7 May 2020

John Pierce
Chairman
Australian Energy Market Commission
PO Box A2449
SYDNEY SOUTH NSW 1235

Dear John

Re: EPR0076 Investigation into system strength frameworks in the NEM

CitiPower, Powercor and United Energy welcome the opportunity to respond to Australian Energy Market Commission's (AEMC) consultation paper on system strength frameworks in the National Electricity Market (NEM).

We agree the current frameworks for system strength need to evolve and be flexible to facilitate the rapidly increasing pace of the energy transition in the NEM.

The need for system strength in distribution networks should be recognised due to the potential impact of connections to the distribution network on the transmission system; and the increasing level of both large scale (>30MW) and small scale non-synchronous generation (<5MW), as well as residential/commercial/industrial rooftop PV and battery systems connected to the networks.

While we consider the system strength frameworks should be extended to smaller scale non-synchronous generation, we note that the deployment of synchronous condensers may not be economically viable for those projects. Challenges may also arise with the ongoing operating cost and the expertise required to operate complex systems that include system strength remediation.

We also note that managing system strength in distribution networks presents a number of challenges:

- distributors are not recognised as system strength providers and practically this places transmission network service providers (TNSPs) in a position where they can only retrospectively declare a system strength shortfall after it has occurred
- access to wide-area network models is limited to network service provider only and there is no agreed process for determining the study area for a system strength assessment
- minimum fault level should be defined at multiple network nodes at both transmission and distribution levels to better represent both the grid-wide and localised impact of system strength
- the do-no-harm rule places the onus on individual connections which does not readily allow for any co-ordinated remediation. Practically, the grouping of connections is challenging to facilitate within the regulatory timeframes. Conversely, if projects are assessed in isolation, the approval of one project results in all later projects being required to re-validate some or all of their system studies.

Please find attached the submission template where we respond to the AEMC's questions.

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Yours sincerely

Brent Cleeve
Head of Regulation
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AEMC

Appendix A

CHAPTER 2 – KEY ISSUES WITH THE CURRENT SYSTEM STRENGTH FRAMEWORKS

Section 2.3 – Key issues of the minimum system strength framework	
Do stakeholders agree with the AEMC's assessment of the issues of the minimum system strength framework?	We agree with the three key issues identified by the AEMC.
Have stakeholders identified any other significant issues as a result of the minimum system strength framework?	The current framework does not recognise the challenges that distributors are facing and their role in maintaining and operating a secure power network. There are many non-synchronous generators which have connected or are going to connect to the distribution networks, from large scale (> 30 MW) to small scale (< 5 MW) as well as rooftop solar and domestic battery systems. They are predominantly inverter-based generating systems which affect system strength.
Section 2.4 – Key issues of the "do no harm" framework	
Do stakeholders agree with this assessment of the issues of "do no harm" framework?	We agree with the three key issues identified by the AEMC.
Have stakeholders identified any other significant issues as a result of the "do no harm" framework?	The "do no harm" framework does not properly account for the challenges in undertaking the impact assessment for new generation connections in the current very dynamic environment. The main issues we see are caused by the delays in interfacing between AEMO, TNSPs and DNSPs for the receipt, approval and issuing of EMT models. In addition generators have no ability to assess their own impact, as wide area EMT models are not available to them at present.
Section 2.7 – Conclusion	
What are stakeholders views on the Commission's proposal to consider evolving the framework to a more integrated approach for system strength in the NEM?	We strongly believe that a more integrated approach for system strength in the NEM is required. The current separated frameworks have shown a number of limitations as identified by the AEMC and other stakeholders.

CHAPTER 3 – CONSIDERATIONS FOR PROVISION OF SYSTEM STRENGTH

Section 3.1 - What is system strength?	
Do stakeholders agree with the Commission's characterisation of system strength?	We agree with the AEMC's characterisation of system strength.

Has the Commission set out all the necessary considerations for defining a system strength service? If not, what additional considerations could be included?	
Do stakeholders consider the regulatory definition of system strength should be updated/changed? If not, why not? If so, how could this be done?	
Do stakeholders consider that the system strength definition should recognise active and passive system strength procurement? If not, why not? If so, how could this be done?	We agree with the AEMC's classification of active and passive system strength procurement. However, tuning non-synchronous generation and/or network voltage control devices may or may not help to improve system strength. The tuning process is a highly complex task and may only work for a small subset of network conditions.
Do stakeholders agree that clarifying the NER system strength service definition is likely to contribute to more/broader options for the system strength provision?	
Are there any additional sources of fault current in the NEM that can contribute to meeting system strength needs?	
Are there any other technologies in the NEM that can contribute to meeting system strength needs that should be considered?	
Section 3.2 - Why is system strength needed?	
Do stakeholders agree with why system strength is needed?	We largely agree with the AEMC's view on why system strength is needed. However, we believe there is a need to differentiate the sufficient fault level required for protection device operation and the sufficient system strength required to maintain stable operation of the network under both system normal conditions and contingency conditions. This is particularly required if the definition of system strength is updated to cover more than just the three phase fault level. Further, we understand that system strength is currently treated using a deterministic approach. We believe that a more probabilistic approach to system strength may yield greater economic outcomes in the medium term, or alternatively a hybrid combining deterministic and probabilistic approaches to system strength. However, we understand that this is not possible in the short term.
Are there any additional reasons for why system strength is needed in a power system?	The reasons why system strength is needed in a power system are dependent on the definition of system strength.

Do stakeholders agree with the characterisation of the impact of inverter-based generation on system strength?	We agree with the AEMC's characterisation of the impact of inverter-based generation on system strength. However, we note that this characterisation is based on the current available technologies. There is significant ongoing effort being put into improving inverters from control system design to hardware which could affect the characterisation in the near future.
Are there any additional impacts on system strength that should be taken into account?	
Section 3.3 - The provision of system strength in the NEM	
Do stakeholders agree that with the characterisation of system strength thresholds?	
Are there any additional thresholds or alternative characterisations that might be included in the investigation?	
Section 3.4 - The provision of system strength in the NEM	
Do stakeholders agree with the system strength attributes?	We agree with the system strength attributes listed in the discussion paper. We would like to emphasise that the third attribute, the locational-specific nature of system strength, is highly applicable to distribution networks.
Are there any additional attributes of system strength that the Commission should be aware of?	

CHAPTER 4 – EVOLVING SYSTEM STRENGTH FRAMEWORKS

Section 4.1 - Approach to developing a new framework	
Do stakeholders agree with approach (Plan, Procure, Price, Pay) to developing a new framework for system strength? Are there additional steps/concepts that should be explored?	We agree with the approach.
Section 4.2 - Models for delivering system strength	
Do stakeholders agree with the summary of the potential capabilities of each system strength model in Table 4.1?	Distributors should be included in the centrally co-ordinated approach.
Section 4.3 - Model 1: Centrally Coordinated	

Do stakeholders agree with the characterisation and assessment of a centrally coordinated model? Are there any other advantages and/or challenges?	Distributors should be included in the centrally co-ordinated approach.
Section 4.4 - Model 2: Market based decentralised	
Do stakeholders agree with the characterisation and assessment of a market based decentralised model? Are there any other advantages and/or challenges?	
Section 4.5 - Model 3: Mandatory service provision	
Do stakeholders agree with the characterisation and assessment of a mandatory service provision model? Are there any other advantages and/or challenges?	
Section 4.6 - Model 4: Access standard	
Do stakeholders agree with the characterisation and assessment of an access standard model? Are there any other advantages and/or challenges?	
Chapter 4 - General	
Are there other model(s) stakeholders think should be explored?	
What combinations of models (i.e. hybrids) should be explored further?	
Do stakeholders have any suggestions as to how any/all the models set out could be implemented or modified? Please comment on any and all models possible.	

CHAPTER 5 – SYSTEM STRENGTH IN DISTRIBUTION NETWORKS

What factors make system strength provision in distribution networks unique from transmission networks?	We note that there are similarities between the system strength provision in distribution networks and transmission networks. Both networks are facing the reduction of system strength caused by the connection of large scale inverter-based generation and the retirement or changing dispatch pattern of synchronous generation. In fact, most of the large scale solar farms built in the last few years in Victoria are connected to the high voltage distribution networks (e.g. 66 kV sub-transmission systems) in regional areas which have excellent solar resource but low system strength. Therefore, distribution networks are facing the

	same challenges as transmission networks. However, distribution networks are also facing unique challenges which are not seen in transmission networks. In addition to the connection of large scale non-synchronous generation, distribution networks are already seeing a large amount of new connections from both small scale solar farms (< 5 MW) and residential/commercial/industrial rooftop PV/battery systems thanks to various government programs as well as a strong movement from the business and community toward renewable energy. These can further reduce the system strength available in the distribution networks and may create local stability issues in the near future. Both the current "do no harm" and "minimum system strength" frameworks do not apply to small scale non-synchronous generation of this kind connected under Chapter 5A.
What are the key issues for system strength in distribution networks, including the magnitude and urgency of system strength issues in distribution networks?	The key issues for system strength in distribution networks as we seem them are listed below: • System strength in distribution networks is reducing due to not only the retirement and changing dispatch pattern of large synchronous generation in the transmission network, but also the increasing level of small scale non-synchronous generation (<5MW) and residential/commercial/industrial rooftop PV and battery systems connected to the networks. The latter one is not covered by the current "do no harm" framework. • AEMO has limited visibility over distribution networks and the new connections in these networks. As a result, AEMO may not be able to identify system strength shortfall in distribution networks. This creates the potential that shortfalls would only be declared after an issue had eventuated creating a rush to procure a solution, at higher cost, creating further constraints on existing market generators while a solution is found. • Distributors are not recognised as "system strength service providers". • The unavailability or limited availability of detailed EMT models for small scale inverter-based generation connections. With some small scale 'string' inverter manufacturers having no ability to provide EMT models. • The limitation of the EMT modelling software including the maximum number of individual models that can be simulated makes broad scale modelling of transmission and distribution impossible at present. Even today, when just considering large scale generating systems, the computing resource requirements are huge with long simulation times required for each system strength impact assessment study. • The difficulty in determining local boundaries as well as obtaining up-to-date information and models across multiple network service provider areas, both transmission and distribution. • Proponents of small scale projects may not be well funded and equipped with the right expertise to understand the necessity and complexity of system strength assessment. The study cost and time may make the new connection more expensive, less attractive and/or unviable. • The cost of system strength remediation (e.g. synchronous condenser, network augmentation) if funded by a new small scale non-synchronous generation can be too high for the project itself. Small synchronous condensers suitable for small scale connection may not be available. Even if they are available, ongoing operating costs and the expertise required to operate complex systems such has this may mean it is not a suitable option. • Passive system strength remediation such as inverter tuning may not be available to small scale inverter-base

	generation due to lack of expertise from either the inverter manufacturer or the developer or both. • Local system strength issues in a distribution network may not be effectively and efficiently addressed by a system strength remediation in the transmission network. • Transmission level system strength remediation would tend to comprise larger single systems, which would create market stability constraints should outages ever occur due to maintenance or faults. At a distribution level opportunities exist to spread remediation across multiple small scale systems, with inherently higher reliability. • Small scale generators in distribution networks may be classified as non-market generators and hence cannot be controlled or constrained by AEMO through market constraints to mitigate system strength related issues.
How should any system strength issues in distribution networks be addressed? Are any model(s) from Chapter 4 appropriate to address system strength provision in distribution networks?	We consider that: • Distributors should be recognised as system strength service providers. • Distributors should be allowed to identify and manage system strength shortfall manifested from within the distribution network. • All or part of the system strength frameworks should apply to new connections under Chapter 5A of the NER. • From the four models presented in Chapter 4 of the discussion paper, the centrally co-ordinated approach (Model 1) is the most efficient in the distribution network. This should be integrated into the planning processes on a forward looking basis. Models 3 and 4 can also be used in co-operation with Model 1 to deliver the most efficient and effective solutions in the distribution networks.