Update report Stakeholder feedback template:

AEMO Review of technical requirements for connection

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Stakeholder: Powerlink Queensland

Schedule 5.2 Conditions for Connection of Generators

NER Schedule 5.2 issue	Schedule 5.2 (Generators) – feedback on revised recommendations and relevant draft NER amendments
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	• Powerlink appreciates the intentions and agrees some performance standards should apply to dynamic plant connecting to the network. However, the whole of Schedule S5.2 should not apply to synchronous condensers, SVC and STATCOMs, particularly for plant that has been installed to address a specific purpose. We consider NSPs and AEMO should retain discretion to apply relevant subclauses for these classes of plant. • Powerlink does not support the default inclusion of synchronous condensers into the S5.2 standards.
NER S5.2.5.1 – Reactive power capability	
Voltage range for full reactive power requirement	• The negotiation framework already permits the provision of capabilities less than the automatic levels of full supply (capacitive) of reactive power at high voltages, and capabilities less than automatic levels of full absorption (inductive) of reactive power at low voltages. The proposed changes do not add material benefits to the performance required, assuming that appropriate engineering judgement is made by all parties when negotiating an access standard. • Powerlink does not support the determination of a mid-point voltage, given this could change over time. • The proposed changes could lead to more complex access standards for S5.2.5.1, which would result in an incrementally more complex task in the assessment of the access standard itself and more complexity in the network and its operation.
Treatment of reactive power capability considering temperature derating	• While some inverter-based generating units derate current as a function of temperature, other generating unit types do not. From our experience, some wind turbines reduce active power as a function of temperature, but do not necessarily reduce reactive power as a function of temperature. Additionally, some thermal plants derate active power as a function of temperature, and do not derate or vary reactive power. • The adoption of an automatic standard that reduces the required reactive power as a function of temperature-derated active power could result in that reactive capability that could be provided by some technologies at no additional cost is no longer provided. • Powerlink suggests that the automatic standard for reactive power is retained as being invariant to temperature and considers that the S5.2.5.1 negotiated access standard already supports negotiation around temperature derating. • We recommend that if there is any temperature derating of active power at the connection point, and if there is a requirement to document the reactive power derating in the GPS, then active power should also be documented within the GPS. • We consider generating unit-level temperature derating information is not needed within the GPS and that only the information for temperature derating of the generating system at the connection point is needed.

NER Schedule 5.2 issue	Schedule 5.2 (Generators) – feedback on revised recommendations and relevant draft NER amendments
Compensation of reactive power when units are out of service	• Powerlink notes that if multiple solar farms were connected in to the one bus or to different buses in the same area, then under the proposed standard, the combined effect of those solar farms at night-time could appreciably increase the voltage by several percent. In some networks, there are pre-existing high voltage challenges to manage, and the proposed standard (of 0.5% voltage increase) would not be appropriate. Solar farms spend more than 50% of the time (i.e. at night-time) with generating units not generating or potentially out of service. • Powerlink suggests that the 0.5% threshold of the proposed General Requirements should instead be considered for a Minimum Standard. We recommend the Automatic Standard be expressed as a requirement for 0 MVAr at the connection point, combined with a nominal reactive power tolerance. • Powerlink recommends that, by default, all clauses of a GPS apply whenever a plant is energised. The performance requirement during the day and at night could differ, and some clauses may not be relevant or could be negotiated for different performance during the day and at night as agreed by NSP and AEMO. For example, for a solar farm at night with a subset of inverters in night-time reactive support mode, S5.2.5.3, S5.2.5.4, S5.2.5.9, S5.2.8, should still apply. Powerlink recommends those clauses that specifically related to active power are carved out (e.g. S5.2.5.11, S5.2.5.14). Components of S5.2.5.5 should still be applicable when a solar farm is operating at night (e.g. the requirement to stay connected). Some flexibility should be provided under a Negotiated Access Standard for provision of reactive current under S5.2.5.5 when a solar farm is operating at night, while other components of S5.2.5.5 (e.g. active power recovery) are not relevant.
S5.2.5.7, S5.2.5.8, S5.2.5.13	
Simplifying 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	• Powerlink considers it more practical to deal with plant connecting to a voltage level below 66 kV by modifying the negotiated access standard or negotiating process for S5.2.5.4. • Powerlink supports the removal of the limit on negotiation based on the size of the plant. • Minor drafting note: The Rules mark-ups refer to the electrically closest location exceeding 66 kV. The revised recommendation in the Update Report refers to the nearest high-voltage *transmission* location, even though some DNSPs have lines operate at 132 kV. Powerlink assumes the Rules mark-up is the intended change, even though it does not exactly align with the description in AEMO's Update Report.
Requirements for overvoltages above 130%	• The proposed change puts an explicit obligation on the NSP to design its network and insulation coordination in a particular manner. In the electrical vicinity of a given connection point, there can be NSP equipment (for which an insulation coordination obligation would be made) as well as equipment that is part of other generating systems. Therefore, we recommend that any insulation coordination obligations are placed on all technically relevant parties. This would include an obligation on each generating system to ensure their equipment has been designed so that switching of their elements does not expose other parties to switching surge voltages. • Powerlink recommends there should be a requirement for no protection elements with trip timer settings <= 20 ms.
Clarification of continuous uninterrupted operation (CUO) in the range 90% to 110% of normal voltage	• We support the limitation of the assessment of maintaining active or reactive power to a maximum voltage change of 10%. • While not considered in AEMO's Update Report, Powerlink suggests that some level of reduction of active and reactive power at the connection point can be accepted as part of CUO and form part of a negotiated access standard, if agreed to by the NSP and AEMO.
NER S5.2.5.5 – Generating system response to disturbances following contingency events	
Definition of end of a disturbance for multiple fault ride through	• Powerlink supports this proposed change.

NER Schedule 5.2 issue	Schedule 5.2 (Generators) – feedback on revised recommendations and relevant draft NER amendments
Form of multiple fault ride through clause	• We do not support this change. Powerlink understands the MFRT requirements were added to the technical standards to identify if there were any plant-level limitations (e.g. protection settings, auxiliaries, breaking register/chopper) that would force a plant to trip under MFRT when a power system could sustain those MFRT in the absence of the plant under consideration for connection. • Powerlink recommends that for multiple faults, AEMO, the NSP and connection applicant should check that the model can ride through multiple faults (which can be assessed in DMAT studies), with plant compliance assessed via OEM statements on capabilities (e.g. of auxiliary system ride through capability). Auxiliary systems may be the most limiting element of a generating system for compliance purposes, but may not be modelled. • Powerlink does not support S5.2.5.5 (r2-3), as this is not aligned with the intent of the multiple ride through capabilities of a plant.
Number of faults with 200 ms between them	•
Reduction of fault level below minimum level for which the plant has been tuned	• For S5.2.5.5 (d) (10), Powerlink considers the plant should be expected to remain connected and stable (not necessarily providing full compliance) for fault levels that are below the minimum expected fault level for a single contingency (i.e. minimum fault level used for tuning purposes), down to the technical capability of the equipment (withstand SCR at the settings that are used for compliance tuning). • Powerlink supports the changes in S5.2.5.5 to make the conditions that might require retuning more transparent.
Active power recovery after a fault	• Powerlink supports this change in principle, noting the following caveats. • There is difference between an actual frequency change compared to a measured frequency change. Measurement of frequency at the inception of a fault, during a fault, or at or immediately after fault clearance, can be extremely challenging. In general, controlled actions based on those measurements should not occur.
Rise time and settling time for reactive current injection	• Powerlink notes that this section of the Rules was recently updated by the AEMC. • We consider the proposed changes are not required and these issues can instead be managed through the negotiated access standard. • Being more prescriptive about the current injection response (e.g. “step like” function) risk bringing more complexity into the assessment of compliance on site and in simulations (e.g. no fault results in a step-like response).
Commencement of reactive current injection	• Powerlink supports this proposed change. Typically, fault ride through current response is implemented at the generating unit level, as distinct from at the connection point.
Clarity on reactive current injection volume and location and consideration of unbalanced voltages	• The control objective includes requirement to “minimise” deviation of voltage, which can be interpreted in different ways. For example, a plant that only has the ability to inject positive sequence current may consider that they minimise over-voltages by reducing positive sequence injection to a very low level; however, this may be at a level that still can’t be accepted. • We recommend that the term “minimise” is framed as “minimise subject to NSP requirements”, because it is the NSP that is affected by high voltages. • Some generating unit types inject current per phase (i.e. no particular negative sequence injection), and that those standards could be expressed on that basis (i.e. without reference to negative sequence voltage or negative sequence current).
Metallic conducting path	• Powerlink supports this change.
Reclassified contingency events	
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	•
NER S5.2.5.8 – Protection of generating systems from power system disturbances	

NER Schedule 5.2 issue	Schedule 5.2 (Generators) – feedback on revised recommendations and relevant draft NER amendments
Emergency over-frequency response	•
NER S5.2.5.10 – Protection to trip plant for unstable operation	
Requirements for stability protection on asynchronous generating systems	• Powerlink considers that "disconnection" in the context of a protection system could be interpreted to mean a fast protection grade ~100ms trip of circuit breakers, or a slower (say 1 or 2 seconds) ramp back of active power and generating unit disconnection. We recommend the meaning of disconnection is made clear in any Rules amendment. • We consider the Rules should clarify if the intent is to have separate devices to detect an instability in voltage, active power and/or reactive power; and a protection system that is capable of disconnection. • We recommend the automatic standard should include provision for SCADA signals and/or alarms as agreed with the NSP and/or AEMO. • We do not support any reference to 'contribution to the oscillations' in AAS, as the methods to prove contribution from a given plant are still not mature and can create confusion for generator, NSP and AEMO. Furthermore, there are cases in the NEM where instabilities in one plant can be caused by another nearby plant. It can become a matter for debate as to which plant is the contributor to the oscillations. • In relation to PMUs and the need for AEMO to receive PMU data, Powerlink considers the intent behind this requirement is not clear. Furthermore, meeting this requirement could become extremely costly for generators. For example, this could include a solution for the generator to provide high speed [non-SCADA] data directly to AEMO.
NER S5.2.5.13 – Voltage and reactive power control	
Voltage control at unit level and slow setpoint change	• Powerlink considers that rate limitations on a setpoint are an operational measure. We do not see the need to include this in the GPS or Rules.
Realignment of performance requirements to optimise power system performance over expected fault level (system impedance) range – Voltage control	• We strongly support inclusion of a longer settling time than 7.5s, to be agreed with the NSP, for a voltage disturbance up to 5% (for both synchronous and asynchronous plant) in MAS. • We do not support the proposed changes to S5.2.5.13. We consider that the concept of apparent system impedance for S5.2.5.13 will devalue the clause's core purpose of control system tuning and further complicate the plant tuning exercise for no material gain. For the power system, the main need from each generating system is to oppose the voltage change caused by external disturbances. Therefore, compliance assessment should, in plant operation, be able to be demonstrated in the context of multiple other dynamic plant operating, as distinct from assessing or calculating what the apparent system impedance is in the field. • Powerlink considers that priorities are: (1) settling time (either into a limiter or not) requirements, to a 5% external disturbance (i.e. in the field and in a NEM model); (2) stability of the plant (either into a limiter or not), to a 5% external disturbance, at SCR = 3; (3) rise time (either into a limiter or not) requirements, to a 5% external disturbance (i.e. in the field or in a NEM model); (4) stable (adequately damped) performance for a 5% voltage reference change in a NEM model and in the field; (5) documentation of the settling and rise time of a 5% voltage reference change. For simplicity, this can be performed in a SMIB file, for a range of fault levels from synchronous sources (as agreed with the NSP, and documented in the GPS); and (6) a reasonability on voltage reference change for settling and rise time should be present as part of good tuning process. In the field operation outside of plant testing, most plants are not subject to 5% Vref changes, and even if they are, there are SCADA / EMS delays that result in delays in seeing any reactive power change. • Powerlink agrees with focusing performance objectives on the lower fault level scenario. Stable plant operation (as distinct from full compliance) at fault levels below a N-1 minimum dispatch scenario, but bounded to a reasonable level (e.g. SCR = 3 / the technical limit of the equipment), can be an important tuning criteria for a plant.
Materiality threshold on settling time error band and voltage settling time for reactive power and power factor setpoints	

NER Schedule 5.2 issue	Schedule 5.2 (Generators) – feedback on revised recommendations and relevant draft NER amendments
Clarification of when multiple modes of operation are required	• Powerlink considers the NSP should be specifying the primary and secondary control modes. We agree that the secondary control mode should have reduced assessment requirements. However, secondary control mode assessment should include that the required reactive power target (or power factor) is met within a given tolerance.
Impact of a generating system on power system oscillation modes	• In relation to: 'where a Schedule 5.2 Participant has elected to pay the system strength charge (under NER 5.4.3B(b1)), require that assessments take into account the performance required to be provided by the SSSP at the relevant system strength node' Powerlink considers that the nature of a system strength solution planned by an SSSP to meet S5.1.14 can change between the planning and implementation phases. Mandating this approach in MAS could lead to tuning/assessment that may not be real. We therefore recommend this is included as an optional (i.e. *may*) instead of a mandatory (i.e. *must*) requirement, based on the NSP's requirements.
Definition – continuous uninterrupted operation	
Recognition of frequency response mode, inertial response and active power response to an angle jump	• We do not see the need for this change. The current definition of CUO can be used to manage the issues raised in the Discussion Paper. The proposed changes appear to focus on 'how to apply engineering', which we do not consider a primary role of the Rules.

Schedule 5.3a Conditions for connection of MNSPs

Issue	Schedule 5.3a (HVDC links) – feedback on revised recommendations and relevant draft NER amendments
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 links) – feedback on revised recommendations and relevant draft NER amendments
New standards	
Voltage control	•
Active power dispatch	•

Multiple Schedules

Issue	Multiple schedules – feedback on revised recommendations and relevant draft NER amendments
NER Multiple clauses	
References to superseded standards	• Powerlink supports this proposed change.

NER structural amendments

Issue	NER structural amendments – feedback on revised recommendations and relevant draft NER amendments
NER structural amendments	
Drafting principles	• Flexibility to include components of S5.2 should be available at NSPs and AEMO at their discretion. (As noted above).
Proposed approach	• Careful consideration needs to be made if there are multiple connecting plant with nameplate capacities close to the 30 MW threshold proposed in the same geographical area.

Consequential amendments

Issue	Consequential amendments – feedback on revised recommendations and relevant draft NER amendments
Definitions	
Definitions changes	• Powerlink generally supports the proposed changes (e.g. to rise time and deletion of normal voltage), noting our comments on CUO above.
Technical changes	
Incorporating synchronous condensers	• We consider there should be discretion, as agreed by the NSP and AEMO, as to which clauses are applicable. Please refer to comments above.
Additions to information provision	• We highlight our comments (with more detail) above, relating to:

Issue	Consequential amendments – feedback on revised recommendations and relevant draft NER amendments
	• S5.2.5.1 – mid-point voltage: This change does not appear to be required. • S5.2.5.5 – lowest / highest single phase and three phase fault level and X/R: It is not clear how a NSP providing this information will add value to the compliance process. Tuning for S5.2.5.5 should be based on minimum fault level/withstand capability level. An outage on the system with non-minimal fault level could have the worst-case X/R value, which may significantly differs from the X/R value at the minimum fault level. • S5.2.5.13 – lowest, highest and typical apparent system impedance: We do not consider these appropriate for compliance assessment purposes and therefore does not support their addition as requirements.
Relevant system – in relation to small plants exempt from some requirements	•
S5.2.5.8 Over-frequency emergency generation reduction requirements	•
S5.2.5.8 Protection settings and relationship to ride through clauses	•
S5.2.5.8 Conditions for which the plant may trip and recording of conditions	• Powerlink supports this proposed change.
S5.2.5.8 Network Service Provider liability	•
S5.2.5.11 Minimum operating level	•
S5.2.5.11 Response direction for bidirectional units taking power from the system	• Powerlink supports this proposed change.
Drafting changes	
Drafting changes	•

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.