Market ancillary service prices above $5000/MW

6 March 2013
South Australia

AUSTRALIAN ENERGY REGULATOR

Introduction

The AER is required to 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.[1]

The report must:

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

Summary

On 6 March 2013 at 5.40 am, there was an outage of the Heywood to Mortlake No.2 500 kV transmission line. AEMO required this outage for voltage control due to the ongoing outage of the Heywood to Portland (APD) No.2 500 kV transmission line, which had been out of service since 4 March. There was no prior notification of the AEMO directed outage, which immediately changed the transfer capability of the Heywood interconnector, requiring forced flows into Victoria and local frequency control ancillary services (FCAS) in South Australia.

The Mortlake Power Station[2] had been forecast (since the previous evening) to start-up and run from 6.30 am to 1.30 pm on 6 March. The combination of the scheduled generation from Mortlake and the outage of the Heywood to Mortlake line further increased the requirement for FCAS in South Australia.[3]

The large FCAS requirement, combined with rebidding of "lower 60 second" ancillary services ("L60") from low prices to above $8900/MW by a number of participants saw the price for the L60 service exceed $5000/MW for 10 consecutive five-minute dispatch intervals. The cost for this service, which is paid for by South Australian customers, totalled around $1 million. This compares to less than $100 per day for the same service on a typical day.

There were no significant impacts to energy market prices.

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[1] This requirement is set out in clause 3.13.7 (e) of the National Electricity Rules.
[2] The Mortlake Power Station connects to the transmission network by bisecting the Heywood to Moorabool 500 kV #2 line, thereby creating two new transmission lines – the Heywood to Mortlake and Mortlake to Moorabool 500 kV lines. The other Heywood to Moorabool line (the #1 line) is unaffected.
[3] The AER published a $5000 report into the events of 4 October 2011, when a similar network outage combined with commissioning at Mortlake Power Station also led to very high prices for FCAS. This report is available at www.aer.gov.au in the Wholesale markets | Market performance section.

Events on the day

On 6 March 2013, the local L60 service price in South Australia exceeded $5000/MW for 10 consecutive dispatch intervals between 7 am and 7.45 pm, inclusive[4]. The high FCAS prices occurred as a result of high requirements for the service driven by the outage of the Heywood to Mortlake No.2 500 kV transmission line in Victoria.

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

- Regulation services, which continuously manage small changes in demand or supply (changes that cause the frequency to move by only a small amount away from 50 Hz) to correct the frequency. 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 contingency services to increase the frequency and 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[5] that leads to a decrease in frequency. As these contingency events usually involve step reductions in supply, 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.

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).

The Mortlake Power Station had been forecast (since the previous evening) to start-up and run from 6.30 am to 1.30 pm on 6 March. The combined effect of output from the Mortlake unit one generator and the outage of the Heywood to Mortlake line saw flows forced into Victoria across the Heywood interconnector. This led to a large requirement for local L60 services in South Australia. Despite offer prices from Mortlake at close to the price floor, the generator was constrained down during this period as a result of the network constraint. The increased requirement for local L60 services in South Australia was relieved when Mortlake shut down at around 8.10 am.

[4] Small requirements for local services commenced from 5.40 am, but the requirement increased and with it the cost - to above $500/MW from 6.45 am to 7.55 am inclusive when the output from Mortlake increased.

[5] Any real power system is subject to shocks, for example the loss of a transmission line or a generator. Those shocks which have a material probability of occurring and/or are likely to have serious consequences are known as “credible contingencies”.

Local ancillary services are explained in the text box below.

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 that result from credible contingencies, including in this instance the loss of the Heywood to Moorabool No.1 line (which would have led to the loss of the interconnector). The Reliability Panel terms this as a "separation event".[6]

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 Jurisdictional Coordinator. In the case of South Australia AEMO states

"the Jurisdictional Coordinator for South Australia has notified AEMO that the frequency band for separation of the South Australian power system is 47 to 52 Hz. … The reliability panel has anticipated 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 previously exporting and the interconnector fails, then local "lower" services are required to lower the frequency (typically generators offer to quickly reduce output to lower frequency). So in the event of a loss of the Heywood interconnector while exporting from South Australia, the resulting oversupply will lead to an increase in frequency in South Australia. In order to manage this, lower contingency FCAS must be sourced from suppliers in South Australia (typically generators). The requirement for this local lower FCAS is proportional to the flow across the interconnector from South Australia to Victoria.

If the region was previously importing and the interconnector fails, then local "raise" services are required to increase the frequency. Typically generators offer to quickly increase output to raise frequency or, as occurs in South Australia, the low frequency will be remedied through involuntarily interrupting customer loads.

Network conditions

From 4 March there was a 24 day planned transmission outage of the Heywood to Portland (APD) No.2 500 kV transmission line in Victoria. On 6 March at around 5.30 am AEMO required the Heywood to Mortlake No.2 500 kV transmission line to be taken out of service for voltage control due to the ongoing outage of the Heywood to Portland line. Network constraints to manage the outage of the Heywood to Mortlake line were invoked and took effect from 5.40 am dispatch interval. AEMO issued Market Notice 41751 at 5.36 am stating:

> *In order to control post contingent voltage levels on the Vic to SA interconnection it has been necessary to offload the Heywood to South East No.2 275kV transmission line.*

This saw the forecast limit for flows into South Australia from Victoria across the Heywood interconnector change from 460 MW into South Australia to forced exports out of South Australia.

The start-up of Mortlake at 6.40 am combined with the Heywood to Mortlake network outage saw the network constraint bind from 6.45 am and required increased flows from South Australia into Victoria. This in turn led to increased requirements for L60 second services in South Australia.

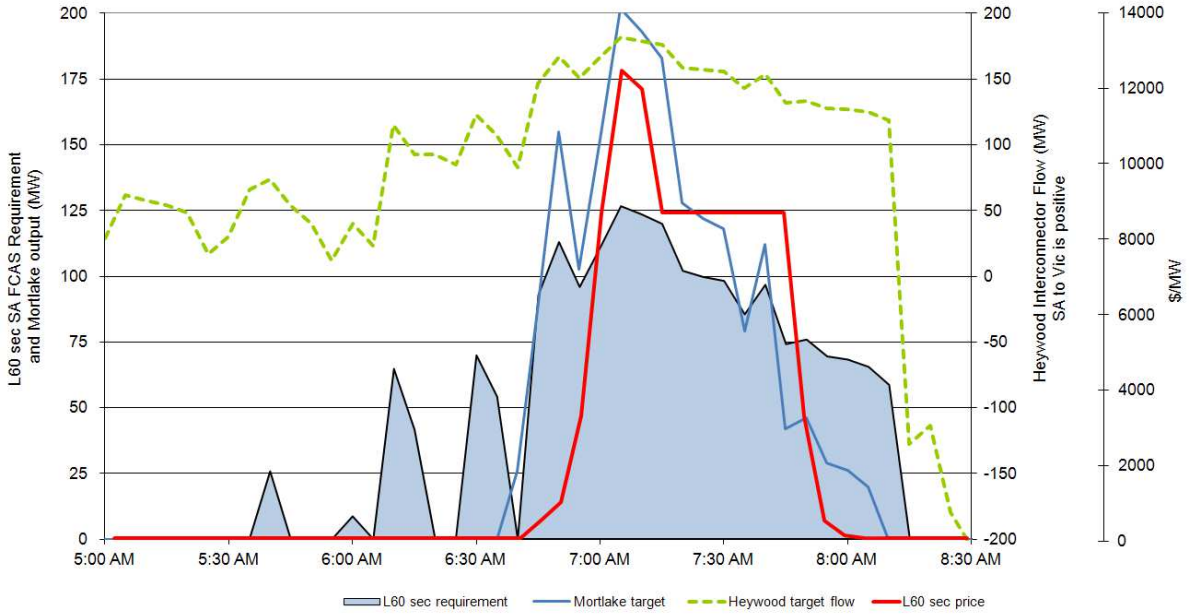
Figure 1 shows for each five minute dispatch interval during the high priced period on 6 March and the requirement and price for local L60 second services, the scheduled output of Mortlake generator and flow across the Heywood interconnector. It highlights the relationship between Mortlake generation and forced exports from South Australia (shown

[6] A separation event is a credible contingency transmission event that forms an island.

on the right hand side vertical axis) and the local L60 second service requirement. A positive flow indicates export of electricity from South Australia to Victoria.

Mortlake unit one was first dispatched at 6.40 am, as forecast from the previous evening. The unit initially received targets to increase its output but never reached its forecast output of 270 MW as a result of being constrained down by the network constraint. A rebid at 8.10 am shut the unit down ahead of schedule.

Figure 1: South Australia local lower 60 second requirements and Heywood interconnector flow



FCAS Price Outcomes

The price for L60 local services reached $9 000/MW or above for 10 consecutive dispatch intervals from 7 am to 7.45 am. Prices returned to below $1/MW by 8.10 am when reduced output from Mortlake saw a reduction in forced exports across the Heywood interconnector. This in turn reduced the South Australian local FCAS requirements.

There was no forecast of local FCAS requirements as the network outage was a last minute requirement from AEMO. The actual prices for FCAS were significantly higher than forecast (once the outage commenced) as a result of rebidding of FCAS offers by participants close to dispatch.

Generator FCAS offers

There are only three power stations registered to provide the L60 contingency services in South Australia: Northern Power Station (owned by Alinta Energy); Torrens Island A and B (owned by AGL); and Pelican Point Power Station (owned by GDF Suez).

Rebids

AGL is the most significant provider of lower frequency control services in South Australia and offered, through day-ahead offers, the majority of the capacity for this service priced at the price cap. At 6.49 am, effective from 6.55 am, AGL rebid 20 MW of L60 FCAS at Torrens Island B from prices below $1/MW to the price cap. The reason given was “06:50A chg in dispatch::price decrease vs PD L60 – 1009.99”.

At 6.42 am, effective from 6.50 am, GDF Suez rebid 17 MW of L60 FCAS at Pelican Point priced at $9000/MW and $12 400/MW down to zero. The reason given was “0642A constraint mgmt – F_S++HYML_L6”. A further rebid at 6.53 am, effective from 7 am shifted 10 MW of L60 back to the previous price. The reason given was “0652A change SRMC: 06:00 Vic gas price”.

At 6.51 am, effective from 7 am, Alinta Energy rebid 10 MW of L60 FCAS at Northern Power Station from prices below $5000/MW (the majority at $4689/MW) to above $8900/MW. The reason given was “0651A SA L60 price at $3396@06:51”.

There were no other rebids that impacted on the high FCAS prices.

AGL is the largest provider of FCAS in South Australia. The requirement for local lower FCAS saw the high priced FCAS offers from AGL dispatched and setting the price for 7 out of 10 dispatch intervals.

The generators involved in setting the price during the high-price period and how that price was determined by the market systems is detailed in Appendix A. The closing bids of the generators offering L60 services are presented in Appendix B.

Australian Energy Regulator
May 2013

Appendix A – FCAS price setters for 6 March 2013

The following tables identify for the five-minute FCAS dispatch prices above $5000/MW, each price and the generating units involved in setting the price for each of the lower Frequency Control Ancillary Services in South Australia. This information is published by AEMO[7]. Also shown is 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.

South Australia – lower 60 second FCAS – 6 March 2013

Time	Dispatch Price	Participant	Unit	Service	Offer Price	Marginal change	Contribution
7:00	8999.90	AGL (SA)	TORRA1	L60S	8999.90	-1	-8999.90
7:05	12899.90	AGL (SA)	TORRB2	L60S	12899.90	-1	-12899.90
7:10	12411.99	Alinta Energy	NPS2	L60S	12411.99	-1	-12411.99
7:15	8999.95	AGL (SA)	TORRA1	L60S	8999.90	-1	-8999.90
		AGL (SA)	TORRA1	ENOF	70.80	-1	-70.80
		Alinta Energy	NPS2	ENOF	70.75	1	70.75
			ENOF,TORRA1,3,TORRA2,3	tbslack1	0	-30	0
			ENOF,TORRA1,3,TORRA3,3	tbslack1	0	-15	0
			ENOF,TORRA1,3,TORRA4,3	tbslack1	0	-15	0
			ENOF,TORRA1,3,TORRB1,3	tbslack1	0	-80	0
			ENOF,TORRA1,3,TORRB2,3	tbslack1	0	-60	0
			ENOF,TORRA1,3,TORRB3,3	tbslack1	0	-60	0
			ENOF,TORRA1,3,TORRB4,3	tbslack1	0	-60	0
7:20	8999.90	AGL (SA)	TORRA1	L60S	8999.90	-1	-8999.90
7:25	8999.90	AGL (SA)	TORRA1	L60S	8999.90	-1	-8999.90
7:30	8999.90	AGL (SA)	TORRB1	L60S	8999.90	-1	-8999.90
7:35	8999.69	International Power	PPCCGT	L60S	8999.69	-1	-8999.69
7:40	8989.00	Alinta Energy	NPS2	L60S	8989.00	-1	-8989.00
7:45	8999.90	AGL (SA)	TORRA1	L60S	8999.90	-1	-8999.90

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

Appendix B – Closing bids

Figures B1a to B3a highlight for each dispatch interval the L60 second FCAS closing bids for AGL, Alinta Energy and GDF Suez (the only participants in South Australia with capacity priced at or above $5000/MW during the period the price exceeded $5000/MW). It also shows the dispatch level of the respective services at each station and the dispatch price. Figures B1b to B3b show the effective bids taking into account the interaction of energy and the offered FCAS trapezium.

Figure B1a: Torrens Island B (AGL) lower 60 second service closing bid prices, dispatch and dispatch price for 6 March

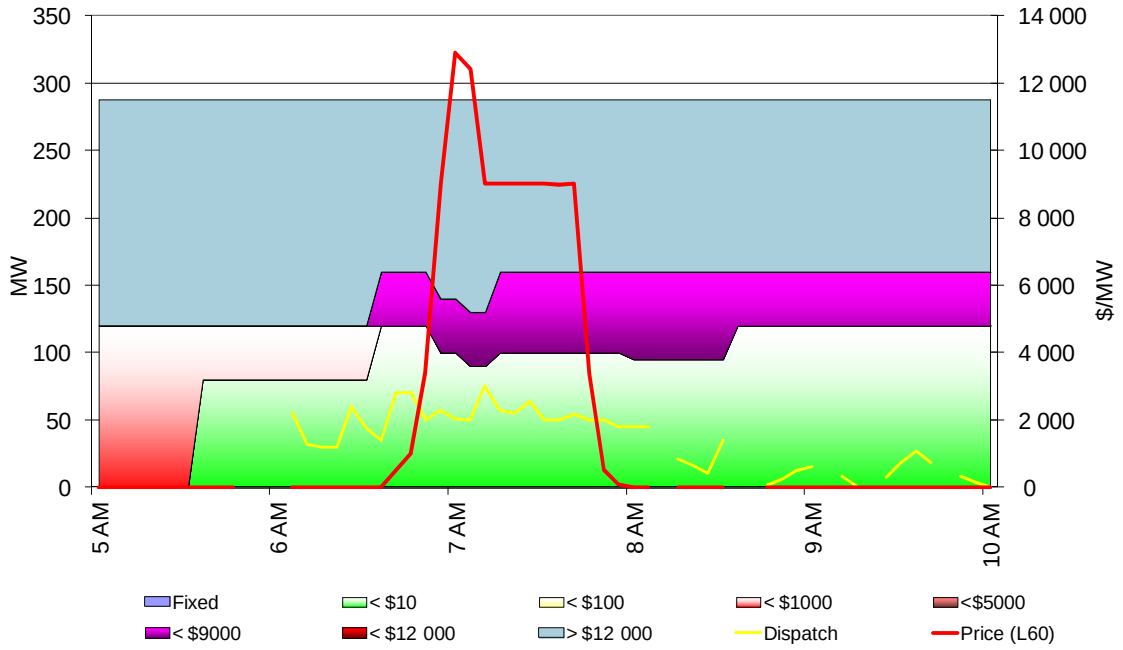


Figure B1b: Torrens Island B (AGL) lower 60 second service closing bid prices, dispatch and dispatch price for 6 March – effective offers

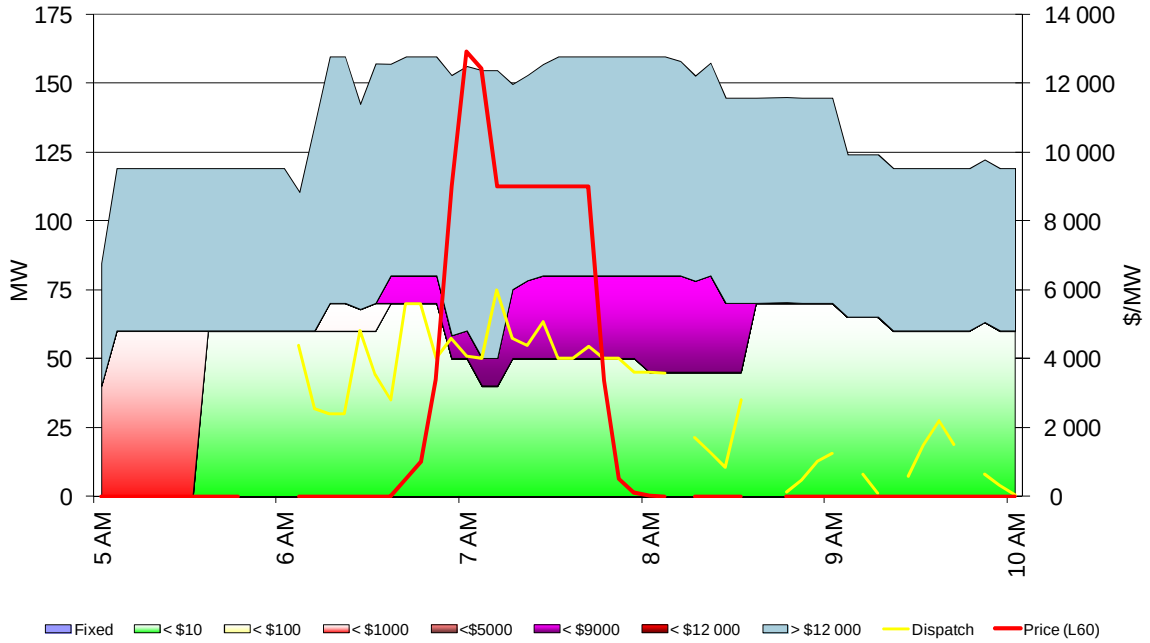


Figure B2a: Northern Power Station (Alinta Energy) lower 60 second service closing bid prices, dispatch and dispatch price for 6 March

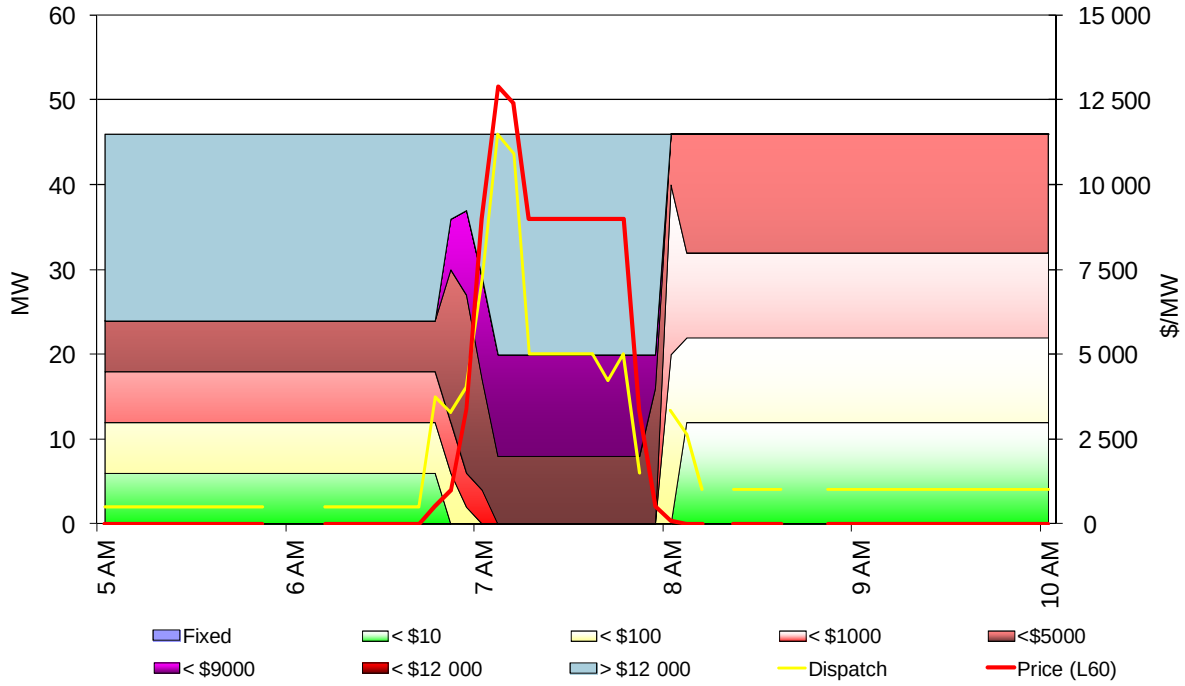


Figure B2b: Northern Power Station (Alinta Energy) lower 60 second service closing bid prices, dispatch and dispatch price for 6 March – effective offers

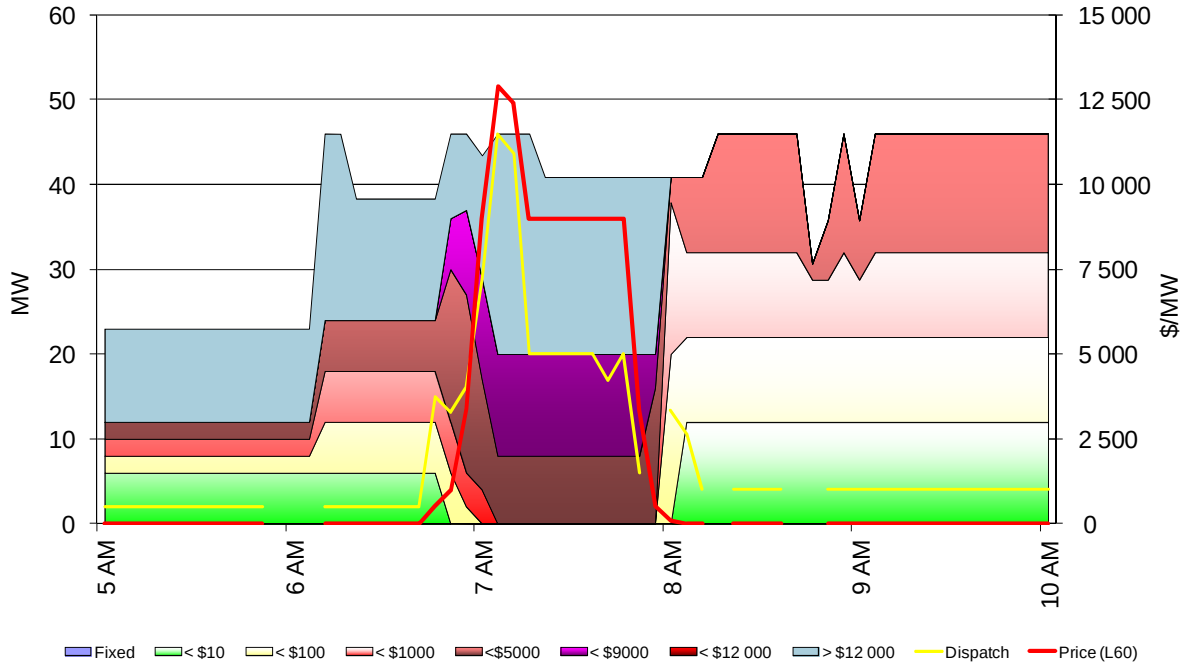


Figure B3a: Pelican Point Power Station (GDF Suez) lower 60 second service closing bid prices, dispatch and dispatch price for 6 March

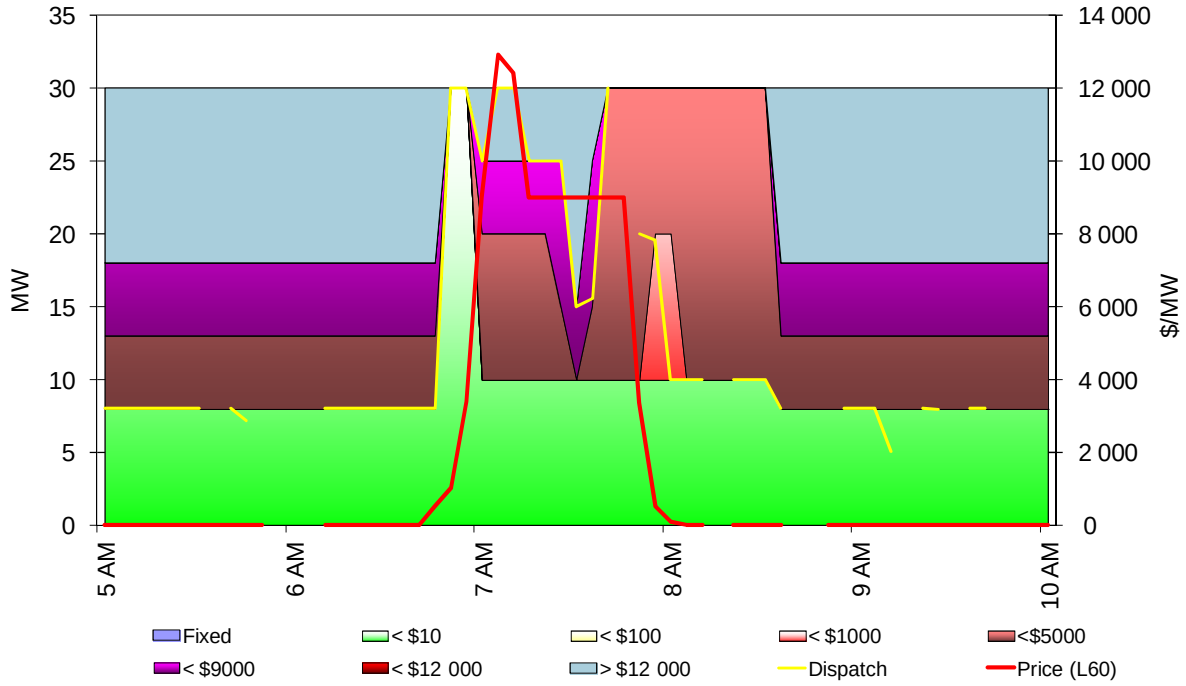
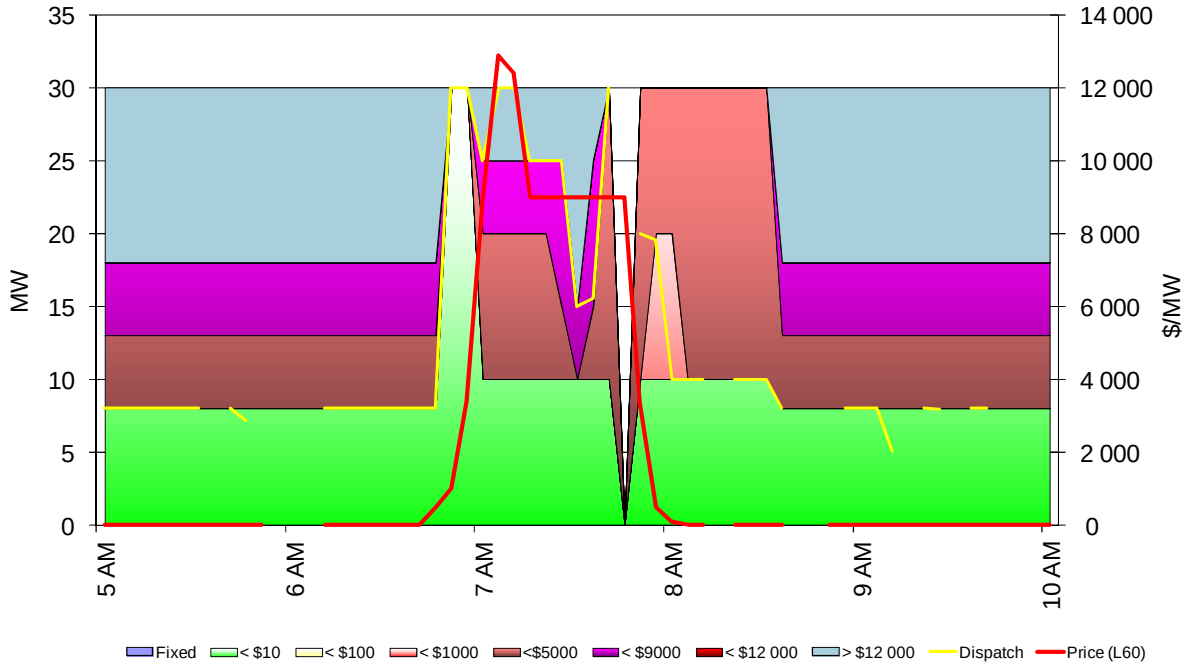


Figure B3b: Pelican Point Power Station (GDF Suez) lower 60 second service closing bid prices, dispatch and dispatch price for 6 March – effective offers



Appendix C – FCAS constraints invoked as a result of the Victorian network outages

From 4 March there was a planned outage of one of the APD to Heywood 500kV lines in Victoria. On 6 March there was a last minute outage of the Heywood to Mortlake No.2 500kV line. The Heywood to Mortlake line forms part of the Heywood interconnector. This means that for the loss of the remaining Heywood to Moorabool line, the Heywood interconnector between South Australia and Victoria would be lost. This would cause a step change in supply into South Australia equivalent to the flow across that interconnector. In the event of the loss of the Heywood interconnector:

- If electricity was being exported from SA this would have resulted in an oversupply and an increase in frequency in SA.
- If electricity was being imported into SA this would have resulted in an undersupply and a decrease in frequency in SA.

The outage of the Heywood to Mortlake 500 kV line required the F-V-HYMO constraint set to be invoked. The constraint equations in this set are:

- F_S++HYML_L5, F_S++HYML_L6, F_S++HYML_L60
    - These constraints determine only the lower contingency (L5, L6 and L60) requirements to manage the impact of loss of the Heywood to Moorabool line on SA. The Heywood interconnector is co-optimised.
    - This group of constraints led to the very high local FCAS requirements and prices in South Australia.
- F_QNV+HYMO_L5, F_QNV+HYMO_L6, F_QNV+HYMO_L60, F_QNV+HYMO_R5, F_QNV+HYMO_R6, F_QNV+HYMO_R60,
    - These constraints determine lower (L5, L6 and L60) and raise (R5, R6 and R60) contingency requirements to manage the impact of loss of the interconnector on NSW, Qld and Vic. BassLink is **unable** to transfer FCAS. The BassLink and Heywood interconnectors are co-optimised.
    - This group of constraints at times set the requirement for **lower** contingency FCAS across the NEM. This is because the contingency (loss of the smelter load, that would also have been interrupted, and flows across the Heywood interconnector) was the largest in the NEM. Prices at all times, however, were less than $1/MW.
- F_ESTN++HYMO_L5, F_ESTN++HYMO_L6, F_ESTN++HYMO_L60, F_ESTN++HYMO_R5 ,F_ESTN++HYMO_R6, F_ESTN++HYMO_R60,
    - These constraints determine lower and raise contingency requirements to manage the impact of loss of the interconnector on NSW, Qld, Vic and Tas. The Heywood interconnector is co-optimised.
    - These constraints did not impact on market outcomes.

- F_QNV++HYMO_L5, F_QNV++HYMO_L6, F_QNV++HYMO_L60, F_QNV++HYMO_R5, F_QNV++HYMO_R6, F_QNV++HYMO_R60,
    - These constraints determine lower and raise contingency requirements to manage the impact of loss of the interconnector on NSW, Qld and Vic. BassLink is able to transfer FCAS. The BassLink and Heywood interconnectors are co-optimised.
    - These constraints did not impact on market outcomes.
- F_ESTN+MO_TG_R5, F_ESTN+MO_TG_R6, F_ESTN+MO_TG_R60,
    - These constraints determine raise contingency requirements to manage the impact of loss of the interconnector on NSW, Qld and Vic.
    - These constraints did not impact on market outcomes.
- F_QNV++MO_TG_R5, F_QNV++MO_TG_R6, F_QNV++MO_TG_R60,
    - These constraints determine raise contingency requirements to manage the impact of loss of the interconnector on NSW, Qld and Vic. BassLink is able to transfer FCAS.
    - These constraints did not impact on market outcomes.
- F_QNV+MO_TG_R5, F_QNV+MO_TG_R6, F_QNV+MO_TG_R60,
    - These constraints determine raise contingency requirements to manage the impact of loss of the interconnector on NSW, Qld and Vic. BassLink is unable to transfer FCAS.
    - These constraints did not impact on market outcomes.