



POWER SYSTEM NOT IN A SECURE OPERATING STATE IN NSW ON 28 NOV 2016

REVIEWABLE OPERATING INCIDENT REPORT UNDER THE
NATIONAL ELECTRICITY RULES

Published: **13 July 2017**





INCIDENT CLASSIFICATIONS

| Classification | Detail |
|---------------------------|---|
| Time and date of incident | 0725 hrs Monday 28 November 2016 |
| Region of incident | New South Wales |
| Affected regions | New South Wales |
| Event type | Power system was not secure |
| Generation Impact | No generator was disconnected or limited as a result of this incident |
| Customer Load Impact | No customer load was disconnected as a result of this incident |
| Associated reports | Nil |

IMPORTANT NOTICE

Purpose

AEMO has prepared this report in accordance with clause 4.8.15(c) of the National Electricity Rules, using information available as at the date of publication, unless otherwise specified.

Disclaimer

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CONTENTS

| | |
|---|----------|
| 1. OVERVIEW | 4 |
| 2. THE INCIDENT | 4 |
| 3. POWER SYSTEM SECURITY | 5 |
| 3.1 Contributing Factors leading to event | 5 |
| 4. CONCLUSIONS | 6 |
| 5. PENDING ACTIONS | 6 |
| APPENDIX A. – POWER SYSTEM DIAGRAM | 7 |



1. OVERVIEW

This report relates to a reviewable operating incident¹ that occurred on 28 November 2016 in the New South Wales (NSW) region. During this incident, the power system in NSW was not in a secure operating state for greater than 30 minutes due to high post-contingent voltage levels at Darlington Point substation.

No customer load or generation was lost as a result of this incident.

As a reviewable operating incident, AEMO is required to assess power system security over the course of this incident, and assess the adequacy of the provision and response of facilities and services and the appropriateness of actions taken to restore or maintain power system security.²

AEMO has concluded that:

- The power system was not in a secure operating state for 63 minutes.
- The root cause of the incident was an incorrect outage assessment due to a process failure.
- The delay in restoring the power system to a secure operating state was related to the time required to return a transmission line to work earlier than planned.

This report is prepared in accordance with clause 4.8.15(c) of the National Electricity Rules (NER). It is based on information from AEMO's energy management system (EMS).

Australian Eastern Standard Time (AEST) is used in this report. Local time in NSW in November is AEST plus one hour.

2. THE INCIDENT

At 0725 hrs on 28 November 2016, the Lower Tumut – Wagga 051 330 kV transmission line (051 line) was taken out of service for planned work. To support this outage, the following transmission lines were opened prior to this outage:

- Buronga – Darlington Pt tee Balranald 220 kV transmission line (X5 line) was opened at Buronga.
 - Wagga-Yass 132kV transmission line (990 line) opened at Yass.
 - Wagga North – Murrumburrah 132kV transmission line (991 line) opened at Murrumburrah.
 - Corowa – Mulwala 132kV transmission line (997 line) opened at Corowa.
 - Gadara – Tumut 132kV transmission line (99P line) opened both ends.
- Wagga – Australian Newsprint Mills 132kV transmission line (996 line) opened at Wagga.

Refer to Appendix A for a diagram of the relevant part of the power system.

From 0727 hrs, AEMO's real time contingency analysis (RTCA) tools indicated that, for the loss of the Buronga X5 reactor, the 330kV voltage levels at Darlington Point would exceed the allowable limit of 362kV. As a result of the high post-contingent voltage, the power system was not in a secure operating state.

AEMO determined there were no available options to reduce the post-contingent voltage levels, and at 0810 hrs AEMO instructed TransGrid to return the 051 line to service. At 0828 hrs, the 051 line was returned to service. The power system was not in a secure operating state for 63 minutes. These actions are explained further in Section 3.

The reason for investigating this incident is that the power system was not in a secure operating state for greater than 30 minutes.

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.

² See NER clause 4.8.15(b).



3. POWER SYSTEM SECURITY

AEMO is responsible for power system security in the National Electricity Market (NEM). This means AEMO is required to operate the power system in a secure operating state to the extent practicable and take all reasonable actions to return the power system to a secure state following a contingency event, in accordance with the NER.³

This section assesses how AEMO managed power system security over the course of this incident.

When the 051 line was taken out of service, AEMO's RTCA showed post-contingent⁴ voltage violations at Darlington Point.

The modelled post-contingent voltage at Darlington Point was 367 kV, which was above the maximum allowable voltage at Darlington Point of 362 kV.

AEMO discussed options to resolve this with TransGrid and Essential Energy. No alternatives were identified apart from recalling the outage of 051 Transmission line.

AEMO instructed TransGrid to return the 051 line to service, to return the power system to a secure operating state.

The power system was not returned to a security operating state within 30 minutes due to the time required to reinstate the line. AEMO considers that the actions taken following identification of the issue were appropriate.

3.1 Contributing Factors leading to event

3.1.1 State of System Configuration

The No. 4 reactor at Darlington point was not available at the time of this event due to a long term outage submitted by TransGrid (asset owner). The unavailability of the reactor resulted in the system being unable to keep the voltage within limits following a contingency.

3.1.2 Outage assessment Process

AEMO conducts assessments of planned outages advised by participants to determine if these outages will present a threat to power system security. The assessment process is described in the AEMO procedure SO_OP_3718 Outage Assessment Procedure⁵. In summary, each outage will undergo the following assessments (subject to how far in advance of the outage commencement the outage plan is submitted) to progressively assess and coordinate this and other outages:

- Medium term (MT) assessment – conducted greater than 8 days prior to outage.
- Short term (ST) assessment – conducted between 40 hours and 8 days prior to outage.
- Pre-dispatch (PD) assessment – less than 40 hours prior to outage.
- Dispatch (DS) assessment – immediately prior to outage, if expected conditions have changed materially since when the PD assessment was conducted.

3.1.3 Assessment of 051 line outage

For the 051 line outage on 28 November, an initial outage assessment was conducted five days before the outage. In this study, the No. 4 reactor at Darlington Point was incorrectly included as available plant.

This error was not discovered, until after the outage of 051 line had commenced and led to incorrect outcomes for this and subsequent assessments in the pre-dispatch and dispatch timeframes before the outage commenced.

The error occurred because

³ Refer to AEMO's functions in section 49 of the National Electricity Law and the power system security principles in clause 4.2.6 of the NER

⁴ Following a contingency event.

⁵ Available at <https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Security-and-reliability/Power-system-operation>



- The reactor model did not have the functionality to 'disconnect' it during outages. This is the functionality normally available and used for transmission equipment that is unavailable due to outages.
- A default model software setting defaulted to using all connected reactors (unless 'disconnected').

An additional error in the studies was modelling the X5 line as opened at both ends. This was due to an incorrect assumption AEMO made based on typical network configuration for a planned outage of X5 line. However, for the outage on 28 November, the X5 line was open at one end only.

These differences between the modelled system configuration and actual system configuration during the outages masked the potential for high post-contingent voltages at Darlington Point.

Following this event, AEMO has identified measures to improve the outage assessment process, including:

- Changed default settings in modelling tools, to prevent incorrect inclusion of plant that is not in service.
- Outage assessment process and procedures will be updated to ensure staff involved in outage assessment are aware of the limitations of the reactive device modelling, and appropriate reactive plant settings are applied during the assessment process. Staff have been advised of changes to this process. Procedure documentation changes will be completed by July 2017.
- Greater emphasis on outage assessment processes and tools will be included in staff training sessions due to commence in July 2017.

4. CONCLUSIONS

AEMO has assessed this incident in accordance with clause 4.8.15(b) of the NER. In particular, AEMO has assessed the adequacy of the provision and response of facilities or services, and the appropriateness of actions taken to restore or maintain power system security.

AEMO has concluded that:

- The power system was not in a secure operating state for 63 minutes.
- The root cause of the incident was an incorrect outage assessment due to a process failure.
- The delay in restoring the power system to a secure operating state was related to the time required to return a transmission line to work earlier than planned.

5. PENDING ACTIONS

- Updates to internal process documentation will be completed by 31 July 2017
- Inclusion of outage assessment processes and tools in training sessions commencing July 2017, with training to be delivered to all staff involved in outage assessment by the end of November 2017.

APPENDIX A. – POWER SYSTEM DIAGRAM

The power system immediately after the incident is indicated in Figure 1

Figure 1 Power system following the incident

