

POWER SYSTEM OPERATING INCIDENT REPORT: TRIP OF MURRAYLINK AND MONASH - NORTHWEST BEND NO.2 132 KV LINE ON 25 DECEMBER 2011

PREPARED BY: Electricity System Operations Planning and Performance

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FINAL

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Abbreviations and Symbols

Abbreviation	Term
APA	APA Group
CB	Circuit Breaker
DC	Direct Current
kV	kilovolt
MW	megawatt
ms	millisecond

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1 Introduction

At 2013 hrs on 25 December 2011, a fault occurred on the Monash - Northwest Bend No. 2 132 kV line in South Australia. Approximately 14 seconds after the fault the Murraylink DC interconnector also tripped.

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 ElectraNet, and APA Group (APA), the operators of Murraylink. Data from AEMO’s Energy Management System has also been used in analysing the incident.

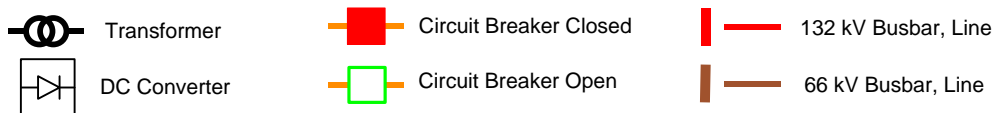
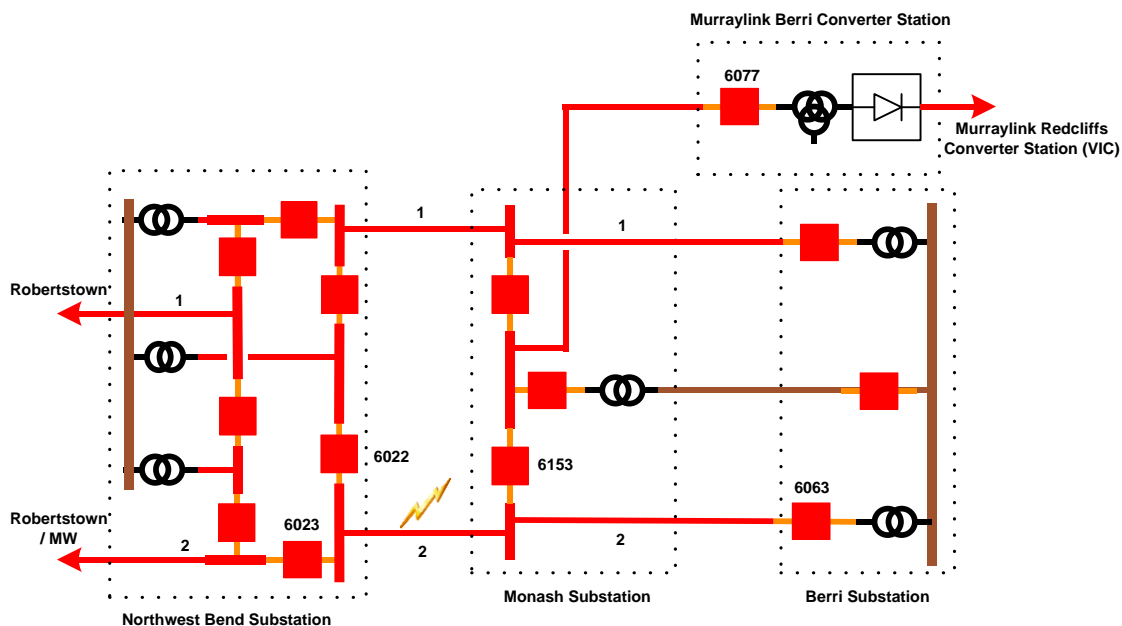
All references to time in this report refer National Electricity Market time (Eastern Standard Time).

2 Pre-Contingent System Conditions

The status of the power system prior to the incident is shown in Figure 1. Immediately prior to this event Murraylink was transferring approximately 46 MW from South Australia to Victoria. The load at Berri was approximately 33 MW.

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

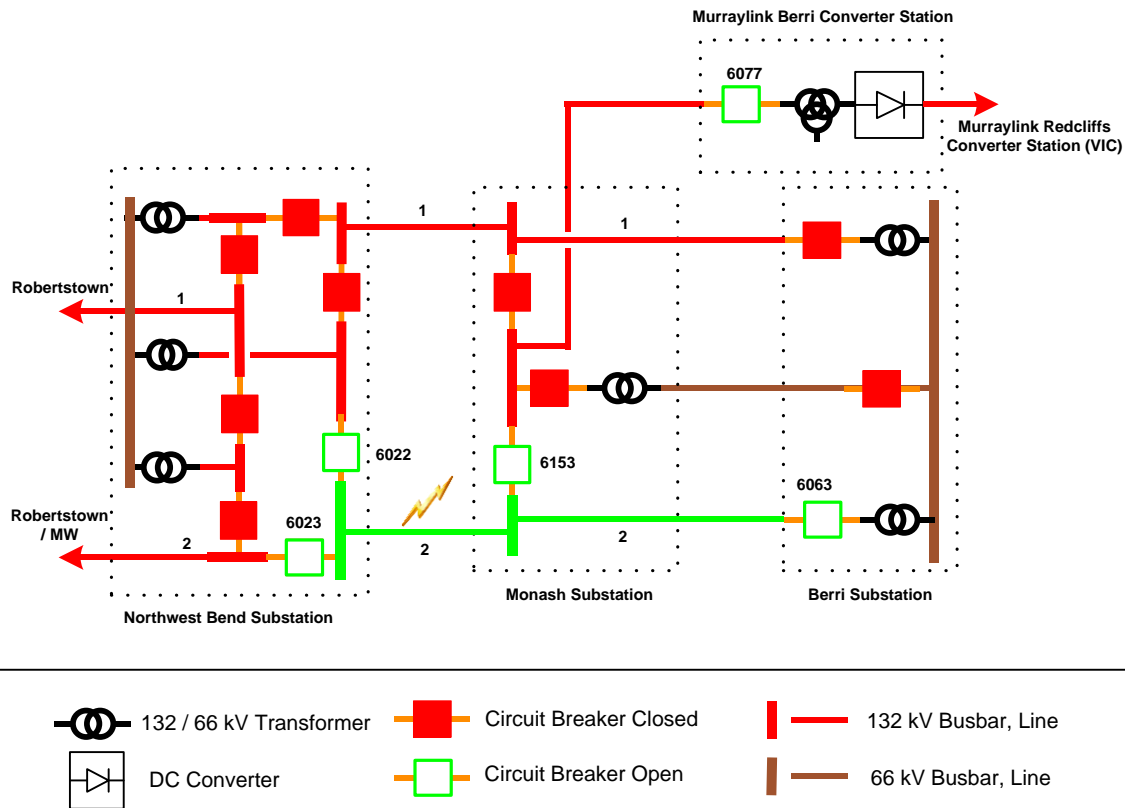
At 2013 hrs on 25 December 2011, a fault occurred on the Monash-Northwest Bend No. 2 132 kV line. ElectraNet advised that the fault occurred approximately 42 km from Northwest Bend, and was correctly cleared in 86 ms. Because of the circuit breaker arrangement at Monash, clearing

this fault resulted in opening of the Monash-Northwest Bend No. 2 132 kV line and the Monash - Berri No 2 132 kV line.

Approximately 14 seconds after the initial fault on the Monash-Northwest Bend No. 2 132 kV line, 132 kV Circuit Breaker 6077 opened at the Murraylink Berri converter station, resulting in disconnection of the Murraylink Berri converter station from the power system.

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

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



4 Immediate Actions Taken

To reflect the outage of Murraylink, AEMO invoked the constraint set I-ML_ZERO from 2020 hrs on 25 December 2011. AEMO issued market notice 37131 at 2020 hrs to advise this to market participants

At 2238 hrs on 25 December 2011, the Monash- Northwest Bend No. 2 132 kV transmission line was returned to service, and at 0012 hrs on 26 December 2011, the Murraylink converter station at Berri was returned to service. At 0025 hrs on 26 December 2011 the constraint set I-ML_ZERO was revoked by AEMO, and Murraylink commenced power transfers at 0030 hrs.

As simultaneous trip of Monash - Northwest Bend No. 2 132 kV line and Murraylink is a non-credible contingency event, in accordance with its operating procedure SO_OP 3715 Power System Security Guidelines¹, AEMO sought information to determine if a future occurrence of this non-credible contingency event was reasonably possible under the prevailing conditions.

¹ Clause 4.2.3B of the NER requires that AEMO establish criteria to use when considering whether a noncredible contingency event is reasonably possible. This is published in AEMO operating procedure

At the time of this incident, ElectraNet advised AEMO they were unable to determine the cause of the simultaneous trip of the Monash - Northwest Bend No. 2 132 kV line and Murraylink.

As AEMO was unable to determine whether the non-credible contingency event was no longer reasonably possible, AEMO reclassified simultaneous trip of the Monash - Northwest Bend No. 2 132 kV line and Murraylink as a credible contingency event from 1230 hrs Wednesday 28 December 2011, until further notice, pending investigation.

AEMO issued market notice 37165 at 1246 hrs on 28 December 2011 to advise this to market participants

5 Follow-up Actions

APA identified that Murraylink tripped due to loss of auxiliary supply, causing loss of Murraylink converter valve and reactor cooling, which in turn resulted in a cooling system protection trip of the converter station approximately 14 seconds after the initial line fault.

The Murraylink Berri converter station has two sources of auxiliary supply. The 'A' supply is taken from the tertiary winding of the power transformer at the converter station. The 'B' supply is taken from the local ETSA utilities 11 kV distribution network supplied from Berri Substation.

Both auxiliary supplies are fitted with under-voltage and over-current protection release. There is an automatic change-over scheme between the 'A' and 'B' auxiliary supplies, designed to operate with a 4 second delay. The under-voltage release prevents the 'B' auxiliary supply from closing if the 'B' auxiliary voltage is below 85% of rated voltage.

APA advised that the 'A' auxiliary supply at the Murraylink Berri converter station opened simultaneously with the the Monash - Northwest Bend No. 2 132 kV line fault, most likely due to the under voltage release.

17 seconds after the 'A' auxiliary supply opened, the automatic auxiliary change-over scheme closed the 'B' auxiliary supply, however this was approximately 3 seconds after Murraylink had been disconnected from the 132 kV system. At this time it has not been identified why the Murraylink Berri converter station auxiliary supply did not close until 17 seconds after the initial line fault.

ElectraNet advised there was no evidence to suggest that the 'B' auxiliary supply to the Murraylink Berri converter station did not recover to above 85% of rated voltage shortly after clearance of the original fault on the Monash - Northwest Bend No. 2 132 kV line.

APA advised that the automatic auxiliary change-over scheme has subsequently operated correctly on a number of occasions, including several occasions between the initial line fault at 2013 hrs on 25 December 2011, and restoration of 132 kV supply to Berri at 0012 hrs on 26 December 2011

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.

Studies suggest there is no risk to system security due to potential simultaneous trip of Murraylink and the Monash - Northwest Bend No. 2 132 kV line, as the rating of a single remaining Monash - Northwest Bend 132 kV line would be sufficient to supply the peak demand at Berri.

At the time of writing the reclassification of the simultaneous trip of Monash - Northwest Bend No. 2 132 kV line and Murraylink remains in place

7 Conclusions

The Murraylink Berri converter station lost auxiliary supply and tripped following a fault on the Monash - Northwest Bend No. 2 132 kV line.

The auxiliary supply change over scheme at the Murraylink Berri converter station did not operate in sufficient time to prevent a protection trip of the converter station due to loss of auxiliary supply.

The reason for this has not been identified, though the auxiliary supply change over scheme has been demonstrated to work correctly on several subsequent occasions.

AEMO correctly applied the criteria published in section 12 of its Power System Security Guidelines in assessing that the circumstances of this incident did warrant reclassifying similar incidents as a credible contingency event.

8 Recommendations

At the next convenient opportunity, APA test and confirm the correct functioning of the auxiliary supply changeover arrangements at the Murraylink Berri converter station, and advise the results of this investigation to AEMO. This is expected to be completed by the end of September 2012.