AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

Simultaneous trip of Cherry Gardens – Tailem Bend 275 kV and Mobilong – Tailem Bend 132 kV lines on 20 September 2020

July 2021

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.

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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.

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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 ElectraNet[2] and from AEMO systems.

Table 1 Simultaneous Trip of Cherry Gardens – Tailem Bend 275 kilovolt (kV) and Mobilong – Tailem Bend 132 kV lines

	Details
Reviewable operating incident type	Non-credible contingency event impacting critical transmission elements.
Incident details	This report relates to a reviewable operating incident that occurred on 20 September 2020 in South Australia. The incident was a non-credible contingency event involving the simultaneous trip and auto-reclose of the Cherry Gardens – Tailem Bend (CHG-TBE) 275 kV line and the Mobilong – Tailem Bend (MOB-TBE) 132 kV line.
Incident classification	Protection-control system mal-operation.
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.
Events	1. At 1736 hrs on 20 September 2020: – The CHG-TBE 275 kV transmission line tripped and auto-reclosed at both ends, and – The MOB-TBE 132 kV transmission line tripped and auto-reclosed at the Tailem Bend end only. 2. AEMO noted that there was lightning activity in the vicinity of both lines at the time. 3. At around 1854 hrs on 20 September 2020, ElectraNet confirmed that the trip of both lines was simultaneous, and the cause of the trip could not be confirmed at this time.
Incident cause	Post-incident analysis has concluded that at 1736 hrs on 20 September 2020 a lightning strike caused a single phase to ground fault on the CHG-TBE 275 kV transmission line. This caused the CHG-TBE 275 kV line to trip and auto-reclose and the unexpected simultaneous trip and auto-reclose of the MOB-TBE 132 kV transmission line.
Power system response (facilities and services)	The lightning strike caused the CHG-TBE 275 kV line to trip and auto-reclose. Coincident with this 275 kV fault, the MOB-TBE 132 kV line Set 2 protection operated unexpectedly at Tailem Bend 132 kV substation, tripping and reclosing the MOB-TBE 132 kV circuit breakers at Tailem Bend 132 kV substation. The CHG-TBE 275 kV circuit breakers and protection systems operated correctly. The MOB-TBE 132 kV circuit breakers and protection systems mal-operated. The MOB-TBE line should not have tripped due to the 275 kV lightning fault. The Set 2 earth fault protection system on the MOB-TBE 132 kV line operated unexpectedly. The earth fault protection mal-operated as it was unable to identify the fault as out of zone due to the applied settings. Please see Figure 1 for a simplified single line diagram of the network around Tailem Bend 275 kV substation.

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

[2] ElectraNet is a Transmission Network Service Provider (TNSP) for South Australia.

	Details
Rectification	After discussion with the relay manufacturer, ElectraNet modified the protection settings at Tailem Bend 132 kV substation on 29 October 2020 to prevent tripping for similar events. ElectraNet has also assessed the risk of similar protection mal-operations in other locations in its network as minimal.
Power system security	The trip of a single circuit is considered a credible contingency event, however the simultaneous and unexpected trip of the MOB-TBE 132 kV line is not a credible contingency event. Despite this not being a credible contingency event, the power system remained in a secure operating state throughout this incident.
Reclassification	AEMO assessed whether to reclassify this incident as a credible contingency event[3]. AEMO was aware of lighting activity in the vicinity of the CHG-TBE 275 kV and MOB-TBE 132 kV lines immediately prior to the incident. However, as these lines had no history of simultaneous tripping due to lightning strikes this contingency was not deemed reasonably possible, and this contingency was correctly[4] not reclassified at the time. After the incident, the cause of the simultaneous trip of the CHG-TBE 275 kV and MOB-TBE 132 kV lines was not known. AEMO could therefore not confirm that the event was unlikely to re-occur and correctly reclassified this incident as a credible contingency at 2005 hrs on 20 September 2020. This reclassification correctly remained in place until ElectraNet modified the protection settings at Tailem Bend 132 kV substation on 29 October 2020.
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 78068 at 1916 hrs on 20 September 2020 – Advice of non-credible contingency event. • AEMO issued Market Notice 78071 at 2005 hrs on 20 September 2020 – Advice of reclassification as a credible contingency event. • On 18 November 2020, ElectraNet informed AEMO of setting changes on the Mobilong – Tailem Bend 132 kV Set 2 protection to reduce the likelihood of this incident re-occurring. Based on this information, AEMO issued Market Notice 80081 at 1458 hrs on 18 November 2020 – Cancellation of reclassification as a credible contingency event.
Conclusions	AEMO has concluded that: 1. The trip and auto-reclose of CHG-TBE 275 kV lines was caused by a lightning strike, and all protection systems on this circuit operated correctly. 2. The simultaneous trip and auto-reclose of the MOB-TBE 132 kV line at the Tailem Bend 132 kV substation was caused by a protection mal-operation. 3. The power system remained in a secure operating state throughout this incident. 4. AEMO correctly determined that reclassification of this event as a credible contingency was required. 5. ElectraNet subsequently identified the cause of the protection mal-operation and implemented setting changes to reduce the likelihood of any re-occurrence. In addition, ElectraNet has advised the risk of similar incidents occurring elsewhere in ElectraNet's network has been assessed as minimal.
Recommendations	Subsequent to the outcome of this investigation, AEMO and ElectraNet to share details of this incident and its findings with the Power System Security Working Group (PSSWG).

[3] 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).

[4] As outlined in section 8.4 of AEMO's power system security guidelines, at 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.

Figure 1 Incident diagram