20 June 2025

Ms Anna Collyer

Chair

Australian Energy Market Commission

GPO Box 2603

Sydney NSW 2001

Electronic Lodgement: ERC394

Dear Anna,

AEMC Improving the NEM Access Standards – Package 2

Energy Networks Australia (ENA) welcomes the opportunity to make this submission in response to the Australian Energy Market Commission's (AEMC's) consultation on *Improving NEM Access Standards- Package 2.* This package focuses on large inverter based loads and several changes to generator access standards – the definition of protection system requirements and conditions for generator protection systems.

ENA represents Australia's electricity transmission and distribution and gas distribution networks. Our members provide more than 16 million electricity and gas connections to almost every home and business across Australia.

There are three common types of data centres that work together to deliver cloud services:

(1) distributed connected 'edge' facilities,

(2) 'enterprise' data centres that support traditional processing and storage needs and

(3) 'hyperscale' data centres that are increasingly focussed on supporting AI.

Each of these types of data centres have their own grid connection requirements, which align with the IT services they provide.

Our members are seeing a large increase in data centre connection interest at both transmission and distribution level. These data centre projects present a significant opportunity for Australia. A typical hyperscale data centre (300 MVA) will result in ~$4b in direct investment.[1] In addition, most data centres fund all of the costs associated with their grid connection. This can bring forward shared network infrastructure expansion plans and avoid future network build costs for other customers.

[1] Mandala, Empowering Australia's Digital Future – Data Centres, 2024
Based on Mandala's estimate that $26 billion of investment to deliver 1750 MW/MVA of data centre deployment, as well as Digital Infrastrucuture's estimate it costs between US$7-12 million per MW to build a data centre. Assumed 1 MW = 1 MVA for simplicity. Applied an exchange rate of 0.67 AUD/USD.

Realising these benefits requires the energy and data centre sector to work together to resolve known challenges to their timely and efficient grid connection. One of the key challenges is whether existing load performance requirements are appropriate for this new type of load, particularly when considered in aggregate. This recognises equipment (i.e. power electronics, protection systems) used and operational behaviour of data centres are different to traditional loads that these requirements were designed for.

ENA agrees with the Australian Energy Market Operator's (AEMO's) view that existing technical access standards for load under Schedule 5.3 are inadequate to address this growth and maintain the secure operation of the power system. We support the intent of these amendments as a first step towards establishing fit for purpose access standards for large loads.

Data centres are sensitive to certain disturbances on the network and can easily trip over to alternative back up power in aggregate in certain conditions. There is the potential for adverse impacts on the power system in these situations.

We strongly support and encourage further work being undertaken to develop a more fulsome set of changes as industry understanding of data centres improves and reviews afoot conclude. More specifically, there are several critical issues that remain unaddressed in the current scope of both the rule change and AEMO's ongoing Large Loads Review. For example, the availability of technology-specific models and application of the system strength framework to inverter-based loads.

It is important to design a robust regulatory framework for load connections upfront given the issues faced around the globe in jurisdictions where data centres have quickly grown to a substantial proportion of total demand. Careful planning now could also allow these new loads to operate flexibly and contribute to positive market outcomes.

ENA notes that data centres have been called out in the forecasting methodology for the next Integrated System Plan, including how to provide more of a forward plan of connections 'likely to proceed.' We strongly support AEMO's efforts in this area, which will enable long term network planning to facilitate data centres.

With respect to the technical changes proposed, we:

- Suggest the AEMC consider a large load definition tailored to inverter based loads.
- Support the proposed change to restrict the application of short circuit ratio (SCR) requirements to large inverter based resources, and preserving the flexibility for AEMO and Network Service Providers (NSPs) to specify a higher SCR requirement.
- Highlight that the System Strength Impact Assessment Guidelines (SSIAG) does not provide specific criteria for identifying inverter-based loads beyond the current definition in the Rules, leading to ambiguity that affects this consultation.
- Recommend further work be conducted to understand the wider implications of adopting a revised set of protection system definitions in the National Electricity Rules (NER) as proposed in the Rod Hughes Consulting rule change.
- Support proposed changes to improve the provision of information from network users on their plants' ride-through capability, albeit suggesting AEMO and NSPs be provided with discretion to determine what a reasonable plant ride through capability is given the surrounding network circumstances.
- Suggest a more detailed proposal is required before stakeholders can practically assess the merits of reclassifying 'routinely expected' non-credible contingencies for disturbance ride through capability of schedule 5.2 plant.

- Support the proposed amendments with respect to under frequency ramp down, noting further work is required to clearly define acceptable ramp-down rates and the corresponding performance standards.

More detail is provided on these points below.

AEMO's ongoing process to address system security implications and performance standards for large loads Q1.1

We support the overarching objective of enhancing system security and performance standards for large loads through amendments to the NER and associated guidelines. As noted earlier, the current rule change proposal, along with AEMO's "Large Loads Review," represents a positive step in this direction.

However, we consider that several critical issues remain unaddressed in the current scope of both the rule change and the review. To ensure a comprehensive and effective regulatory framework, we recommend that AEMO expand the Large Loads Review to incorporate the following areas:

1. Large Load Modelling Practices and Interim Solutions

   A thorough assessment of current large load modelling practices is essential. This should include:

- A review of international and domestic approaches to large load modelling;
- An evaluation of the availability and adequacy of technology-specific models; and
- The development of an interim modelling methodology to support compliance with existing assessment obligations, such as those outlined in NER clause S5.3.11(b), particularly in cases where current models are not fit-for-purpose.

2. Application of the System Strength Framework to Inverter Based Loads (IBL)

   We recommend that the review also consider how the system strength framework applies to IBL. This should involve:

- Clarification of the criteria used to assess system strength impacts from IBL; and
- A review of the methodologies prescribed in the System Strength Impact Assessment Guidelines to ensure they are appropriate and effective for load-related applications.

We believe that addressing these additional considerations will significantly enhance the robustness and applicability of the regulatory framework and technical requirements for load connections.

Defining large loads Q1.2-1.4

ENA accepts that the AEMC will need to apply a definition for large loads in the context of its rule change. We are open to this being included in the NER. Potential benefits could include: flexibility to apply to the technical requirements to relevant large loads, focus regulatory efforts where they are most needed and avoid unnecessary costs for customers whose impact on the power system may be small.

If a decision is made to use this definition to inform specific access standards defined in the NER, we suggest the definition is tailored to inverter-based large loads based on AEMO's Access Standards Review definition, albeit with more defined unit size categories. For example, AEMO's current approach for generation (1) exempts units less than 5 MW from AEMO evaluation, (2) may exempt units from 5-30 MW and (3) makes units greater than 30 MW subject to mandatory access standards.

However, we recognise it may also be prudent to wait for the outcome of AEMO's Large Load review to address this point.

Supportive of flexibility of SCR where agreed between AEMO and the NSP in the access standard Q4.1-4.2

ENA supports the proposed change to restrict the application of short circuit ratio (SCR) requirements to large inverter based resources. We agree that the cost of meeting SCR requirements for some small IBL could outweigh system benefit.

We also agree that preserving the flexibility for AEMO and NSPs to specify a higher SCR requirement can be appropriate in certain circumstances. We understand that AEMO's recommendation is informed by discussions with Original Equipment Manufacturers, who noted that some IBL technologies—such as those using thyristor-based converters—may be unable to operate reliably at an SCR of 3.0. In cases where the proposed IBL connection point is relatively strong compared to the plant size, relaxing the SCR requirement may be reasonable to accommodate these technologies

Since the present rule change proposal does not include changes to the system strength framework or the SSIAG, we see no alternative solutions to above.

Concerns related to SCR requirements Q4.3

In general, we have no concerns with the change to limit the application of short circuit ratio requirements to large inverter based resource. We do however have concerns with the relevant criteria and compliance assessment methodologies specified in the SSIAG. Regarding the present drafting of the proposed rule for S5.3.11, the main areas of concern are that the SSIAG does not provide specific criteria for identifying inverter-based loads beyond the current definition in the Rules, leading to ambiguity. In particular, it does not clarify what is 'potentially susceptible to inverter control instability.

Further, while we agree that flexibility to specify a higher short circuit ratio may be appropriate in some circumstances, addressing the broader issues with the SSIAG methodology for demonstrating withstand SCR is crucial for meaningful progress.

Currently, many customers lack suitable PSCAD (power system computer aided design) models to meet SSIAG requirements. Additionally, there are concerns about the methodology's appropriateness for demonstrating withstand SCR for large loads, which we understand AEMO will review. In the interim, if a customer proposes a higher SCR, the requirement that this be "assessed in accordance with the methodology prescribed in the system strength impact assessment guidelines" means that demonstrating compliance may be difficult.

New definitions of protection settings, clarify the implication Q5.1-5.3

ENA has yet to form a view on concerns raised in the Rod Hughes Consulting rule change on clarifying access standards for generator protection systems via new definitions. It intends to explore implications from this rule change once a draft rule is available.

In the interim, we do not support the new definitions and recommend further work be conducted to understand the wider implications of adopting a revised set of protection system definitions in the NER. We note existing definitions are currently used for purposes outside of generator access standards and if not properly considered risks unintended consequences. For example, Chapter 4 includes obligations on AEMO and NSPs to coordinate the protection of transmission system plant and equipment in system normal and outage conditions. ENA would be happy to explore these implications further with the AEMC.

Ride through capability of loads Q7

The proposed changes to improve the provision of information from network users on their plants' ride-through capability will help to ensure that any latent capability to ride through disturbances for new load connections is maximised. The potential for large amounts of load to trip due to potentially small disturbances must be understood and managed considering the growing levels of data centres across the NEM. There is a risk data centres may be sensitive to the same network conditions, regardless of whether they are clustered within a localised network area.

Whilst ENA considers that the current proposed changes are an improvement, there appears to be no mechanism that would manage any ambiguity that results from the additional information provided and the obligation for network and connecting proponents to cooperate to maximise ride-through performance. In other words, proponents would only be provided with basic information about a load's ride through capability, rather than require dynamic power system modelling and system strength self-remediation that provide confidence that data centres will not disconnect during contingency events.

It may be of benefit for AEMO and networks to have a level of discretion regarding a reasonable amount of plant ride through capability given the surrounding network circumstances.

This issue extends beyond Australia. International task forces, such as those organized by NERC (North American Reliability Corporation) and ESIG (Energy Systems Integration Group), have noted that system operators and transmission owners worldwide lack visibility into load ride-through capability, recognising the potential risk to system security

The initial and most crucial step is to comprehend load ride-through capability, as this understanding can guide planning and operations to maintain system security.

Clarification of credible contingency definition for disturbance ride through Q11.1-11.4

We suggest more detailed consideration is required before stakeholders can practically assess the merits of the proposed changes. This is because there are practical difficulties in reclassifying non-credible contingencies 'routinely expected' to be reclassified as contingency events. Non-credible contingencies are inherently associated with uncertainties. The nature of a contingency event and its potential impact on the grid and connected parties are typically specific network area and subject to conditions at the time. This means that what might be classified as a credible contingency is constantly evolving.

The proposal also implies NSPs should provide connection applicants with a list of non-credible contingencies to clarify when they have met clause S5.2.5.5. ENA does not consider this practical given the list of 'routinely expected' non-credible contingencies to reclassify will change regularly.

Another way of looking at this proposal, would be for the AEMC to consider whether data centre related network events that have occurred overseas would have been included within the definition proposed and practically foreseeable.

Under frequency ramp down, what does it mean in practice? Q10

ENA supports the proposed amendments with respect to under frequency ramp down. We agree that they will provide AEMO with greater flexibility to manage under-frequency events through fast ramp-downs of load, rather than relying on block disconnection for load shedding.

Given the rapid advancement of inverter-based technologies, this approach would be particularly beneficial for this type of large loads, allowing them to reduce demand in a controlled manner rather than curtailing the entire plant.

We note further work is likely required post rule for AEMO to clearly define acceptable ramp-down rates and the corresponding performance standards. This would account for the highly dynamic nature and pace of frequency deviations during under frequency events, which require nuanced and context-sensitive performance thresholds.

ENA welcomes the opportunity to meet with the AEMC to discuss the issues in submissions.

ENA looks forward to working with the AEMC as the rule change proceeds. In the meantime, if you would like to discuss this submission, please contact Verity Watson (vwatson@energynetworks.com.au) in the first instance.

Yours sincerely

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