

POWER SYSTEM OPERATING INCIDENT REPORT – INSECURE POWER SYSTEM OPERATION IN TASMANIA BETWEEN 24 AND 26 OCTOBER 2011

PREPARED BY: Electricity System Operations Planning and Performance

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FINAL

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Abbreviations and Symbols

Abbreviation	Term
CB	Circuit Breaker
DI	Dispatch Interval
EMS	Energy Management System
FCAS	Frequency Control Ancillary Service
MW	Megawatt
DSA	Dynamic Security Assessment
SCADA	Supervisory Control and Data Acquisition
FCSPS	Frequency Control System Protection Scheme

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1 Introduction

Between 24 and 26 October 2011, there were periods where the FCAS enabled in Tasmania was insufficient to manage the contingent loss of the Basslink interconnector when power transfer was from Victoria to Tasmania. This occurred because the incorrect Basslink status was modelled in AEMO's systems and, as a result, it was also used in constraint equations that specify FCAS requirements in the central dispatch process. The power system is considered to be insecure during the periods when insufficient FCAS was enabled because the frequency operating standard¹ in Tasmania would have been violated on loss of Basslink.

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 data from AEMO's Energy Management System and Electricity Market Management System.

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

2 Pre-Contingent System Conditions

Basslink is the direct current interconnector that operates between Tasmania and Victoria. It was taken out of service for planned maintenance work from 20 to 24 October 2011. Shortly after the outage commenced, AEMO's DSA application² failed. Subsequent investigation revealed that the Basslink power system model used in the DSA application caused it to fail when Basslink was taken out-of-service.

At 1037 hrs on 20 October 2011, AEMO artificially hand-dressed³ the EMS statuses of the Basslink CBs from "Open" to "Closed" as a temporary solution to get the DSA application to function correctly. However the solution was only partially completed, and at 1123 hrs AEMO also hand-dressed the Basslink status to "Off" (out-of-service) because it was incorrectly showing "On" (in-service) based on the hand-dressed Basslink CB statuses from which it was derived. The Basslink status is used in constraint equations that specify the FCAS requirements to manage power system frequency in Tasmania, on the contingent loss of Basslink during power transfers from Victoria to Tasmania. After this correction, the hand-dressing had no impact on market operation for the duration of the Basslink outage because the Basslink trader had submitted the power transfer capability of 0 MW in either direction in its dispatch offers.

3 Summary of Events

At 1452 hrs on 24 October 2011 Basslink was returned to service, and by 1456 hrs AEMO had removed all hand-dressing associated with the outage. This was done via the Sydney EMS session⁴ and was automatically replicated to the Brisbane EMS. However, less than a minute earlier AEMO had swapped over the Brisbane EMS from the primary to the standby database in

¹ Frequency Operating Standards for Tasmania is available at: <http://www.aemc.gov.au/Panels-and-Committees/Reliability-Panel/Guidelines-and-standards.html>.

² DSA application performs power system transient stability analysis in real time.

³ Hand-dressing is the manual override of SCADA values in the EMS.

⁴ AEMO has two independent production EMS systems, one at Sydney control centre and another at Brisbane control centre. Each of these EMS systems has primary and standby EMS servers and databases.

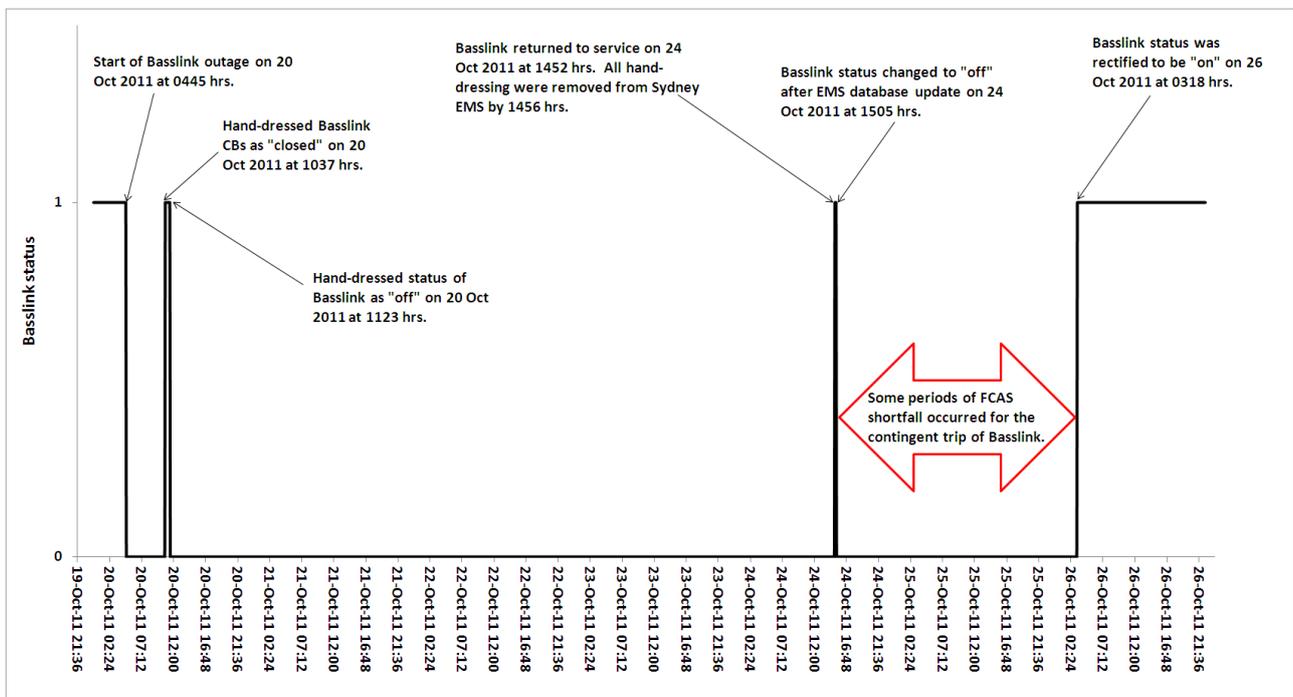
preparation for a routine update, with the Basslink status left in its hand-dressed “Off” state on the primary (but now offline) database. At 1505 hrs, on completion of the database update, AEMO reverted to the Brisbane EMS as the primary database but hand-dressing of the Basslink status was not removed. As a result, from DI ending 1520 hrs onwards the incorrect Basslink “Off” status was used by the central dispatch process⁵ as input to the constraint equations that set Tasmania’s contingency raise FCAS requirements for the loss of Basslink. Basslink received its first dispatch target (after it was returned to service) of 33 MW towards Tasmania for DI ending 1510 hrs.

AEMO has an internal procedure in place to manually perform routine EMS database comparisons between the Sydney and Brisbane EMS using a database comparator tool⁶. However neither logs nor electronic audit trails were kept to verify whether these comparisons were actually done.

The discrepancy was eventually identified following a subsequent EMS check and corrected at 0318 hrs on 26 October 2011.

Figure 1 illustrates changes to the Basslink status during the incident where “0” and “1” represent “Off” and “On” states respectively. It also highlights the period of possible FCAS shortfall between 1505 hrs on 24 October 2011 and 0318 hrs on 26 October 2011.

Figure 1 – Basslink status in EMS



4 Immediate Actions Taken

There were no immediate actions taken, as the discrepancy in the hand-dressed status of the Basslink status was not identified until 26 October 2011.

⁵ The incorrect hand-dressed Basslink “Off” status on the Brisbane EMS was used instead of the correct non hand-dressed Basslink “On” status on the Sydney EMS system, as a hand-dressed value always has priority over a good quality non hand-dressed value.

⁶ The procedure identifies differences between the online EMS databases, including differences in the hand-dressed status of SCADA items.

5 Follow-up Actions

Transend has since provided AEMO with an updated power system model for Basslink interconnector. AEMO is currently undertaking due diligence before implementing the updated Basslink model into the DSA application. When completed, this will prevent failure of the DSA application during future Basslink outages, and thus eliminate the need for temporary hand-dressing of Basslink statuses in the EMS.

AEMO has updated its internal procedures to clearly identify and rectify differences in EMS databases so that errors due to incorrect database replication can be minimised. AEMO has commenced an EMS project to make the identification of failed and hand-dressed SCADA easier. This project is due for completion by the end of 2012.

AEMO has investigated and determined that scheduling errors occurred during the DIs for which the incorrect Basslink status was used in the FCAS constraint equations, and on 24 January 2012 published a Market Event Report⁷.

6 Power System Security Assessment

The Tasmanian FCSPS contributes to ensuring the Tasmanian power system frequency remains within the frequency operating standards following the loss of Basslink. When Basslink transfers power from Victoria to Tasmania, the FCSPS only partially manages frequency control requirements and there is a residual requirement managed by enabling FCAS by means of the following FCAS constraint equations⁸.

- F_T+NIL_BL_R5
- F_T+NIL_BL_R60_1, F_T++NIL_BL_R60_2, F_T++NIL_BL_R60_3, F_T++NIL_BL_R60_4
- F_T+NIL_BL_R6_1, F_T++NIL_BL_R6_2, F_T++NIL_BL_R6_3, F_T++NIL_BL_R6_4

Figure 2 shows the Basslink power transfer during the incident. The FCAS shortfall occurred when Basslink was transferring power from Victoria to Tasmania — this is when Basslink MW flow in the graph is negative⁹.

As shown in Figure 1 and Figure 2, from 1505 hrs on 24 October 2011 to 0318 hrs on 26 October 2011, there were periods where, due to the incorrect “Off” status of Basslink, there was insufficient Tasmanian FCAS enabled to manage the contingent loss of Basslink. This constituted insecure power system operation in Tasmania whenever the level of Basslink power transfer from Victoria to Tasmania exceeded the combined capability of available frequency control from the FCSPS and enabled raise FCAS in Tasmania. The power system is considered to be insecure during these periods because the loss of Basslink would have resulted in frequency falling outside the applicable frequency operating standard.

⁷ The report “Scheduling Error - Incorrect Basslink Status affecting Tasmanian FCAS on 20 and 24 to 26 October 2011” is available at: <http://www.aemo.com.au/reports/0180-0011.html>.

⁸ Refer to AEMO’s Constraint Implementation Guidelines for more information on constraint formulation, 14 September 2011, <http://www.aemo.com.au/electricityops/0100-0015.html>.

⁹ The sign convention used for power transfer on Basslink is such that the positive power transfer on Basslink indicates power flow from Tasmania to Victoria and vice versa.

Figure 2 – Power flow on Basslink during period of incorrect Basslink status

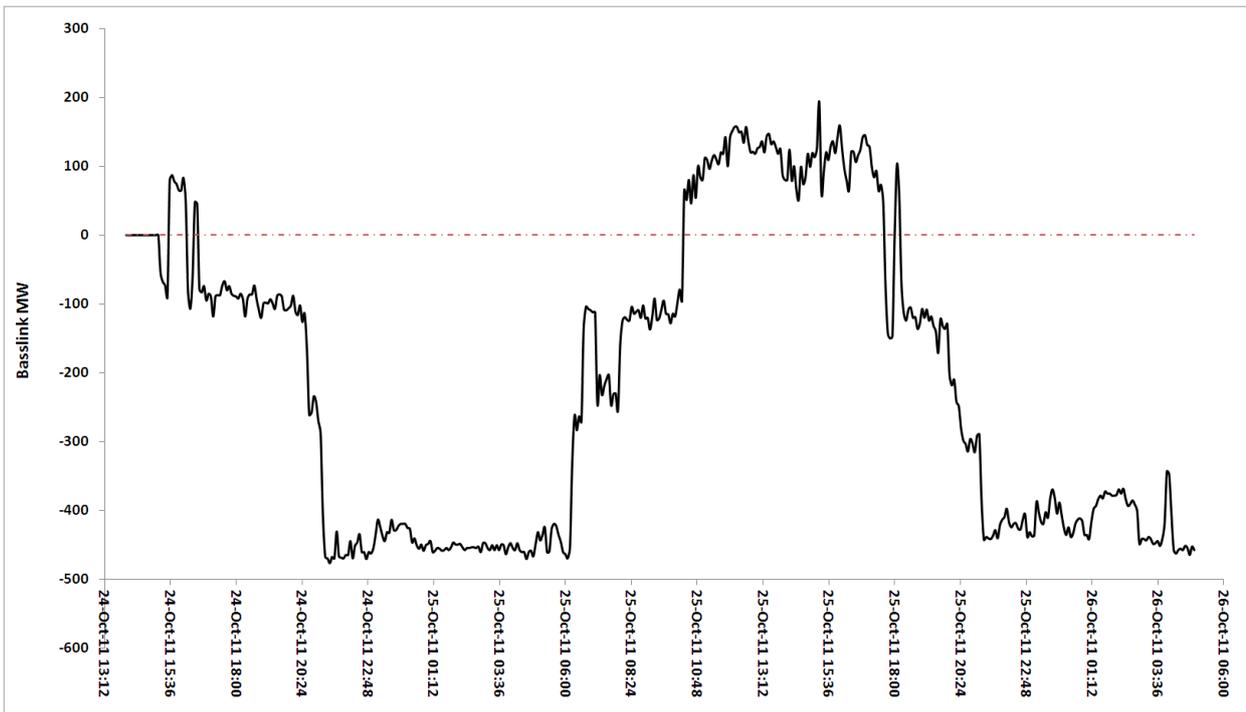


Figure 3 illustrates the amount of FCAS that would have been required to cover the loss of Basslink if its status was correct. Figure 4 shows the actual FCAS enabled in Tasmania during the period of incorrect Basslink status. Figure 5 shows the shortfall of raise FCAS during this period.

Figure 3 – FCAS required to manage the contingent loss of Basslink with power flow from Victoria to Tasmania (FCSPS in-service)

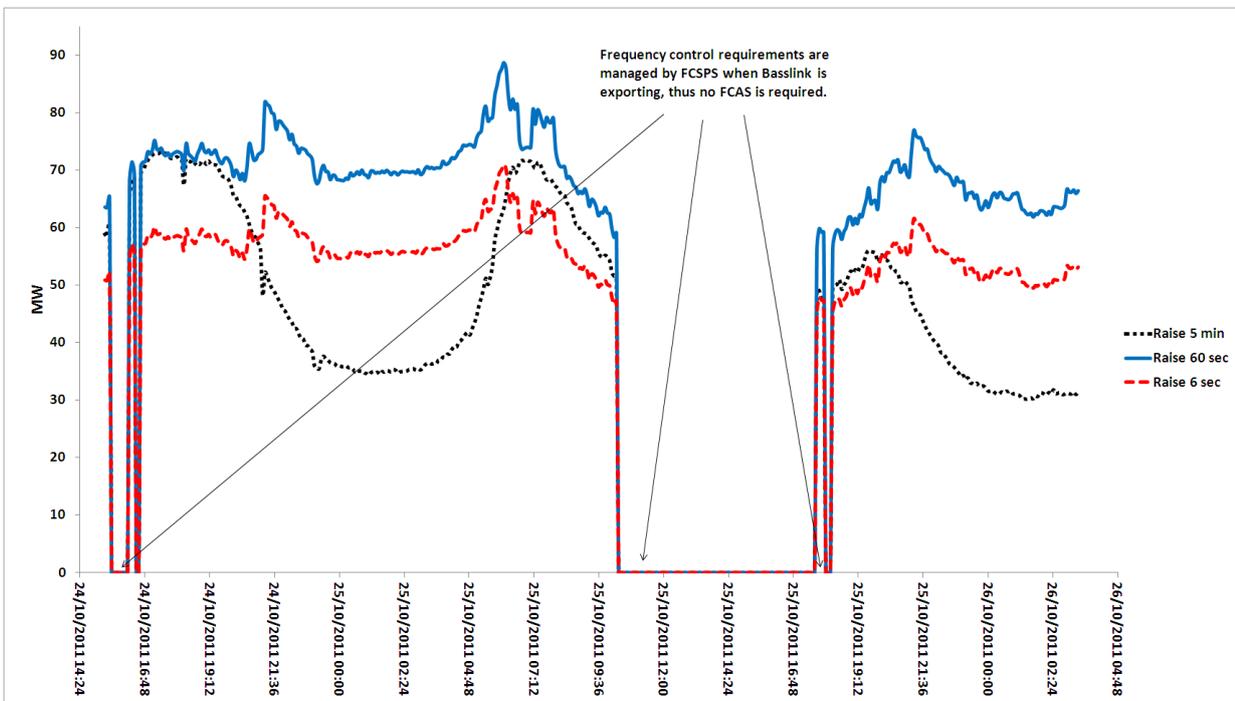


Figure 4 – FCAS enabled in Tasmania during period of incorrect Basslink status

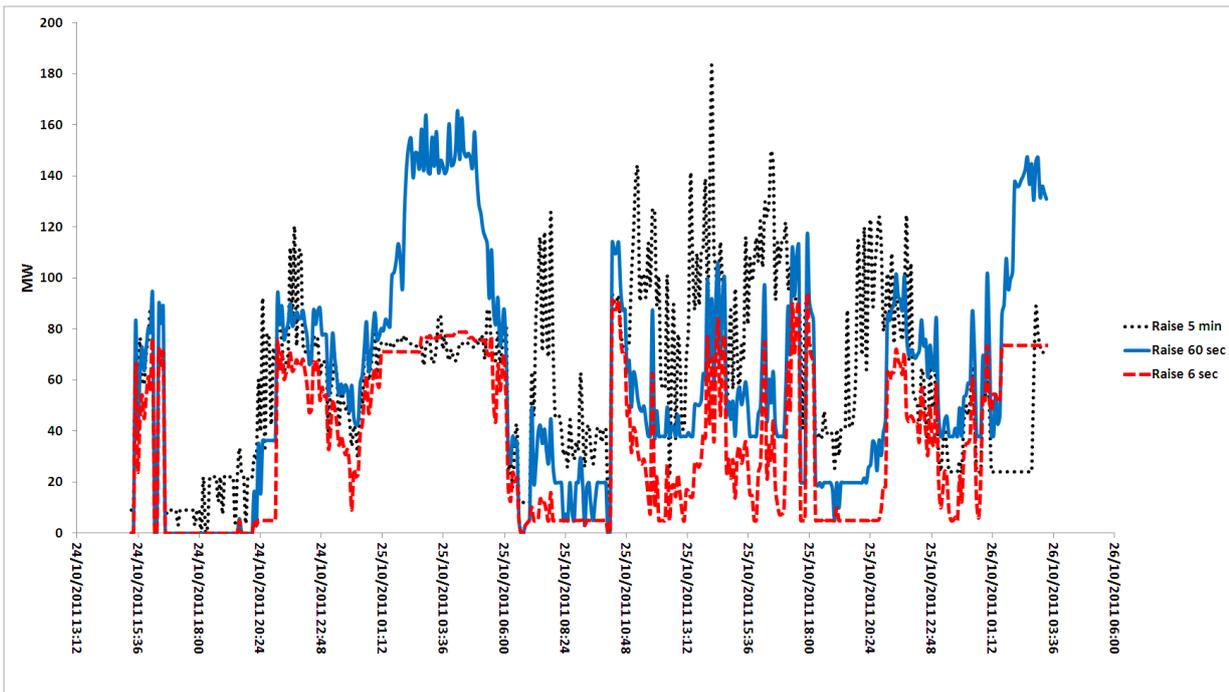
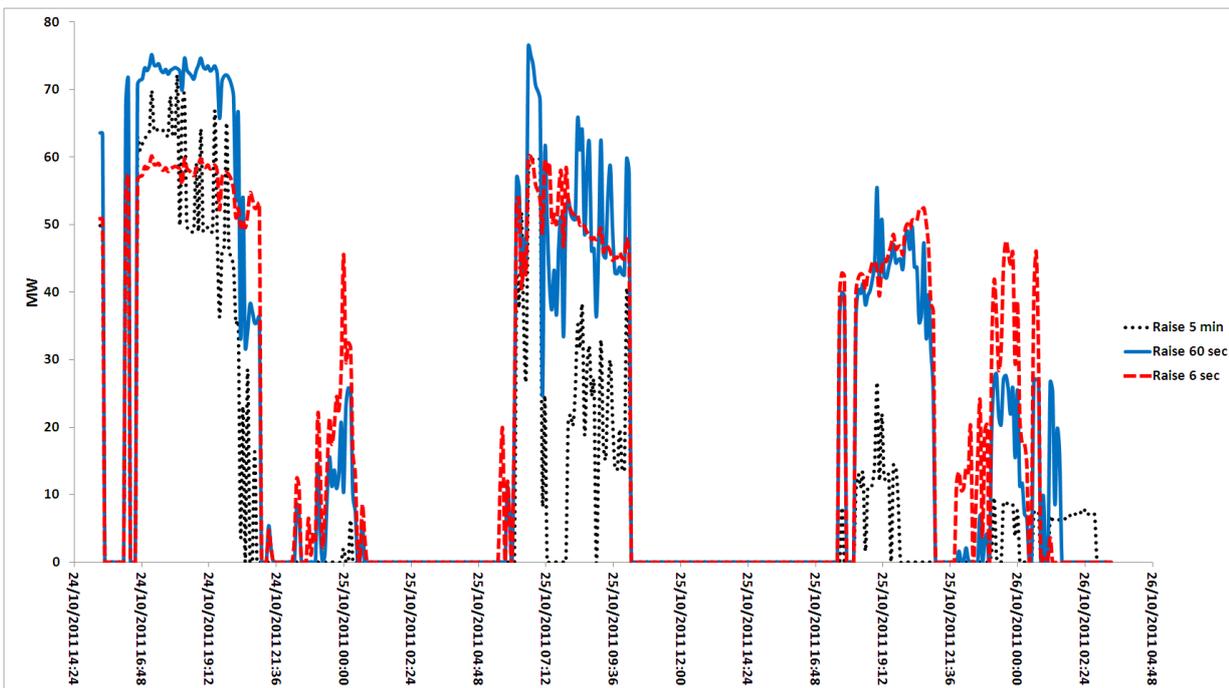


Figure 5 – FCAS shortfall during the period of incorrect Basslink status (FCSPS in-service)



7 Conclusions

From 24 to 26 October 2011, the incorrect Basslink status was modelled in AEMO’s EMS, which resulted in periods when insufficient FCAS was enabled in Tasmania to manage the contingent loss of Basslink. During these periods the power system was being operated in an insecure state. AEMO had hand-dressed the Basslink status to “Off” during a Basslink outage but subsequently failed to correctly remove the hand-dressing after Basslink had returned to service at 1452 hrs on 24 October 2011. AEMO corrected the Basslink status after identifying the discrepancy on 26 October 2011.

AEMO is satisfied that all required actions were taken, including improved logging of database comparisons and internal procedure updates to better identify and rectify differences in EMS databases, to minimise the risk of a similar incident occurring in the future.

8 Recommendations

AEMO will implement the updated power system model for the Basslink interconnector, which will be compatible for use with the DSA application when Basslink is out of service. This will be completed by the end of May 2012.

AEMO will improve processes so that failed and hand-dressed SCADA values are easier to identify. This project is due for completion by the end of 2012.