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Thursday, 7 May 2026

Ms Anna Collyer
Chair
Australian Energy Market Commission

Lodged online: www.aemc.gov.au

Project Ref: ERC0394

Dear Anna

AEMC Improving the NEM access standards - Package 2: Draft Determination

Transgrid welcomes the opportunity to respond to the Australian Energy Market Commission's (**AEMC**) Improving the National Electricity Market access standards - Package 2 draft decision. The draft decision is in response to three Rule change requests submitted by the Australian Energy Market Operator (**AEMO**) and Rod Hughes Consulting (which submitted two separate rule change requests). These requests relate to the access standards for connection to the National Electricity Market (**NEM**).

Transgrid supports the review of the technical requirements for connections, specifically large loads, and appreciates the AEMC's intent to provide clarity through amendments that ensure the standards are fit for purpose to reflect the increasing and evolving connections. Whilst we support this review, we have several concerns with the proposed changes. These are listed below.

- **Tiering system for classifying distribution connected Schedule 5.3 plant**

  While we recognise the importance of establishing a clear threshold for the application of specific access standards to plant seeking to connect to distribution networks, we have several concerns with the draft rule:

  - The threshold between Tier 2 and Tier 3 connections, currently set at a nameplate rating of 100 MW, is too large.
  - The process and associated timeframes for the Distribution Network Service Provider (**DNSP**) to consult with AEMO on the access standards applicable to Tier 1 and Tier 2 connections are not sufficiently defined. Transgrid considers that this process should be explicitly set out in clause S5.3.1a of the Rules and this should occur at the Connection Enquiry stage of the project.

- **Definition of inverter-based load**

  We believe that the proposed definition of inverter based load (**IBL**), particularly its reliance on the concept of loads being "potentially susceptible to power electronic control instability"–does not adequately reflect the stated intent of the draft decision, as set out in Executive Summary paragraphs 22 to 26 of the Draft Determination. This wording lacks sufficient precision and may result in inconsistent interpretation and application, creating uncertainty as to which facilities are captured. In particular, it does not clearly confine the definition to those types of loads most likely to pose material risks to power system security, such as data centres and hydrogen electrolysers.

- **Compliance with performance standards by non-registered Schedule 5 participants**

We do not agree with the draft decisions view that extending Rule 4.15 to non-registered Schedule 5.3 participants would be "*too onerous"* on the basis that such participants have not undergone the registration process under Chapter 2 of the National Electricity Rules (**NER**, **Rules**). Transgrid is currently progressing data centre connections with capacities ranging from approximately 250 MVA to 1,200 MVA and considers it reasonable that facilities of this scale be subject, at a minimum, to the obligations under rule 4.15. We encourage the AEMC to reconsider its position, including whether operators of transmission-connected Schedule 5.3 plant should be formally registered, noting that such facilities are likely to have a material system or market impact.

- **Voltage disturbance ride-through access standards for IBL**

  We encourage the AEMC to consider extending the automatic access standard for S5.3.13 to include non-credible contingency events.

  Transgrid has received connection applications for more than 4.5 GW of data centre facilities in Western Sydney alone, with a further 3.5+ GW at the pre-application stage and presently progressing connection application submissions. The connection points for these proposed data centres (application and pre-application stage) are in close proximity and any significant voltage disturbance in the area will impact all connection points. While we appreciate that the likelihood of non-credible contingency events occurring is low, we believe the potential consequences of disconnecting many GW of data centre load following a single event justify extending the automatic access standard for S5.3.13 to include non-credible contingency events.

- **Clarification of aspects of the disturbance ride-through access standards for generators**

  As outlined in our Consultation Paper submission, we do not consider the current definition of credible contingencies to be problematic. Clause S5.1.8 already provides Network Service Providers with the ability to consider non-credible contingency events where these may threaten power system stability, and to implement appropriate mitigation measures–such as emergency control schemes–which we consider sufficient for managing such events.

  Notwithstanding this position, we have identified a number of practical implementation challenges associated with the proposed rule, as detailed further in the attached submission.

- **Instability detection and response requirements for IBLs**

  Transgrid supports the proposed rule change aimed at addressing the increasing system instability risks associated with **IBL**. We also note opportunities for further clarification and refinement, particularly through the development of clearer guidance for AEMO to establish consistent, NEM-wide instability detection and response guidelines applicable to both IBLs and inverter-based resources.

- **Power system stability and protection requirements**

  We are generally supportive of the introduction of clearer definitions for primary and back-up protection systems but recommend targeted refinements to reduce ambiguity. In particular, we encourage the AEMC to amend the minimum access standard under clause S5.2.5.9 to explicitly require the provision of back-up protection systems. We believe further guidance is also needed to clarify when protection systems should be duplicated and when it is appropriate to rely on upstream or alternative back-up protection arrangements.

- **Improvements to promote power system security and stability**

  We support introducing fast ramp-down alongside block disconnection for under-frequency load shedding, consistent with earlier submission. Definitions of controllable facilities should be updated to explicitly include IBLs, and consideration given to extending fast ramp-down and block disconnection as methods to arrest under-voltage events. Transgrid also highlights emerging system security risks from co-located data centres simultaneously switching to on-site generation, particularly in Sydney West, and notes this may warrant regulatory consideration beyond individual connection agreements.

- **Testing and commissioning**

  We support extending commissioning requirements to Schedule 5 participants, noting that commissioning and any associated testing will likely be staged over several years as large loads progressively reach full demand.

- **AEMO Access Standard Review timeline**

  Transgrid does not object to AEMO being permitted to extend access standard review timelines where justified, provided appropriate transparency and safeguards are maintained.

- **Application of amending Rule to existing Application to Connect**

  Allowing connection applicants to keep using the existing access standards during the transition would allow large data centre projects in Western Sydney (over 4.5 GW already applied for, plus 3.5+ GW in pre-application) proceed without adequate technical requirements, creating a material power-system security risk. Transgrid therefore opposes the opt-in to old standards (and the proposed 6-month transitional date) and recommends the new rule apply from commencement date.

Our attached submission provides further commentary on the above-mentioned points.

We appreciate the opportunity to provide a submission to the Draft Decision and look forward to continuing to work with the AEMC to help ensure the proposed changes to the NEM access standards do not result in unintended consequences. If you or your staff require any further information or clarification on this submission, please contact Zainab Dirani, Policy and Advocacy Manager at [redacted]

Yours faithfully

[redacted]

Malithi Gunawardana

A/General Manager of Customer Management

Transgrid's response to AEMC's Improving the NEM access standards – Draft Determination

1. Overview

Transgrid welcomes the opportunity to respond to the Australian Energy Market Commission's (**AEMC, Commission**) Improving the NEM access standards - Package 2 Draft Decision. AEMC's draft decision covers three rule change requests:

1. AEMO's Improving the NEM access standards – Package 2. This request proposals changes to Chapter 5, Schedule, 5.2, 5.3 and 5.3a.
2. Rod Hughes Consulting - Definitions of protection system requirements. This request proposes changes to Schedule 5.2
3. Rod Hughes Consulting - Conditions for generator protection systems. This request proposes changes to schedule 5.1 and further changes to Schedule 5.1.

Transgrid acknowledges there is an emerging need to amend National Electricity Rules (**NER**, **Rules**) to accommodate for increasing and evolving load connections.

2. System security risks for large load connections

Transgrid has reviewed the section on system security risks associated with large load connections and broadly agrees with the risks and challenges identified by the AEMC.

3. Classifying and defining large IBL

Transgrid agrees that changes to the NER are required to establish a clear and consistent framework for classifying Schedule 5.3 plant. Our views on specific elements related to the draft rule are highlighted below.

Tiering system for classifying Schedule 5.3 plant, including large inverter based load (IBL), that is seeking connection to distribution networks.

While we recognise the need for a clear threshold to applying certain access standards to plant seeking to connect to distribution networks, our concerns are outlined below.

1. We believe the threshold between Tier 2 and Tier 3 connections, presently set at a nameplate rating of 100 MW, is too large. Noting that:

    - As noted on page 29 of the draft determination, the obligation of managing upstream impacts of these distribution connections would fall to the relevant TNSP; however, the draft rule does not include any requirement for the DNSP to consult with the TNSP1 regarding which access standards are applicable to a Tier 2 connection.
    - Provided the new access standards are only applied to the types of loads that are most likely to impact power system security (e.g. data centres and Hydrogen electrolysers), we believe it is reasonable for facilities with a nameplate rating of 30 MW to comply with disturbance ride-through requirements. We understand that data centres are configured with many medium voltage cable “rings” that connect UPS and the associated IT load via many identical ring main units (typically rated in the order of 3.0 MVA each). As a result, the technology installed at a smaller data centre (e.g. 30 MW) is not expected to be significantly different to that of a large transmission connected data centre. Data centre design appears to be very modular in nature, and a smaller data centre simply includes fewer medium voltage “rings” and a smaller number of ring main units and UPS. Given the similarity in the equipment that impacts ride-through capability, the ability to comply with ride-through requirements would be similar to that of a larger data centre.
    - Given the proposed voltage disturbance ride-through requirements are defined by voltage ride-through curves, and do not include a direct requirement to ride-through specific contingency events, we believe the compliance assessment burden is minimal. We understand that some DNSP’s were concerned that voltage disturbance ride-through requirements might introduce the need for detailed power systems studies to confirm compliance. However, we do not believe detailed wide area power systems studies are necessary to demonstrate compliance with a performance standard defined by a ride-through curve.
    - Under the proposed tiering system, access standards for disturbance ride-through would be applied discretionally, with one criterion for applying them to Tier 2 connections being clustering of individual connections. However, clusters of individual connections (and the associated system security risk) may develop over time. With no ability to apply standards retrospectively, later connections may be burdened with standards to address a system security risk that is equally caused by earlier connections that were not subject to disturbance ride-through standards.

    Transgrid proposes that there be a single threshold (e.g. 30 MW), and that all IBL above that threshold would be subject to the new access standards, noting that some flexibility could be included in specific access standards, for example, similar to the thresholds for PMU requirements under the draft rule for S5.3.14. Furthermore, we believe there should be provision for the NSP (in consultation with AEMO and potentially the System Strength Service Provider) to apply S5.3.11 where multiple connections below the threshold may

[1] See further discussion below regarding our concerns with the process the DNSP must follow to consult AEMO.

have an adverse system strength impact. Please see further comment on this in our response to the proposed changes to system strength access standards in Section 6.

2. Neither the Draft Determination nor clause S5.3.1a of the Markup Draft National Electricity Amendment are sufficiently clear on the process the DNSP must follow to consult AEMO regarding whether clauses:

   - S5.3.11, S5.3.12, S5.3.13 and S5.3.14 would apply to a Tier 2 connection.
   - S5.3.12 and S5.3.13 would apply to a **Tier 1 connection**.

   Given (as noted on page 29 of the Draft Determination) that the burden of managing upstream impacts of these connections would fall to the relevant TNSP, and that the TNSP has no input to this determination, Transgrid requests that the AEMC provide further clarification on the process that the DNSP must follow in consulting AEMO ahead of the Final Determination. We recommend that a clear process, including timing, be documented in the Rules. We believe that the DNSP should consult with AEMO at the connection enquiry stage, as the customer needs to be aware of the applicable access standards prior to preparing their connection application. Waiting until a connection application is made and seeking AEMO advice per 5.3.4A (acknowledging these access standards are AEMO advisory matters) of the NER is not adequate.

No classification framework for large IBL connecting at the transmission level, or who have opted to be registered under the NER.

We agree that a classification framework (similar to the tiering system for distribution connections discussed above) is not required for large load connecting at transmission level, or who have opted to be registered under the NER. Furthermore, we agree that 30 MW is an appropriate threshold for IBL that would be deemed a large IBL.

However, we do not believe the proposed changes to the definition of IBL are sufficient, and there remains a risk that this will be applied inconsistently. We note the following points related to the proposed changes to the definition of IBL.

- While the changes make it clear that IBL includes converters operating in both inverter and rectifier modes, the reliance on what is deemed “potentially susceptible to power electronic control instability” leaves the definition open to various interpretations.
- Executive Summary paragraphs 22 to 26 of the Draft Determination make it clear that the intent of the draft rule is to apply new access standards to loads that are most likely to impact power system security (e.g. data centres and Hydrogen electrolysers), and that this would not include facilities such as mines, refineries and processing plants that typically comprise heterogeneous processes.
- This distinction between loads like data centres (that comprise large numbers of homogenous units) and loads like mines is not reflected in the present drafting of the definition of IBL.
- While the AEMC considers (and we agree) that loads like mines are not a concern, as they do not exhibit control driven behaviour to deliberately disconnect and are comprised of heterogenous motors and processes, many of these modern processes are power electronic connected. Without clear criteria as to what is “**potentially susceptible to power electronic control instability**”, there is a risk that the definition of IBL will be applied inconsistently.

We encourage the AEMC to consider further amendments to definition of IBL to ensure that it captures only those loads intended to be included, as highlighted in Executive Summary paragraphs 22 to 26 of the Draft Determination.

Guidance on the types of modelling needed to demonstrate compliance with performance standards

We agree that the Power System Model Guidelines (PSMG) should remain the primary instrument for specifying detailed technical modelling requirements and we support the alignment of modelling

requirements for large IBL with that of generators. We note that while the transitional arrangements in the draft rule will require AEMO to update the PSMG, there is no timing requirements for this update.

Given the rapid progression of data centre connection projects across the NEM, the absence of a defined timeline presents a material risk to Connections seeking to demonstrate compliance with performance standards in a timely manner. We request that the Commission consider specifying an appropriate timeline for AEMO to complete updates to the PSMG (and other relevant guides) as part of the Final Determination.

Reforms to promote compliance with performance standards by non-registered Schedule 5 Participants

While Transgrid agrees that reform to promote compliance with performance standards by non-registered Schedule 5 Participants is required, we do not believe that the proposed changes go far enough noting:

- The AER recommended[2] that rule 4.15 be extended to all Schedule 5.3 Participants, including non-registered participants. The Commissions view on this was that "*it could be too onerous, given that such participants have not undergone the registration process under Chapter 2 of the NER*".

  While the obligations of rule 4.15 may be too onerous for Schedule 5.3 Participant in respect of smaller distribution connected schedule 5.3 plant, we do not agree that it is too onerous for transmission connected Schedule 5.3 Participants. Transgrid is presently progressing data centre connections that range in size from 250 MVA to 1400 MVA. Transgrid believe that including a requirement in the rules to ensure load facilities of this size comply with the agreed performance standards is reasonable.

- The Commission's view (on page 44 of the Draft Determination) "is that under rule 4.15, the AER can take enforcement action against the Registered Participant if its plant is not meeting performance standards, regardless *of whether there is a non-registered third party who caused the non-compliance*."

  Where the Schedule 5.3 Participant's plant is a large transmission connected schedule 5.3 plant, we believe that the AER should have the ability to take enforcement action against the Schedule 5.3 Participant. We believe that enforcement via the Registered Participant (which may be a retailer market participant) is impractical and the ability for the Registered Participant to take enforcement action against the third party would depend on the agreements between the Registered Participant and that third party.

- On page 44 of the Draft Determination, the Commission notes that "*Chapter 2 is designed to ensure that entities with material system or market impact are formally registered and regulated accordingly. Extending rule 4.15 without adjusting the registration framework risks imposing participant-level regulatory burdens on entities that deliberately chose not to register*."

  We would assert that the data centres presently at application stage with Transgrid, which range in size from 250 MW to 1400 MW, will have a ***material system or market impact***.

Transgrid requests that the Commission reconsider the position on applying rule 4.15 to Schedule 5 Participants. We believe that at a minimum, rule 4.15 should be updated to apply to a "Relevant Schedule 5 Participant" in addition to a Registered Participant. What is considered a "Relevant Schedule 5 Participant" for the purposes of

[2] In the AER's submission on the Consultation Paper and discussed on page 43 of the Draft Determination.

rule 4.15 could be defined at top of the rule and could include a threshold such that small distribution connected schedule 5.3 plant is not captured.

We encourage the AEMC to consider whether the operators of transmission connected schedule 5.3 plant should be formally registered, noting that the data centre connections Transgrid is presently progressing will likely have a ***material system or market impact***. Furthermore, we request that the AEMC consult further on this matter prior to the final decision.

4. Disturbance ride-through access standards for loads and clarified requirements for generators

Transgrid agrees that the introduction of disturbance ride-through requirements for IBL, along with information provision for all Schedule 5.3 plant, is appropriate to address system security risks associated with emerging large IBL connections. While the introduction of disturbance ride-through access standards differs from AEMO's rule change proposal, we believe that AEMO's proposal for light-handed information provision and maximisation measures does not sufficiently address the emerging systems security risks and is potentially ambiguous. We agree with the AEMC that clear and predictable technical standards will support a transparent and efficient connections process and will address emerging system security risks.

Our views on specific elements related to the draft rule are highlighted below.

Voltage disturbance ride-through access standards for IBL

While we appreciate the intent of the draft rule is to *"mitigate the risk of cascading outages and sudden load disconnection during credible contingency events"*[3], we believe that the automatic access standard should be extended to consider **non-credible** contingency events.

Transgrid has received connection applications for more than 4.5 GW of data centre facilities in Western Sydney alone, with a further 3.5+ GW at the pre-application stage and presently progressing connection application submissions. The connection points for these proposed data centres (application and pre-application stage) are in very close proximity. While non-credible events such a circuit breaker failure are low likelihood events, the proximity of these facilities means that the voltage depression caused by a 330 kV fault (credible and non-credible), or a post fault over voltage exceeding the system standard for credible contingency events, would be similar at all the proposed connection points (many of which are at the same 330 kV busbar). As such, under the existing draft rule, there is a risk that all the proposed data centre load would disconnect during or following a non-credible event.

Furthermore, the Draft Rule is not consistent in the application of criteria aligned with credible vs non-contingency events:

- Automatic access standards for frequency disturbance ride-through (S5.3.12) in the draft Rule is based on the Frequency Operating Standard, which includes consideration of non-credible events and is aligned with S5.2.5.3 for Schedule 5.2 plant.
- Automatic access standards for voltage disturbance ride-through (S5.3.13) in the draft Rule includes under voltage disturbance requirements that have been aligned with S5.2.5.4 for Schedule 5.2 plant, which includes consideration of non-credible events.
- Automatic access standards for voltage disturbance ride-through (S5.3.13) in the draft Rule includes over voltage disturbance and deep disturbance duration requirements that have only been aligned with system standard requirements for credible events.

While we appreciate that non-credible contingency events are rare, these events must be considered by AEMO and the NSP where there is a risk that these events may lead to cascading outages or major supply disruptions. We believe that the disconnection of GWs of load following a non-credible contingency event in Western Sydney may lead to cascading outages or major supply disruptions. Therefore, we request that the automatic access standard for S5.3.13 be extended to consider non-credible contingency events by:

1. Aligning the overvoltage ride-through requirements with S5.2.5.4 for Schedule 5.2 plant. Part of this could be classified as "Region C", permitting disconnection of plant (e.g. data centre UPS) provided the post disturbance recovery criteria is met.

[3] Per Section 1.2 of the Draft Determination

2. Considering system standard clearing times for breaker fail protection system when setting deep disturbance duration requirements.

Figure 1 shows an example voltage ride-through curve that accommodates Transgrid's recommendations above. We have engaged with multiple data centre customers on this proposal and believe that while it does set a high standard, it is technically feasible for a data centre to meet this. Provided the minimum access standard includes sufficient room to negotiate where plant cannot meet this, we believe it is appropriate to set a high standard for the automatic access standard. Specific points to note with respect to Figure 1 include:

- The high voltage ride-through requirement aligns with NER S5.2.5.4 (noting that the high voltage ride-through performance above 130% presented in the below figure will be updated to align with the most recent rule change for generators).
- The low voltage ride-through requirement for connection point voltages down to 0.7 p.u. aligns with NER S5.2.5.4.
- The deep disturbance requirement is based on 330 kV breaker fail protection system clearing time of 250 ms and includes a requirement to ride-through voltage disturbances of 0.5 to 0.7 p.u. for a period of 1 second. This was based on analysis of the likely voltage disturbances caused by remote faults in the 132 kV system, which may not be cleared in 250 ms.
- Permits plant to disconnect if the connection point voltage falls below 0.5 p.u. or increases above 1.2 p.u. Recovery criteria would apply in this case.

Based on our engagement with data centre customers, we understand that some existing UPS technologies, in their standard configurations, cannot meet the required ride-through thresholds for plant to remain connected during low-voltage events (blue shaded regions). While many UPS vendors are actively working to improve performance to meet these thresholds, where a particular UPS technology cannot do so on its own, connecting parties could supplement the installation with additional reactive plant–such as a STATCOM or synchronous condenser–to improve voltage support and overall robustness during low-voltage disturbances.

We recognise that the Commission has set the upper threshold for "Region C" in the draft rule to align with what existing UPS offerings can achieve. However, as there has traditionally been no requirement for load to ride-through disturbances globally, there is the possibility that the existing UPS offering may not fully utilise inherent ride-through capability. We believe it is appropriate to consider what this technology can practically achieve, rather than what the standard offering currently achieves.

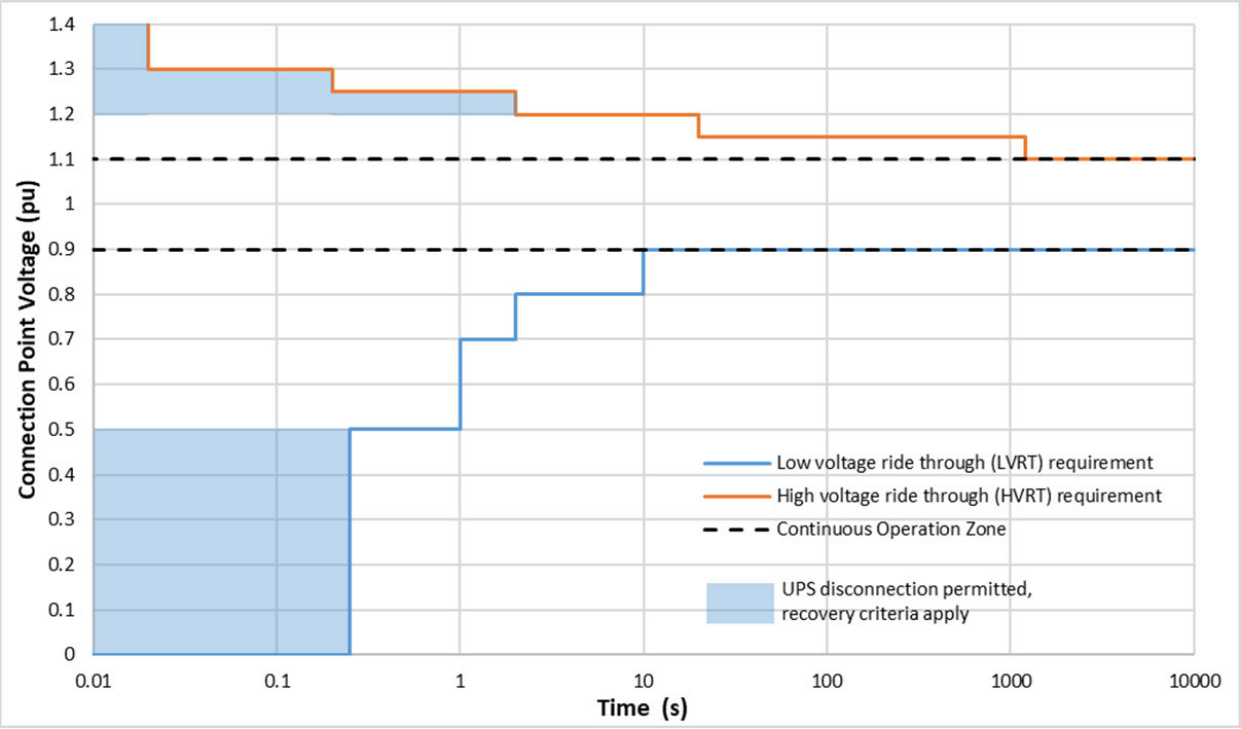

Figure 1: Voltage ride-through envelope

Post-fault active power recovery

Based on Transgrid's engagement with connection applicants to date, we concur that a 500 ms post-fault active power recovery time appears to be aligned with what is presently achievable for many UPS. However, Transgrid is not yet comfortable that recovery of at least 90% of the pre-disturbance active power in 500 ms is sufficiently fast to limit frequency impacts.

The AEMC notes (on page 61 of the Draft Determination) *"we understand AEMO would be able to manage the impacts of a voltage disturbance and resulting loss of load on the power system for that amount of time"*. However, no basis for this position has been provided.

We encourage further analysis be undertaken (or presented if this analysis has already been completed) to assess that the proposed duration for the automatic access standard is sufficiently fast. We note that once the rule is made, and the recovery time of 500 ms is locked into the automatic access standard, the NSP would be responsible for implementing mitigations schemes (e.g. to manage impact to network voltage caused by the slow recovery of potentially GWs of load) to manage impacts if it turns out that 500 ms is not fast enough

Transgrid welcomes the opportunity to participate in the scoping of scenarios for this assessment, noting that we are presently progressing connection applications for more than 4.5 GW of data centre demand in Western Sydney and have plant details and early-stage models that may help inform the assessment.

Frequency disturbance ride-through access standards for IBL

Transgrid agrees that it is appropriate to align the automatic access standard for the draft rule (S5.3.12) with the Frequency Operating Standard. Furthermore, we are comfortable with the draft rule not having a minimum access standard.

Limits on how protection systems operate

We support the draft decision to prevent IBL from using protection systems that operate for phase shifts less than 20 degrees, or for multiple faults in a certain time period, as a general requirement is appropriate.

We agree that this is not onerous, and that there is no need to include it as an automatic access standard to facilitate negotiation. However, we believe it may be more appropriate to include these requirements under S5.3.14 instead of S5.3.3, as these protections systems relate to voltage disturbance ride-through.

In addition to the proposal for vector phase shift and multiple fault protection, we encourage the AEMC consider limits for transient over-voltage protection. We are aware that some UPS have transient over-voltage protection that would disconnect the plant for short duration transient (peak) over-voltage. A requirement similar to the example below could be included as part of the automatic access standard.

> The *schedule 5.3 plant* does not include voltage protection that may commit to *disconnect* any operating plant within 20 milliseconds of the commencement of a transient over-voltage disturbance (the instantaneous voltage exceeding 110% of the peak value of *nominal voltage*) at the Connection Point.

We do not recommend the requirement above be included as a general requirement (like the limits on vector phase shift and multiple fault protection), as we may need to negotiate a standard to accommodate certain transient over-voltage protection. Including it as an automatic access standard with no associated minimum access standard would allow the NSP to consider the specific risk and negotiate an appropriate standard.

Given the similarities between S5.3.3 and S5.2.5.9, and that S5.2.5.9 is presently an AEMO advisory matter, for consistency it may be appropriate to classify S5.3.3 as an AEMO advisory matter also.

Visibility of ride-through capability for all Schedule 5.3 plant

Transgrid supports the introduction of a requirement for the Schedule 5.3 Participant to provide information about their load's ride-through capability. While we agree that non-IBL should not be subject to specific access standards for disturbance ride-through, information about ride-through ride-through capability is required for planning and modelling purposes. We note that composite load type models are presently used in planning studies for existing non-IBL, and the existing modelling (predominantly carried out by AEMO[4]) relies on assumptions due to the lack of visibility of existing load performance. Allowing the NSP (in consultation with AEMO) to request this information will support planning and improve the accuracy of power system models.

Clarification of aspects of the disturbance ride-through access standards for generators

As outlined in Transgrid's previous submission on the Consultation Paper, Transgrid wishes to emphasise that we do not consider the current definition of credible contingencies to be problematic. Currently, in most circumstances, Transgrid does not consider non-credible contingencies in connections assessments, except in limited cases where certain critical non-credible contingencies are assessed. Where new contingencies are reclassified and a generator is unable to ride-through them, these are typically managed through operational arrangements or emergency control measures. However, under the proposed new Rule, once a list of such contingencies is established, connection applicants, NSPs, and AEMO would be required to undertake additional assessments of these non-credible contingencies, over and above the already extensive requirements under clauses S5.2.5.5, S5.2.5.5A, and related provisions. This would result in increased time and cost impacts for all parties.

Within the planning framework, Transgrid notes that clause S5.1.8 already enables NSPs to consider non-credible contingency events that could endanger power system stability and to implement appropriate mitigation measures such as emergency control schemes, which we believe is sufficient to manage non-credible contingencies.

Notwithstanding above, Transgrid agrees with the concept of maintaining a dynamic list of events that may be reclassified, in contrast to the static list referenced in the previous consultation. As noted in our earlier submission, it is not practical to provide a definitive list at the time of a connection application.

However, Transgrid considers that there are a number of practical challenges associated with the implementation of the Draft Rule.

[4] As detailed on AEMO's website: https://www.aemo.com.au/initiatives/major-programs/nem-distributed-energy-resources-der-program/managing-distributed-energy-resources-in-operations/power-system-model-development

1. Under the proposed amendments to clause S5.2.4(e1)(1BA), NSPs would be required to provide this list to connection applicants in consultation with AEMO. Given that, under the current Rules, as per Clause 4.2.3A, the reclassification of contingencies is an AEMO responsibility, Transgrid considers that AEMO is best placed to develop and maintain such list applicable across the NEM, which all connection proponents can reference. This list could be established and maintained through the Power System Security Working Group (PSSWG) and incorporated into AEMO's Power System Security Guidelines (SO_OP_3715). Transgrid also believes that the list should not be limited to operational lines only. It should also include the future non-credible contingencies recommended by the General Power System Risk Review (GPSRR).
2. As the Commission has also acknowledged in the draft determination, the set of events likely to be reclassified will change over time–that is, the list will continue to evolve throughout the life of a plant. Under the proposed drafting of the Rule, generators seeking the Automatic Access Standard are required to ride-through the list of non-credible contingencies that is provided by the NSP under clause S5.2.4(e1)(1BA). This suggests that plant performance is assessed against a definitive list of contingencies provided at the time of the connection application. However, as the power system and network evolve, additional contingencies may be reclassified. To address this gap, Transgrid recommends that where a generator cannot ride-through newly reclassified contingencies, proponents have an obligation to work collaboratively with NSPs to develop appropriate emergency controls or operational arrangements. Transgrid further recommends that the final Rule determination provide clearer guidance–and, if possible, explicit drafting in the final Rule–to confirm this intent. In the absence of such clarification, NSPs may face challenges when engaging with connected parties to ensure adequate arrangements are in place to manage newly reclassified contingencies and maintain power system security.
3. As set out in the draft Rule, the minimum access standard does not require generating plants to ride-through any non-credible contingencies. The draft determination notes that the new minimum access standard allows proponents to negotiate plant capability to ride-through a subset of contingencies that are likely to be reclassified. We understand the intent of the draft Rule to be that remaining contingencies may instead be managed through operational measures or emergency control measures. However, this intent is not explicitly articulated in either the draft Rule or the draft determination. While the draft determination refers to existing clause S5.2.5.5(s), this clause relates to abnormal network or plant conditions. If it is intended that this clause be relied upon to address the management additional reclassified contingencies, further clarity should be provided in both the draft Rule and the draft determination.

5. Power system stability and protection requirements

Instability detection and response requirements for IBLs

Transgrid acknowledges that IBL can contribute to system instability. As more IBL are expected to connect to the NEM, the associated risk to system stability will increase. This underscores the need for measures to detect unstable events at inverter based resource (**IBR**) connection points and to initiate appropriate responsive actions.

Transgrid is supportive of the rule change proposal and request to address and clarify the following:

- The draft rule would introduce a new access standard for instability detection and response applicable to large IBL with the potential to contribute to instability. Transgrid seeks the AEMC's advice on whether this requirement should also extend to Schedule 5.3(a) plant (e.g.: DC links).
- The draft rule refers to the compliance demonstration point at " a connection point" in circumstances where multiple physical connection points may exist for a connection. Under the existing NER Chapter 10 definition, connection point is defined as:
- "…In relation to other transmission networks, the point at which power flows to or from a person connected to the transmission network can be isolated from the transmission network. If there is more than one such point, the Network Service Provider and that person will agree which point is the connection point in their connection agreement".
- This definition makes clear that, where multiple physical interfaces exist, only one point is formally designated as the connection point for the purposes of the Rules and the connection agreement. To avoid ambiguity and ensure alignment with the Chapter 10 definition, Transgrid recommends replacing the phrase "a connection point" with "the connection point" throughout the relevant clauses of the draft rule.
- While Transgrid notes the provisions under clause S5.3.14(h) requiring AEMO to update the Power System Stability Guidelines, this requirement is relatively broad in its current form. Transgrid recommends that the AEMC provide further direction, enabling AEMO to:
    - define the term instability as it applies to IBRs and IBLs, and;
    - develop a NEM-wide guideline on instability detection schemes for IBLs, incorporating the revised Rule requirements.
- It is also noted that no such guideline currently exists for IBRs. Transgrid considers that the development of a unified guideline by AEMO, covering instability detection scheme requirements for both IBLs and IBRs, would promote consistency across the NEM in the application of the Rules.
- According to S5.3.14 (a)(1), Clause S5.3.14 is applicable to large IBR and where NSP/AEMO considers it could reasonably contribute to instability. However, Transgrid believes the use of the term "inverter based resource" in S5.3.14 could lead to confusion. Transgrid recommends adopting the term "inverter based load" instead of "inverter based resource" in S5.3.14. This is consistent with the approach commission has taken under the Clause S5.3.11.

Proposed definition of 'primary protection system' and 'back-up protection system'

Transgrid is supportive of the AEMC's draft determination to formally define the primary and back-up protection systems. However, we consider the proposed definition of the 'primary protection system' to be incomplete and recommend the following amended definition:

"A protection system designed as the initial protection function to detect, select, and clear faults occurring within its defined protection zone".

Further, the proposed definition of Back-up Protections System needs to be updated to clarify the back-up protection is not mandated to meet the same clearance times as primary protection and also to ensure it detects all faults in primary protection zone. Transgrid proposes to update the definition of Back-up Protections System as follows:

"A protection system that is designed to operate to clear the fault in the primary protection system zone after the relevant primary protection system(s) fail to clear the fault within the primary protection's applicable fault clearance time."

Access standard for generator protection systems

As highlighted in Transgrid's previous submission to the AEMC, Transgrid recommends amending the current minimum access standard (MAS) under clause S5.2.5.9 to explicitly include a requirement for the provision of back-up protection systems.

The current Rules do not explicitly specify back-up protection requirements in circumstances where primary protection fault clearance times do not impact power system security. This creates ambiguity regarding whether additional back-up protection is necessary when system security is not at risk. Therefore, Transgrid proposes including the following as a MAS under clause S5.2.5.9 for any connection in the new Rules:

"Protection systems shall be designed to ensure faults are cleared under a single-contingency condition, including but not limited to the failure of a protection device, auxiliary supply, or circuit breaker to operate, unless the protection system is inherently fail-safe for all fault conditions (e.g. fuses)."

This reflects established industry practice, with deviations typically due to design shortcomings or limited technical competence. For example, a single collector feeder serving multiple Wind Turbine Generators and back-up protection to single protection at RMU (connection to WTG transformer) may lack adequate back-up protection for faults on the LV side of the WTG transformer. These issues can be resolved through appropriate feeder design or communication signalling, although the current Rules may be interpreted as not requiring such measures where system security is not impacted.

The Rules do not clearly specify whether back-up protection must clear faults by disconnecting the faulted feeder or equipment. For example, a 132 kV system could be configured with a single primary protection scheme, with back-up protection effectively provided by upstream network protection that would isolate the busbar. The Rules do not explicitly indicate whether such an arrangement is acceptable or unacceptable. Rules need to provide guidance on where protection should be duplicated like at sub-transmission and transmission level, and criterions when upstream protections provide back-up than the limit to maximum load/generation loss is acceptable.

To support consistent and technically robust protection system design, Transgrid considers that the new Rules should provide clear guidance on:

- When protections should be duplicated; or alternatively,
- When back-up protection can be provided in place of duplicate protection

Transgrid notes that back-up protection may result in the disconnection of non-faulted bays. This may be acceptable for collector feeder and downstream protection in Wind Farms, Solar Farms and BESS installations where the additional loss of load or generation is not excessive, and occurs only in the event of primary protection failure.

6. System strength access standards applicable to loads and HVDC links

Transgrid agrees that amendments to the system strength access standards applicable to loads and HVDC links are required. We have outlined below further changes we consider necessary to ensure the system strength framework and associated guidelines adequately address the system strength impact of IBL, which are not fully addressed in the draft rule.

Limiting short circuit ratio requirements to large IBL

We agree that there is a need to limit the application of system strength access standards[5], as it is not practical to apply these to every Schedule 5.3 plant that includes any inverter-based component regardless of size. We recommend aligning the associated threshold with the updated definition for large IBL, and therefore the threshold used for other access standards (e.g. disturbance ride-through).

However, we believe that regardless of the threshold that is selected, it will inevitably incentivise sizing of projects to have a rating that is just under the threshold. This may lead to clustering of smaller IBL projects, that in aggregate may have an adverse impact on system strength. We note that under the proposed tiering framework[6], the NSP may apply the new disturbance ride-through access standards to Tier 1 connections (less than 30 MW) where an aggregate of Tier 1 loads may have an *adverse system **security** impact*[7]. We request that this be extended to include where an aggregate of Tier 1 loads may have an *adverse system **strength** impact*, by including discretion for the NSP to apply S5.3.11 (in consultation with AEMO and the System Strength Service Provider (SSSP)) in the same way as S5.3.12 and S5.3.13 are applied.

Introducing flexibility to the minimum access standard for S5.3.11

While we agree that there is a need to introduce flexibility to the minimum access standard for S5.3.11, acknowledging that certain production technologies (e.g. Hydrogen facilities employing thyristor-based converters) may not be capable of meeting the existing minimum access standard, we request that the AEMC consider alternatives to simply relaxing the requirement.

We would like to emphasise that relaxing the requirement, without addressing the fact that these facilities require more system strength, places the risk of managing the increased system strength impact on the wider power system. This may result in under procurement of system strength by the SSSP and may ultimately result in delays to connections (both generator and loads) if not properly managed.

Furthermore, under the draft rule, the discretion to relax the requirement may be made by the NSP (e.g. by a DNSP) without consultation with the relevant SSSP, who would ultimately be responsible for managing the system strength impact in each jurisdiction. Hence, the decisions of relaxing S5.3.11 standard should be made by the NSP with discretion of the relevant SSSP.

Transgrid recognises that SCR may not be an appropriate or sufficient proxy for assessing the system strength impact of IBLs. Transgrid proposes that instead of simply relaxing the minimum access standard requirement on SCR, the AEMC consider changing to a standard aimed at minimising stable voltage waveform impact. Such a standard would enable a broader set of technical solutions, such as grid-forming STATCOMs and battery energy

[5] Note that we are referring to system strength access standards rather than “short circuit ratio requirements”. There are broader issues with the applicability of short circuit ratio to loads that are not addressed by the draft rule. Please see further comment below.
[6] See Section 3 of this submission - Transgrid feedback on the proposed tiering framework.
[7] Per page 53 of the Draft Determination.

storage systems to be considered, rather than limiting solutions to synchronous sources, as occurs under the withstand SCR approach.

HVDC link operators may procure system strength from third parties

Transgrid agrees that allowing HVDC link operators to procure system strength from third parties will benefit future HVDC link connections and that it is appropriate for this arrangement to be aligned with that afforded to Schedule 5.2 participants.

In our Consultation Paper submission, Transgrid presented the viewpoint that HVDC link owners should not be able to consider procuring system strength support from a third party as the go-to solution, considering the complexities involved with this arrangement (including operationally). However, it may be considered if other options, including additional investment by the Schedule 5.3a participant or an arrangement with the NSP/SSSP, are not viable.

Further amendments to the system strength frameworks and associated guidelines required

The current system strength framework was designed for the forward procurement of system strength services to enable efficient connection of IBRs and IBLs. However, there are significant uncertainties in forecasting the amount of system strength consumed by IBLs:

- Uncertainty in amount of system strength consumed by IBLs, as further work is required to assess whether SCR is an appropriate measure for system strength consumption of IBLs and therefore planning proxy to identify future needs.
- Uncertainty in the materialisation in both timing and size (ramp rate of installed capacity) of IBLs, which complicate future procurement decisions.

Currently, AEMO's system strength standards (defined via the Transition Plan for System Security) have no IBL forecast, and therefore there currently is no obligation (or direction of quantum of remediation) on the SSSP to forward procure system strength for IBLs. Noting this, and the timeline for any analysis and regulatory processes, the ability to deliver SSSP centralised solutions may come too late for soon-to-connect IBLs.

Under the current system strength arrangements, the costs associated with central procurement of system strength required for IBLs (and IBRs) are shared between consumers, and later offset by system strength charges that have been collected from the parties that have elected to pay the system strength charge. This creates a risk that should the SSSP forward procure, the cost of the asset is ultimately borne by the consumer rather than being efficiently allocated to the parties that create the risk (e.g. if the IBLs do not materialise or if the system strength charge paid by the IBL does not reflect the full cost of remediation). This outcome is inconsistent with the intent of the AEMC's Access Standards Package 2 rule change where increased system costs should be borne by the parties causing the impact and suggests that the current system strength rules may need to be refined for IBLs to ensure the risk is allocated appropriately to the parties causing it.

Transgrid acknowledges that AEMO must consult and update the System Strength Impact Assessment Guidelines (**SSIAG**) as part of this rule change. Considering the uncertainty of materiality of system strength impacts, Transgrid recommends the following:

1. Update SSIAG with a methodology of calculating system strength impact on stable voltage waveform for IBLs using power systems model.
2. If SCR is to be used, that it is only used as a starting point to calculate system strength quantity (SSQ) and introduce provision in the NER for this initial calculation to be superseded with an updated methodology from SSIAG when better information becomes available.
3. Once the adverse impact on stable voltage waveform has been identified by the NSP, the proponent may either self-remediate, pay the SSSP for central remediation according to the method introduced in updated

SSIAG or if central remediation is not available, pay the connecting NSP to remediate as part of connection enablement works.

While these steps do not mitigate all the risks, they will at least allow more accurate system strength impact to be reflected in this process and costs allocated to the connecting IBL. Transgrid recognises that the Access Standard Package 2 Rule change may not be able to address these gaps within the system strength framework, however, we do not believe an update to the System Strength Impact Assessment Guidelines alone will address these broader issues.

7. Improvements to promote power system security and stability

Allowing UFLS through fast ramp down in addition to disconnection in blocks

Transgrid supports the introduction of a fast ramp down capability in addition to disconnection in blocks under clause S5.3.10 - Load shedding facilities. This aligns with Transgrid's recommendation in our submission to the AEMC consultation paper. We also note that clause 4.3.5 - Customer obligations has been amended in the draft rule to include both progressive automatic disconnection and reduction of load.

We further note that NER clause S5.1.10.1 - Load, generation and network control facilities requires that:

- "sufficient load is under the control of under-frequency relays or other facilities where required to minimise or reduce the risk that in the event of the sudden, unplanned simultaneous occurrence of multiple contingency events, the power system frequency moves outside the extreme frequency excursion tolerance limits"
- The definition of facilities in Chapter 10 of the current rules does not include IBLs. Given the increasing prevalence of IBLs and their potential to materially influence system frequency outcomes, Transgrid considers that the definition should be updated to explicitly include IBLs.
- Fast ramp down and/or disconnection of loads can help to arrest both under frequency and under voltage issues on the network. Transgrid therefore recommends that the AEMC consider extending the under-frequency control concepts under clause S5.3.10 to also address under-voltage conditions.
- In regard to the General Requirements under clause S5.3.10, Transgrid notes that while it is desirable to specify the details of active power available for disconnection and/or fast ramp-down, this information is often not available during the connection application stage. As such Transgrid recommends that a placeholder to capture the range of the capability be included in the customer performance standards and that this be updated prior to connection (during the details design phase). Documenting the range of the capability rather than the actual setting allows for these settings to be updated in the future in the event the network has changed and an adjustment is needed. It is recommended that specific settings such as active power ramp rates be included in operating protocols that can easily be updated. .
- From a power system security and stability perspective, Transgrid understands that data centres may elect to switch to on-site backup generation (for example, diesel generators) in response to a foreseeable network constraint. This presents a significant operational challenge when multiple data centres are co-located, as they would be exposed to the same network conditions and may act simultaneously.
- In New South Wales, a large number of new data centre connections are anticipated in the Sydney West region. A concurrent transition to on-site generation by these facilities could represent several gigawatts of load reduction from the grid, with the potential to materially impact system voltage and frequency.
- Careful consideration is therefore required as to whether the management of such events should be addressed through the regulatory framework or through individual Connection Agreements. This issue sits outside a NSP remit, as decisions regarding backup generation utilisation and reliability standards are set by data centre developers in accordance with their own customer and commercial requirements.

Equipment assessment and testing, regardless of registration status

We support extending clause 5.8 'Commissioning' to broadly include Schedule 5 Participants. In regards to Schedule 5.3 plant, Transgrid is of the view that a certain level of testing will be required, noting that the specifics of these tests will be determined closer to the energisation and agreed directly with the relevant Schedule 5.3 Participant in consultation with AEMO. Until the rule change is finalised, Transgrid anticipates including the requirements for Commissioning within Connection Agreements for the Schedule 5.3 Participants.

Transgrid understands that large loads such as data centres, may take several years to reach its maximum demand, and as such, commissioning testing could be prolonged, in that tests will likely be required when the Schedule 5.3 participant reaches a certain level of active power. Transgrid requests AEMC to consider this practical requirement in the final rule determination.

Allowing AEMO to extend timeframe for future access standard reviews

In respect to *5.2.6A AEMO review of technical requirements for connection*, Transgrid notes that the proposed provision allows AEMO to extend the timeframe for publication of a final report by up to three months, and only where there are matters of material complexity or a material change in circumstances. The requirement for AEMO to publish a notice of extension, including the reasons for the extension and its stakeholder engagement plan, provides an appropriate level of transparency. On this basis, Transgrid does not oppose the proposal.

8. Transitional Rules

Application of amending Rule to existing Connection Enquiries

Under the draft Rule, the new access standards will be applicable to all existing Connection Enquiries where an Application to Connect is not submitted before the Rule commencement date. Within 10 business days from commencement date, the NSP is required to notify all affected Connection Applicants that the new access standards apply. NSP should also provide technical requirements applicable under the new Rules within 30 business days from the commencement date. Transgrid proposes that the Rules include provisions to extend this timeframe where necessary up to 60 business days, noting that the high volume of existing Connection Enquiries may make it difficult to meet the 30 business day requirement for all projects.

Transgrid also notes that both sub-sections titled “Definitions” and “Application of the Amending Rule to Existing Connection Enquiries “numbered as 11. [XXX].1. The subsection titled “Application of the Amending Rule to Existing Connection Enquiries“ must be corrected as 11.[XXX].2.

Application of amending Rule to existing Application to Connect

- Clause 11.[XXX].3 (f) permits Connection Applicants to elect to apply the existing access standards until the transitional date. As noted in Section 4, Transgrid has received connection applications for more than 4.5 GW of data centre capacity in Western Sydney alone, with a further 3.5+ GW progressing through pre-application. Allowing these projects to proceed under existing access standards presents a material system security risk, as the existing technical standards under Schedule 5.3 are insufficient to address the disturbance ride-through requirements and the broader power-system security and stability impacts associated with large load connections of this scale. Accordingly, Transgrid does not support permitting Connection Applicants to elect to apply the existing rules or the inclusion of a transitional date of 6-months, and recommends that the new Rule apply from its commencement date.
- Under the draft Rule, the new access standards apply by default to ongoing Connection Applications where an Offer to Connect has not been received prior to the commencement date. Within 10 business days of the commencement date, NSPs are required to notify Connection Applicants that the new access standards will apply. In addition, NSPs must provide the relevant updated technical requirements under the new Rules within 30 business days of the commencement date. Transgrid proposes that the Rules include provisions to extend this timeframe where necessary up to 60 business days, noting that the high volume of existing Connection Applications may make it difficult to meet the 30 business day requirement for all projects.
- The draft Rule also requires that any election to apply old access standards be made “as soon as reasonably practicable.” If the AEMC includes provisions in the final Rule allowing applicants to elect to apply old access standards, Transgrid considers it would be beneficial to specify a clear timeframe from the commencement date–for example, within 30 business days of an NSP’s notification that the new Rules apply–to avoid unnecessary time and effort being expended by NSPs in developing and issuing updated technical requirements that may ultimately not be required.
- Clause 11.[XXX].3 (f)(2) allows a Connection Applicant to withdraw its election at any time by providing notice to the NSP. If the AEMC plans to includes provisions in the final Rule allowing applicants to elect to apply the current access standards, Transgrid seeks clarification on the AEMC’s rationale for permitting withdrawal without limitation, given the potential implications for efficiency, resourcing, and project timelines.
- In the wording under clause 11.[XXX].3(f), clause 11.[XXX].2 is referred. Transgrid believes this should refer to 11.[XXX].3.

Application of the Amending Rule to Existing Connection Agreements

- Transgrid has a significant pipeline of data centre connection projects, many of which may enter into connection agreements prior to the commencement of the new Rule. These projects would therefore continue to be governed by the existing Rules, potentially giving rise to system security risks that would need to be managed through NSP and/or AEMO led risk mitigation measures throughout both the connection process and ongoing operation. Transgrid requests that the AEMC review these risks and consider the proposed transitional provision for existing offers to connect and existing connection agreements.
- Draft Rule clause 11.[XXX].5 (b) provides that the new access standards apply where a Schedule 5.3 Participant that has already entered in to a Connection Agreement is required, or proposes, to amend its performance standards after the commencement date. As performance standards can only be amended through a submission under clause 5.3.12, Transgrid recommends that clause 11. [XXX].5 (b) explicitly reference clause 5.3.12 to avoid ambiguity.