

ABN 70 250 995 390
180 Thomas Street, Sydney
 PO Box A1000 Sydney South
 NSW 1235 Australia
 T (02) 9284 3000
 F (02) 9284 3456

Monday, 13 February 2023

Australian Energy Market Operator

Lodged via email: to ssiag@aemo.com.au

AEMO consultation on amendments to the System Strength Impact Assessment Guideline

Transgrid welcomes the opportunity to respond to the Australian Energy Market Operator's (**AEMO**) consultation on amendments to the System Strength Impact Assessment Guideline (**SSIAG**).

As the jurisdictional planner, operator and manager of the transmission network in NSW and the ACT, Transgrid has a responsibility to operate and manage the transmission network safely, securely and efficiently in the long-term interests of consumers. To achieve this aim and remain consistent with the National Electricity Objective (**NEO**), Transgrid supports reforms that will ensure that the necessary levels of system strength are in place to deliver electricity to consumers in the least cost manner.

Transgrid is broadly supportive of AEMO's amendments to the SSIAG, which aims to address the requirements of the Australian Energy Market Commission's (**AEMC**) Amending Rule on Efficient management of system strength on the power system released in October 2021.

The table below provides specific comments from Transgrid on the proposed amendments to the SSIAG and number of key aspects to the proposed amendments that warrant further consideration.

Section	Statement of issue or other comments
2.3	<p>The process applicable for proposed plant alterations (under NER 5.3.9 or NER 5.3.12) described in Section 2.3 requires further clarity.</p> <p>(1) Section 2.3(a) states that for 4.6.6 Connections that are proposed alterations to a generating system under NER 5.3.9, the NER permit (but do not require) an Applicant to request a Preliminary Assessment, prior to the submission. However, NER clause 5.3.4B(a2)(1) specifies that for each proposed new connection or proposed alteration to a generating system or other connected plant to which this clause applies, a Network Service Provider (NSP) must undertake a preliminary system strength impact assessment in accordance with the SSIAG.</p> <p>(2) What are the criteria in 2.3(b) for determining 'where relevant' for an Applicant to propose a system strength remediation scheme (SSRS) or elect to pay system strength charge (SSC) – is this based on AEMO's determination in 2.3(c)?</p>

	<p>(3) When and how will AEMO make the determination described in 2.3(c)? Is it based on a preliminary assessment of the 5.3.9 submission from the applicant or following full assessment of the 5.3.9 submission?</p>
<p>2.5.3</p>	<p>(1) Section 2.5.3 states that: “4.6.6 Connections that are comprised of alterations to plant do not follow the same process as those that are comprised of new plant”. This sentence is contradicting to the rest of the paragraph where it is stated that the system strength assessment process for plant alterations is equivalent to an application to connect. Suggest providing further clarity on this.</p> <p>(2) Given that scope of plant alterations can vary from minor alterations (with no impact on plant ratings or impedance) to significant plant alterations (such as addition of new generating units behind the connection point or change of connection point from HV to MV), Transgrid recommends providing further clarity with worked examples on application of the system strength assessment process for plant alterations.</p>
<p>3.4.2</p>	<p>In regard to the stability coefficient α defined in Section 3.4.2, it is stated that the stability coefficient should reflect the limitations in the network immediately beyond the 4.6.6 Connection and the lowest value must not be less than 1.2.</p> <p>(1) Can AEMO clarify the purpose of the stability coefficient?</p> <p>(2) Can AEMO please include further information on how this lowest value was derived? The definition suggests that the stability coefficient is location dependent. Can AEMO please provide clarity on how the stability coefficient α may be derived for each connection point?</p>
<p>3.5</p>	<p>Section 3.5 on Materiality threshold specifies “For the purposes of NER 5.3.4B(f)(3), no Materiality Threshold is specified below which a general system strength impact may be disregarded”</p> <p>(1) Can AEMO please clarify the application of the Materiality threshold? NER clause 4.6.6(b)(7) suggests that the materiality threshold defined in the SSIAG applies to general system strength impact when determining if system strength connection works (SSCW) are to be undertaken by an NSP for the purpose of 5.3.4B(e) and 5.3.4B(f)(3). However, clause 5.3.4B(a2)(3) suggests that the materiality threshold is also applicable to determining whether a Full Assessment is required following the preliminary assessment. If that is the case, Transgrid suggests amending Section 3.5 to clarify that the materiality threshold specified in the SSIAG is applicable for the purpose of 5.3.4(a2) and 5.3.4(e)/5.3.4(f)(3).</p> <p>(2) In the absence of a materiality threshold defined in the SSIAG, for all 4.6.6 Connections, regardless of the magnitude reduction of the available fault level (AFL) determined in the preliminary assessment, the Applicants will have to</p>

	<p>elect to pay the system strength charge (SSC) or propose a system strength remediation scheme (SSRS), and if necessary, request NSP to undertake SSCW. Transgrid supports the view that the materiality threshold for adverse system strength impact should remain unchanged, from its current definition in the SSIAG (i.e., no materiality threshold applied). However, with respect to reduction in AFL due to 4.6.6 Connections, the absence of a materiality threshold would require small scale 4.6.6 Connections electrically distant from System Strength Nodes (SSN) to bring in additional system strength remediation that may not be commercially feasible or required for the power system. Transgrid acknowledges that determining a suitable metric for the materiality threshold may require further review of technical and financial implications.</p>
<p>3.4.3(b)(i)</p>	<p>As per section 3.4.3(b)(i), for the purpose of forecasting the AFL at each SSN power system model for the region is to be set up with Synchronous Machines that will be providing system strength over a 10-year horizon, including anticipated system strength services (SSS) to be provided by the system strength service provider (SSSP), but excluding generating systems and IBLs where they are not expected to provide system strength.</p> <p>Can AEMO provide clarity on inclusion/exclusion of inverters with grid forming capabilities (i.e., Inverter based resource (IBR) connections with virtual synchronous machine mode functionality) and SSRS associated with existing/committed generating systems and inverter based loads (IBL) (such as synchronous condensers) for the purpose of Section 3.4.3(b)(i)?</p>
<p>4.1</p>	<p>(1) Transgrid notes AEMO's intent in provisionally assessing withstand SCR and the associated reduction in AFL using vendor specific models as part of the Preliminary Assessment, while providing an alternative pathway to Applicants if models are unavailable at the connection enquiry stage. In Transgrid experience, it is very likely for subsequent changes to equipment vendor selection or generating system design to occur at the Application stage, necessitating reassessment of System Strength Quantity (SSQ) and the associated change to the AFL. While the Full Assessment allows for this re-evaluation to be undertaken as part of the general system strength impact assessment, if an Applicant elects to pay the SSC, then re-assessment of SSQ and the applicable SSC will also be required at the Application stage. The requirement for re-assessment based on changes to the generating system design and vendor equipment in the Application stage should be clearly stated in the SSIAG.</p> <p>(2) Section 4.1.2 states that the "purpose of preliminary assessment is to determine whether the 4.6.6 connection will cause a general system strength impact". During preliminary assessment, Transgrid view is that only the reduction in AFL aspect of the general system strength impact can be considered, given that determination of adverse system strength impact will require detailed modelling to undertake wide area system assessments (for example, to assess impact on</p>

	<p>power system stability, adverse control system interactions). Can AEMO please provide more clarity on this in the SSIAG?</p>
<p>4.2.4 and 4.2.7</p>	<p>Section 4.2.4(c)(ii) states that the “model used by the NSP for the Full Assessment must include nearby 4.6.6 Connections, regardless of whether Applicants will be installing SSRSs or relying on the provision of SSS from an SSSP”.</p> <ol style="list-style-type: none"> (1) What is meant by “nearby 4.6.6 Connections”? Does it refer to electrically close 4.6.6 Connections that are currently being assessed (regardless of their committed status)? At early stages of the Application to connect, some IBR plants may not have suitable models that can be used for the Full Assessment. (2) Can AEMO provide clarity on inclusion/exclusion of SSRSs associated with existing/committed projects and nearby 4.6.6 Connections in the power system model used for the Full Assessment? Is it AEMO’s intent that if a nearby 4.6.6 Connection has an associated SSRS, it to be included as part of the generating system for the purpose of the Full Assessment? (3) There’s ambiguity between treatment of nearby 4.6.6 Connections that are not committed for the purpose of Batch Assessment in Section 4.2.7 vs. treatment of 4.6.6 Connections for the purpose of Full Assessment outlined in Section 4.2.4. Transgrid suggests updating Section 4.2.4(c)(ii) to “may” instead of “must”, allowing NSPs flexibility to determine which nearby 4.6.6 Connections that are not committed to be included in the Full Assessment, as appropriate?
<p>4.2.1 and 8.2</p>	<p>Section 4.2.1 states that “Full Assessment must commence upon receipt of an application to connect or a submission under NER 5.3.9(b) or 5.3.12(b)”. Although elaboration on this criterion is provided in Section 4.2.6(a), further clarity is required on the commencement requirement. This also applies for the timing specified in Section 8.2 for the Stability Assessment. Conducting a Full Assessment or a Stability Assessment is a computationally intensive task that takes significant amount of engineering time and effort. For the purpose of the Full Assessment or Stability Assessment, Transgrid recommends introducing a reasonable commencement criterion to minimise unnecessary repetition of assessments due to iterative model/setting changes associated with performance standard negotiations. While Transgrid acknowledges that there are some interdependencies between the Full Assessment and the performance standards, in Transgrid’s view, a reasonable amount of due diligence and negotiations on the performance standards should be completed prior to undertaking the Full Assessment (or Stability Assessment, as applicable).</p> <p>Transgrid consider the following criteria to be appropriate for commencement of the Full Assessment or Stability Assessment: (a) models are of suitable quality for the purpose of Full Assessment; (b) due diligence on critical performance standards are completed; and, (c) performance standards are negotiated to a reasonable level as per the negotiation framework outlined in NER 5.3.4A (b1).</p>

4.2.6(d)	Under section 4.2.6(d), it is unclear what is meant by “likely contingency events”. Does it refer to non-credible contingencies or protected events? Suggest providing further clarity.
4.2.6	<p>Section 4.2.6 on Alterations to Plant suggests that if the alteration is limited to the three criteria specified under (h), (i) and (j), then the Connecting NSP must only assess whether there is an adverse system strength impact. Transgrid infers from this that (1) reduction of AFL does not need to be assessed for plant alterations specified under Section 4.2.6(h), (i) and (j); and (2) for all other plant alterations (excluding alteration outlined in 4.2.6(h), (i) and (j)), the general system strength impact is required to be assessed.</p> <p>Can AEMO please confirm if this interpretation is correct? Suggest providing further clarity on the system strength impact assessment required for plant alterations that are not covered by Section 4.2.6(h), (i) and (j).</p>
5.1.2	Can AEMO provide further clarity on the statement “regardless of whether the network can operate stably despite the adverse system strength impact” in Section 5.1.2(b). For example, if a 4.6.6 Connection has resulted in degradation of damping of an existing mode of oscillation in the power system, regardless of whether the system is stable and the damping ratio is compliant with the adequate damping criteria, would the impact be considered as an adverse system strength impact that needs to be remediated by an SSRS? Perhaps linking this to the absence of materiality threshold may provide the clarity required.
6.4	Transgrid acknowledges that the Amending Rule is prescriptive in terms of the variables to be considered in calculating the System Strength Locational Factor (SSLF), and AEMO’s proposed methodology aligns with the Amending Rule requirement. However, we note that the least cost centralised SSS may be at one or multiple locations that differ from the applicable SSN. In Transgrid’s view, the proposed SSLF methodology is not reflective of the SSS location/s and the cost implications. Addition of further SSNs can address these concerns to a certain degree; however, further consideration will be required to ensure that SSC is a true reflection of the remediation requirement and the attributed cost of the relevant SSSs.
6.4(b)(ii)	Section 6.4(b)(ii) states that SSLF must be calculated considering the “network conditions around the date the Connecting NSP estimates the Applicant and the Connecting NSP will have completed all requirements to be in a position to send a notification to AEMO under NER 5.3.7(g), 5.3.9(h) or 5.3.12(h), as applicable”.

	<p>(1) What is the basis for determining the above commitment date for a proposed connection? Is the intent that the Applicant will need to indicate the expected commitment date to the NSP for consideration? Suggest providing clarity.</p> <p>(2) Implications for the proposed 4.6.6 Connections, if the actual timeline for commitment differ significantly from what was assumed for SSLF calculation during the preliminary assessments should be considered.</p>
6.4(b)(iv)	Regarding selection of nearest SSN, a TNSP must select the nearest node within its network. Suggest making it clear what happens to non TNSP node selection. Do DNSP's need to select the nearest node on any TNSP network?
6.4(b)(vi)	Regarding the short circuit impedance used for SSLF calculation, the methodology outlined does not explicitly state that the short circuit impedance is to be calculated on a per unit basis. Suggest including this for clarity.
7.3.1	What is meant by " <i>commitment patterns</i> "? Is "commitment" a defined term or is this referring to the definition of "committed" in Section 1.2.1? Suggest providing clarity.
8.5(c)	Does this mean that the SSSP will need to consider planned outage of SSS, when determining the level of SSS provision required? For forced outages, special protection schemes or constraints may be applied. Suggest providing clarity.
General	It is helpful if some examples on SSLF calculation could be included in the Appendix section.
General	<p>Transgrid notes that AEMC in the final Rule determination on Efficient management of system strength has stated that general system strength assessment of inverters with grid forming (GFM) capabilities will be covered by the system strength impact assessment guidelines.</p> <p>(1) Is the treatment of inverters with GFM capabilities similar to other IBRs, where withstand SCR assessment outlined in Section 7.4 is required to be undertaken through dynamic simulation studies to establish the associated withstand SCR? If so, in cases where the required vendor-specific modelling is not available, Transgrid's understanding is that a withstand SCR of 3 will be used for 4.6.6 Connections using inverters with GFM capability.</p> <p>(2) Please provide more clarify on treatment of asynchronous generators using inverters with GFM capabilities for the purpose of general system strength assessment.</p>
Appendix A – Section A.2	(1) Can AEMO please clarify the reason for G1 contribution calculated using PSS/E in Step 3 is different to G1 contribution calculated in Step 2? The PSS/E calculated fault level contribution appear to be significantly different to the fault level calculated using the network impedance/IBR connections given in the Figure 4. Please check the PSS/E modelling.

(2) Δ AFL for IBR3: Can AEMO please provide further details on how the final Δ AFL of 0 is calculated, including calculation details on (a) expected reduction in AFL with the proposed connection; and, (b) subsequently with the proposed SSCW and the associated increase of 3phase fault level how it resulted in an offset of the reduction in originally calculated Δ AFL.

We appreciate the opportunity to provide a submission to the consultation on amendments to the System Strength Impact Assessment Guideline, and look forward to engaging further with AEMO on the issues raised in this submission. If you would like to discuss this submission, please feel free to contact Kasia Kulbacka, General Manager of Network Planning, at Kasia.Kulbacka@transgrid.com.au.

Yours faithfully



Kasia Kulbacka
General Manager of Network Planning