

Trip of Rowville Terminal Station – Yallourn Power Station No. 8 220 kV line

June 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

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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
MW	Megawatts
NEM	National Electricity Market
NER	National Electricity Rules
ROTS	Rowville Terminal Station
TNSP	Transmission Network Service Provider
YPS	Yallourn Power Station

Incident review

This reviewable operating incident¹ 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 Services² and from AEMO systems.

Table 1 Summary of event

Details	
Reviewable operating incident type	Non-credible contingency events impacting critical transmission elements.
Incident details	This report relates to reviewable operating incidents ³ that occurred on 30 December 2021 and 6 January 2022 in Victoria. Both incidents involved the trip of the Rowville Terminal Station (ROTS) – Yallourn Power Station (YPS) No. 8 220 kV line at the ROTs end only.
Incident classification	Protection/control system – protection system maloperation.
Generation impact	Nil
Customer load impact	Nil
Incident key events	<p>Incident number 1 – 30 December 2021:</p> <ol style="list-style-type: none"> At 2055 hrs on 30 December 2021 the ROTs-YPS No. 8 220 kV line tripped at the ROTs end only (see Figure 1). At 2056 hrs on 30 December 2021, AusNet closed the open Circuit Breakers (CBs) at ROTs. At 2057 hrs the ROTs-YPS No. 8 line tripped at both ends and remained out of service. At 0000 hrs on 31 December 2021, AusNet advised AEMO that the circuit trip was due to a malfunction of the Set X protection due to a faulty communications card at ROTs. At 0152 hrs on 31 December 2021, the ROTs-YPS No. 8 220 kV line was returned to service. At 0216 hrs on 31 December 2021, AusNet confirmed to AEMO that the communications card at ROTs had been replaced and the event was unlikely to re-occur. <p>Incident number 2 – 6 January 2022:</p> <ol style="list-style-type: none"> At 2042 hrs on 6 January 2022, a single ended trip of the ROTs-YPS No. 8 220 kV line re-occurred, tripping at the ROTs end only (see Figure 1). At 2044 hrs on 6 January 2022, AusNet closed the open CBs at ROTs putting the ROTs-YPS No. 8 220 kV line back on load.
Incident cause	Post-incident investigation confirmed that both incidents were caused by maloperation of distance protection. In both incidents, this was due to communication disturbances, which led to a loss of synchronism between protection relays at both ends on the line. However, in both incidents this asynchronism caused only the relay at ROTs end to trip. The root cause of the communication disturbances was not identified upon AusNet's investigation.
Power system response (facilities and services)	There were no other material impacts on the broader power system, load or generation.
Rectification	Following the first incident on 31 December 2021, as a precaution AusNet replaced the communication card for the ROTs-YPS No. 5, 6, 7 and, 8. However, the incident re-occurred on 6 January 2022 and AusNet identified further rectifications as outlined below:

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 AusNet is a Transmission Network Service Provider (TNSP) for Rowville Terminal Station and Yallourn Power Station.

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.

Details	
	<ul style="list-style-type: none"> AusNet has modified the distance protection settings in the affected L90 relays on the ROTS-YPS 220 kV lines to desensitise the distance protection for similar communication disturbances. These protection setting changes include increasing current supervision for distance protection and addition of an interlock current differential trip with disturbance detector. Given these changes, AusNet has advised the incident is unlikely to re-occur. The relay manufacturer has confirmed that for the L90 Line Differential relays involved in both incidents to operate, there needs to be inter-relay communication between the devices located at each line end. Following the communication disturbance, the relay devices were required to synchronise in order to return the Line Differential element back to normal operation. The synchronisation process caused the sampling frequency to deviate from the system frequency significantly and led to the maloperation of the distance element in both incidents as voltage memory was used for distance polarisation. In addition, the relay manufacturer confirmed that a firmware update is available for the L90 relay which will prevent protection maloperation for similar communication issues in the future. AusNet has only experienced this issue on L90 relays and has advised that this is unlikely to be a widespread issue at this time. AusNet believes that specific communication disturbances can cause the maloperation of the distance protection in all versions of the L90 relays which are using older firmware. AusNet is unable to identify the root cause of the communication disturbance experienced during this incident.
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	<p>AEMO assessed whether to reclassify this incident as a credible contingency event⁵.</p> <p>After the first incident, at 0216 hrs on 31 December 2021, the AusNet control room confirmed to AEMO that repairs had been carried out and the incident was unlikely to re-occur. Based on this information, AEMO correctly did not reclassify the incident as a credible contingency event.</p> <p>Subsequently, after the second incident, during AusNet's incident investigation, it was identified that AusNet site staff had replaced a communication card on site as a precaution only, but the investigation into the root cause was still ongoing. Once this information was received by AEMO, AEMO considered that a re-occurrence of these incidents was reasonably possible. Therefore, AEMO correctly reclassified this incident as a credible contingency from 1030 hrs on 21 February 2022.</p> <p>At 1030 on 3 June 2022, AusNet advised AEMO that the reoccurrence of the trip was not reasonably possible based on changes made to the protection settings as described above. AEMO responded and correctly cancelled the reclassification of this event as a credible contingency.</p>
Market information	<p>For these incidents, AEMO issued the following market notices (all market notices for this incident were issued in accordance with NER requirements):</p> <p>Incident number 1 – 30 December 2021:</p> <ul style="list-style-type: none"> AEMO issued Market Notice 93489 at 2136 hrs on 30 December 2021 – Advice of non-credible contingency event. The cause of this non-credible contingency was not known at this stage. AEMO issued Market Notice 93490 at 0220 hrs on 31 December 2021 – Update on the advice of non-credible contingency event. The cause of this non-credible contingency event had been identified and AEMO was satisfied that another occurrence of this event was unlikely under the current circumstances. <p>Incident number 2 – 6 January 2022:</p> <ul style="list-style-type: none"> AEMO issued Market Notice 93627 at 2222 hrs on 6 January 2022 – Advice of non-credible contingency event. AEMO issued Market Notice 94769 at 1039 hrs on 21 February 2022 – Advice that this incident had been reclassified as a credible contingency from 1030 hrs until further notice. The cause of the incident was unknown and AEMO was not satisfied that the non-credible contingency event was unlikely to re-occur. AEMO issued Market Notice 96747 at 1031 hrs on 3 June 2022 – Cancellation of reclassification of a non-credible contingency event.
Conclusions	<p>AEMO has concluded that:</p> <ol style="list-style-type: none"> The single ended line trip of the ROTS-YPS No. 8 220 kV line was caused by a communication disturbance which led to loss of synchronism between the relays at each end of the line. AusNet is unable to identify the root cause of the communication disturbance. AEMO correctly identified the need to reclassify this incident as a credible contingency, as the root cause of the incident was not known at the time. The reclassification was subsequently cancelled following

⁴ Frequency Operating Standard, effective 1 January 2020, 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 clause 4.2.3A(c) – and to report how the reclassification criteria were applied – NER clause 4.8.15(ca).

Details	
	changes by AusNet to protection settings. The power system remained in a secure operating state and Frequency Operating Standard was met during the incident.
Recommendations	<ol style="list-style-type: none"> 1. AusNet has shared details of the L90 maloperation with the Power System Security Working Group to allow all TNSPs to confirm whether relays on their own networks are affected and take appropriate action. 2. All TNSPs to confirm that these protection relays can correctly operate on distance elements only, in the event of loss of synchronism. 3. AEMO recommends that TNSPs consider reviewing relay information database search functionality to allow efficient management of future relay firmware and type issues. 4. AEMO advises TNSPs consider updating L90 relay firmware to the latest version when working on L90 relays during their existing maintenance/work plans.

Figure 1 Incident diagram – Post-incident diagram (all elements were in service prior to the incident)

