TasNetworks
Delivering your power

Tasmanian Networks Pty Ltd
ABN 24 167 357 299
PO Box 606
Moonah TAS 7009

7 May 2020

Mr John Pierce
Chair
Australian Energy Market Commission
PO Box A2449
Sydney South NSW 1235

Dear Mr Pierce

RE Investigation into System Strength Frameworks in the NEM

TasNetworks welcomes the opportunity to respond to the Australian Energy Market Commission's (**AEMC**) discussion paper on the Investigation into System Strength Frameworks in the National Electricity Market (**Discussion Paper**).

TasNetworks is the Transmission Network Service Provider (**TNSP**), Distribution Network Service Provider (**DNSP**) and Jurisdictional Planner (**JP**) in Tasmania. TasNetworks is also the proponent for Marinus Link, a new interconnector between Tasmania and Victoria. The focus in all of these roles is to deliver safe, secure and reliable electricity network services to Tasmanian and National Electricity Market (**NEM**) customers at the lowest sustainable prices. TasNetworks is therefore appreciative of the AEMC's efforts to review the system strength framework in the NEM.

Noting that the AEMC is undertaking this review in parallel with rule changes relating to similar issues as well as the Energy Security Board's (**ESB**) post 2025 reform work on system services and ahead markets, TasNetworks is expecting a somewhat iterative process as stakeholders respond to the various concepts raised through each process. As each piece of work reaches its next stage it will be important to review progress in the other work streams to prevent duplication of effort and to take on board progress made elsewhere.

TasNetworks has contributed to, and supports, Energy Networks Australia's (**ENA**) submission.

TasNetworks' responses to specific questions are provided as an attachment to this letter. We would welcome the opportunity to discuss any aspects of our response in further detail.

Should you have any questions, please contact Chantal Hopwood, Leader Regulation, via email (chantal.hopwood@tasnetworks.com.au) or by phone on (03) 6271 6511.

Yours sincerely

Wayne Tucker

General Manager, Regulation, Policy and Strategic Asset Management

TasNetworks detailed responses to issues raised by the AEMC

1. Minimum system strength framework

TasNetworks agrees that the issues with minimum system strength highlighted by the AEMC are worthy of review. From our perspective, the objective should be to further enhance the minimum system strength aspects of the framework, rather than assume a wholesale change to the entire system strength framework is required. We contend that elements of the existing minimum system strength framework are already applied in an appropriate manner to cater for both normal operating conditions as well as clearly defined outage events (including credible contingencies and reclassifications).

Potential enhancements include how to better manage longer term forecasting and planning (of system strength requirements) to enable TNSPs to coordinate future network developments. This would enable the adoption of proactive strategies rather than having to react to change almost 'as it happens'. Another enhancement would be to consider, in addition to the impact of intermittent renewables (both large and small scale), the impact of a reduction in system operational demand and the feedback effect this would have on 'typical' generation dispatch requirements.

TasNetworks is already utilising a combination of contracted *system strength services* and network constraints to manage minimum system strength scenarios. Given the lack of extended operational experience with the new rule mechanisms, TasNetworks would prefer to see any changes to the framework which impact on operational time frames to be introduced in an incremental staged manner. We expect that process improvements will likely be identified over time as learnings occur.

TasNetworks acknowledges that the defined minimum levels of system strength (and inertia) currently required to be maintained do not include a substantiative margin to provide added resilience for non-credible contingencies (of various criticality from N-1+ to N-M events). While doing so would obviously be of technical benefit to the power system, it would first be necessary to define 'how much resilience' is appropriate and then consider the corresponding cost of delivery.

In TasNetworks' view, while the intent is technically sound, there is a significant amount of thinking and analysis to do to progress this particular concept including the intended scope (expectation) of emergency frequency control schemes such as that provided by under frequency load shedding (**UFLS**). What non-credible contingencies should the system have a high probability of surviving as compared to 'best endeavours with no guarantees'? TasNetworks has previously floated the concept of 'reference contingency events' which may prove relevant to future deliberations in this space. Previous AEMC reviews have considered the increasing level of uncertainty that needs to be managed in an operational environment. The application of the 'resilience concept' to system strength is really just an extension to that discussion in our opinion.

2. Do no harm framework

TasNetworks broadly agrees with the issues raised by the AEMC, noting that system strength impact assessments involved in the connection of each new generator are at times both intensive and an iterative process.

From our perspective, a significant consideration is how best to coordinate system strength remediation schemes across multiple independent projects so as to deliver the best outcomes for generation developers as well as other stakeholders. This issue can arise in various combinations, for example:

- Projects are in practice occurring concurrently or have near equivalent development time frames.
- There is a high degree of certainty that multiple projects will progress in a given area of the network, but may be physically executed at different points in time after the 'first mover'.
- One project is progressing in an area of the network that is earmarked for future development opportunities (REZ as an example), with timing and scale of subsequent developments being uncertain.

We concur that there is value in considering rules based mechanisms that promote and incentivise scale efficient solutions which support the connection of more than just one specific *generating system*. That is, to encourage solutions that take into account the surrounding network circumstances. Design considerations should extend beyond just 'the provision of fault current' and look to address the broader requirements of the network where cost effective, including, for example, the provision of inertia or voltage control capability (across different time frames).

There will be situations where a centrally coordinated solution will ultimately deliver the best outcome for all concerned, including customers. As mentioned in the Discussion Paper, differing project schedules and cost allocation methodologies are but two significant challenges to be considered as part of this exercise.

3. Characterisation of system strength

TasNetworks is of the view that the specific issues grouped under the general heading of 'system strength' need to be clearly documented and agreed as a first step in the framework review process. While industry understanding of the technical issues being experienced across the NEM has certainly improved (and will continue to evolve), there is still work to be done to define the framework elements which require further refinement.

While the provision of 'fault current' is an important element, it is not the only issue to be addressed. The impacts of insufficient system strength can manifest in many ways across different timeframes and can be effectively solved by various mitigation measures depending on the exact needs of the power system, including through the use of Flexible AC Transmission System (**FACTS**) devices in certain circumstances. It is important that potential solutions to problems are not inadvertently overlooked or inappropriately dismissed without the appropriate level of consideration.

On this basis, TasNetworks contends that there is scope to review the National Electricity Rules (**NER**) system strength service definition. While contribution to three-phase fault level will continue to be important, other factors are also relevant and dependent on the performance characteristics of the network and generating equipment installed. As noted above, TasNetworks would prefer to see incremental change introduced in a staged manner rather than a reflex response to any specific review outcomes.

It is also becoming increasingly important that alignment with international frameworks is considered. While Australia has been at the forefront of a number of technical challenges, they are not unique to the NEM, with a variety of solutions (both technical and market developments) being actively progressed elsewhere in the world, thereby providing valuable learning opportunities. Reference [1] provides useful insight to contemporary thinking including the most important attributes of system strength in the context of the European power system.

TasNetworks sees benefit in the AEMC establishing an 'expert panel' to work through the characterisation of system strength in a collegial environment. This approach is likely to be more efficient than publishing further discussion material and then seeking written submissions.

4. Application of markets to system strength

At this point in time, TasNetworks has reservations related to:

- Attempts to commoditise all system strength services. In TasNetworks' view, synchronous generators dispatched in the energy market should not be compensated for a service that is delivered without additional operating cost and is an inherent part of the equipment's normal operating characteristics.
- Implementation of centralised, co-optimised markets for the provision of system strength through AEMO's National Electricity Market Dispatch Engine (**NEMDE**). Some of TasNetworks' practical experiences with managing minimum fault levels through dispatch constraints are:
    - Formulation of dispatch constraints which properly describe the physics of system strength and related equipment limitations is very difficult. Determining a meaningful relationship between system security and an incremental change in dispatch outcome (described in terms of a delta MW change) may not be possible, e.g. reducing the MW output of inverter based resource (**IBR**) may not address the system security issue if the underlying issues are driven by IBR status (online or not).
    - Depending on how constraints are formulated, the 'binary, lumpy' nature of providing additional system strength can result in very large changes in the energy market, i.e. there may be a significant difference between a binding constraint condition and the counterfactual outcome. The potential dispatch volatility that this could create is a matter for consideration.
    - Neither of these issues are addressed by simply introducing synchronous machine status into the co-optimisation process. It is anticipated that operationalising constraints of this nature will be difficult, raising the question as to what alternative solutions may be more appropriate.
- For the purposes of transparency, TasNetworks does contend there is scope to co-optimise the dispatch of *inertia network services* through NEMDE. The relationship between the generation output of IBR (MW), contingency size (MW), interconnector flows (MW), system inertia (MW.s) and the resulting rate of change of frequency (ROCOF) are much easier to determine and are less affected by the

issues described above for system strength if the constraint formulation is well considered.

Preparation of updated ROCOF limit advice for Tasmania to reflect this position is a work in progress at the current time.

Regardless of the ability to commoditise services or not in an operational environment, TasNetworks is not in favour of relying on markets to deliver essential levels of system strength and inertia (as depicted by the green area in Figure 3.3 of the Discussion Paper). Amongst our concerns is that in many circumstances the number of potential suppliers of these services will be limited. Taking into account the locationally specific nature of some services there may be only be one provider, which makes a market process sub-optimal. Our preference is to use contracts or similar instruments to guarantee access to specific reserves which are available on-call across the contract period to supplement services inherently delivered via the energy market.

This approach is justified because it:

- Provides the necessary level of assurance that the power system can be secured on a continuous basis across a broad range of operating conditions.
- Enables locational aspects of system strength to be more easily managed in real time.
- Should contribute to more predictable and transparent network operating costs, with market volatility being a significant potential issue (as demonstrated by FCAS costs in South Australia in recent years).
- Encourages existing and potential new service providers to invest in solutions knowing that stable period contracts are available to help justify capital expenditure, whether this is for new installations, funding retrofits to existing plant to increase capability, or simply maintaining existing capability to satisfy reliability and availability targets.

TasNetworks' most recent activities to address both system strength and inertia shortfalls (as declared by AEMO in November 2019) have applied the following principles:

- An ongoing reliance on synchronous generators normally dispatched through the energy market to provide their inherent capabilities for free.
- Address shortfall conditions through one or more of the following credible solutions:
    - Consideration of contracts with appropriately located generators offering synchronous condenser and/or minimum load running capabilities.
    - Consideration of network investment where existing generation or synchronous condenser capabilities are insufficient, inappropriately located to efficiently provide the necessary levels of support, or prohibitively expensive to operate when needed.

In determining the final mix of solutions, the overarching principle of least cost has been applied as per the existing rules requirements.

In understanding the generation dispatch combinations which give rise to shortfall conditions, our analysis has concluded that in the Tasmanian region, system inertia is likely to be the dominant metric. That is, if synchronous inertia is maintained above the *secure operating level of inertia*, then system strength requirements (fault levels) will in many cases be satisfied without further action or will only require a minor 'top-up'. Being a synchronous island with a good geographical distribution of synchronous generating units, there is a more direct relationship between inertia and fault levels. This makes the situation somewhat easier to manage than when inertia can be provided from other remote regions across AC interconnectors without the corresponding system strength provisions.

5. Evolving system strength frameworks

The model proposed by the AEMC based on Plan, Procure, Price and Payment is supported by TasNetworks with a caveat that one additional component be added.

TasNetworks recommends that 'Process' be added into the mix at step two to address practical implementation issues like:

- Is the cost and complexity of implementing the plan actually worth the effort? Consider trade-offs between what might be seen as ideal versus what is practical.
- How can the plan be operationalised, i.e. how can it be made work in the real power system taking into account normal day to day control room activities and the inherent limitations of NEMDE?
- What operational tools would we need to make the plan work? What feedback from the network (measurements) and/or real time analysis capability would be needed to execute the plan successfully?

Process is considered an important inclusion in the mix given that the complexity of operationalising certain solutions may simply render them impractical. As highlighted by the AEMC, system strength is already a complex issue and it is important that solutions do not become unwieldy.

6. Potential models

Given the detailed discussion associated with the four models presented, TasNetworks will refrain from offering comments on each.

Our view is that the likely end solution will be a hybrid, with a significant bias toward the centrally coordinated model. As alluded to above, there are elements of the market based de-centralised approach that may prove to be practical and appropriate for implementation, especially for the management of system inertia (treated here as another element of system strength for all practical purposes).

There may also be elements of the access standard model that are worthy of consideration, including a potential revisit of minimum short circuit ratio (**SCR**) requirements as part of NER Schedule 5.2 (Conditions for connection of generators).

TasNetworks contends that a holistic review is needed which maintains a focus on the four key outcomes described for the NEM as part of the Finkel Review, being increased security, future reliability, rewarding consumers and lower emissions. As a result, the aim should be to

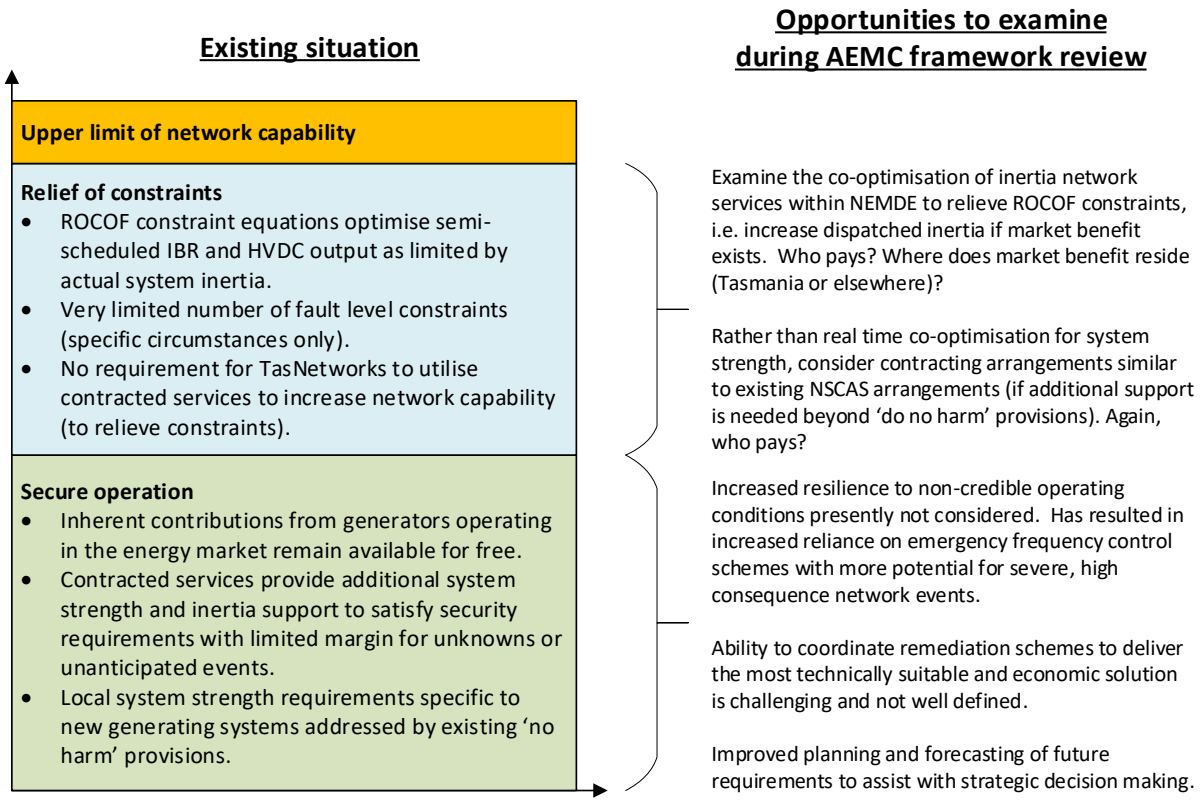
identify whatever elements work best together to deliver the most efficient and economic outcomes for all stakeholders.

On the basis that system strength is a necessary pre-condition to meet a range of network performance standards it is TasNetworks' view that regardless of the model chosen system strength should be considered a network service.

7. Summary of current situation and potential enhancements to framework

By linking the various ideas together, TasNetworks has been working towards the following solution which we believe is supported by the existing system strength framework. The current situation is considered workable and manages power system security in a rules compliant fashion.

TasNetworks does acknowledge however that refinement to the framework would be beneficial, with the key issues for Tasmania reiterated from the above discussions.



8. Distribution network considerations

To the best of TasNetworks' knowledge, system strength is not currently presenting as a technical limitation in the Tasmanian distribution network. For reference, Tasmania currently has just over 160 MW of rooftop solar PV installed (as at the end of April 2020).

It can be noted that during the process of determining the number and location of fault level nodes within the Tasmanian transmission network, as well as the corresponding minimum secure fault levels, TasNetworks considered the historical minimums calculated and published for these locations as part of previous Annual Planning Reports (**APR**). It was known that the published minimum fault levels had been used as a starting point for downstream grading of

protection systems in the distribution network. As it was not clear what 'safety margins' may have been applied over the years, the approach adopted when determining the minimum secure fault levels was to maintain operation of the transmission network at or above the published minimums (taking into account other considerations as relevant to determine the final values).

While this approach may have been considered conservative at the time, it has most likely provided TasNetworks with an operating margin to deal with ongoing installation of distributed energy resources (**DER**) at medium (**MV**) and low voltage (**LV**) connection points. The concern at the time was primarily related to the performance of overcurrent based protection systems (including basic devices like fuses) with a strong focus on equipment and public safety.

Given our dual role in the Tasmanian region, TasNetworks will continue to monitor and assess the situation as distribution network developments continue to occur. While management of system strength issues at the transmission level are currently of much higher priority in our view, TasNetworks would still suggest that any future changes to the system strength framework enable consistency of approach across voltage levels as far as is practical to do so.

References

[1] ENTSO-E Technical Group; "*High Penetration of Power Electronic Interfaced Power Sources and the Potential – Technical report*", Available at:

https://eepublicdownloads.blob.core.windows.net/public-cdn-container/clean-documents/Publications/SOC/High_Penetration_of_Power_Electronic_Interfaced_Power_Sources_and_the_Potential_Contribution_of_Grid_Forming_Converters.pdf