Trip of Transmission lines in Tasmania followed by the loss of Basslink: Dec 2014 and Feb 2015 – Final Report

AN AEMO POWER SYSTEM OPERATING INCIDENT REPORT FOR THE NATIONAL ELECTRICTY MARKET

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AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

INCIDENT CLASSIFICATIONS

Time and date and of incidents	1444 hrs 10 Dec 2014, 0746 hrs 16 Dec 2014, 0054 hrs 23 Feb 2015
Region of incident	Tasmania
Affected regions	Tasmania
Event type	Loss of multiple transmission elements
Primary cause	Environment and lightning
Generation Impact	No generation was lost due to these incidents
Customer Load Impact	Customer load disconnected: 354MW on 10 Dec, 401 MW on 16 Dec and 485 MW on 23 Feb 2015

ABBREVIATIONS

Abbreviation	Term
AC	Alternating Current
AEMO	Australian Energy Market Operator
BLGC	Basslink Georgetown Converter Station
DC	Direct Current
HVDC link	High Voltage Direct Current Link
kV	Kilovolt
MW	Megawatt

IMPORTANT NOTICE

Purpose

AEMO has prepared this document to provide information about this particular Power System Operating Incident.

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1. BACKGROUND

On two occasions in December 2014 the Basslink HVDC link was interrupted due to a faults in the Tasmanian 220kV system leading to tripping of industrial load in Tasmania under contract arrangements. Refer Appendix 1.

This behaviour was not anticipated and had previously not been considered a credible contingency. As a result of these two events, the loss of Basslink when importing into Tasmania due to a remote fault on the Tasmanian 220kV system has been reclassified as a credible contingency event.

A similar event also occurred in February2015.

The findings of an initial investigation published in May 2015 [1] were as follows:

- The three faults on the 220kV system were cleared in accordance with the System Standard and , based upon information provided by TasNetworks, network control and protection systems operated as designed
- Based upon information provided by Basslink Pty Ltd, the Basslink control and protection systems operated as designed
- The unbalanced nature of the faults initiated commutation failure on the inverter at George Town which is a normal occurrence on a temporary basis during faults in the Tasmanian AC system
- The HVDC link was lost because multiple commutation failures were sustained. This had not occurred previously for Basslink. HVDC links of this type are designed to quickly recover from commutation failures so as to avoid loss of the link. However such a recovery is more difficult when the AC system is weak.

[1] For further details refer **http://www.aemo.com.au/Electricity/Resources/Reports-and-Documents/~/link.aspx?_id=10F603F478C04BC7899FB1D41E08A217&_z=z**

AEMO undertook to perform modelling work in conjunction with TasNetworks to better understand the reasons for these recent failures. This modelling exercise has now been completed and this report summarises the results.

2. RESULTS OF THE MODELLING EXERCISE

AEMO and TasNetworks have developed an improved model to study the interaction between Basslink and the Tasmanian Power System during credible faults on the 220kV network

This model has been benchmarked against recent 220kV faults both where Basslink tripped and where Basslink did not trip. The results of this benchmarking have given AEMO reasonable confidence in the model. While the model does not include all details of the Basslink thyristor protection, it is considered adequate to simulate commutation failure, and to therefore give sound insights into the events that have occurred.

The results of the modelling have indicated that:

- Current performance of Basslink is consistent with past performance under similar circumstances. However recent changes in power system operations have meant that the likelihood of a trip occurring under more challenging circumstances has increased.
- Whether or not Basslink will trip in a given scenario will depend upon a number of factors:
  - Level and location of generation within the Tasmanian region (higher levels of generation close to Georgetown reduce the likelihood).
  - Level of import on Basslink (higher levels of import increase the likelihood).
  - Nature of fault (phase to earth or phase to phase) and fault impedance (phase to phase faults are more of a risk than phase to ground faults; higher fault impedance reduces likelihood).
  - Point on the power frequency (50 Hz) voltage wave form at which the a fault is initiated (this timing has a significant impact on the likelihood of tripping).
- The likelihood of Basslink tripping for a fault at any given location remote from Georgetown thus varies depending upon how the above factors apply at that time. However the modelling has shown that it still remains significant enough over the normal range of operating conditions to be considered credible for many remote locations on the 220kV system, particularly for faults at connection points of major generating units where the fault would lead to loss of both a major generating unit and Basslink. [2]
- Commitment of additional generation close to George Town, whilst reducing the likelihood of such an event would not reduce it to a level for which these events could be considered non-credible.

Details of the modelling results are set out the accompanying joint report from TasNetworks and AEMO.

[2] This case is of particular importance as it requires the sourcing of additional Frequency Control Ancillary Raise Services within Tasmania to cover the simultaneous loss of both Basslink when importing and the most heavily loaded generating unit in Tasmania. This has significant market impact.

3. COMPLIANCE WITH PERFORMANCE STANDARDS

AEMO has reviewed the registered performance standards applicable to Basslink for the purpose of identifying any compliance issues under rule 4.15 of the National Electricity Rules.

Due to a lack of clarity in the manner in which the relevant performance standards are expressed, AEMO has not been able to determine whether Basslink has breached any of those performance standards.

4. CONCLUSIONS

Based on the results of this modelling, AEMO is satisfied that the current reclassification should remain in place for the time being.

AEMO intends to use its model to assess whether:

- any additional information that might be provided to AEMO in the future; or
- a change to power system operations or settings of protection and control systems as proposed by a Participant,

would be sufficient to allow the current reclassification to be removed.

APPENDIX 1 – POWER SYSTEM DIAGRAM

Power system diagram showing part of the Tasmanian 220 kV transmission system and the location on the system of the three faults.