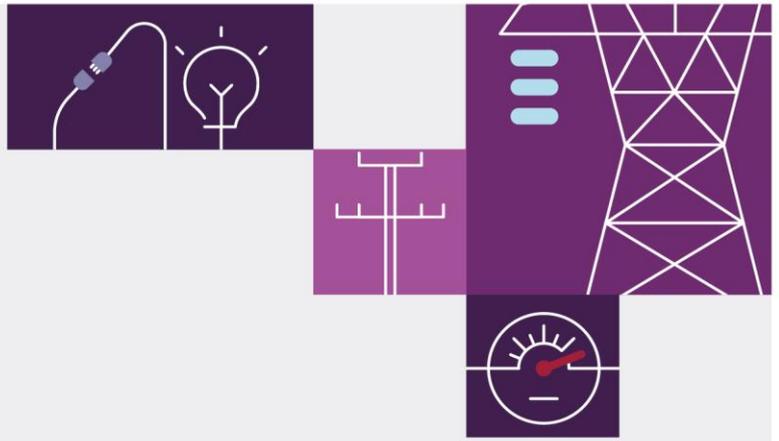


Farrell – Reece – Pieman 220 kV No. 2 line three-phase fault on 23 May 2023

February 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

To inform its review and the findings expressed in this report, AEMO has been provided with data by registered participants as to the status or response of some facilities before, during and after the reviewable incident, and has also collated information from its own observations, records and systems. Any views expressed in this report are those of AEMO unless otherwise stated, and may be based on information given to AEMO by other persons. AEMO has made reasonable efforts 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.

Accordingly, to the maximum extent permitted by law, AEMO and its officers, employees and consultants involved in the preparation of this document:

- make no representation or warranty, express or implied, as to the currency, accuracy, reliability or completeness of the information in this document; and
- are not liable (whether by reason of negligence or otherwise) for any statements or representations in this document, or any omissions from it, or for any use or reliance on the information in it.

Copyright

© 2024 Australian Energy Market Operator Limited. The material in this publication may be used in accordance with the [copyright permissions on AEMO's website](#).

Contact

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

The National Electricity Market (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
CB	Circuit breaker
DPV	Distributed photovoltaic (generation)
kV	kilovolt/s
kW	kilowatt/s
ms	millisecond/s
MW	megawatt/s
NEM	National Electricity Market
NER	National Electricity Rules
PMU	phasor measurement unit
TNSP	Transmission Network Service Provider

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 TasNetworks², Hydro Tasmania³ and APA Group⁴ 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 ⁵ that occurred on 23 May 2023 in Tasmania. The incident involved a three-phase fault on the Farrell – Reece – Pieman 220 kilovolt (kV) No. 2 line ⁶ .
Incident classification	Other causes – human error.
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	Prior to the incident, at 0927 hrs on 22 May 2023, the Farrell – Reece – Pieman 220 kV No. 2 line had been taken out of service for planned maintenance at Reece Power Station.
Incident key events	<p>The key events listed below are based on both the initial information known at the time of the incident and further details determined through post-incident investigations.</p> <ol style="list-style-type: none"> At 1128 hrs on 23 May 2023: <ul style="list-style-type: none"> The Farrell – Reece – Pieman 220 kV No. 2 line was energised by closing the E152 circuit breaker (CB) at Farrell 220 kV Substation (see 0). A three-phase fault occurred on the Farrell – Reece – Pieman 220 kV No. 2 line. The Basslink interconnector underwent commutation failure (with the interconnector recovering and remaining in service thereafter). Disconnection of approximately 3 megawatts (MW) of distributed photovoltaic (DPV) inverters was experienced in Tasmania. The E152 CB at Farrell 220 kV Substation tripped to clear the fault. Shortly after 1128 hrs on 23 May 2023, Hydro Tasmania advised TasNetworks that there was no fault, and that the trip had possibly occurred due to a locking pin⁷ that had been left in at the Reece Power Station CB. Whilst not reported at the time of the event, at 1133 hrs on 23 May 2023, Hydro Tasmania's sequence of events indicated that earth switch B31C at Reece Power Station opened. The operator advised TasNetworks that the issue was resolved (pin removed) and that the line restoration could proceed. At 1141 hrs on 23 May 2023, TasNetworks closed E152 CB at Farrell and the Farrell – Reece – Pieman 220 kV No. 2 line was successfully restored.

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 Provide (TNSP) for Tasmania.

³ Hydro Tasmania is the owner and operator of Reece Power Station in Tasmania.

⁴ APA Group is the owner and operator of the Basslink interconnector.

⁵ 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.

⁶ NER 4.2.3(e)(1) states that non-credible contingency events are likely to include three-phase electrical faults on the power system. This three-phase fault was considered by AEMO to be a non-credible contingency event.

⁷ The locking pin would have prevented Reece Power Station CB B52 from closing.

Details	
	<p>6. Several hours later on 23 May 2023, TasNetworks became aware that a three-phase fault had occurred on the Farrell – Reece – Pieman 220 kV No. 2 line at 1128 hrs, in contrast to the initial advice provided by Hydro Tasmania. This information was not communicated to the AEMO Control Room at the time.</p> <p>7. On 28 September 2023, TasNetworks advised AEMO of the three-phase line fault on the Farrell – Reece – Pieman 220 kV No. 2 line that occurred on 23 May 2023. This was advised during discussions in a meeting with TasNetworks.</p> <p>8. On 7 November 2023, Hydro Tasmania confirmed to AEMO that the three-phase line fault occurred on the Farrell – Reece – Pieman 220 kV No. 2 line.</p>
Incident cause	<p>Post-incident investigation by TasNetworks and Hydro Tasmania has confirmed:</p> <ul style="list-style-type: none"> At 1128 hrs on 23 May 2023, the Farrell – Reece – Pieman 220 kV No. 2 line tripped when being energised from Farrell substation due to earth switch B31C at Reece Power Station being left in the closed position following maintenance. The cause of the incident was due to human error by the operator at Reece Power Station. The operator did not follow the steps in the switching instruction to confirm that the earth switch had opened successfully.
Power system response (facilities and services)	<p>The three-phase fault at Reece resulted in depressed 220 kV bus voltages at George Town substation and caused the subsequent commutation failure of Basslink.</p> <p>Immediately prior to the time of the incident, Basslink was importing 435 MW into Tasmania. This flow was momentarily reduced to 0 MW due to the commutation failure. Power flow was restored to 90% of the pre-fault value within 400 milliseconds (ms) after the fault. Basslink did not trip during the incident.</p> <p>Based on observations from a sample⁸ of DPV inverters in Tasmania, minimal disconnection (shake-off) of DPV was observed for DPV systems on AS/NZS 4777.2:2020 (the 2020 Standard). This may reflect improved disturbance ride-through specifications in the 2020 Standard and higher compliance with this standard⁹, noting the sample size is small and further evidence is required.</p> <p>For DPV systems on AS/NZS 4777.2:2015 (the 2015 Standard), 6%¹⁰ (3 MW) were observed to disconnect (shake off). This is consistent with expectations, given conditions in the transmission network during this event (a three-phase fault resulting in the transmission network reaching a minimum of 0.44 p.u. positive sequence voltage for less than 60 ms as measured via the closest phasor measurement unit (PMU)). Of these 2015 Standard systems, larger systems (30-100 kilowatts (kW)) were observed to disconnect at a rate of 33%. AEMO and TasNetworks are investigating the cause of this increased trip risk for larger systems.</p> <p>There were no other material impacts on the broader power system, load or generation.</p>
Rectification	<p>The findings of this incident were shared to relevant Hydro Tasmania operating staff for awareness and to reduce the likelihood of re-occurrence. Hydro Tasmania also reviewed the existing operating procedures to determine if any updates were required.</p> <p>TasNetworks has shared the findings of this incident with its real time operations group to reiterate the requirement to communicate power system incidents to AEMO.</p>
Power system security	<p>The power system remained in a secure operating state throughout this incident and the Frequency Operating Standard¹¹ was met for this incident.</p>
Reclassification	<p>AEMO assessed whether to reclassify this incident as a credible contingency event¹².</p> <p>The cause of the incident was identified and rectified by Hydro Tasmania prior to the affected equipment's return to service. At the time of the incident, AEMO was not aware that a three-phase line fault had occurred. When AEMO was later made aware of the circumstances giving rise to this non-credible contingency event, AEMO was satisfied that another occurrence of this event was unlikely under the current circumstances and identified that reclassification was not required.</p>
Market information	<p>For this incident, no market notices were issued by AEMO. When AEMO became aware of the non-credible contingency event, any abnormal conditions related to this incident were no longer present and AEMO identified that this non-credible contingency was not more likely to occur.</p>

⁸ Sixty-second resolution data was collected from a sample of 292 DPV circuits in Tasmania collected by Solar Analytics, provided under the Australian Renewable Energy Agency (ARENA)-funded Project MATCH led by University of New South Wales (UNSW) Sydney.

⁹ AEMO, *Compliance of Distributed Energy Resources with Technical Settings: Update*, December 2023, at https://aemo.com.au/-/media/files/initiatives/der/2023/oem_compliance_report_2023.pdf?la=en&hash=E6BEA93263DE58C64FCC957405808CA6.

¹⁰ Based on a sample of 213 circuits in total, in the Solar Analytics dataset for inverters installed on the 2015 Standard prior to December 2021.

¹¹ See <https://www.aemc.gov.au/sites/default/files/2020-01/Frequency%20operating%20standard%20-%20effective%201%20January%202020%20-%20TYPO%20corrected%2019DEC2019.PDF>.

¹² 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).

Details	
Conclusions	<p>AEMO has concluded that:</p> <ol style="list-style-type: none"> 1. This incident occurred due to the Hydro Tasmania operator not correctly following the steps in the switching instruction for restoring the Farrell – Reece – Pieman 220 kV No. 2 line. 2. Communication between Hydro Tasmania and TasNetworks immediately following the incident resulted in incorrect details being reported to TasNetworks. 3. When TasNetworks subsequently became aware that a three-phase fault had occurred on the power system, TasNetworks did not follow the established processes and communicate this to AEMO.
Recommendations	<p>In reviewing this event, AEMO identified the following recommendations that were completed prior to publication of this report:</p> <ol style="list-style-type: none"> 1. AEMO recommends that Hydro Tasmania review operating procedures and communicate required updates and incident findings to relevant staff for training purposes. 2. AEMO recommends that TasNetworks reconfirm the requirement for its real time operations group to advise AEMO of all power system incidents when it is determined that an incident has occurred.

Figure 1 Incident diagram

