POWER SYSTEM OPERATING INCIDENT REPORT – OFFLOADING OF BASSLINK AND TRIPPING OF RIO TINTO LOAD ON 5 JULY 2012.

PREPARED BY: Systems Performance and Commercial

DATE: 30 November 2012

FINAL

Disclaimer

Purpose

This report has been prepared by the Australian Energy Market Operator Limited (**AEMO**) for the sole purpose of meeting obligations in accordance with clause 4.8.15 (c) of the National Electricity Rules (NER).

No reliance or warranty

This report contains data provided by third parties and might contain conclusions or forecasts and the like that rely on that data. This data might not be free from errors or omissions. While AEMO has used due care and skill, AEMO does not warrant or represent that the data, conclusions, forecasts or other information in this report are accurate, reliable, complete or current or that they are suitable for particular purposes. You should verify and check the accuracy, completeness, reliability and suitability of this report for any use to which you intend to put it, and seek independent expert advice before using it, or any information contained in it.

Limitation of liability

To the extent permitted by law, AEMO and its advisers, consultants and other contributors to this report (or their respective associated companies, businesses, partners, directors, officers or employees) shall not be liable for any errors, omissions, defects or misrepresentations in the information contained in this report, or for any loss or damage suffered by persons who use or rely on such information (including by reason of negligence, negligent misstatement or otherwise). If any law prohibits the exclusion of such liability, AEMO's liability is limited, at AEMO's option, to the re-supply of the information, provided that this limitation is permitted by law and is fair and reasonable.

© 2012 Australian Energy Market Operator Ltd. All rights reserved

Abbreviations and Symbols

Abbreviation	Term
FCSPS	Frequency Control System Protection Scheme
CB	Circuit Breaker
kV	Kilovolt
MW	Megawatt
A	Ampere
Hz	Hertz
Ph - N	Phase to Neutral

Contents

1 Introduction

At 1751 hrs on Thursday 5 July 2012, Basslink tripped at the Loy Yang converter station in the Victoria region. Prior to the event Basslink was transferring 597 MW from Tasmania to Victoria. Coincident with the trip of Basslink there was a loss of 121MW from the Rio Tinto aluminium smelter in Tasmania.

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 information provided by Transend, Basslink Pty Ltd and Rio Tinto. Data from AEMO's Energy Management System (EMS) and Electricity Market Management System (EMMS) has also been used in analysing the incident.

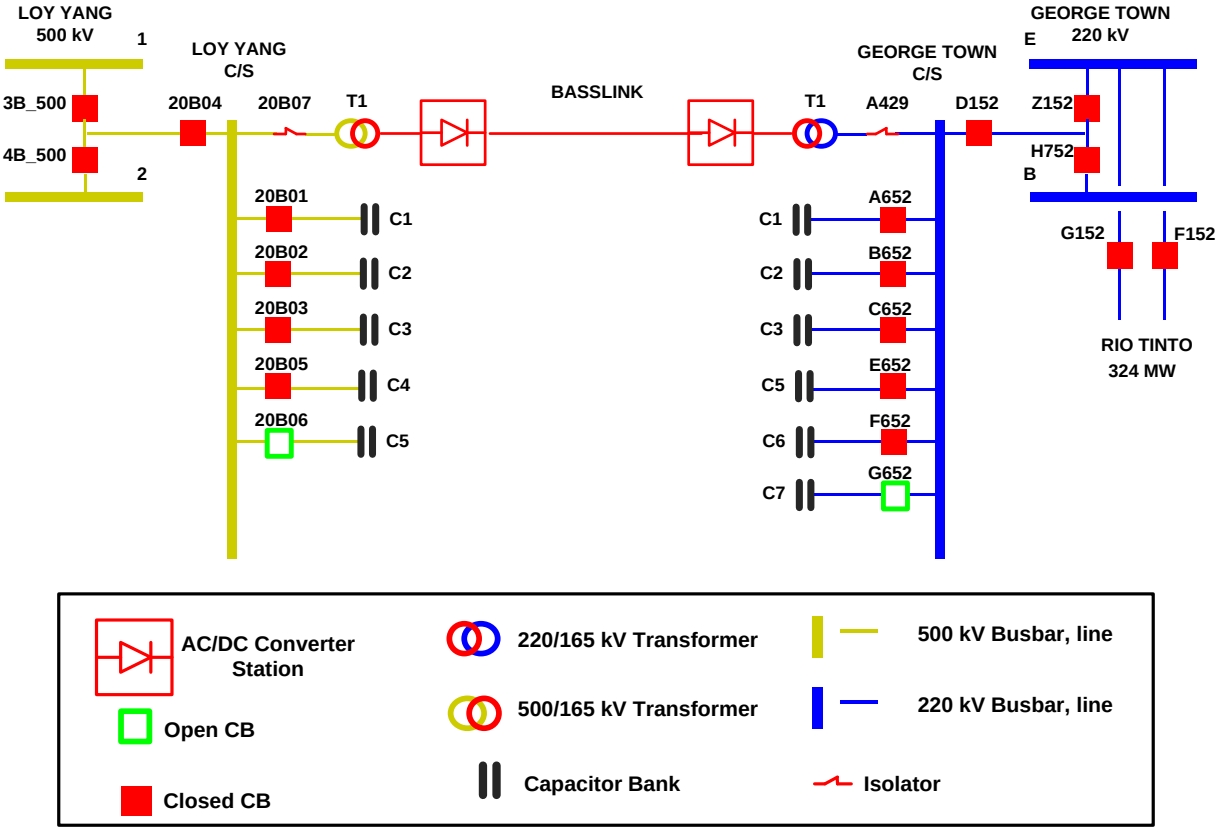
All references to time in this report are to National Electricity Market time (Australian Eastern Standard Time).

2 Pre-Contingent System Conditions

The status of the power system prior to the incident is shown in Figure 1. For clarity only equipment relevant to this incident has been included in the diagram.

Prior to the event, flow on Basslink was 597 MW in the Tasmania to Victoria direction and the load at the Rio Tinto aluminium smelter was 324 MW.

Figure 1 - Status of the power system prior to the incident



3 Summary of Events

At approximately 17:51 hours on Thursday 5 July 2012 Basslink tripped at the Loy Yang converter station.

Prior to the event Basslink was transferring 597 MW from Tasmania to Victoria. When Basslink tripped the Frequency Control System Protection Scheme (FCSPS) operated correctly to manage the frequency in the Tasmania region. The FCSPS tripped six generating units in Tasmania with a total of 604 MW. Refer to Table 1 for details.

Basslink Pty Ltd has confirmed that the transformer at Basslink Loy Yang converter station tripped due a faulty temperature indicator.

Coincident with the trip of Basslink there was an unexpected loss of 121MW of load at the Rio Tinto aluminium smelter in George Town, Tasmania.

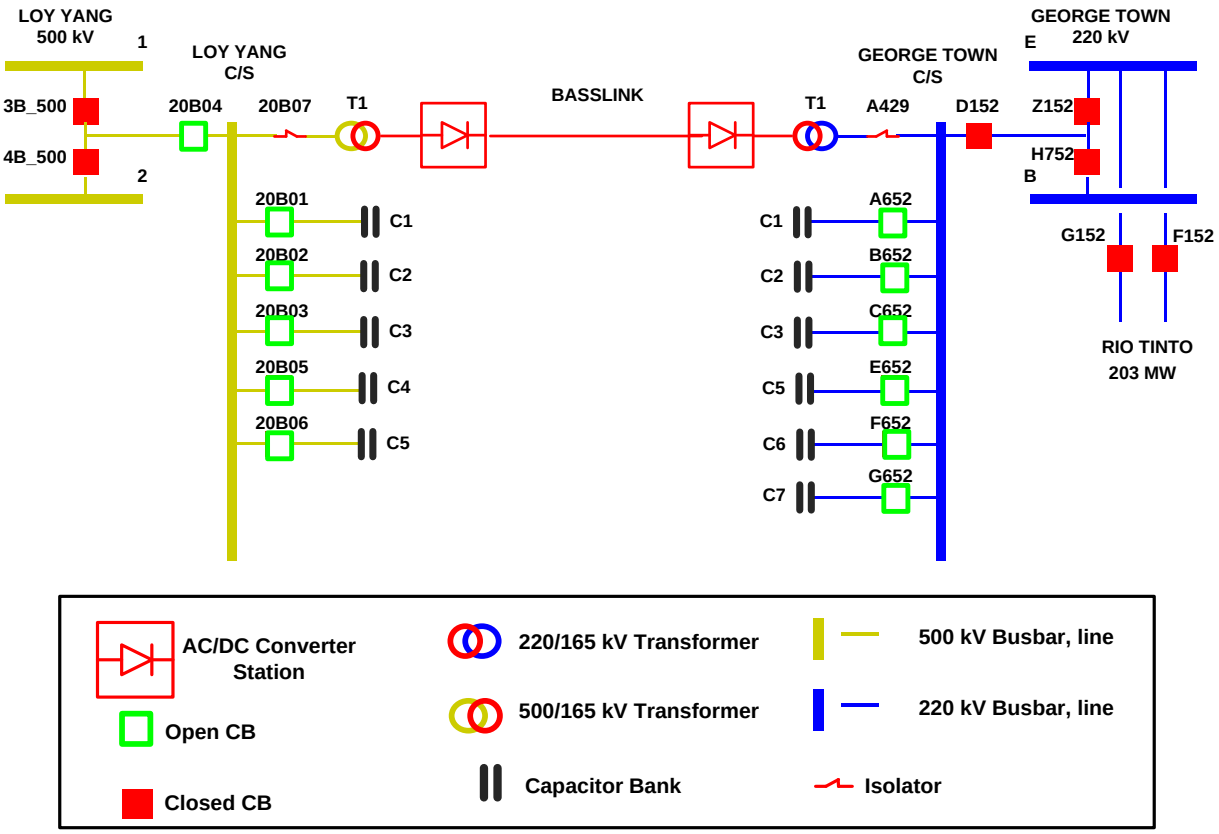
The key events that took place during the incident are summarised in Table 1 below:

Table 1: Summary of events

Time	Events	Comments
05/07/2012 17:51:51	Basslink tripped at Loy Yang converter station.	575 MW at Loy Yang and 597 MW at George Town
17:51:51	Filter Capacitors at Loy Yang tripped	
17:51:51	Gordon units 2 tripped 104 MW	FCSPS action
17:51:51	Gordon units 3 tripped 105 MW	FCSPS action
17:51:51	Devils Gate unit tripped 63 MW	FCSPS action
17:51:51	John Butters tripped 138 MW	FCSPS action
17:51:52	Reece 1 tripped 94 MW	FCSPS action
17:51:52	Reece 2 tripped 100 MW	FCSPS action
17:51:52	Rio Tinto 121 MW Potline load tripped	
17:51:54	Basslink Filter Capacitors at George Town Converter Station tripped	
18:00:00	Constraint set I-BL_ZERO was invoked	From 1800 hrs to 1910 hrs.
21:25:00	Basslink available for dispatch.	

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

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



The frequency both in Tasmania and in the mainland remained within the frequency operating standards during and after the event. Figure 3 and 4 below show Tasmania frequency during and after the event.

Figure 3 – Tasmania Frequency (high speed data)

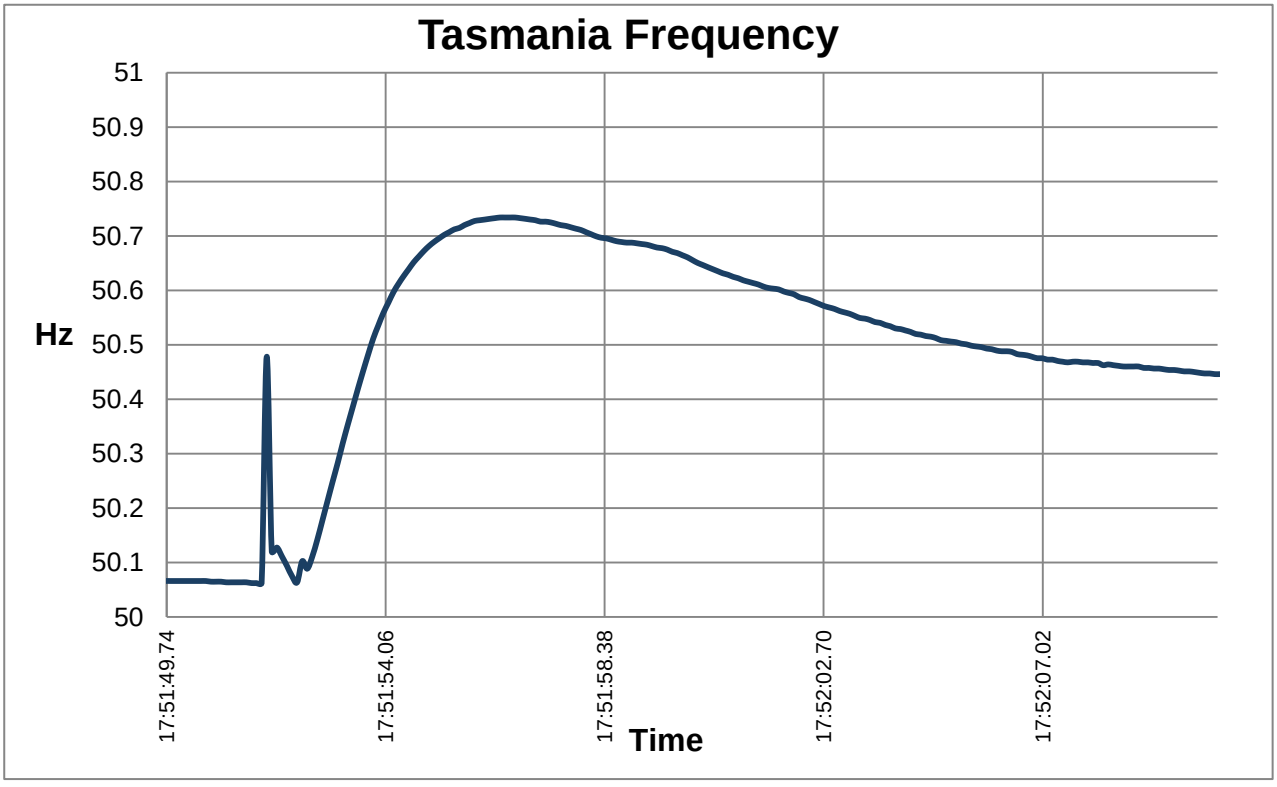


Figure 4 – Tasmania Frequency (1 second data)

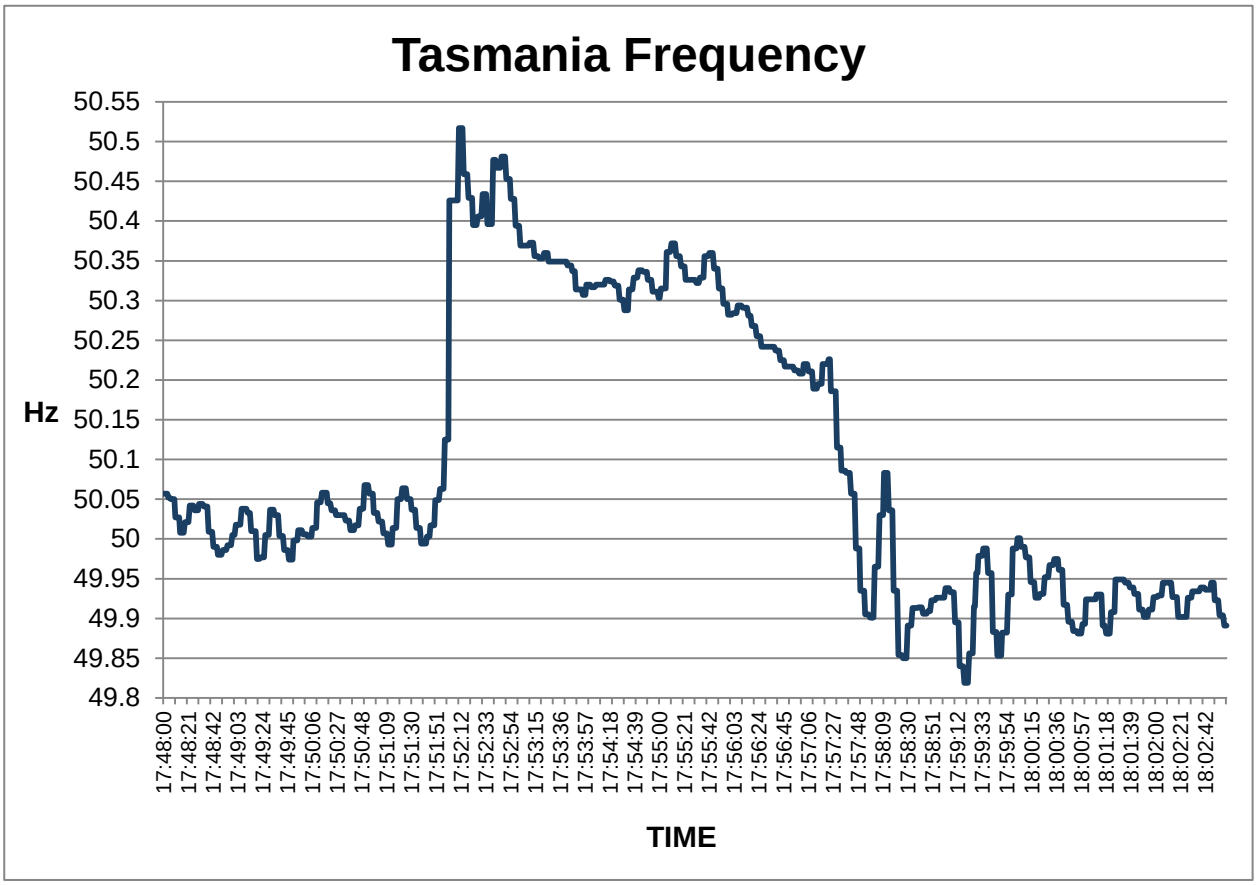


Figure 4 above shows that the Tasmania frequency was within the recovery band (49.85 to 50.15 Hz) within 10 minutes of the event.

3.1 Trip of Rio Tinto Aluminium Smelter Load

Simultaneously with the trip of Basslink, one of the potlines at the Rio Tinto aluminium smelter tripped from 121 MW. Figure 5 shows the current on each of the lines that supply Rio Tinto's load and the Tasmania frequency during this event. For clarity of the graphic, only the current of one phase (phase R) of each line is shown in Figure 5.

It can be seen that the load on both lines, that supply the Rio Tinto aluminium smelter from George Town increased as a response to the rise in frequency and voltage (voltage is shown in Figure 6).

Approximately 600 ms after the trip of Basslink, one of the Rio Tinto potlines (supplied by the George Town No 5 220kV line), tripped.

Figure 5 – Tasmania Frequency and Rio Tinto Load

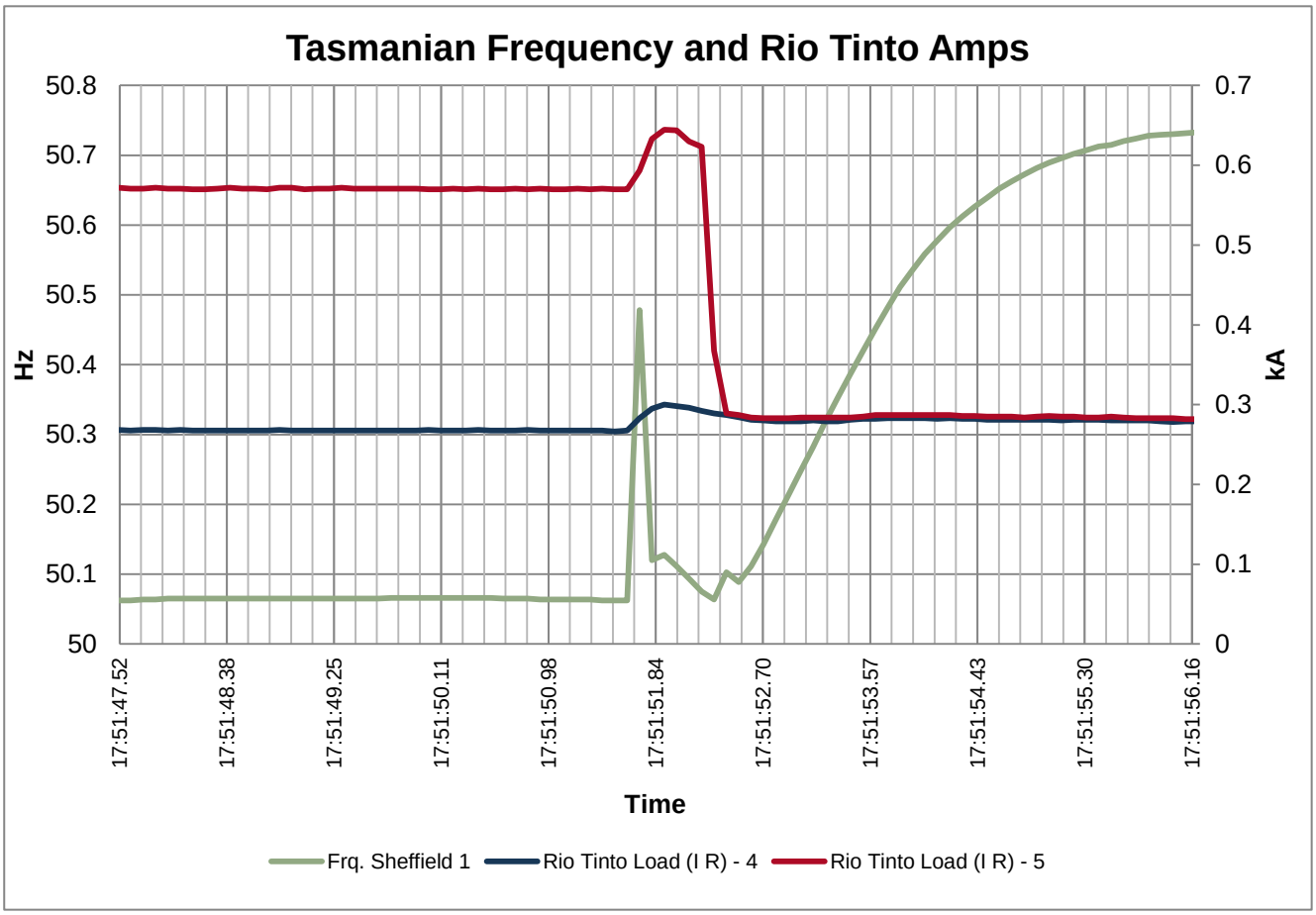


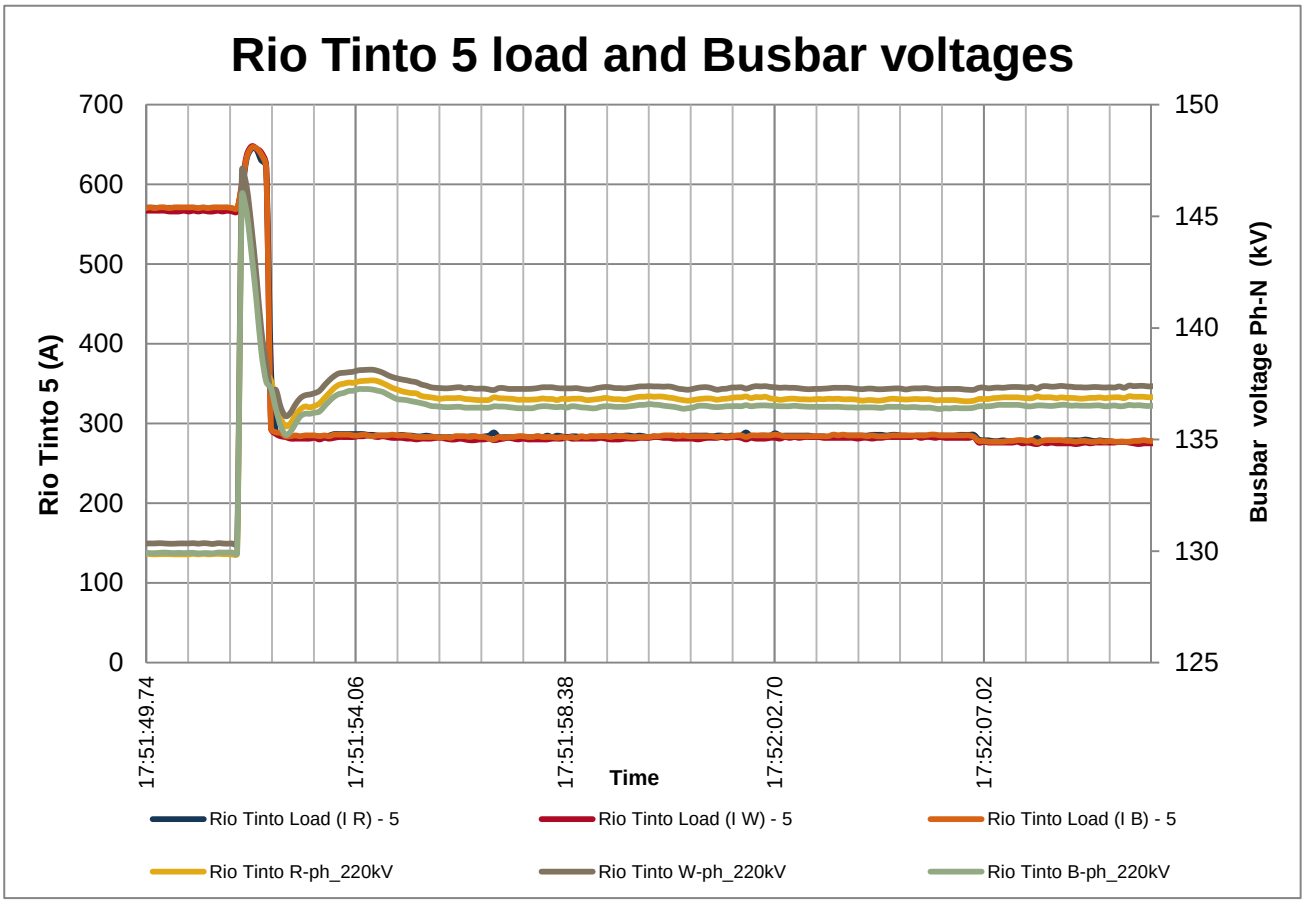
Figure 6 shows the phase to neutral voltages at Rio Tinto 220 kV busbar, and the current through each one of the three phases of the George Town to Rio Tinto No 5 220kV line.

It can be seen that after the trip of Basslink the voltage at Rio Tinto initially increased from around 223 KV (130 kV Ph-N) to around 254 kV (147 kV Ph-N). The voltage values as shown in Figure 6 are within the limits permitted by the National Electricity Rules (S5.1a.4).

This initial voltage rise is due to the normal delayed trip of the Basslink filters at the George Town converter station after the trip of Basslink.

There is no indication that the trip of the potline was directly caused by this increase in voltage.

Figure 6 –Rio Tinto Load (5) and Bus Voltages



Rio Tinto has explained that at the time of this trip, the potlines were not in a normal operating configuration.

The load loss at Rio Tinto did not result from the operation of any protection directly associated with the high voltage supply, but rather from issues associated with the 240 volt distribution supply within the Rio Tinto plant. During this period the Rio Tinto potlines were in an abnormal condition with one of the rectiformers out of service.

An electronic controller associated with the communications systems for the in-service rectiformers sensed an over voltage (from the 240 V supply), tripping the rectiformers and hence, the potline. Rio Tinto has indicated that under normal conditions, this controller would not have tripped the entire potline. The potline was returned to service at 1819 hrs on 5 July, and the out of service rectiformer was returned to service on 17 July at 1517 hrs.

4 Immediate Actions Taken

On loss of Basslink, the FCSPS operated correctly and 604 MW of generation in Tasmania was tripped. The outage constraint set I-BL_ZERO was applied for the duration of the Basslink outage due to this event (1800 -1910 hrs).

At 1803 hrs, AEMO issued Electricity Market Notice No.39189 advising that constraint I-BL_ZERO was invoked.

In this instance AEMO did not reclassify the event as a credible contingency. At that time AEMO's procedure SO_OP3715 Power System Security Guidelines did not specifically deal with what quantum of load or what type of load should be considered when making a determination of reclassification of an event to a credible contingency event.

Since the incident AEMO has reviewed the reclassification process and updated procedure, SO_OP3715 Power System Security Guidelines.

5 Follow-up Actions

Basslink Pty Ltd replaced the faulty temperature indicator and Basslink was returned to service at 2025 hrs on 5 July.

Rio Tinto identified modifications required on the 240 V distribution network at the George Town smelter and have subsequently advised Transend the modifications have been completed and Transend has passed this advice onto AEMO. The modifications were implemented on 3 September 2012.

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.

The FCSPS operated correctly to maintain the power system security.

AEMO did not reclassify this event as credible contingency, and therefore did not consider the potential for this type of event to reoccur.

If the same event had occurred while Rio Tinto remained in the abnormal operating condition there was the potential risk that the Power System may have been in an insecure state. During this time, it is expected that:

- The FCSPS would have operated to cover the loss of Basslink; and
- Tasmanian sourced FCAS would be required to cover the loss of the Potline.

If the contingency lower FCAS dispatched[1] in the Tasmania region was less than that required to cover the loss of a single potline, the frequency in Tasmania may not have met the Tasmanian Frequency Operating standards (FOS). At no time were the Tasmanian FOS actually breached.

7 Conclusions

The trip of Basslink was due to a faulty transformer temperature sensor at the Basslink Loy Yang converter station.

The FCSPS operated correctly, and tripped the required level of generation in the Tasmania region to control frequency in that region. The frequency standards for both the Mainland and Tasmania were not exceeded during this event despite the unexpected loss of 121 MW of load at Rio Tinto.

[1] The amount of contingency lower FCAS required is dependent on load at risk, inertia in the Tasmania region and demand in the Tasmania region.

The loss of 121 MW at Rio Tinto at the time of the trip of Basslink was due to issues with its local 240 V control supplies coupled with abnormal plant configuration within the Rio Tinto aluminium smelter at the time of the event.

AEMO did not reclassify this event as a credible contingency event. Following the event, AEMO reviewed the reclassification process and will update its procedure SO_OP3715 Power System Security Guidelines, section 11.2.

If the same event had occurred while Rio Tinto remained in the abnormal operating condition there was the potential risk that the Power System may have been in an insecure state. If the contingency lower FCAS dispatched in the Tasmania region was less than that required to cover the loss of a single potline, the frequency in Tasmania may not have met the Tasmanian FOS. At no time were the Tasmanian FOS actually breached.

Rio Tinto completed modifications to prevent a re-occurrence of this type of trip.

8 Recommendations

There are no recommendations as a result of this incident.