Electricity Pricing Event Reports

OCTOBER 2016

TABLE OF CONTENTS

** A summary was prepared as the maximum daily spot price was between $500/MWh and $2,000/MWh*

Tuesday 04 October 2016 – High Energy price TAS

Market Outcomes: Spot price in Tasmania reached $2,419.85/MWh for trading interval (TI) ending 0630 hrs.

Energy and FCAS prices in other regions were not affected by this event. Fast Raise FCAS price in Tasmania was elevated, but remained below the reporting threshold.

Detailed Analysis: The 5-Minute dispatch price in Tasmania reached the Market Price Cap (MPC) of $14,000/MWh for dispatch interval (DI) ending 0625 hrs. This high price can be mainly attributed to a reduction in available generation from Musselroe wind farm (WF), during the morning peak demand period, while Basslink was exporting to Victoria.

High wind speeds (> 23 m/s) at Musselroe WF caused high wind speed cut-out of some turbines, resulting in a reduction in generation output. Between DIs ending 0620 hrs and 0625 hrs, Musselroe WF availability decreased by approximately 151 MW, from 161 MW at DI ending 0620 hrs to 10 MW at DI ending 0625 hrs.

During the high priced DI, the target flow on Basslink was forced towards Victoria by the thermal constraint equation T>>T_NIL_BL_EXP_6E. This constraint equation is a network control system protection scheme (NCSPS) constraint that prevents overload on a Sheffield-George Town 220 kV line for the loss of the parallel line.

Lower priced generation was available but limited by ramp rates (Poatina PS units 1 – 6), required more than one DI to synchronise (Tamar Valley Peaking PS unit 2) or was constrained off by the thermal constraint equation T>>T_NIL_BL_EXP_6E (Reece 1 PS, John Butters PS, Gordon PS Lemonthyme and Wilmont PS and Fisher PS).

The reduction in available generation from Musselroe WF during the morning peak demand as well as forced export to Victoria on Basslink resulted in a tight supply situation in Tasmania. Due to the tight supply, target flow towards Victoria on Basslink was limited to 119.02 MW for DI ending 0625 hrs, which violated the limit of 119.81 MW set by the thermal constraint equation T>>T_NIL_BL_EXP_6E.

For DI ending 0625 hrs, the violated constraint reduced generation from a number of Tasmanian generating units by approximately 95 MW.

The decreased target flow towards Victoria on the Basslink interconnector resulted in increased FCAS Contingency Raise requirements in Tasmania. Prices for Fast Raise FCAS were elevated to $547.29/MWh for DI ending 0625 hrs, however remained below the reporting threshold.

The 5-minute dispatch price reduced to $63.26/MWh for DI ending 0630 hrs, when demand reduced by approximately 89 MW, the availability from Musselroe WF increased back to 162 MW and the constraint equation T>>T_NIL_BL_EXP_6E was no longer violating.

The high 30-minute spot price was not forecast in any of the pre-dispatch schedules, as it was due to the reduction in generation availability within the affected trading interval.

Monday 10 October 2016 – High Energy price TAS*

Market Outcomes: Spot price in Tasmania reached $618.67/MWh for trading interval (TI) ending 1000 hrs.

Energy and FCAS prices in other regions were not affected by this event. Raise FCAS prices in Tasmania was elevated, but remained below the reporting threshold.

Detailed Analysis: The 5-Minute dispatch price in Tasmania reached $2,732.96/MWh for dispatch interval (DI) ending 1000 hrs. This high price can be mainly attributed to the following:

- In response to lightning storms in the area, the loss of both the Farrell – Sheffield No. 1 and No. 2 220 kV lines was declared a credible contingency between 0905 hrs and 1000 hrs. The Reclassification constraint sets F-T-FASH_N-2, F-T-FASH_N-2_HM_C and T-NIL_WCP_CLOSE were invoked between DI ending 0910 hrs and 1005 hrs to manage the potential simultaneous loss of the transmission lines.
- Between DIs ending 0955 hrs and 1000 hrs, Musselroe windfarm (WF) availability decreased by approximately 74 MW, from 160 MW to 86 MW.
- The target flow on Basslink was forced towards Victoria by the constraint equations F_T++FASH_N-2_TG_R6, F_T++FASH_N-2_TG_R5, F_T++NIL_WF_TG_R5 and F_T++RREG_0050. The F_T++FASH_N-2_TG_R6 constraint equation specifies the Tasmanian Raise 6 second requirement when the loss of both Farrell – Sheffield 275 kV lines is declared as credible, while Basslink is able to transfer FCAS. The F_T++RREG_0050 constraint equation sets the minimum Raise Regulation requirement in Tasmania to 50 MW, when Basslink is unable to transfer FCAS.
- The reduction in wind generation together with Basslink exporting towards Victoria resulted in a tight supply situation in Tasmania. As a result the target flow towards Victoria on Basslink reduced by 69 MW to 81 MW between DI ending 0955 hrs and 1000 hrs, which violated the lower limit of 105.11 MW set by the constraint equation F_T++FASH_N-2_TG_R6.
- For DI ending 1000 hrs, the violating constraint reduced generation from a number of Tasmanian generating units (Bastyan and Reece 2) by approximately 83 MW. Additional generation was sourced from Gordon PS and Tungatinah PS (95 MW).
- Further lower priced generation was available from Gordon PS, but was constrained by the equation T>T_TUMBNN1_110_1. This constraint prevents the overload on the Meadowbank Tee 2 - New Norfolk 110 kV line for the trip of the Tungatinah - New Norfolk No.3 110 kV line during the outage of the Tungatinah - Meadowbank - New Norfolk No.1 110kV line.
- Lower priced generation was also available from Mackintosh, however was limited by the constraint equation T_FASH_MAXGEN_1. This equation specifies the upper limit on the total generation from Mackintosh, Reece 1 and Tribute PS when both Farrell to Sheffield 220 kV lines are declared a credible contingency.
- The decreased target flow towards Victoria on the Basslink interconnector resulted in increased Contingency FCAS Raise requirements in Tasmania. Prices for Fast Raise and Raise Regulation FCAS were elevated to $2,028.82/MWh and $734.16/MWh for DI ending 1000 hrs, however remained below the reporting threshold.

The 5-minute dispatch price reduced to $195.66/MWh for DI ending 1005 hrs, when:

- Gordon PS rebid an additional 34 MW of Fast Raise FCAS, 125 MW of Slow Raise FCAS, 116 MW of Delayed Raise FCAS and 116 MW of Raise Regulation FCAS capacity.
- The F_T++FASH_N-2_TG_R6 constraint was no longer violating and the F_T++RREG_0050 was no longer binding.
- Flow towards Victoria on the Basslink interconnector increased to 128 MW.
- Lower priced generation from Bastyan and Reece 2 was no longer constrained off.

** A summary was prepared as the maximum daily spot price was between $500/MWh and $2,000/MWh.*

Tuesday 18 October to Saturday 22 October 2016 – High FCAS price SA

Market Outcomes: South Australia Raise Regulation Frequency Control Ancillary Service (FCAS) prices ranged between $74.69/MWh and $13,083.33/MWh for all trading intervals (TIs) between TI ending 0730 hrs on 18 October 2016 and 1100 hrs on 22 October 2016. South Australian Lower Regulation FCAS prices ranged between $74.69/MWh and $12,306/MWh for all TIs over the same period.

South Australia had Negative energy prices of -$195.81/MWh and -$145.03/MWh for TIs ending 1200 hrs and 1530 hrs, respectively, on 18 October 2016. High energy prices of $2,474.13/MWh and $2,377.53/MWh were also observed for TIs ending 0700 hrs and 1600 hrs, respectively, on 19 October 2016.

FCAS and Energy prices in the other regions were not affected by this event.

Actual Lack of Reserve Level 2 (LOR2) conditions had been declared for the South Australia region between:

- 0840 hrs and 1030 hrs on 18 October 2016 (Market Notices 55407 and 55409).
- 1745 hrs on 18 October 2016 and 0610 hrs on 20 October 2016 (Market Notices 55418 and 55434).
- 2050 hrs on 20 October 2016 and 1050 hrs on 22 October 2016 (Market Notices 55445 and 55457).

During these LOR2 periods, there were sufficient capacity reserves in the South Australia region to meet electricity demand. However the planned outage of Heywood – South East No.2 275 kV line meant that a credible contingency could result in South Australia being separated from Victoria, which could in-turn trigger automatic under-frequency load shedding, and result in power interruptions.

Detailed Analysis: The 5-minute Raise Regulation FCAS price ranged between $74.69/MWh and $14,000/MWh for all DIs between DIs ending 0705 hrs on 18 October 2016 and 1050 hrs on 22 October 2016 (total of 1,198 DIs). The 5-minute Lower Regulation FCAS price ranged between $74.69/MWh and $13,799.99/MWh for all DIs over the same period. The high FCAS prices are mainly attributed to the application of local Regulation FCAS requirements within South Australia during a planned outage of the Heywood – South East No.2 275 kV line. Other contributing factors included limitations associated with available Regulation FCAS during some DIs.

The Heywood – South East No.2 275 kV line was on a planned outage between 0712 hrs on 18 October 2016 and 1015 hrs on 22 October. This outage increased the risk of electrical separation

between South Australia and Victoria. The outage constraint sets F-I-HYSE, S-X_BC_CP, V-HYTX_M12 and I-HYSE were invoked for the duration of this outage. The invoked constraint sets limited flow from Victoria to South Australia on the Heywood interconnector to an upper limit of 250 MW. The constraint equations F_S+LREG_0035 and F_S+RREG_0035 contained within the F-I_HYSE constraint sets required 35 MW of Lower and Raise Regulation FCAS capacity to be sourced from within South Australia.

The 5-minute Energy price reduced to the Market Floor Price (MFP) of-$1,000/MWh for DI ending 1150 hrs on 18 October 2016. This negative energy price was mainly attributed to an increase in wind generation and limited interconnector flows, during the planned network outage.

The 5-minute Energy price reduced to MFP for DI ending 1505 hrs on 18 October 2016. This negative energy price was mainly attributed to a decrease in demand and limited interconnector flows, during a planned network outage.

The 5-minute Energy price was $13,998.99/MWh for DI ending 0640 hrs on 19 October 2016. This high energy price was mainly attributed to low wind generation during the morning peak demand period, and limited interconnector support during the planned network outage.

The 5-minute Energy price reached the Market Price Cap (MPC) of $14,000 /MWh for DI ending 1550 hrs on 19 October 2016. This high energy price was attributed to an incorrect SCADA input into the V>S_NIL_HYSE system normal constraint equation. This thermal constraint avoids overloading either of the Heywood – South East 275 kV lines for the trip of parallel line. The incorrect input indicated a flow of 828 MVA on the Heywood – South East No.2 275 kV line which was on planned outage. This caused the V>S_NIL_HYSE constraint equation to violate, reversing flow on the remaining Heywood – South East No.1 275 kV line from 250 MW towards South Australia to 23 MW towards Victoria.

Regulation FCAS in South Australia during the outage period was provided by Torrens Island A PS, Torrens Island B PS, Quarantine PS unit 5 (QPS5) and Pelican Point PS.

18 October 2016

Regulation FCAS prices: Following the commencement of the Heywood – South East No.2 275 kV line outage, between DI ending 0705 hrs and 0820 hrs on 18 October 2016, the 5-minute Regulation FCAS prices ranged between $11,000/MWh and $11,499.99/MWh. The 5-min Regulation FCAS price reduced from DI ending 0825 hrs when Pelican Point became available to provide Regulation FCAS services. The prices ranged between $74.69/MWh and $145.50/MWh for most DIs until DI ending 1900 hrs.

For DI ending 1905 hrs, the Raise and Lower Regulation FCAS price reached $12,899.99/MWh and $12,010.80/MWh, respectively, when Quarantine PS unit 5 was unable to provide Regulation FCAS services and its energy output reduced to 0 MW. For the next DI ending 1910 hrs, Quarantine PS unit 5 withdrew all availability (122 MW) from the energy market with the reason “1858P CHANGE IN AVAIL - GAS VALVE TRIP – SL”. The 5-min Regulation FCAS prices ranged between $12,000/MWh and $14,000/MWh between DI ending 1905 hrs and 2245 hrs. For DI ending 2220 hrs, Quarantine PS rebid its availability (122 MW) back into the energy market, however its Fast Start Profile limited it from providing Regulation FCAS services until DI ending 2250 hrs. Regulation FCAS prices ranged between $74.69/MWh and $1,057.87/MWh for most DIs between DI ending 2250 hrs on 18 October 2016 and 0000 hrs on 19 October 2016.

For DI ending 2330 hrs, Torrens Island B unit 4 output was 195.25 MW, which was above the unit's Regulation FCAS maximum enablement limit of 195 MW. As a result the unit became unavailable (stranded) for Regulation FCAS and the Raise and Lower Regulation FCAS prices in SA increased to $12,899.99/MWh and $12,896.69/MWh, respectively.

Energy prices: For DI ending 1150 hrs, the negative energy price of -$1,000/MWh can be attributed to an increase in wind generation of 150 MW between DIs ending 1145 hrs and 1150 hrs. Demand in SA was 1354 MW for TI ending 1200 hrs, and wind generation was 1091 MW for the same TI. Interconnector export to Victoria was also limited. The export was limited to 175 MW on Murraylink by the system normal thermal constraint equation S>V_NIL_NIL_RBNW and to 75 MW on the Heywood interconnector by the FCAS constraint equation F_S++HYSE_L60 which was invoked during the planned outage. During this DI the Fast Lower and Lower Regulation FCAS price was $846.82/MWh and $601.77/MWh, respectively.

For DI ending 1505 hrs, the negative energy price of -$1,000/MWh can be attributed to a reduction in demand of 79 MW between DI ending 1500 hrs and 1505 hrs. Export to Victoria was limited to 176 MW on Murraylink by the S>V_NIL_NIL_RBNW constraint equation and to 74 MW on the Heywood interconnector by the outage FCAS constraint equation F_++HYSE_L6_1. During DI ending 1505 hrs, the Fast Lower and Lower Regulation FCAS price was $860.58/MWh and $568.88/MWh, respectively.

During all other trading intervals, the South Australia 30-minute energy prices ranged between -$50.63/MWh and $110.43/MWh for all TIs.

19 October 2016

Regulation FCAS prices: 5-minute Regulation FCAS prices ranged between $74.69/MWh and $493.81/MWh for most DIs on 19 October 2016. For DI ending 0620 hrs, Raise and Lower Regulation FCAS prices reached $11,500.28/MWh and $11,000/MWh, respectively, when Pelican Point PS was stranded and unavailable to provide Regulation FCAS services. For this DI, Pelican Point PS energy output of 243.72 MW exceeded its Regulation FCAS enablement maximum limit of 235 MW.

For DI ending 0650 hrs, the 5-minute Raise and Lower Regulation FCAS price reached $12,585.34/MWh and $11,000/MWh when Pelican Point PS was unavailable to provide Regulation FCAS services. For this DI, Pelican Point PS output was 202.08 MW, below its Regulation FCAS enablement minimum of 203.34 MW. Regulation FCAS prices ranged between $74.69/MWh and $1,111.60/MWh for most DIs between DI ending 0655 hrs on 19 October 2016 and 0000 hrs on 20 October 2016.

Energy prices: For DI ending 0640 hrs, the 5-minute energy price reached $13,998.99/MWh and the Raise Regulation FCAS price was $13,913.99/MWh. The high energy price was a result of low wind generation in the region (47 MW) during the morning peak demand period. Target flow on the Heywood interconnector towards South Australia was limited to 250 MW by the dynamic transfer limit constraint equation VS_250_DYN. Target flow on Murraylink interconnector towards South Australia was limited to 183 MW by the thermal constraint equation V^SML_NSWRB_2. This constraint equation prevents voltage collapse in Victoria for the loss of the Darlington Point – Buronga (X5) 220kV line. The high Raise Regulation FCAS price was due to limited availability of lower priced Regulation capacity in SA during this DI.

For DI ending 1550 hrs, the 5-minute energy price reached the MPC and Raise Regulation FCAS price reached $12,899.99/MWh. The high energy price can be attributed to an incorrect SCADA input into

the V>S_NIL_HYSE constraint equation. This caused the V>S_NIL_HYSE constraint equation to violate, reversing flow on the remaining Heywood – South East No.1 275 kV line from 250 MW towards South Australia to 23 MW towards Victoria. This resulted in increased dispatch of lower priced Regulation FCAS providers in the Energy market, resulting in insufficient availability of Raise Regulation FCAS capacity to meet the 35 MW requirement and the constraint equation F_S+RREG_0035 to violate. Raise Regulation FCAS prices remained elevated until DI ending 1605 hrs.

For the remaining TIs on 19 October, South Australia 30-minute energy prices were typical, mostly ranging between $34.80/MWh and $365.20/MWh.

20 October 2016

5-minute Raise Regulation FCAS prices continued to remain at $74.69/MWh for most DIs between DI ending 0005 hrs on 20 October and 0000 hrs on 21 October. For DIs ending 2335 hrs and 2340 hrs, the Raise Regulation FCAS prices were elevated, reaching $399.99/MWh and $1039.58/MWh, respectively. During these DIs, a number of generators providing Raise Regulation FCAS services were dispatched higher in the Energy market due to the hot water load pick-up. This reduced the Raise Regulation FCAS availability of these generators, and more expensive Raise Regulation FCAS capacity had to be procured to meet the 35 MW requirement.

5-minute Lower Regulation FCAS prices remained between $74.69/MWh and $425/MWh for all DIs between DI ending 0005 hrs on 20 October and 0000 hrs on 21 October. Higher priced DIs were attributed to periods with insufficient cheaper priced Lower Regulation FCAS capacity.

For 20 October, South Australia 30-minute energy prices ranged between -$66.69/MWh and $104.93/MWh.

21 October 2016

5-minute Raise Regulation FCAS prices remained between $74.69/MWh and $370.56/MWh and the Lower Regulation FCAS prices remained between $74.69/MWh and $449.20/MWh for all DIs between DI ending 0005 hrs on 21 October and 0000 hrs on 22 October 2016, except for DI ending 0815 hrs. For DI ending 0815 hrs, the Raise and Lower Regulation FCAS prices reached $14,000/MWh and $13,799.99/MWh, respectively, when Torrens Island B PS unit 4 became unavailable (stranded) to provide Regulation FCAS services. For this DI, Torrens Island B unit 4 energy output of 195.8 MW exceeded its Regulation FCAS enablement maximum limit of 195 MW.

For 21 October, South Australia 30-minute energy prices ranged between -$57.01/MWh and $85.56/MWh.

22 October 2016

The 5-minute Regulation FCAS prices remained between $74.69/MWh and $379.69/MWh for all DIs between DI ending 0005 hrs and 1050 hrs on 22 October 2016. During this period, DIs with elevated FCAS prices were mainly attributed to reduced lower priced Regulation FCAS availability due to a number of generators providing these services being dispatched higher in the Energy market. During this period, the 30-min energy price in South Australia ranged between $11.72/MWh and $82.21/MWh.

For DI ending 1055 hrs, the 5-minute Raise and Lower Regulation prices reduced to $7.4/MWh and $9/MWh, respectively, when the outage constraint set F-I-HYSE was revoked following completion

of the Heywood – South East No.2 275 kV line outage and there was no longer a local Regulation FCAS requirement for SA.

The high Regulation FCAS prices were forecast in all pre-dispatch schedules from 1300 hrs on 17 October 2016.

Wednesday 26 October 2016 – High Energy price SA

Market Outcomes: South Australia spot price reached $4,708.99/MWh for trading interval (TI) ending 0000 hrs.

FCAS prices in all regions and Energy prices for the other NEM regions were not affected by this event.

Detailed Analysis: The 5-Minute dispatch price reached $13,998.99/MWh in South Australia for dispatch intervals (DIs) ending 2335 hrs and 2340 hrs. This high price can be mainly attributed to a spike in South Australian demand due to hot water load management, low and constrained wind, limited interconnector support and unavailability of lower priced generation.

Between DIs ending 2330 hrs and 2335 hrs, South Australian demand increased by 244 MW to reach 1,466 MW. This increase in demand was as a result of a spike in hot water load. This demand decreased slightly to 1,457 MW at DI ending 2340 hrs.

The target flow towards South Australia on the Heywood interconnector increased from 416 MW for DI ending 2330 hrs to 449 MW for DI ending 2335 hrs. This increased flow violated the upper transfer limit of 429.12 MW set by the constraint equation V_S_NIL_ROCOF. This is a Rate of Change of Frequency (RoCoF) constraint that limits the flow on the Heywood interconnector from VIC to SA to prevent the RoCoF exceeding 3Hz/sec in SA following the loss of the Heywood interconnector.

The target flow towards South Australia on the Murraylink interconnector increased from 62 MW for DI ending 2330 hrs to 144 MW for DI ending 2335 hrs and was limited by the constraint equation VSML_ROC_80. This constraint equation limits the rate of change of flow towards South Australia across the Murraylink interconnector to 80 MW per 5 minutes.

Wind generation in South Australia was low for these DIs at approximately 216 MW and 206 MW for DI ending 2335 hrs and 2340 hrs, respectively.

At DI ending 2335 hrs, the voltage stability constraint equation V^S_NIL_SA_RECLASS violated when additional generation was sourced from The Bluff and Hallet 2 Wind Farms (21 MW). This constraint equation limits generation in SA to prevent the flow on the Heywood interconnector exceeding 600 MW following reduction in MW output from multiple generating units in SA.

At DI ending 2335 hrs cheaper priced generation was available but either required more than one DI to synchronise (Snuggery and Dry Creek GT 3), or was limited by its ramp rates (Hallet GT).

The flow on the Heywood Interconnector towards South Australia at DI ending 2340 hrs was limited to 440 MW by the V_S_NIL_ROCOF upper limit of 440.40 MW. Flow on Murraylink towards South Australia at the end of this DI increased to the upper limit of 196 MW set by the voltage stability

constraint equation V^SML_NSWRB_2. This equation avoids voltage collapse for the loss of Darlington Point to Buronga 220kV line.

At DI ending 2340 hrs, 39 MW of wind generation from The Bluff and Hallet 1 and 2 Wind Farms was constrained off by V^S_NIL_SA_RECLASS.

For DI ending 2340 hrs ENGIE and Orgin rebid 209 MW of capacity from prices above $13,300.20/MWh to the Market Floor Price (MFP) of -$1,000/MWh. From these units only 40 MW was dispatched, with the rest being limited by ramp rates and requiring more than one DI to synchronise.

Lower priced generation was available (Snuggery) but was limited by ramp rates.

The 5-minute price reduced to $76.67/MWh for DI ending 2345 hrs, when AGL rebid 15 MW of generation capacity from bands priced at $13,998.99/MWh to bands priced at the MFP, demand decreased by 32 MW and additional lower priced generation became available.

The high 30-minute spot price for South Australia was forecast in the pre-dispatch schedule.

Sunday 30 October 2016 – High FCAS price Mainland

Market Outcomes: The Mainland had Raise Frequency Control Ancillary Service (FCAS) prices ranging between $14.83/MWh and $39.78/MWh and Delayed Lower and Lower Regulation FCAS prices ranged between $20.80/MWh and $47.83/MWh for all trading intervals (TIs) between TI ending 0230 hrs and 0500 hrs on 30 October 2016.

FCAS prices in Tasmania and Energy prices in the NEM were not affected by this event.

Detailed Analysis: The 5-minute Raise FCAS prices in the Mainland ranged between $14.60/MWh and $48/MWh for all dispatch intervals (DIs) between DI ending 0205 hrs and 0500 hrs. The 5-minute Delayed Lower and Lower Regulation FCAS prices in the Mainland ranged between $20.80/MWh and $48/MWh for the same DIs. These high FCAS prices can be mainly attributed to Basslink being unable to transfer FCAS and unavailability of lower priced FCAS providers.

Between DIs ending 0150 hrs and 0515 hrs, Basslink flow was low, remaining between 0 MW and 48.2 MW. Basslink was in the no-go zone and unable to transfer FCAS. The Regulation and contingency FCAS service requirements for the Mainland had to be procured locally, from within the Mainland.

At DI ending 0145 hrs, Tasmania was providing between 10.55 MW to 165.71 MW to Raise FCAS services and up to 8.85 MW for Delayed Lower and Lower Regulation FCAS services.

During this period, no FCAS was dispatched from South Australia due to FCAS providers either being offline (Osborne PS, Pelican Point CCGT, Torrens Island A unit 1, 2, 3 and 4 and Torrens Island B units 2 and 3), becoming stranded or having 0 MW FCAS available due to output being equal to their minimum enablement value.

A number of units that typically provide lower priced Raise FCAS services were also offline during this high price period in Victoria (Heywood PS unit 3, New Port PS and Yallourn PS unit 1), New South

Wales (Eraring PS, Liddell unit 4, Mount Piper unit 1 and Snowy Hydro) and Queensland (Gladstone unit 1 and 2, Mount Stuart unit 2, Swanbank PS and Tarong unit 1).

The 5-minute prices reduced to less than $25/MWh for all services at DI ending 0520 hrs when Basslink became available to provide FCAS from Tasmania.

These 30-minute Mainland FCAS prices were forecast in pre-dispatch schedules.

Monday 31 October 2016 – High Energy price TAS*

Market Outcomes: Spot price in Tasmania reached $894.35/MWh for trading interval (TI) ending 0930 hrs.

Energy prices in other regions were not affected by this event. FCAS prices in all regions were not affected by this event.

Detailed Analysis: The 5-Minute dispatch price in Tasmania reached $5,274.18/MWh for dispatch interval (DI) ending 0930 hrs. This high price can be mainly attributed to the following:

- Planned outage of the Palmerston - Hadspen no.1 220 kV line scheduled between 0805 hrs and 1602 hrs on 31 October 2016 and the Tungatinah – New Norfolk – Meadowbank no. 1 110 kV line scheduled between 0709 hrs on 31 October to 1038 hrs on 04 November 2016. Constraint sets T-HAPM_220 and T-TU_MB_NN1 were invoked for the duration of the outages, respectively.
- During the high price interval, target flow on the Basslink interconnector was limited to 93 MW towards Tasmania. The target flow violated the limit of 209.56 MW towards Victoria set by the transient stability constraint equation T::T_HA_GT_PM_4. This constraint equation prevents TAS North to South oscillations following fault and trip of Palmerston - Sheffield 220 kV line during the outage of Hadspen - George Town or Hadspen - Palmerston 220 kV lines.
- For DI ending 0930 hrs, a number of generators (Cethana, Fisher, Mackintosh, Reece unit 2, Tribute, Lemonthyme and Wilmot) were limited by their ramp down rates.
- During this DI, generation from Meadowbank was constrained off by the thermal constraint equation T>T_TUMBNN1_110_1. This constraint equation prevents overload on the Meadowbank Tee 2 - New Norfolk 110kV line for the trip of Tungatinah - New Norfolk No.3 110kV line during the outage of Tungatinah - Meadowbank - New Norfolk No.1 110kV line.
- Lower priced generation was available but was limited by ramping rates (Gordon PS, Poatina units 1 - 6) or required more than one DI to synchronise (Bell Bay Three unit 1 and Tamar Valley OCGT).

The 5-minute dispatch price reduced to $96.55/MWh for DI ending 0935 hrs, when:

- The ramp rates increased, resulting in 266 MW of additional generation from Gordon PS, Poatina units 1 - 6 became available and constraint equation T::T_HA_GT_PM_4 was no longer violating.

** A summary was prepared as the maximum daily spot price was between $500/MWh and $2,000/MWh.*