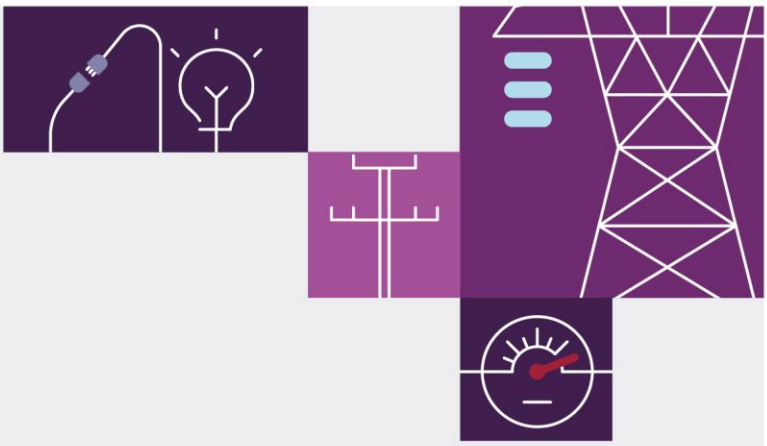
Gordon B 220 kV Busbar Trip on 9 September 2021

January 2022

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

AEMO has made every reasonable effort to ensure the quality of the information in this report but cannot guarantee its accuracy or completeness. Any views expressed in this report may be based on information given to AEMO by other persons.

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Contact

If you have any questions or comments in relation to this report, please contact AEMO at system.incident@aemo.com.au.

The NEM operates on Australian Eastern Standard Time (AEST). All times in this report are in AEST.

Abbreviations

Abbreviation	Term
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AEST	Australian Eastern Standard Time
kV	Kilovolt/s
MW	Megawatt/s
NEM	National Electricity Market
NER	National Electricity Rules
TNSP	Transmission Network Service Provider

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 TasNetworks[2] and from AEMO systems.

Table 1 Summary of event – Gordon B 220 kilovolt (kV) busbar trip

	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 9 September 2021 in Tasmania. The incident involved the trip of the Gordon B 220 kV busbar, which also offloaded the Chapel Street – Gordon No. 2 220 kV line at the Gordon end only. The busbar trip also disconnected Gordon Hydro No. 2 unit from the system.
Incident classification	Protection/control system mal-operation.
Generation impact	20 megawatts (MW)
Customer load impact	Nil
Incident key events	1. At 1738 hrs on 9 September 2021: – The Gordon B 220 kV busbar tripped. – This busbar trip offloaded the Chapel Street – Gordon No. 2 220 kV line at the Gordon end only. – This busbar trip also disconnected the Gordon Hydro No. 2 unit from 20 MW which was connected to the Gordon B 220 kV busbar at the time. 2. At 1846 hrs on 9 September 2021: – The Gordon B 220 kV busbar was returned to service. – The Chapel Street – Gordon No.2 220 kV line was placed on load at this time. 3. Gordon Hydro No. 2 unit reconnected to the system at 1859 hrs on 9 September 2021.
Incident cause	Post-incident investigation by TasNetworks has concluded that: • A lightning strike hit the red phase of the Chapel Street – Gordon No. 2 220 kV circuit close to the Gordon substation. • The lightning strike caused the Gordon B busbar "A" protection to mal-operate. This protection initiated a trip of the Gordon B 220 kV busbar.
Power system response (facilities and services)	Prior to and during the incident, TasNetworks' lightning detection software did not record a lightning strike near to Gordon substation[4]. However, lightning was observed by operational personnel in the vicinity of Gordon substation. Data from protection relays associated with the Chapel Street – Gordon No. 2 circuit has been analysed by the relay manufacturer and is consistent with a lightning strike on the red phase of this circuit (see Figure 1). TasNetworks has confirmed that the Gordon B busbar "A" protection mal-operated due to the lightning strike on the Chapel Street – Gordon No. 2 circuit. The Gordon B busbar protection was found to have operated too quickly for the out of zone fault, clearing the fault before the Chapel Street – Gordon No. 2 circuit could operate. The relay manufacturer has advised that a firmware update is available for the busbar protection relay which operated during this incident. The update allows the relay to perform a final repeat measurement prior to making a trip decision. Once applied, this firmware update will protect against busbar tripping for similar out of zone lightning strikes in the future. TasNetworks has confirmed that there was no indication of any flashover within the Gordon substation.

[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] TasNetworks is a Transmission Network Service Provider (TNSP) for Tasmania.

[3] 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.

[4] The supplier of the lightning detection system advised that the detection software is 98% effective, so it is possible the lightning strike near to Gordon substation was not detected.

	Details
Rectification	TasNetworks inspected the affected equipment at Gordon substation and no equipment damage or indications of flashovers were found. The Gordon B busbar was returned to service at 1846 hrs on 9 September 2021 and the Chapel Street – Gordon No. 2 circuit was also placed on load at this time. TasNetworks has reviewed the protection settings and, on 26 November 2021, updated the firmware of affected busbar protection relays at Gordon 220 kV substation. TasNetworks has confirmed that with the firmware update applied, it is unlikely that Gordon 220 kV busbar protection will operate for similar out of zone lightning strikes in the future. TasNetworks is also planning to complete a review of its network to identify any other similar busbar protection relays which may require the firmware update. If required, the protection settings of any identified relays will be updated in line with TasNetworks' existing maintenance plans.
Power system security	The power system remained in a secure operating state throughout this incident and the Frequency Operating Standard[5] was met for this incident.
Reclassification	AEMO assessed whether to reclassify this incident as a credible contingency event[6]. Initially TasNetworks advised AEMO that it was not reasonably possible for this incident to re-occur. AEMO sought clarification on why a re-occurrence was not reasonably possible, and on 10 September 2021 AEMO correctly identified the need to reclassify the loss of any one of the 220 kV busbars at Gordon as a credible contingency when there is lightning in the vicinity of the Gordon substation[7]. On 26 November 2021, TasNetworks applied a firmware update to the affected relays at Gordon substation, reducing the likelihood of a re-occurrence of this event. Subsequently, on 7 December 2021, AEMO removed the requirement to reclassify the loss of any one of the 220 kV busbars at Gordon as a credible contingency when there is lightning in the vicinity.
Market information	For this incident, AEMO issued the following market notices (all market notices for this incident were issued in accordance with NER requirements): • AEMO issued Market Notice 90306 at 1754 hrs on 9 September 2021, 16 minutes after the incident, to advise of the non-credible contingency event. • AEMO issued Market Notice 90307 at 1916 hrs on 9 September 2021 to advise that AEMO was satisfied that the event was unlikely under the current circumstances and that AEMO would not reclassify this event as a credible contingency. • AEMO issued Market Notice 90345 at 1811 hrs on 11 September 2021 to advise that AEMO had reclassified the trip of any one 220 kV bus at Gordon Substation as a credible contingency event as there was lightning in the vicinity of Gordon 220 kV substation. The reclassification applied from 1800 hrs until further notice. • AEMO issued Market Notice 90346 at 2007 hrs on 11 September 2021 to cancel the reclassification of the trip of any one 220 kV bus at Gordon Substation as a credible contingency. The reclassification was cancelled as there was no longer lightning in the vicinity of the Gordon substation. • AEMO issued Market Notice 93003 at 1722 hrs on 7 December 2021 to advise that, based on TNSP advice, AEMO no longer considered the trip of any one 220 kV bus at Gordon substation as a credible contingency event when there is lightning activity in the vicinity.
Conclusions	AEMO has concluded that: 1. A lightning strike on the red phase of the Chapel Street – Gordon No.2 220 kV circuit initiated the Gordon B busbar protection, which tripped the Gordon B 220 kV busbar. This busbar trip offloaded the Chapel Street – Gordon No. 2 220 kV line at the Gordon end only. 2. TasNetworks has confirmed that the Gordon B busbar "A" protection mal-operated due to the lightning strike on the Chapel Street – Gordon No. 2 circuit. A firmware update is available which will protect against tripping for similar events in the future. TasNetworks applied this firmware update to affected busbar protection relays at Gordon substation on 26 November 2021. In addition, TasNetworks is reviewing its network to identify any other affected busbar protection relays and update their firmware (where required). 3. The power system remained in a secure operating state throughout this incident and the Frequency Operating Standard was met. 4. AEMO correctly identified the need to reclassify the loss of any one of the 220 kV busbars at Gordon as a credible contingency when there is lightning in the vicinity of the Gordon substation[8]. TasNetworks updated the firmware of the affected relays at Gordon 220 kV substation on 26 November 2021. AEMO removed the requirement to reclassify the Gordon 220 kV busbars on 7 December 2021.

[5] See https://www.aemc.gov.au/sites/default/files/2020-01/Frequency%20operating%20standard%20-%20effective%201%20January%202020%20-%20TYPO%20corrected%2019DEC2019.PDF.

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

[7] This reclassification will be made in accordance with section 8.4 of the power system security guidelines; see https://aemo.com.au/-/media/files/electricity/nem/security_and_reliability/power_system_ops/procedures/so_op_3715-power-system-security-guidelines.pdf?la=en.

[8] This reclassification will be made in accordance with section 8.4 of the power system security guidelines; see https://aemo.com.au/-/media/files/electricity/nem/security_and_reliability/power_system_ops/procedures/so_op_3715-power-system-security-guidelines.pdf?la=en.

	Details
Recommendations	1. TasNetworks to carry out a review of its network to identify any other similar relays which may require the firmware update. TasNetworks to review protection settings of any such identified relays and if required update relay firmware in line with existing maintenance plans. 2. TasNetworks to share details of the protection relay and cause of protection mal-operation with the Power System Security Working Group (PSSWG). PSSWG members to review their own networks to identify similar relays which could be affected and take the appropriate action.

Figure 1 Chapel Street – Gordon 220 kV circuits (entry to Gordon 220 kV substation)