

## Market Outcomes

The spot price in South Australia (SA) reached  $-\$297.39/\text{MWh}$  and  $-\$391.30/\text{MWh}$  for trading intervals (TIs) ending 1830 hrs and 1900 hrs, respectively, on 24 October 2017.

Frequency Control Ancillary Service (FCAS) prices in SA were as follows.

- Raise regulation prices reached between  $\$10,642.46/\text{MWh}$  and  $\$11,499.99/\text{MWh}$  for all TIs ending between 1900 to 2030 hrs.
- Lower regulation prices reached between  $\$4698.06/\text{MWh}$  and  $\$13271.62/\text{MWh}$  for all TIs ending 1830 to 2030hrs.
- Lower 6 Sec prices reached  $\$355.12/\text{MWh}$  and  $\$415.87/\text{MWh}$  for TIs ending 1830 and 1900hrs, respectively.

There was a minor impact to neighbouring region energy prices in the 1830 hrs TI: Victoria (VIC) reached  $\$156.51/\text{MWh}$ , Tasmania (TAS) reached  $\$143.78/\text{MWh}$  and New South Wales (NSW) reached  $\$169.77/\text{MWh}$ . FCAS prices were not impacted in other regions by this event.

## Detailed Analysis

At 1812 hrs on 24 October 2017, *Heywood – Mortlake – APD No. 2 500 kV Line* and the *APD No. 1 500 kV bus* tripped. The event was a non-credible contingency. At 2018 hrs *Heywood – Mortlake No. 2 500 kV Line* segment returned to service.

The main cause of the low energy price and high FCAS prices in SA was the aforementioned non-credible contingency event which caused the Heywood interconnector to operate on a single credible contingency. AEMO invoked constraint sets to manage the event. The constraint equations in the sets increased regulation FCAS to be sourced within SA, and co-optimised the interconnector flows between SA and VIC against Contingency FCAS to be sourced with SA (e.g. reduced the interconnector flows from SA to VIC in order to reduce Lower Contingency FCAS to be sourced within SA). As a result, flows from SA to VIC were reduced by approximately 400 MW, causing an increase of surplus generation in SA, which in turn, decreased the SA energy price. The increased local FCAS requirement in SA resulted in high SA FCAS prices.

The low SA energy prices and high SA FCAS prices were not forecast in pre-dispatch schedules as they were due to the unplanned outage caused by a non-credible simultaneous line and bus trip.

### Low energy prices

Energy prices in SA reached Market Floor Price (MFP) for all dispatch intervals (DI) ending between 1825 to 1835 hrs, and  $-\$999.9998/\text{MWh}$  for DI ending 1840 hrs. Operational demand remained constant, 1404MW during the 1830hrs TI and 1400MW during the 1900hrs TI.

AEMO invoked the constraint set F-V-HYMO from DI ending 1825 hrs to manage the unplanned outage of the *Heywood – Mortlake – APD No. 2 500 kV Line*. The FCAS constraint equation F\_S++HYSE\_L6\_1, which belongs to the constraint set F-V-HYMO and covers the loss of any equipment that causes islanding of South Australia, reduced the Heywood interconnector flow from SA to VIC by 403MW between DI ending 1820 hrs and DI ending 1825 hrs. Murraylink flow from SA to VIC increased by 9MW during this time. The net flow reduction from SA to VIC was 394MW. This, in conjunction with a 6MW SA demand reduction, resulted in a 328MW of wind generation reduction in SA from DI ending 1820 hrs to 1825 hrs.

Origin Energy rebid a total of 155MW capacity from  $\$14,200/\text{MWh}$  (Market Price Cap) to  $-\$1000/\text{MWh}$  (MFP) during the 1830 hrs and 1900 hrs trading intervals. 41 MW and 40MW from LADBROK1 and LADBROK2 units were rebid respectively, with a reason that it was due to higher than expected demand in VIC (*1240A INC VIC DEM 5PD 5066MW > 30PD 5005MW @ 1300 SL*). Origin Energy rebid 74MW from QPS5 with a reason that it was due to higher than expected NEM demand (*1350A INC NEM DEM 5PD 7802MW > 30PD 7587MW @ 1400 SL*). During the dispatch interval ending 1840hrs TORRA4 became constrained at 33.37MW providing lower regulation FCAS.

Energy price for DI ending 1845hrs increased to  $-\$89.39/\text{MWh}$  from  $-\$999.9998/\text{MWh}$  and the net interconnector flow from SA to VIC remained constant. During this DI the following changes occurred in SA.

- AGL's windfarms BLUFF1, HALLWF1, HALLWF2 and NBHWF1 rebid: a total of 323MW of generation capacity from -\$1,000/MWh to bands priced between -\$88/MWh and -\$91/MWh.
- Energy Australia's WATERLWF rebid: 130MW from price band -\$1000/MWh to \$500/MWh.

### High FCAS Prices

The SA raise and lower regulation FCAS prices reached between \$11,499.99/MWh and \$14,055.99/MWh for 23 and 26 DIs respectively, between DIs ending 1825 and 2030 hrs.

The SA raise regulation FCAS price reached between \$11,499.99/MWh and \$13,075.14/MWh for all DIs ending between 1840 hrs and 2030 hrs. The SA lower regulation FCAS price reached between \$11,698.76/MWh and \$14,055.99/MWh for all DIs ending between 1825 hrs and 2030 hrs. The SA 6-sec Lower FCAS price reached between \$918.07/MWh and \$1,068.88/MWh for DIs ending between 1825 and 1840 hrs.

The constraint equations F\_S+RREG\_0035 and F\_S+LREG\_0035, which belong to the constraint set F-V-HYMO, require 35MW of raise regulation and lower regulation, respectively, to be source in South Australia. The constraint equation F\_S++HYSE\_L6\_1 is also contained in the constraint set F-V-HYMO, requiring local Lower 6 second contingency FCAS capacity to be sourced from SA.

Lower 6 second contingency FCAS price reduced from \$918.07/MWh at 1840 hrs to \$166.12/MWh at 1845 hrs. This coincided with an energy price increase from -\$999.9998/MWh to -\$89.39/MWh due to rebidding by AGL and Energy Australia. Availability of SA Lower 6 second FCAS increased from 30 to 37 MW and TORRA2 was enabled to provide 5 MW, bringing the total enabled service from 25 to 30 MW.

Raise and lower regulation FCAS during this period was provided by AGL Torrens Island A and B units, Engie's Pelican Point unit and Origin Energy's Quarantine unit 5. SA raise and lower regulation prices in the DI ending 2035hrs dropped to \$14.78/MWh and \$26.01/MWh respectively when AEMO revoked the constraint set F-V-HYMO for DI ending 2035 hrs following the *Heywood – Mortlake No. 2 500 kV Line* segment returning to service. The SA Lower 6 second Contingency price also reduced for the same reason, from \$143.71/MWh to \$0.004/MWh.