TRIP OF YALLOURN POWER STATION NO.2 220 KV BUSBAR ON 8 JUNE 2016

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

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AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

INCIDENT CLASSIFICATIONS

Classification	Detail
Time and date of incident	0129 hrs 8 June 2016
Region of incident	Victoria
Affected regions	Victoria
Event type	Busbar trip (BB)
Generation Impact	670 MW of generation was disconnected as a result of this incident
Customer Load Impact	No customer load was disconnected as a result of this incident
Associated reports	Trip of Yallourn Power Station No.2 220kV Busbar on 6 December 2015

IMPORTANT NOTICE

Purpose

AEMO has prepared this report in accordance with clause 4.8.15(c) of the National Electricity Rules, using information available as at the date of publication, unless otherwise specified.

Disclaimer

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1. OVERVIEW

This report relates to a reviewable operating incident[1] that occurred on 8 June 2016 at Yallourn Power Station (YPS) switchyard in Victoria. This incident involved the trip of a 220 kV busbar and Yallourn West Power Station (YWPS) generating units 1 and 2, resulting in the loss of 670 MW of generation.

There was no loss of customer load as a result of this incident.

As a reviewable operating incident, AEMO is required to assess power system security over the course of this incident, and 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.[2]

AEMO has concluded that:

1. The YPS No. 2 220KV busbar tripped when a CB failed to open correctly during the shutdown of YWPS unit 3.
2. YWPS units 1 and 2 tripped as a consequence of the busbar outage.
3. The provision and response of facilities and services were appropriate and power system security was maintained over the course of the incident.

A similar event involving the same CB occurred on 6 December 2015[3]. As a result of that incident, AusNet Services conducted maintenance on the CB and repaired a faulty latching mechanism.

This report is prepared in accordance with clause 4.8.15(c) of the National Electricity Rules (NER). It is based on information provided by AusNet Services[4], EnergyAustralia[5] and AEMO.

Australian Eastern Standard Time is used in this report.

2. THE INCIDENT

On Wednesday 8 June 2016 at 0129 hrs, the YPS No.2 220kV busbar (No. 2 busbar) tripped. This resulted in the islanding and subsequent trip of YWPS unit 2, off-loading of the Yallourn to Rowville No.8 220kV transmission line (No. 8 Line), the Yallourn to Hazelwood No.2 220kV transmission line (No.2 Line), and disconnection of the 'A' and 'D' auxiliary supply transformers. Two minutes later, at 0131 hrs, YWPS generating unit 1 tripped.

At the time of this incident, YWPS unit 3 was being returned to service after maintenance but tripped during the run-up process.

As a result of this incident 670 MW of generation was lost, but no customer load. The No.2 busbar, No. 8 Line and No.2 Line were returned to service by 0219 hrs on 8 June. The 'A' and 'D' auxiliary transformers were returned to service at 0234 hrs and 0245 hrs respectively on 8 June.

See Appendix A for a power system diagram illustrating the incident and Appendix B for a chronological log of the incident.

The reason for investigating this incident is that the probability of a busbar fault is very low, so is an unexpected event known in power system security terms as a non-credible contingency[6].AEMO is required to investigate and report on non-credible contingencies.

[1] See NER clause 4.8.15(a)(1)(i), as the event relates to a non-credible contingency event; and the AEMC Reliability Panel Guidelines for Identifying Reviewable Operating Incidents.
[2] See NER clause 4.8.15(b).
[3] Report available on the AEMO website at: http://www.aemo.com.au/Electricity/Resources/Reports-and-Documents/~/media/A91BE0F23C344B94AD8CA62BB40A5706.ashx
[4] Information provided by AusNet Services has been provided on a without prejudice basis and nothing in this report is intended to constitute, or may be taken by any person as constituting, an admission of fault, liability, wrongdoing, negligence, bad faith or the like on behalf of AusNet Services (or its respective associated companies, businesses, partners, directors, officers or employees).
[5] EnergyAustralia is the operator of Yallourn Power Station
[6] NER Clause 4.2.3 - Credible and non-credible contingency events; *AEMO Power System Security Guidelines,* Section 10 - Definition of a non-credible contingency events

3. AUSNET SERVICES INVESTIGATION

AusNet Services, as owner of the 220kV busbars and associated switchgear at YPS, investigated this incident and provided the following information.

At 0129 hrs on 8 June 2016, the YPS No.2 220kV busbar tripped via protection.

Inspection of station apparatus and protection targets at YPS indicated that one phase of the Yallourn 3 Generator 2B 220kV CB did not open correctly in response to a trip signal from the power station. This resulted in operation of the CB fail protection to trip the YPS No.2 220KV busbar. This is the correct outcome for this type of fault.

The CB was isolated for further inspection and testing. Timing tests showed that the white phase was slow to open, similar to the previous event on 6 December 2015. The trip latching mechanism was re-examined and found to be clean, in good condition and working correctly. Further testing identified a faulty white phase trip coil. The faulty trip coil was replaced. Subsequent operational and timing tests proved satisfactory, and the CB was returned to service at 1614 hrs on 9 June 2016.

4. ENERGYAUSTRALIA INVESTIGATION

EnergyAustralia, as operator of YWPS, investigated this incident and has provided the following information.

YWPS unit 3 was returning from a maintenance outage and during the run up, at about 60 MW, had a boiler master fuel trip. This initiated an open command to both the unit 3 YPS No1 220kV bus CB and the unit 3 YPS No2 220kV bus CB. This resulted in the unexpected trip of the No2 220kV busbar at YPS.

At the time of incident, YWPS Unit 2 was online and generating 320 MW. As a result of the No.2 Busbar trip, YPS Unit 2 was islanded and subsequently tripped.

YWPS unit 1 was also on line and generating 350 MW and connected to the YPS No1 and No2 220kV Buses. The auxiliary supplies for unit 1 were being fed via auxiliary transformer ‘A’, which was connected to Yallourn No.2 220kV busbar. Because of the trip of No.2 220kV busbar, these station auxiliaries were de-energised. The unit operator changed over the auxiliary supply to auxiliary transformer ‘C’. As auxiliary supplies were interrupted for longer than two seconds, a boiler master fuel trip was initiated. This would normally result in the unit running back to around 20 MW output. However output unexpectedly reduced to 3 MW, and as the operator was unsure of the status of the auxiliary supplies, the unit was manually tripped. The run-back to 3 MW has since been identified as a correct operation.

EnergyAustralia has not identified any plant issues as a result of this incident and considers the actions taken by the plant operators as appropriate.

5. POWER SYSTEM SECURITY

AEMO is responsible for power system security in the NEM. This means AEMO is required to operate the power system in a secure operating state and return the power system to a secure state following a contingency event. This section assesses how AEMO managed how power system security over the course of this incident[7].

[7] AEMO is responsible for power system security in the NEM and is required to operate the power system in a secure operating state (NER Clause 4.2.4 (a)). AEMO must thereby ensure that the power system is maintained in, or returned to, a secure operating state following a contingency event.

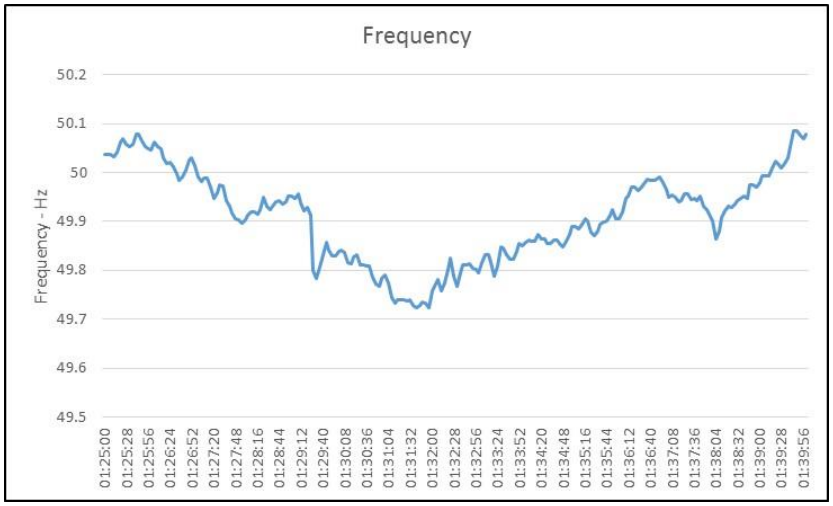
To ensure the power system was returned to and maintained in a secure operating state,[8] AEMO invoked constraint sets V-YP_BUS2[9], V-ROYP78_R[10] and V-HWYP2[11]. Constraint sets V-YP_BUS2 and V-ROYP78_R were invoked approximately 11 minutes after the incident. Although constraint set V-HWYP2 should have been invoked at the same time, this was not done until approximately 35 minutes after the incident. Once invoked, constraint equations within this constraint set did not bind indicating that the delay in invoking this constraint set had no adverse impact on power system security.

No further action was required to maintain power system security.

5.1 Frequency

For multiple contingency events,[12] the frequency operating standards require the frequency to remain above 47 Hz, return to above 49.5 Hz within two minutes and to above 48.85 Hz within ten minutes. The frequency standard was met for this incident. Figure 1 shows the frequency during this incident.

Figure 1: Frequency



5.2 Reclassification

In accordance with clause 4.2.3A of the NER, AEMO considered whether to reclassify this non-credible contingency event as a credible contingency event. As the cause of the contingency was known and the faulty CB had been isolated pending repair, AEMO was satisfied that the non-credible contingency event was unlikely to re-occur, and so did not reclassify it as a credible contingency event.

For this incident, AEMO took appropriate action to ensure the power system was returned to and maintained in a secure operating state.

[8] AEMO is required to return the power system to a secure state within thirty minutes following a contingency event - NER Clause 4.2.6 (b)
[9] Outage of Yallourn PS No2 220KV Bus
[10] Outage of Yallourn to Rowville No7 or No 8 220KV line.
[11] Outage of Yallourn to Hazelwood No2 220KV line
[12] The frequency operating standards define a multiple contingency as either a contingency event other than a credible contingency event, or a sequence of credible contingency events within a period of five minutes.

6. MARKET INFORMATION

AEMO is required by the NER and operating procedures to inform the market about incidents as they progress. This section assesses how AEMO informed the market[13] over the course of this incident.

For this incident, AEMO was required to inform the market on the following matters:

1. The occurrence of a non-credible contingency event - notify within two hours of the event.[14]
    - AEMO issued market notice 53704 at 0141 hrs – 12 minutes after the event.
    - AEMO also issued market notice 53705 at 0245 hrs to advise the cause of the non-credible contingency event had been identified and that the contingency would not be reclassified.

Over the course of this incident AEMO issued appropriate, timely and sufficiently detailed market information.

7. CONCLUSIONS

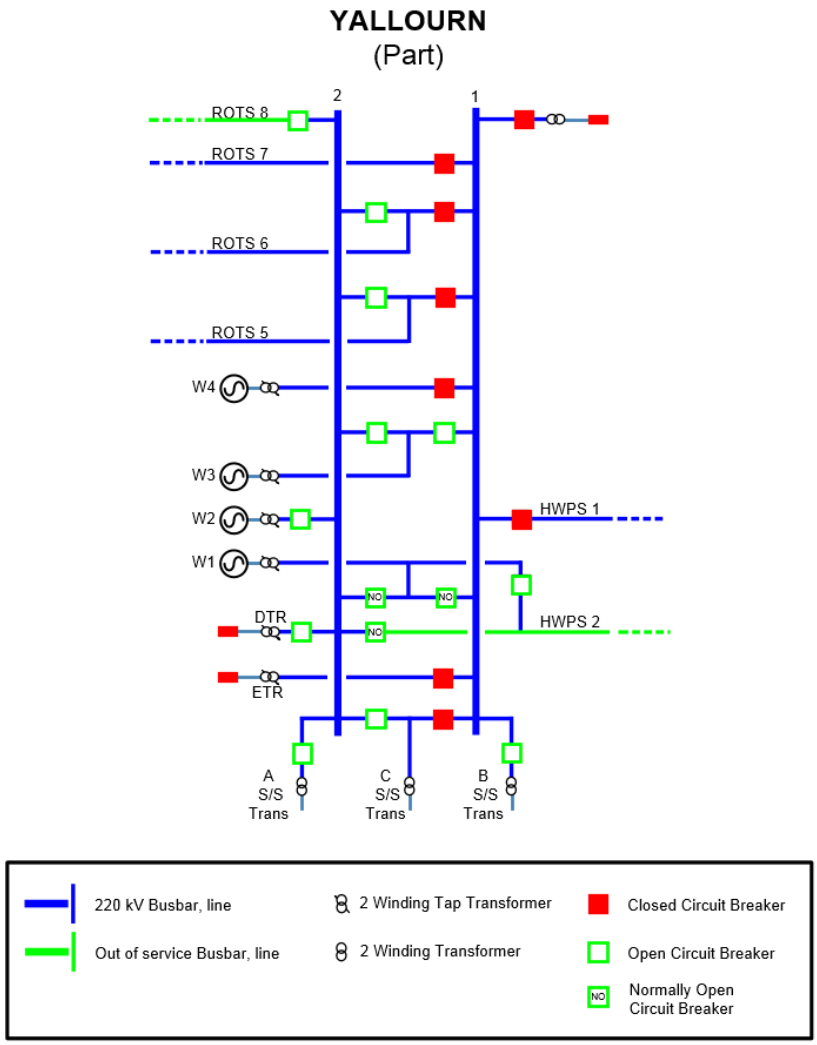
AEMO concluded that:

4. The YPS No. 2 220KV busbar tripped when a circuit breaker failed to open correctly during the shutdown of YWPS unit 3.
5. YWPS units 1 and 2 tripped as a consequence of the busbar outage.
    - Unit 1 tripped as a result of an interruption to its auxiliary supplies
    - Unit 2 tripped due to the loss of connection to the power system
6. The provision and response of facilities and services were appropriate and power system security was maintained over the course of the incident.
    - There was a delay in invoking one constraint set but this had no impact on power system security.

[13] AEMO generally informs the market about operating incidents as the progress by issuing Market Notices – see AEMO website
[14] AEMO is required to notify the Market of a non-credible contingency event within two hours of the event - AEMO, *Power System Security Guidelines,* Section 10.3

APPENDIX A. – POWER SYSTEM DIAGRAM

The power system immediately after the incident



APPENDIX B. – INCIDENT EVENT LOG

Chronological Log of Incident

Time and Date	Event
01:29 – 8 June 2016	YWPS unit 3 trip. Yallourn No. 2 220 kV bus trip, YWPS unit 2 trip. ROTS – YPS No. 8 220 kV Line and the HWPS – YPS No. 2 220 kV Line offloaded.
01:31 – 8 June 2016	YWPS unit 1 trip
01:40 – 8 June 2016	Constraint Sets V-YP_BUS2 and V-ROYP78_R invoked.
01:41 – 8 June 2016	Market Notice 53704 issued
02:05 – 8 June 2016	Constraint Set V-HWYP2 invoked.
02:15 – 8 June 2016	TNSP advise cause of trip YW3 Gen 2B CB. CB isolated.
02:19 – 8 June 2016	YPS No. 2 220 kV bus, ROTS – YPS No. 8 220 kV Line and the HWPS – YPS No. 2 220 kV Line returned to service
02:35 – 8 June 2016	Constraint Sets V-YP_BUS2, V-ROYP78_R and V-HWYP2 revoked.
02:45 – 8 June 2016	Market Notice 53705 issued