

# Appendix A7. System Security

December 2025

Appendix to the 2026 Integrated  
System Plan for the National  
Electricity Market





We acknowledge the Traditional Custodians of the land, seas and waters across Australia. We honour the wisdom of Aboriginal and Torres Strait Islander Elders past and present and embrace future generations.

We acknowledge that, wherever we work, we do so on Aboriginal and Torres Strait Islander lands. We pay respect to the world's oldest continuing culture and First Nations peoples' deep and continuing connection to Country; and hope that our work can benefit both people and Country.

'Journey of unity: AEMO's Reconciliation Path' by Lani Balzan

AEMO is proud to have launched its first [Reconciliation Action Plan](#) in May 2024. 'Journey of unity: AEMO's Reconciliation Path' was created by Wiradjuri artist Lani Balzan to visually narrate our ongoing journey towards reconciliation - a collaborative endeavour that honours First Nations cultures, fosters mutual understanding, and paves the way for a brighter, more inclusive future.

## Important notice

### Purpose

This is Appendix A7 to the 2026 Integrated System Plan (ISP) which is available at <https://aemo.com.au/energy-systems/major-publications/integrated-system-plan-isp>. AEMO publishes the 2026 ISP pursuant to its functions under section 49(2) of the National Electricity Law (which defines AEMO's functions as National Transmission Planner) and its supporting functions under the National Electricity Rules. This publication is generally based on information available to AEMO as at 1 December 2025 unless otherwise indicated.

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### Version control

Version	Release date	Changes
1.0	10/12/2025	First release.

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## Executive summary

AEMO's *Integrated System Plan* (ISP) is a roadmap for the transition of the National Electricity Market (NEM), and outlines an 'optimal development path' (ODP) for generation, storage and network investments to meet Australia's future energy needs.

The Draft 2026 ISP reaffirms that renewable energy, connected by transmission and distribution, firmed with storage and backed up by gas, presents the least-cost way to supply secure and reliable electricity to consumers as coal plants retire, while meeting government policies through to 2050.

The ODP takes into account three future scenarios and their relative likelihood: *Slow Growth*, *Step Change* and *Accelerated Transition*. AEMO has assessed the emerging need for system strength and inertia in the most likely *Step Change* scenario. The assessments include the modelled parts of the preferred option in each transmission network service provider's (TNSP) system strength Regulatory Investment Test for Transmission (RIT-T). This work builds on the existing assessments in the Network Requirements appendix of AEMO's 2025 *Transition Plan for System Security* (TPSS)<sup>1</sup>, and extends their outlook period at five-yearly increments.

AEMO's *Transition Plan for System Security* identifies a rapidly growing need for coordinated investment in system security services across the NEM. These services are necessary to enable delivery of the development plans considered in the ISP and are crucial to maintaining a secure and resilient power system throughout the energy transition.

This appendix quantifies these emerging requirements, and provides insights into the nature, timing, and geography of the services needed to address them. It sets out:

- **A7.1 Recent reforms to the security planning frameworks** – this section provides an overview of recent and ongoing regulatory reforms relevant to the power system security analysis in this appendix. These reforms aim to deliver increasingly efficient and proactive investment in fit-for-purpose services.
- **A7.2 AEMO's approach to system security planning** – this section explains AEMO's approach to power system security planning across multiple timeframes spanning urgent shortfalls to strategic planning, and across a broad remit of potential security services.
- **A7.3 System security concepts and requirements** – this section describes the technical, economic, and locational drivers for these services in the context of the security assessments presented later in the appendix.
- **A7.4 Projected outlook and opportunities** – this section defines the minimum system security planning standards for each NEM region, the factors that influence how these will evolve, and the expected adequacy of services available to address them. This section is structured geographically to reflect the nature of network investment obligations, and to comment on any potential options for co-optimised investment in multiple security services from a single asset or provider.

### Key findings across the NEM

The appendix also highlights the emerging requirements for each NEM region:

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<sup>1</sup> At <https://www.aemo.com.au/-/media/files/major-publications/tpss/2025-tpss-appendix-a2-network-requirements.pdf>.

- **New South Wales** – the projected decommitment and closure of coal fired generation is expected to cause system strength deficits in New South Wales at some nodes. Synchronous condensers identified through the Transgrid system strength RIT-T<sup>2</sup> are now being delivered through the *New South Wales Electricity Infrastructure Investment Act*<sup>3</sup>. These will mitigate system strength deficits partially in 2026-27 and fully for 2031-32 onwards, and allow inertia to remain above the sub-network allocation in New South Wales.
- **Queensland** – the projected decommitment and closure of coal-fired generation in Queensland is expected to result in significant reductions in synchronous fault current. The preferred option in Powerlink’s system strength RIT-T<sup>4</sup> will allow current system strength requirements to be met for the studied periods and allow inertia to remain above the sub network allocation in Queensland. Inertia remediation measures are also being progressed in parallel.
- **South Australia** – four large synchronous condensers in South Australia currently provide sufficient fault current to meet minimum requirements across the horizon. However, significant inverter-based resources (IBR) build will require a corresponding investment in system strength services. Sufficient inertia is available to meet the inertia sub-network allocation requirements in South Australia.
- **Tasmania** – declining utilisation of local synchronous hydro generation will cause deficits in system strength and inertia across the horizon, however remediation measures being progressed are sufficient to cover these deficits. AEMO will continue to work with TasNetworks to track the progress of its remediation activities<sup>5</sup>.
- **Victoria** – projected closure of coal-fired generation in Victoria is expected to result in significant reductions in synchronous fault current at some nodes in Victoria. The preferred option in AEMO Victorian Planning’s system strength RIT-T<sup>6</sup> would allow current system strength requirements to be met for the studied periods. However available inertia in Victoria is expected to fall below the sub-network allocation for the studied periods. VicGrid<sup>7</sup> is required to ensure that the full inertia sub-network allocation is met from 2 December 2027.

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<sup>2</sup> See <https://www.transgrid.com.au/projects-innovation/meeting-system-strength-requirements-in-nsw/>.

<sup>3</sup> See <https://www.transgrid.com.au/projects-innovation/system-strength-project/>.

<sup>4</sup> See <https://www.powerlink.com.au/addressing-system-strength-requirements-queensland-december-2025>.

<sup>5</sup> See <https://www.tasnetworks.com.au/planning-and-projects/major-projects/meeting-system-strength-requirements>.

<sup>6</sup> See <https://www.aemo.com.au/initiatives/major-programs/victorian-system-strength-requirement-regulatory-investment-test-for-transmission>.

<sup>7</sup> From 1 November 2025, AEMO’s Victorian network functions transferred to a new State Business Corporation, VicGrid Body Corporate (VicGrid). VicGrid is the transmission network service provider and the System Strength Service Provider for Victoria under the NER, responsible for planning, procuring and delivering system strength services.

### Key changes from the 2024 ISP

- The projected outlook in this appendix for system strength, IBR, and inertia has been assessed using Draft 2026 ISP *Step Change* scenario generator, storage and transmission build outcomes. These updated projections are presented in Section A7.4.
- TNSPs have now completed their first system strength RIT-Ts under the new frameworks and parts of the preferred option have been incorporated into the assessments presented in this appendix. Through joint planning with TNSPs, AEMO has used the latest available modelling information including the most up to date location, timing, inertia, and fault level contribution for synchronous condensers based on current procurement status, and services from non-network synchronous condensers and synchronous generation where a proponent has been identified.
- For the 2026 ISP, in response to the ISP Review, AEMO has changed the way system strength is considered in market modelling for the ISP to better reflect the impact of system security costs on the optimal mix of generation, storage and transmission investments for the power system. The estimated cost of security remediation is presented in Section A7.4.

## A7.1 Recent reforms to the security planning frameworks

The energy transition is transforming the way electricity is generated, transported, and consumed across the NEM. The pace of this change is still accelerating, and traditional ways of operating are being challenged as system security and reliability become increasingly complex.

The scope of these technological and economic changes must be matched by a supportive and adaptive regulatory framework that can drive action on critical services, remove unnecessary barriers to participation, and streamline investment in least-regret assets and services.

The system security planning frameworks have undergone a series of major overhauls in recent years to ensure they remain fit for purpose, and to continually push for more efficient long-term outcomes.

### Changes to the security frameworks have enabled progress on essential system security services

Significant work has been done on establishing the planning frameworks to date. In 2021 the system strength framework was amended to drive more proactivity in the provision of system strength services, to deliver a streamlined connection process, and to leverage economies of scale in larger, centralised investments. In 2024 the Improving Security Frameworks (ISF) final rule change made several improvements to proactively address system security issues for the energy transition<sup>8</sup>. The final rule was implemented in stages starting 3 June 2024, with full enablement obligations on AEMO commencing on 2 December 2025.

TNSPs have now completed their first system strength RIT-Ts under the new frameworks. With the exit of coal generation, TNSPs are looking to procure synchronous solutions to meet minimum three phase fault level requirements in the short term and have planned investment in the longer term.

AEMO is required to assess and enable the necessary security services in operational timeframes to ensure that the power system is secure day-to-day from 2 December 2025. The methodologies for determining and enabling these system security services, as well as the requirements to be included in agreements for the provision of system security services procured by TNSPs, are outlined in AEMO's Security Enablement Procedures<sup>9</sup>. AEMO has developed a System Security Management (SSM) tool to support its enablement functions, including the management of security service availability from providers, issuance of enablement instructions and automated reporting.

AEMO has implemented the new framework for procuring transitional services as part of the rule change, which enables AEMO to procure transitional services to assist in maintaining power system security in the transition to a low- or zero-emissions power system. Type 1 Transitional Services address near-term power system security needs that cannot be provided by other system services. Type 2 Transitional Services provide services to trial new technologies, or the new application of existing technologies, to manage power system security in the transition to a low- or zero- emissions power system. AEMO has signed two Type 1 Transitional Services contracts, and in November 2025 published five additional Statements of Need for Type 1 Transitional Services across the NEM. AEMO has implemented a Type 2 Services framework, and in October and November 2025 released five Statements of Need for Type 2 Transitional Services.

<sup>8</sup> See <https://www.aemc.gov.au/rule-changes/improving-security-frameworks-energy-transition>.

<sup>9</sup> See <https://www.aemo.com.au/consultations/current-and-closed-consultations/security-enablement-procedures>.



## Framework enhancements to deliver efficient, timely resources to meet system security needs

In November 2025, AEMO submitted a rule change request<sup>10</sup> to the Australian Energy Market Commission (AEMC) to amend the National Electricity Rules (NER) planning and procurement frameworks for system strength and inertia to support the efficient and timely deployment of resources required to meet system security needs over the energy transition.

The rule change seeks to address the issues and challenges observed to date with the planning frameworks which, in their current form, do not currently provide sufficient time or the flexibility needed in planning timeframes to respond to evolving system needs, policy settings and technology capabilities.

Through the rule change process, AEMO seeks to work with the AEMC, industry and other key stakeholders to explore the range of possible options that can best achieve the proposed outcomes. These include enabling system strength and inertia shortfalls to be declared and managed more effectively, improving planning certainty and incentives for non-network and network solutions, and better aligning planning framework timeframes for system security resource entry and exit.

While AEMO acknowledges the significant work already undertaken to establish the current planning frameworks and notes they are still settling and in the early stages of implementation, identifying enhancements now that address the observed issues means the frameworks will be ready and better positioned ahead of the next planning cycle to deliver outcomes that support the energy transition and are in the long-term interests of consumers.

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<sup>10</sup> At <https://www.aemc.gov.au/rule-changes/security-framework-enhancements>.

## A7.2 AEMO's approach to system security planning

AEMO's primary role in the planning horizon is to forecast system security requirements in the next 10 years and assess the likelihood of these requirements being met. AEMO undertakes detailed power system analysis and market simulation to set system standards, determine security requirements, forecast levels of available system services, and declare any network support and control ancillary services (NSCAS) gaps. AEMO also acts as a procurer of last resort for certain security services, under certain conditions.

In the longer term, the ISP provides AEMO's view on the ODP for the system as a whole and provides a solid plan for at least the next 20 years on which system security requirements can be identified, quantified, and proactively planned for.

### AEMO's transition planning activities

Recent rule changes have extended AEMO's planning activities with a dedicated and holistic focus on key transition points. This complements AEMO's long-standing system planning functions.

Transition planning focuses on continual enhancement of operational readiness, preparing for upcoming transition points while continually assessing the end state of the transition. Transition points are events and milestones that require material changes in the operational approach to managing power system security needing detailed analysis, risk assessment, and cross-functional coordination to plan, and manage.

For more information see the TPSS, which is an annual report on these activities that outlines AEMO's preparatory actions and seeks to inform proactive investment for medium-term challenges, and provides signals to stakeholders on nearer-term system security risks. The TPSS uses three horizons:

- **operational planning (0 to 2 years)**, for preparing for imminent transition points,
- **transition planning (2 to 10 years)**, for assessing transition point readiness and risks to inform preparatory actions and investment, and
- **future system needs (10+ years)**, to identify and begin framing risks and opportunities to prepare for anticipated power system conditions outside the Transition planning timeframe.

### General Power System Risk Review (GPSRR)

AEMO undertakes the GPSRR<sup>11</sup> annually for the NEM in consultation with NSPs. It includes review and prioritisation of power system risks, events, and conditions that could lead to cascading outages or supply disruptions. The GPSRR also draws inputs from, and in turn informs and supports, a number of AEMO's related reports and processes, including the ISP and TPSS.

For each priority risk, the GPSRR assesses the adequacy of current risk management arrangements. The GPSRR also reviews arrangements for managing existing protected events and considers any necessary changes or revocations.

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<sup>11</sup> See <https://www.aemo.com.au/energy-systems/electricity/national-electricity-market-nem/system-operations/general-power-system-risk-review>.

## A7.3 System security concepts and requirements

### System strength

System strength is the ability of the power system to maintain and control the voltage waveform at any location during both steady-state operation and following a disturbance. System strength is often approximated by the amount of electrical current available during a network fault (fault current), however the concept also encompasses a collection of broader electrical characteristics and power system interactions<sup>12,13</sup>.

Historically, fault level was often used as a proxy for system strength in the NEM, as areas with strong voltage waveforms typically exhibited high fault levels due to synchronous machine characteristics. With the rapid growth of grid-following IBR, industry understanding has matured, and it is now clear that protection-quality fault current and voltage waveform stability are distinct technical needs.

The current system strength planning framework consists of two complementary requirements:

- **the minimum level**, being the minimum three phase fault levels required for power system security at each system strength node, and
- **the efficient level**, being a requirement to maintain stable voltage waveforms at connection points to host levels of IBR forecast by AEMO (as the national transmission planner) at each system strength node.

Each requirement plays a distinct role – minimum fault levels ensure reliable protection operation and system security, while stable voltage waveforms support the secure operation and connection of IBRs. These requirements are assessed at designated system strength nodes and may be further refined as technology and understanding evolve.

More details on the nature of system strength requirements are available in the *System Strength Requirements Methodology*<sup>14</sup>.

### Inertia

In the context of the power system, inertia describes an immediate, inherent, electrical response from connected devices that acts to oppose changes in frequency. Ensuring sufficient levels of inertia are available allows the power system to resist large changes in frequency that can arise following a contingency event, slowing the rate of change of frequency (RoCoF) and providing time for other automated control systems to respond<sup>15</sup>.

Inertia includes the physical inertia of the spinning masses inside synchronous machines and the emulated ‘synthetic’ inertial response that IBR may be programmed to produce. Inertia impacts the overall system dynamic performance, particularly frequency stability, and interacts with other forms of stability, both local and global.

The current inertia management framework consists of the following requirements:

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<sup>12</sup> AEMO. *System strength in the NEM explained*. March 2020, at [https://www.aemo.com.au/-/media/files/electricity/nem/security\\_and\\_reliability/system-strength-requirements/ssr/system-strength-explained.pdf?la=en](https://www.aemo.com.au/-/media/files/electricity/nem/security_and_reliability/system-strength-requirements/ssr/system-strength-explained.pdf?la=en).

<sup>13</sup> For more information on system strength, see Section 1.2.5 of AEMO’s 2025 *Transition Plan for System Security*, at <https://www.aemo.com.au/-/media/files/major-publications/tpss/2025-transition-plan-for-system-security.pdf>.

<sup>14</sup> At [https://www.aemo.com.au/-/media/files/electricity/nem/security\\_and\\_reliability/system-strength-requirements/system-strength-requirements-methodology.pdf](https://www.aemo.com.au/-/media/files/electricity/nem/security_and_reliability/system-strength-requirements/system-strength-requirements-methodology.pdf).

<sup>15</sup> See <https://aemo.com.au/-/media/files/initiatives/engineering-framework/2023/inertia-in-the-nem-explained.pdf?la=en>.

- **satisfactory inertia level**, being the minimum level of inertia required to operate an inertia sub-network in a satisfactory operating state when the inertia sub-network is islanded,
- **secure inertia level**, being the minimum level of inertia required to operate an inertia sub-network in a secure operating state when the inertia sub-network is islanded,
- **system-wide inertia level**, being the mainland inertia required to operate the mainland regions of the NEM securely,
- **inertia sub-network allocation**, being the portion of the system-wide inertia level allocated to that inertia sub-network, and
- **inertia sub-network islanding risk**, being the likelihood of a sub-network islanding, and whether the secure inertia level is met if it does.

More details on the nature of inertia requirements are available in the *Inertia Requirements Methodology*<sup>16</sup>.

## Network support and control ancillary services (NSCAS)

NSCAS are non-market services with the capability to control the active or reactive power flow into or out of a transmission network. They can be procured to address the following two categories of need<sup>17</sup>:

- **Reliability and security ancillary services (RSAS)** are used to maintain security and supply reliability of the transmission network in accordance with the power system security standards and the reliability standard. RSAS can include any:
  - non-market ancillary service (NMAS),
  - inertia network service, or
  - system strength service.
- **Market benefits ancillary services (MBAS)** are used to maintain or increase the capability of the transmission network to maximise net economic benefits to all those who produce, consume or transport electricity in the market.

AEMO assesses the need for these services annually and declares NSCAS gaps where it identifies an unmet need. This is done annually with a three- to five-year outlook horizon through the NSCAS report (now part of the TPSS).

The Improving security frameworks for the energy transition rule change<sup>18</sup> introduced inertia network services and system strength services into the NSCAS framework in the NER. Under these frameworks, TNSPs have three years to deliver any forecast requirements for additional inertia or system strength from the time AEMO publishes them in the annual system strength report and inertia report (now part of the TPSS). Where these requirements change within the three-year period, AEMO can declare and procure shortfall services via its NSCAS procurer of last resort functions.

## Transitional Services

AEMO has been provided with two new ‘Transitional Services’ powers to assist in maintaining power system security in the transition to a low- or zero-emissions power system (see Section A7.1). These services are additional and temporary, being

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<sup>16</sup> Version 2.0 is on AEMO’s website at [https://www.aemo.com.au/-/media/files/electricity/nem/security\\_and\\_reliability/system\\_security\\_planning/inertia-requirements-methodology-v2-0](https://www.aemo.com.au/-/media/files/electricity/nem/security_and_reliability/system_security_planning/inertia-requirements-methodology-v2-0).

<sup>17</sup> NER 3.11.6 (a)(1) and(a)(2).

<sup>18</sup> See <https://www.aemc.gov.au/rule-changes/improving-security-frameworks-energy-transition>.

time limited to 2029 for Type 1 Services and 2039 for Type 2 Services, and are particularly critical to help decouple reliance on coal for system security as coal generators age and approach retirement.

Type 1 Transitional Services are focused on addressing near-term challenges without issuing directions. Type 2 Transitional Services are focused on addressing longer-term challenges by proving new, low- or zero-emissions contributions to system security through real-world trials. More information on transitional services is available in the TPSS<sup>19</sup>.

### Opportunities to co-optimize investment in reliability and system security

New investments and reforms are needed to maintain system security in advance of these exits occurring, with opportunities to co-optimize both reliability and security to help keep costs of the transition as low as possible. For example:

- Gas turbines (GTs) fitted with clutches (at design or retrofit) can act as synchronous condensers, providing security services even when not generating power. If fitted with self-start capabilities, these units can also support system restart.
- Synchronous condensers fitted with a flywheel can provide both system strength and inertia.
- Grid-forming battery energy storage systems (BESS) are progressing rapidly to be able to deliver a wide range of system security services in the NEM such as frequency control, voltage stability and some aspects of system strength.

For more information, see the TPSS.

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<sup>19</sup> At <https://www.aemo.com.au/-/media/files/major-publications/tpss/2025-transition-plan-for-system-security.pdf>.

## A7.4 Projected outlook and opportunities

This section evaluates the system security services required under the *Step Change* scenario by comparing projected service availability with regional requirements at five-year intervals. It also outlines the estimated build costs for delivering these services within the ODP, ensuring power system security is maintained throughout the planning horizon. The section is structured geographically to reflect the largely regional nature of investment obligations for system security services. This structure also makes it easier to identify any potential options for co-optimised investment to deliver multiple system security services from a single asset or provider.

### Analysis scope and assumptions

In assessing the adequacy of system security services in this appendix, AEMO has considered system strength requirements and inertia requirements as presented in the Network Requirements appendix of the TPSS. These requirements have been assumed to continue unchanged over the assessment period, these requirements may change over time.

The system strength and inertia projections included some parts of the preferred options from each TNSP's system strength RIT-T where modelling information was available or a reasonable assumption could be made. The remainder of the preferred option was not modelled due to uncertainty with contracting or confidentiality. Through joint planning with TNSPs, AEMO has used the latest available modelling information including the most up to date location, timing, inertia, and fault level contribution for synchronous condensers based on current procurement status, and services from non-network synchronous condensers and synchronous generation where a proponent has been identified.

Results are presented for system strength and inertia studies for 2026-27, 2031-32, 2036-37 and 2041-42. The 2026-27 results come from the 2025 TPSS sensitivity implementing the modelled parts of the RIT-T solutions (see the Network Requirements appendix). Results for 2031-32 onwards are from ISP modelling.

Although projections in this appendix may show some new and existing deficits over the studied period, no shortfalls or gaps are declared on the basis of results in this report. The 2025 TPSS Network Requirements appendix (encompassing the system strength, inertia and NSCAS reports) remains the official source specifying requirements that TNSPs must meet.

The market modelling simulations that underpin these projections:

- were based on *Step Change* scenario generator, storage and transmission build outcomes for this Draft 2026 ISP<sup>20</sup>,
- included generator dispatch projections from a time-sequential model with bidding strategies that change to reflect greater uncertainties further out into the future – the 2026-27 projections used benchmarked competitive bidding, included the desynchronisation of one coal power station in New South Wales, and detailed network constraints, and projections from 2031-32 onwards used short run marginal cost bidding<sup>21</sup>
- applied multiple generation outage patterns for the projections, and
- modelled the mainland NEM intact for all inertia projections (Tasmania is always an island from an electrical AC perspective).

<sup>20</sup> Outcomes presented in this appendix are based on the ODP, which is CDP4 described in Appendix A6. Cost benefit analysis. However, the timing for New England REZ Network Infrastructure Project Stage 1 and the Queensland – New South Wales Interconnector (QNI) Connect project was assumed to be 2039 in this appendix, while ISP modelling timed the projects at 2033 and 2034 respectively.

<sup>21</sup> Details for the bidding behaviour model are provided in AEMO's Market Modelling Methodologies report, at [https://www.aemo.com.au/-/media/files/stakeholder\\_consultation/consultations/nem-consultations/2024/2026-isp-methodology/isp-methodology-june-2025.pdf](https://www.aemo.com.au/-/media/files/stakeholder_consultation/consultations/nem-consultations/2024/2026-isp-methodology/isp-methodology-june-2025.pdf).

## A7.4.1 NEM-wide outlook

### Near-term outlook

In the Network Requirements appendix of the 2025 TPSS, AEMO assessed emerging needs and deficits for a broad range of power system needs:

- The system strength assessments identified emerging system strength deficits in Queensland from 2027-28, and in Victoria from 2027-28. Assessments also confirmed immediate system strength deficits across New South Wales and projected system strength deficits across Tasmania. TNSPs in these regions are progressing work to manage these requirements.
- The inertia assessments identified inertia deficits in New South Wales and Victoria from 2027-28, solutions are in progress to address these deficits with some interim deficits remaining. Assessments also identified two emerging inertia needs in Queensland with remedial measures underway, and inertia deficits in Tasmania, noting longer-term contracts are being explored alongside system strength remediation in Tasmania.
- The NSCAS assessment confirmed the existing voltage control and thermal loading risks in Victoria (at Deer Park). The previously declared voltage control gap in South Australia is actively being addressed.

While most of these identified risks have solutions underway, interim measures such as contracting synchronous plant are likely to be required until permanent solutions are installed, and in some cases may form part of the long term solution.

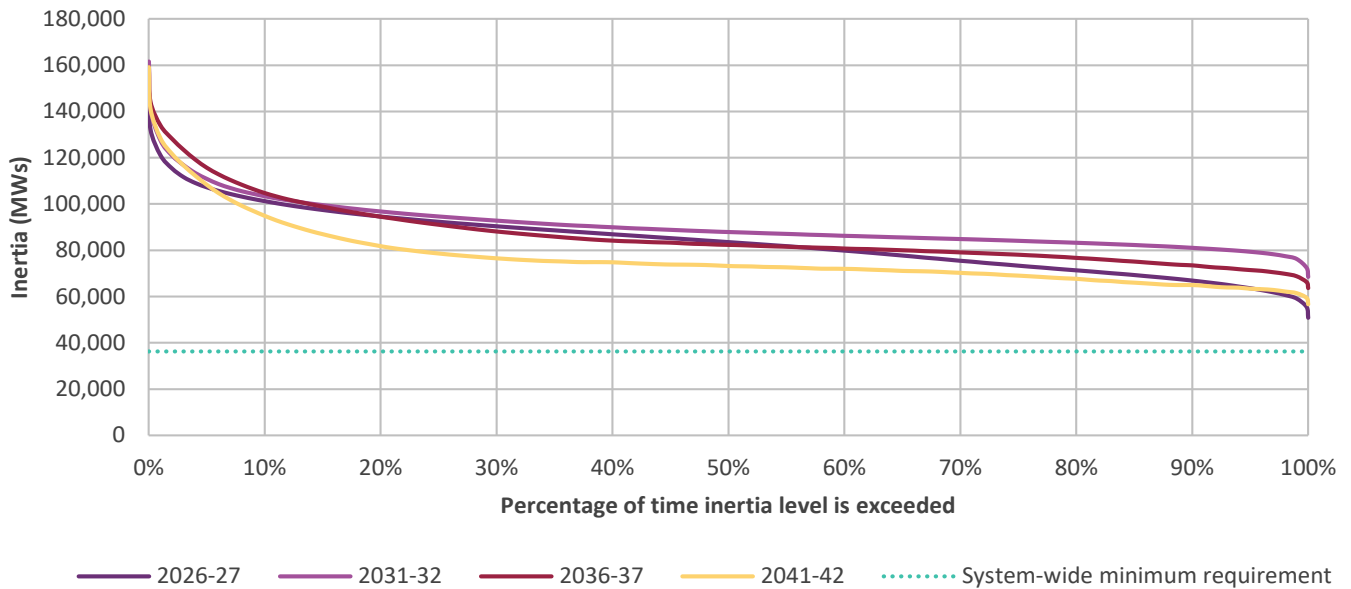
### Long-term outlook

In the long term, trends for system security services are driven by the following phenomena:

- **Retiring coal-fired generation** – historically, coal-fired generation has been the source of the majority of the system strength and inertia in the NEM and a significant source of voltage control capability. The proposed ODP in the *Step Change* scenario projects that about 66% of the NEM’s coal fleet would retire by 2035 (more than have been announced), with all to retire by 2049.
- **Increases in IBR development** – the *Step Change* scenario projects an additional 107 GW of IBR generation by 2041-42. Adequate system strength services will need to be procured to ensure this generation can stably operate. Some of these services will be provided by established technologies and AEMO expects that IBR with grid-forming inverters will also contribute to system strength. Additionally, IBR generation dispersed across the NEM will provide new sources of voltage control capability.
- **Commissioning of major network augmentations such as new interconnectors** – new interconnectors help system strength and voltage control by lowering the system impedance. They will also reduce the likelihood of regions becoming islanded, which can reduce the need for inertia services.
- **Implementation of system strength RIT-T solutions** – the preferred options across the TNSP’s system strength RIT-Ts include plans to install synchronous condensers, contracting, and grid-forming plant as part of portfolios that optimise across all available options. Synchronous condensers support system strength by providing ‘protection quality fault current’ and inertia support.

Figure 1 below shows the projected total inertia online in the mainland NEM remains above system-wide minimum requirement to 2041-42<sup>22</sup>. It illustrates that the declining coal-fired generation utilisation and retirements is mitigated by the delivery of major network augmentations and system strength RIT-T solutions across the NEM.

Figure 1 Projected mainland NEM inertia, Step Change scenario (megawatt seconds [MWS])



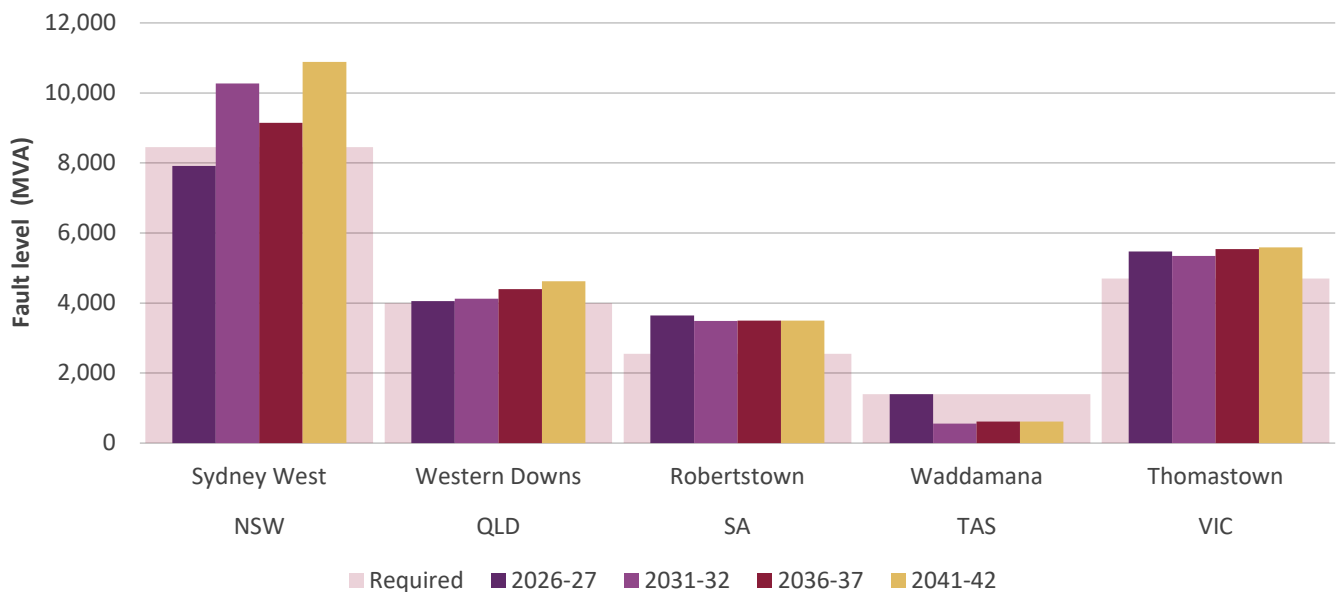
AEMO assesses system strength and inertia deficits against the 99.87th percentile, or three standard deviations from the mean (three-sigma), based on its regular usage for identifying statistical significance, limiting noise in modelled outcomes, and providing a balance between rigour and usability<sup>23</sup>. Figure 2 below shows the 99.87th percentile of synchronous fault level projected to 2041-42 for a representative system strength node in each region, and highlights the following trends:

- **New South Wales** – 99.87th percentile fault levels show deficits in 2026-27 driven by coal behaviour including two-shifting and multiple coal units taking maintenance at once. Coal retirement from 2027-28 would reduce fault levels, however, deficits are no longer present in 2031-32 and onwards due to the delivery of major network augmentations and the preferred option in Transgrid’s System Strength RIT-T.
- **Queensland and Victoria** – 99.87th percentile fault levels will decline as coal generators exit the market, however this is mitigated by 2031-32 and onwards by the delivery of major network augmentations and system strength RIT-T solutions in both regions.
- **South Australia** – 99.87th percentile fault levels remain relatively stable for the studied period.
- **Tasmania** – 99.87th percentile fault levels do not show deficits in 2026-27 due to the expected RIT-T generator and synchronous condenser contracts. The 99.87th percentile fault levels are lower and relatively stable from 2031-32 onwards, reflecting impacts of utilisation of local synchronous hydro generation driven primarily by growth in local IBR and changes in energy exports to the mainland, it is assumed that contracting arrangements similar to those in place for Tasmania are likely to continue and address potential shortfalls.

<sup>22</sup> The modelling accounts for generation, storage, and transmission built as part of the Step Change scenario, which may include some level of associated inherent inertia. Additionally, it includes likely installed plant of the preferred option in the System Strength RIT-Ts for each region.

<sup>23</sup> For more information, see [https://www.aemo.com.au/-/media/files/electricity/nem/security\\_and\\_reliability/system\\_security\\_planning/final-nscas-description-and-quantity-procedure-determination.pdf](https://www.aemo.com.au/-/media/files/electricity/nem/security_and_reliability/system_security_planning/final-nscas-description-and-quantity-procedure-determination.pdf).

**Figure 2** Fault level projections and requirements at representative nodes in each region (megavolt-amperes (MVA))



### Estimated cost of security remediation

AEMO has prepared high-level cost estimates for provision of system strength services in each REZ across the NEM. System strength service requirements are based on assessment of existing synchronous generation dispatch, potential network upgrades, and the potential scale of local IBR.

AEMO has estimated costs for meeting the minimum fault level requirement based on synchronous condenser technology, as an existing, commercially viable, technology that has been demonstrated at scale and is capable of meeting both the minimum and efficient system strength requirements.

Over time, AEMO expects that alternative technologies such as grid-forming inverters will become available to provide system strength services more efficiently following adequate demonstration at scale, as could gas generators installed with a clutch. The cost estimates presented here for minimum level requirements are therefore likely to represent an upper bound of system strength cost.

For the efficient level requirements, the remediation costs use a weighted cost trajectory approach that approximates the percentage of the solution built per year that could leverage grid-forming. Grid-forming BESS technology is assumed to be available to provide efficient level services immediately.

**Figure 3** shows the system strength remediation costs to address system strength remediation projected under the *Step Change* scenario across the NEM, including system strength remediation for the forecast IBR generation connection towards the efficient level<sup>24</sup> and to represent the cost of replacing the fault current contributions of retiring thermal generation towards the minimum fault level requirements. These estimates assume a cost of approximately \$163,000 per megawatt as a baseline<sup>25</sup>. Approximately \$3.6 billion is required across the NEM out to 2049-50 to provide system security services (upper bound).

<sup>24</sup> The system strength remediation costs for the efficient level considers only modelled projects beyond the existing, committed and anticipated projects.

<sup>25</sup> AEMO, 2025 IASR Assumptions Workbook, August 2025, at [https://www.aemo.com.au/-/media/files/stakeholder\\_consultation/consultations/nem-consultations/2024/2025-iasr-scenarios/final-docs/2025-inputs-and-assumptions-workbook.xlsx](https://www.aemo.com.au/-/media/files/stakeholder_consultation/consultations/nem-consultations/2024/2025-iasr-scenarios/final-docs/2025-inputs-and-assumptions-workbook.xlsx).

**Figure 3 Projected system strength remediation costs by year, Step Change scenario (\$ million)**



AEMO has also considered high level cost estimates for provision of inertia services across the NEM based on deficits identified in each region. AEMO has estimated costs based on the incremental cost of fitting high inertia flywheels to synchronous condensers, as an existing, commercially viable, technology that has been demonstrated at scale. This is estimated at \$6,000 per megawatt second (MWs)<sup>26</sup>.

Across the studied periods, AEMO’s regional projections indicate a combined deficit that peaks at approximately 5,700 MWs in 2031-32 then reduces to approximately 3,600 MWs by 2041-42 across all regions against their inertia sub-network allocation for main regions of the NEM and the secure inertia level for Tasmania. To fully meet this deficit across the horizon through flywheel investments would cost approximately \$24 million.

The new requirement exists in parallel with a modified framework to ensure security under islanded conditions. The *Step Change* scenario projects combined inertia deficit that peaks at approximately 2,900 MWs in 2031-32 then reduces to approximately 2,800 MWs by 2041-42 in regions likely to island (Queensland until the commissioning of QNI Connect, South Australia until the commissioning of Project EnergyConnect Stage 2, and Tasmania). It would cost approximately \$11 million to fill these deficits by adding high inertia flywheels to synchronous condensers (where such synchronous condensers were already required to be built for system strength or other purposes).

Not all system strength needs will be met using synchronous equipment, so it is unlikely that the total volume of inertia needs would be met by flywheel-type investments. AEMO notes that other sources of inertia services are also possible, such as contracting with synchronous generators, and a potentially greater role for synthetic inertia from IBR. Under the new inertia framework, TNSPs will be allowed to procure synthetic inertia to meet minimum inertia levels, subject to AEMO’s approval.

<sup>26</sup> Cost based on \$9 million per 1,500 MWs high inertia flywheel. See AEMO’s 2025 *Electricity Network Options Report*, August 2025, Section 6.2, at [https://www.aemo.com.au/-/media/files/stakeholder\\_consultation/consultations/nem-consultations/2025/2025-electricity-network-options-report/final/2025-electricity-network-options-report.pdf](https://www.aemo.com.au/-/media/files/stakeholder_consultation/consultations/nem-consultations/2025/2025-electricity-network-options-report/final/2025-electricity-network-options-report.pdf).



## Opportunities for co-optimised investment

AEMO assessed system strength, inertia and NSCAS gaps separately in the Network Requirements appendix of the TPSS. Each of these reports conducted analysis at a regional level. However, there could be efficiency gains in designing solutions holistically to fill gaps for multiple services or regions.

For example, work is being progressed to deliver the first round of system strength investment as RIT-Ts have now been completed in all NEM regions. These system strength investments may also provide an opportunity to supplement regional inertia levels using the same technical resource and with minimal incremental cost. For example, flywheels could be added to new synchronous condensers and system security services may be available from grid-forming batteries or gas turbines fitted with clutches.

To support co-optimised investment, the AEMC aligned the existing inertia and system strength frameworks procurement timeframes under the 2024 ISF final rule<sup>27</sup>. This alignment is intended to allow TNSPs to better deliver and coordinate system security investment opportunities.

Well-coordinated joint planning between AEMO, NSPs and jurisdictional bodies will be required to support timely investments that address identified gaps most efficiently. This joint planning process must recognise that timing solutions to meet identified shortfalls ‘just in time’ carry an inherent risk associated with project lead time uncertainty. Given the critical nature of maintaining system security and reliability, AEMO considers it prudent to plan the delivery of system security infrastructure well ahead of when shortfalls are expected to occur.

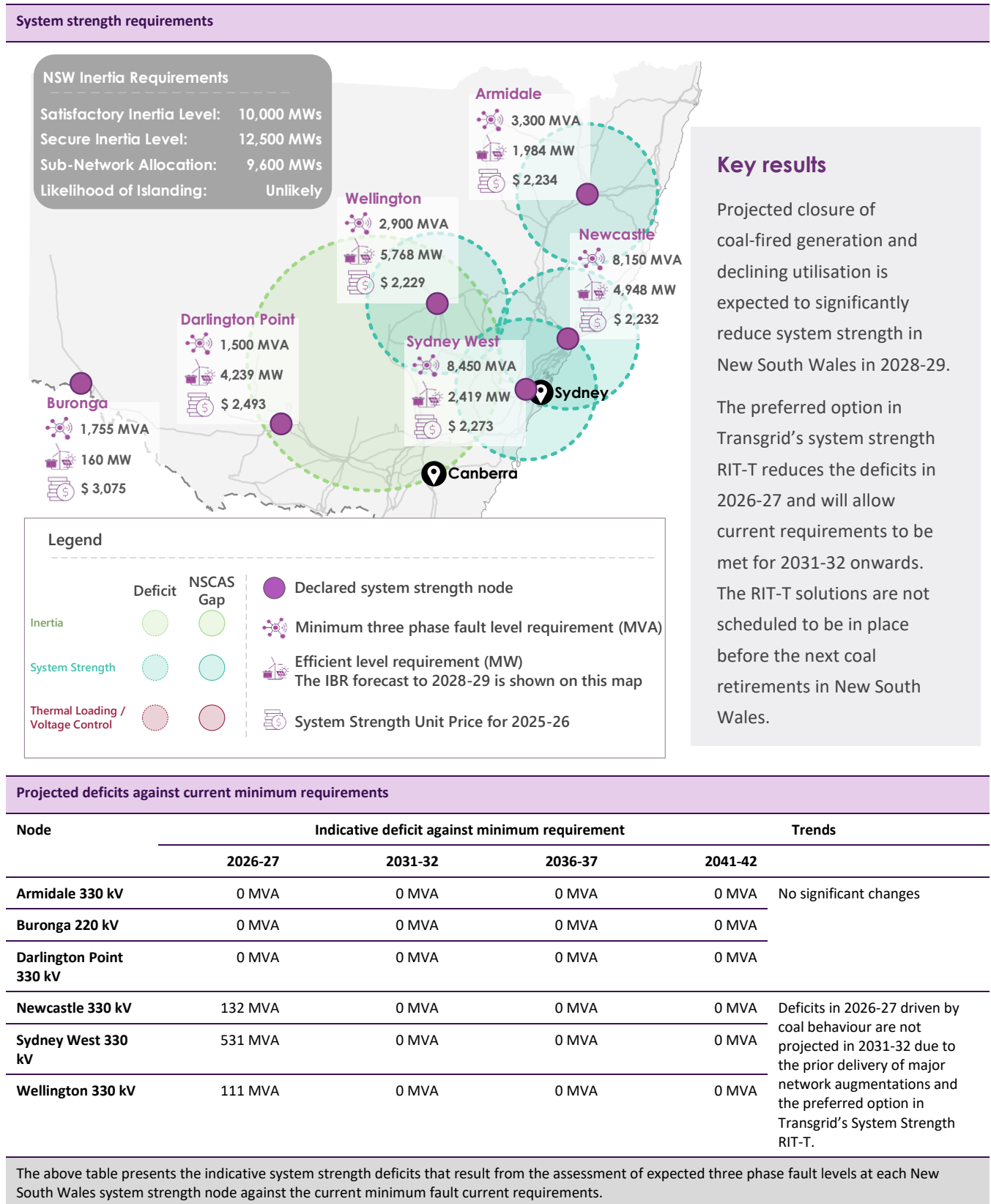
Emerging challenges for maintaining system security and reliability present a range of new risks and opportunities for project developers. Investors need to balance a range of complex technical and economic considerations across both geographical and electrical locations, including security requirements. Decisions made by investors at the design stage may mitigate system security risks or leverage the opportunities of the technology to contribute to security in the NEM – for example, choosing grid-forming technology for inverters or fitting gas turbines with clutches.

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<sup>27</sup> See <https://www.aemc.gov.au/rule-changes/improving-security-frameworks-energy-transition>.

### A7.4.2 New South Wales

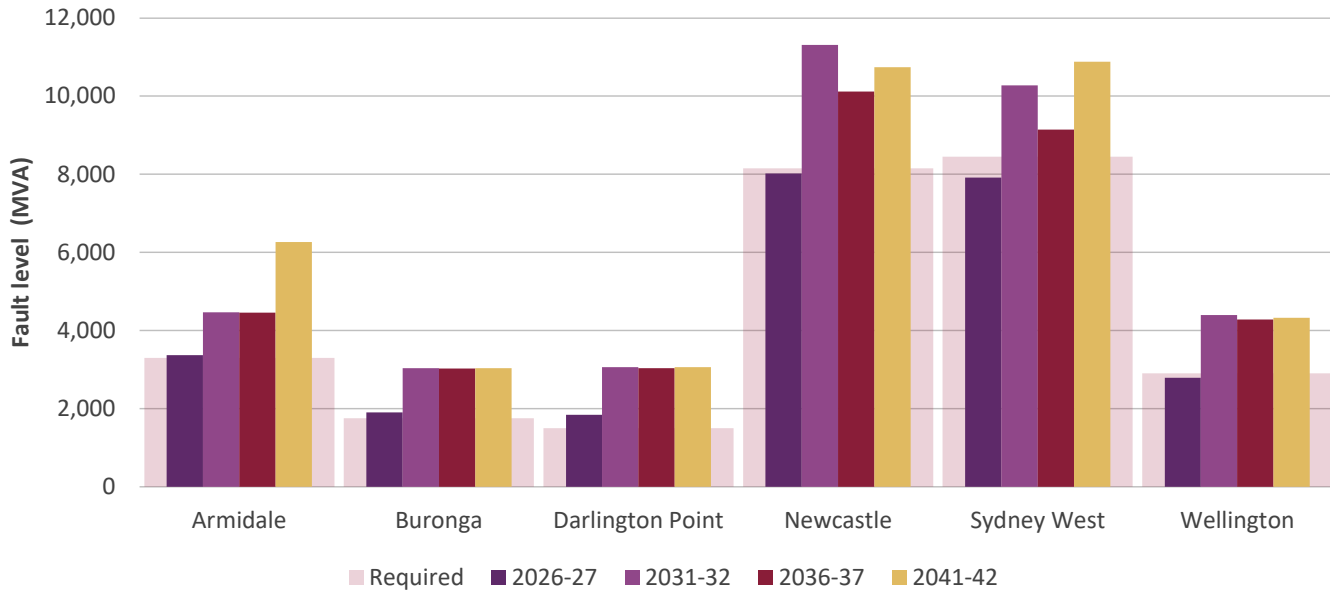
#### System strength outlook – synchronous fault levels





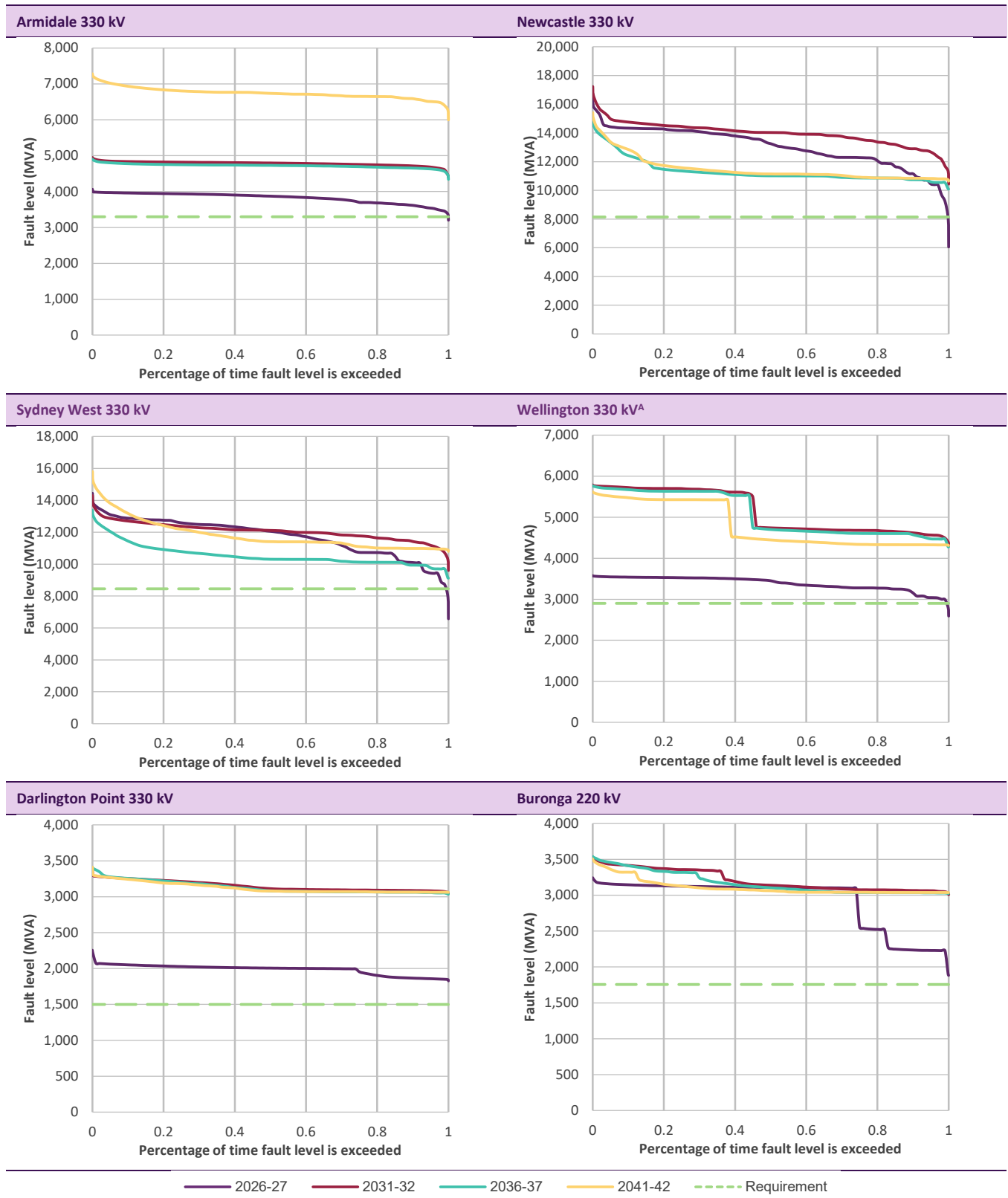
**Projected versus required level of fault current available at least 99.87% of the time**

The figure below shows the amount of synchronous fault level projected to be available 99.87% of the time at each New South Wales system strength node against the current minimum requirements.



**Figure 4** presents the fault level duration curves for New South Wales and shows synchronous fault level projected to be available at each system strength node.

Figure 4 Percentage of time fault level is exceeded in New South Wales



A. The stepped shape of the duration curves for 2031-32 and onwards is due to projected pumped hydro and its contribution to fault level at Wellington when dispatched.

System strength outlook – new IBR investment

Figure 5 presents the projected quantity and technology of IBR investment in New South Wales in the proposed ODP under Step Change scenario; the underlying data is presented in Table 1.

Figure 5 IBR projections for New South Wales in 2026-27, 2031-32, 2036-37, and 2041-42 (MW), Step Change scenario

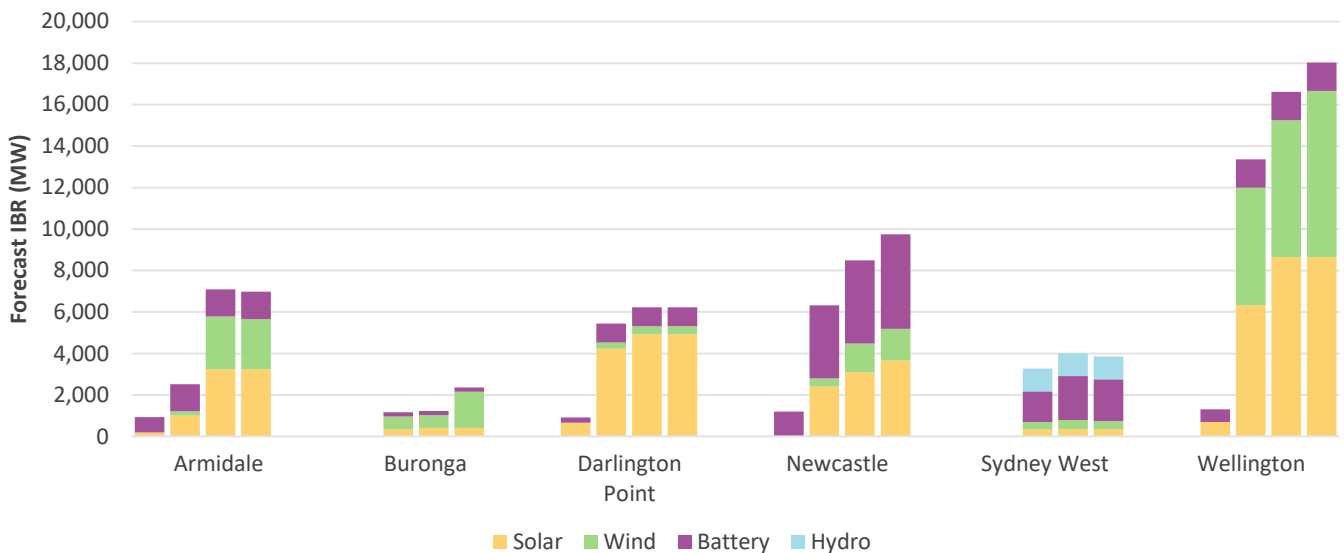


Table 1 IBR projections for New South Wales (MW)

Node	Technology	Existing	2026-27	2031-32	2036-37	2041-42
Armidale	Solar	828	201	1,005	3,243	3,243
	Wind	445	0	210	2,543	2,425
	Battery	0	725	1,308	1,308	1,308
Buronga	Solar	594	0	354	416	416
	Wind	198	0	613	616	1,746
	Battery	207	0	200	200	200
Darlington Point	Solar	1,984	660	4,234	4,922	4,922
	Wind	0	0	300	400	400
	Battery	170	260	905	905	905
Newcastle	Solar	0	0	2,407	3,083	3,659
	Wind	0	0	400	1,400	1,524
	Battery	1,095	1,200	3,167	4,006	4,566
Sydney West	Solar	42	0	332	350	350
	Wind	1,777	0	370	441	399
	Battery	254	0	1,470	2,116	2,001
	Hydro	0	0	1,100	1,100	1,100
Wellington	Solar	2,292	702	6,322	8,646	8,646
	Wind	399	0	5,671	6,606	8,008
	Battery	0	607	1,367	1,367	1,367

Inertia outlook

**Key inertia results**

New South Wales is expected to remain above the sub-network allocation for the studied periods with the inclusion of synchronous condensers identified through the Transgrid System Strength RIT-T, which are now being delivered through the New South Wales System Strength Framework.

Figure 6 presents the projected levels of inertia expected to be available in New South Wales, and Table 2 presents the inertia deficits that result from the assessment of inertia against inertia sub-network allocation for New South Wales.

**Figure 6** Projected levels of inertia available in New South Wales, Step Change scenario (MWs)



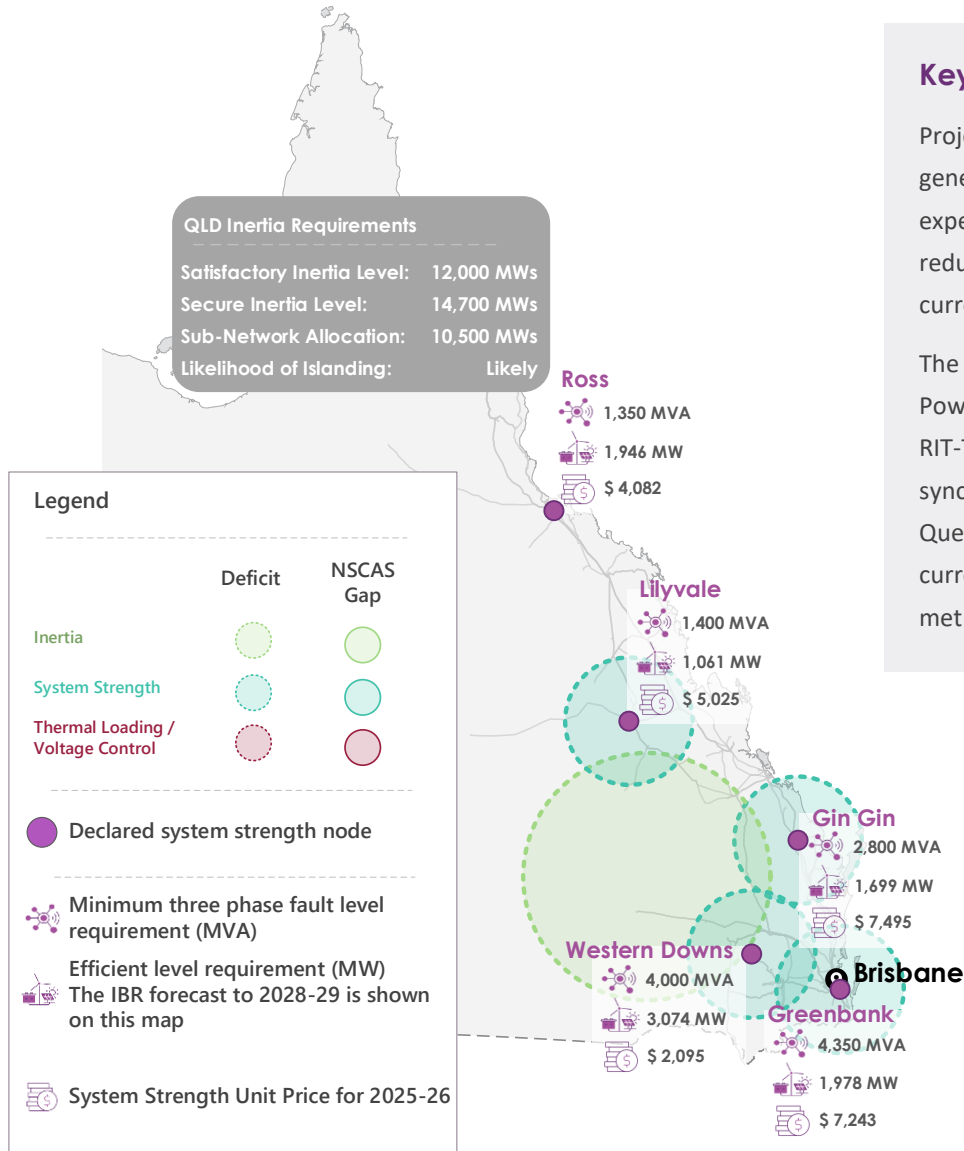
**Table 2** Inertia outlook for New South Wales

	2026-27	2031-32	2036-37	2041-42
Inertia sub-network allocation (MWs)	9,600	9,600	9,600	9,600
Inertia available 99.87% of the time (MWs)	12,552	34,453	29,640	29,640
Calculated inertia deficit (MWs)	0	0	0	0

### A7.4.3 Queensland

#### System strength outlook – synchronous fault levels

#### System strength requirements



**Key results**

Projected closure of coal-fired generation in Queensland is expected to result in significant reductions in synchronous fault current.

The preferred option in Powerlink’s System Strength RIT-T includes plans to install synchronous condensers across Queensland which will allow current requirements to be met for the studied periods.

#### Projected deficits against current minimum requirements

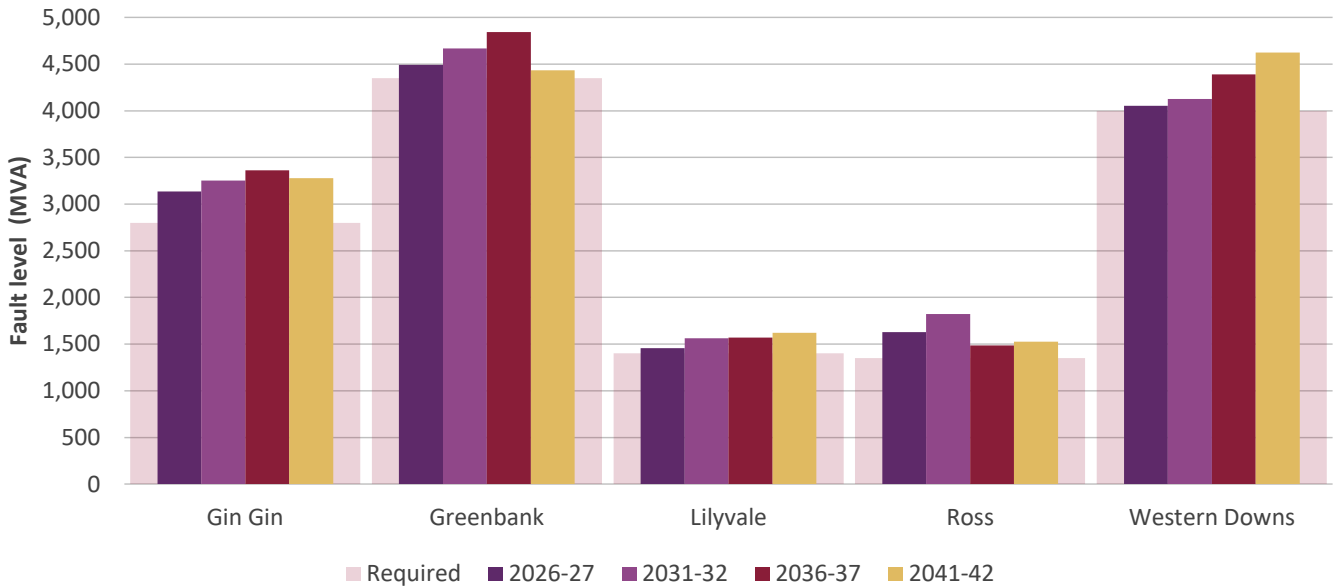
Node	Current requirement met				Trend
	2026-27	2031-32	2036-37	2041-42	
Gin Gin 275 kV	0 MVA	0 MVA	0 MVA	0 MVA	No significant changes
Greenbank 275 kV	0 MVA	0 MVA	0 MVA	0 MVA	
Lilyvale 132 kV	0 MVA	0 MVA	0 MVA	0 MVA	
Ross 275 kV	0 MVA	0 MVA	0 MVA	0 MVA	
Western Downs 275 kV	0 MVA	0 MVA	0 MVA	0 MVA	

The above table presents the indicative system strength deficits that result from the assessment of expected three phase fault levels at Queensland system strength node against the current minimum fault current requirements.



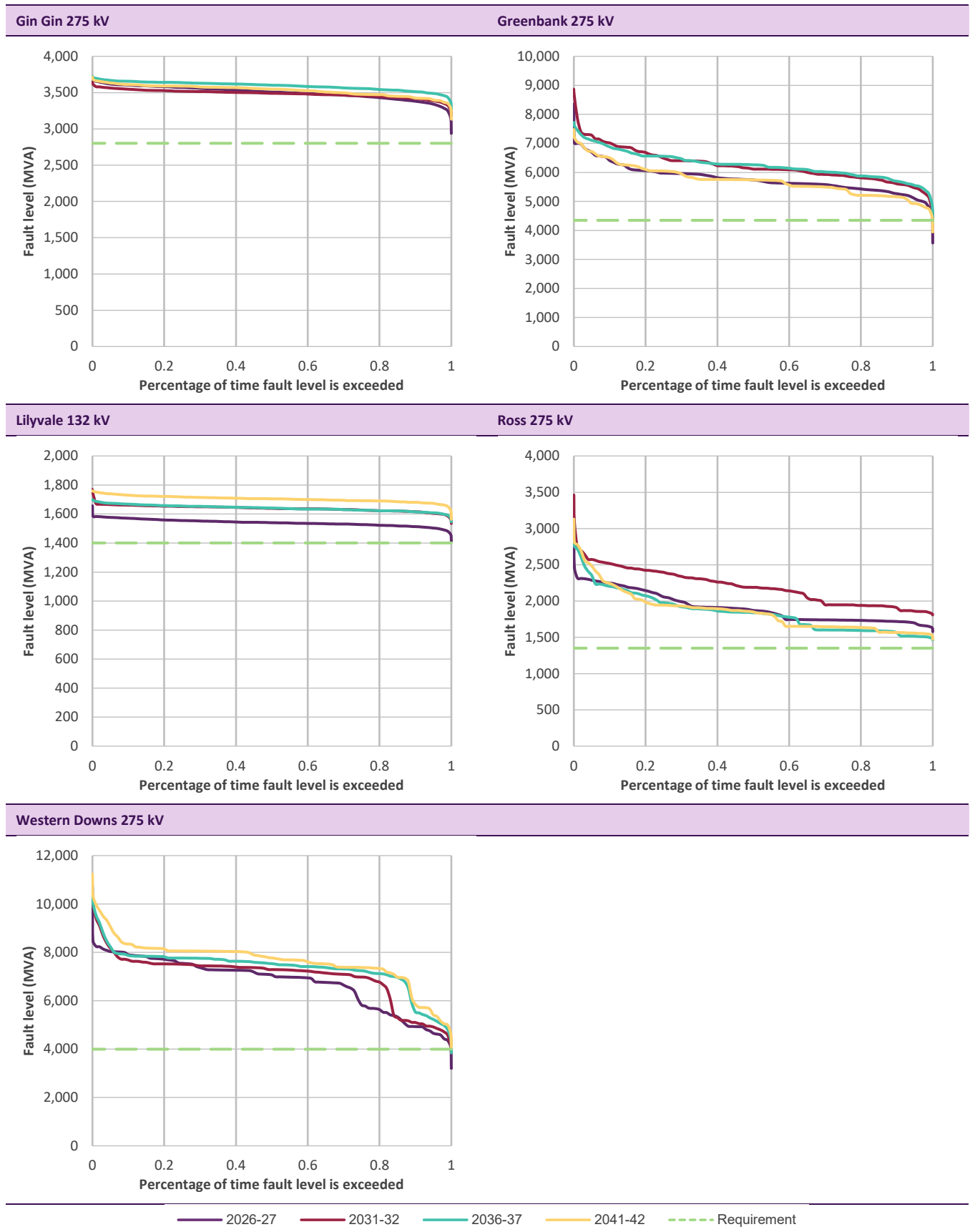
**Projected versus required level of fault current available at least 99.87% of the time**

The figure below shows the amount of synchronous fault level projected to be available 99.87% of the time at each Queensland system strength node against the current minimum requirements.



**Figure 7** presents the fault level duration curves for Queensland and shows synchronous fault level projected to be available at each system strength node.

Figure 7 Percentage of time fault level is exceeded at each system strength node in Queensland



System strength outlook – new IBR investment

Figure 8 presents the projected quantity and technology of IBR investment in Queensland in the proposed ODP under Step Change scenario, and the underlying data is presented in Table 3.

Figure 8 IBR projections for Queensland in 2026-27, 2031-32, 2036-37, and 2041-42 (MW), Step Change scenario

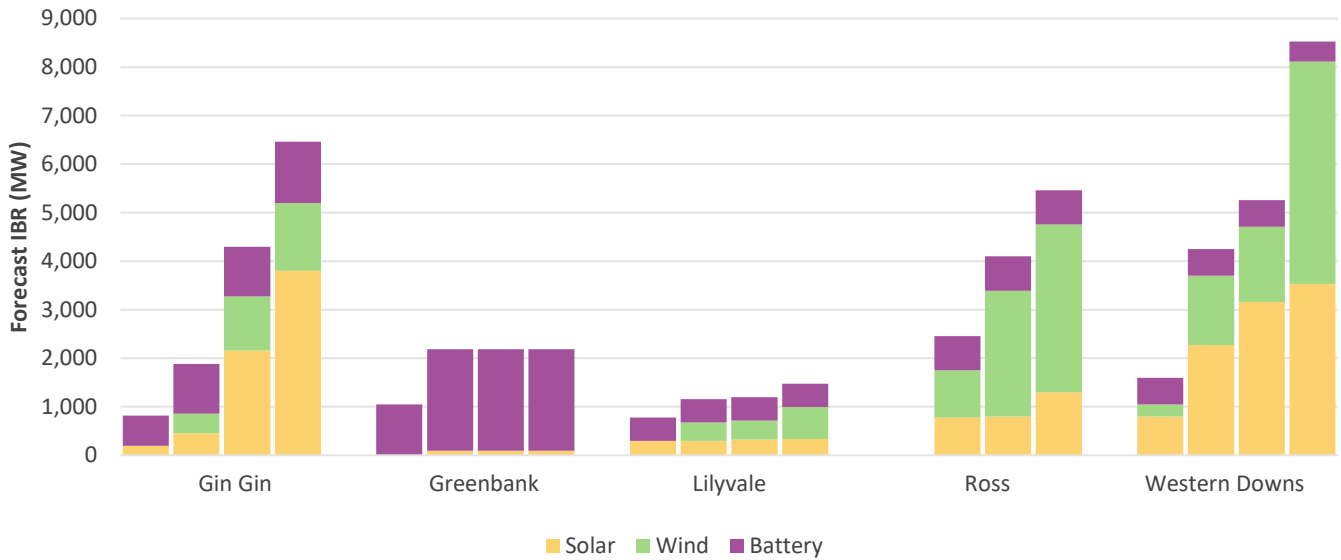


Table 3 IBR projections for Queensland (MW)

Node	Technology	Existing	2026-27	2031-32	2036-37	2041-42
Gin Gin	Solar	1,005	198	456	2,157	3,806
	Wind	0	0	405	1,121	1,391
	Battery	67	622	1,022	1,022	1,264
Greenbank	Solar	15	0	94	94	94
	Wind	0	0	0	0	0
	Battery	259	1,052	2,091	2,091	2,091
Lilyvale	Solar	428	296	296	324	341
	Wind	449	0	379	392	653
	Battery	0	480	480	480	480
Ross	Solar	979	0	781	802	1,298
	Wind	391	0	970	2,592	3,460
	Battery	0	0	704	704	704
Western Downs	Solar	1,914	799	2,274	3,163	3,531
	Wind	1,555	252	1,426	1,547	4,584
	Battery	529	548	548	548	414



## Inertia outlook

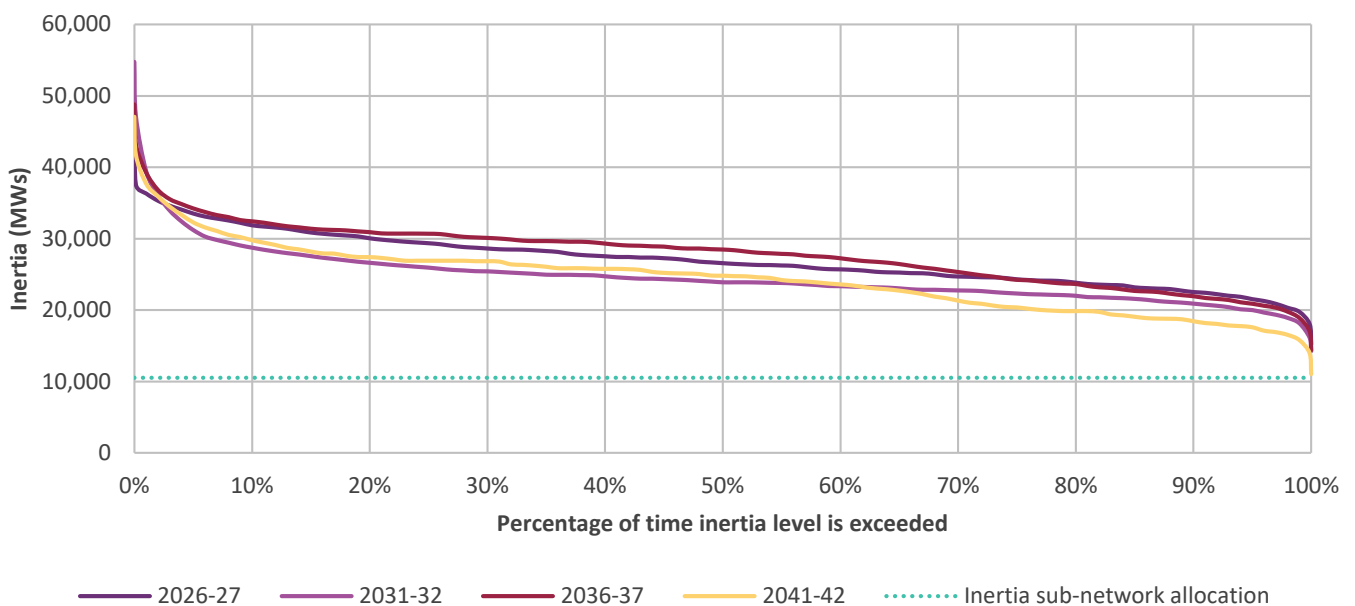
### Key inertia results

Queensland is expected to remain above the sub-network allocation for the studied periods with the inclusion of synchronous condensers from Powerlink’s System Strength RIT-T preferred option. Powerlink is also progressing inertia remediation measures in parallel. AEMO will continue to work with Powerlink to track the progress of its remediation activities.

AEMO’s assessment of Queensland’s inertia needs in the Network Requirements appendix of the TPSS has closed the inertia shortfall declared in the 2024 Inertia Report.

**Figure 9** presents the projected levels of inertia expected to be available in Queensland, and **Table 4** presents the inertia deficits that result from the assessment of inertia against inertia sub-network allocation for Queensland.

**Figure 9** Projected levels of inertia available in Queensland, Step Change scenario (MWs)



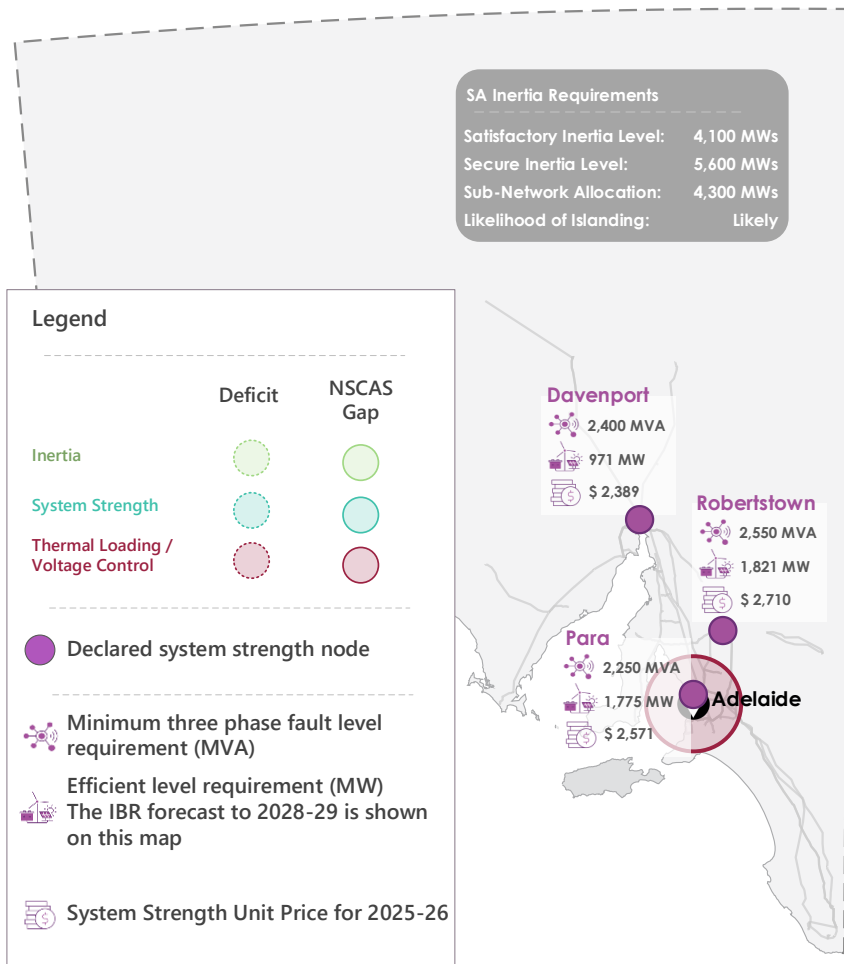
**Table 4** Inertia outlook for Queensland

	2026-27	2031-32	2036-37	2041-42
Inertia sub-network allocation (MWs)	10,500	10,500	10,500	10,500
Inertia available 99.87% of the time (MWs)	18,025	16,117	17,002	13,942
Calculated inertia deficit (MWs)	0	0	0	0

### A7.4.4 South Australia

#### System strength outlook – synchronous fault levels

#### System strength requirements



**Key results**

With the planned synchronous condensers installed in South Australia, projected system strength remains adequate to meet current minimum fault level requirements.

#### Projected deficits against current minimum requirements

Node	Current requirement met				Trend
	2026-27	2031-32	2036-37	2041-42	
Davenport 275 kV	0 MVA	0 MVA	0 MVA	0 MVA	No significant changes
Para 275 kV	0 MVA	0 MVA	0 MVA	0 MVA	
Robertstown 275 kV	0 MVA	0 MVA	0 MVA	0 MVA	

The above table presents the indicative system strength deficits that result from the assessment of expected three phase fault levels at each South Australia system strength node against the current minimum fault current requirements.

Projected versus required level of fault current available at least 99.87% of the time

The figure below shows the amount of synchronous fault level projected to be available 99.87% of the time at each South Australia system strength node against the current minimum requirements.

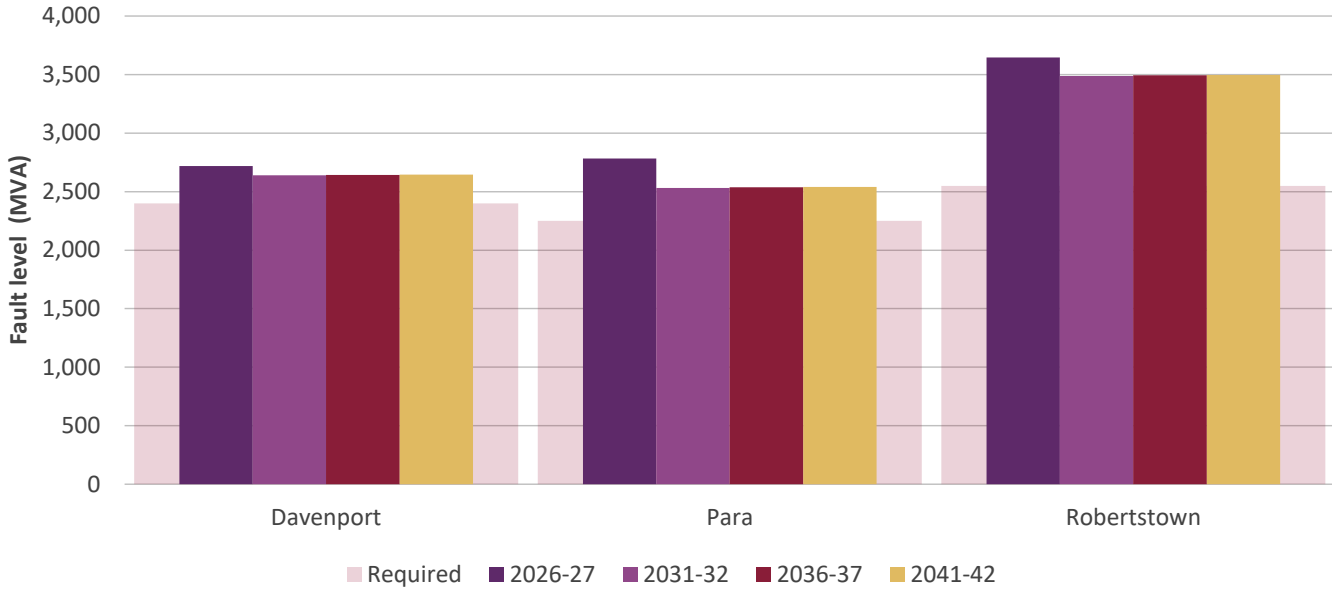
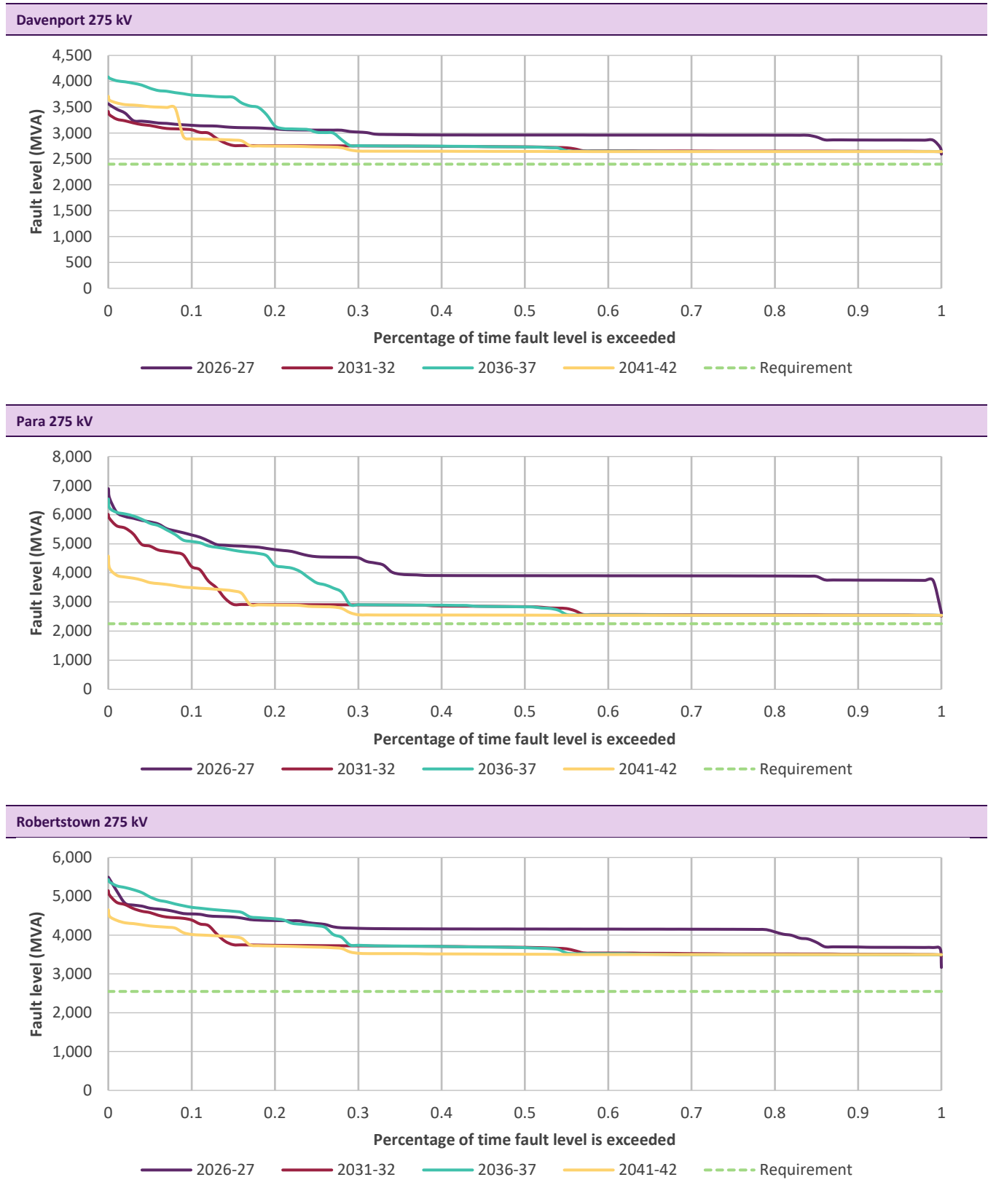


Figure 10 presents the fault level duration curves for South Australia and shows synchronous fault level projected to be available at each system strength node.

Figure 10 Percentage of time fault level is exceeded at each system strength node in South Australia



System strength outlook – new IBR investment

Figure 11 presents the projected quantity and technology of IBR investment in South Australia in the proposed ODP under Step Change scenario, and the underlying data is presented in Table 5.

Figure 11 IBR projections for South Australia in 2026-27, 2031-32, 2036-37, and 2041-42 (MW), Step Change scenario

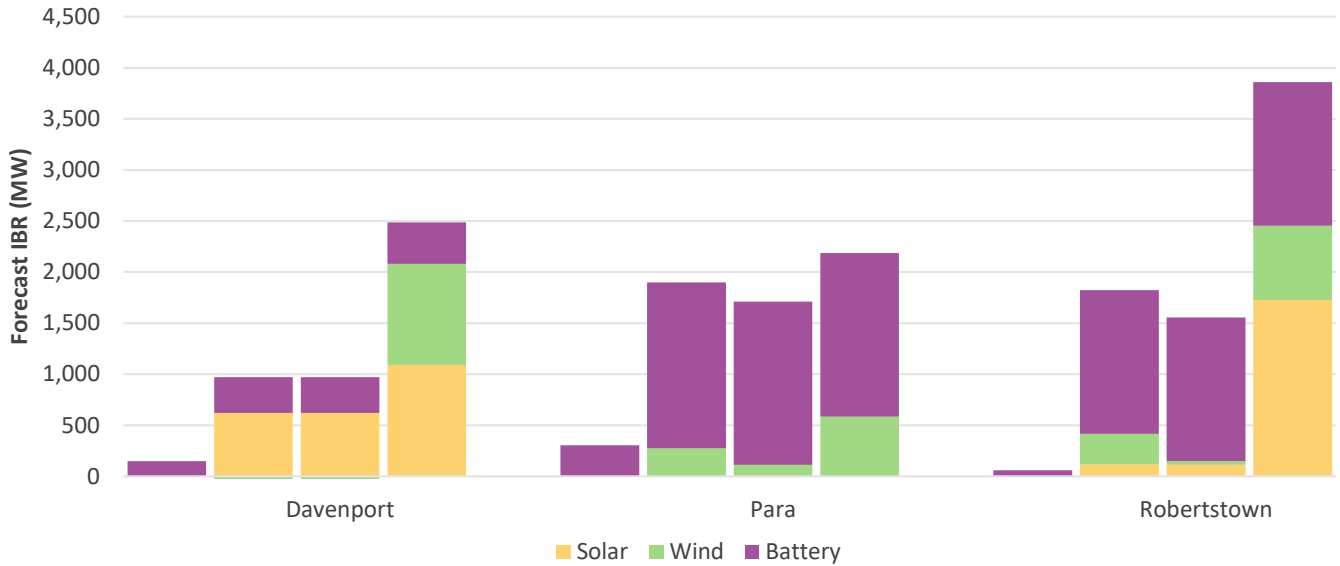


Table 5 IBR projections for South Australia (MW)

Node	Technology	Existing	2026-27	2031-32	2036-37	2041-42
Davenport	Solar	369	0	621	621	1,090
	Wind	558	0	0	0	989
	Battery	10	150	350	350	407
Para	Solar	338	0	0	0	0
	Wind	360	0	274	112	586
	Battery	337	304	1,624	1,599	1,599
Robertstown	Solar	22	0	117	112	1,726
	Wind	1,848	0	300	39	727
	Battery	599	60	1,406	1,406	1,406

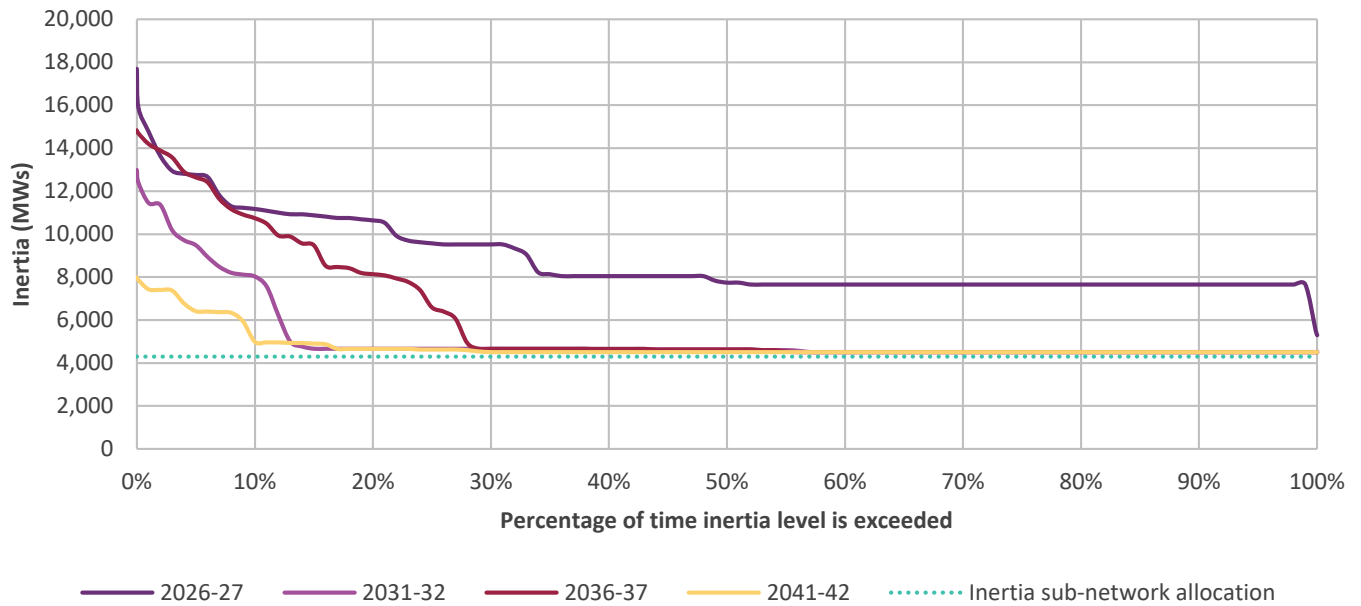
Inertia outlook

**Key inertia results**

AEMO’s assessment of the inertia needs indicates sufficient inertia is available to meet the inertia sub-network allocation requirements in South Australia.

Figure 12 presents the projected levels of inertia expected to be available in South Australia, and Table 6 presents the inertia deficits that result from the assessment of inertia against inertia sub-network allocation for South Australia.

**Figure 12** Projected levels of inertia available in South Australia, Step Change scenario (MWs)

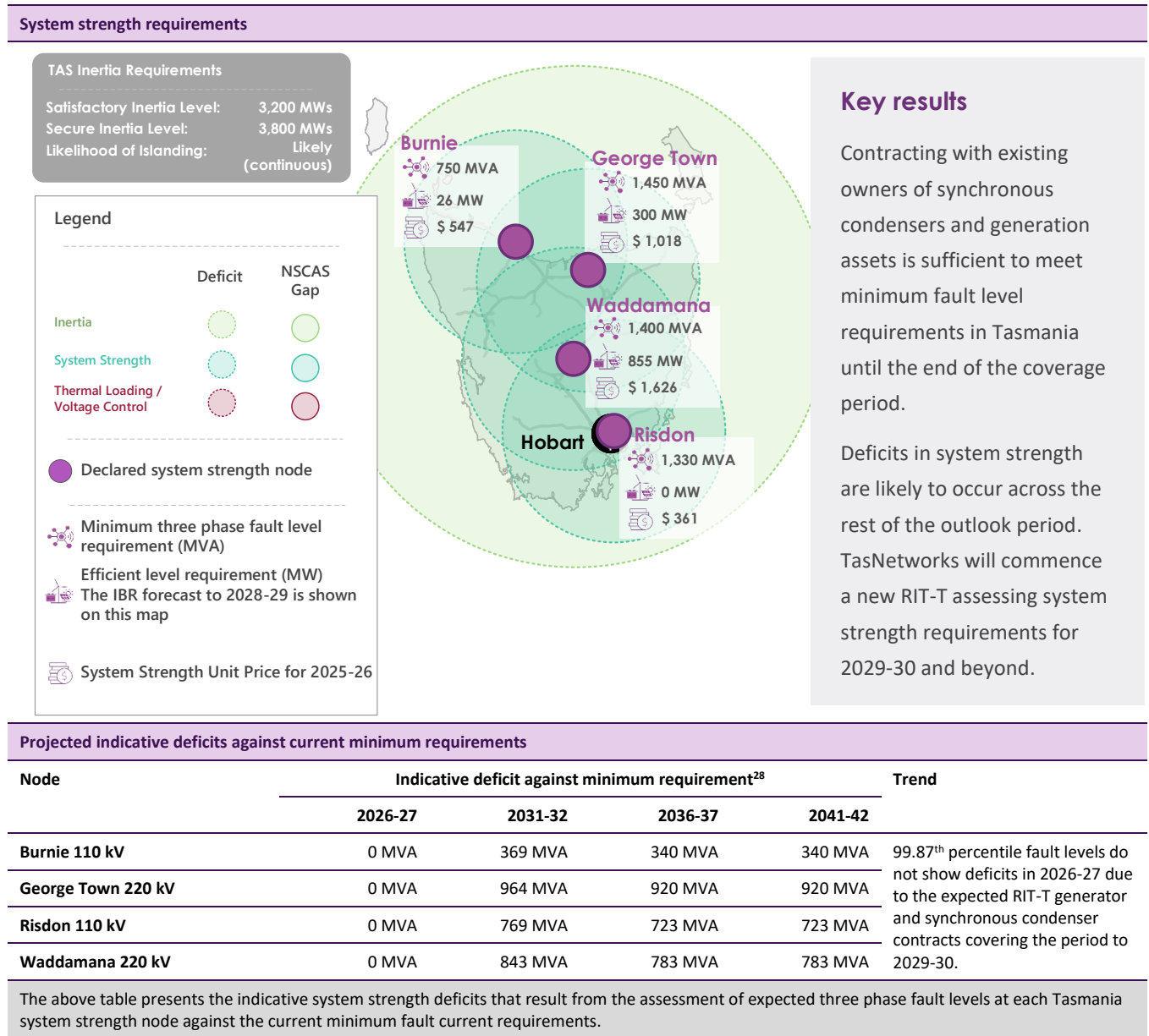


**Table 6** Inertia outlook for South Australia

	2026-27	2031-32	2036-37	2041-42
Inertia sub-network allocation (MWs)	4,300	4,300	4,300	4,300
Inertia available 99.87% of the time (MWs)	5,510	4,503	4,503	4,503
Calculated inertia deficit (MWs)	0	0	0	0

### A7.4.5 Tasmania

#### System strength outlook – synchronous fault levels

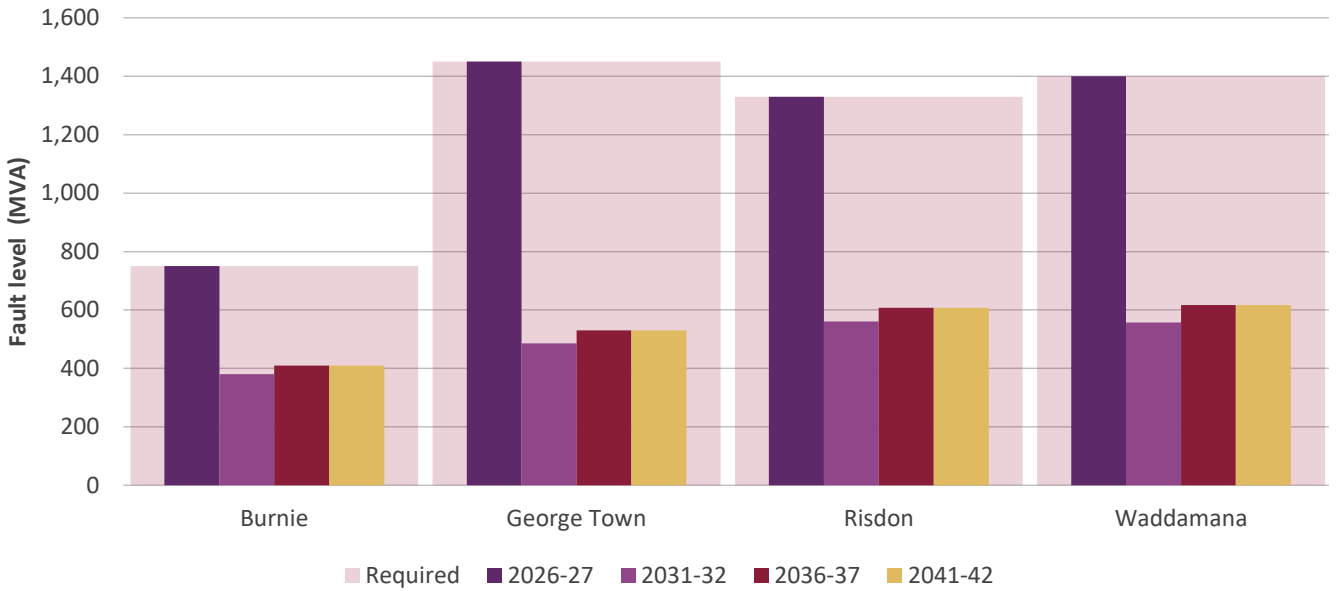


<sup>28</sup> TasNetworks is progressing work into contracting arrangements for additional system strength services for years beyond 2029-30.



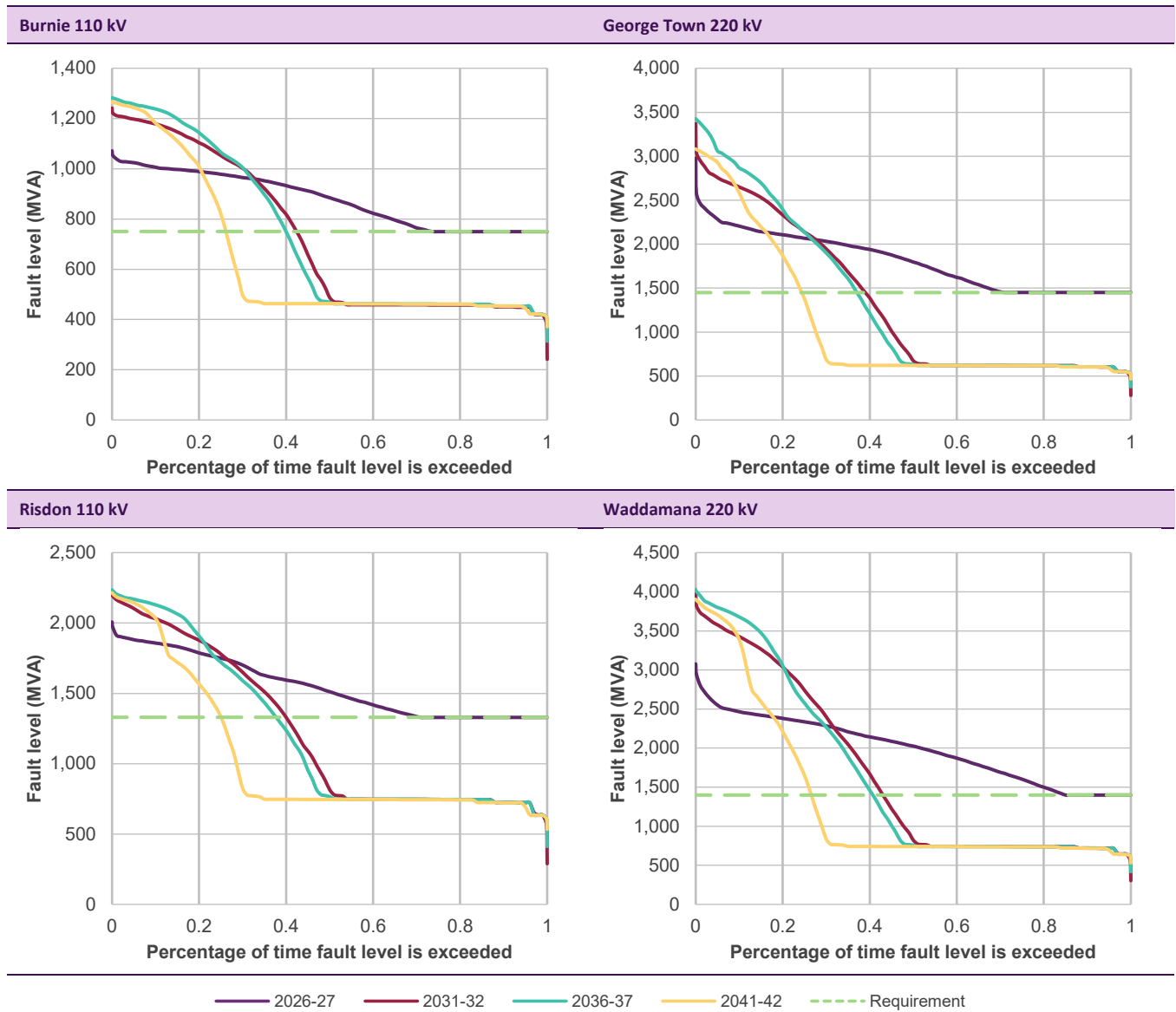
**Projected versus required level of fault current available at least 99.87% of the time**

The figure below shows the amount of synchronous fault level projected to be available 99.87% of the time at each Tasmania system strength node against the current minimum requirements.



**Figure 13** presents the fault level duration curves for Tasmania and shows synchronous fault level projected to be available at each system strength node.

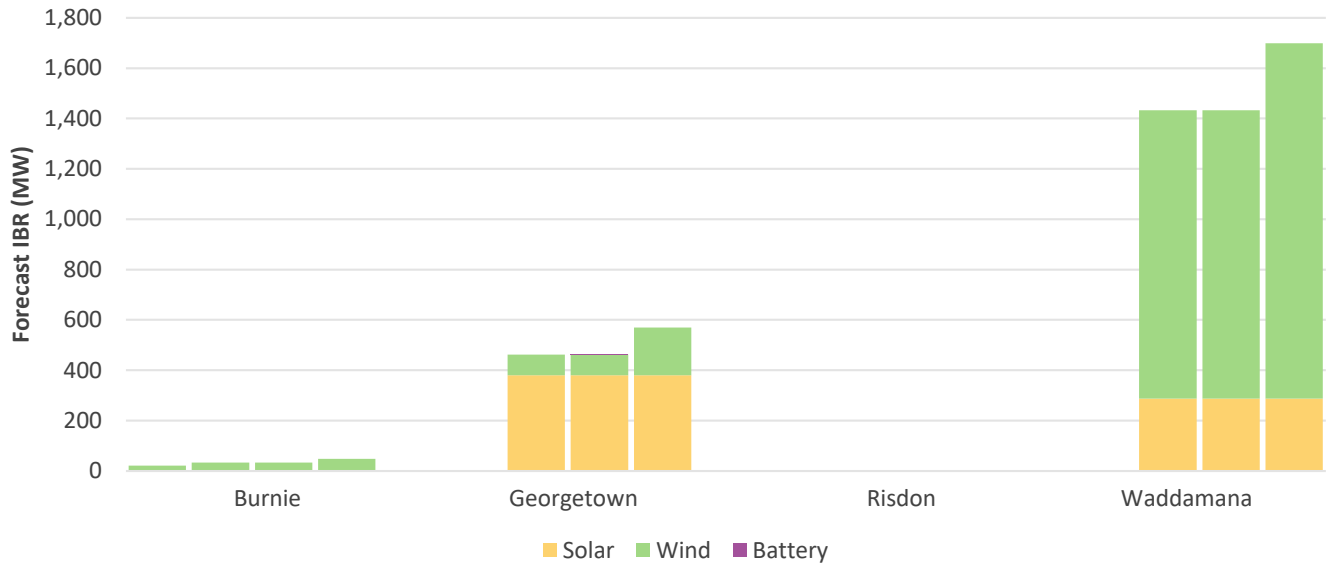
Figure 13 Percentage of time fault level is exceeded at each system strength node in Tasmania



### System strength outlook – new IBR investment

Figure 14 presents the projected quantity and technology of IBR investment in Tasmania in the proposed ODP under *Step Change* scenario, and the underlying data is presented in Table 7.

**Figure 14** IBR projections for Tasmania in 2026-27, 2031-32, 2036-37, and 2041-42 (MW), *Step Change* scenario



**Table 7** IBR projections for Tasmania (MW)

Node	Technology	Existing	2026-27	2031-32	2036-37	2041-42
Burnie	Solar	0	0	0	0	0
	Wind	251	21	33	33	48
	Battery	0	0	0	0	0
Georgetown	Solar	0	0	380	380	380
	Wind	168	0	82	82	189
	Battery	0	0	0	0	0
Risdon	Solar	0	0	0	0	0
	Wind	0	0	0	0	0
	Battery	0	0	0	0	0
Waddamana	Solar	0	0	287	287	287
	Wind	148	0	1,146	1,146	1,412
	Battery	0	0	0	0	0

## Inertia outlook

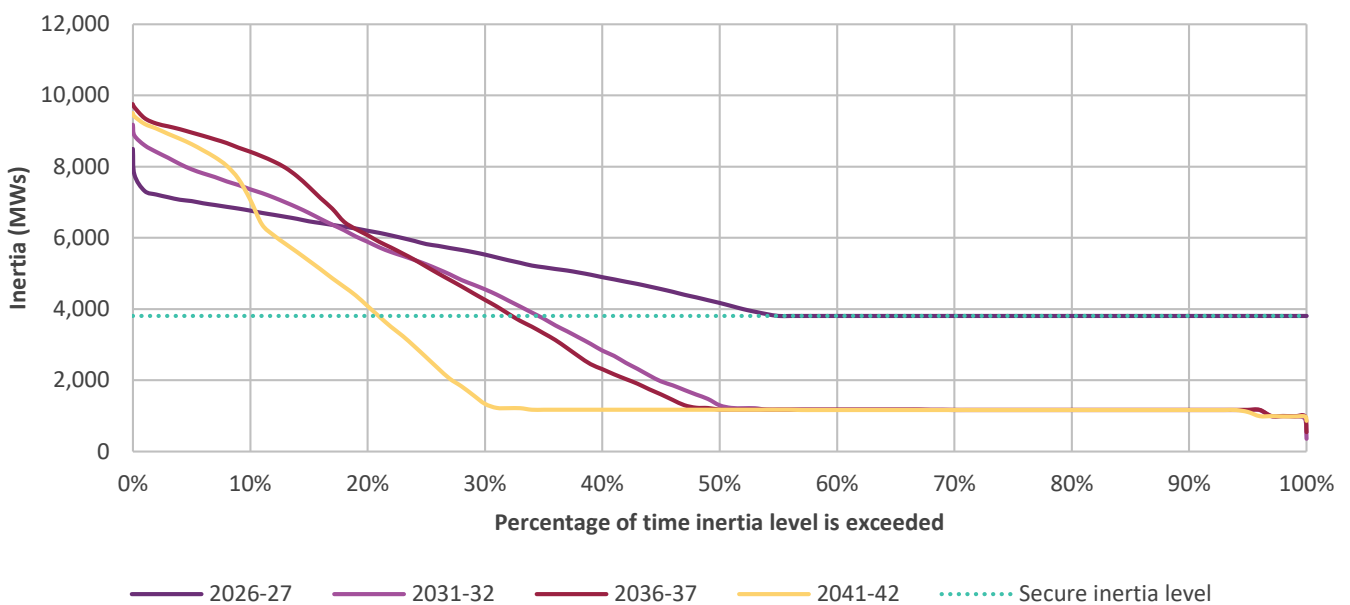
### Key inertia results

AEMO’s assessment of Tasmania’s inertia needs in the Network Requirements appendix of the TPSS indicates that the inertia remediation measures being progressed by TasNetworks is sufficient to cover inertia deficits in Tasmania until the end of the portfolio’s coverage period in 2029-30. TasNetworks will commence a new RIT-T for 2029-30 and beyond.

Tasmania is not subject to the system-wide inertia level, so the assessment for Tasmania considers only the islanded regional requirement.

**Figure 15** presents the projected levels of inertia expected to be available in Tasmania, and **Table 8** presents the inertia deficits that result from the assessment of inertia against secure inertia level for Tasmania. The indicative inertia deficits shown can be remediated through a suite of technologies with potential solutions including synchronous plant or storage projected in the ODP that elect to use grid-forming technology. The cost of security remediation to address these deficits is considered in the cost-benefit analysis, with the estimated costs under the ODP presented in Section A7.4.1.

**Figure 15** Projected levels of inertia available in Tasmania, Step Change scenario (MWs)



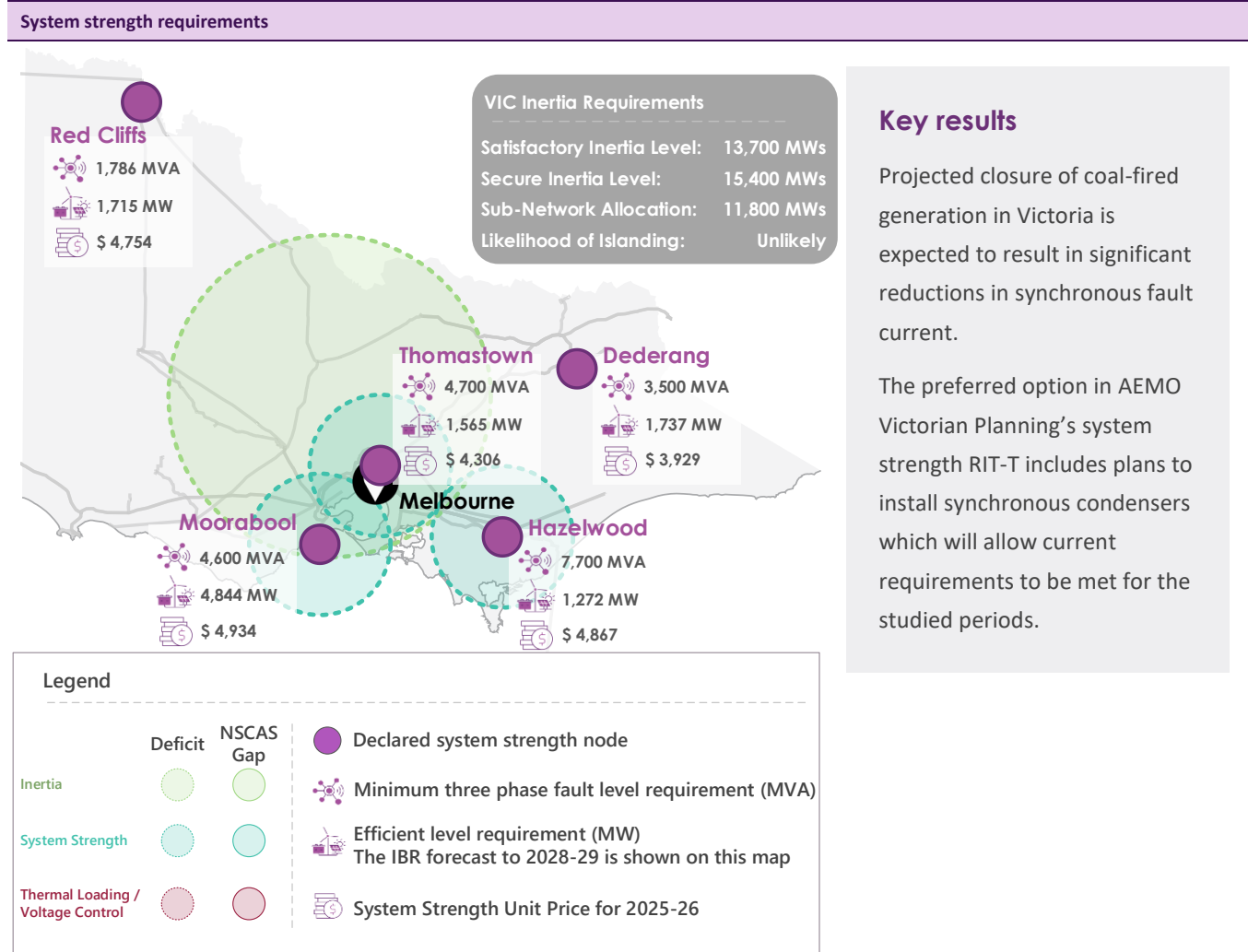
**Table 8** Inertia outlook for Tasmania

	2026-27	2031-32	2036-37	2041-42
Secure inertia level (MWs)	3,800	3,800	3,800	3,800
Inertia available 99.87% of the time (MWs)	3,800	910	983	983
Calculated inertia deficit (MWs)	0	2,890	2,817	2,817

Note: TasNetworks is progressing work into contracting arrangements for years beyond 2029-30.

### A7.4.6 Victoria

#### System strength outlook – synchronous fault levels



**Projected deficits against current minimum requirements**

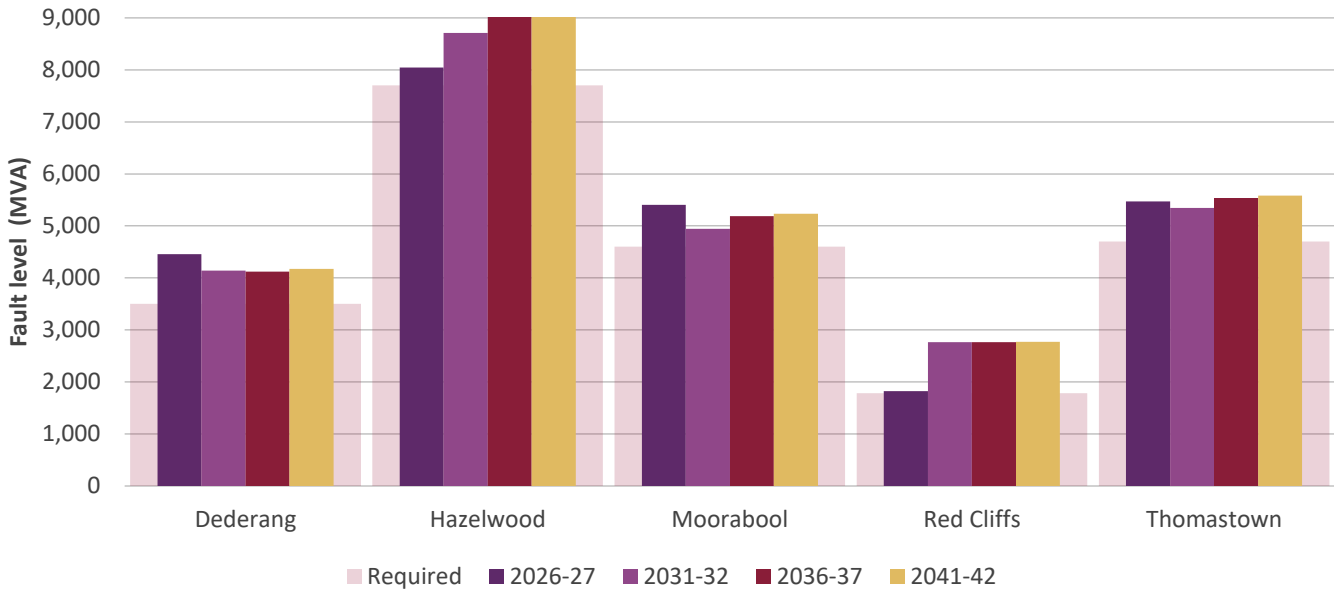
Node	Current requirement met				Trend
	2026-27	2031-32	2036-37	2041-42	
Dederang 220 kV	0 MVA	0 MVA	0 MVA	0 MVA	No significant changes
Hazelwood 500 kV	0 MVA	0 MVA	0 MVA	0 MVA	
Moorabool 220 kV	0 MVA	0 MVA	0 MVA	0 MVA	
Thomastown 220 kV	0 MVA	0 MVA	0 MVA	0 MVA	
Red Cliffs 220 kV	0 MVA	0 MVA	0 MVA	0 MVA	

The above table presents the indicative system strength deficits that result from the assessment of expected three phase fault levels at each Victoria system strength node against the current minimum fault current requirements.



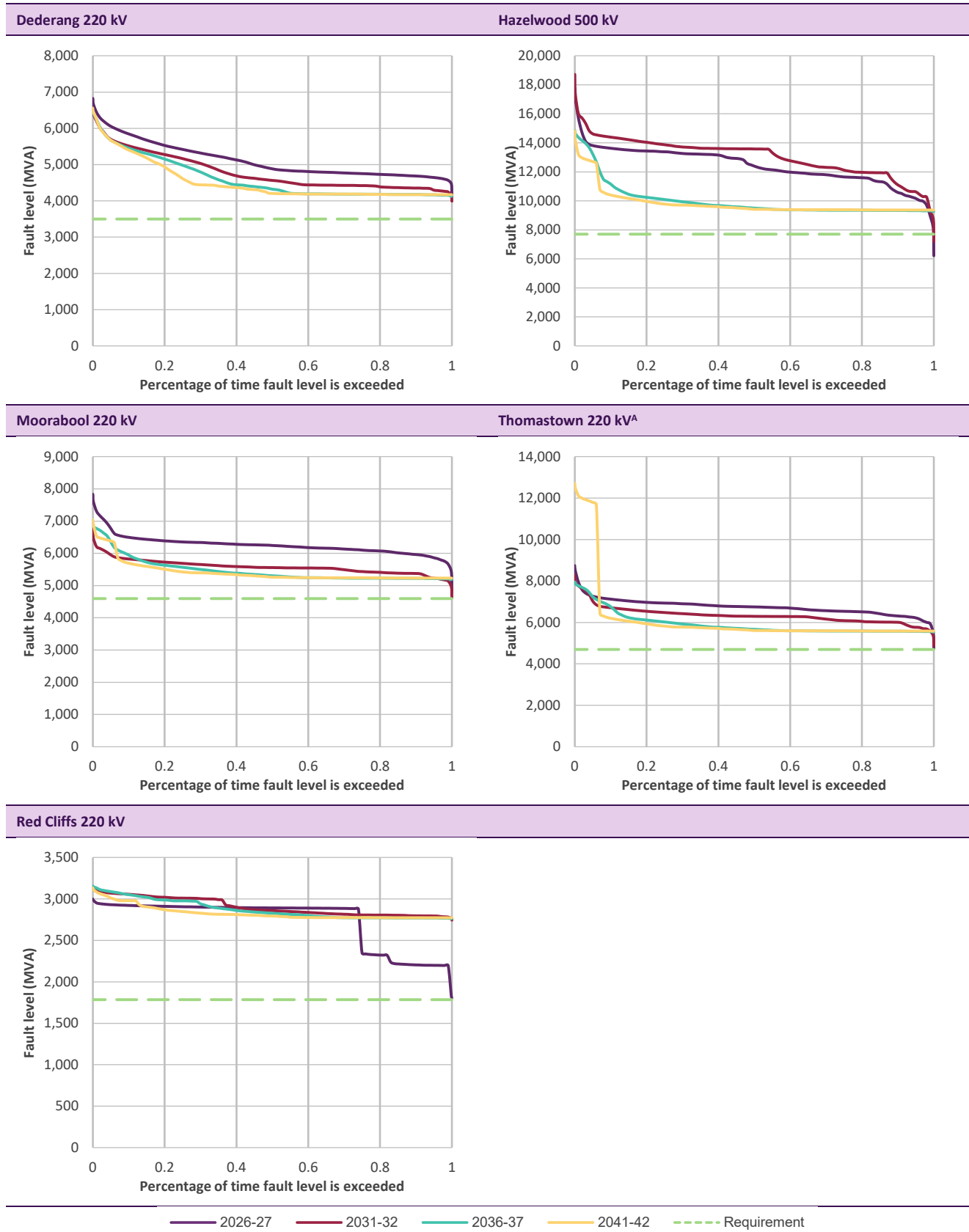
**Projected versus required level of fault current available at least 99.87% of the time**

The figure below shows the amount of synchronous fault level projected to be available 99.87% of the time at each Victoria system strength node against the current minimum requirements.



**Figure 16** presents the fault level duration curves for Victoria and shows synchronous fault level projected to be available at each system strength node.

Figure 16 Percentage of time fault level is exceeded at each system strength node in Victoria



A. The stepped shape of the duration curve for 2041-42 is due to projected flexible gas and its contribution to fault level at Thomastown when dispatched.

System strength outlook – new IBR investment

Figure 17 presents the projected quantity and technology of IBR investment in Victoria in the proposed ODP under Step Change scenario, and the underlying data is presented in Table 9.

Figure 17 IBR projections for Victoria in 2026-27, 2031-32, 2036-37, and 2041-42 (MW), Step Change scenario

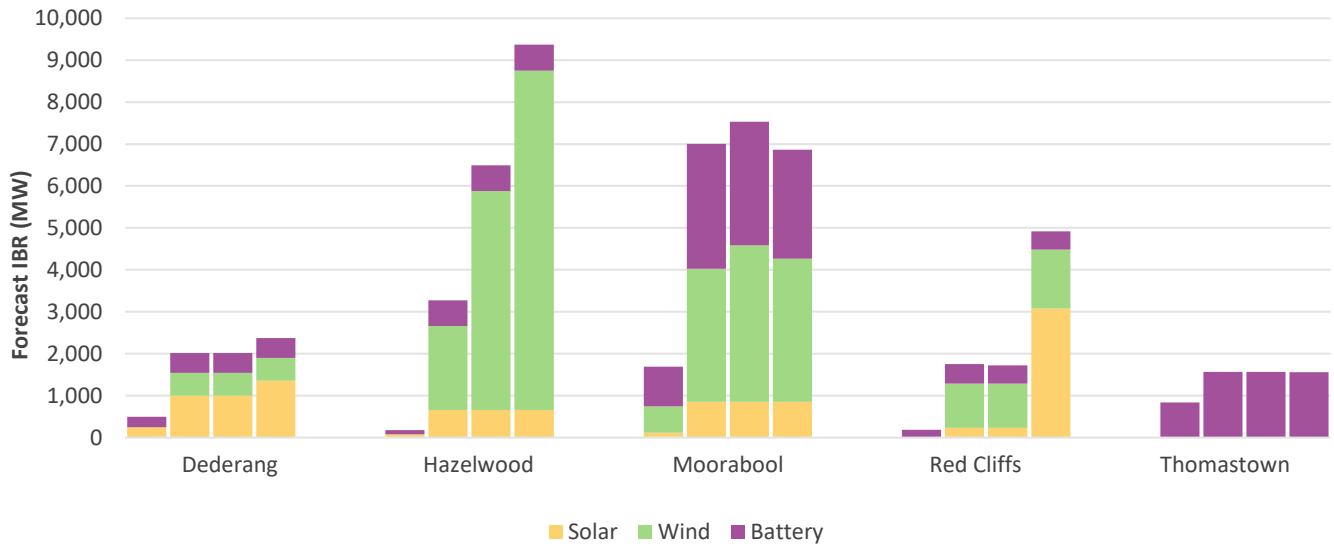


Table 9 IBR projections for Victoria (MW)

Node	Technology	Existing	2026-27	2031-32	2036-37	2041-42
Dederang	Solar	747	250	999	999	1,355
	Wind	0	0	544	544	544
	Battery	0	250	474	474	474
Hazelwood	Solar	0	77	658	658	658
	Wind	127	0	2,000	5,220	8,094
	Battery	200	100	614	614	614
Moorabool	Solar	0	119	857	857	857
	Wind	5,255	629	3,167	3,725	3,409
	Battery	414	947	2,981	2,951	2,601
Red Cliffs	Solar	750	0	233	233	3,081
	Wind	15	0	1,057	1,057	1,406
	Battery	30	185	460	430	430
Thomastown	Solar	0	0	0	0	0
	Wind	69	0	0	0	0
	Battery	267	840	1,565	1,565	1,558

Inertia outlook

**Key inertia results**

Available inertia in Victoria is expected to fall below the sub-network allocation for the studied periods with the synchronous condensers from AEMO Victorian Planning’s system strength RIT-T included.

VicGrid is required to ensure that the full inertia sub-network allocation is met from 2 December 2027.

**Figure 18** presents the projected levels of inertia expected to be available in Victoria, and **Table 10** presents the inertia deficits that result from the assessment of inertia against inertia sub-network allocation for Victoria. The indicative inertia deficits shown can be remediated through a suite of technologies with potential solutions including synchronous plant or storage projected in the ODP that elect to use grid-forming technology. The cost of security remediation to address these deficits is considered in the cost-benefit analysis, with the estimated costs under the ODP presented in Section A7.4.1.

**Figure 18** Projected levels of inertia available in Victoria, Step Change scenario (MWs)



**Table 10** Inertia outlook for Victoria

	2026-27	2031-32	2036-37	2041-42
<b>Inertia sub-network allocation (MWs)</b>	11,800	11,800	11,800	11,800
<b>Inertia available 99.87% of the time (MWs)</b>	9,657	9,016	11,048	11,048
<b>Calculated inertia deficit (MWs)</b>	2,143	2,784	752	752

## Glossary

This glossary has been prepared as a quick guide to help readers understand some of the terms used in the ISP. Words and phrases defined in the National Electricity Rules (NER) have the meaning given to them in the NER. This glossary is not a substitute for consulting the NER, the Australian Energy Regulator's (AER's) Cost Benefit Analysis Guidelines, or AEMO's *ISP Methodology*.

Term	Acronym	Explanation
<b>Actionable ISP project</b>	-	<p>Actionable ISP projects optimise benefits for consumers if progressed before the next ISP. A transmission project (or non-network option) identified as part of the ODP and having a delivery date within an actionable window.</p> <p>For newly actionable ISP projects, the actionable window is two years, meaning it is within the window if the project is needed within two years of its earliest in-service date. The window is longer for projects that have previously been actionable.</p> <p>Project proponents are required to begin newly actionable ISP projects with the release of a final ISP, including commencing a RIT-T.</p>
<b>Actionable project progressing under a jurisdictional framework</b>	-	A transmission project (or non-network option), other than an actionable ISP project, which optimises benefits for consumers if progressed before the next ISP, is identified as part of the ODP, and which will progress under a jurisdictional policy that AEMO considers under NER 5.22.3 (b) and includes in the ISP.
<b>Anticipated project</b>	-	A generation, storage or transmission project that is in the process of meeting at least three of the five commitment criteria (planning, construction, land, contracts, finance), in accordance with the AER's Cost Benefit Analysis Guidelines. Anticipated projects are included in all ISP scenarios.
<b>Candidate development path</b>	CDP	<p>A collection of development paths which share a set of potential actionable projects. Within the collection, potential future ISP projects are allowed to vary across scenarios between the development paths.</p> <p>Candidate development paths have been shortlisted for selection as the ODP and are evaluated in detail to determine the ODP, in accordance with the ISP Methodology.</p>
<b>Capacity</b>	-	The maximum rating of a generating or storage unit (or set of generating units), or transmission line, typically expressed in megawatts (MW). For example, a solar farm may have a nominal capacity of 400 MW.
<b>Committed project</b>	-	A generation, storage or transmission project that has fully met all five commitment criteria (planning, construction, land, contracts, finance), in accordance with the AER's Cost Benefit Analysis Guidelines. Committed projects are included in all ISP scenarios.
<b>Consumer energy resources</b>	CER	Generation or storage assets owned by consumers and installed behind-the-meter. These can include rooftop solar, batteries and electric vehicles (EVs). CER may include demand flexibility.
<b>Consumption</b>	-	The electrical energy used over a period of time (for example a day or year). This quantity is typically expressed in megawatt hours (MWh) or its multiples. Various definitions for consumption apply, depending on where it is measured. For example, underlying consumption means consumption being supplied by both CER and the electricity grid.
<b>Cost-benefit analysis</b>	CBA	A comparison of the quantified costs and benefits of a particular project (or suite of projects) in monetary terms. For the ISP, a cost-benefit analysis is conducted in accordance with the AER's Cost Benefit Analysis Guidelines.
<b>Counterfactual development path</b>	-	The counterfactual development path represents a future without major transmission augmentation. AEMO compares candidate development paths against the counterfactual to calculate the economic benefits of transmission.
<b>Demand</b>	-	The amount of electrical power consumed at a point in time. This quantity is typically expressed in megawatts (MW) or its multiples. Various definitions for demand, depending on where it is measured. For example, underlying demand means demand supplied by both CER and the electricity grid.
<b>Demand-side participation</b>	DSP	The capability of consumers to reduce their demand during periods of high wholesale electricity prices or when reliability issues emerge. This can occur through voluntarily reducing demand, or generating electricity.

Term	Acronym	Explanation
<b>Development path</b>	DP	A set of projects (actionable projects, future projects and ISP development opportunities) in an ISP that together address power system needs.
<b>Dispatchable capacity</b>	-	The total amount of generation that can be turned on or off, without being dependent on the weather. Dispatchable capacity is required to provide firming during periods of low variable renewable energy output in the NEM.
<b>Distribution network service provider</b>	DNSP	A business which owns, controls or operates a distribution system (including a distribution network).
<b>Economic offloading</b>	-	Refers to a generator being dispatched below its maximum availability, because some or all of its output was bid into price bands greater than the regional reference price. This may also be referred to as economic 'spill' or 'spilled energy' as generators reduce output due to low market prices or lack of available demand.
<b>Firming</b>	-	Grid-connected assets that can provide dispatchable capacity when variable renewable energy generation is limited by weather, for example storage (pumped-hydro and batteries) and gas-powered generation.
<b>Future distribution project</b>	-	A distribution project that is part of the ODP and forecast to be needed in the future. The project is an ISP development opportunity and does not address an identified need specified in the ISP. The ISP cannot make a distribution project 'actionable' or require commencement of the Regulatory Investment Test for Distribution (RIT-D).
<b>Future ISP project</b>	-	A transmission project (or non-network option) that addresses an identified need in the ISP, that is part of the ODP, and is forecast to be actionable in the future.
<b>Identified need</b>	-	The objective a TNSP seeks to achieve by investing in the network in accordance with the NER or an ISP. In the context of the ISP, the identified need is the reason an investment in the network is required, and may be met by either a network or a non-network option.
<b>ISP development opportunity</b>	-	A development identified in the ISP that does not relate to a transmission project (or non-network option) and may include generation, storage, demand-side participation, or other developments such as distribution network projects.
<b>National Electricity Rules</b>	NER	The Rules are legally binding rules made under the National Electricity Law, which govern the operation of the National Electricity Market and the ways in which AEMO manages power system security. The Rules also provide the regulatory framework for network connections and access, national transmission planning and pricing for network services. The Rules are mainly made by the AEMC having regard to the National Electricity Objective.
<b>Net market benefits</b>	-	The present value of total market benefits associated with a project (or a group of projects), less its total cost, calculated in accordance with the AER's Cost Benefit Analysis Guidelines.
<b>Non-network option</b>	-	A means by which an identified need can be fully or partly addressed, that is not a network option. A network option means a solution such as transmission lines or substations which are undertaken by a Network Service Provider using regulated expenditure.
<b>Optimal development path</b>	ODP	The development path identified in the ISP as optimal and robust to future states of the world. The ODP contains actionable projects, future ISP projects and ISP development opportunities, and optimises costs and benefits of various options across a range of future ISP scenarios.
<b>Regulatory Investment Test for Transmission</b>	RIT-T	The RIT-T is a cost benefit analysis test that TNSPs must apply to prescribed regulated investments in their network. The purpose of the RIT-T is to identify the credible network or non-network options to address the identified network need that maximise net market benefits to the NEM. RIT-Ts are required for some but not all transmission investments.
<b>Reliable (power system)</b>	-	The ability of the power system to supply adequate power to satisfy consumer demand, allowing for credible generation and transmission network contingencies.
<b>Renewable energy</b>	-	For the purposes of the ISP, the following technologies are referred to under the grouping of renewable energy: "solar, wind, biomass, hydro, and hydrogen turbines". Variable renewable energy is a subset of this group, explained below.
<b>Renewable energy zone</b>	REZ	An area identified in the ISP as high-quality resource areas where clusters of large-scale renewable energy projects can be developed using economies of scale.
<b>Renewable drought</b>	-	A prolonged period of very low levels of variable renewable output, typically associated with dark and still conditions that limit production from both solar and wind generators.

Term	Acronym	Explanation
<b>Rooftop and other small-scale solar</b>	-	Solar photovoltaic (PV) generation assets that are not centrally controlled by AEMO dispatch. Examples include residential and business rooftop PV as well as larger commercial or industrial “non-scheduled” PV systems.
<b>Scenario</b>	-	A possible future of how the NEM may develop to meet a set of conditions that influence consumer demand, economic activity, decarbonisation, and other parameters. For the Draft 2026 ISP, AEMO has considered three scenarios: <i>Slower Growth</i> , <i>Step Change</i> and <i>Accelerated Transition</i> .
<b>Secure (power system)</b>	-	The system is secure if it is operating within defined technical limits and is able to be returned to within those limits after a major power system element is disconnected (such as a generator or a major transmission network element).
<b>Sensitivity analysis</b>	-	Analysis undertaken to determine how modelling outcomes change if an input assumption (or a collection of related input assumptions) is changed.
<b>Spilled energy</b>	-	Energy from variable renewable energy resources that could be generated but is unable to be delivered. Transmission curtailment results in spilled energy when generation is constrained due to operational limits, and economic spill occurs when generation reduces output due to market price. This can also be referred to as ‘economic offloading’.
<b>Transmission network service provider</b>	TNSP	A business that owns, controls or operates a transmission network.
<b>Utility-scale or utility</b>		For the purposes of the ISP, ‘utility-scale’ and ‘utility’ refers to technologies connected to the high-voltage power system rather than behind the meter at a business or residence.
<b>Value of greenhouse gas emissions reduction</b>	VER	The VER estimates the value (dollar per tonne) of avoided greenhouse gas emissions. The VER is calculated consistent with the method agreed to by Australia’s Energy Ministers in February 2024.
<b>Virtual power plant</b>	VPP	An aggregation of resources coordinated to deliver services for power system operations and electricity markets. For the ISP, VPPs enable coordinated control of consumer-scale batteries.
<b>Variable renewable energy</b>	VRE	Renewable resources whose generation output can vary greatly in short time periods due to changing weather conditions, such as solar and wind.