AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

# Preliminary Incident Report - Trip of Torrens Island A and B West 275 kV busbars on 12 March 2021

**March 2021**

A preliminary operating incident report for the National Electricity Market – information as at 16/03/2021

## ABBREVIATIONS

| Abbreviation | Term |
|---|---|
| AEMC | Australian Energy Market Commission |
| AEMO | Australian Energy Market Operator |
| AEST | Australian Eastern Standard Time |
| LOR | Lack of Reserve |
| NEM | National Electricity Market |
| NER | National Electricity Rules |
| TNSP | Transmission Network Service Provider |

# Important notice

## PURPOSE

AEMO has prepared this preliminary report as part of its review of the reviewable operating incident involving trip of Torrens Island 275 kV West busbar in South Australia on 12 March 2021 as a first step in reporting under clause 4.8.15(c) of the National Electricity Rules.

The observations in this report will be updated in AEMO's final operating incident report, where new information becomes available.

## DISCLAIMER

AEMO has been provided with preliminary data by Registered Participants as to the performance of some equipment leading up to, during and after the event in accordance with clause 4.8.15 of the National Electricity Rules. In addition, AEMO has collated preliminary information from its own systems. Any analysis and conclusions expressed in this document are also of a preliminary nature.

While AEMO has made every reasonable effort to ensure the quality of the information in this report, its investigations are incomplete, and any findings expressed in it may change as further information becomes available and further analysis is conducted. Any views expressed in this report are those of AEMO unless otherwise stated and may be based on information given to AEMO by other persons.

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## CONTACT

If you have any questions or comments in relation to this report, please contact AEMO at system.incident@aemo.com.au.

# Contents

# 1. Overview

This preliminary report relates to a reviewable operating incident[1] that occurred on 12 March 2021 in South Australia (SA). The incident involved the simultaneous trip of the Torrens Island A West 275 kV busbar (TORW_A) and Torrens Island B West 275 kV busbar (TORW_B) (a non-credible contingency event). The TORW_B trip disconnected Barker Inlet Power station from the system, and the trip of TORW_A disconnected the Torrens West 275/66 kV West transformer.

This preliminary report provides a summary of the known facts relating to the incident as known at the date of publication and does not attempt to provide any analysis or recommendations.

National Electricity Market time (Australian Eastern Standard Time [AEST]) is used in this report.

# 2. Pre-event conditions

Prior to this incident, there was a planned high impact outage of the Moorabool to Mortlake (MOPS-MLTS) 500 kV line in Victoria, which started at 0506 hrs on 12 March 2021 with an expected finish time of 1730 hrs on 19 March 2021. This planned outage meant that a credible single circuit fault on either the Alcoa Portland-Heywood-Moorabool (APD_HYTS_MOPS) 500 kV line or any transmission lines between Heywood – Tarrone – Haunted Gully – Moorabool 500 kV substations would result in synchronous separation between Victoria and SA. Prior to giving permission to proceed (PTP) for this planned outage AEMO performed a number of checks and the power system at the time of giving PTP was deemed secure for the entire duration of the outage.

Immediately prior to the incident, all circuit breakers at Torrens Island A and B 275 kV substations were closed. In addition, units 2, 3 and 4 at Torrens Island B power station and Barker Inlet power station were operating. Unit 1 at Torrens Island B and all units at Torrens Island A were not generating prior to the incident.

# 3. Event

At 1708 hrs on 12 March 2021 TORW_A and TORW_B 275 kV busbars simultaneously tripped. The event resulted in disconnection of Barker Inlet power station in the order of 111 MW and caused the TORW_A to Torrens West 275/66 kV transformer to disconnect at the TORW_A end. Preliminary investigations have determined the bus trip was caused by the failure of the Current Transformer (CT) associated with the Torrens Island substation West bus section circuit breaker.

Oil from the failed CT leaked into adjacent cable trenches at Torrens Island substation and caught fire. This oil fire impacted circuit breaker air supplies and operability for Torrens Island Power Station B (TIPS B) unit B3 and unit B4 and control and communications equipment at Torrens Island 275 kV substation.

See Appendix A1 for pre and post incident system diagrams.

[1] See NER clause 4.8.15(a)(1)(i), as the event relates to a non-credible contingency event; and the AEMC Reliability Panel Guidelines for Identifying Reviewable Operating Incidents.

Table 1 below summarises the key events during this incident.

Table 1 Sequence of incident events (12 March 2021)

| Time | Event |
|---|---|
| | 12 March 2021 |
| 1708 | Torrens Island A West 275 kV and Torrens Island B West 275 kV busbar tripped, disconnecting Barker Inlet Power Station and the Torrens West 275/66 kV West transformer. |
| 1820 | ElectraNet confirmed that there was a cable trench fire at Torrens Island 275 kV substation |
| 1850 | Torrens Island 275 kV substation SCADA failed |
| 1915 | ElectraNet confirmed they have requested AGL to shut down Torrens Island Power Station (TIPS) B3 and TIPS B4 units. Reason: low compressed air pressure used by TIPS B3 and TIPS B4 circuit breakers. Constraints invoked for TIPS B3 and TIPS B4 at 1915 hrs. |
| 1955 | AEMO advised AusNet Services that AEMO is requesting reversal (recall) of the Moorabool-Mortlake 500 kV line outage. |
| 2057 | ElectraNet advised AEMO of loss of comms at Torrens Island power station A. |
| 2105 | ElectraNet advised AEMO there is no longer a requirement to shut down TIPS units B3 and B4. The constraints to reduce their generation to 0 MW were updated to maintain TIPS units B3 and B4 each at 40 MW. |
| 2253 | ElectraNet advised AEMO that there is no longer a risk of all TIPSB units tripping for a single system fault. |
| | 13 March 2021 |
| 0407 | AEMO advised AusNet Services that the recall of the Moorabool-Mortlake 500 kV line outage is no longer required. |
| 1524 | All Torrens Island 275 kV substation SCADA returned to normal (with the exception of the Torrens Island 275 kV West bus coupler circuit breaker). |
| 2208 | Torrens Island B West 275 kV busbar returned to service. |
| | 14 March 2021 |
| 0922 | Torrens Island A West 275 kV busbar returned to service. |

## 3.1 System impacts

A high-level summary of the impact this incident had on the system follows:

- Due to constraints affecting TIPS B's maximum output, options to manage system strength and post-contingent rate of change of frequency in SA were severely impacted during this incident.
- During this incident Lack of Reserve 1 (LOR1) and Lack of Reserve 2 (LOR2) conditions were declared due to a tightening of electricity supply reserves in SA[2].
- Initial investigations indicate that the system likely remained secure throughout this incident (not withstanding SA system strength considerations).

[2] Refer to Appendix A2.1 for an explanation of LOR conditions and notices.

# 4. Reclassification

- At 1756 hrs on 12 March 2021 AEMO issued market notice 83253 to reclassify the loss of TIPS B units 1, 2, 3 and 4 as a credible contingency event until further notice.
- At 2358 hrs on 12 March 2021 AEMO issued market notice 83276 to advise that the cause of the non-credible contingency had been identified. Cancellation of the reclass of the loss of all TIPS B station units as a credible contingency at 23:40 hrs.
- At 0036 hrs on 13 March 2021 AEMO issued market notice 83278 to reclassify the loss of Torrens Island A - Magill 275 kV Line, Torrens Island A - Para 275 kV Line, Torrens Island A - Northfield 275 kV line and Torrens Island A-Kilburn 275 kV Line as a credible contingency until further notice.
- At 0903 hrs on 13 March 2021 AEMO issued market notice 83281 to reclassify the Torrens Island - Port Adelaide North 66 kV Line, Torrens Island - Kilburn 66 kV Line, Torrens Island - New Osborne No 3 66 kV Line, Torrens Island - New Osborne No 4 66 kV Line, Torrens - Torrens North No 1 66 kV Line and Torrens - Torrens North No 2 66 kV Line as a credible contingency until further notice.
- At 1112 hrs on 13 March 2021 AEMO issued market notice 83283 to cancel the reclassification of Torrens Island A - Magill 275 kV Line, Torrens Island A - Para 275 kV Line, Torrens Island A - Northfield 275 kV line and Torrens Island A-Kilburn 275 kV Line as a credible contingency.
- At 1117 hrs on 13 March 2021 AEMO issued market notice 83282 to reclassify the trip of Torrens Island Power Station - Magill 275 kV Line and either Torrens Island A - Para 275 kV Line or Torrens Island A - Northfield 275 kV line or Torrens Island A - Kilburn 275 kV Line as a credible contingency.
- At 1151 hrs on 13 March 2021 AEMO issued market notice 83285 to cancel the reclassification of Torrens Island A - Magill 275 kV Line and either Torrens Island A - Para 275 kV Line or Torrens Island A - Northfield 275 kV line or Torrens Island A - Kilburn 275 kV Line as a credible contingency.
- At 1952 hrs on 14 March 2021 AEMO issued market notice 83355 to cancel the reclassification of the Torrens Island - Port Adelaide North 66 kV Line, Torrens Island - Kilburn 66 kV Line, Torrens Island - New Osborne No 3 66 kV Line, Torrens Island - New Osborne No 4 66 kV Line, Torrens - Torrens North No 1 66 kV Line and Torrens - Torrens North No 2 66 kV Line as a credible contingency.

# 5. Constraints

- S-BIPS_ZERO from 1725 hrs 12/03/2021 to 2215 hrs 13/03/2021. This constraint limits Barker Inlet power station to 0MW output and was required because Barker Inlet power station was disconnected from the power system.
- S-TIPSB_N-2 from 1750 hrs 12/03/2021 to 2350 hrs 12/03/2021. This constraint is to declare the loss of all Torrens Island B units as a credible contingency
- NC-S_TORRB3 and NC-S_TORRB4 from 2030 hrs 12/03/2021 to 2050 hrs 12/03/2021. These constraints are automatic constraints created in relation to the non-conformance of Torrens Island B power station unit 3 and unit 4 respectively.

- #TORRB3_E from 1915 hrs 12/03/2021 to 2100 hrs 12/03/2021 and subsequently extended to 2205 hrs on 12/03/2021. This is a quick constraint[3] to limit the maximum output of Torrens Island B power station unit 3 to 0MW maximum output. This was required due to low air pressure on circuit breakers associated with unit 3.
- #TORRB4_E from 1915 hrs 12/03/2021 to 2100 hrs 12/03/2021 and subsequently extended to 2205 hrs on 12/03/2021. This is a quick constraint to limit the maximum output of Torrens Island B power station unit 4 to 0MW maximum output. This was required due to low air pressure on circuit breakers associated with unit 4.

# 6. Market notices

- At 1739 hrs on 12 March 2021 AEMO issued market notice 83251 to advise of the non-credible contingency event.
- At 1839 hrs on 12 March 2021 AEMO issued market notice 83254 to advise of a forecast LOR1 condition in SA for the following period: from 1900 hrs 12/03/2021 to 1930 hrs 12/03/2021.
- At 1845 hrs on 12 March 2021 AEMO issued market notice 83255 to advise of an actual LOR1 condition in SA from 1835 hrs. This condition was forecast to exist until 1930 hrs on 12 March 2021.
- At 1925 hrs on 12 March 2021 AEMO issued market notice 83258 to update the actual LOR1 condition in SA. This condition was forecast to exist until 2030 hrs on 12 March 2021.
- At 1933 hrs on 12 March 2021 AEMO issued market notice 83257 to cancel the AEMO direction to participants in SA issued under market notice 83144 at 1732 hrs on 07 March 2021.
- At 1947 hrs on 12 March 2021 AEMO issued market notice 83263 to advise of an actual LOR2 condition in SA from 1930 hrs. This condition was forecast to exist until 2030 hrs on 12 March 2021.
- At 1952 hrs on 12 March 2021 AEMO issued market notice 83262 to advise that AEMO had issued a direction to a participant in the SA region. For the purposes of the National Electricity Rules this is a direction under clause 4.8.9(a).
- At 2004 hrs on 12 March 2021 AEMO issued market notice 83265 to update the actual LOR1 condition in SA from 1835 hrs. This condition was forecast to exist until 2100 hrs on 12 March 2021.
- At 2033 hrs on 12 March 2021 AEMO issued market notice 83268 to cancel the actual LOR2 condition in SA from 2030 hrs.
- At 2042 hrs on 12 March 2021 AEMO issued market notice 83269 to update the capacity reserve requirements and minimum capacity available for the LOR1 condition in SA.
- At 2050 hrs on 12 March 2021 AEMO issued market notice 83270 to advise that Torrens Island power station unit B3 was non-conforming.
- At 2051 hrs on 12 March 2021 AEMO issued market notice 83271 to advise that Torrens Island power station unit B4 was non-conforming.
- At 2110 hrs on 12 March 2021 AEMO issued market notice 83273 to cancel the actual LOR1 condition in SA from 2110 hrs.

[3] Constraints are generally referred to as 'quick constraints' when they are created manually by operational personnel, rather than from pre-defined constraint sets.

# 7. Next steps

AEMO will continue its investigation into this incident and will publish a detailed power system event report. The investigation will include, but not be limited to, the below items:

- The cause of the CT failure at Torrens 275 kV substation.
- The causes of the Torren's 275 kV substation air system, communications and control systems and SCADA output deterioration, and the steps taken to manage/resolve this.
- The impact on system strength and the actions taken during the incident.
- The reasons for the LOR1 and LOR2 condition notices and steps taken in response to these notices.
- Further assessment of system security throughout the event.
- Details of the directions AEMO issued to generators during this incident.
- Any commonalities with other events, such as the Torrens Island CT failure that occurred on 20 January 2020[4].
- Any recommendations arising from the investigation.

AEMO will include any additional findings in its final report on this event.

[4] See https://www.aemo.com.au/-/media/files/electricity/nem/market_notices_and_events/power_system_incident_reports/2020/tips-a-275kv-west-bus-20-jan-2020.pdf?la=en

# A1. System Diagrams

Figure 1: Pre fault system diagram

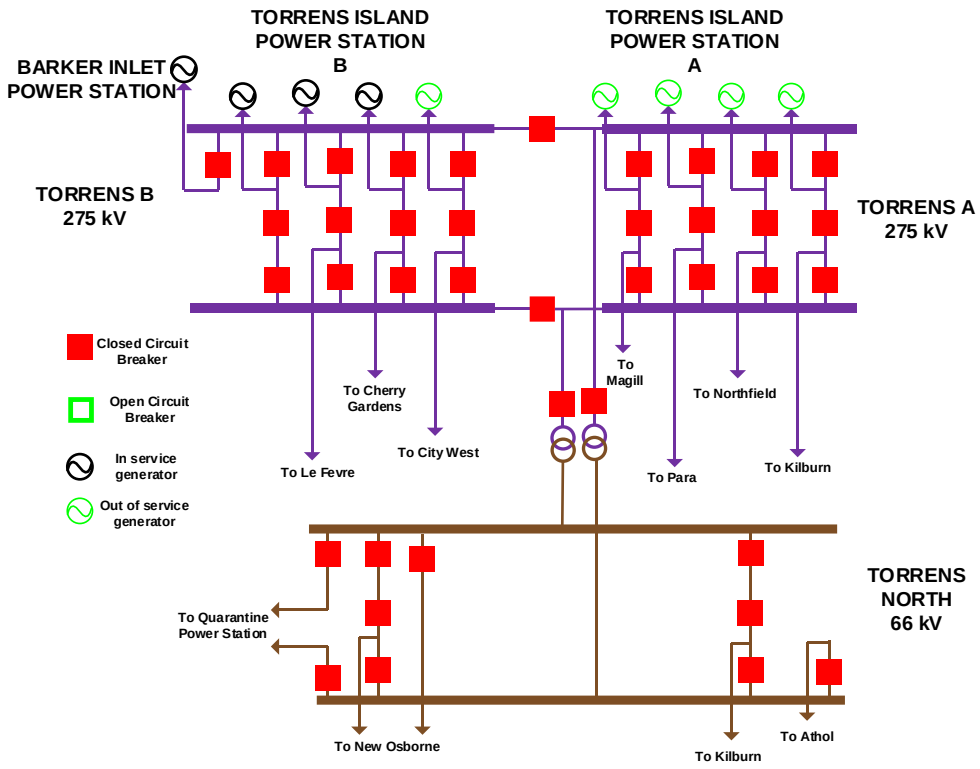
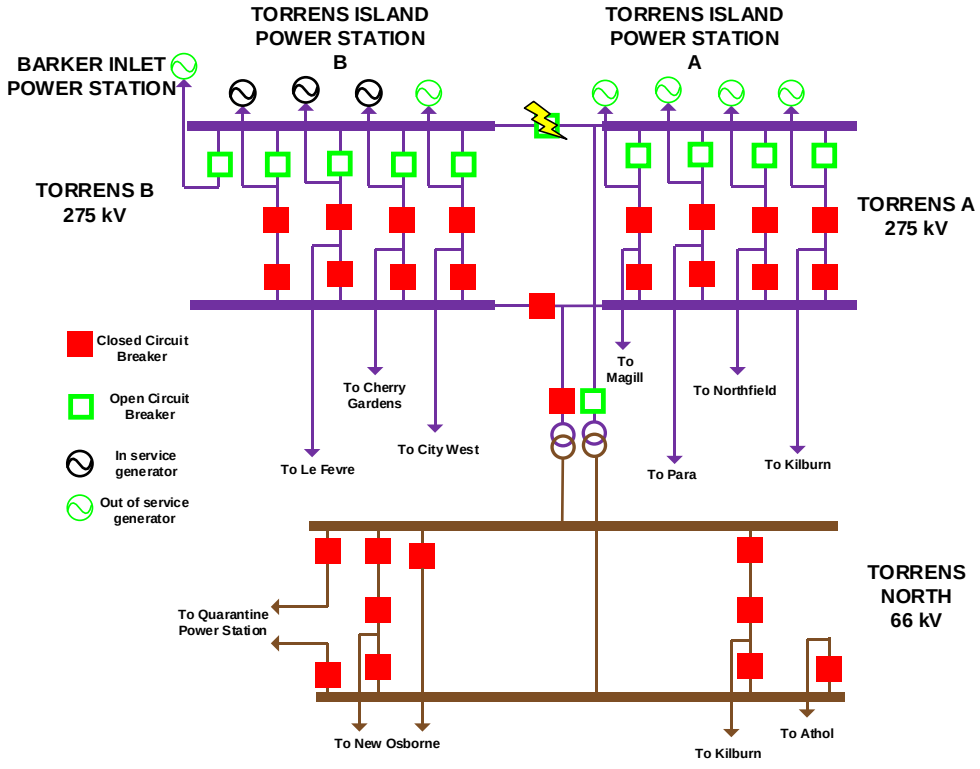



Figure 2: Post fault system diagram



# A2. Lack of reserve notices

In the NEM, the level of energy reserves available to maintain power system supply to energy consumers is continually assessed. Pre-determined reserves refer to the level of 'spare' capacity to provide this buffer, over and above the level of electricity demand that is forecast at any given time. AEMO have a number of processes and arrangements in place to mitigate risk to energy supply when the system is affected by Lack Of Reserve (LOR) conditions.

## A2.1 LOR level 1 notice

A LOR1 notice is given to the market by AEMO to indicate that reserve levels are lower than the two largest supply resources in a state. This notice can be forecast (AEMO is forecasting this situation will arise in the future) or actual (this is the case in the current market interval). LOR1 signals a reduction in pre-determined electricity reserve levels, encouraging generators to offer more supply, or large industrial or commercial consumers to reduce their demand. At this stage, there is no impact to power system security or reliability and AEMO continues to monitor reserve levels to maintain adequate supply.

## A2.2 LOR level 2 notice

A LOR2 notice is given to the market by AEMO to indicate that reserve levels are lower than the single largest supply resource in a state. This notice can be forecast (AEMO is forecasting this situation will arise in the future) or actual (this is the case in the current market interval). At this level, there is no impact to the power system, but supply could be disrupted if a large incident occurred. Once a forecast LOR2 condition is declared, AEMO has the power to direct generators or activate the Reliability & Emergency Reserve Trader (RERT) mechanism to improve the supply-demand balance.

## A2.3 LOR level 3 notice

A LOR3 notice is given to the market by AEMO to indicate a deficit in the supply/demand balance. This condition exists when the available electricity supply is equal to or less than the operational demand. This means there are no reserve supplies available. Controlled load shedding may be required as a last resort to protect system security and avoid damage to system infrastructure.