

20 April 2023

Australian Energy Market Operator (AEMO)
contact.connections@aemo.com.au

Dear AEMO,

AEMO review of technical requirements for connection

Connections & Power Systems Advisory Pty Limited (“CPSA”) welcomes the opportunity to provide a submission to the draft report on the review of technical requirement for connection (NER 5.2.6A)¹.

CPSA is an engineering consultancy firm with a focus on grid connection with a team that has over 5 GW of experience connecting generators and loads to the National Electricity Market. We have experience working with network businesses, the market operator, generators, load customers and hence a range of experience. We do not represent any particular industry group and our submission is based on ensuring there is a pragmatic approach to managing the power system and enabling an orderly transition of the energy sector.

CPSA generally welcomes the changes proposed in AEMO’s draft report which indicate a shift in focus back to a more pragmatic approach to negotiating performance. There are however some areas for improvement and we also note that our feedback is generally consistent with that of the Clean Energy Council (CEC).

We appreciate that this a complex topic and hence welcome the opportunity to discuss any of the aforementioned in further detail with the AEMO.

For any further information, please contact Winodh Jayewardene at
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Our feedback is provided below in Appendix A as per the AEMO Template.

Yours sincerely

Winodh Jayewardene
Managing Director

Date: 20 April 2023

¹ <https://aemo.com.au/consultations/current-and-closed-consultations/aemo-review-of-technical-requirements-for-connection>



Appendix A

CPSA Feedback

Draft report Stakeholder feedback template:

AEMO Review of technical requirements for connection (NER 5.2.6A)

Stakeholders making a submission on the recommendations set out in the AEMO draft report may use the below template to provide feedback. Please consider the confidentiality disclaimer at the end of this document.

Stakeholder: Connections & Power Systems Advisory (CPSA)

Schedule 5.2 Conditions for Connection of Generators

Issue	Schedule 5.2 Generator Recommendation feedback
NER S5.2.1 – Outline of requirements	
Application of Schedule 5.2 based on plant type instead of registration category and extension to synchronous condensers	[feedback on draft report recommendation]
NER S5.2.5.1 – Reactive power capability	
Need to meet the AAS	The 2018 rule change required generators to meet the AAS irrespective of the GPS clause. Meeting the AAS for this clause can require the installation of additional plant resulting in increased CapEx for projects. Where there is no system need for additional reactive power, then the need to meet the AAS should be relaxed.
Voltage range for full reactive power requirement	The reduced reactive power capability requirement at high and low voltages is generally welcome. However, introducing a voltage ‘centre point’ that is determined by the NSP will only introduce uncertainty in the absence of a methodology to determine what this centre point is. Furthermore, if this centre point is not the normal voltage, then it would require primarily plant to be rated higher than +/- 10 % of the normal voltage (which is generally the nominal voltage).
Treatment of reactive power capability considering temperature derating	To the extent what is proposed is simply capturing what the plant can inherently deliver, this is not expected to be problematic. It isn’t clear how this wording would provide any real value if this cannot be tested from a compliance perspective and/or is not considered in any planning and/or operational analysis undertaken by AEMO or the NSP.
Compensation of reactive power when units are out of service	The proposal for the voltage threshold associated with the reactive power range is subject to being able to come up with a suitable voltage threshold. This should be communicated at the connection enquiry stage to allow generators to plan for and design their generating systems. It might not be possible to come up with a consistent threshold across the NEM, thus impacting the feasibility of the approach. Alternatively, a limit which is a percentage of the reactive power capability can be defined which would provide more certainty to generators (eg limited to 5 % of the AAS under S5.2.5.1).

Issue	
Schedule 5.2 Generator Recommendation feedback	
S5.2.5.1, S5.2.5.5, S5.2.5.7, S5.2.5.8, S5.2.5.10	
Simplifying standards for small connections	
NER S5.2.5.2 – Quality of electricity generated	
Reference to plant standard	
NER S5.2.5.4 – Generating system response to voltage disturbances	
Overvoltage requirements for medium voltage and lower connections	
Requirements for overvoltages above 130%	
Clarification of continuous uninterrupted operation in the range 90% to 110% of normal voltage	<p>Inconsistent interpretations of this clause across the NEM have caused uncertainty, risk and the need to install additional equipment (CapEx) to meet requirements and hence plans to address this are welcome.</p> <p>Further clarity is required however on 'not substantially reduced' for active power, allowance for losses within the reticulation system, allowance for the reduction in reactive power due to voltage and confirm that the intent is for a linear ramping of voltage over five seconds. Consideration of a voltage ramp is welcome and it is noted that the intent is to capture sustained reductions in power (typically due to current or MVA limiters) hence an overarching statement is required such that transient variations in active or reactive power are not interpreted to imply a failure to meet CUO.</p>
NER S5.2.5.5 – Generating system response to disturbances following contingency events	
Definition of end of a disturbance for multiple fault ride through	
Form of multiple fault ride through clause	
Number of faults with 200 ms between them	
Reduction of fault level below minimum level for which the plant has been tuned	The enablement of an NSP to require retuning of plant would require significant time and cost to generators over the life of the plant. Will there be a cost recovery mechanism for this? There is work under the CRI looking at the S5.3.9 process so this might be best managed separately through that workstream.
Active power recovery after a fault	
Rise time and settling time for reactive current injection	Removal of adequately damped is welcome, however some clarity is required on what is 'adequately controlled', else it is likely to be interpreted inconsistently.
Commencement of reactive current injection	
Clarity on reactive current injection volume and location and consideration of unbalanced voltages	

Issue		Schedule 5.2 Generator Recommendation feedback
Metallic conducting path	This wording should be retained in that the intent is to capture non high impedance faults. Removal of this would likely require the number of assessments to increase.	
Reclassified contingency events		
NER S5.2.5.7 – Partial load rejection		
Application of minimum generation to energy storage systems		
Clarification of meaning of continuous uninterrupted operation for NER S5.2.5.7		
NER S5.2.5.8 – Protection of generating systems from power system disturbances		
Emergency over-frequency response	<p>The recommendations to remove paragraph (2) are on the premise that PFR implementation will meet the requirements of this clause. However the PFR implementation would only cover the magnitude of the change (provided a suitable droop setting) and not speed of response as the PFR rate of change is substantially slower than what is required under this clause.</p> <p>Where a generating system implements different (slower) ramp rates for PFR versus S5.2.5.8 (faster), removal of obligations under S5.2.5.8 would not allow for a rapid reduction in active power.</p> <p>Option 5 – Noting that the current Rules only have a MAS, rather than having a carve-out, suggest an AAS with the 3 second / 50 % reduction and a MAS that doesn't preclude slower units (such as hydro units) from connecting. A NAS would capture performance of units that cannot meet 3 seconds.</p>	
NER S5.2.5.10 – Protection to trip plant for unstable operation		
Requirements for stability protection on asynchronous generating systems	<ul style="list-style-type: none"> • Caution is urged against automatic disconnection of units until such a scheme is proven. An alarm should be raised followed by manual operator disconnection until such a system is proven • Identifying whether a unit is contributing to a instability or not is not a simple exercise and there isn't an accepted solution in the NEM (although some are currently being trialled for certain types of oscillations). • The nature of data (quantify and frequency of) to be accepted from the central system should be clarified • Trip requirements from AEMO/NSP – speed of trip and what to trip should be clarified • Provision of timestamped data to AEMO – it is not clear whether this is in real time or offline (or both). The resolution (and hence quantity) should be clarified as excessive data transfer requirements could adversely affect communications systems, especially if real time data is required. 	
NER S5.2.5.13 – Voltage and reactive power control		
Voltage control at unit level and slow setpoint change	Unit level voltage control is seen as beneficial and overcomes some of the challenges associated with plant level control. However it isn't clear how much of an impediment the current Rules actually are given there are generating systems from different OEMs already connected. Slow setpoint change is implemented by some plant and makes practical sense from an operational perspective, however may require additional testing if it is codified.	
Realignment of performance requirements to optimise power system performance over expected fault level (system impedance) range – Voltage control	<p>The proposed approach of tuning for the highest system impedance makes sense. However it should be noted that an adjacent generator that normally operates in voltage control mode being taken offline (or changing control modes) can have a similar effect to reducing the system impedance. It isn't clear how changes to other plant / addition of new generating systems will be managed.</p> <p>A focus away from the need to meet the AAS (speed of response) and towards stability of response should be considered for this clause.</p>	

Schedule 5.2 Generator Recommendation feedback	
Materiality threshold on settling time error band and voltage settling time for reactive power and power factor setpoints	Note that PF step tests can also require steps to P (not only PF), in which case settling time for P may require assessment
Clarification of when multiple modes of operation are required	Limitation of control modes to one or two, a primary and secondary is generally welcome. It isn't clear what AEMO is proposing in terms of assessment requirements (simulations and/or testing) and this should be clarified.
Impact of a generating system on power system oscillation modes	More clarity and certainty should be provided on the need for system strength-sensitive oscillation damping and developing controls to damp such oscillations. As mentioned by AEMO, this area is still evolving. However the concern is when such a requirement is mandated for the sake of it (as per the NER) with no proper assessment or testing of the damping controls. Either during the modelling phase or during commissioning. Hence resulting in costs to OEMs, generators and consumers for a function that is not utilised.

Definition – continuous uninterrupted operation

Recognition of frequency response mode, inertial response and active power response to an angle jump	We welcome AEMO's review of the CUO definition and looks forward to reviewing the approaches to S5.2.5.1 & S5.2.5.4 in particular.
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Schedule 5.3a Conditions for connection of MNSPs

Schedule 5.3a HVDC Recommendation feedback	
NER S5.3a.1a Introduction to the schedule	
Alignment of schedule with plant-type rather than registration category	
NER S5.3a.8 – Reactive power capability	
Reactive power	
NER S5.3a.13 – Market network service response to disturbances in the power system	
Voltage disturbances	
Frequency disturbances	
Fault ride through requirements	
NER S5.3a.4 – Monitoring and control requirements	
Remote monitoring and protection against instability	

Issue	Schedule 5.3a HVDC Recommendation feedback
New standards	
Voltage control	
Active power dispatch	

Multiple Schedules

Issue	Multiple schedule Recommendation feedback
NER Multiple clauses	
References to superseded standards	

Confidentiality disclaimer

Under clause 5.2.6A(d)(2), AEMO is required to publish all submissions received about this Review on its website. Please identify any part of your submission that is confidential, which you do not wish to be published. Please note that if material identified as confidential cannot be shared and validated with other interested persons, then it may be accorded less weight in AEMO’s decision-making process than published material. AEMO prefers that submissions be forwarded in electronic format.