AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

Power system in Queensland not in a secure operating state after the trip of the Calvale to Wurdong transmission line on 16 June 2019

December 2019

Reviewable Operating Incident Report under the National Electricity Rules

INCIDENT CLASSIFICATIONS

Classification	Detail
Time and date of incident	0555 hrs 16 June 2019
Region of incident	Queensland
Affected regions	Queensland
Event type	Power system not in a secure operating state
Generation impact	Nil
Customer load impact	Nil
Associated reports	Nil

ABBREVIATIONS

Abbreviation	Term
AEMO	Australian Energy Market Operator
AEST	Australian Eastern Standard Time
CB	Circuit Breaker
HV	High voltage
kV	Kilovolt
NEM	National Electricity Market
NER	National Electricity Rules
TNSP	Transmission Network Service Provider

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

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1. Overview

This report relates to a reviewable operating incident[1] that occurred on 16 June 2019 in Queensland. The incident involved the power system in the Queensland region being operated in a non-secure operating state for greater than 30 minutes after the unplanned outage of the Calvale – Wurdong 871 275 kilovolt (kV) transmission line (871 line).

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. After the trip of the 871 line, the power system was not in a secure operating state for 91 minutes.
2. AEMO took all reasonable actions to restore the power system to a secure operating state as soon as practicable.
3. Subsequent to this incident, Powerlink[3] has developed a contingency plan to manage this situation in a more timely manner in the future. AEMO has reviewed this contingency plan and found it to be acceptable.

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 AEMO.

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

2. The incident

At 0555 hrs on 16 June 2019, the 871 line tripped, auto-reclosed, then immediately tripped again and remained unavailable for service.

With the 871 line out of service, the power system was in a satisfactory operating state, but further actions were required to restore the power system to a secure operating state.

In consultation with Powerlink, the power system was re-configured to restore the power system to a secure operating state by 0726 hrs on 16 June 2019.

The power system was therefore not in a secure operating state for 91 minutes.

[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 a transmission network service provider (TNSP) in Queensland.

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 NER[4].

The power system was in a secure operating state prior to this incident, but was not in a secure operating state after the trip of the 871 line at 0555 hrs.

Immediately after the trip of the 871 line, AEMO's power system analysis tools indicated that if the Calliope River – Wurdong 818 275 kV line (818 line) were to trip, then the Calliope River – Boyne Island 7145 and 7146 132 kV lines (7145 and 7146 lines) would be loaded to 108% of their capacity.

In response to this, Powerlink,and AEMO considered ways to resolve the issue. As there is no generation at Boyne Island there is no market solution to this issue. That is there are no constraint sets that AEMO could invoke that would reduce the potential line overloading. Powerlink had available a contingency plan which involved re-configuring the switchyard at Boyne Island such that Potline No. 1 was fed via the 7146 line, Potline No. 2 was fed via the 7145 line, and Potline No. 3 was fed via the Wurdong – Boyne Island 865 and 866 275 kV lines. This re-configuration switching would normally take up to 20 minutes to complete. Prior to implementing this contingency plan studies were required to ensure it would resolve the potential overloading of the 7145 and 7146 lines given the current generation patterns in Central Queensland. Also Powerlink were still analysing the fault on the 871 line to determine if a manual reclose attempt could be made. At 0625 hrs, after the required studies had been completed and it was determined that a manual reclose attempt would not be made until after a line patrol had be conducted, Powerlink requested Boyne Smelters to commence the re-configuring switching. This switching was completed at 0651 hrs on 16 June 2019, and resolved the potential overloading issue on the 7145 and 7146 lines.

However, at 0651 hrs on 16 June 2019, AEMO's power system analysis indicated a further problem associated with the loss of the 818 line, in that the loss of this line would cause voltage collapse in the Central Queensland area. This was an unexpected outcome as this type of problem had not been seen previously during outages of the 871 line.

After further consultation with Powerlink, and after running a further series of power system studies including reviewing the potential use of the capacitors at Wurdong, AEMO requested that Powerlink re-configure the switchyard at Wurdong by opening circuit breakers 5042 and 5052. In this configuration, the trip of the 818 line would automatically result in the loss of the No. 3 Potline at Boyne Island, preventing voltage collapse from occurring.

This action was completed at 0726 hrs on 16 June 2019, and returned the power system to a secure operating state.

The power system in Queensland was not in a secure operating state from 0555 hrs to 0726 hrs on 16 June 2019, a period of 91 minutes.

Post event analysis has shown that a reduction in load at Boyne Island Smelter would have resolved the initial line loading issues. However AEMO considers load shedding as a last resort method to manage power system security. In this case AEMO and Powerlink were actively working towards a solution that did not require load shedding and it was reasonable to continue with this process.

At 1111 hrs on 16 June 2019, Powerlink returned the 871 line to service[5]. The Wurdong and Boyne Island switchyards were returned to normal configuration at 1112 hrs and 1129 hrs respectively on 16 June 2019. In

[4] 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.

[5] Powerlink advised AEMO the initial fault on the line was caused by a snake.

response to the outage of the 871 line, AEMO invoked constraint set Q-CLWU[6] from 0610 hrs to 1130 hrs on 16 June 2019.

Subsequent to this incident, Powerlink has developed a revised contingency plan to also consider voltage requirements in Central Queensland and to manage this situation in a more timely manner in the future. AEMO has reviewed this contingency plan and found it to be acceptable.

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[7] over the course of this incident.

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

1. Constraints invoked with interconnector terms on left hand side[8].
   - AEMO issued Market Notice 68785 at 0613 hrs on 16 June 2019 to advise that constraint set Q-CLWU had been invoked.

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. After the trip of the 871 line, the power system was not in a secure operating state for 91 minutes.
2. AEMO took all reasonable actions to restore the power system to a secure operating state as soon as practicable.
3. Subsequent to this incident, Powerlink has developed a contingency plan to manage this situation in a more timely manner in the future. AEMO has reviewed this contingency plan and found it to be acceptable.

[6] Out= 871 line. Note this constraint set is designed to manage flows in the 275kV network. It does not manage flows on the 7145 and 7146 lines.

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

[8] For short-term outages, AEMO is required to notify the market of variances to interconnector transfer limits – section 22 of AEMOs Power System Security Guidelines Guidelines (SO_OP_37150), available at SO_OP 3715 Power System Security Guidelines.