AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

Trip of the Calvale to Stanwell 8873 and 8874 275 kV lines on 26 February 2020

June 2020

Reviewable Operating Incident Report under the National Electricity Rules

INCIDENT CLASSIFICATIONS

Classification	Detail
Time and date of incident	2350 hrs on 26 February 2020
Region of incident	Queensland
Affected regions	Queensland
Event type	Environmental – lightning
Generation Impact	No loss of generation
Customer Load Impact	No loss of customer load
Associated reports	Nil

ABBREVIATIONS

Abbreviation	Term
AEMO	Australian Energy Market Operator
AEST	Australian Eastern Standard Time
kV	Kilovolt
NER	National Electricity Rules
SPAR	Single phase auto-reclose

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 incident[1] that occurred on 26 February 2020 in Queensland. The incident involved the single phase trip and auto-reclose of the 8873 Calvale – Stanwell 275 kilovolt (kV) line (8873 line) and the 8874 Calvale – Stanwell 275 kV line (8874 line). These lines are dual circuit construction, meaning they share common towers for the entire length of the lines.

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

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 security[2].

AEMO has concluded that:

1. The single phase trip and reclose on the 8873 and 8874 lines was due to faults caused by lightning, and all protection systems operated as designed and as expected to clear the fault.
2. After the incident, AEMO correctly determined that reclassification of the simultaneous loss of both 8873 and 8874 lines as a credible contingency was not required.
3. 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 Powerlink and AEMO.

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

2. The incident

2.1 Pre-incident conditions

Immediately prior to this incident, AEMO and Powerlink[3] were aware of lightning activity in the area of 8873 and 8874 lines. In accordance with AEMO's Power System Security Guidelines[4], AEMO was not required to reclassify the simultaneous loss of both lines as a credible contingency, because the lines did not have a history of three phase tripping due to lightning.

2.2 The incident

At 23:50:01 hrs on 26 February 2020, the 'A' phase of both 8873 and 8874 lines tripped. The 'B' and 'C' phases of both lines remained in service. The 'A' phase of both lines then successfully auto-reclosed within six seconds.

[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] Powerlink is the transmission network service provider (TNSP) for Queensland.

[4] Refer to Section 8.4 of the Guidelines, at https://www.aemo.com.au/-/media/files/electricity/nem/security_and_reliability/power_system_ops/procedures/so_op_3715---power-system-security-guidelines.pdf?la=en.

2.3 Analysis

The following is based on information provided by Powerlink.

Coincident high voltage phase to ground faults occurred on the 'A' phase conductors of both 8873 and 8874 lines due to a lightning strike to a transmission tower or the overhead earthwire causing a double back-flashover event[5]. Fault location equipment indicated the faults occurred at similar locations on both lines in the area of lightning activity. Powerlink advised that there are no known issues with lightning protection equipment such as the overhead earthwire and surge diverters or tower footing resistance that would have increased the likelihood of these faults ocurring. The protection systems on both 8873 and 8874 lines operated as expected to clear the faults within 70 milliseconds. The faulted phase on both lines was successfully auto-reclosed within six seconds.

2.3.1 Single phase versus three phase tripping

There is an increasing trend towards single pole auto-reclose (SPAR) systems in modern power systems to increase the reliability of transmission systems. When a single phase to ground fault occurs, only that phase is tripped and then automatically reclosed after a suitable time to allow the fault to clear. If the auto-reclose fails, because the fault is still present on the line, then the other two phases are also tripped, and no further auto-reclosing takes place. If a phase to phase fault or a multi-phase to ground fault occurs, then all three phases are tripped and then automatically reclosed after a suitable time delay. Again, if the fault is still present on the line, all three phases will be tripped with no further auto-reclosing.

On non SPAR-equipped lines, a single phase to ground fault will result in the trip of all three phases. Auto-reclosing, if enabled, will then occur on all three phases.

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[6].

The power system was in a secure operating state throughout this incident. No action was required by AEMO to restore or maintain power system security.

3.1 Reclassification

AEMO assessed whether to reclassify this incident as a credible contingency event[7].

AEMO's Power System Security Guidelines indicate that any successful simultaneous SPAR operation on multiple lines does not require AEMO to reclassify the loss of the multiple lines as a credible contingency. Therefore, AEMO correctly determined that reclassification was not required for this incident.

[5] Back flashovers generally occur in transmission lines during lightning strikes when the potential of the tower rises in relation to the conductor. This causes the voltage across the insulators to increase beyond the withstand limits, resulting in a flashover.

[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] 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 market[8] over the course of this incident.

For this non-credible contingency event, AEMO was required to notify the market within two hours of the event[9]. AEMO issued Market Notice 74494 at 0117 hrs on 27 February 2020, 87 minutes after the event, to advise of the non-credible contingency event.

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 single phase trip and reclose on the 8873 and 8874 lines was due to faults caused by lightning, and all protection systems operated as designed and as expected to clear the fault.
2. After the incident, AEMO correctly determined that reclassification of the simultaneous loss of both 8873 and 8874 lines as a credible contingency was not required.
3. The power system remained in a secure operating state throughout this incident.

[8] AEMO generally informs the market about operating incidents as the progress by issuing Market Notices – see https://www.aemo.com.au/Market-Notices.

[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, at https://www.aemo.com.au/-/media/Files/Electricity/NEM/Security_and_Reliability/Power_System_Ops/Procedures/SO_OP_3715---Power-System-Security-Guidelines.pdf.