POWER SYSTEM INCIDENT REPORT - INSECURE OPERATION OF THE POWER SYSTEM IN VICTORIA, 6TH OCTOBER 2009

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1. Introduction

The Victorian Power System was in an insecure operating state between 10:58 hrs and 12:24 hrs (approximately 86 minutes) on the 6th October 2009.

If the Hazelwood Power Station (HWPS) to Jeeralang Terminal Station (JLTS) No. 4 220 kV line had tripped during this period, the Hazelwood Terminal Station (HWTS) A3 500/220 kV transformer would have been loaded beyond its short time rating.

The insecure operating state occurred because of an interaction between two concurrent outages at HWPS, which was not identified by AEMO's outage assessment processes. As a result of the concurrent outages, the outage constraints in place at the time were not effective at managing power system security.

This report has been prepared under clause 4.8.15 of the Rules to assess the underlying cause of the insecure operating state, the adequacy of the provision and response of facilities and services, and the appropriateness of actions taken to restore power system security.

Information for this report has been obtained from AEMO's Market Management System (MMS) and Energy Management System (EMS).

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

2. Summary of Events

On 6th October 2009 a planned outage of the HWTS A4 500/220 kV transformer commenced at 07:34 hrs. The corresponding outage constraint sets were invoked for this outage.

The HWPS and JLTS 220 kV switchyards were configured in '3/5 parallel' operating mode during this outage. This is a normal operating practice, and it reduces the loading on the remaining three HWTS 500/220 kV transformers.

This outage was concurrent with an earlier outage of the HWPS No. 6 Generator No. 4 220 kV bus Circuit Breaker (CB). This outage commenced on the 24th September and was eventually completed on the 9th October 2009.

These concurrent outages resulted in only one bus tie between the No. 3 and No. 4 220 kV buses at HWPS. With all plant in service there are normally three bus ties. When operating in 3/5 parallel mode at HWPS, it is necessary to have a secure bus tie between the No. 3 and No. 4 220 kV busses at HWPS – i.e at least two bus ties in place.

Figure 1 below shows the arrangement of the HWPS 220 kV switchyard during this period.

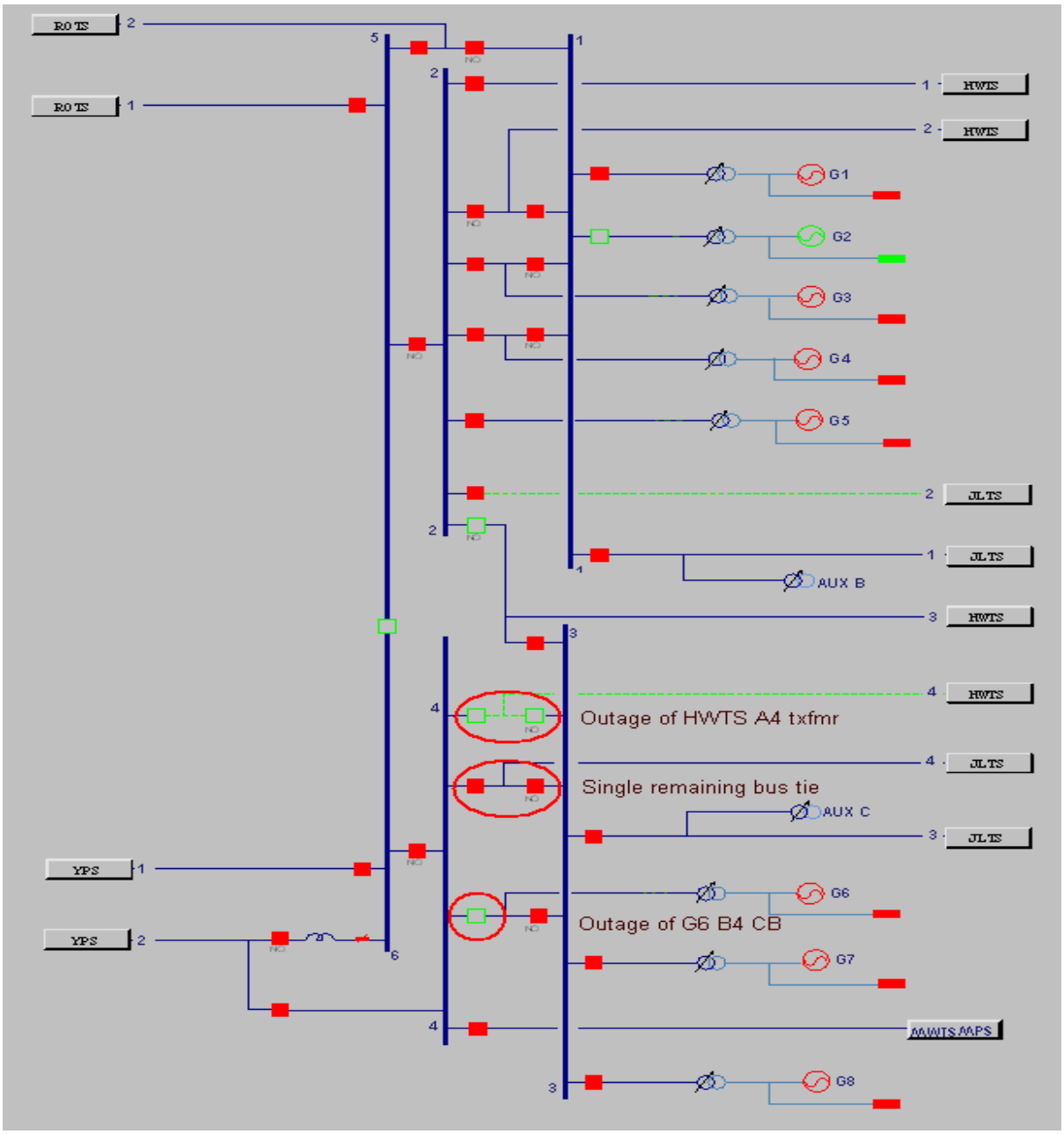

FIGURE 1 – ARRANGEMENT OF HWPS 220 KV SWITCHYARD ON 6TH OCTOBER 2009

Beginning at 10:58 hrs on 6th October contingency violations for an overload on the HWTS A3 500/220 kV transformer for the trip of the HWPS to JLTS No. 4 220 kV line were recorded in AEMO's Contingency Analysis facilities. These violations increased over time to a maximum post contingent overload of 54 MVA at around 12:03 hrs.

AEMO's Power System Operators initially investigated various reconfiguration options at HWPS to address this situation, however high fault levels prevented any reconfiguration.

At 12:10 hrs AEMO's constraint automation facilities were used to develop a new network constraint to manage post contingent loading on the HWTS A3 500/220 kV transformers. This new constraint was effective at managing post contingent loading on the HWTS A3 500/220 kV transformer, and by 12:24 hrs the contingency violations had cleared.

At 13:02 hrs the HWTS A4 500/220 kV transformer was returned to service at the end of its planned outage.

3. Power System Security Assessment

As indicated by AEMO's contingency analysis facilities, and confirmed by subsequent analysis, if the HWPS-JLTS No. 4 220 kV line had tripped between 10:58 hrs and 12:24 hrs on 6th October, the loading on the HWTS A3 550/220 kV transformer would have exceeded its short time rating.

Figure 2 below shows the post contingent overload of the A3 500/220 kV transformer. The peak overload was approximately 54 MVA, above a short time overload rating for this transformer of 638 MVA.

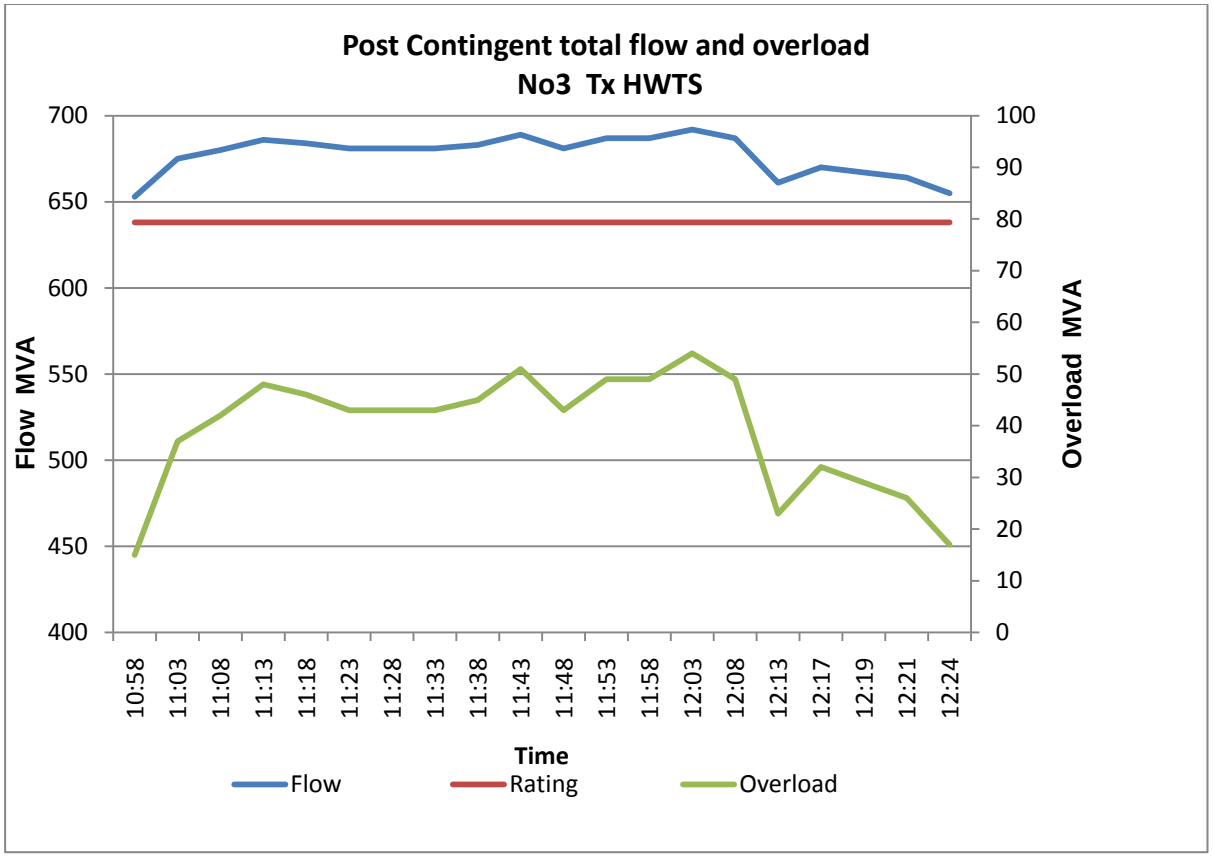

FIGURE 2 – POST CONTINGENT LOADING ON THE HWTS A3 500/220 KV TRANSFORMER

4. Analysis of the event and follow-up actions

4.1 Outage assessment process

As part of the normal assessment process for these outages a system security assessment was made based on the expected power system arrangement during the outage. This assessment included consideration of the concurrent outages, and the fact that there was only one 220 kV bus between the No. 3 and No. 4 220 kV busses, which was a somewhat unusual situation.

However this assessment was made some time prior to the outage proceeding, using the expected generation dispatch during the outage period, which was obtained from AEMO's PreDispatch systems.

AEMO's PreDispatch results from the evening of the 5th October did not indicate that Jeeralang generation would run on the morning of the 6th October, when in fact it did ultimately run at full output on the morning of 6th October. Studies indicate that if this Jeeralang generation had not run, the insecure operating state would not have occurred.

If a security assessment had been made using maximum available generation instead of expected actual generation, this issue may have been identified during the outage assessment process. Future outage assessments of this type will be made using both actual expected and maximum available generation.

4.2 Constraints

During a planned outage such as this outage constraints are invoked to ensure that the power system remained in a secure operating state. However the constraints for outage of the HWTS A4 500/220 kV transformer which were invoked during this period were not effective at keeping the power system in a secure state, because the constraints were not appropriate for the system conditions on the day.

In particular the outage constraints used were not appropriate due to the fact that there was only one 220 kV bus tie in place between the HWPS No. 3 and No. 4 220 kV busses. Loss of the HWPS-JLTS No. 4 220 kV line would have resulted in loss of the last remaining bus tie, producing a significantly different network arrangement to that which the constraints were designed for.

There were no constraints readily available on the day appropriate for the network arrangement in place during this outage. The constraints ultimately developed during the incident using AEMO's constraint automation facility were appropriate for the power system arrangement, and were effective at managing power system security.

4.3 Operator response to contingency violations

The first contingency violations were recorded at 10:58 hrs. It was not until 12:10 hrs that an automated constraint was developed, which ultimately restored the power system to a secure operating state. The long response time here appears to have been an issue with the level of situational awareness, with other AEMO control room logistical issues distracting the person responsible at the time.

Generally contingency violations within a given power system area are only monitored at the control room site responsible for that area. AEMO will evaluate having contingency violations presented at both sites, and whether there are any improvements that can be made to the way staff are alerted to new contingency violations.

5. Conclusions

This insecure operating state arose during a period of two concurrent outages. As a result of these concurrent outages the network constraints in place during the outage were not appropriate for the network arrangement, and were not effective at managing power system security.

Existing outage assessment processes did not detect this, in part because the actual generation dispatch during the outage did not match the expected generation dispatch obtained from PreDispatch used when assessing the outage.

AEMO's constraint automation facilities were effective at restoring the power system to a secure state, however there was some delay after the initial contingency violations were detected before this was used, and the processes for responding to contingency violations could be improved.

6. Recommendations

AEMO's procedures for assessing similar outages at HWPS will be reviewed and updated by the end of March 2010 to specifically consider bus tie capability, and the use of maximum generation output in addition to the generation dispatch predicted by PreDispatch.

By the end of March 2010 AEMO will review control room processes to assess whether situational awareness with regards to real time contingency violations can be improved for day to day operations.