# Trip of Eildon – Mt Beauty 1 & 2 220 kV Lines on 20 December 2016

REVIEWABLE OPERATING INCIDENT REPORT UNDER THE NATIONAL ELECTRICITY RULES

Published: **6 April 2017**

AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

# INCIDENT CLASSIFICATIONS

| Classification | Detail |
|---|---|
| Time and date of incident | 0738 hrs Tuesday 20 December 2017 |
| Region of incident | Victoria |
| Affected regions | Victoria |
| Event type | Environment Lightning |
| 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

AEMO has made every effort to ensure the quality of the information in this report but cannot guarantee its accuracy or completeness. 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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# 1. OVERVIEW

This report relates to a reviewable operating incident[1] that occurred on Tuesday 20 December 2016 where the Eildon – Mt Beauty No.1 and No.2 (EPS-MBTS1 and EPS-MBTS2) 220kV lines in Victoria tripped simultaneously. The weather conditions at the time included lightning, wind and rain.

There was no loss of customer load or loss of any generation 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 trip of the EPS-MBTS1 and EPS-MBTS2 lines was likely due to lightning.
- All protection systems operated as designed and as expected.
- The power system remained in a secure operating state[3] during this incident.
- AEMO correctly reclassified the trip of the EPS-MBTS1 and EPS-MBTS2 lines as a credible contingency.
- As a result of this incident, the EPS-MBTS1 and EPS-MBTS2 lines have been classified as vulnerable to lightning.

This report is prepared in accordance with clause 4.8.15 of the National Electricity Rules (NER). It is based on information provided by AEMO and AusNet Services (AusNet)[4].

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

# 2. THE INCIDENT

On Tuesday 20 December 2016, lightning was occurring in the vicinity of EPS-MBTS1 and EPS-MBTS2 lines. At 0738hrs, both EPS-MBTS1 and EPS-MBTS2 lines tripped and successfully auto reclosed. Following this at 0739hrs, the EPS-MBTS1 line tripped and then auto reclosed at the Mt-Beauty end only.

# 3. PARTICIPANT INVESTIGATION

The following is based on information provided by AusNet.

At 07:38:18 hrs, both EPS-MBTS1 and EPS-MBTS2 lines tripped simultaneously due to a single phase (blue phase) to earth fault on both lines.

At the Eildon end, the fault was detected in zone 1 by both the ‘X’ and ‘Y’ protection relays of both lines and opened the line circuit breakers within 40ms.

At the Mt-Beauty end, the fault was detected in zone 3 (indicating a high impedance fault) and by the Directional Earth Fault (DEF) function of both the ‘X’ and ‘Y’ protection relays on both lines. Due to the high impedance fault, the DEF protection timed out before the zone 3 timer and opened the line circuit

[1] See NER clause 4.8.15
[2] See NER clause 4.8.15(b).
[3] See NER clause 4.2.4
[4] Information provided by AusNet Services has been provided on a without prejudice basis and nothing in this report is intended to constitute, or may be taken by any person as constituting, an admission of fault, liability, wrongdoing, negligence, bad faith or the like on behalf of AusNet Services (or its respective associated companies, businesses, partners, directors, officers or employees).

breakers at Mount Beauty in 220ms. Auto reclose was then initiated on both lines and the circuit breakers at both the Eildon and Mt-Beauty end reclosed successfully to return both lines to service.

At 07:39:08hrs, the EPS-MBTS1 line tripped due to a single phase (white phase) to earth fault. At the Eildon end, the fault was detected in zone 1 by both the 'X' and 'Y' protection relays of both lines and opened the circuit breakers within 45ms.

At the Mt-Beauty end, the fault was initially detected in Zone 3 (high impedance fault) by both the 'X' and 'Y' protection relays, and then migrated to Zone 2 after the circuit breaker at the Eildon end opened. The 'Y' protection then operated in accelerated zone two time and opened the circuit breaker at Mt Beauty within 73ms.

At the Mt-Beauty end, the circuit breaker reclosed successfully, but at the Eildon end auto reclose did not operate as the auto reclose was still being reset by AusNet following the first fault. The circuit breaker at the Eildon end was closed by AusNet at 0740hrs to return the line to service.

All protection operated as designed and as expected, and all faults were cleared within the timeframes required by the NER.[5]

On 20 December 2016, AusNet patrolled both lines based on fault location information from the protection relays. A damaged polymeric insulator was found on the White (top) phase at tower 339 of the EPS-MBTS1 line. AusNet plans to replace this insulator by the end of June 2017.

The weather conditions in the vicinity of the Eildon – Mt Beauty lines at the time of event included lightning, wind and rain.

# 4. 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.[6]

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

As the EPS-MBTS1 and EPS-MBTS2 lines were returned to service within a maximum of one minute, no action was required by AEMO to manage Power System Security.

## 4.1 Reclassification

AEMO was aware of lightning in the vicinity of the EPS-MBTS1 and EPS-MBTS2 lines prior to this incident. As the lines were not previously classified as vulnerable to tripping due to lightning, in accordance with operational procedures[7] AEMO did not reclassify the simultaneous loss of both lines as a credible contingency before the incident.

Immediately after the trip of the EPS-MBTS lines, AusNet advised AEMO that both lines had tripped on all three phases and the likely cause was lightning. In accordance with AEMO's procedures, AEMO then reclassified the loss of both lines as a credible contingency at 0752hrs. The reclassification was cancelled at 1315hrs. No constraints were required as part of this reclassification.

As a result of this incident, the EPS-MBTS1 and EPS-MBTS2 lines have been classified as vulnerable to tripping due to lightning, and AEMO's procedures have been updated to reflect this.

[5] See NER clause S5.1a8.
[6] 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
[7] SO_OP 3715 Power System Security Guidelines

# 5. MARKET INFORMATION

AEMO is required by the NER and operating procedures to inform the market about incidents as they progress. This section assesses how AEMO informed the market[8] over the course of this incident.

For this incident, AEMO was required to inform the market on the following matters:

- A non-credible contingency event - notify within two hours of the event.[9]
    - AEMO issued Market Notice 56339 at 0801 hrs – 22 minutes after the event
- Reclassification, details, and cancelation of a non-credible contingency – notify as soon as practical.[10]
    - AEMO issued Market Notice 56340 at 0802 hrs to advise market participants of the reclassification of the Eildon – Mt Beauty lines as a credible contingency.
    - AEMO issued Market Notice 56362 at 1320 hrs, to advise market participants that the reclassification of the Eildon – Mt Beauty lines as a credible contingency had been cancelled.

Over the course of this incident, AEMO issued appropriate, timely and sufficiently detailed market information.

# 6. CONCLUSIONS

AEMO has assessed this incident in accordance with clause 4.8.15 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 trip of the EPS-MBTS1 and EPS-MBTS2 lines was likely due to lightning.
- All protection systems operated as designed and as expected.
- The power system remained in a secure operating state during this incident.
- AEMO correctly reclassified the trip of the EPS-MBTS1 and EPS-MBTS2 lines as a credible contingency.
- As a result of this incident, the EPS-MBTS1 and EPS-MBTS2 lines have been classified as vulnerable to lightning.

[8] AEMO generally informs the market about operating incidents as the progress by issuing Market Notices – see AEMO website
[9] 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
[10] AEMO is required to notify the market of a reclassification NER clause 4.2.3(g), details of the reclassification 4.2.3(c) and when AEMO cancels the reclassification 4.2.3(h)