

# POWER SYSTEM INCIDENT REPORT TRIP OF COWRA 132 KV BUSBAR ON 5 FEBRUARY 2011

PREPARED BY: Electricity System Operations Planning and Performance

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FINAL

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## Abbreviations and Symbols

Abbreviation	Term
AEMO	Australian Energy Market Operator Ltd
EST	Eastern Standard Time
kV	kilovolt
MW	megawatt
MWh	megawatt hour (also MW-h)
NEM	National Electricity Market
NER	National Electricity Rules

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# 1 Introduction

At 1845 hrs on 5 February 2011, the 132 kV busbar at Cowra 132 kV substation in New South Wales tripped disconnecting approximately 50 MW of customer load. Thunderstorm activity was experienced in the area at the time. The customer load was restored by 2115 hrs on the same day.

This report has been prepared under clause 4.8.15 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 TransGrid. Data from AEMO’s Energy Management System has also been used in analysing the event.

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

# 2 Pre-contingency System Conditions

The status of the relevant power system equipment before the incident is shown in Figure 1. Prior to the incident, the 94U Forbes–Parkes 132 kV line was open and Forbes was supplied from Cowra via the 998 Cowra–Forbes 132 kV line as shown in Figure 1.

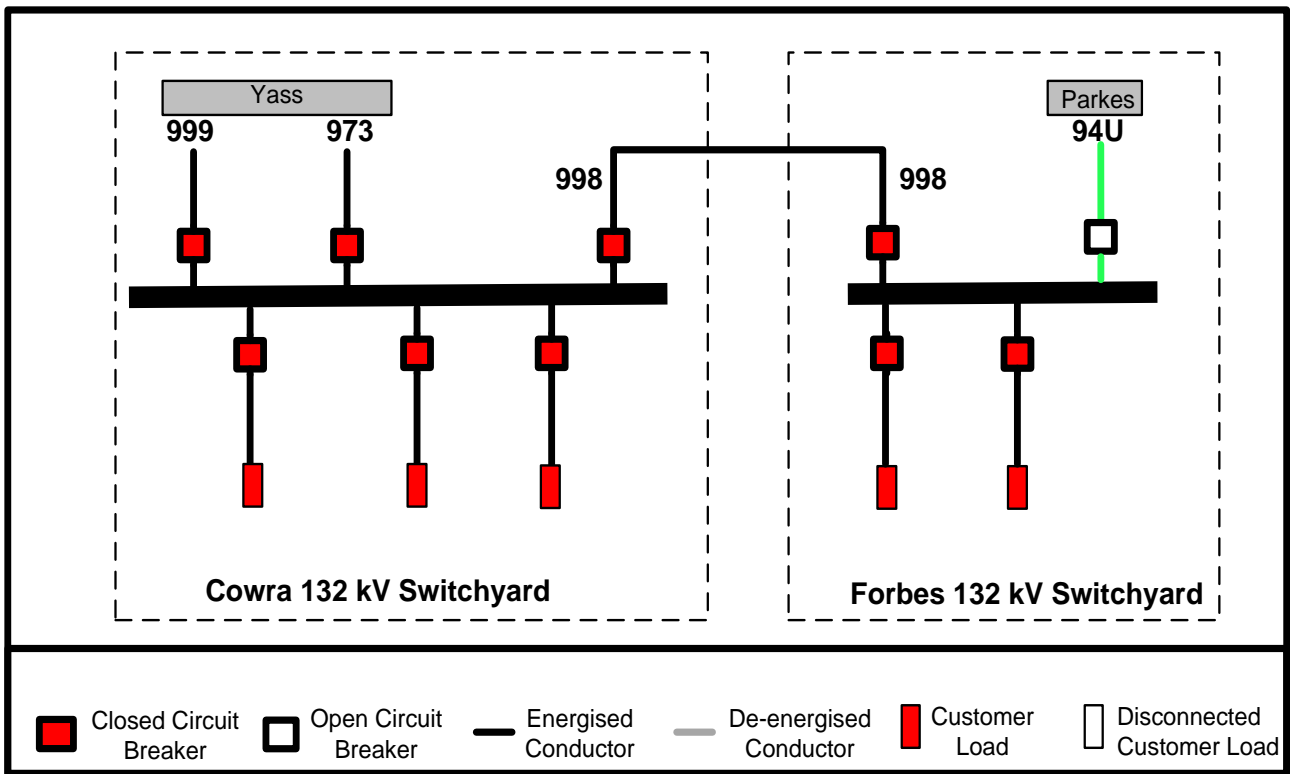


Figure 1 - Status of relevant circuit breakers lines and customer loads prior to the event

# 3 Summary of Events

At 1845 hrs on Saturday 5 February 2011 a non-credible contingency event occurred at Cowra substation at a time when thunderstorm activity was experienced in the area. The Cowra 132 kV

busbar tripped at 1845 hrs resulting in the interruption of power supply to the Cowra and Forbes areas.

Prior to the incident the 94U Parkes–Forbes 132 kV line was operated open at Forbes as a pre-contingency operational action to avoid post-contingency overloads whenever high loads are experienced in the area. Hence Forbes was being supplied radially via the 998 Cowra–Forbes 132 kV line when the incident took place.

Approximately 50 MW of customer load supplied from Cowra and Forbes was interrupted as a result of the incident. All customer loads were restored by 2115 hrs. Figure 2 shows the status of relevant circuit breakers, lines and customer loads following the operation of protection systems at Cowra 132 kV substation.

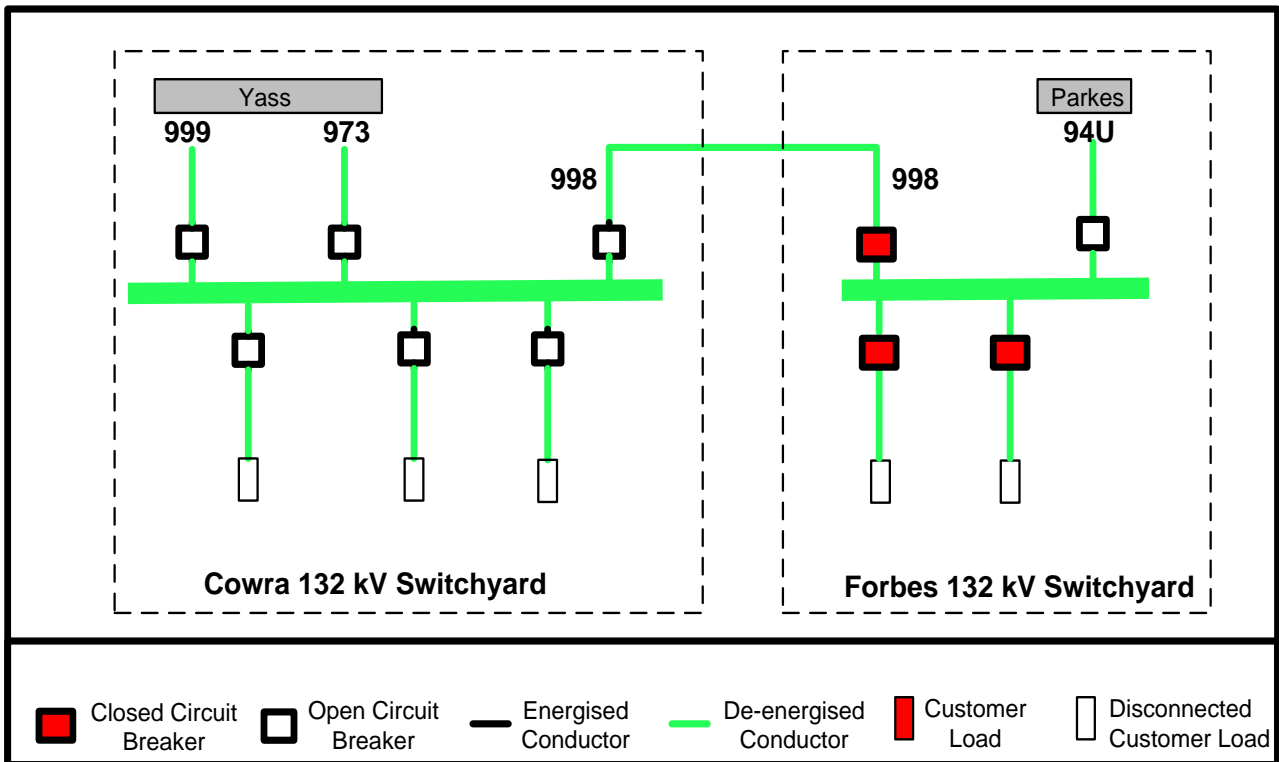


Figure 2 - Status of relevant circuit breakers, lines and customer loads after the event

#### 4 Power System Security Assessment

As a result of this incident, approximately 50 MW of load supplied from Cowra and Forbes substations was interrupted. The load was restored by 2115 hrs on the same day and the power system remained in a secure operating state throughout the incident.

AEMO determined that it was not required to reclassify the loss of Cowra 132 kV busbar as a credible contingency because TransGrid investigated the incident, undertook the appropriate remedial measures and a further incident was consequently considered unlikely.

AEMO issued Market Notice 34441 advising market participants of the incident.

#### 5 Follow-up Action

TransGrid investigations revealed that both Nos 1 and 2 protection systems of the 999 Yass–Cowra 132 kV line at Cowra detected a high impedance one phase to ground fault on the line.

The No.2 protection of the 999 line at Cowra detected the fault within zone 1 of its distance protection and initiated a trip signal. However, because a protection trip link of the No.2 protection system had been left open, the protection trip signal was unable to trip the circuit breaker of the 999 line. Because the fault was still evolving, the No.2 protection operation started the circuit breaker failure protection after the set time delay. All circuit breakers connected to the Cowra busbar were opened on the operation of circuit breaker failure protection disconnecting the 132 kV busbar from the power system.

The No.1 protection of the 999 line at Cowra also detected the fault, initially in zone 2 of its distance protection. The nature of the fault was such that, over time, the initial fault developed into a more solid fault and at that stage the No.1 protection system detected the fault in zone 1 protection time. However, the circuit breaker failure protection had already disconnected the 132kV busbar at Cowra before the No.1 protection system had time to respond.

TransGrid has reported that the differences in fault detection characteristics of distance protections used at Cowra accounted for the different responses of the two protections<sup>1</sup>. The time taken to clear the fault on the 999 line at Cowra was consistent with the clearance of a high impedance fault.

The fault on 999 line was correctly cleared at Yass.

The protection trip link associated with the No.2 protection of 999 line at Cowra was reconnected and the line was returned to service after carrying out suitable testing. The line was made available for emergency use at 1800 hrs on 6 February 2011. The line was returned to service at 1500 hrs on 7 February 2011.

TransGrid reviewed the settings of the No.1 protection system of the 999 line at Cowra and found that the settings currently used are appropriate.

TransGrid has also reinforced the importance of following restoration procedures with the relevant staff.

## 6 Conclusion

The loss of the 132 kV busbar at Cowra and the consequential load interruption can be attributed to incomplete restoration of secondary systems. The misoperation of the secondary systems was probably due to work conducted at an earlier date at Cowra substation. The secondary system in question has since been restored and tested. All affected network elements have been returned to service.

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<sup>1</sup> The No.1 protection of the 999 line at Cowra has a mho characteristic in its distance protection whereas the No.2 protection uses distance protection with a quadrilateral characteristic which has inherent extended resistive reach.