Meeting the System Strength Standard in Tasmania from December 2025 onward.

Project Assessment Draft Report

8 November 2024

Official

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TasNetworks acknowledges the palawa (Tasmanian Aboriginal community) as the original owners and custodians of lutruwita (Tasmania). TasNetworks, acknowledges the palawa have maintained their spiritual and cultural connection to the land and water. We pay respect to Elders past and present and all Aboriginal and Torres Strait Islander peoples.

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Glossary

AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
AFL	Available Fault Level (methodology)
BESS	Battery Energy Storage System
EMT	Electro-Magnetic Transients
EOI	Expression of Interest
FID	Final Investment Decision
GWh	Gigawatt Hours
HVDC	High Voltage Direct Current
IASR	Inputs, Assumptions and Scenarios Report
IBR	Inverter Based Resources
ISF	Improving Security Frameworks for the Energy Transition
ISP	Integrated System Plan
MVA	Megavolt-Ampere
NEM	National Electricity Market
NER	National Electricity Rules (Version 216 referenced throughout this document)
PADR	Project Assessment Draft Report
PSCR	Project Specification Consultation Report
RIT-T	Regulatory Investment Test for Transmission
SSN	System Strength Node
SSSP	System Strength Service Provider
TRET	Tasmanian Renewable Energy Target
TNSP	Transmission Network Service Provider
WAM	Wide Area Model (WAM)

Executive Summary

TasNetworks is the Transmission Network Service Provider (**TNSP**), System Strength Service Provider (**SSSP**) and Inertia Service Provider for Tasmania. The Project Assessment Draft Report (**PADR**) is the second stage of the Regulatory Investment Test for Transmission (**RIT-T**) that is being applied by TasNetworks to meet our system strength obligations under the National Electricity Rules (**NER**).

This document establishes the preferred option to meet TasNetworks' obligations and follows from the Project Specification Consultation Report (**PSCR**) that was published in August 2023.

System Strength in Tasmania

Although the smallest state, Tasmania has the potential to play a significant role in decarbonisation of the National Electricity Market (**NEM**), directly through the installation of significant renewable energy resources, and indirectly by providing access to flexible firming capacity and deep storage via existing (and new) hydro generation assets.

Underpinning Tasmania's energy future is the Tasmanian Renewable Energy Target (**TRET**), state government legislation which requires an increase in renewable generation from an existing baseline of 10,500 gigawatt hours (GWh) to 21,000 GWh by 2040. This will require the installation of at least 2,500 MW of new wind generation, which will increase the total installed wind capacity in Tasmania to over 3,000 MW.

Although this new generation will play a key role in decarbonising the NEM, it currently interacts with and supports the power system in a fundamentally different way to that of more traditional forms of generation such as thermal (e.g. coal and gas) or hydroelectric generation. Specifically, these traditional forms of generation, known as synchronous generation, inherently provide system strength as a by-product of their operation. The newer forms of generation (e.g. wind, solar photovoltaics), known as Inverter Based Resources (**IBR**), do not currently have this capability and generally reduce the strength of the power system.

Importantly, many forms of IBR presently being connected to electricity networks rely on other grid forming technologies to remain stable, operate in a predictable manner and provide the levels of short circuit current required to satisfy protection requirements. As the installed capacity of IBR continues to grow to meet TRET, there will be increasing periods where little, if any, synchronous generation will be required to remain online to satisfy electricity demand. In the context of the Tasmanian power system, any power imported across high voltage direct current (**HVDC**) interconnectors also reduces the need for synchronous generation, exacerbating the issues further.

Identified need: Meeting system strength requirements

In response to the increasing penetration of IBR and importance of maintaining system strength, the Australian Energy Market Commission (**AEMC**) introduced changes to the NER, which requires TasNetworks to proactively plan for and pre-emptively provide sufficient system strength services right across our network. Consistent with this new rule and PSCR published in August 2023, the identified need for this RIT-T is:

*to provide, from 2 December 2025, sufficient system strength at each System Strength Node (**SSN**) to satisfy minimum fault level requirements, as well as provide an efficient level of system strength, so as to maintain power system security while facilitating forecast developments of IBR in Tasmania.*

As underlined above, the new rule requires TasNetworks to not only meet the requirements of the existing power system (the minimum fault level requirements), but also what is required to support the forecast connection of future IBR (the efficient level of system strength). AEMO publishes a 10-year forecast of the minimum fault level and forecast IBR connections at each SSN in their annual System Strength Report.

Under the NER, TasNetworks must use reasonable endeavours to satisfy the expected system requirements three years in advance of the latest System Strength Report published by AEMO. TasNetworks must currently plan to meet the forecast requirements for 2 December 2025 and 2026, with the obligation extending to 2 December 2027 when the forecasts are updated again in December 2024. Given AEMO publishes a 10-year forecast, TasNetworks can plan for longer term solutions where it is efficient and prudent. In this RIT-T, TasNetworks has opted to identify solutions capable of meeting our system strength obligations to 2029. TasNetworks will consider solutions to meeting system strength post-2029 in a future RIT-T when there is less uncertainty regarding the volume of new connecting IBR.

System strength requirements for the forward planning period

There are currently four SSNs defined across the Tasmanian power system. The existing minimum fault level defined for each node to maintain secure operation is presented in Table 1. Unless otherwise noted and explained as part of this PADR, the minimum three phase fault levels are expected to remain fixed over the forward planning period.

Table 1 Minimum fault levels

System Strength Node	Minimum three phase fault current [MVA]
Burnie	850
George Town	1,450
Risdon	1,330
Waddamana	1400

The IBR forecast for Tasmania, as presented in the 2023 System Strength Report and updated by TasNetworks as appropriate, are provided below in Table 2. For clarity, the forecast only considers future wind and solar developments.

Table 2 Project IBR developments for Tasmania

System strength node	Tech.	Existing IBR [MW]	Forecast IBR [MW]										
			2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Burnie	Wind	250	0	0	0	5	5	181	703	703	703	703	703
George Town	Solar	0	0	288	288	288	288	288	288	288	288	288	288
	Wind	168	0	0	0	41	41	41	41	41	53	53	53
Risdon	Wind	0	0	0	0	0	0	0	0	0	0	0	0
Waddamana	Wind	144	0	0	0	603	603	612	1362	1362	1370	1370	1370

TasNetworks has converted the forecast IBR developments described in Table 2 into an equivalent three phase fault level which represents the 'efficient level of system strength' required at each SSN. This is provided in Table 3.

Table 3 Efficient level of system strength

System strength node	Efficient level of system strength [MVA]					
	2024	2025	2026	2027	2028	2029
Burnie 110 kV	850	850	850	1,050	1,050	1,050
George Town 220 kV	1,450	1600	1600	2,000	2,000	2,000
Risdon 110 kV	1,330	1,330	1,330	1,450	1,450	1,450
Waddamana 220 kV	1,400	1,400	1,400	2,000	2,000	2,050

Developments since publication of the PSCR

Since the publication of the PSCR in August 2023, AEMO have released both the 2023 System Strength Report and the 2024 Integrated System Plan (**ISP**). Both these publications reduced the forecast level of IBR in Tasmania, which influences TasNetworks calculation of the efficient level of system strength (the minimum fault level has remained the same). TasNetworks has taken a practical approach to determining which information best reflects our system strength obligations.

Since the publication of the PSCR, the AEMC has also made a final determination on the Improving Security Frameworks for the Energy Transition (**ISF**) rule change. Importantly, this means the Australian Energy Regulator (**AER**) will make a determination in advance on whether expenditure under our proposed system strength contracts promote economic efficiency. As a result, we will assess these contract costs as part of the PADR to identify whether we believe they would successfully pass the AER's assessment.

Identification of the preferred option

TasNetworks considered the credibility of four main options to meet the identified need:

1. A network solution – installation of synchronous condensers.
2. A non-network solution involving contracting with an existing owner of synchronous condenser and generation assets.
3. A non-network solution involving the installation of new battery energy storage system (**BESS**)
4. A hybrid solution of 2 and 3.

Consistent with the NER, in assessing the credibility of the above options, TasNetworks considered their technical and economic feasibility and whether they could be implemented in time to address the identified need.

Option 1 was deemed non-credible as TasNetworks considered it unlikely that we could procure, install and commission synchronous condensers in time to meet our system strength obligations at a lower cost to a non-network solution.

Option 3 was deemed non-credible as TasNetworks did not consider it technically feasible that a BESS-only solution would be capable of addressing all of TasNetworks' system strength requirements within the required timeframes. This is consistent with the responses TasNetworks received to the expression of interest (**EOI**) published alongside the PSCR.

Option 4 was deemed non-credible as TasNetworks did not consider a hybrid solution including a BESS was commercially feasible compared to an option that only relied on existing third-party assets.

Specifically, TasNetworks does not consider a BESS would provide sufficient incremental market benefits above existing assets that would outweigh the higher economic costs.

As a result, Option 2 was the only option that was deemed credible. Specifically, contracting with existing assets is the only option that is both technically and commercially feasible and capable of being implemented in time to meet the identified need at the lowest cost to Tasmanian customers.

TasNetworks acknowledges that this outcome is largely a consequence of TasNetworks choosing to only consider the system strength requirements out to 2029. Although we consider this the appropriate approach, we acknowledge it is highly likely that, should AEMO's long term (i.e. post 2029) IBR forecast materialise, we will not be capable of meeting the system strength requirements with only existing third-party assets. We expect to commence a RIT-T for the post 2029 period when IBR forecasts become more certain, taking into account the long regulatory approval and procurement / construction timeframes for potential system strength solutions. This approach prevents inefficient build or contracting of system strength for significant but uncertain forecasts. We consider a final investment decision to proceed with Project Marinus will provide a strong likelihood that the forecast IBR will eventuate.

Given TasNetworks has concluded that there is no credible network solution, a RIT-T is not strictly required under the NER as the investment does not meet the capital expenditure threshold of $7 million. TasNetworks has chosen to continue with the RIT-T process to provide transparency to stakeholders regarding the methodology applied to determine the preferred option.

Next Steps

TasNetworks now welcomes submissions from interested parties on the analysis and information contained in this PADR. Submissions will be open for 8 weeks from 8 November 2024 and ending on Friday 10 January 2025. Submissions should be addressed to Chris Noye, Leader Regulation and emailed to regulation@tasnetworks.com.au

Following completion of the consultation period, we will update the RIT-T analysis with any new information including that received from submissions.

We will then publish a Project Assessment Conclusions Report to close out the RIT-T process.

Introduction

TasNetworks owns, operates and maintains the transmission and distribution electricity networks in Tasmania. As the TNSP and Jurisdictional Planner for the Tasmanian region of the NEM, we are also the SSSP and Inertia Service Provider as defined by the NER.

System strength is a broad term encapsulating a number of specific technical issues. In context of the NER requirements, system strength addresses minimum three phase fault levels which are necessary to ensure power system security, including maintaining the stability of voltage waveforms. The latter issue can be significantly impacted by the connection of grid-following IBR technologies, being the typical solution implemented by wind and solar generators in today's market. It is especially challenging whenever the need to run traditional synchronous generators is diminished, i.e. when the output of IBR meets a significant portion of the total energy demand.

While Tasmania's generation outlook is vastly different to the rest of Australia, with little to no reliance on thermal generation given our significant hydro assets, management of system strength and inertia remains critically important as new on-island renewable energy developments occur. The TRET legislation indicates that a minimum of 2,500 MW of new wind generation be constructed, with Tasmania's wind resources capable of supporting considerably more. Such capacity will at times be well in excess of Tasmania's needs, creating a situation where hydro units will not be required to generate. Ensuring that power system security and reliability are not compromised during such operating conditions, that are currently considered extreme, is of paramount importance to TasNetworks.

TasNetworks is obligated to consider the investment needed to meet our system strength obligations at the lowest cost to consumers, established through the "efficient management of system strength on the power system" rule change.

To ensure that any required investment results in a least cost outcome for Tasmanian consumers, the NER requires that TasNetworks undertake a RIT-T whenever a credible option has an estimated capital cost above $7 million. The RIT-T ensures that stakeholders have visibility of the process, understand the need for expenditure, and are able to actively participate in helping identify potential solutions. This PADR is the second step in that process.

TasNetworks published the first step in the RIT-T process, the PSCR, in August 2023. In the PSCR, TasNetworks provided significant context for managing system strength in Tasmania and identified some broad potential credible options. TasNetworks encourages stakeholders to visit our system strength project page[1], which includes a copy of the PSCR and a Fact Sheet for more information on our system strength obligations.

As part of the PSCR, TasNetworks invited proponents of system strength services to respond to an EOI outlining how they could contribute to meeting the identified need. TasNetworks received three responses to this EOI.

The purpose of this PADR is to:

- Reintroduce and expand on the why action needs to be taken (the 'identified need').

[1] TasNetworks, Meeting System Strength Requirements, https://www.tasnetworks.com.au/Poles-and-wires/Planning-and-developments/Our-current-projects/Meeting-System-Strength-Requirements.

- With reference to the submissions received to the EOI, describe the credible options capable of addressing the identified need.
- Present the reasoning for choosing the preferred option.

Identified need

Consistent with the PSCR, the identified need is to provide, from 2 December 2025, sufficient system strength at each system strength node (**SSN**) to satisfy minimum fault level requirements, as well as provide an efficient level of system strength, so as to maintain power system security while facilitating forecast developments of IBR in Tasmania. In doing so, TasNetworks will satisfy its obligations under NER S5.1.14(b).

The role of system strength in the power system

A key attribute of a secure and resilient power system is the provision of sufficient system strength. System strength is a broad term encapsulating several technical components, including ensuring that:

a) Adequate short circuit current is available to facilitate the correct operation of network protection systems.
b) Stable voltage control can be maintained across the network, both before and after network contingency events.
c) The voltage at the connection point of grid-following IBR is sufficient to allow for their continuous, uninterrupted operation – even when subjected to network faults and other credible disturbances.

Many forms of IBR presently being connected to electricity networks rely on other grid-forming technologies to remain stable, operate in a predictable manner and provide the levels of short circuit current required to satisfy protection requirements. Historically, synchronous machines (e.g. hydroelectric and coal-fired power plants) have typically supplied the requisite system strength in the power system – essentially as a biproduct of energy dispatch. Such machines are inherently capable of addressing the core elements outlined above, as well as providing inertia. However, as the installed capacity of IBR continues to grow, there will be increasing periods where little (if any) synchronous generation will be required to remain online to satisfy electricity demand. In the context of the Tasmanian power system, any power imported across HVDC interconnectors also reduces the need for synchronous generation, exacerbating the issues further.

In the future, with a power system potentially dominated by IBR, alternative mechanisms will be required to support system strength whenever the dispatch of synchronous generation (via the energy market) is insufficient to maintain network security. The Tasmanian power system has historically operated with up to 92% of its instantaneous demand being supplied by IBR energy sources, mostly comprised of Tasmanian wind farm output and HVDC import across Basslink. With forecast wind developments to meet the TRET, the ability to achieve 100% will become increasingly likely, further impacting system strength requirements and reinforcing the need to having appropriate mitigation measures in place.

System Strength in Tasmania

Tasmania has the potential to play a significant role in contributing to the decarbonisation of the NEM, through the connection of significant renewable energy resources and through access to flexible firming capacity and deep storage via existing and new hydro generation assets. Additional transmission interconnector capacity in the form of Marinus Link will enable Tasmania to contribute more significantly to the future needs of the NEM, as well as encourage local generation and customer developments.

Tasmania's energy future is described by state government legislation which targets an increase in renewable generation from an existing baseline of 10,500 GWh to 21,000 GWh by 2040. The TRET translates to the installation of at least 2,500 MW of new wind generation, which will increase the total installed wind capacity in Tasmania to over 3,000 MW. The ISP published by AEMO forecasts that most of this generation will be installed within the next ten years, aligned with the expected completion of both stages of Marinus Link (2 x 750 MW).

A near five-fold increase in IBR generation capacity will not only allow Tasmania's electricity demands to be fully satisfied at times, but will also be sufficient to support significant levels of export to the mainland via Basslink and Marinus Link. The role of synchronous hydro generation in such a future will be very different, with the provision of flexible, dispatchable firming capacity expected to become more critical (and valuable) than in today's market.

An important follow-on observation which differentiates Tasmania from virtually all other states is that while the role of the states hydroelectric synchronous generators will evolve, there is no expectation of mass withdrawal of capacity from the network. Being a hydro dominated power system, we are not exposed to the same issues being driven by large scale coal and gas retirements now needing to be planned for across the mainland states. The future need to procure, install and actively manage system security services like system strength and inertia will be a product of the concentrated IBR capacity proposed to be built in Tasmania as a means of contributing to broader NEM goals, including a transition away from fossil fuelled generation.

System strength planning obligations

There are two key components that define TasNetworks' new planning obligations (established in schedule 5.1.14 of the NER).

For each year, at each SSN (for which there are currently four in Tasmania), we must use reasonable endeavours to plan, design, maintain and operate the transmission network (or make system strength services available to AEMO) to:

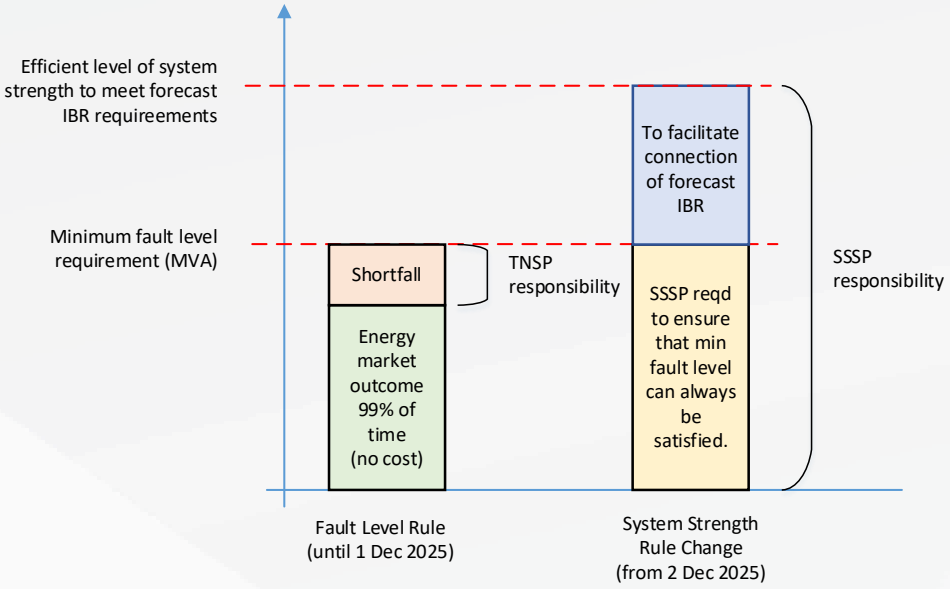
a) Maintain the minimum three phase fault level specified by AEMO, and
b) Achieve stable voltage waveforms for the level and type of inverter-based resources and market network service facilities projected by AEMO.

These requirements are to be satisfied in steady state conditions and following any credible contingency events or protected events.

AEMO's inputs, as per the publication of the system strength report in December each year, define the binding planning requirements for three years after publication (i.e. the 2024 publication defines the 2027 requirement). AEMO also undertakes a 10-year forecast that guides the longer-term planning inputs.

This differs to the existing way system strength is planned for. Currently, we plan to meet any forecast shortfall of system strength services. Moving forward, we will instead need to procure the "full amount" of system strength – encompassing both "minimum fault level" and "IBR forecast" components to arrive at an "efficient level", as presented below:

Figure 1: Comparison of system strength rule frameworks



The system strength planning obligation is a reliability corrective action because it is for the purposes of meeting a service standard as part of the technical requirements of schedule 5.1 of the NER. From a RIT-T perspective, in accordance with clause 5.15A.1(c) of the NER, this means the investment can have a net economic cost to the market.

Timing and duration of identified need

In accordance with NER S5.1.4(a), TasNetworks 'must use reasonable endeavours to plan, design, maintain and operate its transmission network, or make system strength services available to AEMO' to satisfy the expected system requirements at a point in time three years in advance of the latest AEMO forecasts. i.e. TasNetworks must currently plan to meet the forecast requirements for 2 December 2025 and 2026, with the obligation extending to 2 December 2027 when the forecasts are updated again in December 2024.

As described in the next section, there is a significant step change in IBR forecast in 2030. TasNetworks understands that the timing and size of this step change corresponds with the commissioning and energising of the first stage of Project Marinus.

TasNetworks does not consider it prudent to procure system strength services prior to final investment decision (FID) on Project Marinus. TasNetworks considers that implementing a solution now to support IBR that is contingent on Project Marinus would expose Tasmanian customers to an unacceptable level of risk. Project Marinus is currently progressing through regulatory approvals and a final investment decision is currently expected in May 2025.

Our intended approach to managing uncertainty in the need for additional system strength is as follows:

- Acknowledge that the minimum three phase fault level requirements as currently stipulated are highly likely to be enduring. The risk of procuring services over extended timeframes carries a very low risk to consumers who are only exposed to system strength implementation costs if they are unable to be recovered through charges levied against IBR connections who choose not to self-remediate.[2]

[2] Clause 6A.23.3

- Manage the risk of unnecessary over-procurement of system strength support in future years (beyond 2029) by allowing technology to improve, new technologies to develop, and the industries general understanding of system strength related issues to mature, before committing to solutions.

For the above reasons, TasNetworks is only considering our system strength requirements for the period from 2 December 2025 (i.e. the commencement date of our obligation) to 30 June 2029.

TasNetworks will commence another RIT-T to address our system strength requirements post 2029 when IBR forecasts become more certain, noting the long regulatory approval and procurement / construction timeframes for potential system strength solutions.

We are of the view that this provides the right balance between encouraging the development of scale efficient solutions (which could include period contracts), and exposing network users to unnecessary, imprudent and inefficient costs.

We believe that this approach remains consistent with the requirements of the NER, while managing our obligations to promote efficient investment in the long term interest of customers.

Minimum three phase fault levels

The intent of the minimum fault level requirement is described in Clause S5.1a.9 of the NER.

In addition to the technical issues described in the rules, the minimum fault levels defined in Tasmania have also considered the system strength requirements for existing IBR connections, i.e. network users who have established connections pre-dating the rule requirements and who are exempt from system strength charges under the new framework. For clarity, satisfaction of the minimum fault levels as currently defined will be adequate to achieve secure operation of the intact network with the IBR connections already present.

It follows that the minimum fault level requirements for each existing SSN are forecast to remain unchanged over the forward planning period. The minimum three phase fault currents across Tasmania's SSNs have remained unchanged over the various iterations of the annual System Strength Report. They are summarised in Table 4 (and apply consistently for each future year):

Table 4: Minimum three phase fault current at Tasmania's declared SSNs

System Strength Node	Minimum three phase fault current [MVA]
Burnie	850
George Town	1,450
Risdon	1,330
Waddamana	1,400

The incremental increases in system strength requirements needed to support future IBR connections are captured by the efficient level of system strength discussed below.

Efficient level of system strength

The efficient level of system strength required going forward will be a function of IBR capacity and its performance characteristics. The rule requirement in this regard is that TasNetworks must provide sufficient system strength to ensure stable voltage waveforms both in steady state and following any credible contingency event or protected event. The underlying intent is to support the operation of future IBR connections while maintaining power system security and reliability.

TasNetworks is not strictly bound to forecast the efficient level of system strength using only the latest inputs published by AEMO. TasNetworks can use different inputs where better information is available. The final inputs chosen by TasNetworks for the final analysis are described below.

AEMO IBR forecasts

TasNetworks published our PSCR in August 2023. At that time, the IBR forecasts published in the 2022 System Strength Report were used to describe the identified need for this RIT-T. These forecasts are shown in Table 5.

Table 5 Forecast IBR as per 2022 System Strength Report

	Forecast IBR (MW)								
System strength node	2025	2026	2027	2028	2029	2030	2031	2032	2033
Burnie	0	0	0	0	83	351	351	1301	1301
Georgetown	258	258	258	258	258	376	376	376	376
Waddamana	0	0	275	275	279	768	768	823	823

In December 2023, AEMO published their 2023 System Strength Report. As shown in Table 6, the key changes between the 2022 and 2023 reports was the reduction in forecast IBR at the George Town and Burnie nodes and reallocation to the Waddamana node.

Table 6 Forecast IBR as per 2023 System Strength Report

	Forecast IBR (MW)									
System strength node	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Burnie	0	0	5	5	181	703	703	703	703	703
Georgetown	0	0	41	41	41	41	41	53	53	53
Waddamana	0	0	603	603	612	1362	1362	1370	1370	1370

In June 2024, the ISP established different IBR projections than the 2023 System Strength Report as shown in Table 7. This includes a reallocation of IBR from the Burnie node to the George Town node.

Table 7 Forecast IBR as per 2024 Final ISP

	Forecast IBR (MW)									
System strength node	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Burnie	0	0	6	6	15	15	15	91	100	100
Georgetown	0	0	152	152	242	242	242	400	400	400
Waddamana	0	0	601	601	644	1301	1301	1381	1392	1392

AEMO's System Strength Report typically uses the most likely scenario in the ISP. That is, the "Step Change" scenario. However, the likelihood of the Step Change scenario is only 1% more likely than the next most likely, "Progressive Change" scenario (43% compared to 42%). This is important because the

forecast IBR (and therefore necessary amount of system strength services) under the Progressive Change scenario is materially less than that under the Step Change scenario. However, TasNetworks has incorporated the Step Change inputs because:

a) This approach was followed by AEMO in preparing the 2023 System Strength Report.
b) The results are not likely to be materially different for the purposes of the RIT-T to the period to 2029. That is, most of the differences in IBR forecasts are post 2029.

TasNetworks' IBR forecasts

In a practical sense, the development of IBR is unlikely to follow the exact trajectory as forecast by AEMO. TasNetworks has applied judgement in determining the appropriate use of AEMO's forecast in meeting our system strength obligation. Where known IBR based projects have a proposed capacity and connection date that generally aligns with the forecasts as presented in the AEMO System Strength Report, those project(s) have been applied for modelling purposes. Specifically, the IBR forecasts TasNetworks has adopted largely reflect the 2023 System Strength Report. The exception is that TasNetworks has maintained the 2025 forecast from the 2022 System Strength Report for solar, despite it being removed in more recent forecasts. TasNetworks considers this a reasonable approach given progress of specific connections towards committed project status. This is the origin of the IBR capacity differences highlighted in Table 8 (assumed versus AEMO).

Furthermore, where future network topology changes are already known and have been communicated to AEMO and the broader industry, we have included those network developments in our modelling activities at the year when in-service operation can be reasonably expected. Reinforcement of the transmission network can have a notable impact on system strength requirements depending on the location of IBR connection points relative to support mechanisms including synchronous machines. This is consistent with the requirements of Step 1 in the AEMO AFL methodology[3].

TasNetworks has also considered the potential for new IBR proponents to self-remediate their system strength impact rather than use the TasNetworks provided service. Where an IBR connections elects to self-remediate their impact, this could reduce the size of a network solution or amount of system strength services that TasNetworks needs to install or procure. Based on the most recent connection information, TasNetworks is not aware of any new IBR proponents that are captured in AEMO's forecasts and choosing to self-remediate.

Although the 2024 ISP has provided more recent IBR projections, TasNetworks does not consider the these will materially change the equivalent fault current requirements (efficient level of system strength) in the 2025 to 2029 period – nor identification of the preferred option. TasNetworks considers the IBR forecast presented in Table 8 to be sufficient for the purposes of the RIT-T.

[3] AEMO System Strength Impact Assessment Guidelines, Version 2.2, 1 July 2024, section 3.4.4

Table 8 Summary of Tasmania's IBR forecasts – following adjustments

System strength node	Tech.	Existing IBR [MW]	Forecast IBR [MW]									
			2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Burnie	Wind	250	0	0	0	5	5	181	703	703	703	703	703
George Town	Solar	0	0	288	288	288	288	288	288	288	288	288	288
	Wind	168	0	0	0	41	41	41	41	41	53	53	53
Risdon	Wind	0	0	0	0	0	0	0	0	0	0	0	0
Waddamana	Wind	144	0	0	0	603	603	612	1362	1362	1370	1370	1370

Note that there is a considerable step change in forecast IBR in TasNetworks' next regulatory control period (from 2030), particularly at the Waddamana system strength node.

Conversion of IBR forecasts to planning inputs

TasNetworks must convert the forecast IBR developments (described in terms of installed capacity, MW) into an equivalent efficient level of system strength (described in terms of three phase fault level, MVA). For forward planning studies, the technical characteristics of the plant to be connected and even the network connection arrangements, may not be known.

TasNetworks has undertaken extensive technical analysis to convert the forecast IBR into an equivalent fault current amount, such that the total, efficient level of system strength for each SSN can be established in each year to test credible options against. This is to meet the planning requirements established in schedule 5.1.14 of the NER.

TasNetworks, as the SSSP for Tasmania, must use reasonable endeavours to provide efficient/sufficient[4] system strength services to maintain the stability of the Tasmanian power system. In summary the services must:

- Achieve stable voltage waveforms in steady state conditions, and
- Not depend on disconnection of IBR to maintain post contingent stability.

TasNetworks' understanding is that an IBR must meet its generator performance standards at low system strength, at least with a minimum short circuit ratio (**SCR**) of 3.0, when tested in isolation in the "single machine infinite bus (**SMIB**)" environment. Having passed this minimum SCR requirement, it then becomes the responsibility of the SSSP to provide efficient system strength services, in real time, for stable operation in the actual power system. As the system strength service is provided on an aggregate basis, the SSSP must provide efficient system strength services for stable operation of multiple IBR connections when operating together. The NER give the SSSP flexibility in the methodology it uses to determine the efficient level of system strength services:[5]

- It may apply the available fault level (**AFL**) methodology using PSS/E loadflow and fault calculations, or

[4] Note: the NER define *sufficient* fault levels, whereas AEMO's system strength report requires *efficient* System Strength Services
[5] Clause S5.1.14(b)(2)

- It may undertake wide area model (**WAM**) studies in the electro-magnetic transients (**EMT**) environment.

The AFL methodology will deliver a secure solution but may be more costly for Tasmania where, unlike the mainland NEM, it is feasible to undertake accurate and timely EMT studies. In Tasmania, although applying the AFL will generally trigger an EMT full system study (WAM study), such studies can be undertaken in tolerable simulation timeframes. Fundamentally, the WAM study should deliver more accurate results leading to lower cost system strength requirements. Therefore, TasNetworks has determined our system strength requirements using the EMT WAM methodology.

Total planning need – the efficient level of system strength

Based on the analysis undertaken using the above mentioned WAM EMT methodology, we expect that there will be a requirement for increased system strength services at the George Town, Waddamana and Burnie SSN as shown in Table 9 and Figure 2. The most significant increase is expected to be at the Waddamana 220 kV node, with an increase of 600 MVA from the existing minimum fault level requirement of 1,400 MVA. A similar increase is expected at George Town.

Table 9 Fault level projections at SSNs until 2029 (MVA)

System strength node	Efficient level of system strength [MVA]					
	2024	2025	2026	2027	2028	2029
Burnie 110 kV	850	850	850	1,050	1,050	1,050
George Town 220 kV	1,450	1,600	1,600	2,000	2,000	2,000
Risdon 110 kV	1,330	1,330	1,330	1,450	1,450	1,450
Waddamana 220 kV	1,400	1,400	1,400	2,000	2,000	2,050

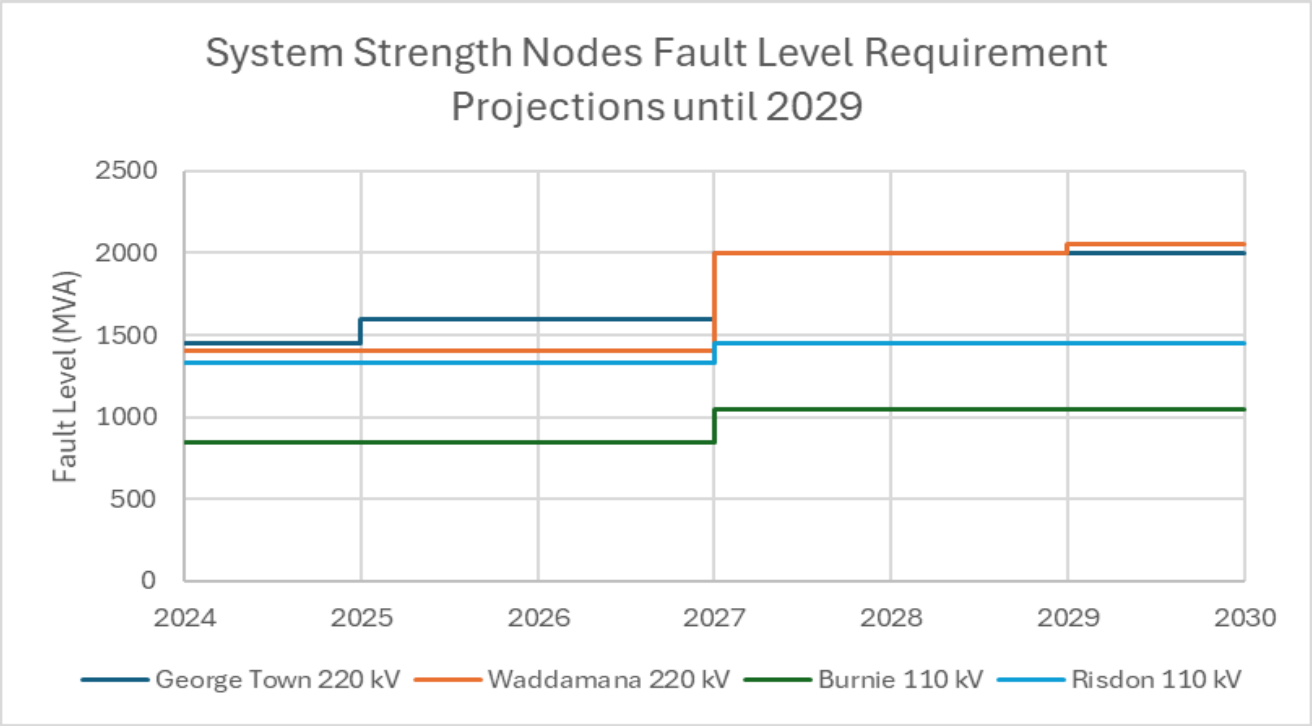


Figure 2 Fault level projections at System Strength Nodes until 2029

Analysis of the identified need within this PADR has been solely based on the minimum and efficient levels of system strength identified by AEMO and TasNetworks. On that basis, the following issues have been specifically excluded from consideration:

- Any system strength to support the operation of Marinus Link. At this stage, it is unclear if the new HVDC interconnector will have a net positive or negative impact on system strength in Tasmania.
- Any system strength requirements associated with future customer loads that utilise controllable IBR technologies, e.g. electrolysis processes. Large IBR loads have not been forecast by AEMO and would need to be considered on a case-by-case basis.
- Any system strength requirements to support future BESS which are operated as grid-following (rather than grid-forming) devices.
- Any system strength requirements associated with future dynamic reactive support devices installed as network assets. The intention would be to design such equipment to operate at the minimum three phase fault level and not materially add to the overall system strength requirement.

Responses to Project Specification Consultation Report

TasNetworks received two submissions to the PSCR. This is in addition to the three submissions received from potential non-network service providers in response to the corresponding EOI.

The only non-confidential submission to the PSCR was submitted by Jack Gilding. Mr Gilding's concerns and TasNetworks' responses are provided in Table 10.

Table 10 TasNetworks responses to PSCR submissions

Concern	Description	TasNetworks response
Extent of required infrastructure	TasNetworks is required to organise and charge for system strength enhancements based on AEMO's predictions of future developments even though these developments may not materialise.	TasNetworks is required to use reasonable endeavours to plan, design, maintain and operate the transmission network to: 1. maintain the minimum three phase fault level specified by AEMO, and 2. achieve stable voltage waveforms for the level and type of inverter-based resources and market network service facilities projected by AEMO: TasNetworks has attempted to reduce the risk of stranded assets and over procurement of system strength services by only considering system strength needs prior to the construction of Marinus Link. This limits TasNetworks procurement of system strength services to support new IBR developments that are not contingent on Project Marinus proceeding.
Alternative technologies	This is a rapidly changing area of technology and there is a risk that traditional large-scale infrastructure (in particular synchronous condensers) will be commissioned at greater cost than could be met by emerging technologies.	As part of the RIT-T, TasNetworks is required to consider all technologies that are capable of addressing the identified need. As part of the RIT-T process, TasNetworks has considered a range of alternative technologies including those proposed as part of the EOI process.
Cost allocation	Some of the cost may be passed on to existing consumers even though the technical requirements are a response to the development of new	The system strength costs associated with supporting the connection of new IBR are intended to be recovered from the connecting party. Given TasNetworks is required to procure sufficient system

	infrastructure (in particular Marinus Link and possible new large-scale wind and solar generation) that is of limited benefit to existing consumers.	strength services to support a forecast level of IBR, it is possible that customers bear some of these costs where the expected new connection does not materialise. TasNetworks has attempted to minimise this risk by only considering system strength needs prior to the construction of Marinus Link. This limits the consideration of credible options to non-network solutions, which reduces the risk of stranded network assets. TasNetworks has also considered estimated contract costs rather than only economic costs in our PADR assessment to understand the costs that could be borne directly by customers rather than the broader electricity system.

Key changes since the Project Specification Consultation Report

Since the publication and consultation on the PSCR, new information has been published that impacts the PADR analysis. These are commented on in the following section.

2023 System Strength Report and 2024 Integrated System Plan

AEMO published the 2023 System Strength Report in December 2023 and the 2024 ISP in June 2024. As described in the previous section, these reports change the amount of forecast IBR at some SSNs. TasNetworks has incorporated this updated modelling in the PADR where appropriate to do so.

Improving security frameworks for the energy transition rule change

In March 2024, the AEMC made final rule determination and rule change that directly impacts how the preferred option (established through this RIT-T) will be implemented. Specifically:

- AEMO, rather than individual TNSPs, will be responsible for enabling system security contracts, including system strength and inertia, from 2 December 2025.
- Individual SSSPs will be responsible for entering into system security contracts, as required to meet the new planning requirements.
- Therefore, there needs to be alignment in the contract process and the operational requirements of AEMO.
- AEMO has published minimum and recommended information requirements to be established in contracts to facilitate efficient enablement of non-network solutions.
- AEMO will publish its full enablement procedures by 31 August 2025, and this will be another key input for TasNetworks to meet its planning obligations.

A key consideration for the PADR as consequence of this rule change is that, from 1 December 2024, the AER will make determinations in advance when requested on whether expenditure under a TNSP's proposed system security network support contract is consistent with the operational expenditure objectives, criteria, and factors to promote economic efficiency. As a result, we will assess these contract costs to identify whether we believe they would successfully pass the AER's assessment. Where we consider proposed network support contract costs are not expected to pass this new process (i.e., where they are not considered 'prudent and efficient'), then we will not be considering these solutions as credible in accordance with the NER and RIT-T Guidelines.

TasNetworks' approach to satisfying planning obligations

As explained previously, Tasmania is unique in the energy transition and is facing a different set of circumstances to the mainland with respect to system strength. Specifically,

- The existing synchronous machines in Tasmania are not exiting the market.
- There is limited IBR growth anticipated in Tasmania prior to the construction of Project Marinus in 2030.
- TasNetworks' near-term system strength obligation is capable of being met by existing assets.

Therefore, TasNetworks' RIT-T and planning approach differs to mainland SSSPs.

Application of reasonable endeavours criteria

NER S5.1.14(b) describes the planning obligations for SSSPs in regard to the forward-looking provision of system strength. The overarching requirement is that:

> "A Transmission Network Service Provider who is a System Strength Service Provider must use ***reasonable endeavours*** to plan, design, maintain and operate its transmission network, or make system strength services available to AEMO, to meet the following requirements at system strength nodes on its transmission network in each relevant year":

At the current time, our interpretation of the requirements, including the 'reasonable endeavours' criteria, is as follows:

- The obligation is to provide sufficient system strength to support operation of the intact transmission network such that system security can be adequately maintained and that forecast IBR connections can be accommodated.
- The system strength provided must also be adequate to manage the occurrence of any credible contingency event or protected event.
- It is acceptable to apply market constraints to manage prior outage or post-contingency network operating conditions to maintain power system security.
- Unlike the previous shortfall framework which only considered 99% of forecast operating conditions, the system strength planning requirements apply to all times of the year.

As described for the base case development, we intend to take into account the 100% probability scenario when considering forecast contributions from synchronous generators continuing to operate in the energy market. This will help inform what additional contributions need to come from higher cost solutions predicated on the minimum contribution from the energy market. However, there is an additional element that needs to be considered and this relates to service redundancy. It is expected to be particularly relevant when the contribution from non-network solutions is significant. Such assets will continue to be maintained and operated by third party providers and therefore beyond the immediate control of the SSSP. Even for network assets, the risk of unplanned outages, and the need for scheduled maintenance, still needs to be considered.

In our view, it is not economically feasible to plan for 100% redundancy. This would in theory necessitate the duplication of all required services, which is unrealistic. It is also likely to be insufficient to

simply plan for an outage of the largest system strength source, as this may coincide with the planned or forced outage of another device. Determining what is 'reasonable' when it comes to meeting the ongoing needs of the future power system is a matter not yet formally resolved.

For the purposes of the PADR, we propose to examine the practical and cost implications of targeting 95% and 99% redundancy of system strength services. We will utilise offered 'plant availability' as an input to a statistical analysis and endeavour to take locational impacts into consideration where practical to do so. The objective of this analysis will be to determine how much 'additional' capability needs to be contracted over and above that which would be 'just' enough. The total amount of accepted over-procurement will be a function of the 'availability' that service providers feel confident to offer and will likely be impacted by technology type, maintenance profiles, age and condition of equipment, fuel source availability etc.

The cost to provide higher levels of redundancy will be a significant consideration in determining what is ultimately 'reasonable'.

Options Considered

Credible options are required[6] to:

- Address the identified need.
- Be commercially and technically feasible.
- Be able to be implemented in sufficient time to meet the identified need.

Further, as a reliability corrective action, the preferred option is required[7] to have a proponent.

The AER has stated in its RIT-T application guidelines[8] that:

- "An option is commercially feasible if a reasonable and objective operator, acting rationally in accordance with the requirements of the RIT–T, would be prepared to develop or provide the option in isolation of any substitute options".
- "An option is technically feasible if there is a high likelihood that it will, if developed, provide the services that the RIT–T proponent has claimed it could provide for the purposes of the RIT–T assessment".

TasNetworks has considered the credibility of both network and non-network options.

Network options - Synchronous condensers installed as network assets

TasNetworks has considered the potential for TasNetworks to own and operate synchronous condensers for the purpose of meeting our system strength obligation. The potential advantage of purpose-built synchronous condensers is the ability to locate them at points in the network where the need is highest and/or delivers the best distribution of system strength benefits. Such network assets could also be used to provide additional network services including inertia and reactive power compensation (both dynamic and steady state requirements).

However, TasNetworks does not consider installing new synchronous condensers to be a credible solution to meeting the identified need in this RIT-T for the following reasons:

- Cost: As per AEMO's 2023 Inputs, Assumptions and Scenarios Report (**IASR**), a single 125 MVA synchronous condenser is expected to cost $97-98 million over the RIT-T modelling period. Assuming a 30 year asset life and a 7% discount rate, this equates to an equivalent annual cost of $6.86 million. TasNetworks expects the annual contract costs of implementing a non-network solution to be less for the period between 2025 and 2029. Therefore, network options are not considered commercially feasible for this RIT-T as an objective operator would not be prepared to make the investment compared to the non-network option.
- Timing: Given the expected lead times for new synchronous condensers, TasNetworks does not expect to be in a position to install sufficient network assets in time to address the identified need during the modelling period (i.e. by 2029). TasNetworks does not consider it feasible to complete

[6] NER clause 5.15.2(a)
[7] NER clause 5.16.4(l)
[8] AER - RIT-T guidelines - final amendments (clean) - 6 October 2023_0.pdf

the RIT-T, contingent project application, procurement process, installation and commissioning of these assets within the imposed time constraints.

Despite network assets not forming part of a solution in this RIT-T, TasNetworks expects synchronous condensers may be required at some point in the future. To meet the significant increase in new IBR connections expected following the commissioning of Marinus Link, TasNetworks expects network assets may be required to complement the non-network solutions. This will be considered further in the post 2029 system strength RIT-T.

Non-network options

TasNetworks received three responses to the EOI process. One from an existing owner and operator of synchronous machines in Tasmania and two from BESS proponents that do meet the definition of anticipated or committed projects as defined in the RIT-T Guidelines. TasNetworks has developed a high-level screening test for establishing whether the proposed solutions should be deemed a "credible option" within the meaning of clause 5.15.2 of the NER. Options identified as non-credible through this test can be excluded from detailed assessment in the PADR.

The options feasibility test set out below is split into two parts: technical feasibility and economic and commercial feasibility.

Consistent with the terms of the EOI, TasNetworks treats proponent responses as confidential and has not reproduced any non-public information.

Technical feasibility

The technical feasibility test it outlined in Table 11 and focusses on whether the option is capable of providing system strength at the declared nodes and being implemented in time to meet the identified need.

Table 11 Technical feasibility test

Test criteria	Description	Conclusion
Volume	The solution must provide the required amount of system strength support to address the projected shortfall.	To meet the efficient level of system strength, significant increases will be required at certain SSNs. A solution that only provides a marginal increase in fault level will be insufficient to meet the regulatory requirements.
Location	The solution must be able to provide system strength support at a location on the network where there is an identified need.	The projected system strength requirements vary across each SSN. Consequently, the value of system strength support varies greatly depending on the location in which the services are provided.
Timing	The solution must be operational in time to deliver system strength support during the identified period (2 December 2025 to 30 June 2029).	A solution that is not available to provide system strength support for some or all of the period between 2 December 2025 to 30 June 2029 will not meet the identified need.
Reliability	The solution must meet certain reliability criteria in	The solution must be available to provide critical services to the network when needed. Any reliability issues relating

	relation to the provision of system strength services.	to operational performance could threaten the stability of the Tasmanian power system.
Risk	The solution must not involve an undue level of risk. This includes risk related to project deliver timelines, technological maturity, financial viability, planning approval, and operational performance.	TasNetworks as the TNSP in Tasmania has a responsibility to maintain power system security. Any solution that cannot be delivered potentially threatens TasNetworks' ability to meet its network obligations.

Commercial feasibility

If an option is deemed technically feasible, TasNetworks will then assess whether it is commercially feasible. An option that is substantially more expensive, but is not also expected to have substantially higher benefits, is not considered 'commercially feasible.'

In the PADR, TasNetworks has implemented a two-stage process to assessing the commercial feasibility of the options.

1. First, assessing whether the incremental benefits of the non-network option outweigh its incremental costs, and
2. Second, if this is the case, assessing whether the option represents the least cost option for consumers by reference to the cost of providing system strength.

Option 1: Synchronous condensers and generators owned and operated by third parties

TasNetworks received an EOI response from an existing owner of synchronous condenser and generator assets offering to provide system strength services. This includes a distributed portfolio of assets across Tasmania which have been assessed by TasNetworks as capable of meeting efficient system strength levels up until 2029 and the connection of Marinus Link.

This option is consistent with the approach TasNetworks currently utilises to help manage system strength and inertia shortfall requirements. As a result, this option is deemed technically feasible.

Under this option, synchronous generators (the majority able to operate as synchronous condensers) would be contracted to come online specifically when required for the provision of additional system strength (and/or inertia). Such generators are subject to the spot market restrictions as described in NER 5.20C.4 and 5.20B.6 as they potentially send active power into the network out of merit order. It follows that the ability to operate for extended periods of time at very low power outputs is preferable, as this has less distortionary impact on the market without impeding the supply of system strength or inertia.

Given the distortionary impacts and opportunity costs of enabling a generator out of merit order to provide system strength, TasNetworks expects to structure any contract to ensure synchronous condenser capabilities are exhausted prior to relying on generators.

A limitation of this solution is the geographical distribution of existing synchronous condenser assets which may not be capable of fulfilling all future network requirements without some form of additional support. The provision of new synchronous condenser capabilities by third parties in alternate locations could form part of the longer-term solution subject to the commercial terms offered. This will be explored further in the post 2029 system strength RIT-T.

Option 2: BESS

TasNetworks received two submissions from BESS proponents and have assessed their technical feasibility against the criteria in in Table 11.

Volume: Both BESS claim to be capable of providing a material quantity of system strength support, at least sufficient to provide the incremental growth in system strength requirements at the Waddamana and George Town SSNs.

Location: Both proponents propose to develop grid-forming BESS in central Tasmania, adjacent to the Palmerston substation. This would be closest to the Waddamana and George Town SSNs.

Timing: Neither BESS will be available to provide the required system strength services for at least the first year of the forward planning period.

Despite this failure to be operational by December 2025, based on TasNetworks' forecast system strength requirements (outlined in the provided memorandum) the main jump does not occur until 2027. Therefore, either BESS could theoretically be ready to provide these additional requirements from 2027 onwards.

Reliability: The proponents have provided the expected availability of the BESS.

Risk: Both BESS have received planning approval by the local council.

Conclusion on Option 2

Neither BESS is capable of meeting Tasmania's overall system strength obligation either together or individually. As such, they are not considered technically feasible as standalone options and should only be considered as part of a hybrid solution.

Option 3: Hybrid solution

As described in Option 2, BESS are technically capable of providing system strength and therefore contributing to meeting the need. However, given their size and location, the BESS proposed through the EOI process are not capable of providing sufficient system strength to meet TasNetworks' obligation in its entirety. As a result, the BESS is only considered as part of a hybrid solution with the existing third party operator of synchronous machines described in Option 1.

Approach to assessing the hybrid option

Given the hybrid option can be deemed 'technically feasible', the consideration of whether the hybrid option should be considered credible for the purposes of the RIT-T assessment is related to its commercial feasibility.

Economic cost / market benefits assessment hybrid option

The RIT-T assessment needs to consider the resource cost impacts of any non-network options. These resource costs may not correspond with the amounts that a non-network proponent proposes to charge a TNSP for network support.

Consistent with the RIT-T handbook and Guidelines, the approach to include non-network option costs in a RIT-T is as follows:

1. Include the proponent's proposed network support contract costs as part of the option cost in the RIT-T (together with any associated TNSP costs):
    a. An equal and offsetting amount to the network support payment should also be reflected in the market benefit side of the RIT-T calculation, as the proponent will receive this

payment from the TNSP (i.e., it is a wealth transfer which will ultimately not affect the RIT-T net benefit outcome).

2. Include the incremental capital and operating costs of the non-network option as part of the assessment of market benefits (i.e., as a 'negative benefit'), as this reflects a resource cost that would not have been incurred in the absence of the option. This may be:
    a. the full cost of the assets used to provide the non-network option (and associated operating costs), if the non-network solution involves completely new assets.
    b. the cost of upgrades or additions to an existing asset.
    c. zero where an existing asset does not need upgrades or additions in order to provide the network support service.
3. Include an estimate of the market benefits arising as a consequence of the operation of the non-network option e.g., as a result of the impact of the option on the operation of the wholesale and/or ancillary services markets.

Costs

The RIT-T requires TasNetworks to assess the direct costs of a credible option. As discussed above, where a non-network option reflects a project that already exists or that is expected to be developed regardless of the outcome of the RIT-T, then the resource costs of this option (i.e., the capital and operating costs) are considered to already be sunk (i.e., they are assumed in the base case). The resource costs of this option in the option case will only reflect any incremental costs incurred to enable the non-network option to provide network support services. To be included in the RIT-T base case, the project must be either "committed" or "anticipated".

A project is committed if it meets the following criteria:

- The proponent has obtained all required planning consents, construction approvals and licenses, including completion and acceptance of any necessary environmental impact statement.
- Construction has either commenced or a firm commencement date has been set.
- The proponent has purchased/settled/acquired land (or commenced legal proceedings to acquire land) for the purposes of construction.
- Contracts for supply and construction of the major components of the necessary plant and equipment (such as generators, turbines, boilers, transmission towers, conductors, terminal station equipment) have been finalised and executed, including any provisions for cancellation payments.
- The necessary financing arrangements, including any debt plans, have been finalised and contracts executed.

A project is anticipated if it does not meet all of the criteria of a committed project as defined above but is in the process of meeting at least three of the criteria.

At this stage, TasNetworks does not consider either of the BESS proponents to meet these criteria. As a result, the full cost of the assets must be considered in the RIT-T assessment. To ensure consistency in the assessment, TasNetworks has assumed the 2023 IASR cost assumptions for the relevant size of BESS proposed in the EOIs.

As per above, the costs of the existing assets operating in the market that were proposed in the EOI are considered sunk and therefore have no costs for the purposes of the RIT-T assessment. Therefore, the cost of the hybrid option reflects the cost of the BESS.

Benefits

As described above, the cost of the hybrid option reflects the full economic cost of constructing a new BESS in Tasmania. Therefore, this option will evidently be higher cost than Option 1, that only includes existing assets. Hence, to assess the economic feasibility of the hybrid option, TasNetworks must assess whether the incremental benefits of the hybrid option outweigh its higher costs.

Under the RIT-T, from 2025-2029, the only relevant incremental benefit provided by a BESS is "changes in fuel consumption arising through different patterns of generation dispatch". This benefit arises when there is a new source of electricity supply that displaces a source with a higher fuel cost. It is conceivable that a BESS is capable of resulting in fuel cost savings where it charges with a low-cost fuel (e.g. wind/solar/hydro) and discharges to offset generation from a higher cost fuel (e.g. gas).

Assessing this benefit requires TasNetworks to make an assumption regarding how the BESS will operate. Operating profiles influence when the BESS charges and discharges, as well as the generator or type of generator that is being displaced. This ultimately determines the fuel cost savings associated with a new BESS in Tasmania.

TasNetworks acknowledges that BESS operating models are complex, and it is reasonable to expect that each BESS operator would apply its own detailed approach. However, a reasonable operating principle is that a BESS will charge when electricity is cheap and discharge when electricity is expensive. TasNetworks is aware that in other jurisdictions this has been approximated by assuming that a BESS will charge during daylight hours when solar generation is in abundance and discharge in the evenings and early mornings when prices are typically higher. In jurisdictions where the marginal generator during high price periods is a thermal plant (e.g. gas) there are generally fuel cost savings associated with displacing that generator. However, in Tasmania, the marginal generator during peak periods will generally be a hydroelectric generator.

As per the 2023 IASR, there are no fuel costs associated with hydroelectric generation. Therefore, there are no fuel costs savings from BESS discharge displacing hydro generation. On this basis, TasNetworks does not consider there would be material fuel cost savings associated with a new BESS operating in Tasmania.

Conclusion

Based on the above assessment, TasNetworks does not consider there are material benefits between Option 1 and Option 3. Specifically, the BESS introduced through Option 3 is not expected to provide material incremental benefits above Option 1 to offset its higher costs. This is because the required volume of system strength required in Tasmania between 2025 and 2029 can be met by the existing synchronous condensers and generators available via Option 1.

Therefore, given Option 2 is not technically feasible, and Option 3 is not commercially feasible, the only credible option in this RIT-T analysis is Option 1.

Given TasNetworks has concluded that there is no credible network solution, a RIT-T is not strictly required under the NER as the investment does not meet the capital expenditure threshold of $7 million. TasNetworks has chosen to continue with the RIT-T process to provide transparency to stakeholders regarding the methodology applied to determine the preferred option.

Materiality of market benefits

The NER requires that RIT-T proponents consider a number of different classes of market benefits that could be delivered by a credible option. Furthermore, the NER requires that a RIT-T proponent consider all classes of market benefits as material unless it can provide reasons why:

- A particular class of market benefit is likely not to materially affect the outcome of the assessment of the credible options under the RIT-T, or
- The estimated cost of undertaking the analysis to quantify the market benefit is likely to be disproportionate to the scale, size and potential benefits of each credible option being considered.

Market benefits not considered material

TasNetworks does not consider any of the relevant market benefits categories to be material for the purposes of this RIT-T.

Specifically, TasNetworks does not consider quantifying any class of market benefit will affect the outcome of the assessment. This is because TasNetworks has only identified a single credible option capable of addressing the identified need. Furthermore, as the solution is for a reliability correct action, there is no merit in quantifying the benefits as TasNetworks must implement the solution to meet our rule-based obligation. As such, a negative net present value would not change the outcome of the RIT-T.

TasNetworks also notes that given there is no change to the power system (in terms of new assets) between Option 1 and the base case (as Option 1 only includes existing assets), all of the benefits associated with Option 1 are not material.

Materiality of inter-network impacts

As Tasmania is coupled to Victoria via a HVDC interconnection, there will be no material inter-network impacts from the preferred option. The benefits of any solutions implemented for the provision of system strength are limited to our region, with the counterfactual being that Tasmania cannot rely on support from the mainland and must be self-sufficient in terms of providing the necessary services

Overview of the option assessment approach

Base case

The base case adopted for this PADR describes a business-as-usual scenario in which no network investments or non-network solutions are entered into to meet the planning obligation. This results in non-compliance of the planning obligations set in schedule 5.1.14 of the NER.

While practically, the realistic base case would see AEMO utilise its powers to require various machines to operate (likely existing synchronous machines), this approach has not been modelled due to excessive complexity and cost. Rather, the base case adopted for this PADR can be used to quantify the expected gaps in meeting SSN requirements from energy dispatch to forecast contract costs associated with the preferred option.

Scenarios and sensitivities

The assessment considers the ISP step change scenario

AEMO adopts the ISP Step Change scenario for the purposes of its System Strength Report. Given our obligation is specifically related to maintaining stable voltage waveform to meet AEMO's forecast IBR developments in the System Strength Report, TasNetworks have assessed the credibility of options against the 2024 ISP Step Change scenario.

On this basis, TasNetworks does not consider the other two ISP scenarios (i.e., the Progressive Change and Green Energy Exports scenarios) to be relevant for meeting our system strength obligations.

If the NEM development and policy landscape changes and we were, for example, in a future state that looked more like the Green Energy Exports scenario then the system strength obligation on TasNetworks would not automatically change. Instead, the obligation would be updated by AEMO in time and would then only apply to TasNetworks via the next binding three-year period.

TasNetworks has addressed some of this uncertainty by limiting the analysis in this RIT-T to the period prior to the expected commissioning date of Project Marinus. There is limited variation in the IBR forecast during this period between ISP scenarios. On this basis, TasNetworks does not consider analysing options under different ISP scenarios will materially impact the outcome of the RIT-T.

Furthermore, given that the identified need will be addressed entirely through non-network services, TasNetworks considers there is flexibility through our contracting approach to manage different IBR development scenarios. The risk of over/under procurement is therefore easier to mitigate than if we identified the need for network assets.

Sensitivity analysis

Given TasNetworks has only identified a single credible option to address the need, we do not consider there is value in undertaking quantitative sensitivity analysis. TasNetworks does not consider there are any likely future states where implementing a hybrid (or BESS only) option is preferable to the Hydro only option. The consideration of BESS may improve under the following conditions:

- They become anticipated or committed for the purposes of the RIT-T.
- The existing fleet of Hydro Tasmania's assets are incapable of meeting TasNetworks system strength obligations or Hydro Tasmania does not offer sufficient services to meet the need.
- The reliance on gas powered generation (or other thermal generation imported over Basslink) significantly increases in Tasmania.

A qualitative consideration of these scenarios is considered below.

BESS becomes anticipated or committed

Should a BESS meet the criteria to be considered anticipated or committed, they will form part of the base case in the RIT-T and their development costs will be considered sunk. This would significantly reduce the economic cost of an option that includes the BESS. Under this scenario, consideration of BESS in comparison to the Hydro only option would likely be focussed on contract costs, as the construction and development costs will be sunk. This may improve the competitiveness of the BESS in providing system strength compared to existing sources in the network.

TasNetworks does not consider any known BESS proponents in Tasmania are sufficiently progressed to be considered committed or anticipated for the purposes of this RIT-T.

Furthermore, based on the information provided through the EOI process, TasNetworks does not consider BESS will be competitive to the Hydro solution on a contract cost basis. This means that even if these proponents were included in base case, it is unlikely they would form part of the preferred option.

Changes in provision of system strength services from existing sources

As noted previously, under Hydro Tasmania's response to the EOI, there are sufficient units available to be contracted to meet TasNetworks system strength obligations out to 2029. TasNetworks does not foresee sufficient IBR developing in Tasmania before 2029 that would prevent Hydro Tasmania from meeting these obligations based on AEMO's current ISP projections. Furthermore, TasNetworks does not foresee a scenario where Hydro Tasmania removes synchronous machines from service. Rather TasNetworks considers it more likely that Hydro Tasmania improves its service offering through various planned upgrades.

TasNetworks also does not consider it feasible that Hydro Tasmania chooses to no longer offer system strength services as part of a network support contract with TasNetworks. Hydro Tasmania offered services as part of the recent EOI process and has a history of making these services available to TasNetworks under past and existing contracting arrangements.

Were either of these scenarios to eventuate, it would likely require TasNetworks to either invest in a network solution or BESS/hybrid solution to meet our system strength obligations. However, as explained above, TasNetworks does not consider either are likely to occur and therefore it is necessary to consider further for this period of analysis.

Change in generation mix in Tasmania

As explained previously, under this RIT-T, the key benefit of introducing a BESS into the Tasmanian network is reducing fuel costs by displacing generation from higher cost fuel sources. Currently, there is little value from displacing existing generation as it is predominately from hydroelectric or other renewable sources. Therefore, there are very limited fuel cost savings.

The net benefits of a BESS/hybrid option could improve where the generation mix in Tasmania changes to include a greater emphasis on existing gas-powered generation or imports during periods of high thermal generation on the mainland. Should the BESS discharge during times of high thermal generation, it may result in fuel costs savings and emissions reduction benefits that can be considered

under the RIT-T. Should these benefits be high enough, it could offset the materially higher cost of the BESS.

TasNetworks does not foresee the generation mix changing in Tasmania to the extent that the benefits associated with a BESS would materially increase. Although, in recent months, Hydro Tasmania has operated the gas-powered Tamar Valley Power Station (including the closed cycle turbine for baseload power) more frequently, TasNetworks does not consider this is sufficient to result in significant fuel cost savings based on the plants historical operation since being acquired by Hydro Tasmania. In addition, TasNetworks considers Basslink will continue to operate as usual, specifically importing during low price periods in Victoria (corresponding with high renewable output) and export during high price periods. As such, it is unlikely that a BESS will offset thermal generation from the mainland.

Conclusion

Based on the above analysis, TasNetworks does not consider changing any key variable would materially impact the outcome of the RIT-T.

Measuring contract costs

As described above, TasNetworks has identified a single credible option that only utilises existing assets. As a result, the economic cost of the solution in this RIT-T is $0.

As previously mentioned, the contract costs incurred by TasNetworks in procuring the services from this party are considered a wealth transfer under the RIT-T. This is because these costs are transferred from one market participant (TasNetworks and electricity customers) to another (the third-party provider).

TasNetworks acknowledges that this system is not transparent as it does not give an indication of the quantum of costs borne by customers. In response, TasNetworks has estimated the expected system strength contributions coming from synchronous generation participating in the energy market through natural market dispatch solutions for the period 2025 to 2029. This enables us to estimate how frequently there will be a system strength deficit in Tasmania. Under the NER, the expected costs of providing system strength are used to calculate the system strength charge that may be paid by parties connecting to Tasmania's transmission system. The charge is designed to reflect the system strength costs that a connecting party would impose on the system.

If TasNetworks' revenue from system strength charges is less than our costs of providing those services, the difference is recovered from transmission customers. That amount will be recovered equally from all transmission customers without any differential based on where on the network those customers are connected. Although the forecast costs of the Hydro Tasmania contracting arrangements are confidential, TasNetworks can provide the methodology we used to forecast these costs.

A range of hydroelectric synchronous condenser dispatch solutions are calculated based on the projected deficits using historical information to inform the credibility of the dispatch solution in each case. This has been determined accounting for expected IBR growth[9] and planned network augmentations[10] occurring during of the study period.

A range of study cases are then prepared using Siemen PTI's PSS®E power system modelling software based on how frequently the dispatch patterns will occur. The cases are developed with consideration

[9] Source: 2023 AEMO System Strength Report
[10] Source: 2024 AEMO Integrated System Plan

of both system strength and inertia[11] forecasts, looking at the duration likelihood of each dispatch pattern as a percentage of time for each of the years in the study period. Thousands of fault study simulations are then performed for each year studied and categorised in terms of achieving the least cost solution, with the subset of these cases deemed credible.[12]

ASX Futures energy prices for Victoria are then applied to determine the probable costs associated with each credible solution to estimate a conservative upper limit for the procurement costs in each case, given the tight coupling between Tasmanian and Victorian spot market prices.

We then estimated the contract costs of providing system strength by identifying how frequently this contract will be operationalised based on the percentage of time the credible dispatch patterns occur.

This approach has determined the approximate likely volume of system strength to be procured in each calendar year, with costs varying as a function of projected IBR and planned network augmentations over this period. We consider the forecast contract costs to be efficient and prudent.

Providing further cost transparency for customers, we note that the AER can now undertake an ex-ante assessment of these costs as part of the 'improving security frameworks for the energy transition' rule change. Specifically, from 1 December 2024, the AER can make determinations in advance when requested on whether expenditure under TasNetworks' proposed system security network support contract is consistent with the operational expenditure objectives, criteria, and factors to promote economic efficiency. This will safeguard customers from excessive network support costs, which are not currently reflected in the RIT-T assessment of the preferred option.

[11] Source: 2023 AEMO Inertia Report

[12] For a synchronous dispatch combination for a specific system requirement to be credible, it must bring the fault level at an SSN to greater than or equal to the efficient fault level but less than the efficient fault level plus 10%.

Preferred option

Based on the analysis in the previous sections, TasNetworks concludes that a continuation of the contracting arrangements with Hydro Tasmania is the preferred option to meet our system strength obligations to 30 June 2029. This is on the basis that there are no other options capable of providing the required volume of system strength services in time or at a sufficiently lower cost.

Following conclusion of the RIT-T, TasNetworks will ensure the preferred option is operational by 2 December 2025.

Consideration of Inertia

The current rules framework continues to require inertia service providers to make services available that are sufficient to meet the forecast shortfalls as declared by AEMO. Although the current rules do not require TasNetworks to apply the RIT-T when identifying and implementing solutions to address an inertia shortfall, in the PSCR, TasNetworks flagged we would also consider the options available to provide inertia. We are of the view that inertia and system strength services, whether they be procured in the form of non-network solutions or provided by network assets, should be considered together in parallel. There are a number of credible options capable of delivering the services simultaneously, raising the prospect that 'common solutions' will deliver the least overall cost outcome for consumers. We structured the EOI to address both system strength and inertia network services as part of the one submission, noting that potential service providers may elect to offer only one of the services if they so desire.

With respect to inertia, TasNetworks is required to implement the lowest cost solution.

As with system strength, TasNetworks has an existing contract with Hydro Tasmania to address the inertia shortfall to 2 December 2025.

The inertia shortfalls forecast by AEMO in its 2023 inertia report are provided in Table 12 below.

Table 12 Forecast inertia shortfalls - Tasmania region

Financial year	2024-2025	2025-2026	2026-2027	2027-2028	2028-2029
Available inertia 99% of the time [MW.s]	1,926	1,965	1,230	1,291	1,291
Inertia shortfall against secure operating level [3,800 MW.s]	1,880	1,840	2,570	2,510	2,510

We considered how we manage forecast inertia shortfalls over the defined analysis period as a further input to the PADR cost benefit analysis. In doing so we identified an overall least cost outcome for the provision of both system strength and inertia services going forward.

Recognising that we will require new network services agreement(s) for both services from 2 December 2025, this will enable us to undertake efficient planning, followed by commercial negotiations to secure the necessary capabilities in a timely manner.

Assessment of EOI responses

Technical

Hydro Tasmania's offering is well understood based on its current provision of inertia services and is proven in meeting the secure operating level of inertia for the Tasmanian region mandated by AEMO for the foreseeable future.

Each BESS was assessed based on the information provided as part of the EOI process, in each case a single BESS unit is unable to provide sufficient inertia to meet the secure operating level requirement and would need to be supplemented by inertia provision from synchronous condensers.

The BESS in each case provides a highly configurable solution, but unlike synchronous condensers, limitations exist in terms of how reserve capability could be arranged under a range of market conditions.

TasNetworks has little experience with the provision of synthetic inertia and looks to our mainland counterparts as their experience with this technology progresses. Further information is required in terms of the responsiveness and time delays introduced following a contingency event. This would need to be examined using the tuned models provided once committed status for these projects is achieved.

Synchronous machines don't exhibit any time delay in their response post contingency, meaning the known inertia constants can be directly translated into the unit's contribution to meet minimum and secure inertia levels. In contrast, the inherent time delays expected from BESS operation would degrade contributions based on their specified inertia constants and further studies and experience is required to understand their actual capabilities before TasNetworks would commit to including them as inertia service providers in our network.

Commercial

Based on the responses to the EOI, TasNetworks does not consider either BESS proponent is capable of providing inertia at a lower cost than Hydro Tasmania.

Conclusion

Based on the above responses, TasNetworks considers a continuation of the existing Hydro Tasmania contract to be the preferred solution for addressing the forecast inertia shortfalls in Tasmania to June 2029. This is consistent with the preferred solution for system strength.

Regulatory compliance

This appendix sets out a checklist which demonstrates the compliance of this PADR with the requirements of the National Electricity Rules version 211.

Rules clause	Summary of requirements	Relevant section(s) in PADR
5.16.4(k)	A RIT-T proponent must prepare a report (the assessment draft report), which must include:	
	1) a description of each credible option assessed.	*Options Considered* Pages 26-31
	2) a summary of, and commentary on, the submissions to the project specification consultation report.	*Responses to Project* Specification Consultation Report Pages 21-22
	3) a quantification of the costs, including a breakdown of operating and capital expenditure, and classes of material market benefit for each credible option.	As per *Costs* (Page 30), there is no capital expenditure associated with the investment. As per *Measuring contract costs* (Page 35), forecast operational expenditure is based on confidential information provided by proponent.
	4) a detailed description of the methodologies used in quantifying each class of material market benefit and cost.	As per *Market benefits not considered material* (Page 32), there are no material market benefits.
	5) reasons why the RIT-T proponent has determined that a class or classes of market benefit are not material.	Materiality of market benefits Page 32
	6) the identification of any class of market benefit estimated to arise outside the region of the Transmission Network Service	*Materiality of inter-network impacts*

Provider affected by the RIT-T project, and quantification of the value of such market benefits (in aggregate across all regions).	Page 32
7) the results of a net present value analysis of each credible option and accompanying explanatory statements regarding the results.	As per *Costs* (Page 30) and ***Market benefits not considered material*** (Page 32), there are no economic costs or benefits as the assets utilised through the preferred option are also in the base case.
8) the identification of the proposed preferred option.	*Preferred option* Page 37
9) for the proposed preferred option identified under subparagraph (8), the RIT T proponent must provide: a) Details of the technical characteristics. b) The estimated construction timetable and commissioning date. c) If the proposed preferred option is likely to have a material inter-network impact and if the Transmission Network Service Provider affected by the RIT-T project has received an augmentation technical report, that report. d) A statement and the accompanying detailed analysis that the preferred option satisfies the regulatory investment test for transmission.	a) *Options Considered* Pages 26-31 b) As per ***Preferred option*** (Page 37), the option will be operationalised by 2 December 2025. c) N/A d) *Preferred option* Page 37

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