AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

Trip of both Tungatinah - Meadowbank - New Norfolk 110 kV Lines on 28 February 2018

November 2018

Reviewable Operating Incident Report under the National Electricity Rules

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.

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INCIDENT CLASSIFICATIONS

Classification	Detail
Time and date of incident	1443 hrs on 28 February 2018
Region of incident	Tasmania
Affected regions	Tasmania
Event type	Environmental - lightning
Generation Impact	10 MW generation lost
Customer Load Impact	3 MW load lost
Associated reports	Nil

ABBREVIATIONS

Abbreviation	Term
AEMO	Australian Energy Market Operator
CB	Circuit Breaker
kV	Kilovolt
MW	Megawatt
NER	National Electricity Rules

1. Overview

This report relates to a reviewable operating incident (being a non-credible contingency event)[1] that occurred on 28 February 2018 in Tasmania. This incident involved the simultaneous outage of the No.1 and No.2 Tungatinah-Meadowbank-New Norfolk 110kV transmission lines (No.1 & No.2 lines). This incident resulted in the loss of three megawatts (MW) of customer load and 10 MW of generation.

As this was 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:

1. The simultaneous trip of the No.1 & No.2 lines was caused by lightning. All protection operated as designed to clear the fault.
2. The power system remained in a secure operating state during this incident.
3. Before the incident occurred, the No.1 & No.2 lines had not been identified as vulnerable to lightning and the simultaneous trip of both lines was therefore not reclassified as a credible contingency event.
4. AEMO appropriately reclassified the event as a credible contingency immediately after the incident.
5. Following this incident and based on subsequent advice from TasNetworks, AEMO has updated its Power System Security Guidelines to list the No.1 & No.2 lines in the category of 'proven' on the list of lines vulnerable to lightning.

This report is prepared in accordance with clause 4.8.15(c) of the National Electricity Rules (NER). It is based on information provided by TasNetworks[3] and from AEMO's Energy Management Systems.

National Electricity Market Time (Australian Eastern Standard Time) is used in this report. Local time in Tasmania at the time of this incident is Market Time plus one hour.

2. The incident

At 1443 hrs on Wednesday, 28 February 2018 the No.1 & No.2 lines tripped simultaneously and then automatically reclosed at Tungatinah and New Norfolk. This resulted in the loss of 3 MW of customer load and 10 MW of generation at Meadowbank. TasNetworks manually reclosed the line circuit breakers at Meadowbank at 1456 hrs on the same day. All load was restored by 1456 hrs.

The simultaneous trip of multiple transmission lines is a non-credible contingency event under the NER. As it relates to a critical transmission element[4], it is a reviewable operating incident.

[1] See NER clause 4.8.15(a)(1)(i), as the event relates to a non-credible contingency event of significance to the operation of the power system under the AEMC Reliability Panel Guidelines for Identifying Reviewable Operating Incidents, being part of the 110kV network between Chapel St and Palmerston, which is a critical transmission element as identified on the list of critical transmission elements.

[2] See NER clause 4.8.15(b).

[3] TasNetworks is the transmission network service provider (TNSP) for the area in question.

[4] See AEMC Reliability Panel Guidelines for Identifying Reviewable Operating Incidents list of critical transmission elements

3. Incident Analysis

The following is based on information provided by TasNetworks as transmission network service provider (TNSP) for the Tasmania region.

There was a lightning storm in the vicinity of the No.1 & No.2 lines at the time of this incident. Both lines tripped at 1443 hrs on 28 February 2018, as a result of a fault consistent with a lightning strike approximately 13 km from Tungatinah, and approximately 380 metres[5] from the lines. In the area of the fault, the No.1 and No.2 lines are on the same dual circuit towers. There is no overhead earth-wire (OHEW) installed on these lines in the vicinity of the lightning strike[6].

An analysis of voltage indications at New Norfolk shows the strike resulted in a two phase to earth fault and was cleared by protection within approximately 0.07 seconds.

The circuit breakers (CBs) at both Tungatinah and New Norfolk substations successfully auto-reclosed to restore both lines. The auto-reclose function of the CBs at the Meadowbank substation is automatically blocked if both lines trip, to protect against an un-synchronised reclose on the Meadowbank generating unit. There is also an anti-islanding protection scheme at Meadowbank which operates to trip the Meadowbank generating unit following the loss of both transmission lines to Meadowbank substation. This is to prevent voltage and frequency excursions on the Meadowbank 22kV network. This protection scheme operated correctly. The CBs at Meadowbank were reclosed manually at 1456 hrs on 28 February.

TasNetworks conducted a line patrol in the area where the lightning strike was recorded. No damage or evidence of a fault was found.

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 operating state following a contingency event, in accordance with the NER[7].

The power system was in a secure operating state prior to and immediately after this incident. No specific action was required by AEMO to restore or maintain power system security.

AEMO invoked constraint set T-MB_ZERO during the period the Meadowbank generating unit was out of service to ensure it did not receive a dispatch target while disconnected from the power system.

4.1 Reclassification

Immediately after the incident AEMO assessed whether to reclassify this incident as a credible contingency event[8].

[5] As recorded by the GPATS Lightning tracking system

[6] As subsequently advised by TasNetworks. When these lines were constructed, the standard was to only install earth wire for the first 1.5km out from substations.

[7] 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

[8] AEMO is required to assess whether or not to reclassify a non-credible contingency event as a credible contingency event – NER clause 4.2.3A(c), and to report how the reclassification criteria were applied – NER clause 4.8.15(ca).

Prior to the event AEMO was aware of the lightning activity in the vicinity of the No.1 & No.2 lines. AEMO assessed it was not required to reclassify the loss of both lines as a credible contingency event, as its published Power System Security Guidelines did not identify these lines as vulnerable to lightning[9].

Immediately after the incident, TasNetworks advised that the lines had tripped simultaneously as a result of lightning. Based on this information, at 1500 hrs on 28 February, AEMO reclassified the simultaneous loss of the No.1 & No.2 lines as a single credible contingency event due to the continuing lightning activity in the vicinity of the lines. This reclassification remained in place until 1925 hrs on 28 February.

On 1 March 2018, AEMO updated its Power System Security Guidelines procedure to list the No.1 & No.2 lines as vulnerable to lightning in the category of 'probable'.

As noted, prior to this incident an outage to these lines due to lightning was not considered as 'reasonably possible' in accordance with the Power System Security Guidelines[10]. This is because the lines were assumed to have been fully covered by an OHEW when the guideline classifications were established.[11]. AEMO was subsequently advised by TasNetworks that the No.1 & No.2 lines are only partially covered by an OHEW. On 4 September 2018 AEMO therefore updated the Power System Security Guidelines to list the No.1 & No.2 lines as vulnerable to lightning in the category of 'proven'. This is standard practice for transmission lines without OHEW, irrespective of whether they have previously tripped due to lightning strikes.

During this investigation a small number of additional dual circuit transmission lines in Tasmania were identified as not fully covered by an OHEW, contrary to AEMO's previous understanding. The Power System Security Guidelines are being updated to reflect this new information. To ensure AEMO has the correct information for all regions, AEMO expects to complete a review of the OHEW status of all double circuit lines in other NEM regions by early December 2018.

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[12] over the course of this incident.

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

1. A non-credible contingency event - notify within two hours of the event[13].
   - AEMO issued Market Notice 61604 at 1506 hrs – 22 minutes after the event
2. Reclassification, details, and cancellation of a non-credible contingency – notify as soon as practical[14].
   - AEMO issued Market Notice 61606 at 1526 hrs hrs – 42 minutes after the event to advise participants that AEMO had reclassified the simultaneous loss of No.1 & No.2 lines as a credible contingency.
   - AEMO issued Market Notice 61611[15] at 1929 hrs to advise participants the reclassification had been cancelled.

[9] Refer to SO_OP 3715 *Power System Security Guidelines*, section 11.4

[10] Refer to SO_OP 3715 *Power System Security Guidelines*, section 11.4.1

[11] Unless informed by a TNSP AEMO assumes all major transmission lines are fully covered by an OHEW

[12] AEMO generally informs the market about operating incidents as the progress by issuing Market Notices – see AEMO website

[13] AEMO is required to notify the Market of a non-credible contingency event within two hours of the event - AEMO, Refer to SO_OP 3715 *Power System Security Guidelines*, section 10.3

[14] AEMO is required to notify the market of a reclassification NER clause 4.2.3A(g), details of the reclassification 4.2.3A(c) and when AEMO cancels the reclassification 4.2.3A(h)

[15] Corrected by Market Notice 61612 at 1949 hrs to advise participants of the correct constraint sets

6. 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:

1. The simultaneous trip of the No.1 & No.2 lines was caused by lightning. All protection operated as designed to clear the fault.
2. The power system remained in a secure operating state during this incident.
3. Before the incident occurred, the No.1 & No.2 lines had not been identified as vulnerable to lightning and the simultaneous trip of both lines was therefore not reclassified as a credible contingency event.
4. AEMO appropriately reclassified the event as a credible contingency immediately after the incident.
5. Following this incident and based on subsequent advice from TasNetworks, AEMO has updated its Power System Security Guidelines to list the No.1 & No.2 lines in the category of 'proven' on the list of lines vulnerable to lightning

7. Pending Actions

AEMO will review the coverage by OHEW of dual circuit transmission lines in other regions of the NEM, to be completed by early December 2018.