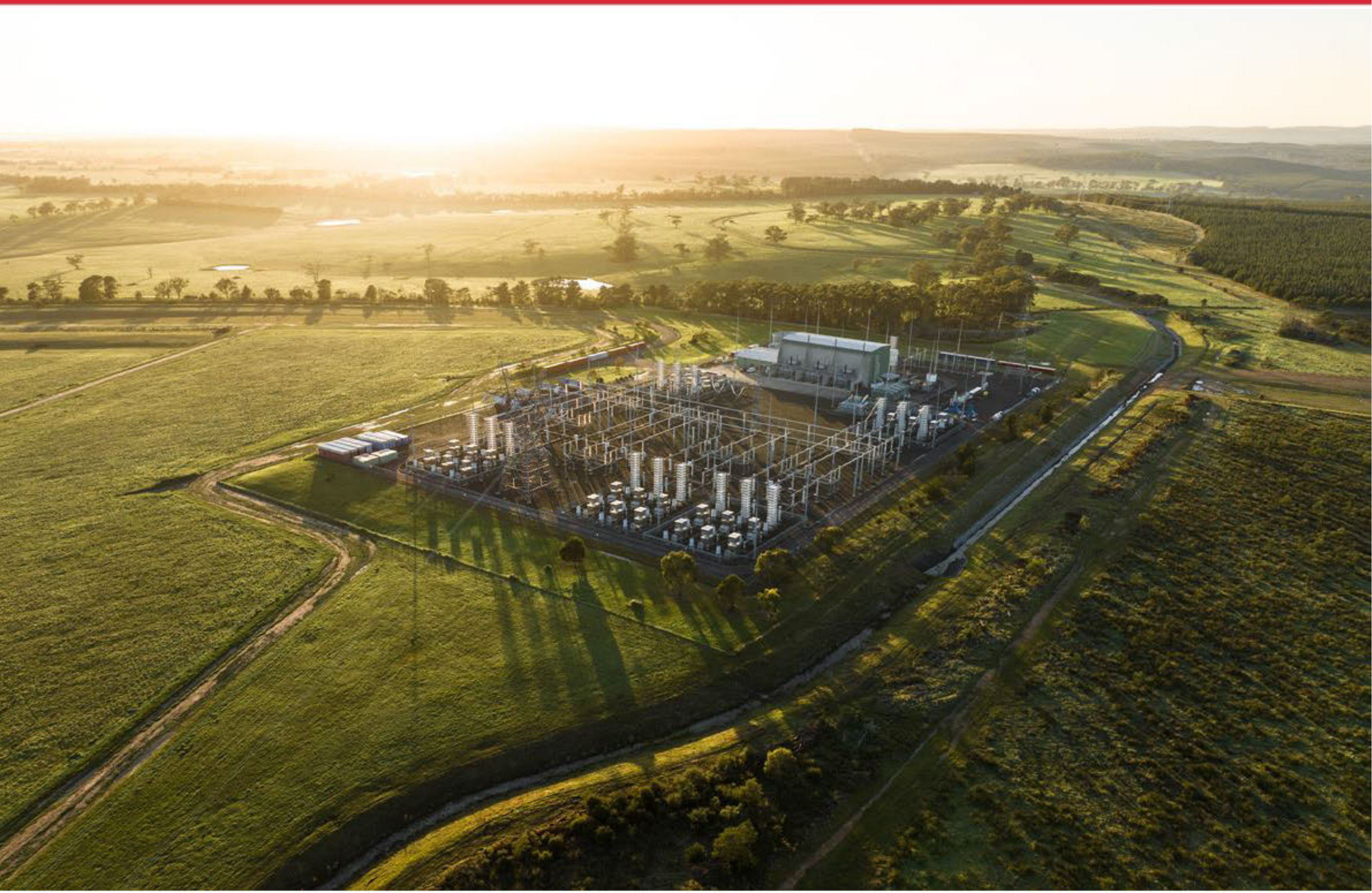
ERC0393 Improving the NEM access standards

APA Submission

30 January 2025



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Anna Collyer
Chair
Australian Energy Market Commission

Lodged online

30 January 2025

RE: APA Submission to ERC0393 - Improving the NEM access standards

Dear Ms Collyer,

Thank you for the opportunity to comment on the AEMC's ERC0393 Improving the National Electricity Market (NEM) access standards rule change draft determination (Draft Determination). We appreciate the opportunity to contribute to this important rule change process.

APA is an ASX listed owner, operator, and developer of energy infrastructure assets across Australia. Through a diverse portfolio of assets, we provide energy to customers in every state and territory. As well as an extensive network of natural gas pipelines, we own or have interests in gas storage and generation facilities, electricity transmission networks, and 692 MW of renewable generation and battery storage infrastructure.

APA owns and operates the Basslink High Voltage Direct Current (HVDC) Market Network Service Provider (MNSP) interconnector between Tasmania and Victoria. APA also manages the Murraylink and Directlink HVDC regulated interconnectors on behalf of Energy Infrastructure Investments (EII). As HVDC interconnectors, Basslink, Murraylink and Directlink provide transmission services to the NEM as prescribed by the National Electricity Rules (NER).

APA supported AEMO's recent initiatives to streamline the connection process through the Connections Reforms Initiative (CRI). This initiative enabled AEMO to identify existing and emerging issues related to the NEM access standards through the collaborative participation of CRI participants. Generally, AEMO's proposed Schedule 5.2 reflects a balanced view from different groups of stakeholders to best promote the National Electricity Objectives (NEO).

AEMO's rule change proposal aims to address a broader range of areas relevant to access standards, including small connections, synchronous condensers, and HVDC links. The Draft Determination has broadened the application of Schedule 5.3a to all existing and future HVDC links.

The AEMC initiated this rule change request under the fast-track process with the assumption that AEMO undertook extensive consultation during its review. APA provides comments on the Draft Determination in the context of limited engagement to date, despite operating three HVDC interconnectors in the NEM.

APA supports establishing access standards for new or significantly modified HVDC links. Existing links will find it difficult to meet and/or demonstrate performance against all proposed access standards due to technology type and original design. Significant

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investment would be required to meet the proposed minimum access standards, if at all technically possible. It is vital that existing performance standards for HVDC links that are already defined in the existing connection agreements are preserved through grandfathering arrangements.

As a key stakeholder that owns and operates all three existing HVDC links, APA would appreciate the opportunity to discuss the proposed performance standards with respect to existing HVDC links with AEMC, given APA's limited involvement in the development of the Schedule 5.3a performance standards.

If you have any questions about our submission, please contact Annie Martyn on [redacted] or annie.martyn@apa.com.au.

Regards,

[redacted]

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1. APA as a partner of choice in Australia's energy transition

APA is a leading ASX listed energy infrastructure business. Consistent with our purpose of securing Australia's energy future, our diverse portfolio of energy infrastructure delivers energy to customers in every Australian state and territory. For decades we have owned, operated, and maintained some of Australia's most important energy infrastructure.

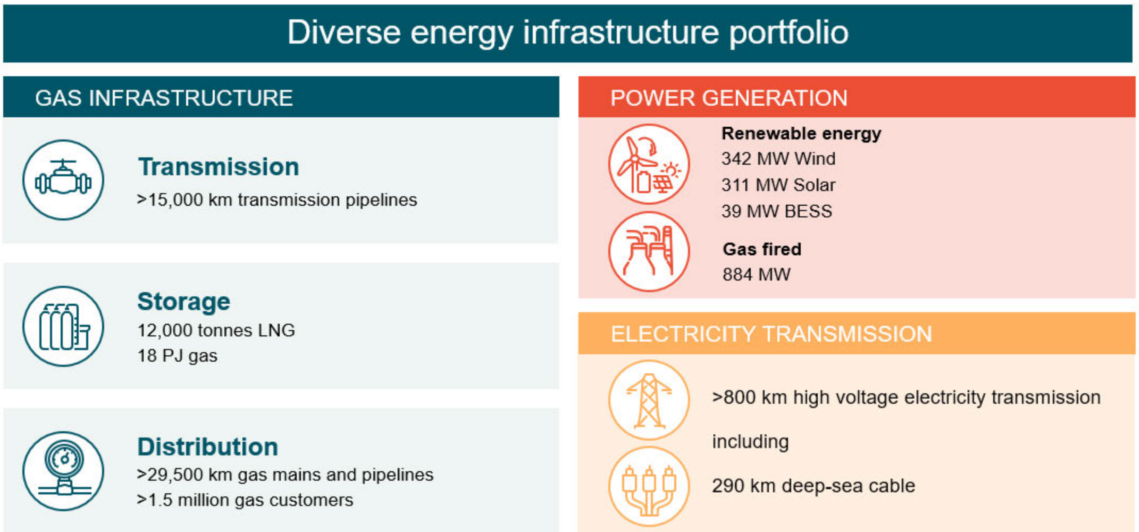

Figure 1: APA's portfolio

Our 15,000 kilometres of natural gas pipelines connect sources of supply and markets across mainland Australia. We operate and maintain networks connecting 1.5 million Australian homes and businesses to the benefits of natural gas. We also own or have interests in gas storage facilities and Gas Powered Generation (GPG).

We operate and have interests in 692 MW of renewable generation and battery storage infrastructure, while our high voltage electricity transmission assets connect Victoria with South Australia, New South Wales with Queensland and Tasmania with Victoria.

APA actively supports the transition to a lower carbon future. In September 2024, we published our FY24 Climate Report, detailing our progress against our Climate Transition Plan. This plan outlines our commitments to support Australia's energy transition and pathway to net zero operations emissions by 2050.

In early 2023, APA established an Electricity Transmission business unit with a focus on electricity transmission infrastructure across Australia. We have recruited a team of established industry professionals to lead APA in playing a pivotal role in the energy transition. In line with our strategic focus, we have also announced a partnership with leading global infrastructure organisation EDF Group. This partnership synergises EDF's global experience in electricity transmission delivery and operations, with APA's strong local experience in the construction and operation of linear energy infrastructure.[1]

With our extensive portfolio of assets and expertise across gas, electricity and renewables, APA is well-placed to support the energy transition towards net zero.

[1] APA, '*APA Group and EDF Group to pursue electricity transmission projects*' (Media Release, 31 October 2023).

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2. Draft rule to amend the access standards for new or modified HVDC links

2.1. Introduction to current NEM HVDC interconnectors

APA owns and operates the Basslink HVDC interconnector (Basslink) which connects the 220kV Tasmanian transmission network at George Town Substation with the 500kV Victorian transmission network at Loy Yang Power Station (LYPS).

Basslink began operations in 2006 as a Market Network Service Provider (MNSP). A MNSP is a transmission network asset that is not economically regulated by the Australian Energy Regulator (AER). Instead, the MNSP earns its revenue by trading in the wholesale electricity market, and 'arbitraging' wholesale electricity market prices between NEM price regions.

APA manages the Murraylink and Directlink HVDC regulated electricity interconnectors on behalf of Energy Infrastructure Investments (EII), in which it also holds a 19.9% interest (with Marubeni Corporation holding a 49.9% stake and Osaka Gas, 30.2%).

The Directlink interconnector, commissioned in 2000 is a 59 km HVDC interconnector transferring power between the New South Wales and Queensland. The Murraylink interconnector, commissioned in 2002 is a 180 km HVDC interconnector transferring power between the Victoria and South Australia.

Basslink, Murraylink and Directlink provide transmission services to the NEM as prescribed by the NER.

2.1.1. Basslink

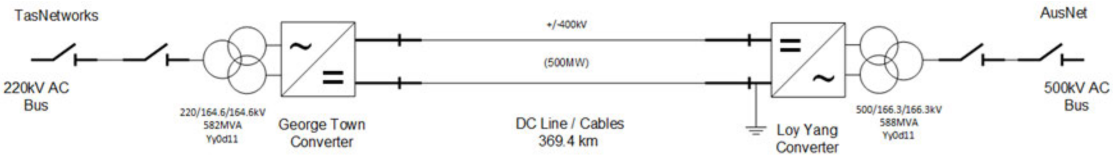

Figure 2 - Basslink Overview

Figure 2 shows the configuration of Basslink, a grid following current source converter, implemented as an asymmetrical monopole. Basslink has been in service for 19 years with the following limitations:

- Ambient temperature design maximum is 40°C in Victoria and 30°C in Tasmania.
- For a power direction change a 5-minute deionisation time is required for the voltage polarity to reverse.
- 50MW minimum power transfer due to the minimum hold on current of the thyristor-based converter.
- The inverter relies on the shape of the Alternating Current (AC) waveform to transfer conduction from one valve group to the next and is susceptible to a commutation failure from the phase advance or voltage reduction of an external AC system fault. The control response is to fire the rectifier at minimum transfer and decrease the inverter firing angle until commutation is restored, then increase the inverter firing angle for the recovery.

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The control and protection platform, and Human Machine Interface (HMI) were replaced in 2011.

2.1.2. Directlink

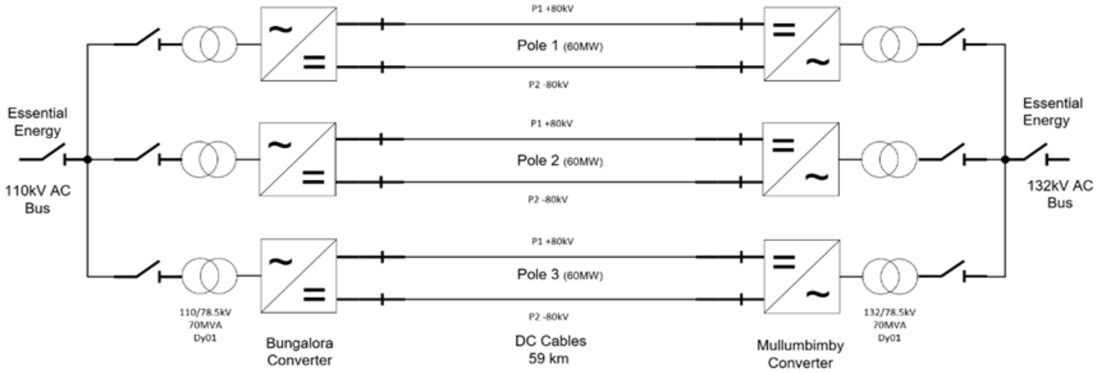

Figure 3. - Directlink Overview

Figure 3 shows the configuration of Directlink, a two-level grid following voltage source converter, implemented as three symmetrical monopoles. Directlink has been in service for 25 years with the following limitations:

- Ambient temperature design maximum is 40°C.
- As a grid following converter, the converter trips on under/over voltage and frequency.

The control and protection system was replaced at the Mullumbimby 1 converter station in 2015 and the remaining converter stations in 2019. A project is underway to progressively replace the generation 1 Insulated-Gate Bipolar Transistors (IGBTs) with generation 3.

2.1.3. Murraylink

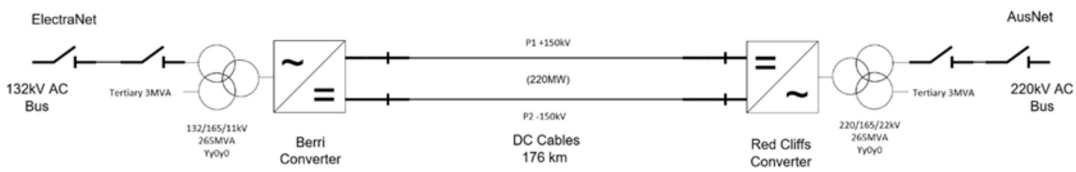

Figure 4 - Murraylink Overview

Figure 4 shows the configuration of Murraylink, a three-level grid following voltage source converter, implemented as a symmetrical monopole. Murraylink has been in service for 23 years with the following limitations:

- Ambient temperature design maximum is 40°C.
- As a grid following converter, the converter trips on under/over voltage and frequency.

The control and protection system was replaced in 2020.

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2.2. Application of Schedule 5.3a to existing HVDC links

2.2.1. Application of the amending rule to existing connection agreements

APA supports sections of the transitional rule in 11.[xxx].6(a) that makes clear that the Draft Determination is not intended to have the effect of requiring alteration of existing connection agreements. Where a performance standard is to be amended in accordance with the proposed rules, this will be the trigger and result in the application of the new Chapter 5 as per transitional rule 11.[xxx].6(b).

It is recommended that transitional rule 11.[xxx].6(a) be clarified to ensure that the Final Rule change, by itself, does not intend to require modifications to 'Existing Performance Standards' already established in an 'Existing Connection Agreement.'[2] Where included, these standards would form part of an existing agreement's terms.

2.2.2. Provision of performance standard information to AEMO

The Draft Determination requires Network Service Providers (NSP) to determine, document and advise AEMO of the performance standards of existing schedule 5.3 plant (HVDC links owned or operated by the NSP), that are not subject to terms of a connection agreement, within 12 months of the commencement date.

APA's interpretation of this new obligation within clause 5.2.3(c1) is that this is provision of information is only intended to cover plant operated and connected wholly within the NSP's own network for which performance standards have not previously been provided to AEMO.

Performance standards for all of APA's existing HVDC links are included in their relevant connection agreements to their interconnecting NSP that AEMO would have existing visibility of as part of the initial connections process.

APA supports a final rule that does not introduce new requirements for the provision of performance standards and relevant supporting information already established, negotiated and previously provided to AEMO. Development of this information would be redundant, costly and administratively burdensome and of limited additional value.

2.3. Proposed amendments for Schedule 5.3a

APA's generic feedback on amended access standards under Schedule 5.3a are set out below.

2.3.1. Clause S5.3a.4 — Monitoring and control requirements

The Draft Determination requires duplicated instability detection mechanisms for HVDC links under clause S5.3a.4.1 and clause S5.3a.4.2. Although clause S5.3a.4.1 relates to remote monitoring, subclauses (a)(1)(ii) to (iv) includes key elements of a centralised instability detection system.

Both clause S5.3a.4.1 and clause S5.3a.4.2 require HVDC systems to comply with similar detection and response mechanisms for unstable operation, applicable to both asynchronous production units and synchronous condenser systems under clause S5.2.5.10(a)(2) and (3). The approaches in clause S5.2.5.10 differ in addressing plant

[2] Relevant plant not subject to 5.2.3(c1)

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instability for asynchronous and synchronous condenser units. Clause S5.3a.4.1(a)(1) requires an instability detection methodology based on phasor measurement units (PMU) measurements, where the information collected is centrally processed by AEMO, and trip signals are sent by AEMO through the NSP. In contrast, clause S5.3a.4.2(a) requires a standalone onsite instability detection system that can detect, manage, and act on unstable behaviour at the connection point.

The AEMC's rationale identifies that the performance requirements for HVDC links should generally align with those in clause S5.2.5.10 for asynchronous plants. Although HVDC links are considered asynchronous plants, duplicated instability detection methodologies are required for HVDC links under clause S5.3a.4.1 and clause S5.3a.4.2. During the implementation of detection systems, different functionalities under clause S5.3a.4.1 and clause S5.3a.4.2 may overlap and eventually may not be used in the future.

2.3.2. Clause S5.3a.4.2 — Detection and response to unstable operation

Current and future HVDC links form important interconnections between different networks within the NEM. As an integral part of the transmission network, HVDC links significantly influence power flows, spinning reserves, frequency, and voltage within the NEM. Any hierarchical actions, including de-loading and disconnection, require consideration of real-time conditions of the broader power system before such actions are taken.

A standalone, bespoke Instability Detection System (IDS) that only monitors connection points may not have sufficient information to incorporate the most appropriate control action logic to suit power system security requirements. Therefore, integrating all HVDC links into a PMU-based centralised wider area network detection system can better promote the NEO compared to the benefits of a site-specific instability detection system designed at the plant level.

There could be merit in reconsidering the proposed duplicated instability protection requirements under clause S5.3a.4.1 and clause S5.3a.4.2.

2.3.3. Clause S5.3a.9— Balancing of load currents

Comparison of automatic access standards in Schedule 5.2 plants and Schedule 5.3a plants are shown in Table 1 below.

Table 1 : Comparison of terminology used in Schedule 5.2 and Schedule 5.3a

Schedule 5.2 plant clause	Schedule 5.2 Description	Schedule 5.3a plant clause	Schedule 5.3a Description	Relevant Schedule 5.1 clause
S5.2.5.2(b)(1)	Voltage fluctuation	S5.3a.10(a)	Voltage fluctuation	S5.1.5(a)
S5.2.5.2(b)(2)	Harmonic voltage distortion	S5.3a.11(a)	Harmonics and voltage notching	S5.1.6(a)

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S5.2.5.2(b)(3)	Voltage unbalance	S5.3a.9(b)	Balancing of load currents	S5.1.7(c)

APA notes some inconsistencies in the terminology and performance requirements, particularly for the clause S5.3a.9 'Balance of load current' requirement. Historically, clause S5.3a.9 was derived from requirements applicable to loads under S5.3.6. In the Draft Determination, AEMO proposes to introduce Schedule 5.3a performance requirements similar to those in Schedule 5.2. APA suggests changing the terminology and performance wording under clause S5.3a.9 to align with the updated standards.

2.3.4. Clause S5.3a.13 — Response to disturbances in the power system

HVDC links may connect two jurisdictions with different frequency operating standards (similar to Basslink). Such links will be required to set clause S5.3a.13 for frequency ranges applicable to the specific connecting network frequency operating standards. Acknowledging that clause S5.3a.1a(c)(4) references to the connection point are taken to refer to each of the interfaces between Schedule 5.3a plants, this clause's general requirement must include a clause to clarify the application of different frequency operating standards for applicable connection points of the Schedule 5.3a plant.

It would be appropriate for clause S5.3a.13(e) general requirements on equipment design to withstand capability to be included under the general requirements of clauses S5.3a.11 and S5.3a.9. APA also notes that the general requirements under clause S5.3a.11 include similar general requirements for Schedule 5.3a plants capable of withstanding the effects of harmonic levels produced by that plant plus those imposed from the network.

2.3.5. Clause S5.3a.14 — Disturbance ride through and response capability

Clause S5.3a.14(a) defines the end of the disturbance, which is applicable for determining the relevant subclauses of S5.2.5.5 and S5.2.5.5A. S5.2.5.5A includes additional definitions (e.g., S5.2.5.5A(b)(1) and (2)) beyond the disturbance end time, which are not included under S5.3a.14 or referenced in the general requirements of clause S5.3a.14(e). Thus, it is understood that definitions are automatically considered when interpreting the clause and do not require specific reference to Schedule 5.2 under Schedule 5.3a

Each HVDC link has two connection points to the connecting networks. Following a fault, the respective voltages of each connection point may recover at different rates. Therefore, APA suggests clarifying the application of the definition under clause S5.3a.14(a) for disturbance end time in the context of the recovery of voltages at the two connection points to 90%-110% within different time frames.

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3. Draft rule to amend the access standards for generators, integrated resource systems and synchronous condensers.

3.1. Simplifying standards for small connections

APA views AEMO's proposal to apply certain performance requirements based on the size of the plant as a positive change to improve the commercial viability and efficiency of the process for these projects. Historically, some performance requirements and other complexities, such as modelling and compliance requirements, have caused unnecessary delays to new or existing small plant alterations.

A threshold has now been defined to determine the application of certain clauses to small connections. The combined nameplate rating is set at 30 MW for asynchronous and synchronous production units, and 30 MVA for synchronous condensers. Normally, production units' nameplates are defined in MVA. Section 6.3 of the Draft Determination correctly identifies that the nameplate rating is interpreted as an apparent power MVA rating, rather than an active power MW rating.

Synchronous production units' continuous ratings are subject to a power factor, and continuous ratings may also be defined for multiple power factors on the nameplate. It should be noted that asynchronous generating units' continuous ratings in MW can be purposely modified through controller limits to suit the project's commercial and technical requirements. The industry has recent examples of modified nameplate ratings in MW to qualify for AEMO standing exemptions using 4.99 MW nameplate ratings. APA suggests that AEMC should carefully specify the criteria for defining combined nameplate ratings to remove any future ambiguity that could result from modified nameplates in MW to fit within the eligibility criteria of a small connection.

Section 1.2.2 of AEMO's Guide to Registration Exemptions and Production Unit Classification includes criteria for determining nameplate ratings for the exemption of generators from registration. This criterion applies a conversion factor of 1 (equivalent to a power factor of 1) if manufacturers specify the nameplate in MVA rather than in MW. A similar criterion can be adopted to convert the nameplate rating for small connections that are defined in MVA.

3.2. Proposed amendments for Schedule 5.2

APA's generic feedback on amended access standards under Schedule 5.2 are set out below.

3.2.1. Broaden the application of Schedule 5.2 to include synchronous condenser systems

APA supports the AEMC's proposal to broaden the application of relevant Schedule 5.2 access standards to synchronous condensers. The proposed requirement will promote consistent performance standards across all the synchronous condensers regardless of the owners or operators of the assets.

Section 3.2.1 in the Draft Determination outlines that NSPs would have the ability to determine and establish appropriate performance standards for their own synchronous condensers without the need for any negotiation process. APA notes footnote 46: *"Draft rule, clause 5.2.3(c1). Performance standards determined by NSPs for their synchronous condensers would be required to comply with all the usual requirements of a negotiated access standard in S5.2 and as described in clause 5.3.4A (for example, be no less onerous*

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than the minimum access standard)," which is inconsistent with the section 3.2.1 determination rationale.

Draft Determination clause 5.2.3(c1) requires NSPs to determine and document access standards for their Schedule 5.2 and Schedule 5.3a plants in accordance with the relevant schedule. This will require AEMO to provide advice on AEMO advisory matters for negotiated access standards. Synchronous condenser performance standards are not exempt from the negotiation process, given that Schedule 5.2 requires Schedule 5.2 participants to consult with AEMO and follow AEMO's advice in determining a matter that is an AEMO advisory matter relevant to negotiated access standards (NAS).

There may be merit in standardising the clause 5.3.4A negotiated access standards process, regardless of asset ownership, to maintain consistency in the synchronous condenser performance requirements across the NEM.

3.2.2. Clause S5.2.5.1 Reactive power capability

The proposed changes within the access standards to reduce full reactive power capability across the full voltage range, introduce a mid-point voltage, and allow for temperature de-rating incorporate established good industry practices into the rules to standardise the approach for the access standards with less negotiation.

There could be merit in unifying the 'mid-point voltage' defined under S5.2.5.1 and the 'target voltage' determined under S5.1.4(c). If the mid-point voltage and target voltage reasonably represent the same quantity, it will eliminate the need for NSPs to define two separate values for target voltage and mid-point voltage.

The mid-point voltage for the capability curve is nominated by the NSP. It is not clear whether the mid-point voltage is a static value applicable for the lifetime of the project or defined by the NSP from time to time. Due to changes within the network, the NSP may need to alter the mid-point voltage over time. Changing the mid-point may require reassessment of the reactive power capability curve based on the new mid-point voltage. There could be merit in considering the inclusion of a general requirement detailing the process for mid-point voltage determination and change.

The proposed automatic access standards require reactive power capability with no de-rating up to an ambient temperature of 50°C. The majority of inverter-based technologies, particularly solar and wind production units, significantly de-rate their active and reactive power at 50°C. Historically, automatic reactive power capability was defined for a lower ambient temperature below 50°C. Most wind and solar production systems may not be able to meet the automatic access standard, which requires reactive power capability up to 50°C for Pmax. The majority of renewable projects will need to negotiate with the NSP to agree on a temperature de-rated capability curve under a negotiated access standard. There could be a benefit in setting the automatic access standard capability at 40°C and recording the de-rated capabilities at 50°C under clause S5.2.5.1(f), making clause S5.2.5.1 AAS more achievable for major renewable technologies without negotiation.

Certain production unit technologies enable reactive power compensation as required under clause S5.2.5.1(h) while units are not in service to maintain the voltage at the connection point (clause S5.2.5.1(a2)). This includes a few production units that operate in a different mode (e.g., solar inverters operate in reactive power at night mode) to absorb reactive power injection into the network by its reticulation network.

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Establishing performance standards for settling time for applicable voltage control modes under clause S5.2.5.13 will require additional modelling and updated models with such mode controls updated. Only certain OEM technologies are capable of providing reactive power compensation while not generating electricity. In most cases, electrically connected production units' MVA is typically less than 10 MVA.

Given that clause S5.2.5.13(a1) excludes small connections less than 30 MW from clause S5.2.5.13 settling time requirements, APA suggests limiting this requirement based on the aggregate size of connected production units that operate in this mode while not producing electricity above a certain MVA threshold.

3.2.3. Clause S5.2.5.4 Response to voltage disturbances

APA agrees with the draft clause S5.2.5.4(c1), which allows Schedule 5.2 plants connected at medium and low voltage connection points without an on-load tap-changing transformer. Following the ERC0294-Connection to Dedicated Connection Assets rule change in 2021 and the proposed Renewable Energy Zone access right networks by state governments, medium voltage assets can be part of the transmission network. There is a likelihood of multiple plants sharing a common step-up transformer with an on-load tap changer while connecting to separate connection points before the tap-changing transformer. The flexibility to nominate a specified point other than the connection point removes complexities around setting up performance standards.

APA supports the proposed change on over 130% voltage disturbance ride-through performance, which previously created confusion over the boundary of the over-voltage for performance requirements. The new subclause clarifies the boundary of the over-voltage range for 130% voltage disturbance. AEMO requires to further clarify upper boundary of the "marginal exceeding 130%" for the assessment purposes.

APA also supports the Draft Determination clarifying the meaning of 'continuous uninterrupted operation' for disturbances within 90-110% of the nominal voltage range under clause S5.2.5.4(e1) and (e2). Historically, AEMO and NSP used the continuous uninterrupted operation (CUO) definition to influence the maximum capacity (Pmax) to installed capacity ratio of inverter-based production systems to provide reactive current response without compromising the active current capability within the normal voltage operating range. The proposed clarification permits the use of transformer tapping, plant switching, and overload capability to achieve CUO. APA agrees with the proposed new general requirements that acknowledge the reliance on load tap-changing transformers and overload capability to maintain continuous uninterrupted operation (CUO) for voltage variations up to 10% and above 10%.

Our previous experience suggests that the use of mechanical plant switching, such as switching of capacitor banks to achieve CUO, can lead to very complex and unnecessary control mechanisms, which can also cause breaches of other access standards (e.g. clause S5.2.5.2).

3.2.4. Clause S5.2.5.5 Disturbance ride-through capability

APA supports the addition of a subclause to clarify disturbance end time under S5.2.5.5(a), which resolves different misinterpretations regarding the next fault commence time for multiple fault ride-through capability requirements. This clarification within the rules defines clear performance requirements for multiple fault ride-through fault sequences for assessments.

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Certain technologies may have limitations for different combinations of faults for multiple fault ride-through capability. APA agrees with the provisions within the negotiated access standards to specify plant limitations that can impact its ability to remain in continuous uninterrupted operation for certain combinations of disturbances or associated conditions. This enables generators to manage the risk of non-compliance for un-modelled known plant limitations.

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

APA supports separating the previous clause S5.2.5.5 into two clauses to improve understanding and clarity of the subclauses for synchronous and asynchronous technologies.

The proposed amendment to clause S5.2.5.5A(f)(3) active power recovery clause now considers a range of external factors, such as frequency disturbances during this time, that impact active power recovery. APA notes that even though the active power recovery time under clause S5.2.5.5A(f)(3) remains at 100 ms, the new definition under clause S5.2.5.5A(b)(3) introduces additional time until the fault ends, and the voltage recovers within 90% to 110% and remains within 20 milliseconds. This change increases the absolute active power recovery time performance requirement to above 120 ms. It would be appropriate to acknowledge the increase in active power recovery time requirement due to the application of the new definition of the end of a disturbance to active power recovery.

3.2.6. Clause S5.2.5.8 Protection from power system disturbances

Clause S5.2.5.8(a1) requires production systems to reduce active power by 50% before the expiry of 3 seconds after the frequency reaches a level that is 0.5 Hz below the upper limit of the extreme frequency tolerance. Considering the system normal mainland extreme frequency tolerance upper limit of 52 Hz, the 3-second counter commences after the frequency reaches 51.5 Hz. Production systems are capable of enabling different droop settings for segmented frequency bands to suit primary frequency response, FACS, and clause S5.2.5.8(a1) requirements. This suggests that clause S5.2.5.8(a1) automatic access standard compliance may lead to a production system having an overall compliant droop control system for the entire frequency range up to 52 Hz, but slightly poorer over-frequency performance between 50.15 Hz and 51.5 Hz.

Historical NEM interconnector separation events typically caused over-frequencies below 51.5 Hz. The NEM will require better active power reduction capability within production systems for frequencies above 51 Hz to avoid load shedding followed by any catastrophic frequency collapse. There could be merit in AEMO considering requirements to reduce active power proportionately above a certain threshold or general requirements to record active power percentage reduction for frequencies above 50.5 Hz to maintain linear performance through the over-frequency range.

Clause S5.2.5.8(a0) indicates that paragraphs (a)(1), (b)(1), (b1), (b2), and (b3) of this clause S5.2.5.8 do not apply to synchronous condensers. Subclause (a)(1) cannot be found in the mark-up version of the amended rules. APA considers that draft subclauses S5.2.5.8(a1) and (b) performance requirements are not relevant to synchronous condensers. Furthermore, subclause S5.2.5.8(b4) refers to the presence of fast ramping production units over disconnection, which is not relevant to synchronous condensers. APA suggests clause S5.2.5.8(a0) be amended to "Paragraphs (a1), (b), (b1), (b2), (b3), and (b4) of this clause S5.2.5.8 do not apply to synchronous condensers."

If AEMC determines that clause S5.2.5.8(a1)(2), (b)(2), and (b4) are applicable to synchronous condensers, it would be appropriate to clarify that clause S5.2.5.8(a1)(2),

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(b)(2), and (b4) subclauses include references to production units, minimum operating levels, and disconnection of production units. Synchronous condensers are primarily online to provide system strength mitigation services; therefore, the disconnection of system strength mitigation can cause system security issues.

3.2.7. Clause S5.2.5.10 Detection and response to unstable operation

APA supports the inclusion of clarifying clauses that define the functionality of instability detection systems (IDS) for asynchronous production units. Recently, sub-synchronous oscillations (SSO) have been detected within the NEM due to the high penetration of inverter-based resources (IBRs). The sub-synchronous controller interactions introduced by these devices necessitate more comprehensive studies to identify and design the systems. If mitigation techniques malfunction or sub-synchronous oscillations occur due to unforeseen conditions, proper monitoring, protective, and operational measures should be in place to securely operate a power system.

Generally, a NSP expects IDS to be capable of calculating a contribution factor to the oscillation for each threshold, which ultimately decides the protection trip. The system should be capable of specifying a few levels of thresholds for both alarms and trips. Each threshold should be configurable either as an alarm or a protection trip. The protection trip can be in the form of a ramp-down through the power plant controller (PPC), followed by the disconnection of the production unit, or full or partial disconnection through the medium voltage (MV) feeder level. Protection mechanisms, stages, and ramp rates are agreed upon with NSP during the detailed design stage based on the generating system's size and configuration. The majority of current IDS providers have not fully demonstrated their IDS capability to calculate the contribution factor to the oscillation to initiate any threshold-based ramp-down followed by a disconnection. Therefore such IDS installed within the NEM cannot be considered as proven to be used for threshold based production unit disconnection.

APA suggests that AEMO publish a document that details expectations on the design, implementation, and testing of an IDS for asynchronous production units.

3.2.8. Clause S5.2.5.11 Frequency control

APA notes that subclauses S5.2.5.11(b)(1A) and S5.2.5.11(c)(1A) are the only subclauses that define specific performance requirements for bidirectional units while transferring power from the power system to the production units (i.e., charging mode). There may be a benefit in including a clarification note within the AEMC's final determination.

3.2.9. Clause S5.2.5.13 Voltage and reactive power control

APA agrees with AEMO's proposal to change the automatic access standard clause S5.2.5.13(b)(2B)(iii) for the voltage set point to "configurable" rather than continuously controllable within the 5% range of the target voltage, providing more clarity on the compliance requirement. However, the corresponding minimum access standard clause S5.2.5.13(d)(2B)(ii) still requires the voltage set point to be continuously controllable in the range of 98% to 102% of the target voltage. To maintain consistency with the corresponding automatic clause S5.2.5.13(b)(2B)(iii), it may be beneficial to define clause S5.2.5.13(d)(2B)(ii) as "voltage set point to be configurable in the range of at least 2% of nominal voltage above and below the target voltage."

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3.2.10. Clause S5.2.6.1 Remote Monitoring

Clause S5.2.6.1(b) includes relevant remote monitoring quantities that AEMO may require to discharge its market operation. There could be merit in considering the following remote monitoring quantities applicable for production systems with bidirectional units:

- Energy Remaining (MWh)
- Estimated Maximum Energy Capacity (Full Pack Energy) (MWh)
- State of Energy Available (Available Maximum Capacity) (%)