

7 May 2020

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Via electronic lodgement

Dear John

**Discussion Paper: Investigation into System Strength Frameworks
in the NEM (Ref EPR0076)**

AusNet Services welcomes the opportunity to make this submission in response to the Commission's discussion paper on issues related to the current system strength frameworks and potential framework changes for the effective and efficient delivery of this critical system service.

We support the Commission's initiation of this investigation. It is several years since the current frameworks were put in place, and in the intervening period the transition of the generation sector toward renewables has become rapid, with significant amounts of renewable generation being established in weak parts of the power system. Experience implementing the frameworks in this environment has revealed a range of issues that need to be addressed, to ensure the security of the power system is not put at risk, and to improve the framework to better support transition of the generation sector.

The investigation should recognise that the power system has drifted toward a sub-optimal state with the rapid connection of new generation, with heightened risk to security. The investigation should therefore recognise that action is required to address an urgent and immediate issue and is not something that is suited to conceptual approach development and testing. As outlined in the Commission's discussion paper, there remains a lot to learn about system strength implications for the power system, and accordingly it is not practical to seek to fine tune provision of system strength. In addition, a long period of inaction will add significant risk and worsen the problem that urgently needs to be addressed.

The investigation should seek out frameworks where accountabilities for planning and delivering design level of system strength are clear and are forward looking so that services are available when required. The risk to consumers from ineffectual approaches should also be taken into account when determining the best approach.

AusNet Services considers that adoption of the centrally coordinated approach discussed in the Commission's paper is necessary to provide the certainty needed for secure power system operation, especially as the generation transition progresses. System strength is a measure underlying the delivery of network performance and the provision of this functionality is inherently a network service. TNSPs are ideally positioned to deliver this functionality. We also

note the impact on system strength levels arising from planned network outages and other contingencies, and the need to design levels of system strength to account for these events and provide for operational flexibility.

We have also given consideration to the implications in relation to distribution networks. As well as owning and operating Victoria's transmission system, AusNet Services owns the distribution network serving the outer eastern metropolitan area of Melbourne and the east of Victoria.

There are a number of features within the distribution services landscape that add complexity to the consideration of system strength implications. And while system security is a lesser concern from eroding system strength within the distribution network, the impacts on network services for customers can be severe. Consideration of the appropriate system strength frameworks for the distribution networks is also necessary in the AEMCs investigation.

Our conclusion is that the Commission's investigation is critical and must lead to reform of the frameworks to address deficiencies in the maintaining of system strength levels that have become apparent with dispersed responsibilities. Reforms should ensure that adequate levels of system strength are efficiently and effectively provided going forward to ensure the power system can develop and be operated optimally.

Our detailed response is contained in the Attachment, which applies the Commission's submission template.

Please contact Charlotte Eddy, Manager Economic Regulation on 03 9695 6309, if we can assist with any queries in relation to this submission.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Tom Hallam', written in a cursive style.

Tom Hallam
General Manager Regulation and Network Strategy

Investigation into system strength frameworks in the NEM

STAKEHOLDER SUBMISSION TEMPLATE

The template below has been developed to enable stakeholders to provide their feedback on specific questions that the Commission is interested in due to the discussion paper. It is designed to assist stakeholders provide valuable input on those questions the Commission is interested in. However, it is not meant to restrict any other issues that stakeholders would like to provide feedback on.

SUBMITTER DETAILS

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CHAPTER 2 – KEY ISSUES WITH THE CURRENT SYSTEM STRENGTH FRAMEWORKS

Section 2.3 – Key issues of the minimum system strength framework

1. Do stakeholders agree with the AEMC’s assessment of the issues of the minimum system strength framework?	<p>AusNet Services is the Victorian transmission network owner, manager and operator. We agree with the Commission that the reactive approach of the current framework is an issue that needs to be addressed. There are significant capability limitations in the network to support the transition to (mainly inverter connected) renewable energy sources in the regional network, and system strength issues also impact operability of the transmission network.</p> <p>Our observation is that the issues identified in the paper need to be addressed, and we concur with the Commission’s conclusion (page 30) that future regulatory frameworks for system strength will need to recognise the different values that system strength can provide, including system security, resilience, alleviating constraints on dispatch and supporting efficient investment in new capacity.</p> <p>As noted by the Commission (page 12) when a system strength shortfall is declared, problems are already prevailing, rather than having been averted. The methodology for setting minimum system strength levels has, in our view, not reflected the issues prevailing in north west Victoria for at least two years before a system strength shortfall was ultimately declared for this region. The experience is that significant non-synchronous generation has been curtailed, and new connections are facing long delays, or unable to be connected, in North Western Victoria. This reflects that the system is operating too close to the edge of stability. Headroom is required to ensure that</p>
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	<p>new generation development, in conjunction with non-normal network operating configurations, does not impact security.</p> <p>The assessment of system strength needs is not sufficiently forward looking. It does not enable the services to be most effectively delivered, with continuity and timeliness, and to account for different scenarios in development of the power system.</p>
<p>2. Have stakeholders identified any other significant issues as a result of the minimum system strength framework?</p>	<p>The consultation paper already addresses:</p> <ul style="list-style-type: none"> • System strength definition may need to include parameters beyond fault current (as AEMO has pointed out) • Lack of consideration of non-credible contingencies • Lack of margin for resilience • Efficient allocation of responsibility between AEMO and the TNSP (we perceive this as a clarification of accountabilities rather than an allocation issue) <p>In addition to these, the assessment of system strength needs is not sufficiently forward looking. It does not enable the services to be most effectively delivered, with continuity and timeliness, and to account for different scenarios in development of the power system.</p> <p>Specific consideration of the need for outages for planned maintenance and inspections activities as well as project delivery (connections, augmentation and replacement) is required in the new framework. Having a system that only operates satisfactorily when all assets are in service and does not allow standard operational activities to be completed without interruption of service to generators and/or energy consumer is not practical.</p>
<p>Section 2.4 – Key issues of the “do no harm” framework</p>	
<p>3. Do stakeholders agree with this assessment of the issues of "do no harm" framework?</p>	<p>As the Commission identifies in the discussion paper (page 45), sufficient system strength is a condition precedent for the secure operation of the system. We agree that the issues identified impact the effectiveness of the 'do no harm' framework. Analysis to determine impact is complex, time-consuming, require multiple iterations and may lack reasonable accuracy. It is also unlikely to capture all relevant parameters. Overall, the current approach tends to the conclusion that the connection of generators is impacting the power system, when in the midst of the rapidly changing generation mix (a change sought by society) system strength should be viewed as a component of shared network or system capability, and hosting capacity, hence a driver of wider economic benefit.</p>
<p>4. Have stakeholders identified any other significant issues as a result of the "do no harm" framework?</p>	<p>We consider the current framework creates a disconnect between the responsibility to maintain power system strength/security and the function to design, maintain, operate and control the provision of equipment required to do this function.</p> <p>An implication is delegation to connecting parties the provision, design and operation of assets to provide services for functionality that is complex, where knowledge amongst experts continues to grow, and has system wide</p>

	<p>impacts. The connecting generators that are responsible for these decisions under the “do no harm” framework are not specialists in this field, have a different market role, do not have access to detailed models and information to enable a system wide perspective and have commercial incentives to minimise the functionality and thereby the cost of solutions they are required to implement at the expense of cheaper regional or system wide solutions. This mismatch in responsibilities and capability combined with commercial drivers is bound to result in sub-optimal outcomes, including through overbuilding of assets.</p> <p>The result of do no harm is likely to be insufficient system strength measures that are not optimally located and are poorly coordinated. A contributor to poor coordination would be that the primary objective of any facilities is to support the delivery of the service providers energy, and accordingly its competitive energy position.</p> <p>The framework results ultimately in the crowding out of potential scale-efficient and optimised shared system solutions, which ultimately results in more costly outcomes for consumers.</p>
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Section 2.7 – Conclusion

<p>5. 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?</p>	<p>Provision of system strength under the current framework has provided valuable learnings, which can inform direction for an improved framework. Starting from that point, it is clear that a more integrated approach would be beneficial.</p> <p>However, it is critical to recognise that the power system is already in a sub-optimal (and precarious) state, therefore, the approach needs to recognise this is an urgent and immediate issue, not a future challenge that we can consider at length and await evolution of an ideal framework. There is an immediate problem that requires urgent and immediate action.</p>
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CHAPTER 3 – CONSIDERATIONS FOR PROVISION OF SYSTEM STRENGTH

Section 3.1 - What is system strength?

<p>6. Do stakeholders agree with the Commission’s characterisation of system strength?</p>	<p>We agree with the Commission’s analysis and assessment in the discussion paper that the current approach of using a three phase fault level as proxy does not necessarily provide a complete description of the system strength service. It is important that the framework recognise the interdependence on system strength and network operability and implications of system strength for network design. This is reflected in Figure 1 / Figure 3.3 of the discussion paper, however the upper limit should recognise network asset and service performance impacts. The TNSP has substantial NER system security accountabilities that would include identifying requirements for and managing system strength.</p> <p>In essence, system strength is a term that captures various characteristics underlying transmission network capability, i.e. system strength is inherent in defining network capability.</p>
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Stakeholder submission template

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7. Has the Commission set out all the necessary considerations for defining a system strength service? If not, what additional considerations could be included?	As noted in response to Q4, there is likely some way to go before all the interdependencies affecting, and therefore defining, system strength, are fully understood. This means that there can be no precision in setting levels of system strength, and this is an area where a conservative outcome is necessary to ensure the framework confidently supports system security.
8. Do stakeholders consider the regulatory definition of system strength should be updated/changed? If not, why not? If so, how could this be done?	As discussed in response to previous questions, system strength is a complex concept, and the technical expertise to determine the specifics may be sparse and spread in the industry. Potentially drawing these skills together in a truly expert panel, also including expert external assistance, is warranted. This group should be able to advise on the what other properties, in addition to minimum fault level, would be useful in defining system strength,
9. 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?	The sources that may contribute to system strength may be considered per the discussion in section 3.1.2 of the discussion paper. However, it is not clear that this is necessary to place obligations on the responsible party, who we think is the TNSP, to maintain prescribed levels.
10. Do stakeholders agree that clarifying the NER system strength service definition is likely to contribute to more/broader options for the system strength provision?	It is unclear whether more or broader options would arise. However, an improved definition would better enable this prime indicator for system security to be managed. It is not clear yet that system strength can be better defined. It is also unclear whether attempting this, to seek out further options for provision of system strength will be fruitful. This does not reflect that there is an immediate problem that requires urgent and immediate action.
11. Are there any additional sources of fault current in the NEM that can contribute to meeting system strength needs?	AusNet Services is not aware of any additional sources of system strength
12. Are there any other technologies in the NEM that can contribute to meeting system strength needs that should be considered?	The consultation paper discusses the accretive value to system strength of grid forming inverters, however also makes the point that the operation of this type of inverter on transmission systems is unproven (page 36). It is not clear that grid forming inverters could contribute to meeting system strength needs, as distinct from enabling the associated generator to operate in network areas with low system strength. Given the technology is unproven, there may not be benefit to developing a framework that assumes contribution from this source. Nevertheless, the framework should provide room for future technologies to be included if they emerge as effective sources.
Section 3.2 - Why is system strength needed?	
13. Do stakeholders agree with why system strength is needed?	The consultation paper assessment of why system strength, maintained within system design levels, is needed. Per our response to Q6, system strength is a characteristic in defining network capability

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14. Are there any additional reasons for why system strength is needed in a power system?	System strength is a key consideration in assessing and ensuring operational flexibility, resilience in contingency events, system security, and ability to accommodate a diverse and dynamic mix of generation types
15. Do stakeholders agree with the characterisation of the impact of inverter-based generation on system strength?	Our understanding is consistent with the Commission’s characterisation.
16. Are there any additional impacts on system strength that should be taken into account?	The ISP identifies an optimal development plan for the power system. This enables valuable insights into how system strength might alter in parts of the network over time. A forward looking approach, based on the ISP, would identify where and when system strength issues are likely to eventuate in the power system The new framework must align with the optimal power system development pathway, allowing for system strength developments to occur in concert with development of the generation mix.
Section 3.3 - The provision of system strength in the NEM	
17. Do stakeholders agree that with the characterisation of system strength thresholds?	The discussion on thresholds in the consultation paper captures the key characteristics. Potentially, reporting on system strength across the power system could identify each location against this threshold set. Depending on the projected system development this may allow stakeholders to observe the likely progression of system strength impacts.
18. Are there any additional thresholds or alternative characterisations that might be included in the investigation?	System strength should be considered as an inherent requirement of the power system, a network service, and should be planned and managed in a similar way to transmission capacity. From the discussion it may be inferred that system strength has attributes applicable to an optional “service” that could be procured occasionally/as required. This notion does not represent the true nature and need for system strength, or alternatively may be a paradigm shift that is not yet within reach given the current issues that need to be urgently addressed. As we have noted in response to Q2, specific consideration of the need for outages for planned maintenance and inspections activities as well as project delivery (connections, augmentation and replacement) is required in the new framework. Having a system that only operates satisfactorily when all assets are in service is not practical. As well as consideration of other than normal, all elements in service network configuration, the assumptions for other key inputs, such as for synchronous generation on line, should be understood by stakeholders and be transparent. The assumptions made will affect the outcomes of the system strength assessments.
Section 3.4 - The provision of system strength in the NEM	
19. Do stakeholders agree with the system strength attributes?	Our understanding is consistent with the discussion in the consultation paper.
20. Are there any additional attributes of system strength that the Commission should be aware of?	Refer response to Q8 and Q18 in particular

CHAPTER 4 – EVOLVING SYSTEM STRENGTH FRAMEWORKS

Section 4.1 - Approach to developing a new framework

<p>21. 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?</p>	<p>The proposed approach will enable holistic evaluation of the framework options, in respect of whether they can be practically implemented and achieve technical criteria. However, they do not appear to explore the relative efficiencies.</p> <p>Per our response to Q5, it is critical to recognise that power system is already in a sub-optimal (and precarious) state in Victoria, therefore the approach needs to recognise this is an urgent and immediate issue, and a lengthy approach to consider all possibilities cannot be afforded. There is an immediate problem that requires urgent and immediate action.</p> <p>The risk to consumers of not providing timely and adequate system strength services is considerable and should be taken into account when determining the best approach (market or centralised coordinated) and the certainty that these approaches will provide the necessary service.</p> <p>The risk (of losing supply and/or System Black) is so great that in the short-term the more certain centralised coordinated approach seems clearly superior, and much better aligned with the underlying nature of system strength, i.e. it is essentially a characteristic of network capability, and most effectively addressed in provision of that service. The time to design, trial and prove the effectiveness of a market and allow this to mature and deliver solutions does not recognise the current urgency and risks.</p> <p>Work on developing and detailing market solutions could also continue in parallel, identifying practicality and efficiency and how these could be integrated or how transition might occur.</p>
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Section 4.2 - Models for delivering system strength

<p>22. Do stakeholders agree with the summary of the potential capabilities of each system strength model in Table 4.1?</p>	<p>We broadly agree with the assessment. However, the bottom 3 questions, which are important criteria outside of the 4 Ps, are rated on a continuum. We would expect that a transparent and well explained centralised coordinated approach would provide greater certainty in meeting the identified criteria than the other options. This is due to single point accountability that is strongest in this option</p>
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Section 4.3 - Model 1: Centrally Coordinated

<p>23. Do stakeholders agree with the characterisation and assessment of a centrally coordinated model? Are there any other advantages and/or challenges?</p>	<p>We broadly agree with the assessment. An important advantage of the centrally coordinated model is that it exhibits greater (concentrated) accountability for critical system security obligations.</p>
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Section 4.4 - Model 2: Market based decentralised

<p>24. Do stakeholders agree with the characterisation and assessment of a market based decentralised model? Are there any other advantages and/or challenges?</p>	<p>We broadly agree with the assessment / characterisation. However, the characterisation depicted for longer term planning is actually more relevant to shorter timeframe considerations. Evolution of system strength capability in alignment with the NEM strategic development plan would likely be a challenge for each of options 2-4.</p> <p>The scale of the risk of attempting a market-based approach should be considered. The security of the entire NEM</p>
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	is at risk if appropriately located system strength services are not available when required. Placing the responsibility on a fledgling market for delivering sufficient levels of technical, location specific would seem incongruous with the criticality and the immediate need.
Section 4.5 - Model 3: Mandatroy service provision	
25. Do stakeholders agree with the characterisation and assessment of a mandatory service provision model? Are there any other advantages and/or challenges?	As above. This approach has similar implications to the market-based model discussed in our response to Q24.
Section 4.6 - Model 4: Access standard	
26. Do stakeholders agree with the characterisation and assessment of an access standard model? Are there any other advantages and/or challenges?	As above
Chapter 4 - General	
27. Are there other model(s) stakeholders think should be explored?	The consultation paper discusses the provision of system strength by synchronous generators as a by-product of being dispatched (page 106). A methodology to properly value those system strength services and appropriately compensate synchronous generators, and the effect on the overall cost of electricity should be explored.
28. What combiantions of models (i.e. hybrids) should be explored further?	Models that provide for long term efficient provision (central procurement), ability to meet any near-term shortfalls identified in operational context (AEMO procurement), and retention of a backstop mechanism (AEMO direction).
29. 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.	In AusNet Services opinion, the needs of the power system require a centralised coordinated model for provision of system strength, that provides a strong connection between the parties responsible for maintaining and operating a stable, secure power system and those with responsibility to plan and implement the assets and services to ensure this is achieved.

CHAPTER 5 – SYSTEM STRENGTH IN DISTRIBUTION NETWORKS

30. What factors make system strength provision in distribution networks unique from transmission networks?	<p>There are several features of distribution networks that add further complexity. These include:</p> <ul style="list-style-type: none"> the common radial configuration of distribution networks, and having significantly lower capacity than transmission networks, yet this does not dissuade large generators wanting to connect distribution networks are also planned with reference to the system strength at the transmission connection point, such that there is high dependency on these levels not deteriorating, or rising above design thresholds as a result of above network characteristics, system strength is very locational and heavily dependent on the impedance of the network elements down through the network, e.g. transformers and long, low capacity lines
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	<ul style="list-style-type: none"> • As well as connecting large asynchronous generators, distribution networks connect the mass market micro-scale DER (primarily roof top solar and battery) • the development of a distribution network is not within the notion of national flowpaths which is the focus of the ISP. A distinct approach to guide and fund system strength adequacy may be necessary
<p>31. What are the key issues for system strength in distribution networks, including the magnitude and urgency of system strength issues in distribution networks?</p>	<p>The emergence of significant generation on the distribution networks through the energy sector transformation is challenging for DNSPs, as there has not historically been the need to maintain dynamic or EMPT models for the distribution networks. The energy transition is leading to each distribution network having to respond to more of the dynamic system characteristics previously only routinely the domain of transmission systems analysis. The tools, granularity of network parameter data available, and skill sets for this analysis now required are a significant change. There is a much-reduced system security implication from eroding of system strength in the distribution network, however the impacts on network services for customers can be severe.</p> <p>There is increasing interest in connection of large generators to subtransmission networks. The do no harm principles currently apply equally to these generators. Assessment of harm includes upstream impact on the transmission network and potentially on adjacent distribution networks. For distribution network connection there is also the prospect of generators keeping the capacity of developments to just below the thresholds, so that generator performance standard negotiation is not a bottleneck in the connection process. Multiple such generators located in proximity can contribute significant impact. The connection and system strength frameworks may not adequately provide for the analysis and assessment necessary to capture and treat all implications.</p> <p>For residential DER, which is connected to the LV networks, system strength is primarily determined by LV conductor impedance and is very locational. Accordingly, hosting capacity is typically limited by voltage rise due to network impedance rather than stability issues. Individual inverters are unlikely to cause stability issues / oscillations because they are typically open loop control so less susceptible to control loop interactions. Individually they are not large enough to impact system stability, although collectively they can displace synchronous generation and influence system strength. Locally, strong DER uptake will affect the variability of the voltage level on the network, and connections or export must be curtailed to ensure voltage limits are not exceeded, which could impact both load and generation connected customers, and network operability.</p> <p>AusNet Services has explored the benefits of relieving constraints and has made a proposal to the AER in its 2022-26 Distribution Revenue Proposal to augment the network to improve hosting capacity where this is economic. The proposals are expected to support the exports of an additional 31,000 customers. This will also address adverse voltage impacts that would otherwise be experienced by 228,000 customers.</p>
<p>32. 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?</p>	<p>Further consideration of the alignment in issues between transmission and distribution network operation is warranted, which would inform the appropriate treatment for distribution networks. This may find that it would be most efficient for distributors to also have obligations to maintain adequate system strength levels.</p>