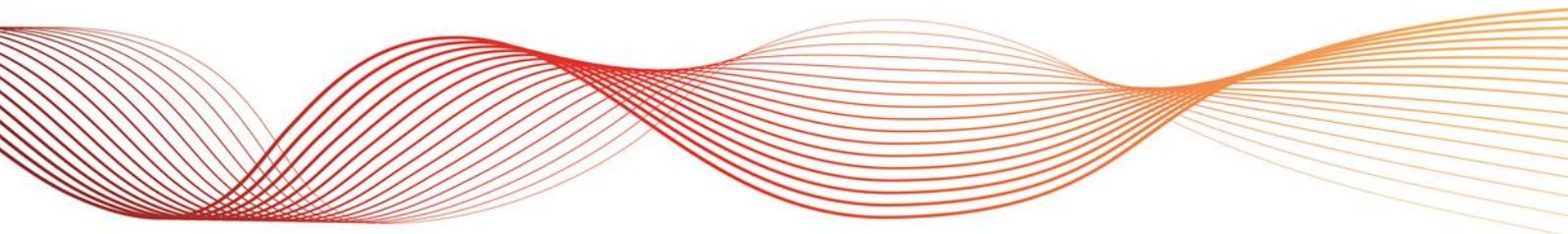




TRIP OF BOTH FARRELL– REECE 220KV TRANSMISSION LINES ON 31 JULY 2016

REVIEWABLE OPERATING INCIDENT REPORT UNDER THE
NATIONAL ELECTRICITY RULES

Published: **October 2016**





INCIDENT CLASSIFICATIONS

Classification	Detail
Time and date of incident	0602 hrs 31 July 2016
Region of incident	Tasmania
Affected regions	Tasmania
Event type	Environmental – lightning
Generation Impact	269 MW of generation was lost as a result of this incident
Customer Load Impact	No loss of customer load
Associated reports	Nil

Abbreviations

Abbreviation	Term
Hz	hertz
kV	kilovolt
MW	megawatt
ms	millisecond
NER	National Electricity Rules
NEM	National Electricity Market
pu	per unit



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 incident¹ that occurred on 31 July 2016 in Tasmania. This incident involved the simultaneous trip of the Farrell–Reece No.1 and No.2 220 kV transmission lines and the loss of 239 MW of generation at Reece power station.

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 power system security over the course of this 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 simultaneous trip of the Farrell–Reece No.1 and No.2 220 kV lines was likely due to lightning.
2. The power system remained in a secure operating state after this incident and no action was required by AEMO.
3. AEMO's reclassification procedures incorrectly identified the Farrell-Reece lines as not vulnerable to tripping due to lightning.
 - AEMO has amended its procedures to show that the Farrell–Reece No.1 and No.2 220 kV lines are vulnerable to simultaneous tripping due to lightning.

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 TasNetworks and Hydro Tasmania.

Australian Eastern Standard Time is used in this report.

2. THE INCIDENT

At 0602 hrs on 31 July 2016, the Farrell–Reece No.1 and No.2 lines tripped simultaneously. There was lightning reported in the area at the time. Prior to the incident, the Reece generating units were generating 120 MW and 119 MW, resulting in a generation loss of 239 MW.

At the time of the incident, generation from the Woolnorth (Bluff Point) wind farm reduced from 53 MW to 23 MW.

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

Both transmission lines were returned to service at 0606 hrs on 31 July 2016, and Reece power station resumed operation at 1130 hrs on 31 July 2016. Woolnorth (Bluff Point) generation returned to near pre-incident levels by 0607 hrs on 31 July 2016.

The reason for investigating this incident is that the simultaneous trip of two transmission lines is considered a non-credible contingency.³

3. PARTICIPANT INVESTIGATIONS

3.1 TasNetworks

TasNetworks, as the owner and operator of the transmission network in Tasmania, investigated this incident and provided the following information.

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 See NER clause 4.2.3.

At 0602 hours on 31 July 2016, the Farrell–Reece No 1 and 2 220 kV transmission lines tripped due to a suspected lightning strike. Both transmission lines were tripped from the Farrell end and locked out.

Lightning strikes were reported in close proximity to the Farrell–Reece 220 kV transmission corridor. However, a ground patrol completed on 8 August 2016 did not find any obvious flashover marks in the area of the lightning strikes.

Protection relay data indicated phase to phase faults for both circuits. Both faults were cleared in less than 60ms. TasNetworks has a policy of not auto-reclosing transmission lines for phase to phase faults. It is suspected that the phase to phase flashover could be as a result of the towers in the fault area having relatively high tower footing resistance.⁴

Both transmission lines were returned to service at 0606 hrs on 31 July 2016.

3.2 Hydro Tasmania

Hydro Tasmania, as the operator of the Woolnorth wind farms, has investigated the reduction in output and provided the following information.

At the time of the incident, 15 turbines at Bluff Point shut down for up to two minutes. Voltage levels at the connection point fell to a minimum of around 80 kV (0.73 pu) and recovered to above 110 kV (1.0 pu) within around 100ms.

Hydro Tasmania is continuing to assess the operation of these turbines to determine both:

- The cause of the shutdown.
- Whether the turbines responded in accordance with the Generator Performance Standard for Bluff Point.

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 and return the power system to a secure state following a contingency event. This section assesses how AEMO managed power system security over the course of this incident.⁵

No action was required by AEMO to manage power system security. As both the Farrell–Reece transmission lines were returned to service within less than five minutes, no constraints were required to be invoked.

4.1 Frequency

The minimum observed frequency in Tasmania during this incident was 49.025 Hz. The frequency returned to 50 Hz within around eight seconds, largely due to the response of the Basslink frequency controller, which (as it is designed to do) rapidly reduced the flow on Basslink.⁶

The frequency operating standard was met for this event.⁷

Figure 1 shows the frequency and the subsequent change in flow on Basslink.

⁴ TasNetworks has initiated a project to review and improve tower earthing arrangements in this area under its 2014–2019 Network Capability Incentive Parameter Action Plan (NCIPAP).

⁵ AEMO is responsible for power system security in the NEM and is required to operate the power system in a secure operating state (NER Clause 4.2.4 (a)). AEMO must thereby ensure that the power system is maintained in, or returned to, a secure operating state following a contingency event.

⁶ Basslink flow was from Tasmania to Victoria at the time of this incident.

⁷ The frequency operating standard allows frequency to fall to 47 Hz for a multiple contingency event.

Figure 1 Frequency and Basslink flow


4.2 Reclassification

Prior to this incident, AEMO was aware of lightning in the west coast area of Tasmania. Earlier in the morning, AEMO had reclassified the loss of other lines in the Farrell / Sheffield area as credible contingency events.⁸ However, at the time of this incident, the Farrell–Reece lines were not classified as vulnerable to tripping due to lightning⁹, and AEMO did not reclassify the loss of the Farrell–Reece No.1 & No.2 lines as a credible contingency event prior to the incident.

At 0606 hrs, when the Farrell–Reece lines had been returned to service, AEMO assessed whether to reclassify the simultaneous trip of both Farrell–Reece lines as a single credible contingency.¹⁰ On the basis that no further lightning activity was observed in the area, and the Reece generation had not been returned to service, AEMO determined not to reclassify the loss of the Farrell–Reece No.1 and No.2 220 kV lines as a single credible contingency, and no constraint sets were invoked.

As a result of this incident, the Farrell–Reece No.1 and No.2 220 kV lines were classified as vulnerable¹¹ to tripping due to lightning. Market Notice 54640 was issued on 31 July 2016 to advise the market of this change, and AEMO’s Power System Security Guidelines procedure was updated on 9 August 2016 to reflect this change.

Subsequent to this incident, AEMO has determined that the Farrell-Reece lines should not have been removed from the list of vulnerable lines during the review of reclassification criteria due to lightning. In the review process, AEMO failed to take account of a similar trip of both Farrell-Reece lines on 2 August 2015¹².

Records show very few lightning strikes in the vicinity of the Farrell-Reece lines prior to the lines tripping. If the Farrell-Reece lines had been considered as vulnerable on 31 July 2016, it is unlikely that AEMO would have reclassified the simultaneous trip of both Farrell-Reece lines as a single credible contingency.

However if the loss of both lines had been reclassified as a single credible contingency this would require AEMO to invoke constraint set F-T-FARE_N-2¹³. AEMO has re-run the dispatch interval for 0530 hrs on 31 July 2016 with the F-T-FARE_N-2 constraint set invoked to determine the impact this constraint set would have had if a reclassification had been in place. There was no change to market outcomes.

⁸ Refer to Market Notices 54633 and 55634 issued at 0412 hrs and 0458 hrs respectively on 31 July 2016.

⁹ The Farrell-Reece lines had been removed from the list of vulnerable lines after a review of the reclassification criteria due to lightning. Refer to section 11 of SO_OP 3715 – Power System Security Guidelines, and AEMO Communication issued on 29 July 2016.

¹⁰ AEMO is required to assess whether or not to reclassify a non-credible contingency event as a credible contingency - NER Clause 4.2.3A (c) - and to report how re-classification criteria were applied - NER Clause 4.8.15 (ca). AEMO has to determine if the condition that caused the non-credible contingency event has been resolved.

¹¹ In the category of probable.

¹² A report on this incident is available on the AEMO website at:

<http://www.aemo.com.au/media/Under%20frequency%20load%20shedding%20in%20Tasmania%20on%20Sunday%202%20August%202015.pdf>

¹³ F-T-FARE_N-2 sets frequency control ancillary service (FCAS) requirements to cover the loss of both Reece generating units.

AEMO has updated the Power System Security Guidelines procedure to include the Farrell-Reece lines as vulnerable in the category of proven.

For this incident the power system remained in a secure operating state over the course of the incident.

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 market¹⁴ over the course of this incident.

For this incident, AEMO was required to inform the market on the following matters:

1. A non-credible contingency event – notify within two hours of the event.¹⁵
 - AEMO issued Market Notice 54639 at 0625 hrs on 31 July 2016, 23 minutes after the event occurred at 0602 hrs).
2. Determination that the Farrell-Reece No.1 and No.2 lines have been assessed as vulnerable lines.¹⁶
 - AEMO issued Market Notice 54640 at 0705 hrs on 31 July 2016.

Over the course of this incident, AEMO issued appropriate, timely, and sufficiently detailed market information.

6. 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 simultaneous trip of the Farrell-Reece No.1 and No.2 220 kV lines was likely due to lightning.
2. The power system remained in a secure operating state after this incident and no action was required by AEMO.
3. AEMOs reclassification procedures incorrectly identified the Farrell-Reece lines as not vulnerable to tripping due to lightning.
 - AEMO has amended its procedures to show that the Farrell-Reece No.1 and No.2 220 kV lines are vulnerable to simultaneous tripping due to lightning.

7. PENDING ACTIONS

1. Hydro Tasmania will advise AEMO of the cause of the turbine shutdowns at Woolnorth (Bluff Point) wind farm. This action is to be completed by 31 October 2016.
2. On receipt of this advice from Hydro Tasmania, AEMO will determine if the operation of the turbines at Woolnorth (Bluff Point) wind farm was in accordance with the registered Generator Performance Standard.

¹⁴ AEMO generally informs the market about operating incidents as they progress by issuing Market Notices – see AEMO website.

¹⁵ 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

¹⁶ According to Section 11 of SO_OP 3715 – Power System Security Guidelines.