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Lodged via email contact.connections@aemo.com.au

AEMO Review of Technical Requirements for Connection (NER clause 5.2.6A)

Dear Merryn,

The CEC is the peak body for the clean energy industry in Australia, representing over 1,000 of the leading businesses operating in renewable energy, energy storage and renewable hydrogen. We are committed to accelerating the decarbonisation of Australia's energy system as rapidly as possible, while maintaining a secure and reliable supply of electricity for customers.

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We welcome the opportunity to comment on the review of technical requirements for connection (NER clause 5.2.6A) as outlined below and in the subsequent table.

- The changes proposed are generally welcome and should help alleviate the challenge faced by the industry.
- **Negotiating Framework and need to meet the Automatic Access Standard (5.3.4A(b)(1))** - AEMO has stated that this is not considered within the scope of this review, however this requirement is resulting in the industry being exposed to higher CapEx and development costs without any system need for additional capability. We strongly urge AEMO to consider this as part of their review. Recommendations are provided in the subsequent table.
- **Negotiating performance for legacy assets** – clause 5.3.4A(b)(1A) requires the existing GPS be the new 'minimum access standard'. This has proven problematic on projects where performance less than the original GPS cannot be accepted by connecting NSPs and is limiting the ability to accommodate grid forming technologies.
- **Barriers to modifying legacy assets** – the 5.3.9 process under the NER requires legacy assets to meet the new rules and the automatic access standard. This is proving to be a disincentive to modify or upgrade existing plant despite having an overall benefit to the power system.
- **AEMO advisory matters deferred to NSPs (5 to 30 MW/MVA)** – having less parties to negotiate with is generally welcome, however there could be some benefits in having the ability to consult AEMO (by exception) if a proponent and the NSP cannot agree on a set of negotiated performance standards.

Our response to each of the recommendation is provided in the following table.

Technical Requirements - Generators, IRPs & Synchronous Condensers

NER Clause	Item	CEC Commentary
5.3.4A(b)(1A)	Requirement for the performance standard modified to be 'no less onerous' than the existing performance standard	• This clause applies to performance standards that are modified and can prevent new technologies from connecting or upgrading existing plant where there are benefits to the power system. For example, adding grid forming mode on an existing BESS has overall system benefits but may result in slower active power recovery (S5.2.5.5) than that in the original GPS. • We recommend this clause be removed as it presents a barrier to upgrading existing plant and/or new capabilities from being implemented to existing assets where there is an overall benefit to the power system.
5.3.4A(b1)	Requirement to meet the AAS	• The need to meet the AAS is resulting in additional CapEx and development costs to projects without there being a substantiated system need. • The requirement to meet the AAS is at odds with the NEO which requires '…efficient investment in, and efficient operation and use of, electricity services…'. • We recommend this clause be removed or where the NSP or AEMO rejects a negotiated access, then the level of performance that will be accepted should be proposed along with a justification which clearly ties the rejection with an associated network need for additional performance. • Furthermore, we recommend there be a carveout of this clause for legacy assets that are not affected by an alternation. • This clause has been especially problematic for existing assets looking to retrofit a BESS behind the existing connection point. Grandfathering of these legacy assets will not discourage plant upgrades and /or modification that can have an overall positive impact on the power system. • The CEC appreciates that AEMO is running a separate workstream reviewing the 5.3.9 process, however this issue is best managed as part of this workstream.
S5.2.5.1 Reactive Power Capability	Compensation of reactive power when units are out service	• It is not clear how the requirement to limit impact on voltage to [0.5]% will be assessed. Can AEMO provide an example? • Subject to clarification of the above, the 0.5 % figure seems extremely low and arbitrary. Any requirements should be determined based on the needs of the power system at a particular location.

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		• The draft report isn't clear on what is 'not in service'. Depending on the technology used, there are three operating scenarios that result in different reactive power capabilities at the connection point. Namely,
		  ○ generating,
		  ○ not generating (but units electrically connected), and
		  ○ units disconnected.
		• Seldom are all units fully disconnected. Hence some operational flexibility should be exercised to avoid having to over capitalise on solutions for the rare event that all units are disconnected. E.g., allow the use of operational solutions such as switching out equipment within (say) 30 minutes if required by the NSP (to manage voltages) to bring reactive power at the connection point to a small MVAR band.
		• Recommend de-italicising the word 'disconnect' (defined term) such that disconnection does not have to be via the connection point circuit breaker.

S5.2.5.4 Response to voltage disturbances	Overvoltages for MV connection points	No comments on what is proposed.
	Overvoltages	• Reference to peak voltage of 184 % is likely to cause confusion with RMS voltage. It is unclear as to why reference to peak voltage and non-power frequency voltage is required. • Subject to agreement by the OEM, blocking may be considered an appropriate response which is less disruptive than a protection trip. • It is unclear why non-power frequency voltages have been introduced into this clause. Reference to insulation coordination in this clause is not appropriate and is a design matter. • We are concerned that referring to IEC 60071-1 and insulation coordination will require proponents to undertaken insulation coordination studies in order to demonstrate compliance with this clause. • The root cause of the issues of this clause is that the upper limit is unbounded. Hence the correct approach to updating this clause should be to specify an upper limit for high power frequency voltages. These are typically what result in equipment tripping (based on a protection setting).
	CUO – maintain active and reactive power	No comments on what is proposed in principle.
	Definition of end of a disturbance for multiple fault ride through	No comments on what is proposed apart from the fact that these studies have become mostly an academic exercise with no real-world context considered.

NER S5.2.5.5 – Generating system response to disturbances following contingency events	Form of multiple fault ride through clause	• The presumption that an NSP requesting additional studies when there are reasonable grounds to believe there is inadequately disclosed information is unlikely to yield the desired outcome. For example, if a protection system which limits MFRT capability is not modelled, undertaking additional studies will yield the same results as previous studies. Hence the outcome would be an endless loop of studies being undertaken. • The focus should instead be on having a carveout to MFRT requirements by documenting specific technology limitations in the performance standards to avoid an endless loop of studies. • In assessing this clause the NSP and /or AEMO should provide guidance on the nature of multiple fault expected based on previous events and /or considering the actual power system.
	Number of faults with 200 ms between them	No comments on what is proposed subject to review of rule drafting.
	Reduction of fault level below minimum level for which the plant has been tuned	• No comments on what is proposed. • It is unclear what the changes to S5.2.2 are in relation to making retuning requests 'more transparent'. Could AEMO advise?
	Active power recovery after a fault	No comments on what is proposed.
	Rise time and settling time for reactive current injection	• No comments on what is proposed. • We note that the term 'adequately controlled' is more qualitative in nature. As a general principle, the control transients should be assessed on what is required and/or desirable to maintain system security and reliability of supply.
	Metallic conducting path	• Strongly recommend the wording remain as removal of it could require additional studies to assess high impedance faults (including faults with varying impedance). • AEMO's draft report states that the 'existing wording does not appear to add anything useful'. We strongly disagreed and the fact that the wording exists, yet is not creating problems for the industry is a testament to the value that the wording provides.

	Reclassified contingency events	Additional study cases may be required however no further comments given the proposed wording incorporates those contingencies that are commonly reclassified and are ones that are likely to affect the connection point.
NER S5.2.5.7 – Partial load rejection	Application of minimum generation to energy storage systems Clarification of meaning of CUO for NER S5.2.5.7	• Note that the NER wording amendments do not seem to have been made in Appendix A2. • To be revisited – members raised a concern that this may affect the serviceable life of Battery storage systems depending on how it is drafted.
NER S5.2.5.8 – Protection of generating systems from power system disturbances	Emergency over-frequency response	• We note that AEMO has accepted our proposal to establish an AAS, NAS and MAS which is welcome, and the new wording provides flexibility for different plant types. • Recommend removing the capitalising of 'disconnect' for the NAS and MAS to allow disconnection other than at the connection point. • Reference to vector shift protection not operating for less than 20 degrees is questionable as desensitising vector shift protection to such an extent would likely negate its use as an anti-islanding scheme. Reliance on Vector shift protection for anti-islanding is questionable (there are better alternatives such as topology-based schemes). • Recommend clarification of 'disconnect' under the General Requirements. Use of '*disconnect*' (italicised) requires opening the connection point circuit breaker and there should be flexibility for the generator to disconnect other than at the connection point (which would allow auxiliary supplies to be maintained and allow for faster restoration).
NER S5.2.5.10 – Protection to trip plant for unstable operation	Requirements for stability protection on asynchronous generating systems	AAS • Members had concerns around automatically disconnecting via a system that has not yet been proven and the impact this can have on power system security and / or non-compliant with its performance standards. • Computing contributions to oscillations in real time is not a proven concept and this area is evolving. Hence mandating requirements in the Rules is not appropriate at this stage. • Requirements for production systems >100 MW to install a PMU and receive information from AEMO. It is unclear what information is provided, how often and what needs to be done with this information provided by AEMO.

		• AEMO considering the need for a system-based approach to assessing control interactions which is generally welcome and is the most suitable way to identify control interactions. MAS • If required by the NSP & AEMO, requirements for production systems <100 MW to install a PMU and receive information from AEMO. It is unclear what information is provided, how often and what needs to be done with this information provided by AEMO. It is also unclear what triggers would require an NSP/AEMO to request this hence the requirement should be on reasonable technical grounds. Generally: • There are concerns that a solution is being designed without truly understanding the nature of the problem or the symptoms. There are various failure modes that may result in unstable operation, all of which have different frequencies, magnitudes and variations in output quantities. For example, FRT re-triggering, PPC-INV communications loss, interactions between PV inverter MPPT & active power controllers, low SCR instability etc. Without understanding the nature of these issues and the resultant plant output, designing a scheme to detect this is at best a guess. • It is recommended that these proposed changes be omitted until a proven solution is agreed upon. • The need to communicate information from the detection system to the NSP/AEMO control centre (if required by the NSP/AEMO). Clarity should be provided on the type, number of and refresh frequency for these signals. • The proposed changes to this clause raised many concerns from our members. In particular, was the concern that mandating the need to trip for an unproven scheme would present a risk to system security and compliance with performance standards. A safer solution would be to raise an alarm but initiate manual tripping. • Some OEMs advised that the setting of threshold and/or delays should be determined by the OEM as the technology provider.
NER S5.2.5.13 – Voltage and reactive power control	Voltage control at unit level and slow setpoint change	• No major comments on what is proposed. • Propose more specific wording that implementation of rate limited setpoint control is solely at the discretion of the generator.
	Realignment of performance requirements to optimise power system performance over	• AEMO's proposal is understood in principle in relation to an apparent system impedance.

	expected fault level (system impedance) range – Voltage control	• It is recommended that an example of calculation of apparent system impedance' be provided to ensure it is clear to all, else it may be interpreted differently by various stakeholders.
	Materiality threshold on settling time error band and voltage settling time for reactive power and power factor setpoints	• The threshold is generally welcome. • For larger projects however, this value is small. For example, 3 MW on 700 MW project is 0.43 % and 3 MW on a 1,000 MW project is 0.3 % and can be less than the measurement accuracy. • We recommend the greater of the MW value proposed or a percentage of the Maximum Capacity to capture larger projects.
	Clarification of when multiple modes of operation are required	• The concept of a primary and alternate control mode is welcome. This would reduce time and effort required for modelling as well as during commissioning where presently three modes are assessed. • The codifying of voltage control as the primary mode may preclude using other modes as the primary mode (eg power factor). Both for existing and well as legacy plant that may be currently operating in power factor mode that go through the 5.3.9 process. • Alternatively, propose that only two modes are required, a primary and alternate mode. • Unclear why settling time compliance for setpoint changes is carved out but for voltage disturbances it is retained. A generator would need to apply setpoint changes to confirm compliance rather than wait for a network event.
	Impact of a generating system on power system oscillation modes	No major comments on what is proposed
	Minimum Access Standard for Settling Time	• Member feedback was received where the 7.5 second settling time could not be met due to a network asset that had a very slow settling time, hence voltage would not settle within 7.5 seconds resulting in the generator being non-compliant. • The MAS for settling time is 7.5 seconds for non-limiter operation. Recommend that the requirement for settling time in the MAS be removed to account for the above scenario.

NER S5.2.5.16 – Voltage vector shift	Clause removal	No major comments on what is proposed. Refer comments above in S5.2.5.8 regarding use of vector shift protection.
Definition	Continuous uninterrupted operation	No major comments on what is proposed.

As always, the CEC welcomes further engagement from the AEMO on this reform. Further queries can be directed to Paul Beaton at the CEC on pbeaton@cleanenergycouncil.org.au

Kind regards,

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