Trip of Nebo – Strathmore 878 and 8845 275kV transmission lines on 31 July 2018

November 2018

Reviewable Operating Incident Report under the National Electricity Rules

INCIDENT CLASSIFICATIONS

Classification	Detail
Time and date of incident	1337 hrs on 31 July 2018
Region of incident	Queensland
Affected regions	Queensland
Event type	Operator error
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 either incident
Associated reports	Nil

ABBREVIATIONS

Abbreviation	Term
AEMO	Australian Energy Market Operator
CB	Circuit Breaker
kV	Kilovolt
MW	Megawatt
NER	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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1. Overview

This report relates to a reviewable operating incident[1] that occurred on 31 July 2018 in North Queensland. The incident involved the near simultaneous trip of the 878 Nebo -Strathmore 275kV transmission line (878 line) and the 8845 Nebo – Strathmore 275kV transmission line (8845 line) and occurred during planned maintenance on the 7125 Collinsville North – Proserpine 132kV transmission line (7125 line).

No generation or customer load was lost because of the incident.

As this was a reviewable operating incident, AEMO is required to assess power system security over the course of each 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 878 and 8845 lines tripped due to single phase high voltage faults on each line. All protection operated as expected to clear the faults.
2. The high voltage faults occurred when the earth wire on the 7125 line came into close proximity to the 878 and 8845 lines conductors during planned work on the 7125 line.
3. Powerlink has reviewed the relevant procedures and made changes where considered necessary
4. The power system remained in a secure operating state over the course of the 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[3] and AEMO.

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

2. The incident

2.1 Pre-event conditions

Prior to this incident the 275kV and 132kV transmission networks between Nebo and Strathmore substations were in system normal condition with all lines except the 7125 line in service. The 7125 line was out of service for planned works in the area where this line crosses underneath the 878 and 8845 lines.

The 879 Strathmore – Ross 275kV transmission line (879 line) was also out of service for planned work with constraint set Q-SMRS[4] invoked.

2.2 The incident

At 13:37:54 hrs on 31 July the 878 line tripped followed by the 8845 line two seconds later due to single phase high voltage faults on both lines. There was no loss of generation or customer load as a result of this incident.

The 8845 line and 878 line were returned to service at 1530 hrs and 1531 hrs respectively on 31 July 2018.

[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 for the area in question.

[4] Out = 879 or 8857 or 8858 Strathmore to Ross 275kV lines. Limit Central to North Queensland flow for voltage stability.

2.3 Powerlink investigation

The following is based on information provided by Powerlink.

At 13:37:49 hrs the 878 line tripped single phase due to a high voltage fault of the 'C' phase conductors. At 13:37:54 hrs the 'C' phase auto-reclosed with the line then tripping on all three phases as the fault had not been cleared.

Similarly, at 13:37:51 hrs the 8845 line tripped single phase due to a high voltage fault on the 'B' phase conductors. At 13:37:56 hrs the 'B' phase auto-reclosed with the line then tripping on all three phases as the fault had not been cleared.

All protection systems operated as designed and as expected.

The high voltage faults on both lines occurred when the earth wire on the 7125 line came into close proximity to the 878 and 8845 line conductors during work on the 7125 line.

Powerlink has reviewed the relevant procedures and made changes where considered necessary.

2.4 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[5].

Immediately after the trip of the 878 and 8845 lines the power system was in a secure operating state. The transfer across the Central Queensland to North Queensland cut-set[6] was approximately 263 MW and approximately 83 MW across the Ross cut-set[7].

In consultation with Powerlink AEMO determined that to maintain the power system in a secure operating state a limit of 100MW should be applied to the Ross cut-set and constraint set Q-RS_100 was invoked at 1405 hrs. Further analysis showed this limit could be increased to 160 MW. Constraint set Q-RS_100 was revoked and constraint set Q-RS_160 invoked at 1420 hrs.

Initially it was not known when the 878 and 8845 lines would be available for service and it was possible they would still be unavailable after dark when the solar generation would reduce[8] resulting in a corresponding increase in flow across the Ross cut-set. To plan for this situation AEMO contacted the Generators in the area to determine their likely response to dispatch targets and availability for direction. It was determined that sufficient generation would be available to ensure the limit of 160 MW across the Ross cut-set could be maintained.

Both the 878 and 8845 lines were returned to service by 1531 hrs. The maximum flow across the Ross cut-set during this incident was 160 MW and there was no requirement for AEMO to issue any directions or take any further actions to maintain power system security.

2.4.1 Reclassification

AEMO assessed whether or not to reclassify this incident as a credible contingency[9].

Prior to the 878 and 8845 lines being returned to service Powerlink advised AEMO that the faults were due to an earth wire on the 7125 line contacting conductors on the 878 and 8845 lines during planned work. Powerlink advised this was unlikely to occur again. Based on this advice AEMO correctly determine that

[5] 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.

[6] Sum of flow on 275kV lines 834, 8846, 8847 & 821 at Nebo and 132kV lines 7124 & 7383 at Dysart.

[7] Sum of flow on 275kV lines 879, 8857 & 8858 at Ross, 132kV line 7128/2 at Collinsville and 132kV line 7208 at Strathmore.

[8] The large scale solar generatin north of Ross was approximately 160 MW at the time.

[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).

reclassification of the simultaneous loss of both the 878 and 8845 lines as a credible contingency was not required.

AEMO issued Market Notice 63678 at 1408 hrs on 31 July 2018 to notify the market that the incident would not be reclassified as a credible contingency.

2.5 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[10] 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 event[11].
   - AEMO issued Market Notice 63678 at 1408 hrs – 31 minutes after the event.

3. 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 878 and 8845 lines tripped due to single phase high voltage faults on each line. All protection operated as expected to clear the faults.
2. The high voltage faults occurred when the earth wire on the 7125 line came into close proximity to the 878 and 8845 lines conductors during planned work on the 7125 line.
3. Powerlink has reviewed the relevant procedures and made changes where considered necessary
4. The power system remained in a secure operating state over the course of the incident.

[10] AEMO generally informs the market about operating incidents as the progress by issuing Market Notices – see AEMO website at 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 10.3.