



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

South Australia,
26 March 2016

27 May 2016

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Amendment Record

Version	Date	Pages
1 For publication	27/05/2016	18

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1 Obligation

In accordance with the clause 3.13.7(e) of the National Electricity Rules, the AER is required to monitor significant variation 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 for a number of trading intervals within that period.

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.

On 26 March 2016, an outage in Victoria, affecting the Heywood interconnector, led to a 35 MW local regulation Frequency Control Ancillary Service (FCAS) requirement in South Australia. While there was no material affect on the spot price, regulation FCAS prices exceeded \$5000/MW for seven consecutive dispatch intervals over two trading intervals. Rebidding was not a contributing factor. This report presents our analysis of the events in accordance with this obligation.

2 Summary

An unplanned outage of a circuit breaker at the South Morang Terminal Station required the South Morang to Sydenham and Sydenham to Moorabool 500kV transmission lines in Victoria to be taken out of service placing South Australia on a single contingency. AEMO invoked a constraint requiring 35 MW of regulation FCAS in South Australia and with only 10 MW regulation FCAS in South Australia priced less than \$5000/MW, the price for these services exceeded \$12 400/MW for seven consecutive dispatch intervals affecting two trading intervals.¹

Table 1: Regulation FCAS prices

Period ending	Regulation FCAS Prices (\$/MW)	
	Lower	Raise
2.20 am	13 800	13 800
2.25 am	13 800	13 800
2.30 am	13 800	13 800
2.35 am	13 800	13 800
2.40 am	13 800	13 800
2.45 am	13 800	13 800
2.50 am	13 435	12 400

Our analysis concludes that rebidding did not contribute to the high FCAS prices and they were not forecast by the market systems. The spot price for energy for the two effected trading intervals was around \$65/MWh.

¹ See previous \$5000 FCAS report <http://www.aer.gov.au/wholesale-markets/market-performance/prices-above-5000-mw-11-12-and-25-october-2015-sa> for details on why the 35 MW requirement is required.

3 Analysis

This section sets out the factors which contributed to the price outcomes and observations about relevant participant behaviour.

Prior to an unplanned outage in Victoria, four conventional generators and ten wind farms were operating in South Australia. Approximately 250 MW and 172 MW of power was flowing from Victoria into South Australia over the Heywood and Murraylink interconnectors respectively. Local regulation FCAS prices were \$0/MW because there was no requirement for these services.

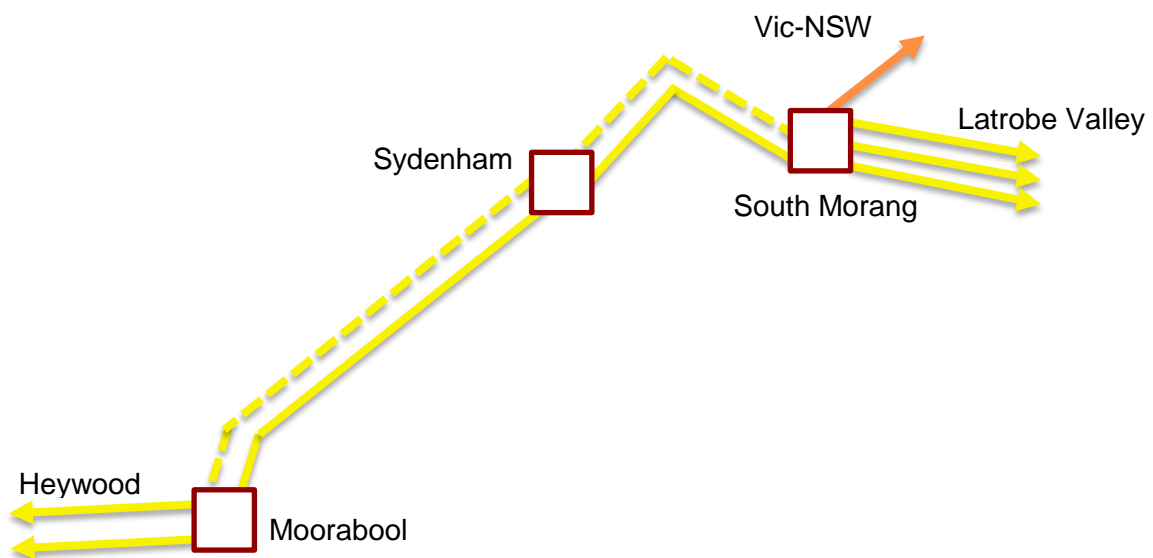
The four conventional generators that were on could provide around 50 MW each of the regulations services with only around 10 MW of this priced below \$5000/MW.

3.1 Network issues

At around 2.05 am there was an unplanned outage of a circuit breaker at the South Morang Terminal Station in Victoria which required the South Morang to Sydenham and Sydenham to Moorabool No.1 500kV lines in Victoria to be taken out of service. At 2.20 am AEMO invoked constraints to manage the outage of these lines. The outage of one of two lines between Sydenham and Moorabool places the loss of the Heywood interconnector into South Australia on a single contingency. If the remaining Sydenham to Moorabool line fails then South Australia would be islanded. When this is the case, constraints are invoked in South Australia to source 35 MW of regulation services locally.

The yellow lines in Figure 1 represent 500 kV transmission lines and the orange line represents a 330 kV transmission line. The dotted yellow lines represent the lines that were taken out of service. The squares indicate the substations relevant to the constraints managing the outages.

Figure 1 Simplified network in Victoria



The outage lasted until 2.50 am, which is longer than would normally be expected to isolate a circuit breaker. The delay was caused by complications in isolating the circuit breaker.

3.2 Generator offers and FCAS Prices

There are only four power stations registered to provide Raise and Lower regulation services in South Australia:

- Northern Power Station (owned by Alinta Energy);
- Torrens Island A and B (owned by AGL);
- Pelican Point Power Station (owned by GDF Suez (ENGIE)); and
- Quarantine Power Station (owned by Origin).

Table 2 shows the maximum FCAS capacity available by station; Torrens Island is the largest registered provider of FCAS in South Australia.

Table 2: Maximum capacity available by station and regulation service

Power Station	Max Capacity	
	Lower regulation	Raise regulation
Northern	20	20
Pelican Point	100	100
Torrens Island	200	260
Quarantine	50	50

At the time the event occurred, only two of these stations had generators online, Northern and Torrens Island.

For the regulation FCAS markets, Figure 2 and Figure 3 show the price, requirement and the combined effective capacity being offered in price bands for each local service sourced in South Australia.² The orange line in these figures shows the local requirement for that service, the coloured areas show the effective volumes while the light brown line shows the price of that service.

Figure 2 and Figure 3 highlight that there was only 10 MW of capacity offered at less than \$5000/MW for each of the regulation FCAS. The offer profile was set up a day ahead, with no significant rebidding.

² Effective FCAS capacity takes into account the co-optimisation process with energy offers

Figure 2: Lower regulation services price, requirement and effective capacity by price band

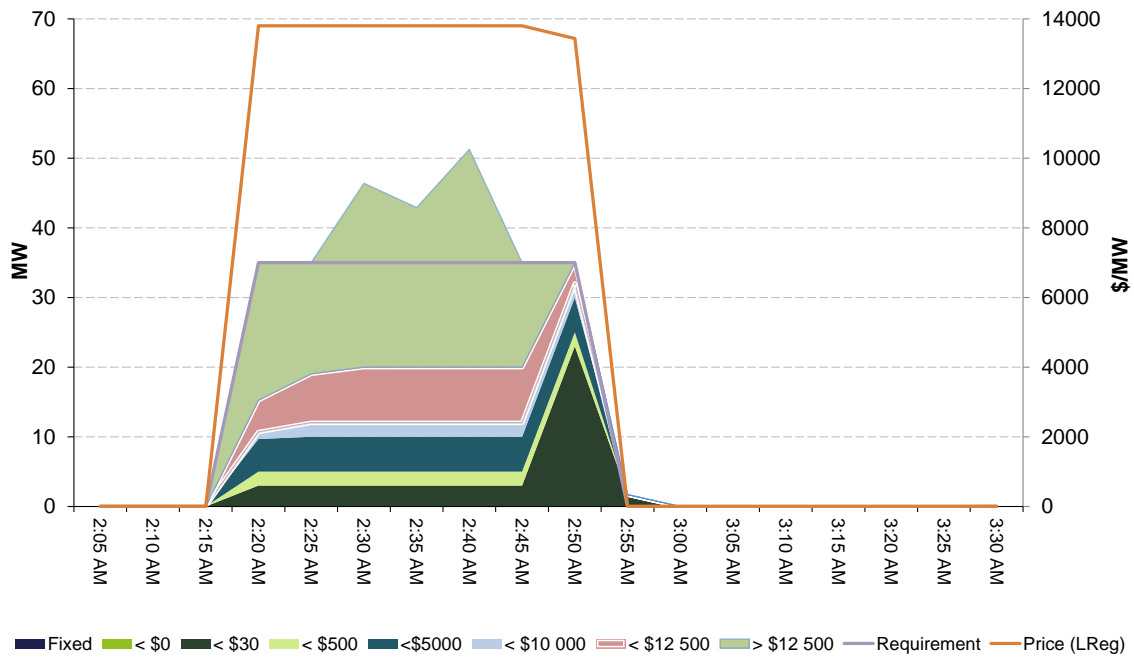
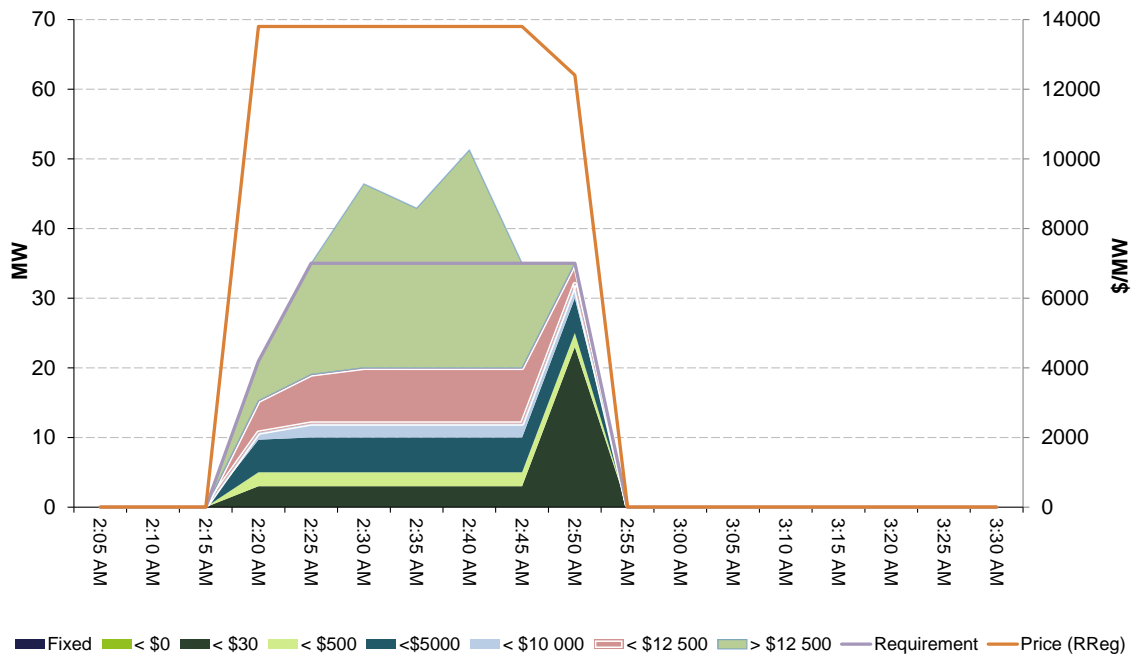


Figure 3: Raise regulation services price, requirement and effective capacity by price band



With only 10 MW of low-priced capacity available for each service when the 35 MW regulation FCAS constraint was invoked at 2.20 am, the price increased to above \$5000/MW and stayed there until the requirement was no longer needed as shown in Table 3.

Table 3: Local Regulation requirements and prices

Time	Lower reg Requirement	Raise reg Requirement	Lower reg Price	Raise reg Price
2.05 am	0	0	0	0
2.10 am	0	0	0	0
2.15 am	0	0	0	0
2.20 am	35	21	13 800	13 800
2.25 am	35	35	13 800	13 800
2.30 am	35	35	13 800	13 800
2.35 am	35	35	13 800	13 800
2.40 am	35	35	13 800	13 800
2.45 am	35	35	13 800	13 800
2.50 am	35	35	13 435	12 400
2.55 am	0	0	0	0
3.00 am	0	0	0	0

The closing bids for each participant for FCAS are shown in Appendix B.

Appendix D lists the price setter information for each dispatch interval and FCAS for the period of the separation.

Australian Energy Regulator

May 2016

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. There are two general categories of FCAS:

- 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 the 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 will 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, that 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.

Appendix B Closing bids

Figures B1a to B4a highlight for each dispatch interval the lower and raise regulation services closing bids for AGL and Alinta Energy (the only participants in South Australia at the time with ancillary service capability). It also shows the dispatch level of the respective services at each station and the dispatch price.

FCAS is co-optimised with energy offers. For example a generator that is operating at its maximum capacity cannot provide raise services so its effective available capacity for that service 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.

Figure B1a: Torrens Island Power Station (AGL) lower regulation service closing bid prices, dispatch and dispatch price

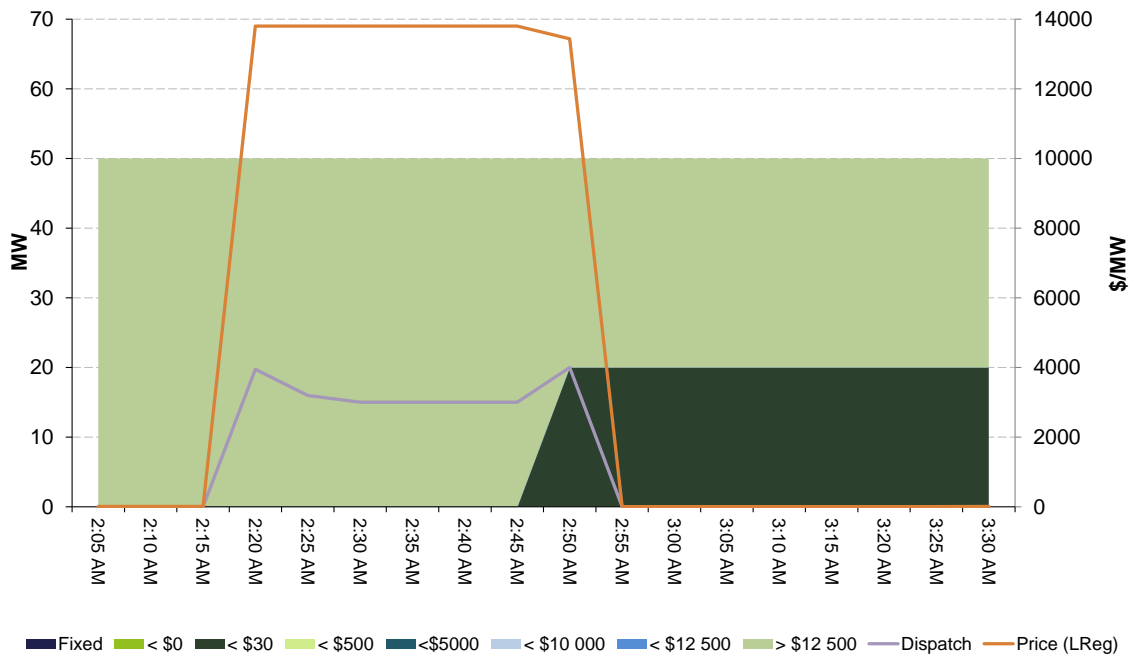


Figure B1b: Torrens Island Power Station (AGL) lower regulation service closing bid prices, dispatch and dispatch price – effective offers

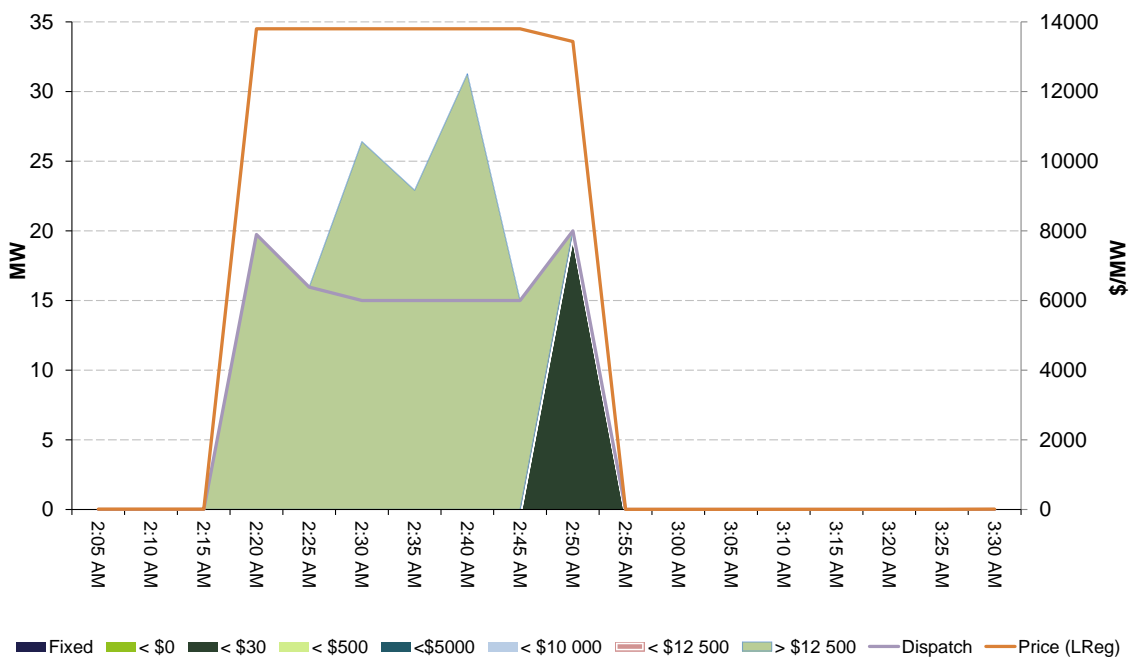


Figure B2a: Northern Power Station (Alinta Energy) lower regulation service closing bid prices, dispatch and dispatch

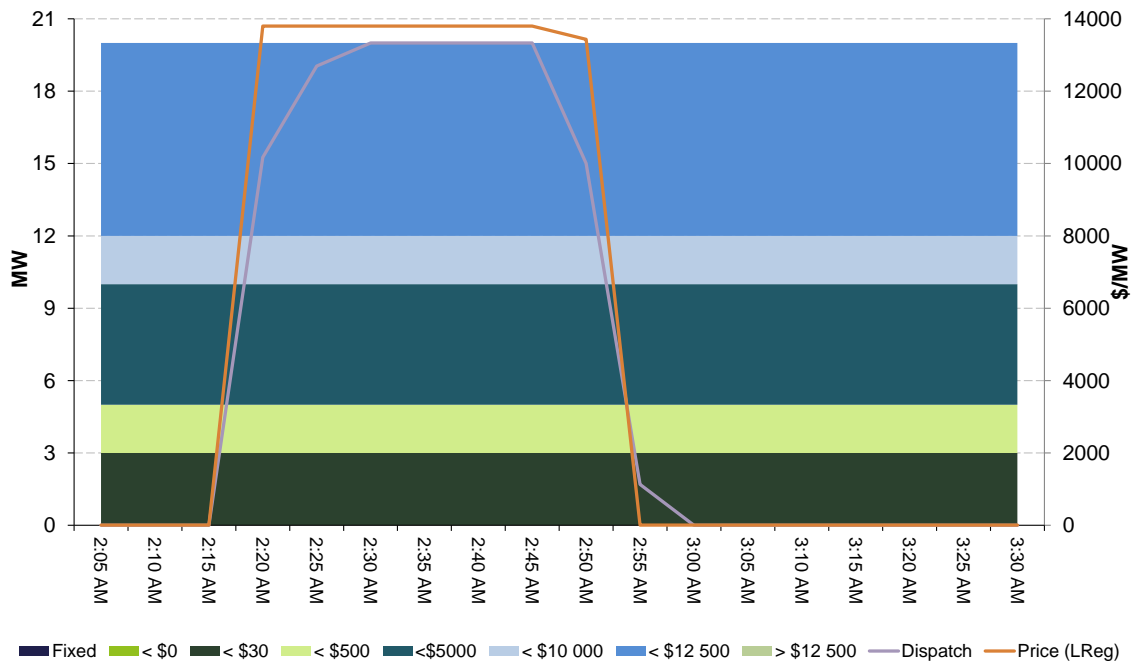


Figure B2b: Northern Power Station (Alinta Energy) lower regulation service closing bid prices, dispatch and dispatch price – effective offers

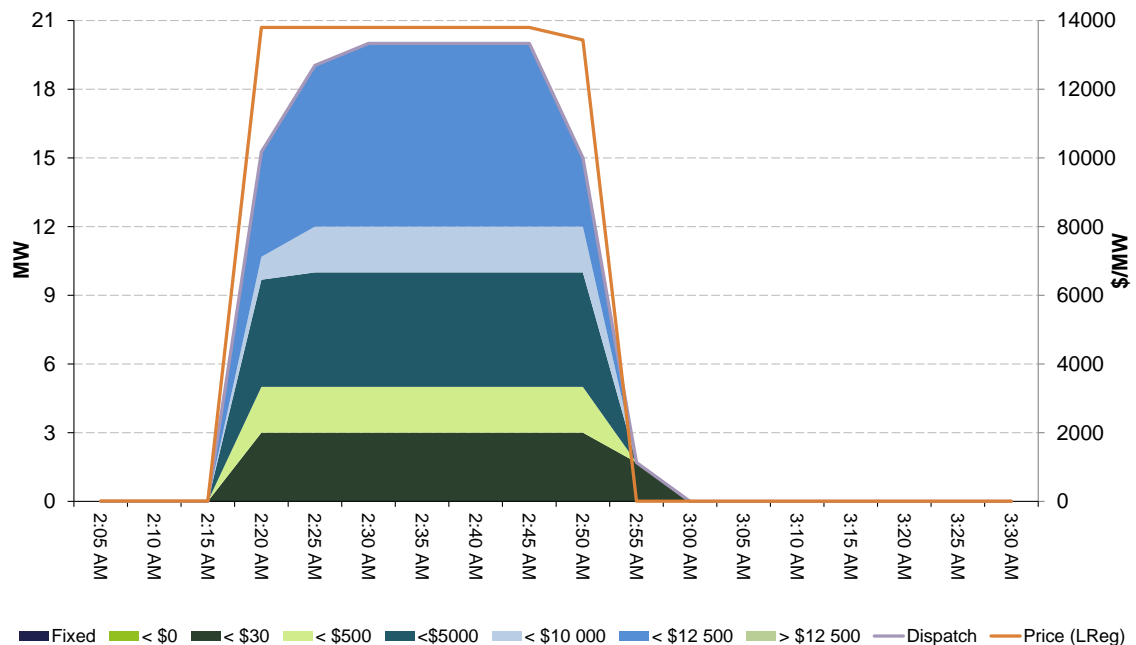


Figure B3a: Torrens Island Power Station (AGL) raise regulation service closing bid prices, dispatch and dispatch price

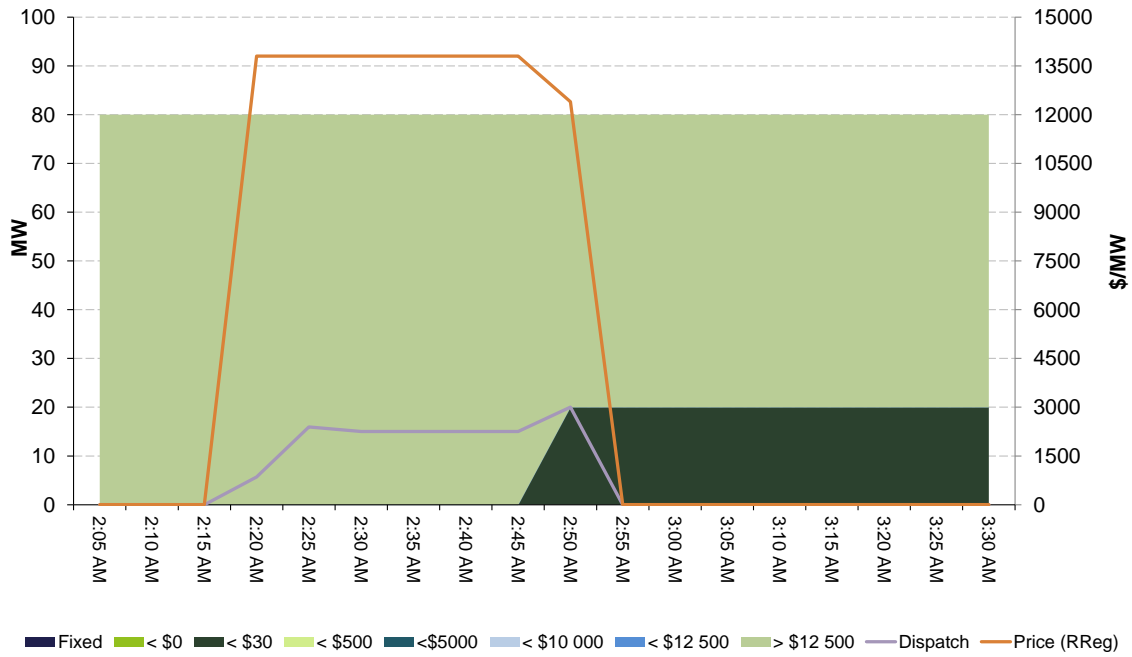


Figure B3b: Torrens Island Power Station (AGL) raise regulation service closing bid prices, dispatch and dispatch price – effective offers

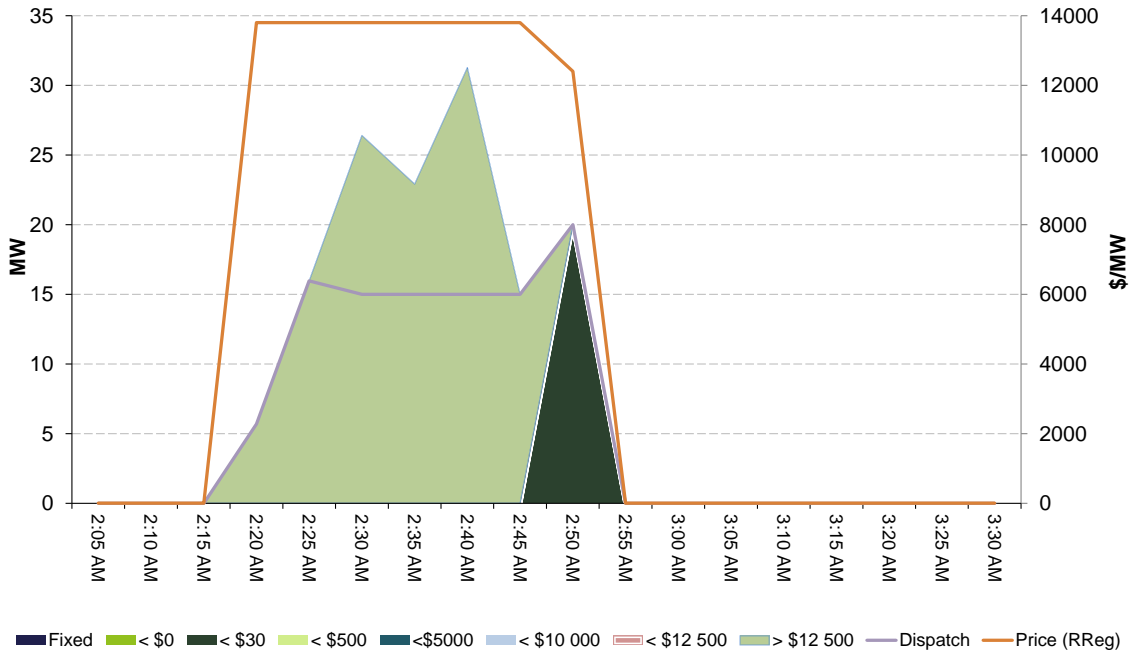


Figure B4a: Northern Power Station (Alinta Energy) raise regulation service closing bid prices, dispatch and dispatch price

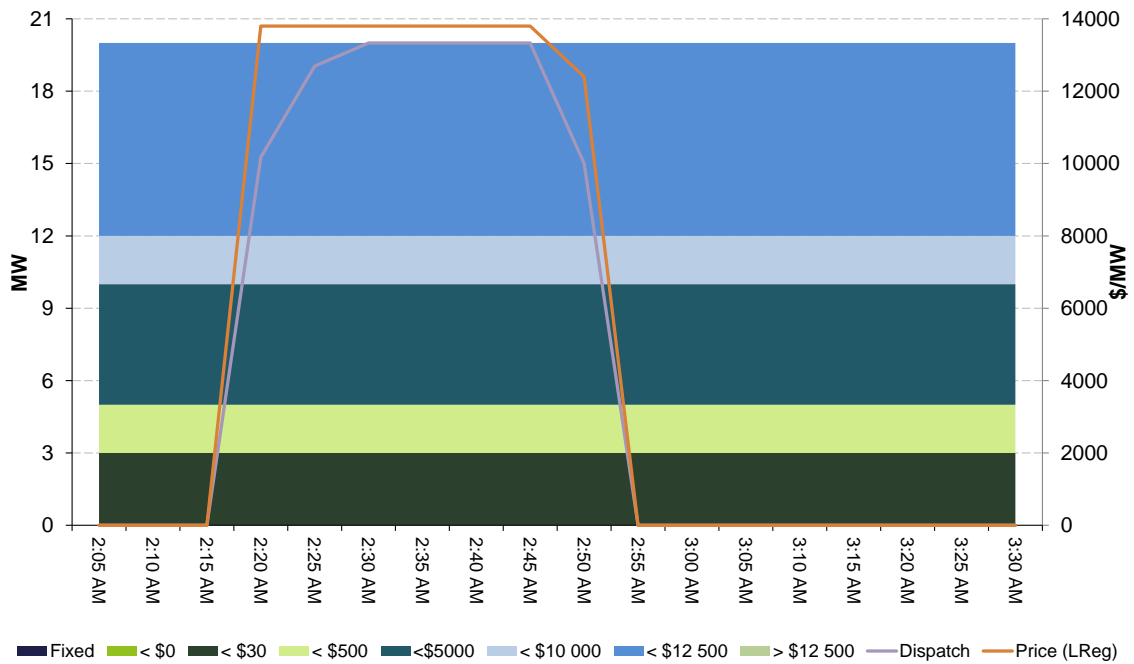
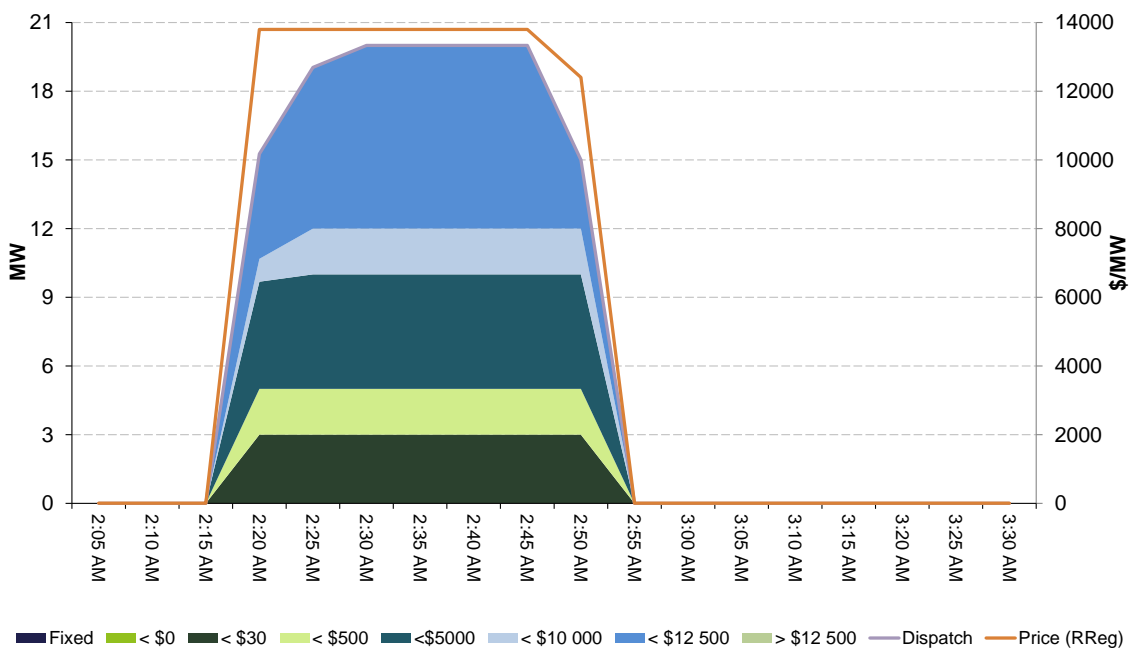


Figure B4b: Northern Power Station (Alinta Energy) raise regulation service closing bid prices, dispatch and dispatch price – effective offers



Appendix C Relevant Market Notices

The following market notices either were notifying the market of the regulation requirement for South Australia or were referenced in participant rebidding reasons.

Market Notice	Type	Date of issue	Last Changed
52563	INTER-REGIONAL TRANSFER	26/03/2016 2:39:04 AM	26/03/2016 2:39:04 AM

External Reference

Short Notice Outage - South Morang No.1 500 kV Bus and South Morang - Sydenham No.1 500 kV Line - VIC Region

Reason

AEMO ELECTRICITY MARKET NOTICE

Short Notice Outage - South Morang No.1 500 kV Bus and South Morang - Sydenham No.1 500 kV Line - VIC Region - Saturday, 26 March 2016.

A short notice outage of South Morang No.1 500 kV Bus and South Morang - Sydenham No.1 500 kV Line in the VIC Region was required at 0225 hrs.

The following constraint Sets were invoked:

V-MLSY_R

V-SMSY

V-SMTS_BYPASS_HW_SY

V-SY_CB

F-V-MLSY

The constraint sets contains equations with the following interconnectors on the LHS:

NSW1-QLD1

T-V-MNSP1

V-SA

V-S-MNSP1

VIC1- NSW1

Refer to AEMO Network Outage Scheduler (NOS) for further details.

Manager NEM Real Time Operations

Appendix D Price setter

The following tables identify for each five-minute dispatch interval where FCAS dispatch prices were above \$5000/MW, the price and the generating units involved in setting the price for each regulation FCAS in South Australia. This information is published by AEMO.³ 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. The dispatch prices that are in italics are capped at the price cap of \$13 800/MW when published by AEMO.

Lower regulation

DI	Dispatch Price (\$/MW)	Participant	Unit	Service	Offer price (\$/MW)	Marginal change	Contribution
02:20	\$13 799.99	AGL (SA)	TORRB2	Lower reg	\$13 799.99	-1.00	-\$13 799.99
		AGL (SA)	TORRB2	Energy	\$124.99	-1.00	-\$124.99
		AGL (SA)	TORRB3	Energy	\$124.99	1.00	\$124.99
02:25	<i>\$13 803.70</i>	AGL (SA)	TORRB2	Lower reg	\$13 799.99	-1.00	-\$13 799.99
		EnergyAustralia	MP2	Raise 6 sec	\$4.45	-0.83	-\$3.69
02:30	\$13 799.99	AGL (SA)	TORRB2	Lower reg	\$13 799.99	-1.00	-\$13 799.99
02:35	\$13 799.99	AGL (SA)	TORRB3	Lower reg	\$13 799.99	-1.00	-\$13 799.99
02:40	\$13 799.99	AGL (SA)	TORRB3	Lower reg	\$13 799.99	-1.00	-\$13 799.99
02:45	<i>\$13 803.70</i>	AGL (SA)	TORRB3	Lower reg	\$13 799.99	-1.00	-\$13 799.99
		EnergyAustralia	MP2	Raise 6 sec	\$4.45	-0.83	-\$3.69
02:50	\$13 435.22	Alinta Power	NPS2	Lower reg	\$12 399.79	-1.00	-\$12 399.79
		AGL Energy	BW02	Energy	\$29.96	-1.18	-\$35.35
		Alinta Power	NPS2	Energy	-\$1000.00	1.00	-\$1000.00

Raise regulation

DI	Dispatch Price (\$/MW)	Participant	Unit	Service	Offer price (\$/MW)	Marginal change	Contribution
02:20	\$13 799.99	AGL (SA)	TORRB2	Raise reg	\$13 799.99	-1.00	-\$13 799.99
02:25	<i>\$13 877.13</i>	AGL (SA)	TORRB2	Lower reg	\$13 799.99	0.50	\$6900.00
		AGL (SA)	TORRB2	Raise reg	\$13 799.99	-0.50	-\$6900.00
		AGL (SA)	TORRB3	Lower reg	\$13 799.99	-0.50	-\$6900.00
		AGL (SA)	TORRB3	Raise reg	\$13 799.99	-0.50	-\$6900.00
		AGL (SA)	TORRB2	Energy	\$124.99	-0.50	-\$62.50
		AGL (SA)	TORRB3	Energy	\$124.99	-0.50	-\$62.50
		Origin Energy	ER01	Energy	\$31.03	0.47	\$14.58

³ Details on how the price is determined can be found at www.aemo.com.au

DI	Dispatch Price (\$/MW)	Participant	Unit	Service	Offer price (\$/MW)	Marginal change	Contribution
		Origin Energy	ER02	Energy	\$31.03	0.47	\$14.58
		Origin Energy	ER04	Energy	\$31.03	0.47	\$14.58
		EnergyAustralia	MP2	Raise 6 sec	\$4.45	0.83	\$3.69
02:30	\$13 799.99	AGL (SA)	TORRB2	Raise reg	\$13 799.99	-1.00	-\$13 799.99
02:35	\$13 799.99	AGL (SA)	TORRB2	Raise reg	\$13 799.99	-1.00	-\$13 799.99
02:40	\$13 799.99	AGL (SA)	TORRB3	Raise reg	\$13 799.99	-1.00	-\$13 799.99
02:45	\$13 881.70	AGL (SA)	TORRB2	Lower reg	\$13 799.99	-0.50	-\$6900.00
		AGL (SA)	TORRB2	Raise reg	\$13 799.99	-0.50	-\$6900.00
		AGL (SA)	TORRB3	Lower reg	\$13 799.99	0.50	\$6900.00
		AGL (SA)	TORRB3	Raise reg	\$13 799.99	-0.50	-\$6900.00
		AGL (SA)	TORRB2	Energy	\$124.99	-0.50	-\$62.50
		AGL (SA)	TORRB3	Energy	\$124.99	-0.50	-\$62.50
		AGL Energy	BW01	Energy	\$29.96	0.66	\$19.77
		AGL Energy	BW02	Energy	\$29.96	0.66	\$19.77
		EnergyAustralia	MP2	Raise 6 sec	\$4.45	0.83	\$3.69
02:50	\$12 399.79	Alinta Power	NPS2	Raise reg	\$12 399.79	-1.00	-\$12 399.79