

Electricity spot prices above $5000/MWh

South Australia,  
7 July 2016

13 September 2016

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# Introduction

The AER is required to publish a report whenever the electricity spot price exceeds $5000/MWh.[[1]](#footnote-1) The report:

* describes the significant factors contributing to the spot price exceeding $5000/MWh, including withdrawal of generation capacity and network availability;
* assesses whether rebidding contributed to the spot price exceeding $5000/MWh;
* identifies the marginal scheduled generating units; and
* identifies all units with offers for the trading interval equal to or greater than $5000/MWh and compares these dispatch offers to relevant dispatch offers in previous trading intervals.

On 7 July 2016 at 7.30 pm, the spot price for electricity reached $8879/MWh in South Australia exceeding the $5000/MWh threshold. This report presents our analysis of the events in accordance with this obligation.

# Summary

Twelve hour ahead forecasts for 7 July 2016 predicted the spot price would exceed $5000/MWh for 33 trading intervals. On the day, dispatch prices were volatile, exceeding $10 000/MWh on multiple occasions between 8.40 am and 9.40 pm. However, the spot price exceeded $5000/MWh only once, reaching $8898/MWh for the 7.30 pm trading interval. Other high spot prices on the day ranged from between $400/MWh and $3625/MWh (see Table 1).

The high prices were the culmination of a number of factors:

* Network outages to complete augmentation works on the Heywood Interconnector between Victoria and South Australia materially reduced its capacity. These were first announced to the market in late 2015. The impact of these outages was to reduce the capability of the interconnector to deliver power into South Australia. While this major upgrade was flagged to the market, its impact on Heywood’s operating capability was, at times, not clear.
* The change in the generation mix following the closure of Northern Power station (coal fuelled) in May 2016 means that South Australia is dependent on two primary fuel sources: gas and wind.
  + While there is in the order of 1200 MW of Semi-scheduled wind installed in South Australia, on the day it was generating below 20 MW, as forecast.
  + Gas fired generators were faced with limited gas and transport capacity making scheduling of the limited fuel problematic. Given the uncertainty, energy constrained generators were cautious not to commit plant too far in advance, instead adjusting output as market outcomes became more certain. While two gas generators; Pelican Point Power Station and Torrens Island B3, were unavailable on planned outages the remaining available generating capacity was dispatched.

Rebidding of capacity from low to high prices did not contribute to the price exceeding $5000/MWh. Demand was at similar levels to previous days and to average demand levels of last winter.

# Analysis

Table 1 shows the actual and forecast spot price, demand and generator availability for the 7.30 pm trading interval and other high priced consecutive trading intervals.

Table : Actual and forecast spot price and demand

| Trading interval | Price ($/MWh) | | | | Demand (MW) | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Actual | 0.5 hr forecast | 4 hr forecast | 12 hr forecast | Actual | 0.5 hr forecast | 4 hr forecast | 12 hr forecast |
| 1.30 pm | 2090 | 411 | 10 586 | 10 586 | 1565 | 1535 | 1594 | 1567 |
| 2 pm | 1964 | 499 | 10 586 | 10 586 | 1605 | 1570 | 1594 | 1587 |
| 2.30 pm | 2450 | 10 580 | 411 | 10 586 | 1632 | 1585 | 1561 | 1585 |
| 3 pm | 1941 | 10 580 | 300 | 10 586 | 1634 | 1595 | 1532 | 1589 |
| 3.30 pm | 407 | 13 330 | 300 | 10 586 | 1577 | 1634 | 1532 | 1610 |
| 4 pm | 2146 | 13 330 | 495 | 10 586 | 1586 | 1675 | 1579 | 1632 |
| 4.30 pm | 1901 | 10 580 | 13 330 | 10 586 | 1699 | 1720 | 1642 | 1684 |
| 5 pm | 2036 | 456 | 13 330 | 13 482 | 1768 | 1682 | 1715 | 1747 |
| 5.30 pm | 1961 | 300 | 13 330 | 10 586 | 1871 | 1813 | 1835 | 1853 |
| 6 pm | 2087 | 10 580 | 13 482 | 14 000 | 2008 | 2013 | 1987 | 1995 |
| 6.30 pm | 2375 | 14 000 | 14 000 | 14 000 | 2151 | 2165 | 2151 | 2144 |
| 7 pm | 2482 | 14 000 | 14 000 | 14 000 | 2159 | 2222 | 2226 | 2206 |
| **7.30 pm** | **8898** | **13 482** | **14 000** | **14 000** | **2140** | **2207** | **2233** | **2206** |
| 8 pm | 3605 | 10 580 | 14 000 | 14 000 | 2110 | 2149 | 2204 | 2177 |
| 8.30 pm | 1985 | 10 580 | 13 330 | 14 000 | 2089 | 2075 | 2127 | 2151 |
| 9 pm | 3624 | 10 580 | 13 330 | 14 000 | 2042 | 2022 | 2087 | 2106 |
| 9.30 pm | 3580 | 10 580 | 13 330 | 14 000 | 1998 | 1975 | 2057 | 2064 |
| 10 pm | 1915 | 10 580 | 13 330 | 14 000 | 1909 | 1915 | 1974 | 1985 |

Table 1 shows selected price and demand forecasts for the period 1.30 pm to 10 pm. The line of bold text at 7.30 pm corresponds to the spot price exceeding $5000/MWh. The table shows that the high prices were forecast in advance giving time for participants to respond. AEMO’s initial forecasts, at around 12.30 pm the day before, showed high prices. These high forecast prices remained 12 hours ahead, while 14 of 18 high prices were forecast four hours ahead, and most were still forecast 30 minutes prior to dispatch.

Table 1 also shows that demand was generally close to that forecast and, at the time the price exceeded $5000/MWh demand, was marginally lower than that forecast.

Demand forecasts, provided by AEMO in the Short Term Projected Assessment System Adequacy (STPASA) 7 days ahead, were also close to actual demand.

## Network Availability

This section examines the change in network capability approaching the event and its contribution to price outcomes.

Table 2 shows actual and forecast net import limit into South Australia (MurrayLink and Heywood) for the trading intervals from 1.30 pm to 10 pm on 7 July 2016.

The MurrayLink interconnector was limited to between 180 MW and 220 MW (its nominal limit).[[2]](#footnote-2)

Table : Actual and forecast net network capability

| Trading interval | Flows into  South Australia (MW) | | | Net Import limit (MW) | | |
| --- | --- | --- | --- | --- | --- | --- |
|  | Actual | 4 hr forecast | 12 hr forecast | Actual | 4 hr forecast | 12 hr forecast |
| 1.30 pm | 205 | 248 | 254 | 270 | 248 | 254 |
| 2 pm | 141 | 244 | 261 | 238 | 244 | 261 |
| 2.30 pm | 97 | 247 | 269 | 257 | 247 | 269 |
| 3 pm | 64 | 246 | 268 | 264 | 246 | 268 |
| 3.30 pm | 156 | 245 | 268 | 255 | 245 | 268 |
| 4 pm | 241 | 266 | 267 | 257 | 266 | 267 |
| 4.30 pm | 1 | 269 | 270 | 262 | 269 | 270 |
| 5 pm | 133 | 260 | 260 | 269 | 260 | 260 |
| 5.30 pm | 198 | 253 | 256 | 262 | 253 | 256 |
| 6 pm | 188 | 245 | 238 | 248 | 245 | 238 |
| 6.30 pm | 116 | 246 | 237 | 224 | 246 | 237 |
| 7 pm | 88 | 235 | 237 | 222 | 235 | 237 |
| **7.30 pm** | **236** | **232** | **247** | **236** | **232** | **247** |
| 8 pm | 135 | 240 | 251 | 251 | 240 | 251 |
| 8.30 pm | 153 | 245 | 251 | 249 | 245 | 251 |
| 9 pm | 123 | 264 | 256 | 257 | 264 | 256 |
| 9.30 pm | 84 | 266 | 258 | 257 | 266 | 258 |
| 10 pm | 52 | 274 | 261 | 245 | 274 | 261 |

The notable difference between the actual net import limits and actual flows for all periods other than 7.30 pm, when the price reached $8898/MWh, was as a result of participants in South Australia rebidding capacity into low prices after the initial high dispatch price early in the trading interval, reducing flows into South Australia. See Figure 6 which shows the variation in price and offers.

Network constraints were invoked to manage a planned network outage on equipment at Tailem Bend in South Australia as part of the Heywood interconnector upgrade.[[3]](#footnote-3) On 7 July, these constraints reduced the import limit into South Australia and limited generation in the south east of the State. Appendix A provides a description of the constraint and network configuration. While this major upgrade was flagged to the market as early as November 2015, its impact on Heywood’s operating capability was, at times, not clear. The timing and notification of the network outages can be found in Appendix F.

Figure 1 shows the import limit, and target flows of the Heywood interconnector. As is evident, flows on Heywood into South Australia, were forecast to be low. STPASA showed that the Heywood interconnector would be zero while Murraylink would be around 200 MW.

Figure : Heywood interconnector import limits and target flows



## Generator availability and offers

This section discusses changes to the price and capacity offered by generators, and demand conditions relevant to the pricing event.

### Generator Availability

Generator availability and low wind generation affected outcomes on the day.

The available capacity from thermal generators during the first weeks of July remained relatively consistent. While high prices were also forecast on these days the contribution from wind was more than that during 7 July 2016. Figure 2 shows the output from semi-scheduled wind farms in South Australia for 7 July and the previous three days.

Figure : Semi-scheduled wind output



There were some long term outages of generators, Engie’s Pelican Point Power station was placed on 48 hour recall in 2015 and AGL’s Torrens Island B3 unit had been unavailable since 28 June 2016 to complete mandatory safety and compliance work and could not be returned to service quickly.

Figure 3 shows the installed generation capacity in South Australia versus that which was available on the day. The solid red line at around 4100 MW shows the total scheduled and semi-scheduled generation capacity installed in South Australia after the retirement of Northern Power station in May 2016. Deducting the wind capacity, this figure drops 1200 MW (on the day only around 40 MW was operating compared to an average of around 600 MW in the weeks prior), to around 2900 MW. The purple line shows that slightly less than 2500 MW was available after the deduction of Pelican Point and this drops another 200 MW after Torrens Island B3 is removed. Torrens Island A1 was also not offered into the market until 4 pm.

Figure : Installed versus actual availability



Figure 3 shows that South Australia’s generation mix is heavily dependent on two fuels: Gas and wind, one of which is intermittent. On this day, with low wind and without the full capacity of the interconnector all conventional generators were dispatched, resulting in high prices, as was forecast.

The first STPASA run published by AEMO on 1 July flagged Lack of Reserve 1 (LOR1) conditions for 7 pm and 7.30 pm. The Lack of Reserve flag is the first in a series of escalating notices and indicates that AEMO considers that there is insufficient short term capacity available to maintain the necessary reserves in an operational timeframe in the event of a credible contingency occurring. The LOR is a trigger for the market to respond. There was very limited response and an actual LOR1 was declared at 6.15 pm on 7 July. Given a demand forecast peaking at around 2220 MW and around 2400 MW of thermal generation available in South Australia, high prices under such conditions were not unexpected.

While, at the time of high prices wind generation in South Australia was less than 20 MW, it had been forecast to be low. Figure 4 shows the actual and forecast wind generation, four and 12 hours ahead and as shown in STPASA 7 days ahead.

Figure : Actual and forecast wind generation



### Offers and rebidding.

Figure 5 shows the initial offers of South Australian generators as well as initial forecast demand, generation and spot price. Initial offers created a situation where there was no capacity priced between $580/MWh and $12 000/MWh and the forecast price was expected to be greater than $5000/MWh for the majority of the peak of the day. At the beginning of the 7.30 pm trading interval there was around 1880 MW of capacity priced below $5000/MWh.

Figure : Initial bids of South Australia generators and forecast price



There was no significant rebidding of capacity from low to high prices that contributed to the high priced outcomes. High prices resulted from initial offers lodged prior to the first pre-dispatch run, at 12.30 pm the preceding day.

High forecast prices persisted until dispatch when, in response to actual high prices, participants were prompted to rebid capacity from high to low prices.

The protracted period of high forecast prices and limited gas and transport capacity made scheduling of the limited fuel available problematic, with generators not being prepared to commit plant before outcomes became more certain. Consequently the generators waited until prices actually went high then rebid capacity to low prices to increase their dispatch. The effect this has on the closing bids for the generators in South Australia is shown below in Figure 6.

This is supported by public statements made by AGL to the ASX regarding the lack of adequate gas supplies that could be transported to South Australia and a significant increase in the level of gas generation.[[4]](#footnote-4)

Figure : Closing bids of South Australia generators, output and dispatch price



Price exceeding $5000/MWh

Figure 6 shows that after high 5-minute dispatch prices occurred, participants in South Australia rebid capacity from high to low prices on most occasions, resulting in lower dispatch prices for the remainder of the 30 minute trading interval. A notable exception is for the 7.30 pm trading interval where there was no rebidding into lower prices and the resultant spot price exceeded $5000/MWh.

Appendix B details the generators involved in setting the price during the high-price periods, and how that price was determined by the market systems.

The closing bids for all participants in South Australia with capacity priced at or above $5000/MWh for the high-price periods are set out in Appendix C.

A summary of the rebids in response to the high prices are in Appendix E.

Appendix A: Network Diagram

In March 2014 the Heywood augmentation project to increase the capacity of the transmission system between South Australia and Victoria to 650 MW in both directions satisfied the Regulatory Investment Test (transmission). Until the completion of the augmentation, the Heywood interconnector has a nominal capacity of 460 MW. While the Heywood interconnector is notionally only the lines between South East Substation and the Heywood Terminal Station it effectively comprised:

* four parallel circuits (two circuits operating at 275 kV and two circuits operating at 132 kV) between Tailem Bend (near Adelaide) and South East Substation (close to the border). These lines also deliver power to the load centres at Keith, Kincraig; Penola, Blanche and Mount Gambier; and
* two parallel 275 kV circuits between South East Substation to Heywood Terminal Station in south-west Victoria and two parallel 500 kV circuits from the Heywood Terminal Station to Moorabool Terminal Stations and on to the Sydenham Terminal Station 29 kms north west of Melbourne.

The upgrade works:

* reduce the number of parallel circuits in South Australia between Tailem Bend and South East Substation to three; and
* install an additional transformer and associated switchgear at Heywood terminal station and compensation equipment along the transmission path.

Tailem Bend

Ladbroke Grove

South East

Heywood

Melbourne

Snuggery

Canunda

Lake Bonney

South Australia

Victoria

Wind Farm

Generator

132 kV

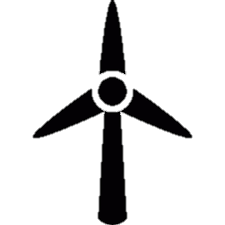
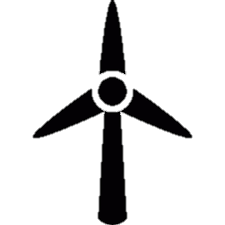
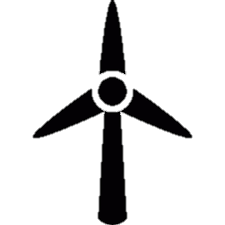
275 kV

500 kV

~

~

~



The V::S\_TB\_275kV\_W\_B1 constraint was invoked to manage the outage of the Tailem Bend West bus. The constraint contains six variables, all of which have a factor of one:

* generation from Ladbroke units 1 and 2
* generation from Lake Bonney units 2 and 3
* generation from Snuggery unit 1 and
* flow from Vic to SA on the Heywood interconnector.

This means that an increase in generation from these units or an increase in flow into South Australia across Heywood will reduce the headroom of the constraint, until it binds. Conversely reduced generation from the units or flows into Victoria increases the headroom. If the constraint is binding, flows on Heywood are optimised with local generation in the South East. For example a MW increase in generation in the South East must be balanced against either a MW reduction in flow into South Australia or a MW increase in flow into Victoria across Heywood.

Appendix B: Price setter

The following table identifies for the trading interval in which the spot price exceeded $5000/MWh, each five minute dispatch interval price and the generating units involved in setting the energy price. This information is published by AEMO.[[5]](#footnote-5) The 30-minute spot price is the average of the six dispatch interval prices.

Table : price setter for the 7.30 pm trading interval

| DI | Dispatch Price ($/MWh) | Participant | Unit | Service | Offer price ($/MWh) | Marginal change | Contribution |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 19:05 | $10 580.30 | Engie | DRYCGT2 | Energy | $10 580.30 | 1.00 | $10 580.30 |
| 19:10 | $10 580.40 | Engie | DRYCGT1 | Energy | $10 580.4 0 | 1.00 | $10 580.40 |
| 19:15 | $10 580.30 | Engie | DRYCGT2 | Energy | $10 580.30 | 1.00 | $10 580.30 |
| 19:20 | $10 580.30 | Engie | DRYCGT2 | Energy | $10 580.30 | 1.00 | $10 580.30 |
| 19:25 | $10 580.20 | Engie | DRYCGT3 | Energy | $10 580.20 | 1.00 | $10 580.20 |
| 19:30 | $485.29 | AGL (SA) | TORRB1 | Energy | $484.99 | 0.50 | $242.50 |
|  |  | AGL (SA) | TORRB2 | Energy | $484.99 | 0.50 | $242.50 |
|  |  | Hydro Tasmania | GORDON | Raise 5 min | $2.10 | 1.00 | $2.10 |
|  |  | AGL (SA) | TORRB1 | Raise 5 min | $1.80 | -0.50 | -$0.90 |
|  |  | AGL (SA) | TORRB2 | Raise 5 min | $1.80 | -0.50 | -$0.90 |
|  |  |  | ENOF,TORRB1,7,TORRB4,7 |  | $0.00 | -5.00 | $0.00 |
|  |  |  | ENOF,TORRB2,7,TORRB4,7 |  | $0.00 | -5.00 | $0.00 |
| **Spot Price** | | **$8898/MWh** |  |  |  |  |  |

Appendix C: Closing bids

Figures C1 to C4 highlight the half hour closing bids for participants in South Australia with significant capacity priced at or above $5000/MWh during the periods in which the spot price exceeded $5000/MWh. They also show generation output and the spot price. While Origin Energy offered around 500 MW of capacity, only 1 MW was priced above $5000/MWh when the price exceeded $5000/MWh.

Figure C1 - AGL (Torrens Island, The Bluff, Hallett Wind Farm, North Brown Hill) closing bid prices, dispatch and spot price



Figure C2 - EnergyAustralia (Hallett, Waterloo) closing bid prices, dispatch and spot price



Figure C3 - Engie (Dry Creek, Mintaro, Port Lincoln, Snuggery) closing bid prices, dispatch and spot price



Figure C4 – Snowy Hydro (Lonsdale, Pt Stanvac and Angaston) closing bid prices, dispatch and spot price



Appendix D: Relevant Market Notices

The following market notices either were notifying the market of the network issues in South Australia.

|  |  |  |  |
| --- | --- | --- | --- |
| Market Notice | Type | Date of issue | Last Changed |
| 54171 | GENERAL NOTICE | 29/06/2016 14:55:03 | 29/06/2016 14:55:03 |
| **External Reference** | | | |
| Planned outage of Tailem Bend 275kV - South East 275kV No.1 line from 04/07/2016 0745 hrs to 12/07/2016 1730hrs | | | |
| **Reason** | | | |
| AEMO ELECTRICITY MARKET NOTICE.  Planned outage of Tailem Bend 275kV - South East 275kV No.1 line from 04/07/2016 0745 hrs to 12/07/2016 1730hrs  During these outage, South Australia region will remain connected to the NEM. However, there is a risk of South Australia region separating from the rest of the NEM following the next credible contingency (trip Tailem Bend 275kV - South East 275kV No.2 line).  AEMO will take all necessary steps as outlined in Section 6.1 of SO-OP-3715 Power System Security Guideline to manage the orderly separation of SA from the NEM following the next credible contingency.  Prior to the orderly separation of SA, the following FCAS regulation constraints will be invoked to manage security of South Australia power system.  F-S\_LREG\_0035  F-S\_RREG\_0035  Refer to AEMO Network Outage Schedule (NOS) for further details  Operations Planning | | | |

|  |  |  |  |
| --- | --- | --- | --- |
| Market Notice | Type | Date of issue | Last Changed |
| 54188 | RESERVE NOTICE | 01/07/2016 14:51:08 | 01/07/2016 14:51:08 |
| **External Reference** | | | |
| Update: Forecast Lack Of Reserve Level 1(LOR1) in the South Australia region - STPASA - 4, 6 and 7 July 2016 | | | |
| **Reason** | | | |
| AEMO ELECTRICITY MARKET NOTICE RE: AEMO Electricity Market Notice(s) No. 54183. NOTICE OF UPDATE AEMO declares a Forecast LOR1 condition for the South Australia region for the following period(s): 1. From 04/07/2016 1800 hrs to 1900 hrs The minimum reserve available is 365 MW. 2. From 06/07/2016 1800 hrs to 2100 hrs The minimum reserve available is 273 MW. 3. From 07/07/2016 1800 hrs to 2100 hrs The minimum reserve available is 217 MW. The contingency capacity reserve required over the above periods of forecast LOR1 conditions is 400 MW. Harmohan Singh Operations Planning | | | |

|  |  |  |  |
| --- | --- | --- | --- |
| Market Notice | Type | Date of issue | Last Changed |
| 54306 | Reserve Notice | 07/07/2016 18:12:30 | 07/07/2016 18:12:30 |
| **External Reference** | | | |
| Actual Lack Of Reserve Level 1 (LOR1) in the SA Region - 07 July 2016 | | | |
| **Reason** | | | |
| AEMO ELECTRICITY MARKET NOTICE  Actual Lack Of Reserve Level 1 (LOR1) in the SA Region - 07 July 2016 An Actual LOR1 condition has been declared for the SA Region from 1815 hrs. The Actual LOR1 condition is forecast to exist until 2130 hrs  The contingency capacity reserve required is 400 MW  The reserve available is 277 MW Manager NEM Real Time Operations | | | |

|  |  |  |  |
| --- | --- | --- | --- |
| Market Notice | Type | Date of issue | Last Changed |
| 54352 | Reserve Notice | 07/07/2016 21:53:00 | 07/07/2016 21:53:00 |
| **External Reference** | | | |
| Cancellation of the Actual (LOR1) condition in the SA region - 7/07/2016 | | | |
| **Reason** | | | |
| AEMO ELECTRICITY MARKET NOTICE  Cancellation of Actual (LOR1) condition in the SA region - 7/07/2016  The Actual LOR1 Condition in the SA Region advised in AEMO Electricity Market Notice No.54306 is cancelled at 2130 hrs 7/07/2016.  Manager NEM Real Time Operations | | | |

Appendix E: Rebid summary

Table 4 below shows the net effect of rebids by South Australian participants where capacity was moved from above to below the actual price. A negative number refers to the MW capacity being withdrawn and a positive means additional capacity.

Table : Net Effective rebids for South Australia from 1.30 pm to 10 pm

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Origin | | EA | | Snowy Hydro | | Engie | | AGL | | Total | |
|  | **Above** | **Below** | **Above** | **Below** | **Above** | **Below** | **Above** | **Below** | **Above** | **Below** | **Above** | **Below** |
| 1.30 pm | -83 | 79 | -20 | 20 | -95 | 94 | -5 | 5 | -250 | 250 | **-453** | **448** |
| 2 pm | -82 | 78 | -25 | 25 | -95 | 94 | 11 | -11 | -250 | 250 | **-441** | **436** |
| 2.30 pm | -82 | 80 | -25 | 25 | -95 | 94 | -51 | 51 | -250 | 250 | **-503** | **500** |
| 3 pm | -82 | 84 | -25 | 25 | -95 | 94 | 16 | -16 | -250 | 250 | **-436** | **437** |
| 3.30 pm | **No high price** | | | | | | | | | | | |
| 4 pm | -27 | 29 |  |  | 20 | -21 | -25 | 25 |  |  | **-32** | **33** |
| 4.30 pm | -82 | 84 | -25 | 25 | -61 | 61 | -138 | 141 | -310 | 310 | **-616** | **621** |
| 5 pm | -47 | 49 | -45 | 45 | -61 | 61 | -138 | 141 | -280 | 280 | **-571** | **576** |
| 5.30 pm | -47 | 49 |  |  | -61 | 61 | -128 | 131 | -240 | 240 | **-476** | **481** |
| 6 pm | 0 | 2 | 15 | -15 | -61 | 61 | -149 | 152 | -180 | 180 | **-375** | **380** |
| 6.30 pm | 1 | 2 | -20 | 20 | -54 | 54 | -134 | 134 | -120 | 120 | **-327** | **330** |
| 7 pm | 1 | 2 | -20 | 20 | -54 | 54 | -195 | 195 | -90 | 90 | **-358** | **361** |
| *7.30 pm* | *0* | *1* | *-20* | *20* |  |  | *-88* | *88* | *20* | *-20* | *-88* | *89* |
| 8 pm | 0 | 1 | -20 | 20 | -61 | 61 | -58 | 58 | -90 | 90 | **-229** | **230** |
| 8.30 pm | -48 | 49 | -20 | 20 | -61 | 61 | -58 | 58 | -90 | 90 | **-277** | **278** |
| 9 pm | -48 | 49 | -50 | 50 | -61 | 61 | -58 | 58 | -120 | 120 | **-337** | **338** |
| 9.30 pm | -49 | 50 | -20 | 20 | -61 | 61 | -83 | 83 | -180 | 180 | **-393** | **394** |
| 10 pm | -49 | 50 | -20 | 20 | -81 | 81 | -84 | 84 | -210 | 210 | **-444** | **445** |

Appendix F Network Outage Timing

The following table contains a summary of information provided by ElectraNet and AEMO on the outages and their impact on the market. While various capacity limits were listed in MTPASA over the months preceding the Heywood outage, the first indication that the transfer limit from VIC to SA would be 0 MW occurred in STPASA 7 days prior to the commencement of the outage.

| Mechanism | Date | By Whom | Comment |
| --- | --- | --- | --- |
| 13 Month Outage Plan | 20 Nov 2015 | ElectraNet | Initial request  Job EN34907 30/5/16 to 2/6/16 SE – Tailem Bend 1  Job EN34908 6/6/16 to 9/6/16 SE – Tailem Bend 2 |
| MTPASA | 22 Nov 2015 | AEMO | MTPASA run 720  run types RELIABILITY\_LIMITS, RELIABILTY\_LOR, OUTAGE\_LIMITS OUTAGE\_LOR  VIC to SA = 570 MW : V>S\_570\_MT  SA to VIC = 550 MW : S>V\_550\_MT, V>>V\_NIL\_2A\_R |
| Network Outage Scheduler | 23 Mar 2016 | ElectraNet | Initial entry  Job EN34907 4/7/16 to 13/7/16 SE – Tailem Bend 1  Job EN34908 15/7/16 to 23/7/16 SE – Tailem Bend 2 |
| MTPASA | 24 Mar 2016 | AEMO | MTPASA run 748  run types RELIABILITY\_LIMITS, RELIABILTY\_LOR, OUTAGE\_LIMITS OUTAGE\_LOR  VIC to SA = 570 MW : V>S\_570\_MT  SA to VIC = 550 MW : S>V\_550\_MT, V>>V\_NIL\_2A\_R |
| Constraint Invoke tables | 6 Apr 2016 | AEMO | Constraint set V\_S\_SETB entered into the Constraint invoke tables.[[6]](#footnote-6) |
| MTPASA | 19 Apr 2016 | AEMO | MTPASA run 757  run types RELIABILITY\_LIMITS, RELIABILTY\_LOR  VIC to SA = 570 MW : V>S\_570\_MT  SA to VIC = 550 MW : S>V\_550\_MT, V>>V\_NIL\_2A\_R  OUTAGE\_LIMITS  VIC to SA = 377 MW : V^^S\_PAVC\_SETB[[7]](#footnote-7)  SA to VIC = 550 MW : S>V\_550\_MT  OUTAGE\_LOR  VIC to SA = 505 MW : V^^S\_PAVC\_SETB  SA to VIC = 550 MW : V>>V\_NIL\_2A\_R |
| Network Outage Scheduler | 26 Apr 2016 | ElectraNet | Timing adjustment  Job EN34907 4/7/16 to 13/7/16 SE – Tailem Bend 1  Job EN34908 15/7/16 to 23/7/16 SE – Tailem Bend 2 |
| MTPASA | 17 May 2016 | AEMO | MTPASA run 766  run types RELIABILITY\_LIMITS, RELIABILTY\_LOR  VIC to SA = 570 MW : V>S\_570\_MT  SA to VIC = 550 MW : S>V\_550\_MT, V>>V\_NIL\_2A\_R  OUTAGE\_LIMITS  VIC to SA = 377 MW : V^^S\_PAVC\_SETB  SA to VIC = 216 MW : S^^V\_SETB\_SETB[[8]](#footnote-8)  OUTAGE\_LOR  VIC to SA = 505 MW : V^^S\_PAVC\_SETB  SA to VIC = 270 MW : V>>V\_NIL\_2A\_R |
| MTPASA | 24 May 2016 | AEMO | MTPASA run 768  run types RELIABILITY\_LIMITS, RELIABILTY\_LOR  VIC to SA = 570 MW : V>S\_570\_MT  SA to VIC = 500 MW : S>V\_550\_MT, V>>V\_NIL\_2A\_R  OUTAGE\_LIMITS  VIC to SA = 377 MW : V^^S\_PAVC\_SETB  SA to VIC = 550 MW : S>V\_550\_MT  OUTAGE\_LOR  VIC to SA = 505 MW : V^^S\_PAVC\_SETB  SA to VIC = 550 MW : V>>V\_NIL\_2A\_R |
| MTPASA | 14 Jun 2016 | AEMO | MTPASA run 777  run types RELIABILITY\_LIMITS, RELIABILTY\_LOR  VIC to SA = 570 MW : V>S\_570\_MT  SA to VIC = 550 MW : S>V\_550\_MT, V>>V\_NIL\_2A\_R  OUTAGE\_LIMITS  VIC to SA = 377 MW : V^^S\_PAVC\_SETB  SA to VIC = 530 MW : S:V\_530  OUTAGE\_LOR  VIC to SA = 505 MW : V^^S\_PAVC\_SETB  SA to VIC = 550 MW : V>>V\_NIL\_2A\_R |
| Settlement surplus residue auction | 15 Jun 2016 | AEMO | Settlement Residue Auction |
| MTPASA | 21 Jun 2016 | AEMO | MTPASA run 779  run types RELIABILITY\_LIMITS, RELIABILTY\_LOR  VIC to SA = 570 MW : V>S\_570\_MT  SA to VIC = 500 MW : S>V\_500\_MT, V>>V\_NIL\_2A\_R  OUTAGE\_LIMITS  VIC to SA = 377 MW : V^^S\_PAVC\_SETB  SA to VIC = 500 MW : S>V\_500\_MT  OUTAGE\_LOR  VIC to SA = 505 MW : V^^S\_PAVC\_SETB  SA to VIC = 500 MW : S>V\_500\_MT |
| 7 day out assessments and STPASA | 1 Jul 2016 | AEMO | STPASA 1 July 2016 4.00am for 7 July 2016  Region Solution OUTAGE\_LOR flagged LOR1 for 19:00 and 19:30  Demand and wind forecast close to actual  Interconnector Solution  VIC to SA = 0 MW : ST\_SA\_0  SA to VIC = 110 MW : S::V\_TBSE\_TBSE  RELIABILITY\_LRC  VIC to SA = 0 MW : ST\_SA\_0  SA to VIC = 500 MW : S:V\_500\_HY\_TEST |
| Pre-dispatch | 6 Jul 2016 | AEMO | Heywood Interconnector export limit from VIC to SA shown as around 70 MW. |

1. This requirement is set out in clause 3.13.7 (d) of the National Electricity Rules. [↑](#footnote-ref-1)
2. Limits were reduced by a constraint managing the outage of the New South Wales MurrayLink runback scheme. [↑](#footnote-ref-2)
3. At 7 am on 4 July, a planned network outage commenced on equipment at Tailem Bend in South Australia as part of the Heywood interconnector upgrade. This outage continued until the evening of 14 July. [↑](#footnote-ref-3)
4. AGL media statement : <https://www.agl.com.au/about-agl/media-centre/article-list/2016/august/agl-comments-on-recent-market-events-in-south-australia> [↑](#footnote-ref-4)
5. Details on how the price is determined can be found at [www.aemo.com.au](http://www.aemo.com.au) [↑](#footnote-ref-5)
6. The GENCONSETINVOKE as defined in the MMS Data Model v4.25 Oracle published by AEMO at https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/IT-systems-and-change states: “GENCONSETINVOKE provides details of invoked and revoked generic constraints. GENCONSETINVOKE is the key table for determining what constraints are active in dispatch, pre-dispatch and PASA.” This does not however indicate what the effect of the constraint will be on network transfer capabilities. [↑](#footnote-ref-6)
7. AEMO has indicated that this constraint was operating erroneously and had no relevance to the outage on the interconnector. The constraint was withdrawn on 8/8/16. [↑](#footnote-ref-7)
8. AEMO has indicated that this constraint was operating erroneously and had no relevance to the outage on the interconnector. The constraint was withdrawn on 8/8/16. [↑](#footnote-ref-8)