POWER SYSTEM OPERATING INCIDENT REPORT – TRIP OF BELMONT NO.7 110 KV BUSBAR ON 16 JUNE 2012

PREPARED BY: Systems Capability

DATE: 4 October 2012

FINAL

Disclaimer

Purpose

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Abbreviations and Symbols

Abbreviation	Term
CB	Circuit breaker
kV	kilovolt

1 Introduction

At 2025 hrs on 16 June 2012, the No.7 110 kV busbar at Belmont substation in Queensland tripped. The incident occurred when an attempt was made to switch the No.7 110 kV capacitor bank out of service at this substation for voltage control. The busbar and all network elements connected to it were returned to service at approximately 2240 hrs with the exception of the No.7 capacitor bank.

This report has been prepared under clause 4.8.15 of the National Electricity Rules 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 Powerlink. Data from AEMO's Energy Management System has also been used in analysing the incident.

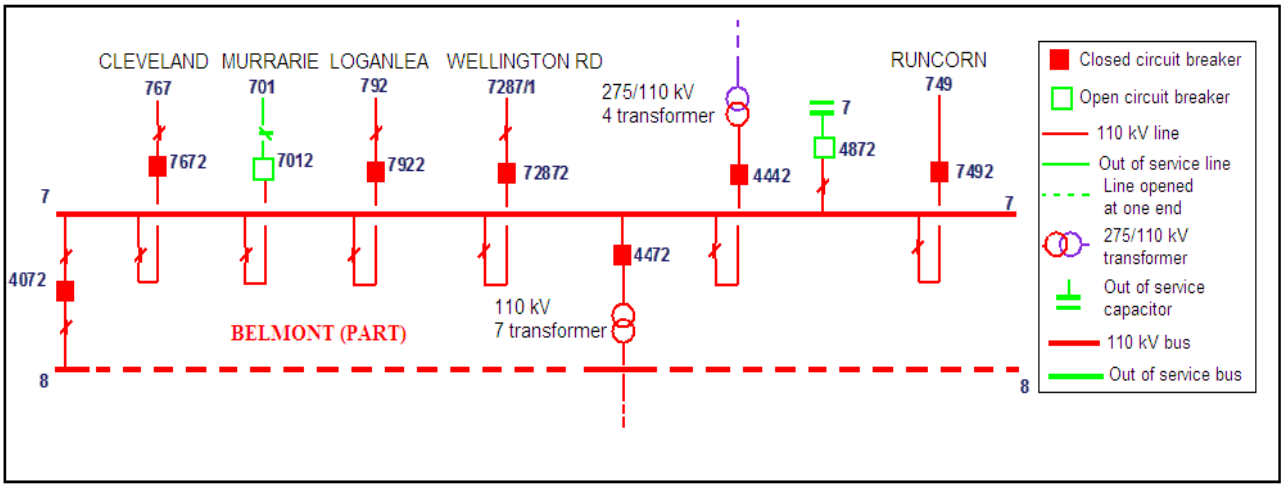
All references to time in this report refer National Electricity Market time (Eastern Standard Time).

2 Pre-Contingent System Conditions

At 2018 hrs on 16 June 2012, Powerlink switched the No.7 110 kV capacitor bank out of service at Belmont substation by opening the capacitor bank circuit breaker CB 4872 for voltage control.

The Belmont No.7 110 kV busbar and the status of its connections prior to the incident are shown in Figure 1. Only the equipment relevant to this incident has been included in the diagram for clarity.

Figure 1 – Status of Belmont No.7 110 kV busbar and its connections prior to the incident



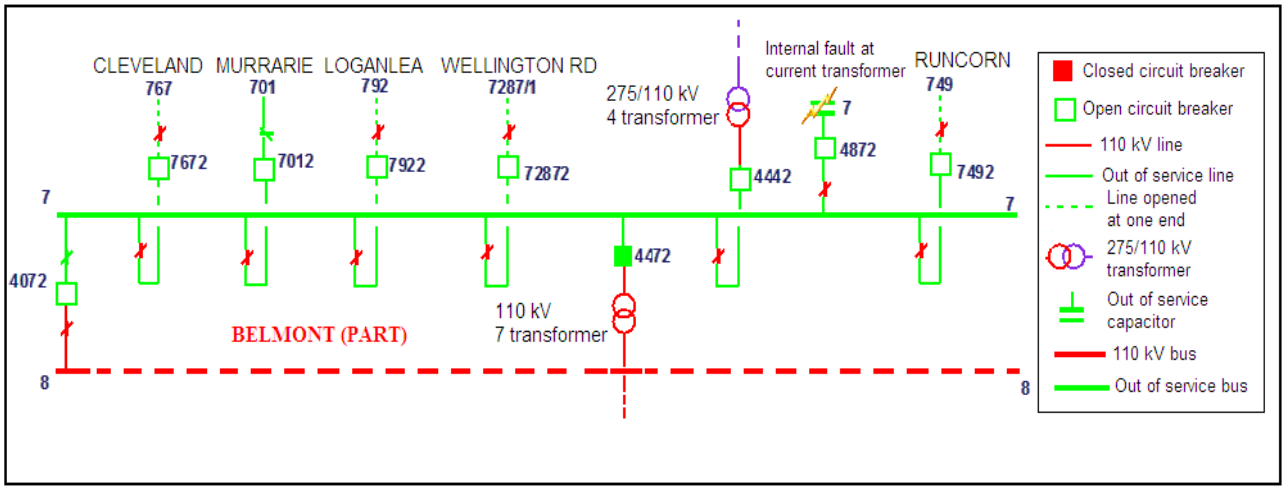
3 Summary of Events

At 2025 hrs, the Belmont No.7 110 kV busbar tripped out of service due to operation of circuit breaker failure protection associated with the No.7 110 kV capacitor bank CB 4872. This caused the off-loading of the following network elements:

- 749 Belmont–Runcorn 110 kV transmission line
- 767 Belmont–Cleveland 110 kV transmission line
- 792 Belmont–Loganlea 110 kV transmission line
- 7287 Belmont–Murrarie Tee Wellington Road 110 kV transmission line at the Belmont end
- Belmont No.4 275/110 kV transformer
- Belmont No.7 110/33 kV transformer

The status of Belmont No.7 110 kV busbar and its connections immediately after the incident are shown in Figure 2.

Figure 2 - Status of Belmont No.7 110 kV busbar and its connections immediately after the incident



4 Follow up actions

Investigation by Powerlink found that switching of the CB 4872 at 2018 hrs was not successful. Only A and B phases of the CB opened while C phase remained closed. This resulted in C phase of the capacitor bank remaining connected to the power system. The protection system associated with the capacitor bank is not designed to monitor the differences between the normal load current of each phase. For this reason, the unsuccessful opening of the CB was not detected immediately by the protection systems of the capacitor.

Due to the unbalanced loading conditions caused by the C phase remaining in service, a current transformer associated with the capacitor bank balance protection developed an internal fault. As a result, the capacitor bank protections sent a trip signal to open the No.7 110 kV capacitor bank CB 4872. The trip signal as well as the load current still present on the C phase of the CB 4872 initiated operation of circuit breaker failure protection associated with this CB.

At 2143 hrs, AEMO issued the Electricity Market Notice No. 39020 advising the occurrence of this non-credible contingency event.

The key events that took place during the restoration process are summarised in Table 1 below.

Table 1: Summary of restoration process

Time	Event
16/06/2012 2228 hrs	Belmont No.7 110 kV busbar was re-energised after isolating the No.7 110 kV capacitor bank CB 4872 from the power system.
16/06/2012 2233 hrs	Belmont 4 275/110 kV transformer was returned to service.
16/06/2012 2235 hrs	Belmont 7 110/33 kV transformer was returned to service.
16/06/2012 2237 hrs	767 Belmont–Cleveland 110 kV transmission line was returned to service.
16/06/2012 2238 hrs	749 Belmont–Runcorn 110 kV transmission line was returned to service.
16/06/2012 2239 hrs	7287 Belmont–Murrarie Tee Wellington Road 110 kV transmission line was returned to service.
16/06/2012 2240 hrs	792 Belmont–Loganlea 110 kV transmission line was returned to service.

5 Power System Security Assessment

There was no loss of load or generation as a result of the event.

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.

AEMO followed its procedures and determined that it was not appropriate to reclassify the trip of the No.7 Belmont 110 kV busbar as a credible contingency following this event because the equipment experienced the fault remained out of service.

6 Conclusions

AEMO concludes that the trip of Belmont No.7 110 kV busbar was caused by the failure of CB 4872 associated with the No.7 110 kV capacitor bank at Belmont to open.

AEMO is satisfied that Powerlink has carried out the appropriate work to mitigate the risk of a similar incident occurring in the future.

7 Recommendations

1. Powerlink will return the No.7 110 kV capacitor bank to service after repairs to the CB 4872 are completed. Powerlink will inform the progress of this task to AEMO by the end of October 2012.
2. Powerlink will investigate the possibility of enhancing the protection systems associated with CBs which have similar settings to the CB 4872 such that faster detection of unsuccessful switching can be achieved. Powerlink will complete this action and inform AEMO by the end of December 2012.