



Trip of Liddell Unit 1 and 83 Line on 7 February 2020

July 2020

Reviewable Operating Incident Report under the
National Electricity Rules

INCIDENT CLASSIFICATIONS

Classification	Detail
Time and date of incident	04:10:50 hrs on 7 February 2020
Region of incident	New South Wales
Affected regions	New South Wales
Event type	Equipment failure
Generation impact	500 MW of generation capacity and 0 MW of actual generation was disconnected as a result of this incident
Customer load impact	No customer load was disconnected as a result of this incident.
Associated reports	Nil

ABBREVIATIONS

Abbreviation	Term
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AEST	Australian Eastern Standard Time
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.

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1. Overview

This report relates to a reviewable operating incident¹ that occurred on 7 February 2020 in New South Wales. The incident involved the trip of Liddell Unit 1 during its synchronisation, followed by the trip and reclosure of Liddell – Muswellbrook 83 330 kilovolt (kV) transmission line (83 line) at Muswellbrook.

There was a loss of 500 megawatts (MW) of generation capacity and 0 MW of actual generation as a result of this incident. There was no loss of 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 security².

AEMO has concluded that:

1. Liddell Unit 1 tripped at 04:10:50 on 7 February 2020 due to pole discrepancy on Circuit Breaker (CB) 5212 during its synchronization.
2. Liddell – Muswellbrook 83 330 kV line tripped and reclosed at the Muswellbrook end only.
3. The root cause of the 83 line trip was the failure of CB 5212 to open fully. The white phase of CB 5212 remained partially closed resulting in a partial fault that was seen by the 83 line directional earth fault (DEF) and distance protection elements.
4. The faulted CB was isolated and Liddell generator bus returned to service at 04:59 hrs on 7 February 2020.
5. Liddell CB 5212 returned to service on 19 February 2020.
6. The power system remained in a secure operating state.

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 TransGrid and AEMO.

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

2. The incident

2.1 The incident

At 04:11 hrs on 7 February 2020, Liddell Unit 1 tripped on pole discrepancy on CB 5212 during its synchronisation. Liddell – Muswellbrook 83 line also tripped at the Muswellbrook end following the unit 1 trip. Liddell generator bus was de-energised, and CB 5212 was isolated at 04:32 hrs on 7 February 2020.

Liddell generator bus returned to service at 04:59 hrs on 7 February 2020. Liddell CB 5212 returned to service on 19 February 2020.

A simplified circuit diagram of part of the power system immediately after the incident is in Appendix A1.

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).

2.2 Analysis

The following is based on information provided by TransGrid.

At 04:10:50 hrs on Friday 7 February 2020, Liddell Unit 1 tripped on pole discrepancy on CB 5212 during its synchronisation. Liddell Unit 1 was energised via the CB 5212, but it opened immediately. However, white phase of CB 5212 failed to open fully, resulting in tripping and reclosure of Liddell – Muswellbrook 83 line at the Muswellbrook end.

TransGrid confirmed that the cause of the trip of 83 line was the failure of white phase on CB 5212 to open fully, resulting in a partial (single-phase) fault that was seen by the 83 DEF and distance protection elements.

TransGrid confirmed that the 83 line is the only line on site which has combined distance and DEF protection schemes at both ends of the line. The Muswellbrook protection correctly sensed the forward DEF due to CB maloperation at the Liddell end and sent the DEF signal to the Liddell end. The protection relay at the Liddell end sensed that the fault was in reverse direction, and blocked the DEF elements, preventing the relay from operating. However, on receiving the DEF signal from Muswellbrook, it echoed back the DEF signal on “Weak Infeed” distance protection. The Muswellbrook protection relay then operated on receiving this echoed signal on DEF protection. TransGrid confirmed that the 83 line protections operated as designed.

TransGrid confirmed that Weak Infeed protection is designed to pick up low level earth faults that are very close to one end and cannot be seen from the other end. As 83 line is relatively short, this is an unlikely scenario, hence the Weak Infeed setting in the Liddell end of 83 Line Protection Scheme was disabled on 7 February 2020 to avoid any similar maloperation.

TransGrid also confirmed that it has checked all other similar CBs on site for the identified issue and did not find a problem elsewhere. TransGrid advised that this is the first failure of this type resulting in a partially opening 330 kV CB, and there is no history or trend identified that would warrant further investigations.

Liddell generator bus was de-energised, and CB 5212 was isolated at 04:32 hrs on 7 February 2020.

Liddell generator bus returned to service at 04:59 hrs on 7 February 2020. Liddell CB 5212 returned in service on 19 February 2020.

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 NER³.

The power system was in a secure operating state prior to and during this incident and AEMO was not required to take any action in relation to power system security.

3.1 Reclassification

AEMO assessed whether to reclassify this incident as a credible contingency event⁴.

AEMO was advised by TransGrid that the cause of the incident had been identified and the CB 5212 had been isolated prior to restoration of the busbar. As such, AEMO responded correctly and did not classify this non-credible contingency as a credible contingency event.

³ 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.

⁴ 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 market⁵ 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 event⁶.
 - AEMO issued Market Notice 73893 at 0457 hrs on 7 February 2020, 46 minutes after the event, to advise of the non-credible contingency event, and to advise that the cause of this non-credible contingency event had been identified and AEMO was satisfied that another occurrence of this event was unlikely under the circumstances.

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. Liddell Unit 1 tripped at 04:10:50 on 7 February 2020 due to pole discrepancy on CB 5212 during its synchronisation.
2. Liddell – Muswellbrook 83 330 kV line tripped and reclosed at the Muswellbrook end only.
3. The root cause of the 83 line trip was the failure of CB 5212 to open fully. The white phase of CB 5212 failed to open fully resulting in a partial fault that was seen by the 83 line DEF and distance protection elements.
4. The faulted CB was isolated and Liddell generator bus returned to service at 04:59 hrs on 7 February 2020.
5. Liddell CB 5212 returned to service on 19 February 2020.
6. The power system remained in a secure operating state.

⁵ AEMO generally informs the market about operating incidents as they progress by issuing Market Notices – see <https://www.aemo.com.au/Market-Notices>.

⁶ 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.

A1. System diagram

The diagram below provides an overview of part of the power system immediately after the incident .

Figure 1 Simplified single line diagram of 330 kV Liddell substation

