

TRIP OF BAYSWATER – REGENTVILLE AND BAYSWATER – SYDNEY WEST 330 KV TRANSMISSION LINES ON 24 JANUARY 2015

AN AEMO POWER SYSTEM OPERATING INCIDENT REPORT
FOR THE NATIONAL ELECTRICITY MARKET

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VERSION RELEASE HISTORY

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1	16 June 2015	M Diesendorf	DRAFT	S Darnell, J Lu	P Biddle

INCIDENT CLASSIFICATIONS

Time and date of incident	2045 hrs Saturday 24 January 2015
Region of incident	NSW
Affected regions	NSW
Event type	Loss of Multiple Transmission Elements (TT)
Primary cause	Protection and Control (PTN & CTR)
Generation Impact	No generation 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

ABBREVIATIONS

Abbreviation	Term
AEMO	Australian Energy Market Operator
CB	Circuit Breaker
DEF	Directional Earth Fault
kV	Kilovolt
Line 31	Bayswater - Regentville 31 330 kV transmission line
Line 32	Bayswater - Sydney West 32 330 kV transmission line
MW	Megawatt
NER	National Electricity Rules



IMPORTANT NOTICE

Purpose

AEMO has prepared this document to provide information about this particular Power System Operating Incident.

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1. OVERVIEW

This report reviews a power system operating incident that occurred on Saturday 24 January 2015 in New South Wales. This incident involved

- The trip and auto-reclose, at one end only, of the Bayswater – Regentville 31 330 kV transmission line (Line 31), and
- The trip of Bayswater – Sydney West 32 330 kV transmission (Line 32)

AEMO is required to assess power system security over the course of this incident as the incident is classified as a non-credible contingency that under the National Electricity Rules (NER)¹. Specifically, AEMO is required to 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 concluded that

- Line 31 tripped because of instability in a protection relay.
- Line 32 tripped due to a failed line insulator during a storm.
- Power system security was maintained over the course of the incident

This report is based on information provided by TransGrid³ and AEMO. National Electricity Market time (Australian Eastern Standard Time) is used in this report.

2. THE INCIDENT

On Saturday 24 January 2015 at 2045 hrs, during a lightning storm, Line 32 tripped and remained out of service. Simultaneously Line 31 tripped at one end then auto reclosed. Line 32 correctly tripped due to a line fault caused by lightning. Line 31 incorrectly tripped as a result of the line fault on Line 32.

No load or generation was lost as a result of this incident. Line 32 was returned to service the following day. See Appendix 1 for a power system diagram illustrating the incident and Appendix 2 for a chronological log of the incident.

The reason for investigating this incident is that Line 31 incorrectly tripped for a fault on Line 32. Generally transmission lines should remain connected to the power system for faults on other transmission Lines. The trip of Line 31 is an unexpected event and is identified in power system security terms as a non-credible contingency.⁴

3. TRANSGRID INVESTIGATION

TransGrid investigated the incident found that Line 32 tripped and locked out due to a phase to earth fault. The fault location was 3.55km from Bayswater 500/330kV substation. A patrol was carried out on Sunday 25 January 2015 and identified a failed insulator. TransGrid considered that a lightning strike had damaged the porcelain on a disc that then caused the insulator string to fail. The insulator was repaired and the line returned to service at 1532 hrs on Sunday 25 January 2015.

¹ Clause 4.8.15(a)(1)(i) and AEMC Reliability Panel Guidelines for Identifying Reviewable Operating Incidents.

² NER Clause 4.8.15 (b)

³ TransGrid is the Transmission Network Service Provider in the New South Wales region.

⁴ NER Clause 4.2.3 - Credible and non-credible contingency events; AEMO Power System Security Guidelines, Section 10 - Definition of a non-credible contingency events

TransGrid also investigated the trip of Line 31. TransGrid found that Line 31 tripped and auto reclosed at the Regentville end only. The trip at the Regentville was initiated by the No.2 Protection Directional Earth Fault (DEF) scheme. Following analysis of protection relay data TransGrid determined that the DEF relay was not defective but became unstable during the fault on Line 32. On Tuesday 3 February (10 days later) TransGrid disabled the No. 2 protection DEF scheme on Line 31. DEF protection is not required to meet NER requirements.

4. POWER SYSTEM SECURITY

This section assesses how power system security was managed over the course of the incident.⁵

Immediately following the incident AEMO invoked constraint set N-BWSW_32_OPEN.⁶ This action ensured that the power system remained in a secure state whilst the Line 32 was out of service.⁷

AEMO then issued Market Notice 47887 at 2123 hrs, approximately 38 minutes after the lines tripped, to notify the market of the non-credible contingency event.⁸

AEMO then assessed whether or not to reclassify the event as a credible contingency.⁹ For this incident AEMO was not satisfied that the cause had been identified and considered that the incident may reoccur. AEMO thereby reclassified the incident as a credible contingency and issued Market Notice 47888 at 2216 hrs to notify the market of the reclassification.

TransGrid replaced the damaged insulator disc on 25 January, the following day after the incident, and returned Line 32 to service. As result AEMO revoked constraint set N-BWSW_32_OPEN.

Following investigations TransGrid disabled the faulty DEF relay on 3 February. As a result, AEMO cancelled the reclassification and issued Market Notice 48073 at 1605 hrs 4 February 2015 to notify the market of the cancellation.

Over the course of the incident power system security was maintained. AEMO returned the power system to a secure state, correctly reclassified the incident, and issued appropriate notifications.

5. CONCLUSIONS

AEMO concluded that:

1. Line 32 tripped due to a defective insulator.
2. Line 31 tripped due to an unstable Directional Earth Fault Relay. The relay was disabled on 3 February. The protection is not required to meet NER requirements.
3. Power system security was maintained over the course of the incident.

⁵ AEMO is responsible for power system security in the NEM and is required to operate the power system in a secure operating state (NER Clause 4.2.4 (a)). AEMO must thereby ensure that the power system is maintained in, or returned to, a secure operating state following a contingency event.

⁶ Constraint set N-BWSW_32_OPEN constrains the power system for an outage of Line 32 while Redbank and Kuri 132 kV loop opened

⁷ AEMO is required to return the power system to a secure state within thirty minutes following a contingency event - NER Clause 4.2.6 (b)

⁸ AEMO is required to notify the Market of a non-credible contingency event within two hours of the event - AEMO, Power System Security Guidelines, Section 10.3

⁹ AEMO is required to assess whether or not to reclassify a non credible contingency event as a credible contingency - NER Clause 4.2.3A (c)) - and to report how re-classification criteria were applied - NER Clause 4.8.15 (ca). AEMO has to determine if the condition that caused the non-credible contingency event has been resolved.

APPENDIX A. – POWER SYSTEM DIAGRAM

The power system immediately after the incident

The status of the power system after the incident is shown below. The two circuit breakers at Regentville end of the Bayswater – Regentville 31 330 kV transmission line opened and reclosed. The two circuit breakers at Sydney West end and a circuit breaker at Bayswater end of the Bayswater – Sydney West 32 330 kV transmission line opened.

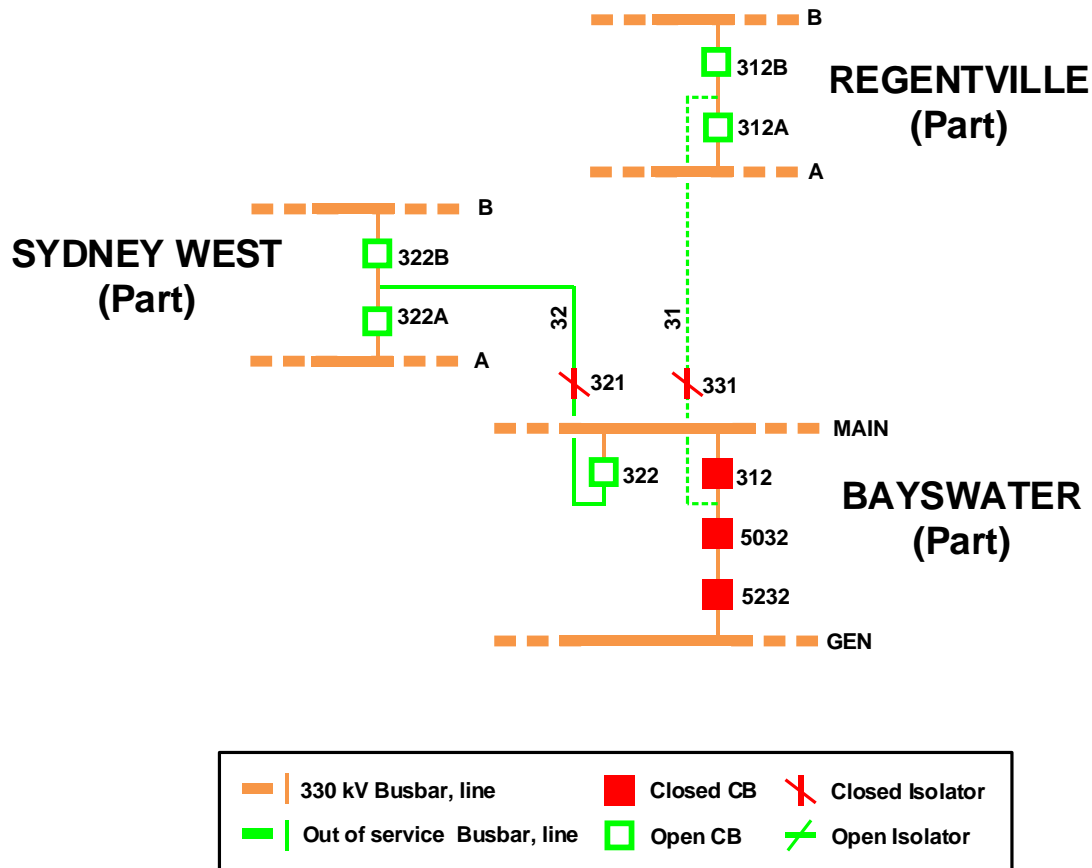


Figure 1 Status of the power system immediately after the incident



APPENDIX B. – INCIDENT EVENT LOG

Table 1 Incident Log

Time and Date	Event
2045 hrs 24 Jan 2015	Bayswater - Regentville 31 330 kV transmission line tripped and auto reclosed at the Regentville end (only)
2055 hrs 24 Jan 2015	Constraint set N-BWSW_32_OPEN invoked
2123 hrs 24 Jan 2015	AEMO issued Market Notice 47887: notified the market of the non-credible contingency event
2216 hrs 24 Jan 2015	AEMO issued Market Notice 47888: notification of reclassification non-credible contingency event to a credible contingency event.
25 Jan 2015	TransGrid repaired the defective insulator and returned Line 32 to service
1540 hrs 25 Jan 2015	AEMO revoked constraint set N-BWSW_32_OPEN
3 Feb 2015	TransGrid disabled the Directional Earth Fault scheme at the Regentville end (No.2 protection) on Line 31
1605 hrs 4 Feb 2015	AEMO issued Market Notice 48073: notification that AEMO had cancelled the reclassification because the cause has been identified and rectified