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Mr John Pierce AO
Chair
Australian Energy Market Commission
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Lodged online via: www.aemc.gov.au

Dear John,

EPR0070 – Investigation into intervention mechanisms and system strength in the NEM

TransGrid welcomes the opportunity to provide comments on the Australian Energy Market Commission's (**AEMC**'s) consultation paper on the Investigation into intervention mechanisms and system strength in the National Electricity Market (**NEM**).

TransGrid is the operator and manager of the high voltage transmission network connecting electricity generators, distributors and major end users in New South Wales and the Australian Capital Territory. TransGrid's network is also interconnected to Queensland and Victoria, and is instrumental to an electricity system that allows for interstate energy trading.

Australia is in the midst of an energy transformation. This is primarily driven by changing community expectations and choices, advances in renewable energy technologies, retirement of existing generation, and the adjustments required in Australia's economy to meet our international climate change commitments. These changes raise complex issues in relation to the design of the NEM, which must adapt to these changes and provide the basis for low emissions, reliable supply at the lowest cost to consumers over the long run.

We agree with the AEMC that it is the right time to consider the operation of the system strength framework to make sure it is able to produce the best outcomes for consumers going forward, while addressing emerging system strength issues across the NEM. However, we disagree that it is possible to consider these issues without looking at the system strength framework as a whole, including the "do no harm" obligations on proponents of new generator connections.[1] While the current framework has effectively addressed the immediate system security concerns relating to falling system strength on the power system, we consider that moving toward a more coordinated approach to system strength which is integrated within existing planning and investment frameworks would better achieve efficient total system costs which is in the long-term interest of consumers.

Our comments immediately below consider the system strength framework as a whole. Our comments further below respond to the specific issues relating to the system strength framework the AEMC has raised in the consultation paper.

We have not commented on other matters in this review relating to the interventions framework, however as a general principle we consider approaches that minimise costs for consumers and minimise impacts on efficient market signals are to be preferred.

[1] See AEMC, *Managing power system fault levels rule*, September 2017.

The current system strength framework is not producing efficient outcomes and should be changed

The current framework creates a shared responsibility for managing system strength so that the power system remains in a secure operating state. The Australian Energy Market Operator (**AEMO**) is tasked with setting minimum fault levels at nodes across the NEM, forecasting emerging shortfalls and directing transmission network service providers (**TNSP**s) to procure system strength services to address any shortfalls. TNSPs must address those shortfalls when directed to, and new connecting generators must "do no harm" to the security of the power system when they connect, including remediating any adverse impact on system strength.

This framework creates relatively clear responsibilities and is therefore likely to maintain system strength at levels that are manageable, helping to keep the power system in a secure operating state. The separation of responsibilities is theoretically consistent with the current access arrangements for the NEM, but we would argue this has occurred at the expense of aligning the framework more closely with the frameworks for planning and investment to address power system needs. The result is a framework that is a far more expensive way to achieve a secure power system than the alternatives.

The current framework is too reactive and does not allow for efficient long term planning

The current framework relies on AEMO being able to accurately forecast the emergence of system strength issues before they can be addressed by a TNSP. In essence, it is a reactive framework. However, forecasting levels of system strength over the short-term, in order to react to shortfalls, is difficult. Significant areas of uncertainty in the factors that contribute to system strength result in a high risk of shorter term changes in fault levels occurring without enough time to respond in the most efficient way.

Forecasting emerging system strength issues in the short term (i.e. within 5 years) relies on having good information available on a range of factors that are difficult to predict, such as synchronous generator retirement, asynchronous generator connection, as well as changes in network and generation operating patterns. System strength levels can change as network operations vary and as generators react to changes in the energy market (such as makeup of the generator fleet) and even costs outside of the energy market (such as coal and gas prices). Further, new asynchronous generators can be proposed, built and commissioned within 18 months, with immediate impacts on dispatch patterns. These timescales clearly do not align with AEMO's obligation to consider emerging system strength shortfalls over a 5 year planning horizon.

The reactive approach under the current system strength framework involves a high risk of shortfalls occurring that are not able to be foreseen with enough warning to address the issue efficiently and at lowest cost. This issue cannot be mitigated by simply asking AEMO to improve its forecasting abilities, or by extending the planning horizon it is required to take into account beyond 5 years. The issue stems from the practical engineering reality that by the time a system strength issue is able to be foreseen with a high degree of certainty, there is unlikely to be enough time to address it in the most efficient way. Accordingly, under this framework there could be extended periods of time where AEMO is required to resort to costly interventions to maintain sufficient levels of system strength, or alternatively periods where a limited pool of synchronous generators (given the localised nature of system strength issues) are being paid to provide system strength services until longer term solutions are put in place.

We consider the most efficient way to address system strength issues over the long term is, in most cases, for timely investments to occur in larger synchronous condensers (or potentially alternative technologies) that provide fault current at strategic locations in the power system. The current framework however does not accommodate a planned and strategic approach to addressing system strength issues over the long term as the power system transforms. Indeed, there is no ability for TNSPs to effectively plan for emerging system strength issues, given it is AEMO's responsibility to forecast these issues. Further, there is no ability for TNSPs to incorporate these issues in their usual planning and investment processes that look beyond the 5 year horizon that AEMO is required to take into account. The current framework therefore results in reactive approaches to address system strength issues incrementally as they are identified by AEMO, and in doing so fail to take advantage of the cost efficiencies that could occur were the issues to be addressed and coordinated on a scale-

efficient basis (including to co-optimise investments to address other issues, such as inertia) through the usual network planning and investment processes.

The do no harm obligations on new connecting generators lead to significant inefficiencies in practice

The allocation of part of the responsibility of maintaining levels of system strength to connecting generators through the "do no harm" obligations is resulting, in practice, in a proliferation of smaller synchronous condensers across the power system that are not efficiently coordinated in either investment or operation. This is significantly more costly for consumers than alternative approaches.

In terms of like-for-like capacity it is much more costly to install many smaller synchronous condensers than in is to install fewer, larger synchronous condensers. As a point of reference, ElectraNet has proposed installing four synchronous condensers to address the Network Support and Control Ancillary Services (**NSCAS**) gap identified by AEMO, at an estimated (central case) cost of around $160 million. The cost of providing a similar amount of capacity by installing smaller synchronous condensers typically used by connecting generators (usually in the order of $15 to $20 million each) is far greater.

However, that cost difference on a capacity for capacity basis is just the beginning. The proliferation of smaller synchronous condensers driven by the "do no harm" obligations also increases costs in a range of other areas and fails to optimise the benefits of installing synchronous condensers. Reasons for this include:

- Synchronous condensers installed by connecting generators are not placed at optimal locations to support the broader power system. The location and timing of installation is outside the control of TNSPs, leading to poorly coordinated investments in system strength services.
- The synchronous condensers are owned and operated by generators who are required to address their own impact on the power system. There is a fuel cost to run synchronous condensers and there is no incentive for generators to provide system strength services (or inertia services) for the benefit of others. Accordingly, it is unlikely they will operate their synchronous condensers when their own plant is not generating. In fact, there is likely a positive incentive not to incur costs to provide system strength services to alleviate constraints on the shared network and support the connection and dispatch of competitors.
- As there is no certainty that inverter based generators will operate their synchronous condensers at all times, TNSPs will likely still need to procure system strength services, particularly as the power system evolves over the longer term. Given the above point, and the fact that there will be a limited number of counterparties to negotiate with for the provision of system strength services, it is likely to be costly to procure system strength services from generators. We note this was also the experience of ElectraNet when considering options to address the shortfall in system strength in South Australia.
- Increasing the number of smaller synchronous condensers on the power system unnecessarily increases the complexity of the system, leading to increased modelling and operating costs for AEMO and TNSPs. Synchronous condensers owned by different parties that are close together could also create challenges in coordinating control systems and managing adverse interactions. Flow on impacts of this complexity could also include an increase in data flows across the power system and potentially the need to bring forward upgrades to communications infrastructure.
- The increased complexity of the power system also increases the costs for new generators to connect to the power system. These costs include power system modelling, preparation and agreement of system strength remediation arrangements and time delays associated with these tasks, in addition to the costs of installing, operating and maintaining synchronous condensers to support their connection. These costs are significant and create unnecessary barriers to entry for prospective generators, further limiting competition in energy services.

All of these cost increases add up to a significant impact across the power system. The costs to AEMO and TNSPs directly flow through to consumers, whereas the costs to connecting generators indirectly flow through to consumers as wholesale market costs.

When these costs are added to the potential for significant market impacts resulting from the other parts of the system strength framework (such as interventions and intervention pricing), the overall

costs of the current framework are significant. We consider alternative arrangements are needed, as a matter of urgency, to reduce costs for consumers and improve the efficiency and coordination of approaches to address the issues of system strength and inertia in the power system.

While we note that the inertia framework does not have costs associated with "do no harm" obligations, the synergies of addressing inertia together with system strength (due to the similarity in technical solutions) suggest that aligning the inertia framework with the system strength framework would produce the most efficient outcomes.

Proposal for a better system strength and inertia framework

We consider a framework for managing system strength should be integrated within existing planning and investment frameworks for TNSPs in the NEM. However, we appreciate the complexity of doing this in a way that is also flexible enough to adapt as that planning and investment framework evolves. This includes taking into account work being done by the Energy Security Board and the AEMC to embed the Integrated System Plan (**ISP**) in the rules, to consider access and charging arrangements, and to support the development of renewable energy zones.

At a high level, we propose that the requirements for proponents of connecting generators to "do no harm" to minimum fault levels should be removed. The obligations to address system strength issues should be placed on AEMO and TNSPs, consistent with their responsibilities to manage other power system security services, such as voltage. As such, system strength services should be defined and the responsibility for providing them clearly allocated. Consumers should face lower overall costs for scale-efficient long term solutions with costs transparently recovered through the economic regulatory framework.

Broadly, we consider the following roles and responsibilities are appropriate in an alternative framework and are consistent with the existing functions of these entities:

> AEMO:
  - determine efficient levels of system strength across the power system to maintain power system security, similar to current arrangements setting minimum fault levels at nodes identified by AEMO
  - provide longer term scenario based projections of system strength across the power system in the National Transmission Network Development Plan (**NTNDP**) and ISP process, and
  - monitor and provide shorter term projections for system strength on the power system, for example through the Medium Term Projected Assessment of System Adequacy reporting.

> TNSPs:
  - are required to plan, invest in and operate the power system to minimise the risk that fault levels fall below the minimum levels identified by AEMO (this could, for example, be achieved by including specific system security obligations relating to system strength under Schedule 5.1 of the National Electricity Rules (NER) that are linked to the minimum fault levels determined by AEMO), and
  - are allowed to invest in further system strength services where doing so would produce more efficient market outcomes (including where required by AEMO through the declaration of an NSCAS gap, or where the Regulatory Investment Test for Transmission (**RIT-T**) is passed on a market benefits test).

> The AER undertakes cost scrutiny of the proposed investment through existing frameworks (such as the regulatory determination process) to confirm the efficiency of proposed approaches to addressing system strength issues, to help discipline costs and maximise the benefits for consumers.

These arrangements could be mirrored for other emerging power system security services, such as inertia. The AEMC should also consider whether it is appropriate to include separate and discreet 'grid forming services' that may be needed even where sufficient system strength and inertia are present.

We consider it is important for efficient levels of system strength to be set independently by AEMO, and based on a methodology that is developed in a transparent and open manner, such as through the rules consultation procedures. With the removal of the "do no harm" obligations under this proposal, AEMO's methodology would need to take into account projected new generator connections across the power system. This task may become easier as the issues of access and arrangements for the development of renewable energy zones are clarified.

AEMO is also the appropriate body to be tasked with projecting longer term trends in system strength across the power system given its role as transmission planner under the NTNDP / ISP process. Longer term projections taking into account the known end of life of synchronous generators, connection of asynchronous generation and other power system changes are likely to be less volatile than shorter term projections. Shorter term monitoring and projections are also necessary for monitoring and compliance and for AEMO to consider whether it is appropriate to declare an NSCAS gap. AEMO is naturally well placed to fulfil these roles given its operational role in market frameworks that interact closely with the physical provision of system strength, such as the dispatch of energy on the power system.

Information from TNSPs will play an important role feeding into AEMO's tasks of setting efficient fault levels for the power system, and conducting long term projections of system strength.

The information published by AEMO should then be taken into account in TNSP planning frameworks, such as the Transmission Annual Planning Reports (**TAPR**s). The TAPR provides useful information for stakeholders in relation to network planning and potential opportunities for non-network alternatives. As such, it is an important part of the overall process to identify emerging needs and develop the most efficient response to those needs across the power system. Scale-efficient solutions to address long-term needs are likely to be the cheapest overall for consumers. Including the management of system strength within the TNSP's planning framework should naturally flow into the investment and economic regulation frameworks, allowing TNSPs to include the procurement of system strength services (whether through operational or capital expenditure) within the revenue determination and RIT-T processes.

TNSPs would need to provide system strength services to support the connection of new generation, as well as the retirement and changed operating patters of existing synchronous generation. TNSPs are best placed to plan and coordinate options to provide system strength services. This avoids the problems associated with generator owned synchronous condensers. It also allows TNSPs to manage the provision of system strength services proactively, so there is little risk of having to rely on AEMO interventions to address shortfalls. Lastly, it allows TNSPs to manage system strength efficiently within the broader asset management framework. For example, as system strength is also influenced by impedance on the physical network, the asset management strategy relating to replacement and retirement of network elements can take into account the optimal outcomes for the provision of system strength services.

The transparency of the TNSP's investment processes, together with the AER's role in determining prudent and efficient network expenditure in providing services, is an appropriate mechanism to discipline the costs of providing system strength services.

Matters raised in the consultation paper

In addition to the above more general comments, we have a number of comments on the issues specifically raised in the consultation paper.

The optimal outcome for the management of system strength on the power system is for:

1. an efficient level of system strength to be provided across the system to ensure its security and minimise inefficient market impacts (such as a high risk of constraints and interventions)
2. shortfalls in system strength to be predicted accurately and well in advance, and
3. the shortfalls identified to be rectified in a timely fashion and at lowest overall cost.

Our comments below touch on each of these components.

Firstly, the minimum fault levels AEMO is required to set at nodes across the power system do not represent an efficient level of system strength to be provided across the power system to ensure

system security *and minimise inefficient market impacts*. The levels only seek to address power system security issues.

Secondly, emerging system strength issues are inherently difficult to predict in the short term and so a finely balanced framework that keeps the levels of system strength on the power system at *efficient* levels is not possible. Under this approach there will be times where system strength levels drop below that efficient level, simply because of the unpredictability of some short term changes in system strength. Within the current framework there are two ways to mitigate the risk and cost associated with uncertainties in forecasting reductions in system strength:

> by increasing the minimum level of system strength required to a level above the most efficient amount needed to keep the power system in a secure operating state (and, we argue, minimise inefficient market impacts), or

> by being more conservative in forecasting system strength levels, so that the risk weighting of the level forecast is closer to a 'worst case' scenario.

Each of these approaches involves taking a more conservative outlook to plan for unforeseen circumstances. The benefits of taking a more conservative approach are significant, including reducing connection costs for proponents of generator connections, the market costs of constraints and the impact of interventions to address system strength issues.

Taking a more conservative approach that captures these benefits could also be achieved by effectively incorporating system strength adequacy within the planning and investment framework for TNSPs, as proposed above. The approach proposed above would also have additional benefits of aligning the framework to address system strength issues with the planning and investment frameworks for TNSPs, as well as ensuring those investments are disciplined by the economic regulatory frameworks that apply to TNSPs.

Lastly, aspects of the current framework make it difficult for TNSPs to address identified system strength issues in the most efficient way. For example:

> The five year planning horizon for AEMO to forecast emerging system strength issues is not sufficient to allow for TNSPs to respond in the most efficient way. Even if AEMO identifies a shortfall at the extremity of that range, addressing that issue may not be possible within the TNSP's revenue reset process. That process begins with identifying needs well in advance, and identifying projects to address those needs about two years before the regulatory control period begins.

> The current framework does not require a RIT-T process to be conducted where the projected shortfall occurs within 18 months. However 18 months is only just long enough to conduct a RIT-T, and does not allow sufficient time to procure system strength services on completion of the RIT-T. The 18 months provided under the NER does not take into account the time for planning, procuring, building and commissioning any equipment that may form part of the most efficient longer term solution to the system strength shortfall. This will inevitably lead to periods of time where reliance on costly interventions or contracts with system strength service providers (such as generators) may be required to address issues until lower cost options are implemented.

We appreciate the opportunity to respond to this consultation paper and look forward to engaging with the AEMC and stakeholders further on this project. If you would like to discuss our submission, please contact Dominic Adams, Regulatory Reform Manager on 02 9284 3377.

Yours faithfully

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