

POWER SYSTEM OPERATING INCIDENT REPORT – SIMULTANEOUS TRIP OF FARRELL-REECE NO.1 AND NO.2 220 KV LINES ON 8 AUGUST 2012

PREPARED BY: Systems Capability

DATE: 24 October 2012

FINAL

Disclaimer

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Abbreviations and Symbols

Abbreviation	Term
AEMO	Australian Energy Market Operator
CB	Circuit Breaker
EMMS	Electricity Market Management System
EMS	Energy Management System
GPATS	Global Position and Tracking Systems
kV	Kilovolt
MW	Megawatt
NEM	National Electricity Market

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1 Introduction

At 2159 hours on 8 August 2012, the Farrell-Reece No.1 and No. 2 220 kV transmission lines in Tasmania simultaneously tripped out of service. The tripping of the two lines resulted in the loss of both generating units at Reece Power Station, which were generating a total of 80 MW prior to the incident. The Global Position and Tracking Systems (GPATS) at AEMO and Transend indicated that there was lightning activity in the vicinity of the lines at the time of the incident. Both lines were returned to service by 2212 hours on 8 August 2012.

This report has been prepared under clause 4.8.15 (c) of the National Electricity Rules (NER) 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.

This report is largely based upon information provided by Transend Networks. Data from AEMO's Energy Management System (EMS) and Electricity Market Management System (EMMS) has also been used in analysing the incident.

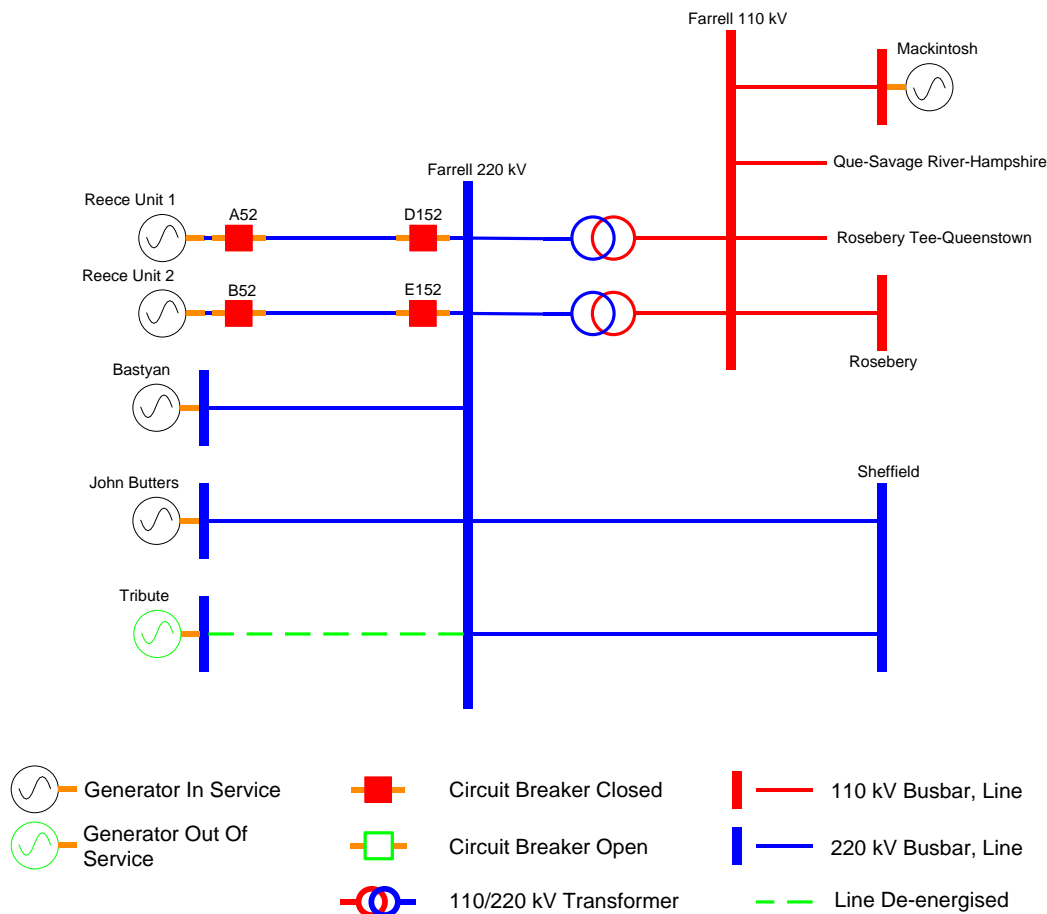
All references to time in this report are to National Electricity Market time (Australian Eastern Standard Time).

2 Pre-Contingent System Conditions

Prior to the incident, all equipment connected to the Farrell 220 kV busbars was in-service except for the Tribute generator, which was offline. There were no planned outages or protection system works being carried out in the vicinity prior to the system incident.

The status of the power system prior to the incident is shown in Figure 1. For clarity only equipment relevant to this incident has been included in the diagram.

Figure 1 - Status of the power system prior to the incident



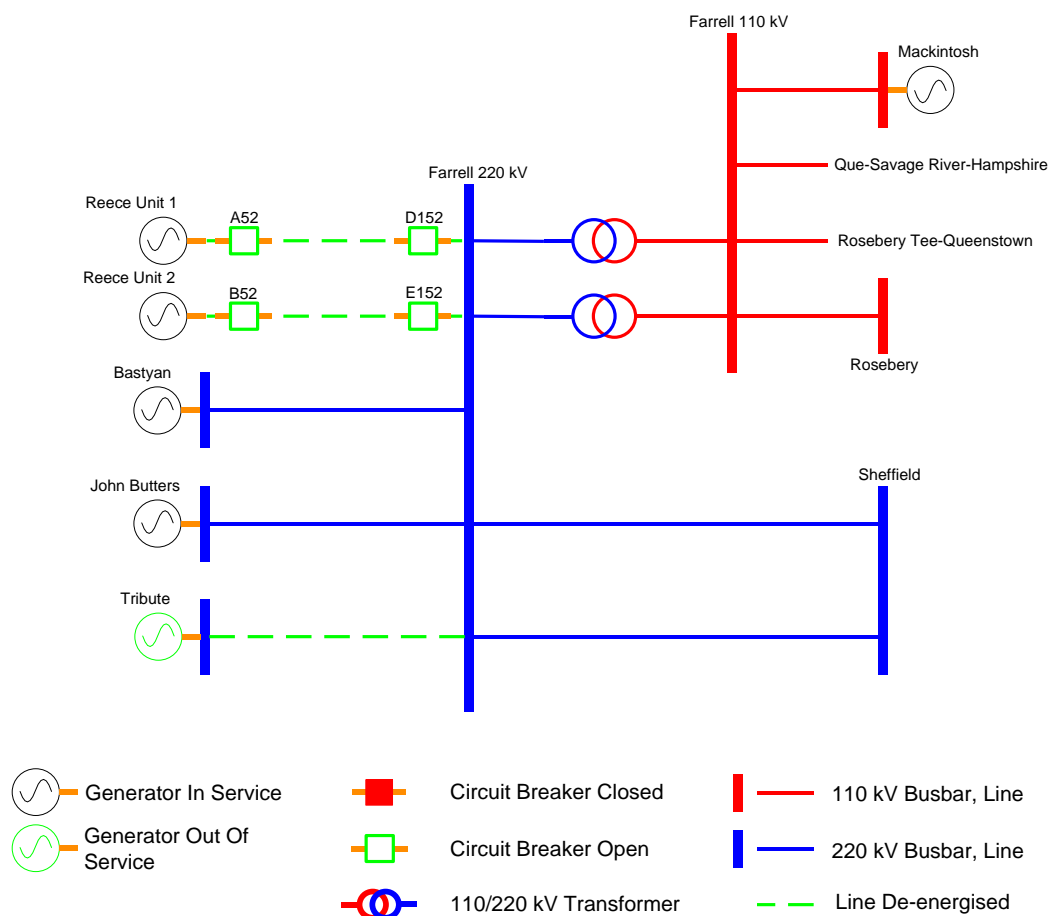
3 Summary of Events

At 2159 hours on 8 August 2012, the Farrell-Reece No.1 and No. 2 220 kV transmission lines simultaneously tripped due to a phase to phase fault, opening the following circuit breakers at Farrell Substation and Reece Power Station:

- 220 kV D152 Circuit breaker at Farrell Substation;
- 220 kV E152 Circuit Breaker at Farrell Substation;
- 220 kV A52 Circuit Breaker at Reece Power Station; and
- 220 kV B52 Circuit Breaker at Reece Power Station.

The status of the power system immediately after the incident is shown in Figure 2.

Figure 2 - Status of the power system immediately after the incident



The line protection systems on the Farrell-Reece No.1 and No. 2 transmission lines detected a fault on the white and blue phase conductors of each line. The protection system for each line issued a three pole trip to the circuit breakers D152 and E152 at Farrell Substation respectively, and locked out single pole auto-reclose. The protection system also operated correctly by transmitting permissive inter-trip signals to the remote end line protection systems, and tripped the circuit breakers A52 and B52 at Reece Power Station.

At 2212 hours on 8 August 2012, both Farrell-Reece No.1 and No. 2 transmission lines were returned to service by closing the circuit breakers D152 and E152 at Farrell Substation.

At 2317 hours on 8 August 2012, Generating Unit No.1 at Reece Power Station was returned to service.

At 2321 hours on 8 August 2012, Generating Unit No.2 at Reece Power Station was returned to service.

Ground inspection was performed by Transend at the fault location indicated by the GPATS and protection systems, but the exact cause of the fault was not found. However the information from Transend GPATS suggested that the lightning strike may have hit the ground beside the Farrell-Reece No.1 and No. 2 transmission lines. Based on the GPATS information, fault recordings and past experiences, Transend believe that due to the resistive nature of the soil in the transmission line easement the lightning strike to the ground near the transmission line caused a ground potential rise, and subsequently initiated a flash over from the tower to the white and blue phase conductors on the lines.

4 Immediate Actions Taken

Following the incident, Transend personnel were dispatched to investigate the Farrell-Reece No.1 and No. 2 transmission lines based on the fault location indicated by the GPATS and protection systems. Ground inspection was performed at the fault location, but no evidence of fault was found. The ongoing lightning activity prevented the Transend personnel from climbing the towers for further investigation.

At 2228 hours on 8 August 2012, AEMO issued Electricity Market Notice No.39378 advising of the occurrence of this non-credible contingency event.

In accordance with its operating procedure SO_OP 3715 Power System Security Guidelines, AEMO determined that it was appropriate to declare the Farrell-Reece No.1 and No. 2 220 kV lines as vulnerable and reclassify the lines as a credible contingency event when lightning is detected in proximity of the lines.

5 Follow-up Actions

Transend checked the protection relays at Farrell Substation and confirmed that the protection on the Farrell-Reece No.1 and No. 2 220 kV transmission lines operated as expected. The protection relay logs indicated that the fault occurred simultaneously on the white and blue phases on both Farrell-Reece No.1 and No. 2 220 kV transmission lines. The logs also indicated that three pole trips were issued to the circuit breakers at Farrell Substation, and locked out single pole auto reclose as per design.

Transend are planning to conduct aerial patrols of these lines in October and will advise AEMO of any significant findings.

Transend have identified time stamping issues affecting the protection on the Farrell-Reece No.1 and No. 2 220 kV transmission lines, and incorrect indication of some protection relay operations. Transend will investigate and rectify the issues.

The historical analysis of similar faults performed by Transend revealed some long term trends indicating that the simultaneous trip of both Farrell-Reece No.1 and No.2 220 kV transmission lines is likely to occur every 4.3 years. Transend will investigate the adequacy of the earthing and lightning protection arrangement on the Farrell-Reece No.1 and No.2 220 kV transmission lines.

On 9 August 2012, AEMO updated its operating procedure SO_OP 3715 Power System Security Guidelines to include the Farrell-Reece No.1 and No. 2 220 kV transmission lines as vulnerable transmission lines.

6 Power System Security Assessment

The power system voltages and frequencies remained within the normal operating bands and the power system remained in a secure operating state throughout the incident.

The provision and response of facilities and services were adequate to maintain power system security.

7 Conclusions

At 2159 hours on 8 August 2012, the Farrell-Reece No.1 and No. 2 transmission lines tripped simultaneously on white to blue phase faults, resulting in a loss of 80 MW of generation at Reece Power Station.

There was no loss of power system security as a result of this incident.

AEMO correctly applied the criteria published in section 12 of its Power System Security Guidelines in assessing the reclassification of the Farrell-Reece No.1 and 2 220 kV transmission lines as a credible contingency event when lightning is detected in the vicinity of the lines.

8 Recommendations

1. Transend to inform AEMO on any findings from the aerial inspection on the Farrell-Reece No.1 and No. 2 220 kV transmission lines by 31 October 2012.
2. Transend to resolve the time stamping issues with the relevant protection relays on the Farrell-Reece No.1 and No. 2 220 kV transmission lines by 30 December 2012.
3. Transend to resolve the incorrect protection relay indications on the Farrell-Reece No.1 and No. 2 220 kV transmission lines by 30 December 2012.
4. Transend to investigate and report on the adequacy of the earthing and lightning protection arrangement on the Farrell-Reece No.1 and No.2 220 kV transmission lines by 30 December 2012.