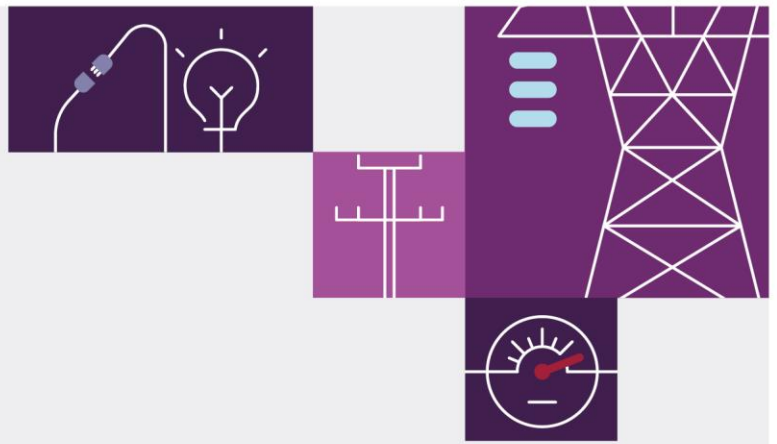


# Low fault level at Burnie on 6 March 2023

August 2023

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.

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## Contact

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# Abbreviations

Abbreviation	Term
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AEST	Australian Eastern Standard Time
kV	kilovolt/s
MW	megawatt/s
MVA	megavolt-ampere/s
NEM	National Electricity Market
NER	National Electricity Rules
NOS	Network Outage Schedule
NSP	Network Service Provider
OPWG	Operations Planning Working Group
PSSWG	Power System Security Working Group
TNSP	Transmission Network Service Provider

# Incident review

This reviewable operating incident<sup>1</sup> 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<sup>2</sup> and from AEMO systems.

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

**Table 1 Summary of event**

Details	
<b>Reviewable operating incident type</b>	The power system was not in a secure operating state for greater than 30 minutes (124 minutes).
<b>Incident details</b>	This report relates to a reviewable operating incident <sup>3</sup> that occurred on 6 March 2023 in Tasmania. The incident involved the synchronous fault level at the Burnie 110 kilovolts (kV) busbar dropping below the 850 megavolt-amperes (MVA) secure limit for approximately 124 minutes. An overview of the power system adjacent to Burnie substation is provided in Figure 1.
<b>Incident classification</b>	Human error – incorrect minimum fault level limit specified in TasNetworks' outage assessment technical advice in the Network Outage Schedule (NOS) <sup>4</sup> notes.
<b>Generation impact</b>	No generation was lost as a result of this incident.
<b>Customer load impact</b>	No load was lost as a result of this incident.
<b>Pre-incident conditions</b>	A planned outage of Palmerston – Sheffield 220 kV transmission line was scheduled for 6 March 2023 between 0700 hrs and 1500 hrs. NOS booking notes submitted by TasNetworks to AEMO advised of a requirement to maintain a minimum fault level at the Burnie 110 kV bus of 560 MVA.
<b>Incident key events</b>	<p>Incident key events are listed below (see Figure 2).</p> <ol style="list-style-type: none"> <li>At 0704 hrs on 6 March 2023, the Palmerston – Sheffield 220 kV line was switched out of service at commencement of a planned outage.</li> <li>At 0717 hrs on 6 March 2023, the fault level at Burnie (measured at the 110 kV busbar) reduced to 883 MVA, below the AEMO control room's 900 MVA warning alarm. This warning alarm was acknowledged by the AEMO control room, but no action was taken given advice associated with the outage submission.</li> <li>At 0738 hrs on 6 March 2023, the fault level at Burnie 110 kV busbar reduced to 849.3 MVA, below the secure limit (850 MVA). The fault level briefly exceeded 850 MVA between 0739 hrs and 0742 hrs, but then remained below 850 MVA from 0743 hrs to 0947 hrs (124 minutes). The secure limit alarm was acknowledged by the AEMO control room, but no action was taken given advice associated with the outage submission.</li> <li>At 0748 hrs on 6 March 2023, the AEMO Tasmania Region Operator reconfirmed the minimum fault level requirement at the Burnie 110 kV busbar was 560 MVA using the NOS notes submitted for the planned Palmerston – Sheffield 220 kV line outage.</li> <li>At 0947 hrs on 6 March 2023, the fault level at Burnie increased above the secure limit (850 MVA).</li> <li>At 1546 hrs on 6 March 2023, the Palmerston – Sheffield 220 kV line returned to service (as the planned outage works were completed).</li> <li>At 1706 hrs on 6 March 2023, AEMO called TasNetworks regarding the outage assessment for the next day (7 March 2023) and asked for clarification regarding the fault levels listed in the NOS notes. Subsequently, TasNetworks updated the 6 March 2023 outage notes to revise the Burnie 110 kV secure limit requirement from 560 MVA to 850 MVA.</li> </ol>

<sup>1</sup> Reviewable operating incidents are defined by NER 4.8.15(a) and the AEMC Reliability Panel Guidelines for Identifying Reviewable Operating Incidents.

<sup>2</sup> TasNetworks is the Transmission Network Service Provider (TNSP) for Tasmania.

<sup>3</sup> See NER clause 4.8.15(a)(1)(iv), as the event relates to an event where the power system is not in a secure operating state for more than 30 minutes; and the AEMC Reliability Panel Guidelines for Identifying Reviewable Operating Incidents.

<sup>4</sup> These notes are used by TNSPs to advise AEMO on planned and unplanned network outages on the transmission system. See <https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/data-nem/network-data/network-outage-schedule> for more details.

Details	
<b>Incident cause</b>	<p>Post-incident investigation has confirmed:</p> <ul style="list-style-type: none"> <li>From discussions between TasNetworks and AEMO, it was determined that the system was not operated in a secure state due to an incorrect minimum fault level limit being specified in the TasNetworks outage assessment technical advice. This advice related to the planned outage of the Palmerston – Sheffield 220 kV line that occurred on 6 March 2023.</li> <li>The NOS booking notes as provided by TasNetworks stated that the minimum fault level at Burnie 110 kV busbar was 560 MVA. This was interpreted as being the fault level limits advice for the outage. The minimum secure fault level advised by TasNetworks in the NOS was incorrect. The correct secure fault level limit for the Burnie 110 kV busbar is 850 MVA.</li> <li>When the fault level first dropped below the secure level of 850 MVA at 0737 hrs, an alarm alerted AEMO controllers of this system condition. While AEMO controllers had identified the alarm, no corrective action was taken due to the NOS fault level limits advice provided by TasNetworks.</li> <li>As part of its incident review, TasNetworks identified the root cause of this incident as human error. TasNetworks identified that its outage planner specified the incorrect fault level limit at the Burnie 110 kV busbar as 560 MVA, instead of specifying 850 MVA.</li> <li>The fault level limits advice from TasNetworks was communicated to AEMO through the NOS instead of the appropriate process for provision of limit advice. As a result, it was not subjected to due diligence through the normal process.</li> </ul>
<b>Power system response (facilities and services)</b>	<p>Fault level limit alarms were triggered when the fault level dropped below 900 MVA and 850 MVA. No action was taken by the AEMO control room in response to these alarms due to the fault level limits advice provided. There were no other material impacts on the broader power system, load, or generation.</p>
<b>Rectification</b>	<p>As a result of this incident, the following actions were taken to reduce the likelihood of reoccurrence:</p> <ul style="list-style-type: none"> <li>TasNetworks conducted an internal review and determined that the root cause for this incident was that the incorrect fault level limit was specified by the TasNetworks outage planner. TasNetworks have communicated the findings of this incident with their outage planning teams to ensure that the minimum system strength requirements are conveyed correctly in future. TasNetworks has also reviewed relevant standing instructions to ensure that fault level limits are correctly stated.</li> <li>TasNetworks reviewed the incident with their control room operators for situational awareness.</li> <li>AEMO has reaffirmed that minimum fault level limits constitute limits advice and therefore should not be provided through the NOS. Limits advice should only be provided to AEMO through approved channels that allow for AEMO to conduct due diligence.</li> <li>AEMO has reaffirmed that its controllers and operations planners should query any NOS entries that include limits advice, given it should be provided through a separate process.</li> <li>As an additional measure, AEMO has implemented a new standing note that has been added to the plant equipment in the NOS for the Palmerston to Sheffield 220 kV line to advise the location of the relevant fault level limits.</li> </ul>
<b>Power system security</b>	<p>For the period from 0743 hrs to 0947 hrs on 6 March 2023, the fault level at Burnie 110 kV busbar was:</p> <ul style="list-style-type: none"> <li>Marginally below the secure limit for 101 minutes, in the range of 837 MVA to 847 MVA.</li> <li>Significantly below the secure limit for 23 minutes, below 800 MVA.</li> </ul> <p>TasNetworks' subsequent review concluded that, given there was no operational margin in the secure fault level limit of 850 MVA, the power system was not secure during this period. AEMO's independent studies also concluded that critical system faults may result in the wind farms failing to successfully ride through the fault. Therefore, on the basis of TasNetworks' advice and AEMO's PSCAD™ studies, it is AEMO's reasonable opinion that, because the synchronous fault level was below 850 MVA at the Burnie 110 kV busbar from 0743 hrs to 0947 hrs, the power system was not secure for 124 minutes. In the event of certain credible contingency events, modelling indicates that the Woolnorth wind farm would have been unable to successfully ride through the fault and the Tasmanian power system may not have returned to a stable operating state. For critical system faults, persistent oscillations could arise. To regain stability, the Woolnorth wind farm output would be reduced until the oscillations cease.</p> <p>No critical system fault occurred during the period from 0743 hrs to 0947 hrs, therefore the Tasmanian power system remained in a satisfactory operating state throughout this incident.</p>
<b>Recommendations</b>	<p>AEMO to share findings from this incident review with the Operations Planning Working Group (OPWG) and Power System Security Working Group (PSSWG), in particular regarding the process for provision of all limit advice (including low fault level limit advice). Discussions will include confirmation that for due diligence purposes, limit advice should be submitted through the normal limit advice process and not submitted through the NOS.</p>

Figure 1 Single line diagram of north-western Tasmania

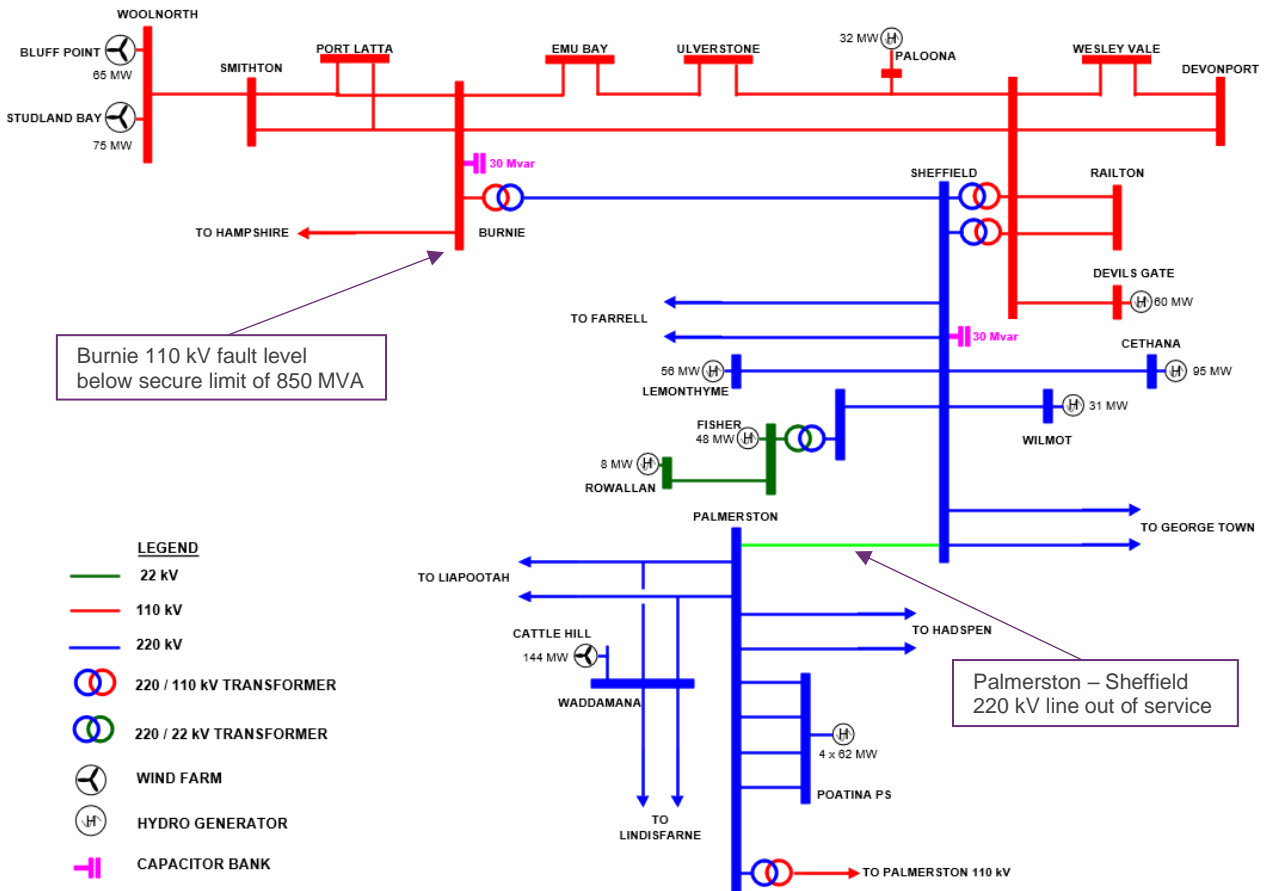


Figure 2 Burnie 110 kV fault level (MVA), 0700 hrs to 1000 hrs, 6 March 2023

