



Trip of Lismore – Mullumbimby tee Dunoon 9U6 and 9U7 132 kV lines on 25 January 2020

September 2020

Reviewable Operating Incident Report under the
National Electricity Rules

INCIDENT CLASSIFICATIONS

Classification	Detail
Time and date of Incident	1248 hrs on 25 January 2020
Region of incident	New South Wales
Affected regions	New South Wales
Event type	Environmental – lightning
Generation impact	No generation was disconnected as a result of this incident
Customer load impact	3 MW of customer load was momentarily disconnected as a result of this incident
Associated reports	Nil

ABBREVIATIONS

Abbreviation	Term
AEMO	Australian Energy Market Operator
AEST	Australian Eastern Standard Time
kV	Kilovolt
NEM	National Electricity Market
NER	National Electricity Rules
TNSP	Transmission Network Service Provider
OHEW	Overhead Earth Wire

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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1. Overview

This report relates to a reviewable operating incident¹ that occurred on 25 January 2020 in New South Wales. The incident involved the trip of Lismore – Mullumbimby tee Dunoon 9U6 and 9U7 132 kilovolt (kV) lines².

There was no loss of generation as a result of this incident.

This incident resulted in the momentary disconnection of 3 megawatts (MW) of customer load at Dunoon.

As this was a reviewable operating incident, 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 security³.

AEMO has concluded that:

1. The trip of the 9U6 and the 9U7 lines was likely due to lightning, and all protection operated as designed and as expected to clear the fault.
2. AEMO correctly reclassified the simultaneous trip of the 9U6 and 9U7 lines as a credible contingency after the incident.
3. AEMO now considers the 9U6 and 9U7 lines as vulnerable transmission lines with a category of probable due to lightning.
4. Essential Energy confirmed that the issue related to operation of the 9U6 line auto reclose at the Mullumbimby end has been resolved.
5. The power system remained in a secure operating state throughout this incident.

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 Essential Energy⁴ and AEMO.

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

2. The incident

2.1 Pre-incident conditions

The 9U6 and the 9U7 lines are double circuit lines on a single structure. Prior to the incident, there was lightning activity in the vicinity of the 9U6 and 9U7 lines.

At 1048 hrs on 25 January 2020, the 9U6 line tripped due to lightning and successfully auto reclosed. The 9U7 line tripped and successfully auto reclosed at 1246 hrs on the same day, two minutes before the non-credible contingency affecting both the 9U6 and 9U7 lines. Unlike the 9U6 line trip, there were no lightning strikes

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 critical transmission elements for the purpose of identifying reviewable operating incidents: https://www.aemo.com.au/-/media/files/electricity/nem/market_notices_and_events/power_system_incident_reports/critical_transmission_elements_for_identifying_reviewable_operating_incidents.pdf

³ See NER clause 4.8.15(b).

⁴ Essential Energy is an electricity infrastructure company which owns, maintains and operates the electrical distribution networks for much of New South Wales.

recorded at the time of trip. However, there were four lightning strikes recorded within a two-minute window either side of the time of trip.

As there has been no history of a simultaneous trip of both 9U6 and 9U7 lines due to lightning, AEMO was not required to reclassify simultaneous trip of the 9U6 and 9U7 lines prior to the incident.

2.2 The incident

At 1248 hrs on 25 January 2020, the 9U6 and the 9U7 lines tripped almost simultaneously, resulting in the trip of Directlink as per design⁵. The 9U7 line successfully auto reclosed at 1248 hrs. The 9U6 line auto reclosed at Lismore but was manually reclosed at the Mullumbimby end by Essential Energy at 1341 hrs due to failure of the auto reclose function. Two of the three cables of Directlink, DC1 and DC2, were returned to service at 1403 hrs and 1407 hrs, respectively. DC3 remained out of service until 28 January 2020 due to communication equipment issues. DC3 was returned to service at 1426 hrs on 28 January 2020.

2.3 Analysis

The following is based on information provided by Essential Energy.

2.3.1 Trip of 9U6 line

At 1248 hrs on 25 January 2020, the 9U6 tripped due to a B phase to earth fault and successfully auto reclosed at the Lismore end but not at the Mullumbimby end due to failure of the auto reclose function. The 9U6 line was restored to service manually at 1341 hrs. The B phase is the closest phase to the Overhead Earth Wire (OHEW), and this might have been a contributing factor.

Essential Energy advised that there were two lightning strikes on or near the 9U6 and the 9U7 lines at the estimated fault location at the time of incident. The lightning strikes had an approximate magnitude of 101.7 kA and 25 kA indicating one high magnitude lightning strike. Distance to fault location indicated that the fault was approximately 26 km from Mullumbimby.

Protection detected the earth fault and operated correctly and as expected to clear the fault.

Essential Energy have identified and corrected the auto reclose issue of the 9U6 line at the Mullumbimby end.

2.3.2 Trip of 9U7 line

At 1248 hrs, the 9U7 line also tripped due to a C phase to earth fault and successfully auto reclosed at 1248 hrs. The C phase is the closest phase to the OHEW, and this might have been a contributing factor.

Distance to fault location indicated that the fault was approximately 28 km from Mullumbimby.

Protection detected the earth fault and operated correctly and as expected to clear the fault.

Aerial patrols have been carried out on the 9U6 and the 9U7 lines and Essential Energy advised that no obvious signs of damage were observed which may have caused (or be the result of) the incident.

⁵ If both 9U6 and 9U7 line trip, the Essential Energy control scheme will automatically operate and trip all three legs of Directlink.

3. Power system security

AEMO is responsible for power system security in the 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 NER⁶.

The power system was in a secure operating state throughout this incident. The only action required by AEMO in relation to power system security was to invoke constraint set N-X_MBTE_3⁷ at 1255 hrs on 25 January 2020 to ensure Directlink did not receive dispatch targets while disconnected. Constraint set N-X_MBTE_3 was revoked at 1430 hrs after two legs of Directlink had been returned to service and constraint set N-MBTE_1⁸ was invoked at the same time. Constraint set N-MBTE_1 was revoked at 1255 hrs on 28 January 2020 after the third leg of Directlink, DC3, returned to service at 1426 hrs on the same day.

3.1 Reclassification

AEMO assessed whether to reclassify this incident as a credible contingency event⁹.

As Essential Energy could not determine whether the lightning strikes caused the incident, AEMO determined that a simultaneous trip of the 9U6 and 9U7 lines was likely to reoccur and correctly reclassified the simultaneous loss of the 9U6 and 9U7 transmission lines as a credible contingency from 1452 hrs on 25 January 2020.

AEMO followed up with Essential Energy on a regular basis, but Essential Energy was still unable to conclude that the lightning strike had caused the incident and the faults were not due to some other exceptional event. In February 2020, Essential Energy advised AEMO that the cause of the simultaneous trip of the 9U6 and 9U7 lines by a lightning strike was highly probable; however, AEMO did not interpret this advice as a conclusive determination that the double circuit trip was caused by lightning.

On 18 June 2020, Essential Energy confirmed that there was no evidence of any other cause that would have caused the double circuit trip.

AEMO followed the process specified in section 8.4 of SO_OP_3715 Power System Security Guidelines and attributed the double circuit trip to lightning.

This reclassification was cancelled at 1657 hrs on 18 June 2020. AEMO now considers the 9U6 and 9U7 lines as vulnerable transmission lines with a category of probable due to lightning.

The reclassification did not involve any constraints and consequently had no market impacts.

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 Out = all 3 legs of Directlink

⁸ Out = one leg of Directlink only.

⁹ 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).

4. 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 market¹⁰ over the course of this incident.

For this incident, AEMO informed the market on the following matters:

1. A non-credible contingency event – notify within two hours of the event¹¹.
 - AEMO issued Market Notice 73008 at 1452 hrs on 25 January 2020, 124 minutes¹² after the event, to advise of the non-credible contingency event, which was marginally beyond the two-hour time limit required by the Power System Security Guidelines.
2. Reclassification, details, and cancellation of a non-credible contingency – notify as soon as practical¹³.
 - AEMO issued Market Notice 73008 at 1452 hrs on 25 January 2020 to advise that AEMO had reclassified the incident as a credible contingency.
 - AEMO issued Market Notices 76003 at 1657 hrs on 18 June 2020 to advise that the reclassification of the simultaneous trip of the 9U6 and 9U7 lines had been cancelled, because a reoccurrence of the incident at that time was considered no longer reasonably possible.
3. Constraints invoked with interconnector N-Q-MNSP1 on Left Hand Side¹⁴.
 - AEMO issued Market Notice 73002 at 1259 hrs on 25 January 2020 to advise that it had invoked constraint set N-X_MBTE_3 at 1255 hrs. This constraint set contains constraint equations with the interconnector N-Q-MNSP1 on the LHS.
 - AEMO issued Market Notice 73007 at 1438 hrs on 25 January 2020 to advise that it had revoked the constraint set N-X_MBTE_3 at 1430 hrs and invoked constraint set N-MBTE_1 at the same time. This constraint set contains constraint equations with interconnector N-Q-MNSP1 on the LHS. The constraint set N-MBTE_1 was revoked at 1255 hrs on 28 January 2020.

5. 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 trip of the 9U6 and the 9U7 lines was likely due to lightning, and all protection operated as designed and as expected to clear the fault.

¹⁰ AEMO generally informs the market about operating incidents as they progress by issuing Market Notices – see <https://www.aemo.com.au/Market-Notices>.

¹¹ 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 7.3.

¹² AEMO complied with the two hours obligation; the additional four minutes was caused by a software delay.

¹³ 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).

¹⁴ For short notice outages, AEMO is required to notify the Market of variances to interconnector transfer limits as per section 22 of AEMO's Power System Security Guidelines.

2. AEMO correctly reclassified the simultaneous trip of the 9U6 and 9U7 lines as a credible contingency after the incident.
3. AEMO now considers the 9U6 and 9U7 lines as vulnerable transmission lines with a category of probable due to lightning.
4. Essential Energy confirmed that the issue related to operation of the 9U6 line auto reclose at the Mullumbimby end has been resolved.
5. The power system remained in a secure operating state throughout this incident.