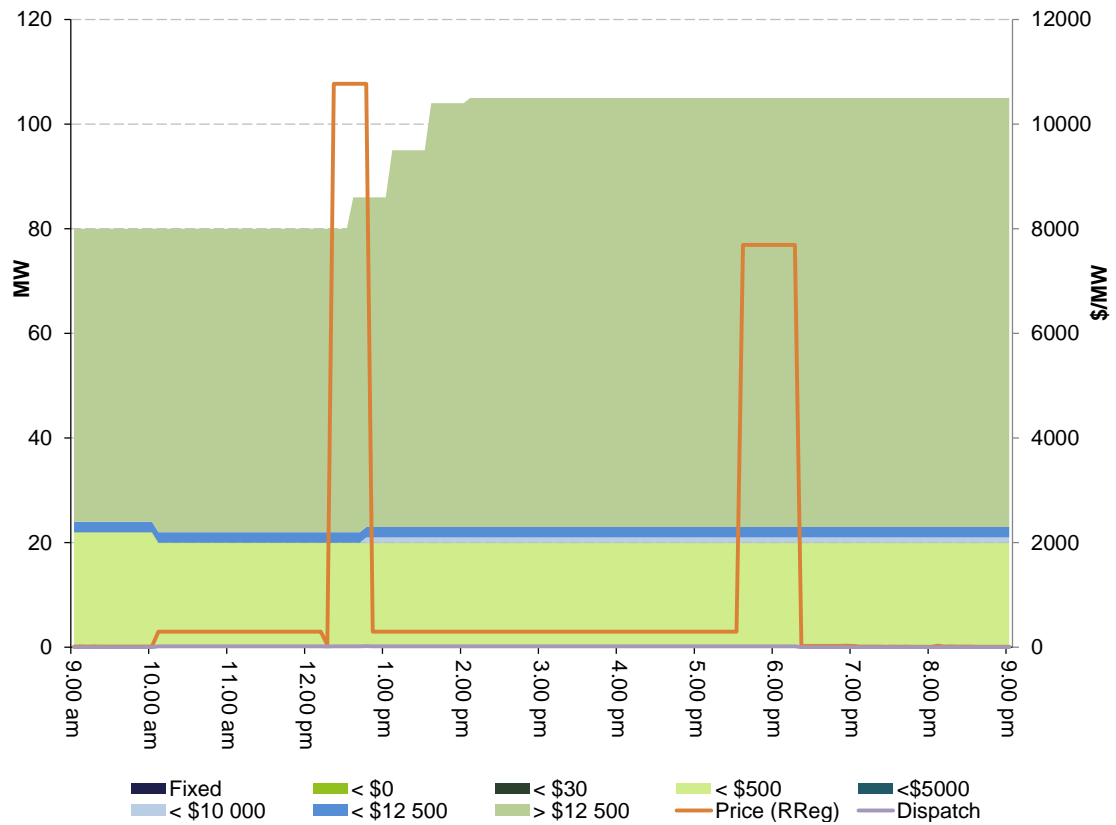


**Figure D7b: Pelican Point (Engie) raise regulation service closing bid prices, dispatch and dispatch price – effective offers**

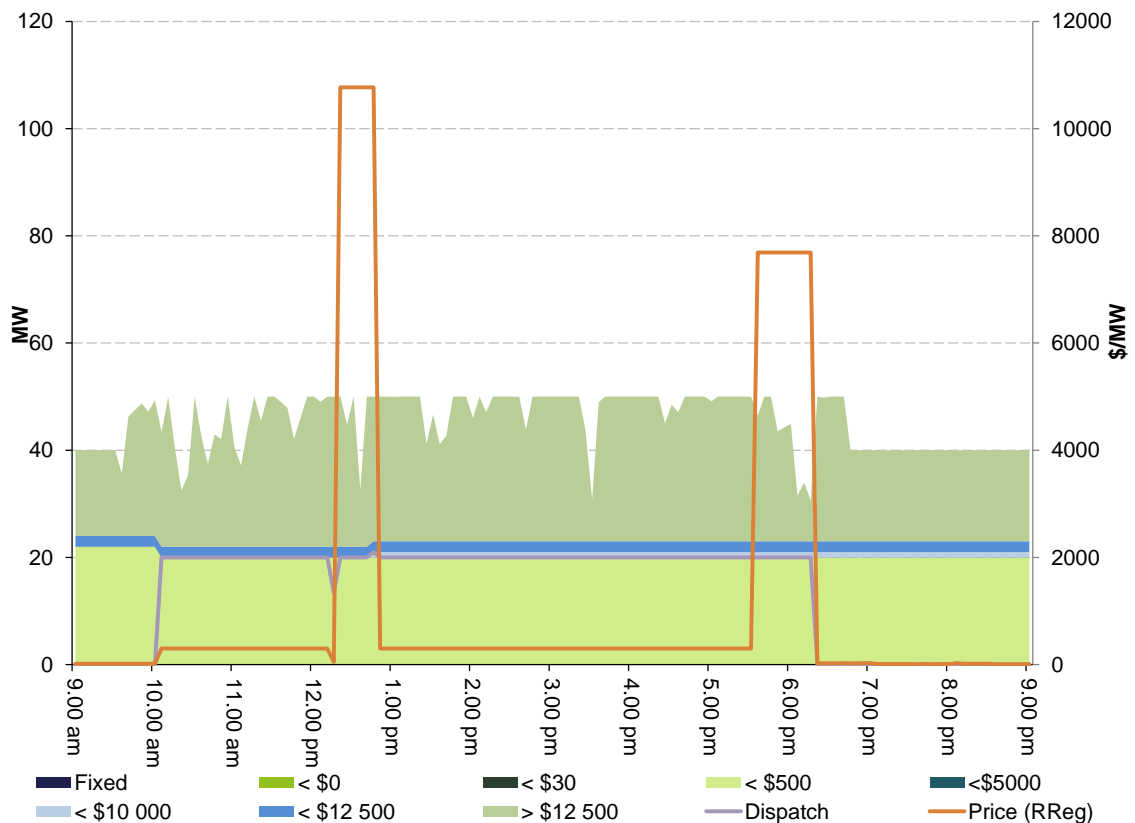




**Figure D8a: Torrens Island (AGL) raise regulation service closing bid prices, dispatch and dispatch price – maximum offers**



**Figure D8b: Torrens Island (AGL) raise regulation service closing bid prices, dispatch and dispatch price – effective offers**



# Appendix E Relevant Market Notices

AEMO issued the following market notices to advise of the outage.

Market Notice	Type	Date of issue	Last Changed
58470	GENERAL NOTICE	4/05/2017 8:56:02	4/05/2017 8:56:02

## Reason

### AEMO ELECTRICITY MARKET NOTICE

This market notice is FOR INFORMATION ONLY.

The Heywood No.1 500 kV busbar in Victoria Region is planned to be out of service from 22/05/2017 0600 hrs - 22/05/2017 1800 hrs .

A credible contingency event during this planned outage could cause synchronous separation of the South Australia (SA) region from the rest of the NEM. If separation occurs, load may be interrupted due to the operation of the Automatic Under Frequency Load Shedding (AUFLS) scheme in SA.

The credible separation contingency is managed as follows:

- o 35 MW of raise and lower regulation FCAS will be sourced from SA.
- o When power transfer is from SA to Victoria (Vic), contingency lower FCAS will be sourced from SA.
- o When power transfer is from Vic to SA, due to the 47-52Hz island separation frequency band advised by the SA jurisdiction, contingency raise FCAS is not sourced in SA and the AUFLS scheme may respond to low frequency events.

Forecast capacity reserves in the SA region are currently sufficient to meet electricity demand during the planned outage.

The following constraint sets have been invoked for this outage:

F-I\_HYSE (includes F-S\_LREG\_0035 and F-S\_RREG\_0035)  
S-X\_BC\_CP  
V-HYTX\_M12  
V-HY\_500BUS  
I-VS\_050

Refer AEMO Network Outage Schedule (NOS) for further details.

Diyoni Hoole  
AEMO Operations

Market Notice	Type	Date of issue	Last Changed
58606	GENERAL NOTICE	21/05/2017 17:00:13	21/05/2017 17:00:13

## Reason

### AEMO ELECTRICITY MARKET NOTICE

This market notice is FOR INFORMATION ONLY.

The Heywood No.1 500 kV busbar in Victorian Region was planned to be out of service from 0600 hrs 22/05/2017 - 1800 hrs 22/05/2017

The Heywood No.1 500 kV busbar in Victorian Region will now be out of service from 1000 hrs 22/05/2017 - 2200 hrs 22/05/2017

A credible contingency event during this planned outage could cause synchronous separation of the South Australia (SA) region from the rest of the NEM. If separation occurs, load may be interrupted due to the operation of the Automatic Under Frequency Load Shedding (AUFLS) scheme in SA.

The credible separation contingency is managed as follows:

- o 35 MW of raise and lower regulation FCAS will be sourced from SA.
- o When power transfer is from SA to Victoria (Vic), contingency lower FCAS will be sourced from SA.
- o When power transfer is from Vic to SA, due to the 47-52Hz island separation frequency band advised by the SA jurisdiction, contingency raise FCAS is not sourced in SA and the AUFLS scheme may respond to low frequency events.

Forecast capacity reserves in the SA region are currently sufficient to meet electricity demand during this planned outage.

The following constraint sets have been invoked for this outage:

F-I\_HYSE (includes F-S\_LREG\_0035 and F-S\_RREG\_0035)  
S-X\_BC\_CP  
V-HYTX\_M12  
V-HY\_500BUS  
I-VS\_050

Refer AEMO Network Outage Schedule (NOS) for further details.

Manager Nem Real Time Operations

## Appendix F Price setter

The following tables identify for each five-minute dispatch interval where regulation dispatch prices were above \$5000/MW, the price and the generating units involved in setting the price for each of the lower and raise regulation services in South Australia. This information is published by AEMO.<sup>4</sup> Also shown are the offer prices involved in determining the dispatch price, together with the quantity of that service and the contribution to the total price. AEMO reports an increase as a negative marginal change in FCAS price setter. Generator offers which contributed zero to the price have been removed for clarity.

### Lower regulation 22 May

DI	Dispatch Price (\$/MW)	Participant	Unit	Service	Offer price (\$/MW)	Marginal change	Contribution
12:20	\$10 772.29	Engie	PPCCGT	Lower reg	\$10 769.69	-1.00	-\$10 769.69
		AGL Energy	BW01	Energy	\$92.96	0.31	\$28.82
		AGL Energy	BW02	Energy	\$92.96	0.31	\$28.82
		AGL Energy	BW04	Energy	\$92.96	0.20	\$18.59
		Engie	PPCCGT	Energy	\$78.69	-1.00	-\$78.69
12:25	\$10 775.10	Engie	PPCCGT	Lower reg	\$10 769.69	-1.00	-\$10 769.69
		CS Energy	GSTONE1	Energy	\$83.73	-0.02	-\$1.67
		CS Energy	GSTONE2	Energy	\$83.73	-0.02	-\$1.67
		CS Energy	GSTONE3	Energy	\$83.73	-0.02	-\$1.67
		CS Energy	GSTONE5	Energy	\$83.73	-0.01	-\$0.84
		Engie	LOYYB1	Lower 60 sec	\$0.02	-0.83	-\$0.02
		Engie	LOYYB2	Lower 6 sec	\$0.02	-1.00	-\$0.02
		Engie	PPCCGT	Lower 60 sec	\$0.03	1.00	\$0.03
		Engie	PPCCGT	Lower 6 sec	\$0.03	1.00	\$0.03
		AGL (SA)	TORRB1	Lower 60 sec	\$0.03	-0.17	-\$0.01
12:30	\$10 774.78	Engie	PPCCGT	Lower reg	\$10 769.69	-1.00	-\$10 769.69
		Origin Energy	ER01	Energy	\$70.92	-0.03	-\$2.13
		Origin Energy	ER01	Energy	\$70.92	-0.03	-\$2.13
		Origin Energy	ER02	Energy	\$70.92	-0.03	-\$2.13
		CS Energy	W/HOE#2	Raise 5 min	\$9.97	-0.06	-\$0.60
		Hydro Tasmania	LEM_WIL	Raise 6 sec	\$5.00	-0.06	-\$0.30
		Origin Energy	ER01	Raise 5 min	\$2.79	0.03	\$0.08
		Origin Energy	ER02	Raise 5 min	\$2.79	0.03	\$0.08
		Origin Energy	ER01	Raise 60 sec	\$1.99	0.03	\$0.06
		Origin Energy	ER02	Raise 60 sec	\$1.99	-0.03	-\$0.06

<sup>4</sup> Details on how the price is determined can be found at [www.aemo.com.au](http://www.aemo.com.au)

DI	Dispatch Price (\$/MW)	Participant	Unit	Service	Offer price (\$/MW)	Marginal change	Contribution
		Origin Energy	ER01	Raise 6 sec	\$1.74	0.03	\$0.05
		Origin Energy	ER02	Raise 6 sec	\$1.74	0.03	\$0.05
		Engie	PPCCGT	Lower 60 sec	\$0.03	1.00	\$0.03
		Engie	PPCCGT	Lower 6 sec	\$0.03	1.00	\$0.03
		AGL (SA)	TORRB4	Lower 60 sec	\$0.03	-0.17	-\$0.01
		Engie	LOYB2	Lower 6 sec	\$0.02	-1.00	-\$0.02
		Engie	LOYB2	Lower 60 sec	\$0.02	-0.83	-\$0.02
12:35	\$10 794.80	Engie	PPCCGT	Lower reg	\$10 769.69	-1.00	-\$10 769.69
		Snowy Hydro	MURRAY	Energy	\$74.00	0.72	\$53.28
		Engie	PPCCGT	Energy	\$78.69	-1	-\$78.69
12:40	\$10 789.46	Engie	PPCCGT	Lower reg	\$10 769.69	-1	-\$10 769.69
		CS Energy	GSTONE2	Energy	\$83.73	0.18	\$15.07
		CS Energy	GSTONE3	Energy	\$83.73	0.41	\$34.33
		CS Energy	GSTONE5	Energy	\$83.73	0.12	\$10.05
		Engie	PPCCGT	Energy	\$78.69	-1.00	-\$78.69
12:45	\$10 785.31	Engie	PPCCGT	Lower reg	\$10 769.69	-1	-\$10 769.69
		Delta Electricity	VP5	Energy	\$85.00	0.37	\$31.45
		Delta Electricity	VP6	Energy	\$85.00	0.37	\$31.45
		Engie	PPCCGT	Energy	\$78.69	-1.00	-\$78.69

## Raise regulation 22 May

DI	Dispatch Price (\$/MW)	Participant	Unit	Service	Offer price (\$/MW)	Marginal change	Contribution
12:20	\$10 769.69	Engie	PPCCGT	Raise reg	\$10 769.69	-1.00	-\$10 769.69
12:25	\$10 769.69	Engie	PPCCGT	Raise reg	\$10 769.69	-1.00	-\$10 769.69
12:30	\$10 769.69	Engie	PPCCGT	Raise reg	\$10 769.69	-1.00	-\$10 769.69
12:35	\$10 769.69	Engie	PPCCGT	Raise reg	\$10 769.69	-1.00	-\$10 769.69
12:40	\$10 769.69	Engie	PPCCGT	Raise reg	\$10 769.69	-1.00	-\$10 769.69
12:45	\$10 769.69	Engie	PPCCGT	Raise reg	\$10 769.69	-1.00	-\$10 769.69
17:35	\$7689.75	Origin Energy	QPS5	Raise reg	\$7689.75	-1.00	-\$7689.75
17:40	\$7689.75	Origin Energy	QPS5	Raise reg	\$7689.75	-1.00	-\$7689.75
17:45	\$7689.75	Origin Energy	QPS5	Raise reg	\$7689.75	-1.00	-\$7689.75
17:50	\$7689.75	Origin Energy	QPS5	Raise reg	\$7689.75	-1.00	-\$7689.75
17:55	\$7689.75	Origin Energy	QPS5	Raise reg	\$7689.75	-1.00	-\$7689.75
18:00	\$7689.75	Origin Energy	QPS5	Raise reg	\$7689.75	-1.00	-\$7689.75
18:05	\$7689.75	Origin Energy	QPS5	Raise reg	\$7689.75	-1.00	-\$7689.75
18:10	\$7689.75	Origin Energy	QPS5	Raise reg	\$7689.75	-1.00	-\$7689.75

DI	Dispatch Price (\$/MW)	Participant	Unit	Service	Offer price (\$/MW)	Marginal change	Contribution
18:15	\$7689.75	Origin Energy	QPS5	Raise reg	\$7689.75	-1.00	-\$7689.75