TasNetworks Stakeholder Consultation

Regulatory Investment Test for Transmission (RIT-T)

Provision of *System Strength Services* in Tasmania from 2 December 2025.

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Thursday 14 September 2023

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 here with us today.

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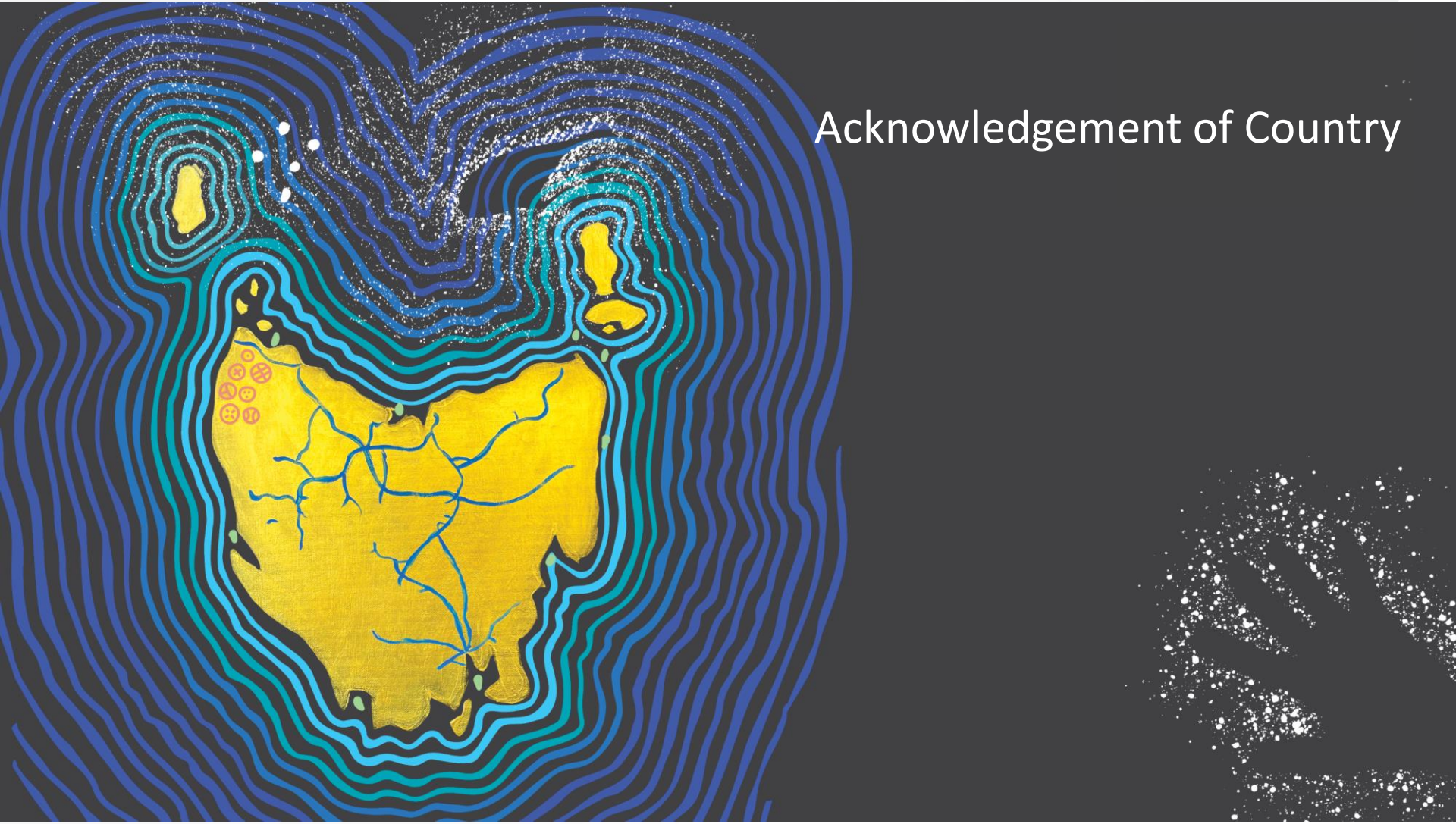

Acknowledgement of Country

Objective

Provide stakeholders with a practical understanding of ‘system strength’ and to encourage engagement with our Regulatory Investment Test for Transmission (**RIT-T**) process.

Any ‘light bulb moments’ will be a bonus!

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Agenda

a) What do we mean by '*system strength*' – What is it, why does it matter?

b) Why has this become an issue and where is it headed?

c) Changes to the National Electricity Rules (**NER**).

- Implications for TasNetworks.
- Implications for existing *network users*.
- Implications for new network connections (generators and load customers).

d) What we need to plan for in Tasmania.

- Forecast IBR capacity to be installed and resulting system strength requirements.
- Credible options identified to date.

e) Overview of the RIT-T process.

- Purpose of the RIT-T including key activities, milestones and overall time frame.
- The role of stakeholders.

f) Where are we at and what comes next?

g) Time for Q&A.

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What is ‘system strength’?

- ✓ Probably more confusing than ‘reactive power’ for many people!
- ✓ Lets go back to engineering basics...
- ✓ A ‘strong’ power system tends to exhibit the following characteristics:
  - ➢ High fault currents, i.e. the current that flows into a short circuit.
  - ➢ Relatively constant (rigid) network voltages, i.e. low sensitivity to changes in the network, including power flows variations, switching events etc.
  - ➢ Fast voltage recovery once network faults are cleared by protection.
  - ➢ Waveform distortion also tends to be lower in the absence of fault events, i.e. the voltage on each phase is nicely sinusoidal and there is a consistent 120° offset between the three phases.
- ✓ A ‘weak’ power system often exhibits issues which are to the contrary.
- ✓ Historically, we have used three phase fault level (MVA) as a ‘proxy’ to describe ‘strong’ and ‘weak’ systems.
  - ➢ Easy to calculate, apply and understand.

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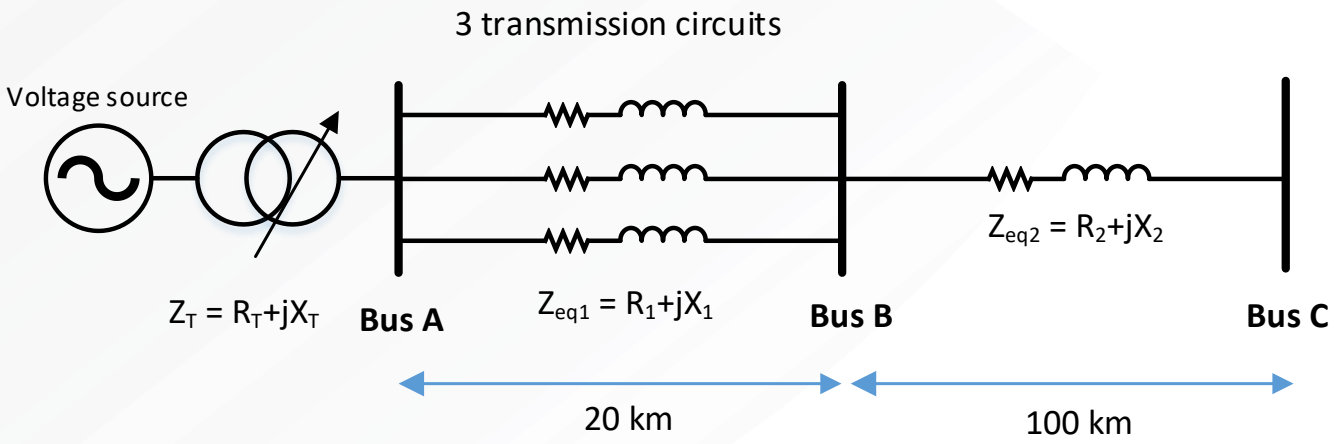
What is ‘system strength’?

- ✓ System strength is a location specific issue:
  - ➢ Possible to have a ‘generally weak system’ where the risk of various technical issues occurring is widespread.
  - ➢ Also possible to have ‘weak points’ in an otherwise strong system.
  - ➢ Very much a function of where **voltage sources** are located and the network impedance in between.



Bus C will be ‘weaker’ than Bus B and Bus A and be more susceptible to experiencing performance issues.

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Why has this become an issue?

"All ~~animals~~ MW's are equal, but some ~~animals~~ MW's are more equal than others".

"Animal Farm", George Orwell (1945), electrical references by Andrew Halley (2014)

- ✓ Traditional synchronous generation is either being replaced or temporarily displaced in the energy market by Inverter Based Resources (**IBR**), e.g. wind, solar and high voltage direct current (**HVDC**) transmission.
- ✓ They are very different technologies with very different performance characteristics.
- ✓ Power systems have evolved around the use of synchronous machines for over 130 years.
- ✓ Significant change is now happening in a fraction of that time – changes need to be understood and managed.

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Why has this become an issue?

Characteristic (*) System strength related issue	Synchronous Machine (SM)	Prevalent IBR Technologies (HVDC, wind and photovoltaics)
Type of device (*)	Voltage source (Inherent grid forming)	**Current source – Grid Following (GFL) (reliant on voltage coming from the network)**
Provision of inertia	Yes (inherent)	**No in practical terms**
Provision of fault current (*)	Yes (inherent) (300-500% of rated MVA)	**Very limited, often ≤ 110-120% (due to limited overload of power electronics)**
Provision of FCAS (Frequency Control Ancillary Services)	Yes (generally, in most cases)	Possible (but not usually desirable for raise services)
Provision of reactive power for voltage control	Yes	Yes, but with caveats (Park level control can be slower than SM)
Fault ride through capability (*)	Not normally an issue	**Can be problematic (and is impacted by available system strength)**
Active power recovery following network faults (*)	Immediate power recovery following fault clearance	**Power recovery may need to be delayed depending on 'strength' of connection point.**
Power quality issues (*)	Not normally a problem	Can require deliberate management
Generation output	Controllable	Can be variable, even in short term

Where is this issue headed?

- ✓ Inevitably, technology will continue to advance to help address a number of the issues currently caused by grid-following IBR.
- ✓ Example: Grid Forming (**GFM**) inverters.
  - ➢ Emulate the performance characteristics of synchronous machines via software.
  - ➢ Limited overload capacity of power electronic components remains a design issue – can be partially addressed by over-sizing critical components (but at a cost).
  - ➢ Commercially available solutions already available for some applications, particularly in Battery Energy Storage Systems (**BESS**).
- ✓ We need to manage **power system security and reliability** as part of the energy transition process – this will inherently include managing some legacy issues which are unavoidable at this point in time given the rate of change.

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Changes to the NER

- ✓ Australian Energy Market Commission (**AEMC**) Rule Determination 2021 – "*Efficient management of system strength on the power system*".
- ✓ Broad intention was to centralise the planning and provision of system strength services to support the ongoing connection of renewable IBRs, e.g. wind and solar, while also addressing existing system security and reliability requirements.
- ✓ Three components to the Rule change:
  - ➢ Supply side – Requirement on *System Strength Service Providers* to proactively plan for and pre-emptively provide the 'right' amount of system strength services across planning time frames.
  - ➢ Demand side – new *access standards* for generators and customers who wish to connect equipment reliant on particular levels of system strength being present at their *connection point*.
  - ➢ Coordination of supply and demand sides – new cost allocation methods akin to 'causer pays'.

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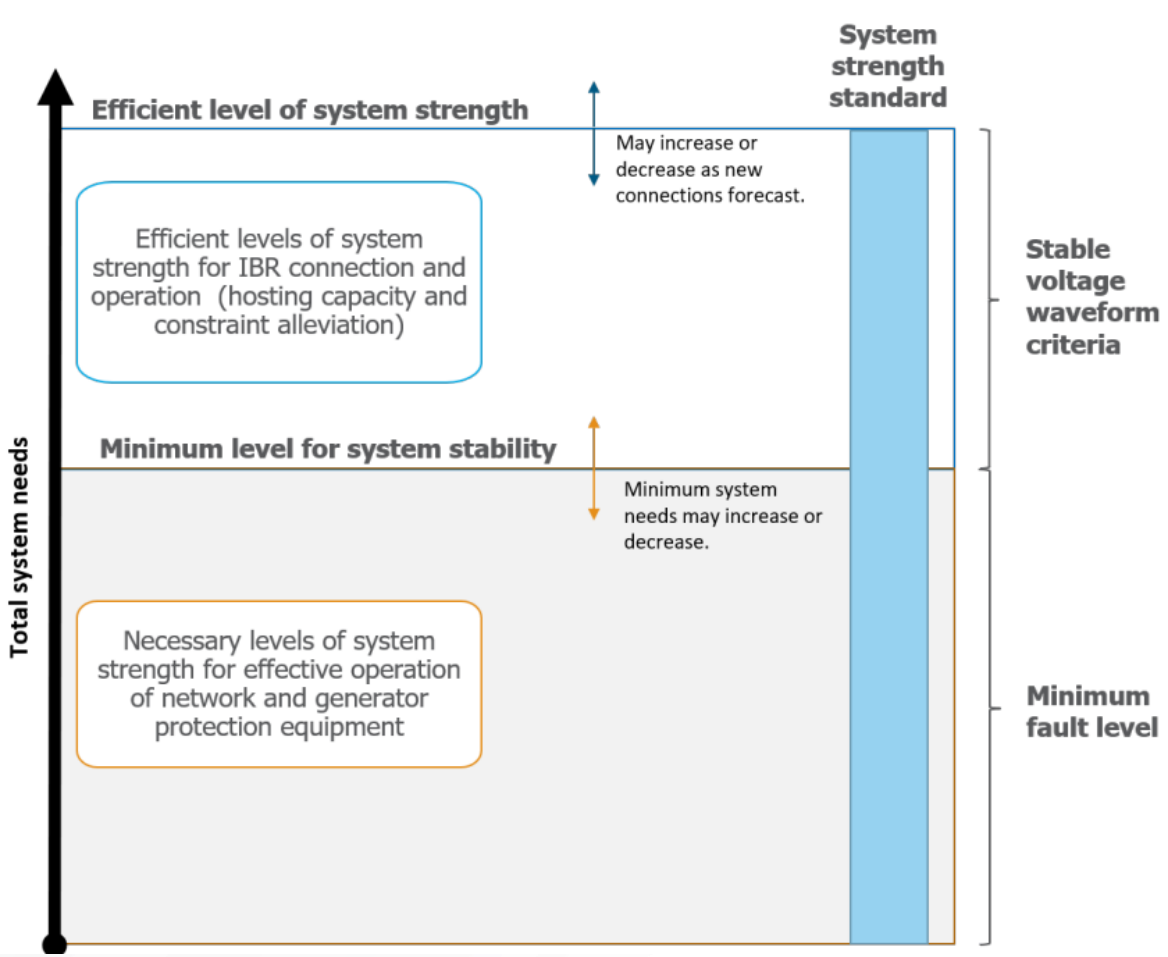
Implications for TasNetworks

- ✓ TasNetworks is the *System Strength Service Provider (**SSSP**)* for Tasmania – This RIT-T relates to the 'supply side' requirements.



The *efficient level of system strength* is to support the IBR capacity forecast to be connected – System Strength Report published by AEMO on 1 December each year.

In Tasmania, the *minimum fault level requirement* is largely determined by power system security criteria related to the existing power system.

Source: AEMC Efficient Management Of System Strength On The Power System) Rule 2021 Final Determination

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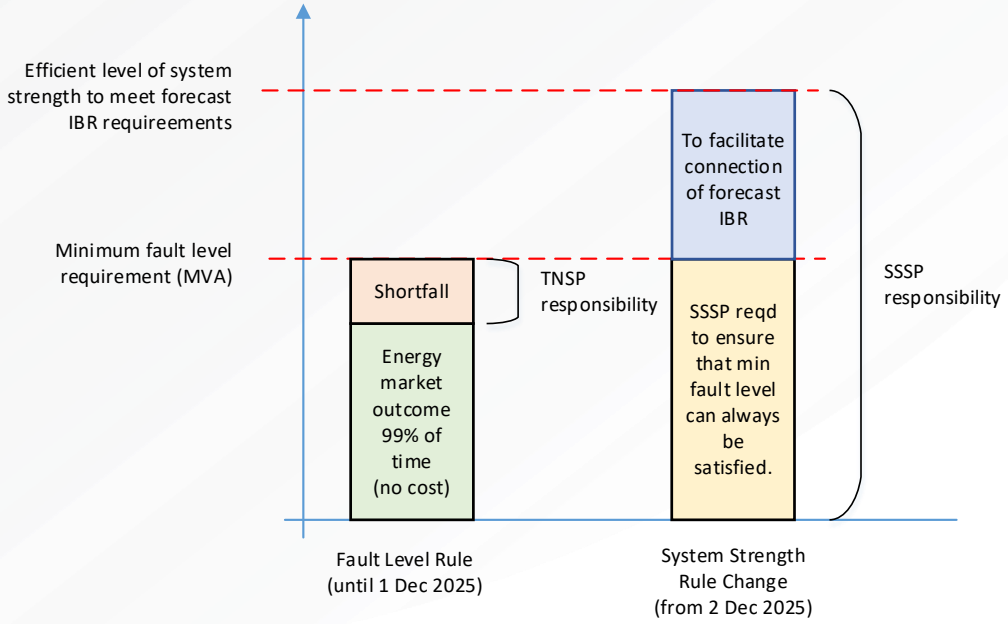
Implications for TasNetworks

- ✓ Our obligation is to ensure that sufficient *system strength services* are available in three years time to meet the most recent *system strength standard specification*. For example:
  - ➢ On 2 December 2025, we must have solutions in place (operationalised) to address the needs identified by AEMO in their 2022 System Strength Report published on 1 December 2022 – ***irrespective of what gets built in reality***.
  - ➢ The same obligation exists for 2026 when the 2023 report is published.
- ✓ This is a 'big change' from the shortfall mechanism introduced in 2017.



Previously TasNetworks was only required to procure services to address system strength shortfalls declared by AEMO. We now need to procure all services – **no reliance on energy market outcomes.**

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Implications for existing Network Users

- ✓ In short, the implications for those with an existing network connection agreement are as follows:
  - Any system strength requirements necessary to support operation of existing equipment are addressed as part of the defined *minimum fault level*.
  - The new system strength charging regime is not being applied retrospectively to existing operators of IBR equipment who have a system strength requirement, e.g. Basslink, existing wind farms etc.
  - Network customers will be exposed to the costs incurred by TasNetworks that cannot be recouped from system strength charges to be levied on new IBR connections (both generators and load customers) who don't self-remediate.
  - The RIT-T process is used to determine what expenditure TasNetworks can reasonably incur to meet our Rules obligations.
  - Administered by the Australian Energy Regulator (**AER**).

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Implications for new Network Connections

- ✓ New *minimum access standards* must be satisfied.
- ✓ In simple terms, two options exist to address any system strength requirement imposed on the network by the connection of new equipment:
  - ➢ Purchase system strength services from TasNetworks acting as the SSSP;

    OR

  - ➢ Self-remediate the network impact by installing auxiliary equipment such as synchronous condensers (as an example of one possible solution).
- ✓ The details of each option are quite involved and are not elaborated on here.
- ✓ Importantly, for the purposes of forward network planning, TasNetworks has little option but to assume that services will be purchased and must therefore be provided by us acting as the SSSP.

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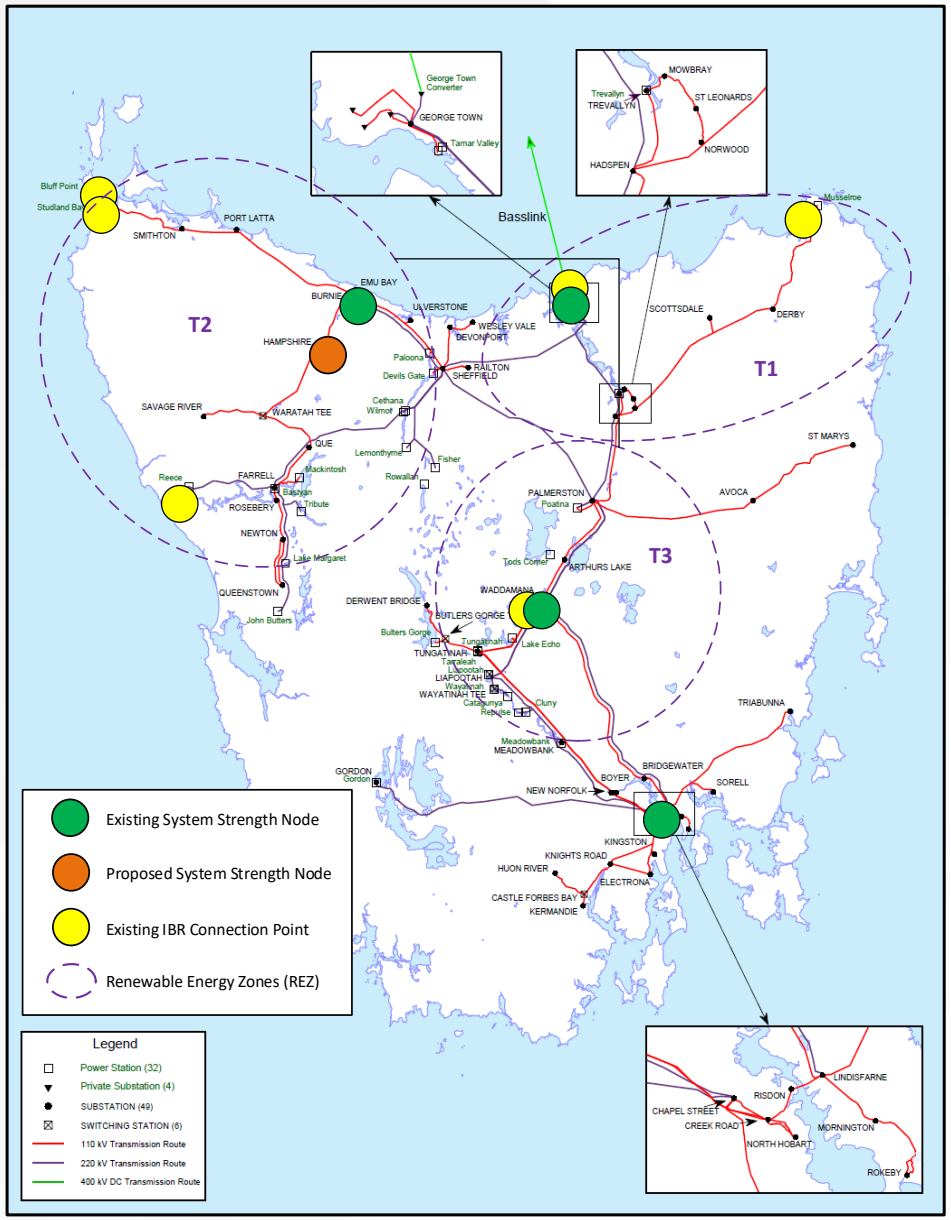
Forecast system strength requirements



- ✓ System strength is managed across the network using nominated '*system strength nodes*' (**SSN**).
- ✓ Four nodes are currently used to help manage system strength 'shortfalls'.
- ✓ In future, a fifth node (Hampshire Hills) is anticipated to help manage developments in the yet-to-be-built north west 220 kV network associated with REZ T2.
- ✓ Forecast IBR capacity increases are linked to each SSN.

Minimum three phase fault levels

SSN	Min 3ϕ FL	REZ
George Town 220 kV	1,450 MVA	T1
Burnie 110 kV	850 MVA	T2
Waddamana 220 kV	1,400 MVA	T3
Risdon 110 kV	1,330 MVA	n/a
Hampshire Hills 220 kV	*1,650 MVA?*	*T2*

Forecast additional IBR capacity (MW)

Reference SSN	2024	2025	2026	2027	2028	2029
Burnie 110 kV	0	0	0	0	0	83
George Town 220 kV	0	258	258	258	258	258
Waddamana 220 kV	0	0	275	275	275	279
Risdon 110 kV	0	0	0	0	0	0
Hampshire Hills 220 kV	0	0	0	0	0	0
Aggregate new capacity (MW)	**0**	**258**	**533**	**533**	**533**	**620**

Reference SSN	2030	2031	2032	2033
Burnie 110 kV	83	83	83	83
George Town 220 kV	376	376	376	376
Waddamana 220 kV	768	768	823	823
Risdon 110 kV	0	0	0	0
Hampshire Hills 220 kV	268	268	1218	1218
Aggregate new capacity (MW)	**1495**	**1495**	**2500**	**2500**

As published within **AEMO's 2022 System Strength Report**.

Forecasts have been influenced by the Tasmanian Renewable Energy Target (**TRET**).

www.aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/nem-forecasting-and-planning/system-security-planning

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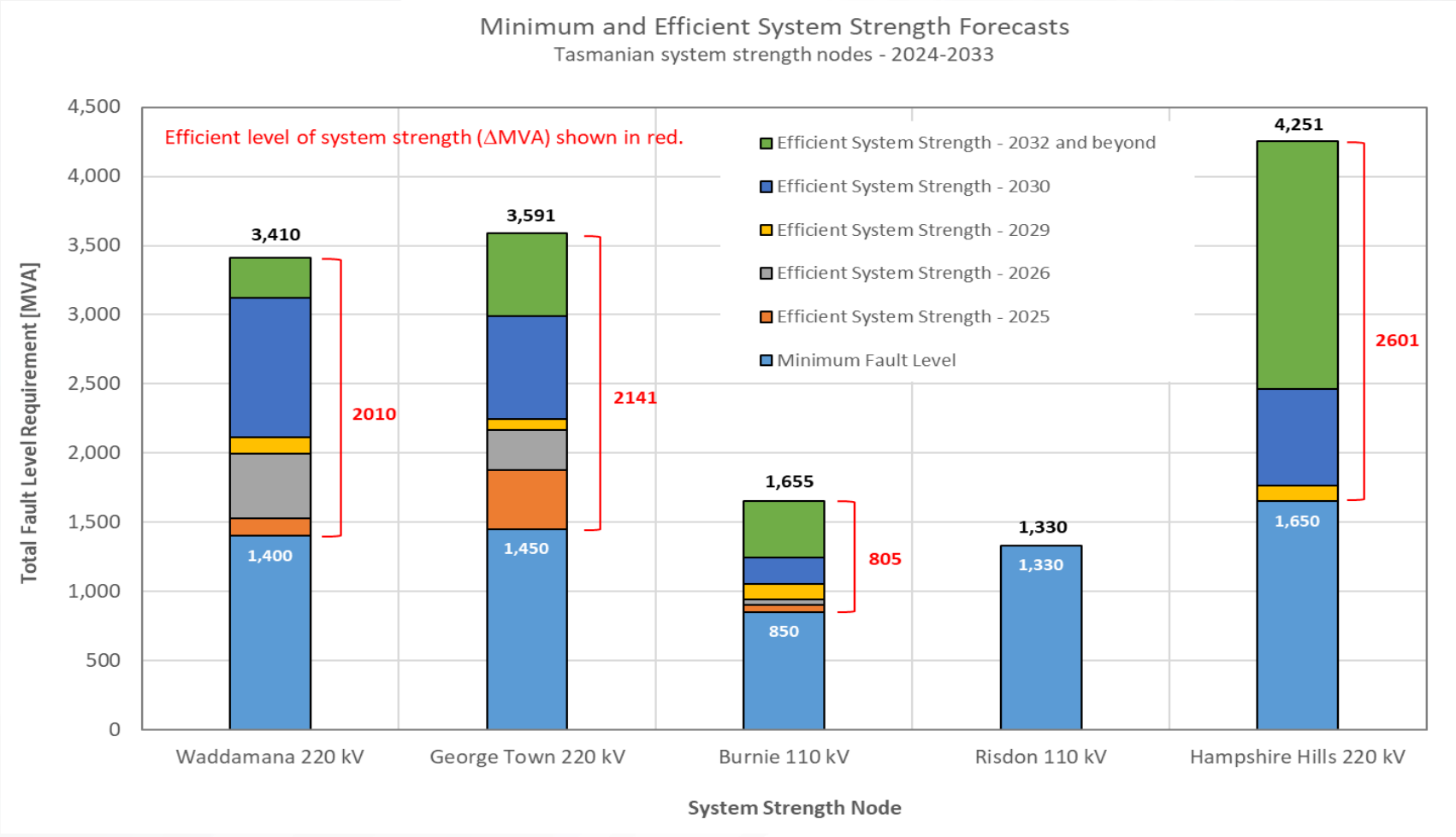
Overall system strength requirement (MVA)



This is the result of 'converting' the IBR capacity forecasts into an equivalent three phase fault level requirement at each SSN. A number of assumptions required to perform this analysis! Likely to be conservative in our view.

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Credible options to address the identified need

Non-Network solutions

- Synchronous generators continuing to participate in the energy market
- Synchronous condensers owned and operated by third parties
- Contributions from Battery Energy Storage Systems (BESS)
- Synchronous generators able to operate at low power output when not required for energy production

Network solutions

- Synchronous condensers installed as network assets

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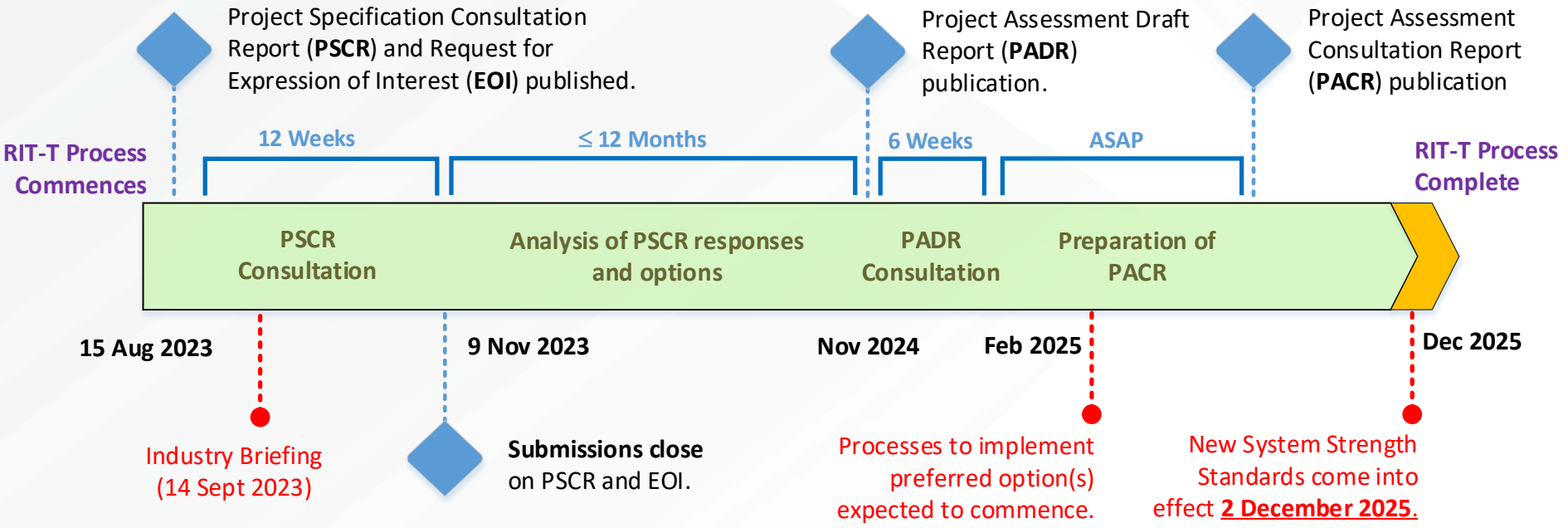
Overview of the RIT-T process

- ✓ RIT-T framework is defined within Chapter 5 of the NER.
- ✓ Efficient expenditure is ultimately approved by the AER in a process separate to the RIT-T, but that will have regard to RIT-T outcomes.



Basic objective:

Determine the credible option that satisfies the 'identified need' at the least net cost while taking into account relevant technical and practical constraints.

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Where are we at?

- ✓ Project Specification Consultation Report (**PSCR**) published on 15 August.
- ✓ A request for Expressions of Interest (**EOI**) has been issued in parallel.
- ✓ Stakeholder consultation period is **open until 2PM Thursday 9 November**.

What are we seeking from you?

- ✓ Feedback on the PSCR which you feel needs to be considered (in the next stage of the RIT-T process).
- ✓ Submissions from interested providers of *non-network services*.
  - ➢ Important for us to validate what we believe are the credible options, including what opportunities might exist in the future.
  - ➢ Provides us with the necessary input data to perform defensible cost benefit analysis (across the different options identified).
  - ➢ Promote the most efficient use of power system assets.

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How to respond and access more information?

All documentation and communications related to this RIT-T, including the PSCR and EOI, are available from TasNetworks website:

www.tasnetworks.com.au/Poles-and-wires/Planning-and-developments/Our-current-projects/Meeting-System-Strength-Requirements

Email submissions or queries in relation to the PSCR to:

regulation@tasnetworks.com.au

Submissions and queries in relation to the EOI should be made through Tenderlink.

For any further advice on our System Strength RIT-T, please contact:

Chris Noye
Leader Regulation
Tasmanian Networks

via the regulation email address given above.

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What comes next?

- ✓ Preparation and publication of the Project Assessment Draft Report (**PADR**) within 12 months of the PSCR consultation ending.
- ✓ The PADR must include:
  - A description of the credible options that have been assessed.
  - Indicative costs associated with each credible option.
  - A description of the methodologies used to quantify costs and benefits.
  - Net present value analysis for each credible option.
  - The proposed **preferred option**.
  - Responses to any formal PSCR submissions.
- ✓ Publication of the PADR is followed by a 6-week consultation period.
- ✓ **Updates to the RIT-T, including future engagement opportunities will be emailed to webinar participants.**
- ✓ A Project Assessment Consultation Report (**PACR**) will complete the RIT-T process.
- ✓ **Tuesday 2 December 2025** is a non-negotiable end date!

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Recap of key discussion points

- ✓ The basic concepts which underpin ‘system strength’ and why we need to actively manage it going forward.
- ✓ TasNetworks obligations under the NER and implications for other stakeholders.
- ✓ Forecasted IBR developments in Tasmania that need to be planned for.
- ✓ Conservative estimates of future system strength requirements which will be analysed in more detail alongside confirmed credible options.
- ✓ How the RIT-T process is being applied by TasNetworks to address the identified needs of the Tasmanian power system.
- ✓ How stakeholders can get involved and assist us.
- ✓ Next steps to be aware of and participate in.

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Thanks for participating.

Questions?

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