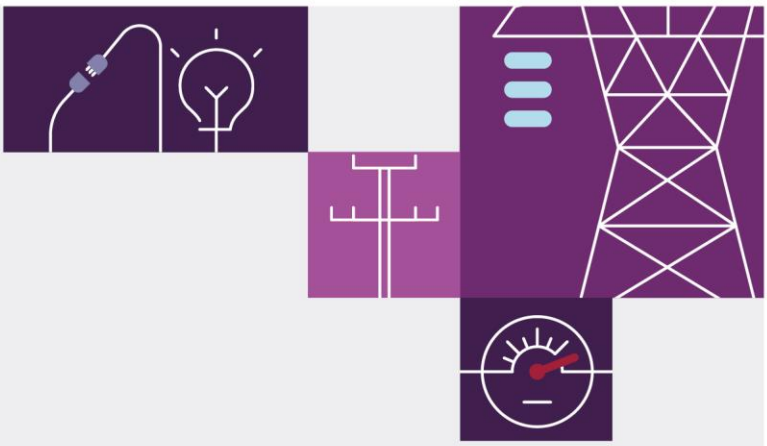
Trip of Mount Beauty Terminal Station 220 kV No. 2 busbar on 3 November 2023

April 2024

Reviewable Operating Incident Report under the National Electricity Rules



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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Abbreviations

Abbreviation	Term
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AEST	Australian Eastern Standard Time
BOPS	Bogong Power Station
CB	circuit breaker
CLPS	Clover Power Station
DDTS	Dederang Terminal Station
DPS	Dartmouth Power station
EPS	Eildon Power Station
FOS	Frequency Operating Standard
GNTS	Glenrowan Terminal Station
kV	kilovolt/s
km	kilometre/s
LHS	left hand side
MBTS	Mount Beauty Terminal Station
MKPS	McKay Creek Power Station
NEM	National Electricity Market
NER	National Electricity Rules
PSSWG	Power System Security Working Group
s	second/s
SHTS	Shepparton Terminal Station
SMTS	South Morang Terminal Station
TTS	Thomastown Terminal Station
WKPS	West Kiewa Power Station
WOTS	Wodonga Terminal Station

Incident review

This reviewable operating incident[1] report is prepared in accordance with clause 4.8.15(c) of the National Electricity Rules (NER). It has been prepared using information provided by AusNet Services[2] and from AEMO systems.

Table 1 Summary of event

	Details
Reviewable operating incident type	Non-credible contingency event impacting critical transmission elements.
Incident details	This report relates to a reviewable operating incident[3] that occurred on 3 November 2023 in Victoria. The incident involved the trip of the Mount Beauty Terminal Station (MBTS) 220 kilovolt (kV) No. 2 busbar.
Incident classification	Transmission equipment failure – Internal flashover within the white phase associated with the MBTS – Dederang Terminal Station (DDTS) No. 1 line 220 kV circuit breaker (CB).
Generation impact	No generation was lost as a result of this incident.
Customer load impact	No load was lost as a result of this incident.
Pre-incident conditions	Nearby hydro generators Bogong Power Station (BOPS), Clover Power Station (CLPS), Dartmouth Power Station (DPS), McKay Creek Power Station (MKPS) and West Kiewa Power Station (WKPS) were not generating at the time of the incident.
Incident key events	1. At 0412.40 hrs on 3 November 2023, the DDTS – MBTS 220 kV No. 1 line tripped. 2. Two seconds later at 0412.42 hrs on 3 November 2023, the DDTS – MBTS 220 kV No. 1 line auto-reclosed. 3. A further seven seconds later at 0412.49 hrs on 3 November 2023: – The DDTS – MBTS 220 kV No. 1 line tripped and did not auto reclose. – The MBTS 220 kV No. 2 busbar tripped (see Figure 1). This offloaded the Eildon Power Station (EPS) – MBTS 220 kV No. 1 line at the MBTS end. 4. At 0427 hrs on 3 November 2023, AEMO requested AusNet Services de-energise the EPS – MBTS 220 kV No. 1 line (which was already open at the MBTS end) for voltage control. 5. At 0430 hrs on 3 November 2023, AusNet Services deenergised the EPS – MBTS 220 kV No. 1 line by opening the line at the EPS end. 6. At 0840 hrs on 3 November 2023, the MBTS 220 kV No. 2 busbar and the EPS – MBTS 220 kV No. 1 line returned to service. 7. At 1622 hrs on 13 November 2023, the DDTS – MBTS 220 kV No. 1 line and DDTS – MBTS Line No. 1 220 kV CB returned to service.
Incident cause	AusNet Services' post-incident investigation confirmed that: • The initial trip at approximately 0412.40 hrs was caused by a white phase-earth fault located on the DDTS – MBTS 220 kV No. 1 line, approximately 11.5 kilometres (km) from DDTS. Later that day, AusNet Services conducted a post-incident line patrol and was not able to identify a root cause for this initial fault. • The DDTS – MBTS 220 kV No. 1 line completed an auto-reclosure at 0412.42 hrs. A second trip occurred at approximately 0412.49 hrs and was also caused by a white phase-earth fault, caused by an internal flashover within the MBTS DDTS No. 1 line 220 kV CB. All CBs connected to the MBTS 220 kV No. 2 busbar and the DDTS – MBTS 220 kV No. 1 line tripped. As the reclaim timer of 25 seconds (s) from the initial trip had not expired, there was no subsequent auto-reclosure attempt of the DDTS – MBTS 220 kV No. 1 line. As per AusNet's busbar protection design philosophy, the MBTS 220 kV No. 2 busbar protection also did not attempt to auto-reclose. • All protection referred to in this section operated as expected.

[1] Reviewable operating incidents are defined by NER clause 4.8.15(a) and the Australian Energy Market Commission (AEMC) Reliability Panel Guidelines for Identifying Reviewable Operating Incidents.

[2] AusNet Services is the Victorian Declared Transmission System Operator.

[3] See NER 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.

	Details
Power system response (facilities and services)	There was no other material impact on the broader power system, load, or generation.
Rectification	The MBTS DDTS No. 1 line 220 kV CB was isolated until AusNet Services replaced the CB on 13 November 2023. AusNet Services is continuing to investigate the root cause of the CB's failure and plans to share any key findings with AEMO and where relevant the Power System Security Working Group (PSSWG).
Power system security	Following the contingency at 0412.49 hrs on 3 November 2023, AEMO's energy management system (EMS) showed alarms that a trip of the EPS – Thomastown Terminal Station (TTS) 220 kV line would cause a subsequent overvoltage of 1.12 per unit, which is above the limit at MBTS. To maintain the power system security, at 0428 hrs, AEMO requested AusNet Services de-energise the EPS – MBTS No. 1 220 kV line to manage the post-contingent voltage at MBTS. AusNet de-energised the EPS – MBTS No. 1 220 kV line at 0430 hrs. During this incident AEMO invoked the following constraint sets: • V-EPMB and V-MB_BUS2 between 0425 hrs and 0905 hrs on 3 November 2023 to manage the MBTS 220 kV No. 2 busbar outage. • V-DDMB between 0425 hrs on 3 November 2023 and 1630 hrs on 13 November 2023 to manage the outage of DDTS – MBTS 220 kV No. 1 line. AEMO and AusNet appropriately responded to address the power system security issue and returned the power system to a secure operating state within 30 minutes[4]. The power system was in a satisfactory operating state from the commencement of the event at 0412 hrs until 0430 hrs, when the power system was returned to a secure operating state. The Frequency Operating Standard (FOS) was met for this incident[5].
Reclassification	AEMO assessed whether to reclassify this incident as a credible contingency event[6]. On 3 November 2023, AusNet Services advised AEMO that the incident was caused by the MBTS DDTS No. 1 line 220 kV CB and that the CB was to remain out of service. On this basis and information from AusNet Services that the issue was limited to this CB, AEMO determined that recurrence of this incident was not reasonably possible. On 13 November 2023, MBTS DDTS No. 1 line 220 kV CB was returned to service following replacement of the failed CB. As the failed CB had been replaced, there was no requirement to consider reclassifying the event. AusNet Services has advised AEMO that it has experience with many CBs of this type and that this is the first failure of this type on its network, and has advised AEMO that it considers the probability of a repeat event to be very low. AEMO has not become aware of any further information that indicates that there is a risk on the power system that requires further action from AEMO to maintain power system security. Based on the information available to AEMO at the relevant time, it has been assessed that AEMO appropriately applied the reclassification criteria throughout the event and during its investigation.
Market information	For this incident, AEMO issued the following market notices: • AEMO issued Market Notice 110687 at 0437 hrs on 3 November 2023 to advise the market of this non-credible contingency event. • AEMO issued Market Notice 110690 at 0919 hrs on 3 November 2023 to advise the market that the cause of this non-credible contingency event had been identified and that it was unlikely to re-occur in the present conditions. AEMO invoked constraint set V-EPMB[7] between 0425 hrs and 0905 hrs, which contains constraints which can affect Victoria – New South Wales Interconnector (VNI) and Murraylink limits. The Power System Security Guidelines (SO_OP_3715)[8] indicate that AEMO should issue a market notice in these circumstances, however AEMO did not do so in this event. While AEMO has reinforced the requirement to publish market notices in such circumstances, challenges with identifying the need for a market notice highlight the potential benefit of an automated solution.

[4] The general principles for maintaining power system security require AEMO to take all reasonable actions following a contingency event to adjust the operating conditions to return the power system to a secure operating state within 30 minutes – NER 4.2.6(b).

[5] Frequency Operating Standard; see https://www.aemc.gov.au/sites/default/files/2024-01/Frequency%20Operating%20Standard.pdf.

[6] AEMO is required to assess whether or not to reclassify a non-credible contingency event as a credible contingency event – NER 4.2.3A(c) – and to report how the reclassification criteria were applied – NER 4.8.15(ca).

[7] Constraints in constraint set V-EPMB manages thermal limits on DDTS – MBTS for loss of the other DDTS – MBTS line.

[8] See Section 19 of the Power System Security Guidelines at https://www.aemo.com.au/-/media/Files/Electricity/NEM/Security_and_Reliability/Power_System_Ops/Procedures/SO_OP_3715%20Power-System-Security-Guidelines.pdf.

	Details
Recommendations	1. AusNet Services to share the findings of the investigation of the incident with the PSSWG by Q2 2024. 2. AEMO supports AusNet Services' plan to continue its investigation into the root cause of the CB's failure and to share key findings with AEMO and, where relevant, the PSSWG. 3. AEMO to investigate opportunities to automate publication of market notices when there are constraints invoked with interconnector terms on the left hand side (LHS).

Figure 1 Post-incident diagram