AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

Notice of Tasmania system strength and inertia shortfalls

May 2021

A report for the National Electricity Market

Important notice

PURPOSE

This report is a notice of AEMO's determination of inertia and system strength requirements and shortfalls for the Tasmania region of the National Electricity Market, for the purposes of clauses 5.20B and 5.20C of the National Electricity Rules (NER). It has been prepared by AEMO using studies performed using information available as at May 2021.

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VERSION CONTROL

Version	Release date	Changes
1.0	7/5/2021	Initial release.

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1. Summary

In this document AEMO provides notification of system strength and inertia shortfalls to be addressed by TasNetworks for the Tasmania region of the National Electricity Market. These shortfalls were originally canvassed in the 2020 System Strength and Inertia (SSI) report[1] and are in addition to the shortfalls already addressed by TasNetworks following AEMO's November 2019 declaration[2]. AEMO has investigated the drivers behind the projections in the 2020 SSI report, and as a result is declaring immediate system strength and inertia shortfalls in Tasmania.

Table 1 shows the system strength shortfalls and Table 2 shows the inertia shortfalls, for the coming five years.[3]. A portion of these shortfall amounts are expected to be met by the existing contract made by TasNetworks with Hydro Tasmania.

Table 1 2021 declaration of Tasmania system strength shortfalls

Fault level node	Fault level node class	2019 shortfall addressed by TasNetworks until April 2024 (megavolt amperes [MVA])	System strength shortfall from May 2021 to May 2026 (MVA)
Burnie 110 kilovolts (kV)	Remote from synchronous generation	180	200
George Town 220 kV	High inverter-based resources	530	770
Risdon 110 kV	Metropolitan load centre	320	580
Waddamana 220 kV	Synchronous generation centre	310	620

Table 2 2021 declaration of Tasmania inertia shortfalls

Inertia requirement	2019 shortfall addressed by TasNetworks until April 2024 (megawatt seconds [MWs])	Inertia shortfall from May 2021 to May 2026 (MWs)
Secure operating level of inertia (3,800 MWs)	2,350	2,620

At all times, the services or activities delivered to meet the secure operating level of inertia (3,800 MWs) must only be sourced from within the Tasmania region[4].

Addressing these system strength and inertia shortfalls will allow the network to continue to be operated securely[5].

[1] AEMO, 2020 System Strength and Inertia Report, December 2020, at https://aemo.com.au/-/media/files/electricity/nem/planning_and_forecasting/operability/2020/2020-system-strength-and-inertia-report.pdf?la=en.

[2] AEMO, Notice of Inertia and Fault Level Shortfalls in Tasmania, November 2019, at https://aemo.com.au/-/media/files/electricity/nem/security_and_reliability/system-security-market-frameworks-review/2019/notice-of-inertia-fault-level-shortfalls-tasmania-nov-2019.pdf?la=en.

[3] Projected fault level and inertia amounts are based on the 'traditional operations' projections outlined in the 2020 SSI report over the five-year horizon, under a specific set of modelling assumptions.

[4] This requirement arises because AEMO considers Tasmania to always be an electrical island within the NEM due to its asynchronous interconnection via Basslink. For more information please see the 2020 System Strength and Inertia Report.

[5] The declaration of this shortfall does not remove the need for generators (when applicable) to mitigate their impact on system strength.

2. Background and drivers for changed projections

System strength and inertia are critical requirements for a secure power system. A minimum level of system strength is required for the power system to remain stable, particularly for stability of the voltage waveform. Inertia, in conjunction with frequency control services, is needed for maintaining the power system frequency within limits[6].

Power system services such as system strength and inertia have traditionally been provided by large thermal and hydro synchronous generation. Ongoing trends in the National Electricity Market – commissioning of new utility-scale generation resources, changes in behaviour of synchronous generators in the market, and decreases in minimum demand – are having significant implications for the future operation of synchronous generation units, and the provision of associated power system services.

In November 2019, AEMO declared system strength and inertia shortfalls in Tasmania[7]. Those shortfalls have been addressed by TasNetworks entering into a commercial agreement with Hydro Tasmania for the provision of system strength and inertia services, which expires in April 2024.

In December 2020, AEMO published updated projections showing the risk of larger shortfall magnitudes and durations for system strength and inertia in Tasmania than those declared in 2019. Since the December 2020 publication, AEMO has investigated the drivers of these increased projections and has found that a greater proportion of Tasmanian load is projected to be supplied from Victoria via Basslink during the middle of the day. This is a result of:

- declining minimum demand projections for Victoria (largely due to increased distributed PV projections)[8] resulting in higher exports of variable renewable energy from Victoria to Tasmania via Basslink, timed with
- a continued expectation that Tasmanian minimum operational demand will move more 'firmly' to the early afternoon, meaning that minimum demand may be met by utility-scale solar rather than from synchronous machines.

This increased supply via Basslink is indicated to displace local synchronous sources of generation which would otherwise be projected to provide system strength and inertia. AEMO has also confirmed that these projections are consistent with observed trends in actual dispatch and interconnector flows for 2019 and 2020.

As such, AEMO has now firmed its view of the projections provided in the 2020 SSI report. AEMO has formed the view that it is likely that system strength shortfalls and inertia shortfalls will arise on the basis of those projections and declares shortfalls accordingly.

[6] AEMO's Power System Requirements paper, published in July 2020, provides further detail on these electrical phenomena, at https://www.aemo.com.au/-/media/Files/Electricity/NEM/Security_and_Reliability/Power-system-requirements.pdf.

[7] AEMO, Notice of Inertia and Fault Level Shortfalls in Tasmania, November 2019, at https://aemo.com.au/-/media/files/electricity/nem/security_and_reliability/system-security-market-frameworks-review/2019/notice-of-inertia-fault-level-shortfalls-tasmania-nov-2019.pdf?la=en.

[8] As provided in AEMO's 2020 Electricity Statement of Opportunities, August 2020, at https://aemo.com.au/-/media/files/electricity/nem/planning_and_forecasting/nem_esoo/2020/2020-electricity-statement-of-opportunities.pdf?la=en.

3. Revised system strength outlook for Tasmania

AEMO has compared the updated system strength and inertia projections prepared for the 2020 SSI Report[9] against the minimum three phase fault level requirements for each fault level node in Tasmania[10], and observes potential shortfalls for system strength at each of the nodes within the coming five years[11].

AEMO has assessed whether there is or is likely to be a fault level shortfall in the Tasmania region. As a result of its assessment, AEMO declares immediate shortfalls as noted in Table 3.

It is noted that in the 2020 SSI report, AEMO extended the previous 2019 declaration beyond the end of the existing contract with Hydro Tasmania. This 2021 system strength shortfall declaration supersedes that extension because the shortfalls declared here are larger than those declared under the 2020 SSI report.

Figures 1 to 4 show the fault level projections for each year against the minimum requirements for each fault level node. AEMO is also releasing an attachment, the 2021 System strength and inertia workbook[12], providing the data used to prepare these charts.

Table 3 2021 Tasmania system strength outlook

Value	Three phase fault level (MVA)
Burnie fault level node [A]	
Minimum pre-contingent three phase fault level [B]	850
Minimum post-contingent three phase fault level [B]	560
Available 99% of time [C]	350
Existing system strength contract until April 2024 [D]	180
2021 system strength shortfall declared from May 2021 to May 2026	200
George Town fault level node	
Minimum pre-contingent three phase fault level	1,450
Available 99% of time [C]	650
Existing system strength contract until April 2024 [D]	530
2021 system strength shortfall declared from May 2021 to May 2026	770

[9] AEMO, 2020 System Strength and Inertia Report, December 2020, at https://aemo.com.au/-/media/files/electricity/nem/planning_and_forecasting/operability/2020/2020-system-strength-and-inertia-report.pdf?la=en.

[10] The system strength requirements, comprising the fault level nodes and the minimum three phase fault level requirements, were prepared in compliance with the System Strength Requirements Methodology (via https://www.aemo.com.au/-/media/Files/Electricity/NEM/Security_and_Reliability/System-Security-Market-Frameworks-Review/2018/System_Strength_Requirements_Methodology_PUBLISHED.pdf), including the use of detailed electromagnetic transient (EMT) analysis, and are reported and declared in the 2020 System Strength and Inertia Report accessible via https://www.aemo.com.au/-/media/files/electricity/nem/planning_and_forecasting/Operability/2020/2020-System-Strength-and-Inertia-Report.

[11] Since the 2019 system strength and inertia shortfall declarations for Tasmania, AEMO has standardised its fault level calculation method to assume a conservative network status which does not presume a particular generation dispatch configuration. This is implemented by imposing a 'flat' condition in the network simulation – that is, setting busbar voltages to their nominal values (one per unit), setting voltage angles to zero at busbars, and removing any fault level contribution from loads, shunt reactive equipment and line-charging. This calculation produces slightly lower fault level values at some busbars compared to the previous approaches.

[12] Available via https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/nem-forecasting-and-planning/planning-for-operability.

Value	Three phase fault level (MVA)
Risdon fault level node	
Minimum pre-contingent three phase fault level	1,330
Available 99% of time [C]	750
Existing system strength contract until April 2024 [D]	320
2021 system strength shortfall declared from May 2021 to May 2026	580
Waddamana fault level node	
Minimum pre-contingent three phase fault level	1,400
Available 99% of time [C]	790
Existing system strength contract until April 2024 [D]	310
2021 system strength shortfall declared from May 2021 to May 2026	620

A. In the 2020 SSI Report, AEMO decided to assess the Burnie system strength shortfalls against the post-contingent minimum level rather than the pre-contingent minimum level, and this approach also applied in this report. This is consistent with treatment of most other fault level nodes in the NEM. Shortfalls for the other fault level nodes in Tasmania are assessed against their pre-contingent levels because those nodes have specific local requirements which must be met for the pre-contingent levels, namely to do with maintaining Basslink requirements, switching requirements for local reactive plant, and some power quality requirements for metropolitan load centres. All pre- and post-contingency levels have been assessed in alignment with ensuring maintenance of a secure operating state.

B. The 2019 system strength shortfall declared for the Burnie node was declared based on a pre-contingent fault level requirement of 750 MVA. In 2020 as a result of updated EMT models, this pre-contingent fault level requirement was reviewed and changed to 850 MVA in the 2020 SSI Report. In addition, the post-contingent level was reviewed and changed to 560 MVA.

C. Projected fault levels exclude the contribution from existing system strength services procured by TasNetworks to fulfil the 2019 system strength shortfall. The projections are based on the traditional operation projections outlined in the 2020 SSI report, taken over the five-year horizon and through applying a specific set of modelling assumptions. These projections exclude the impact of frequency control ancillary service (FCAS) constraints in Tasmania as the market modelling does not model the FCAS markets. As a result, the market modelling projections are likely to be slightly more pessimistic than if the FCAS constraints were modelled. The values selected for this table show the lowest fault level projections across the five-year outlook period and are rounded down to the nearest 10.

D. System strength services procured by TasNetworks to fulfil the system strength shortfall declared by AEMO in 2019.

Figures 1 to 4 show the system strength outlook for each fault level node in Tasmania[13,14], and do not include the system strength contributions from the existing agreement to address the 2019 SSI shortfalls.

[13] Please refer to the 2021 System strength and inertia workbook for the data behind Figures 1 to 4, at https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/nem-forecasting-and-planning/planning-for-operability.

[14] When reading a system strength outlook chart, the dashed black lines show the minimum three phase fault level requirement and the coloured lines show the projected fault level available for each year in the outlook, arranged by the percentage of time for each year that each fault level amount is indicated to be available. Where the projection is that the minimum requirement amount will not be available for at least 99% of the year, AEMO may consider declaring a system strength shortfall.

Figure 1 shows the Burnie outlook including fault level below the requirement for 40% of the year in 2025-26, and a worst-case shortfall of 200MVA (for 1% of the time) across the 5-year horizon.

Figure 1 System strength outlook for Burnie under the traditional operations projections

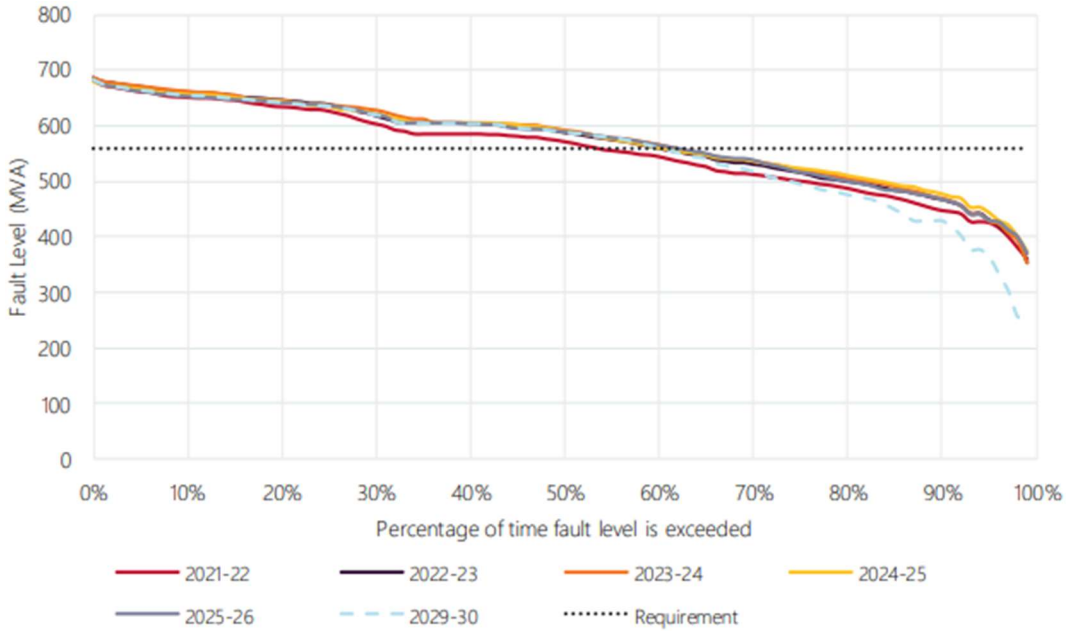


Figure 2 shows the George Town outlook including fault level below the requirement for 37% of the year in 2025-26, and a worst-case shortfall of 770 MVA (for 1% of the time) across the 5-year horizon.

Figure 2 System strength outlook for George Town under the traditional operations projections

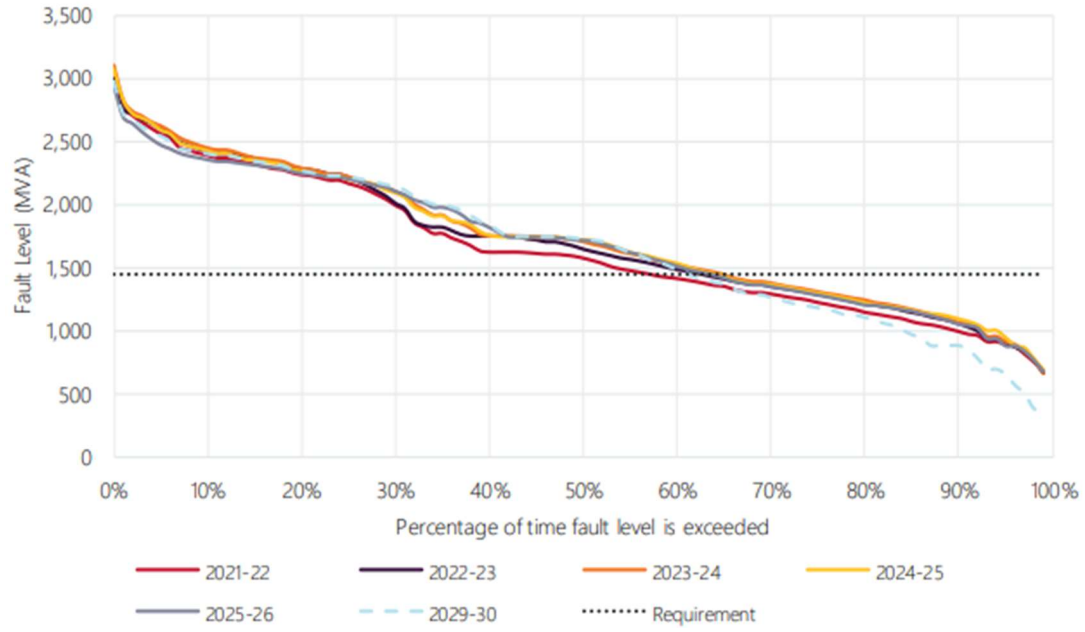


Figure 3 shows the Risdon outlook including fault level below the requirement for 29% of the year in 2025-26, and a worst-case shortfall of 580 MVA (for 1% of the time) across the 5-year horizon.

Figure 3 System strength outlook for Risdon under the traditional operations projections

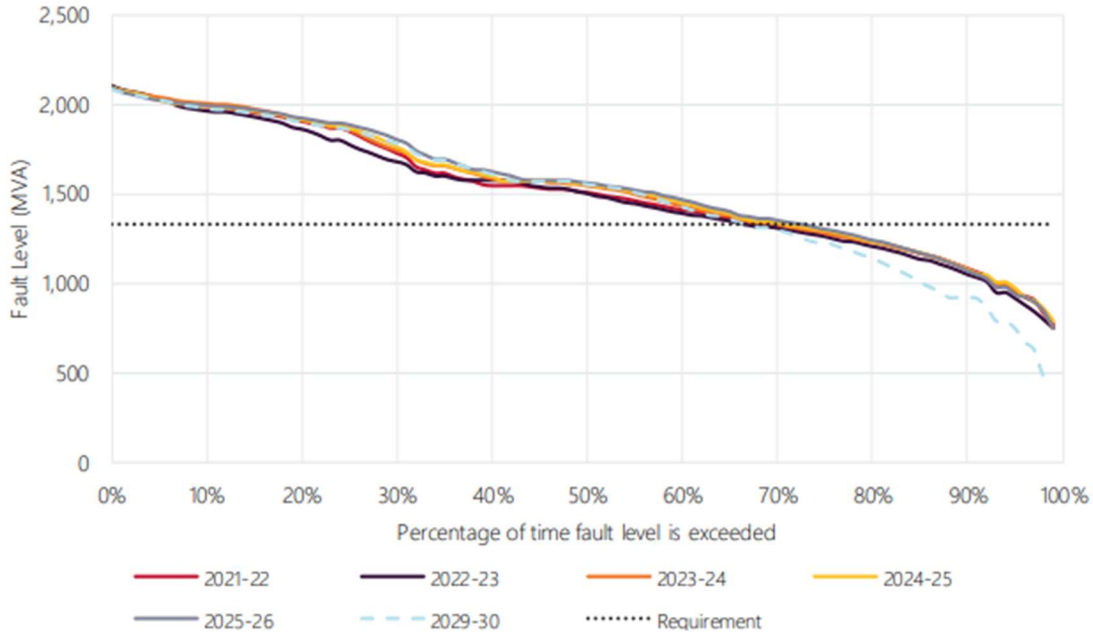
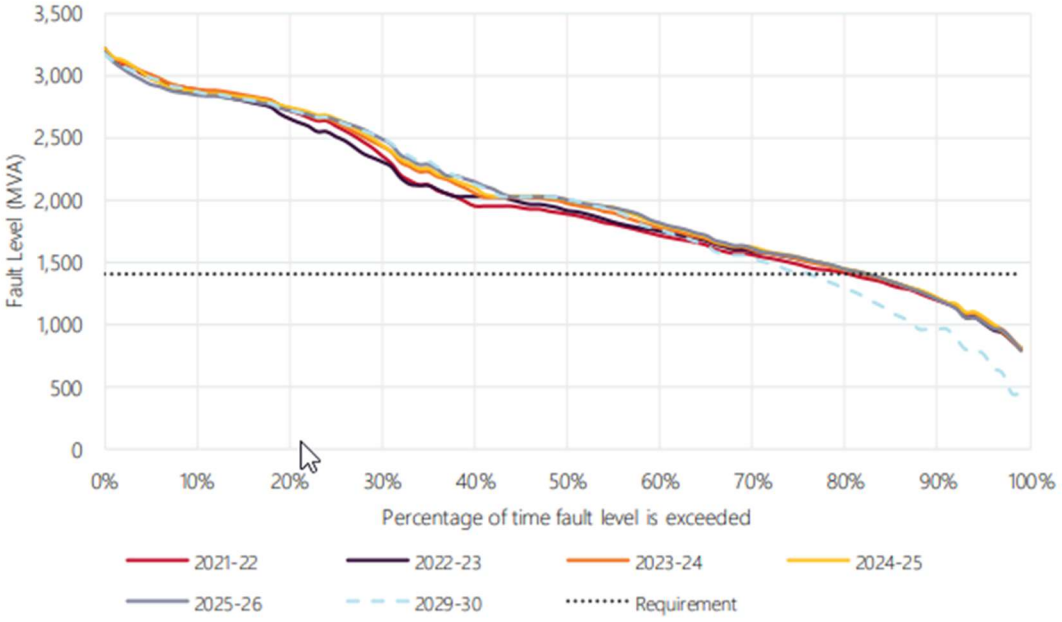


Figure 4 shows the Waddamana outlook including fault level below the requirement for 17% of the year in 2025-26, and a worst-case shortfall of 620 MVA (for 1% of the time) across the 5-year horizon.

Figure 4 System strength outlook for Waddamana under the traditional operations projections



4. Revised inertia outlook for Tasmania

AEMO has compared the updated system strength and inertia projections prepared for the 2020 SSI Report[15] against the minimum threshold level of inertia and the secure operating level of inertia for the Tasmania region[16], and observes a potential shortfall against the secure operating level of inertia within the coming five years.

AEMO has assessed whether there is or is likely to be an inertia shortfall in the Tasmania region. As a result of its assessment, AEMO declares an immediate shortfall as noted in Table 4.

It is noted that in the 2020 SSI report, AEMO extended the previous 2019 declaration beyond the end of the existing contract with Hydro Tasmania. This 2021 declaration supersedes that extension because the shortfalls declared here are larger than those declared under the 2020 SSI report.

Figure 5 shows the inertia projections for each year against the minimum requirements. AEMO is also releasing an attachment, the 2021 System strength and inertia workbook[17], providing the data used to prepare this chart.

At all times, the inertia delivered to meet the secure operating level of inertia (3,800 MWs) must only be sourced from within the Tasmania region as AEMO considers Tasmania to always be an electrical island within the NEM due to its asynchronous connection (Basslink).

AEMO is increasingly seeing fast frequency response (FFR) services being used as a partial substitute for inertial response (measured in MWs) for the secure operating level of inertia in the NEM. To address the shortfall declared for secure operating level of inertia, TasNetworks may wish to explore the substitution of inertial response with an appropriate level of FFR.

Table 4 2021 Tasmania inertia outlook

Value	Inertia (MWs)
Minimum threshold level of inertia requirement	3,200
Secure operating level of inertia requirement [A]	3,800
Available 99% of time [B]	1,180
Existing inertia contract until April 2024 [C]	2,350
2021 Inertia shortfall declared against the secure operating level of inertia requirement from May 2021 to May 2026	2,620

[15] 2020 System Strength and Inertia Report at https://www.aemo.com.au/-/media/files/electricity/nem/planning_and_forecasting/Operability/2020/2020-System-Strength-and-Inertia-Report

[16] The inertia requirements, comprising the minimum threshold level of inertia and the secure operating level of inertia, were prepared in compliance with the Inertia Requirements Methodology accessible via https://www.aemo.com.au/-/media/Files/Electricity/NEM/Security_and_Reliability/System-Security-Market-Frameworks-Review/2018/Inertia_Requirements_Methodology_PUBLISHED.pdf, including the use of detailed electromagnetic transient (EMT) analysis, and are reported and declared in the 2020 System Strength and Inertia Report accessible via https://www.aemo.com.au/-/media/files/electricity/nem/planning_and_forecasting/Operability/2020/2020-System-Strength-and-Inertia-Report.

[17] That workbook, along with a copy of this report, is available via https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/nem-forecasting-and-planning/planning-for-operability.

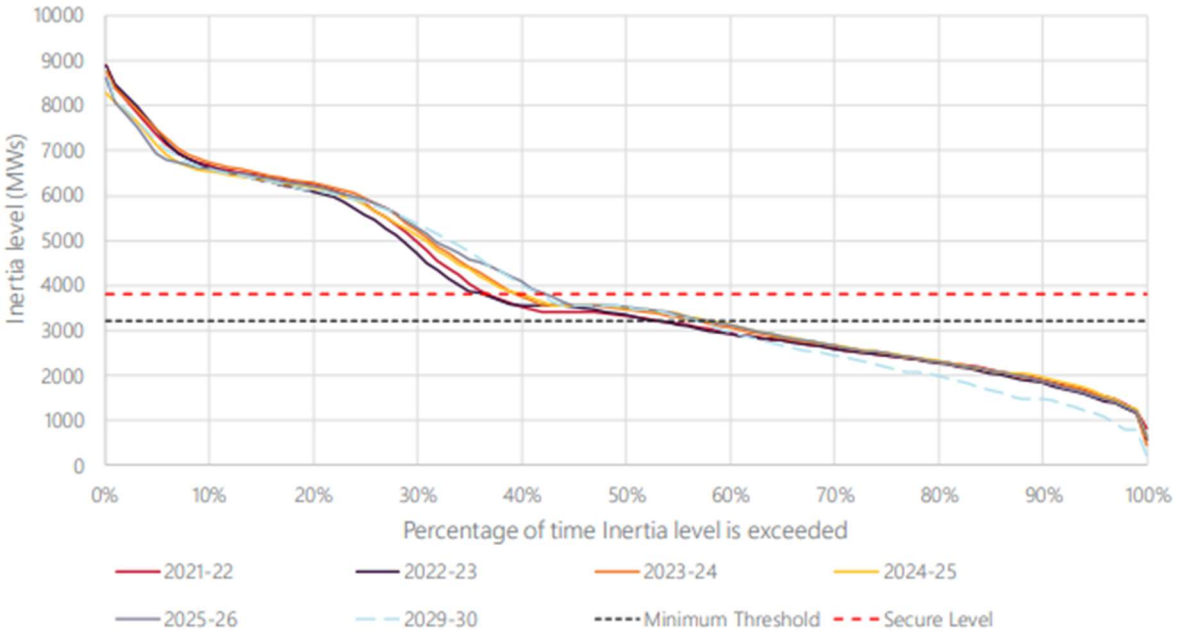
A. 3,800 MWs is the secure operating level of inertia assuming a loss of the largest hydro generation unit in Tasmania.

B. Projected inertia levels exclude the contribution from existing inertia services procured by TasNetworks to fulfil the 2019 system strength shortfall. The projections are based on traditional operation projections outlined in the 2020 SSI report, taken over the five-year horizon and through applying a specific set of modelling assumptions. These projections exclude the impact of frequency control ancillary service (FCAS) constraints in Tasmania as the market modelling does not model the FCAS markets. As a result, the market modelling projections are likely to be slightly more pessimistic than if the FCAS constraints were modelled. The values selected for this table show the lowest inertia projections across the five-year outlook period and are rounded down to the nearest 10. While these inertia projections do not include contributions from the Tamar Valley Combined Cycle Gas Turbine generator (CCGT), it is noted that this unit is still registered and available for service. The inertia provided by this unit when online will be taken into account operationally, and does not impact on the requirement and timing of the inertia shortfall.

C. Inertia services procured by TasNetworks to fulfil the inertia shortfall declared by AEMO in 2019.

Figure 5 shows the inertia outlook for Tasmania[18,19], and does not include the inertia contributions from the existing agreement to address the 2019 SSI shortfalls. Figure 5 shows the Tasmania outlook including the region's inertia below the secure operating level of inertia for 57% of the year in 2025-26, and a worst-case shortfall of 2,620 MWs (for 1% of the time) across the 5-year horizon.

Figure 5 Inertia outlook for Tasmania under the traditional operations projection



5. Next steps

AEMO requires that TasNetworks make system strength and inertia services available by 12 November 2021 to address the newly declared shortfalls under NER clauses 5.20C.2(c)(2) and 5.20B.3(c). As the transmission network service provider in the Tasmania region of the NEM, TasNetworks is the responsible system strength service provider and inertia service provider in Tasmania in accordance with NER clause 5.20C.3 and 5.20B.4.

[18] The 2021 System strength and inertia workbook contains the data behind Figure 5, accessible via https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/nem-forecasting-and-planning/planning-for-operability.

[19] When reading an inertia outlook chart, the dashed black and red lines show the minimum threshold level of inertia and secure operating level of inertia, and the coloured lines show the projected inertia levels available for each year in the outlook, arranged by the percentage of time for each year that each inertial response amount is indicated to be available. Where the projection is that the minimum requirement amount will not be available for at least 99% of the year, AEMO may consider declaring an inertia shortfall.