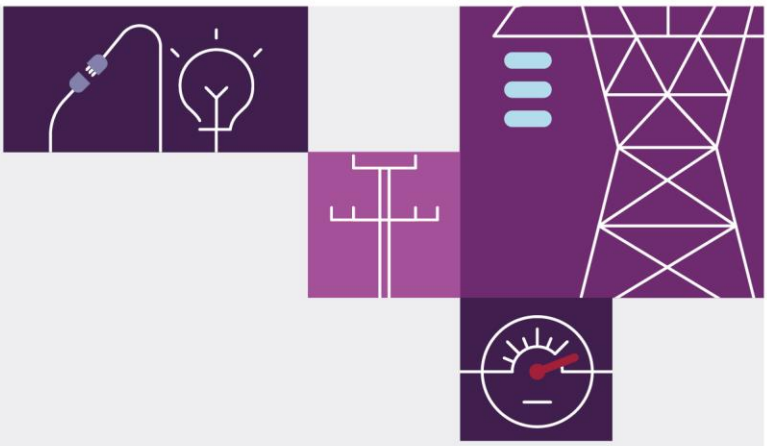
Trip of Haunted Gully – Moorabool, Haunted Gully – Tarrone 500 kV lines on 19 October 2023

May 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
ARPS	Anti-Resonance Protection Scheme
CB	circuit breaker
CBF	circuit breaker fail
HGTS	Haunted Gully Terminal Station
kV	kilovolt/s
MLTS	Moorabool Terminal Station
MW	megawatts/s
NEM	National Electricity Market
NER	National Electricity Rules
SHWF	Stockyard Hill Wind Farm
TNSP	Transmission Network Service Provider
TRTS	Tarrone 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[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 19 October 2023 in Victoria. This incident involved the trip of Haunted Gully Terminal Station (HGTS) – Moorabool Terminal Station (MLTS) and HGTS – Tarrone Terminal Station (TRTS) 500 kilovolt (kV) lines.
Incident classification	Human error – Incorrect protection logic design not aligned with AusNet design philosophy.
Generation impact	Approximately 58 megawatts (MW) of generation was tripped as a result of the Stockyard Hill Wind Farm (SHWF) trip during this incident.
Customer load impact	No customer load was tripped or automatically shed in response to these incidents.
Pre-incident conditions	Prior to the event, the HGTS No. 1 500 kV line shunt reactor and its circuit breaker (CB) at MLTS were isolated from the line for planned maintenance and SHWF was generating approximately 58 MW. All other transmission elements were in service prior to the event.
Incident key events	On 19 October 2023, the following events occurred: • At 0901 hrs the HGTS – MLTS and the HGTS – TRTS 500 kV lines tripped (see Figure 1). This resulted in disconnection of HGTS from the power system. • At 1039 hrs the HGTS – MLTS and the HGTS – TRTS 500 kV lines were returned to service.
Incident cause	Post incident investigation by AusNet has confirmed that: • At 0901 hrs on 19 October 2023, the HGTS – MLTS 500 kV line and the HGTS – TRTS 500 kV line tripped. The incident occurred when a primary testing team representing AusNet was conducting tests on the isolated HGTS 500 kV line shunt reactor CB at MLTS. During the CB pole discrepancy test, the HGTS – MLTS Anti-Resonance Protection Scheme (ARPS) associated with the HGTS 500 kV line shunt reactor at MLTS, HGTS – MLTS and HGTS – TRTS 500 kV lines initiated a circuit breaker failure (CBF) trip, resulting in the trip of the HGTS – MLTS 500 kV line. Following the CBF event, the HGTS – MLTS ARPS issued remote trip commands as designed from MLTS to the remote ends of the HGTS – TRTS 500 kV line, tripping the HGTS – TRTS 500 kV line. • AusNet design philosophy for the ARPS is to prevent protection outputs when the primary plant is isolated for maintenance. AusNet has confirmed that during this event, the HGTS 500 kV line shunt reactor at MLTS and its CB were isolated, and due to incorrect protection logic design, the ARPS failed to block the CBF trip signals.
Power system response (facilities and services)	In this event, SHWF was disconnected from the system as a result of tripping the two 500 kV lines to HGTS and the generator fast trip scheme operated to trip the SHWF 132 kV feeder circuit breakers as per its design. There were no other material impacts on the broader power system, load, or generation.
Rectification	Immediately after the incident, the primary testing team informed the AusNet control room of the incident. After identifying the cause of the incident, at 1039 hrs on 19 October 2023, the HGTS – MLTS 500 kV line and the HGTS – TRTS 500 kV line were returned to service. AusNet is planning to update the HGTS – MLTS and HGTS – TRTS 500 kV line ARPS logic to prevent similar incidents.

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

[2] AusNet is the Victorian Declared Shared Network 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
	As an interim measure, until the logic update is completed, AusNet has updated its operational control procedure and informed relevant maintenance teams of the logic issue in the existing ARPS. The updated procedure ensures that maintenance teams establish secondary protection isolations whenever an electrical access permit is issued for the HGTS No. 1 500 kV line shunt reactor. In addition, during the post incident investigation AusNet reviewed the logic of similar ARPS within their network. AusNet's review did not identify any other ARPS with similar logic issues.
Power system security	The power system remained in a secure operating state throughout this incident and the Frequency Operating Standard[4] was met for this incident.
Reclassification	AEMO assessed whether to reclassify this incident as a credible contingency event[5]. During this incident the AusNet control room advised AEMO that the HGTS – MLTS ARPS had operated as per its design. At the time, AEMO therefore did not identify that a non-credible contingency event had occurred. During AEMO's subsequent investigation, AusNet confirmed that the HGTS – MLTS ARPS had not operated as per its design as the scheme's logic had failed to prevent protection outputs when the primary plant was isolated for maintenance and had incorrectly initiated a circuit breaker fail trip, resulting in a non-credible contingency event. Prior to restoring the HGTS – MLTS 500 kV and the HGTS – TRTS 500 kV lines to service, AusNet had identified the cause of the incident and confirmed it was unlikely to re-occur. Therefore, it was not necessary for AEMO to evaluate the potential need for reclassification.
Market information	AEMO did not identify this incident as a non-credible contingency therefore, no market notices were issued on the day of the incident to notify the market of a non-credible contingency event. While AEMO identified in retrospect that this incident had been a non-credible contingency event, AEMO did not notify the market as at that time there were no prevailing additional power system risks that required further action from AEMO to maintain power system security and no requirement to consider reclassification.
Conclusions	AEMO has concluded that: 1. On 19 October 2023, the HGTS – MLTS and HGTS – TRTS 500 kV lines tripped due to the operation of the HGTS 500 kV line shunt reactor CB CBF protection at MLTS and the operation of the HGTS – MLTS ARPS remote trip commands during the HGTS No. 1 500 kV line shunt reactor CB primary testing. These protection functions operated due to the shortcomings in the HGTS – MLTS ARPS logic associated with the HGTS No 1 500 kV line shunt reactor CB. The HGTS – MLTS ARPS logic did not identify the isolated status of the CB and the reactor and issued trip signals against its intended function. 2. During this incident, the AusNet control room advised AEMO that the HGTS – MLTS ARPS had operated as per its design. AEMO was not aware that the scheme had initiated a circuit breaker fail operation and a non-credible contingency event had occurred. Therefore, this incident was not identified as a non-credible contingency. 3. The power system remained in a secure operating state and the Frequency Operating Standard was met throughout this incident.
Recommendations	The following recommendations have been agreed between AEMO and AusNet: • AusNet to review the HGTS – MLTS ARPS design and implement a solution to accommodate maintenance activity of the HGTS line shunt reactor 500 kV CB by May 2024. • AEMO will share the findings of this incident at the Power System Security Working Group by Q3 2024 and will confirm there is a consistent approach for NSPs sharing information with AEMO related to protection schemes operating as per their design.

[4] Frequency Operating Standard, effective 9 October 2023, available at https://www.aemc.gov.au/media/87484.

[5] 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).

Figure 1 Post-incident diagram