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Australian Energy Market Commission

Level 15, 60 Castlereagh St

Sydney, NSW 2000

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ERC0393 - Improving the NEM Access Standards – Package 1

EPEC Group (EPEC) welcomes the opportunity to provide feedback on the Australian Energy Market Commission's (AEMC) draft determination on Improving the NEM Access Standards – Package 1.

EPEC is a High Voltage (HV) connections specialist providing end-to-end power engineering services including market modelling, connection application, Generator Performance Standards (GPS) negotiations, generation registration, commissioning, Engineering Procurement and Construction for substations, lines, BESS Balance of Plant (BoP) as well as plant testing and compliance services.

Thanks to wide portfolio of projects which encompasses all Australian states and most leading OEMs, EPEC has in-depth experience in identifying and overcoming challenges associated with grid connections. Our promise is certainty, delivered through our knowledge of delivering large scale energy infrastructure project within the existing regulatory environment, and taking a risk-based approach to technical outcomes.

Our mission is to lead the way in connecting the future of Australia's energy supply to renewable power generation sources. Thanks to ongoing collaboration with a range of Inverter Based Resources (IBR) Original Equipment Manufacturers (OEMs) and research projects with Australian universities, EPEC actively contributes to shaping the technology landscape for HV connections, e.g. by leading the industry in implementing the Hardware-in-the-Loop technique in the generation connection process.

EPEC welcomes continuous engagement with the AEMC to support this rule change and future rule changes.

Yours sincerely,

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Summary

EPEC supports the general themes of the rule change request submitted by AEMO and the draft determination published by the AEMC. EPEC notices the comprehensive scope of proposed changes but at the same time EPEC acknowledges the extensive industry consultation process AEMO undertook before submitting the rule change request.

EPEC also acknowledges that more regulatory changes for connections are expected in incoming years (e.g. Improving the NEM Access Standards – Package 2 or technical requirements for Grid Forming Technologies). Nonetheless, based on our experience in the industry, we wish to provide more specific feedback to some of the concepts proposed in the draft determination as well as to some of the wording proposed in the draft rule markup version. We strongly believe our comments will help enhancing the clarity of the NER and will support having stable and robust power system.

General comments to the draft determination

Change/Issue	Comment
Detailed guidance on the interpretation of the proposed rule changes	EPEC would like to kindly notice that historically, in the absence of detailed guidance on new or modified technical requirements for connections, multiple parties (such as NSPs or AEMO) were providing their own technical interpretations and assessment methodology expectations for proposed changes. More often than not that led to inconsistencies, extended connection negotiations or even re-works that stretched projects budgets. Considering how comprehensive the scope of this rule change is, EPEC kindly requests AEMC to consider how to ensure consistent interpretation and assessment methodology of the proposed changes so the intents of specific changes are maintained. While a black and white interpretation of the NER is not always possible, and engineering judgment should be applied, EPEC notes that Connection Assessment Guidelines could be considered. They could be established in a similar way Power System Model Guidelines are established in the NER. When that option is anticipated, EPEC would like to highlight that such Connection Assessment Guidelines shall provide meaningful guidance for typical generation connection but shall also be flexible enough to cater for non-standard generation design.
Explicit inclusion of synchronous condensers in the Schedule 5.2	EPEC welcomes the proposed clarity on the extent of inclusion of synchronous condensers in the Schedule 5.2. However, minor rewording could bring extra clarity. For example, in S5.2.5.5A(a) wording *"This clause applies to synchronous condensers (…)"* could be re-phrased to *"For synchronous condensers, the following modifications to this clause apply (…)".*

Clause S5.2.5.1 - Reactive power capability

Change/Issue	Comment
Compensation of reactive power when units are out of service	EPEC would like the AEMC or AEMO to provide further guidance to industry around expected compliance demonstration both during the connection process as well as during regular commercial operations.

Clause S5.2.5.2 - Quality of electricity generated

Issue	Comment
Delete reference to AS1359.101	EPEC supports this change as the standard is outdated and is prone to cause the confusion.

Clause S5.2.5.4 - Response to voltage disturbances

Issue	Comment
Bounding requirements for over-voltages above 130% and introducing obligations to minimise recurring switching surges	New wording indicates proponents must ride through "at least marginally exceeding 130%" connection point voltage. EPEC considers this a welcome change; however, we believe that the assessment details shall be further described. E.g. if the plant demonstrates ride-through of 131% for 20 ms, is this sufficient to demonstrate compliance? In addition, EPEC notes the system standards under S5.1a.4 are silent on sub-20ms range as it refers to power frequency voltages. In its submission, AEMO considers alignment of requirements between generators (S5.2.5.4) and NSPs (S5.1a.4) and adds a requirement that protection shall not disconnect the generating system within 20ms under S5.2.5.8 AAS. However, in our experience, 20ms may be quicker than the physical response of breakers; therefore we suggest the S5.2.5.8 wording be changed to 'no commit to trip within 20ms'.
Clause S5.2.5.4(e2)(1) permits reliance on OLTCs	EPEC acknowledges the significant commercial impact this will have to further the efficient investment, and emissions arms of the NEO.
Clause S5.2.5.4(e3) describes "…temporary *reductions* in active power…" are permitted	The continuous uninterrupted operation only considers reasonable temporary 'reductions' in active power output for voltage variations greater than 10%. It can also be observed that the active power may temporarily increase in this situation depending on OEM, wherein the voltage variation increases the headroom of the equipment. It therefore may be more appropriate to state temporary '*alterations*' instead of *'reductions*'.

Clause S5.2.5.5A - Responses to disturbances following contingency events

Issue	Comment
Clause S5.2.5.5A(d)(3) does not consider rotor dynamics	For synchronous plant, depending on the nature of the fault, it is possible for active power recovery to be delayed due to rotor angle, despite the prime mover active power input remaining unchanged. The draft rule does not appear to consider this and EPEC suggests to consider adding the wording "taking account of inertial effects or rotor dynamics" to this clause.
Clause S5.2.5.5A(g)(2) implies a commencement time however this is not a NER defined term	The lack of commencement time definition may lead to inconsistent approaches between NSPs and inconsistent results between projects. Therefore, commencement time definition or a clarification in a form of guidelines that all parties would follow would be appreciated.
Clause S5.2.5.5A(f)(1) doesn't specify whether	S5.2.5.5A(f)(1) clarifies that the dI/dV factor at the connection point is to be calculated for positive voltage drop which EPEC believes to be right direction but the clause doesn't

Issue	Comment
calculations are required for unbalanced faults	seem to specify whether calculation is required for unbalanced faults. Considering the control objective specifies expected behaviour for negative sequence injection (i.e. keeping healthy phases healthy), enforcing dI/dV compliance during unbalance faults may create competing objectives for Iq positive injection vs Iq negative injection.
Clause S5.2.5.5A(f) does not clarify requirements for unbalanced faults	The automatic access standard in clause S5.2.5.5A(f) doesn't specify if only positive sequence reactive current injection should be used for calculating the reactive injection for unbalanced faults. It is unclear what direction industry should take to demonstrate compliance against this clause.

Clause S5.2.5.8 - Protection from power system disturbances

Issue	Comment
Strengthening and streamlining emergency over-frequency response	S5.2.5.8(a1) of the draft rule refers to an automatic droop response, with droop's meaning given in clause S5.2.5.11(a). EPEC understands that new AAS, MAS and negotiation criteria of S5.2.5.8 provide clear preferences how over-frequency events should be handled. However, since S5.2.5.8 refers to protection from power system disturbances whereas droop response refers to a control requirement, EPEC considers the placement of an control requirement (automatic droop response) to be questionable in a protection-specific clause S5.2.5.8.

Clause S5.2.5.10 - Detection and response to unstable operation

Issue	Comment
Adding new requirements for instability detection and response	EPEC supports attempts to clarify that technical requirement and to allow for greater negotiation flexibility. Considering the scale of change to this technical requirement, EPEC suggests AEMC and AEMO to publish guidelines which would be outlining expectations in that matter.

Clause S5.2.5.13 - Voltage and reactive power control

Issue	Comment
Prioritising stability over speed of responses across a range of typical to highest system impedances	EPEC notes the draft determination indicates a priority of stability over speed. The draft rules and determination also introduce the notion of a 'typical impedance' that is nominated by the NSP. Currently, SMIB studies are typically performed under maximum and minimum SCR at the connection point with the idea that this would capture the range of conditions the plant may experience most of the time. It is unclear what purpose the addition of a 'typical impedance' would bring as it would be expected to be within the maximum and minimum SCRs. Equally important, the drafting provided appears to lack guidance for the NSPs to provide a typical impedance and is unclear whether it would bring more studies beyond what is currently being done.
Adding materiality thresholds on settling time error bands	A newly proposed wording under S5.2.5.13(l) introduces necessary clarification on when not to calculate the settling time. Whereas EPEC does not object the proposed changes, we notice that it is not clear what error is discussed in S5.2.5.13(l) (i.e. dynamic or steady state). Also, EPEC suggests to re-consider specific active and reactive

Issue	Comment
	power thresholds discussed in S5.2.5.13(l)(2) as a 10% band requested in the proposed settling time definition for a change of 2% for low Pmax values may be comparable with signal noise and as such settling time may be still difficult to calculate precisely.
Table S5.2.1 AAS	It appears that the reactive power control mode settling times for setpoint changes are very long (<30 seconds) for overdamped responses. EPEC considers this arose to promote stable response over fast response. However, proposed wording indicates 30 s settling time at high impedance (low SCR) whereas low impedance (high SCR) conditions may be more prone to long settling times. Thus, EPEC suggests the final determination includes specific scenarios to illustrate the purpose. Aside: EPEC notes that it is industry standard to refer to SCR as it is clear what is being referenced, rather than low or high impedances.

Definitions

Issue	Comment
Amending definitions of rated active power and rated maximum demand	EPEC welcomes the attempt to replace rated active power with active power capability and with maximum active power. However, EPEC wishes to highlight that definition of active power capability would benefit from providing more clarity, i.e. the proposed definition discusses maximum active power transfer and discusses this needs to be specified in the GPS but proposed wording doesn't indicate what should be considered a maximum transfer. In practice, maximum active power transfer is capped at the level which allows to meet all remaining GPS requirements. Similarly, the term maximum active power introduced in S5.2.5.1 would benefit from additional clarity as wording "the maximum active power (…) refers to (…) both the active power capability and the maximum demand with all its production units in service" can be interpreted in a way that there is a separate maximum active power level for charging and discharging operations. A consequence of that will be different reactive power capability requirements for charging and discharging operations under S5.2.5.1. In EPEC's experience, some NSPs have strong preference of preventing from such arrangement as reactive power capability would change instantly when crossing 0 MW level. Thus, it would be beneficial to clarify whether reactive power requirement shall refer to the greatest value of charging/discharging maximum active power or to charging and discharging separately.

Clause S5.1a.5 and S5.1a.6

Issue	Comment
There is no guidance to what version of the standard should be applied	References to AS61000, year 2001 have been replaced with IEC61000 without a year. While EPEC is cognisant that standards change from time to time and therefore removing reference to a specific year was made with this in mind, this may lead to inconsistent versions being applied. To avoid confusion what standard version should apply for specific project and to avoid re-work if standard changes mid-connection application, EPEC suggests to specify in

Issue	Comment
	the NER that the intent is to use the latest standard available, lock the standard version at the time of connection enquiry, and the version of the standard be captured in the relevant section of the GPS.

Clause S5.1.13

Issue	Comment
Clause S5.1.13 Information to be provided has been removed	This clause required NSPs to provide electrical information pertaining to the proposed Connection Point of a connection enquiry. There does not appear to be any explanation if this has been replaced elsewhere or why this should be removed.

Considerations for future changes

Issue	Comment
S5.2.5.10 for synchronous generating systems	EPEC understands the focus of the current rule change was to provide a meaningful approach for asynchronous generating systems under the clause S5.2.5.10. However, synchronous generating systems would also benefit from bringing more clarity to this technical requirement. For example, proposed draft for synchronous generating systems still has wording "a condition that would lead to pole slipping is detected". This probably refers to Loss-of-Field (LoF) protection but doesn't really say "detect actual pole slip and trip for it". Unless in LoF conditions, predicting pole slip before it happens is technologically challenging whereas it is certainly possible to detect pole slipping and trip when it occurs.
S5.2.5.4 V/Hz protection to be considered for synchronous generating systems	Proposed clause S5.2.5.4(e2) introduces much needed clarification on the extent of CUO requirement but that clarification seems to primary address requirements for asynchronous generating systems. For synchronous machines the V/Hz is a concern, and it would be beneficial for future synchronous generation projects to include that consideration in the NER. A synchronous generator may be perfectly capable of riding through elevated V at 50 Hz, but not at off-nominal frequency. EPEC suggests wording to allow reduction of the high-voltage ride-through requirements in proportion with per-unit frequency, e.g. at 0.99 pu freq, V ride through at 99% of the existing S5.2.5.4 values. This would allow V/Hz protection to be set at a level that would protect the machine, whilst still meeting S5.2.5.4 at all frequencies.