TasNetworks
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13 July 2018

Mr John Pierce
Chair
Australian Energy Market Commission
PO BOX A2449
Sydney South NSW 1235

Via online submission

Dear Mr Pierce,

RE ERC0222 – National Electricity Amendment (Generator technical performance standards) Rule 2018

TasNetworks welcomes the opportunity to make a submission to the Australian Energy Market Commission (**AEMC**) on the National Electricity Amendment (Generator technical performance standards) Rule 2018 Draft Determination.

As the Transmission Network Service Provider (**TNSP**), Distribution Network Service Provider (**DNSP**) and jurisdictional planner in Tasmania, TasNetworks is focused on delivering safe and reliable electricity network services while achieving the lowest sustainable prices for Tasmanian customers. This requires the prudent, safe and efficient management and development of the Tasmanian power system. In this regard, TasNetworks is appreciative of the AEMC's efforts to improve the standards for equipment connecting to the power system.

TasNetworks supports Energy Networks Australia's (**ENA's**) submission and would like to make further comments with a particular focus on the Tasmanian jurisdiction. The main points in this submission are:

- In general, TasNetworks supports the Draft Determination as a workable and meaningful step forward which will help address many of the issues brought about by the technology transition that is underway across the National Electricity Market (**NEM**). TasNetworks therefore strongly supports the intent behind changes to the negotiating framework to facilitate negotiated outcomes that are close as practicable to the *automatic access standard*.
- Acknowledging that the AEMC has not adopted all of the recommendations put forward by the Australian Energy Market Operator (**AEMO**), TasNetworks considers that the direction to review the Generator Technical Performance Standards (**GTPS**) on a more regular basis is relevant and appropriate. Subsequent reviews will have the advantage of ever improving insight and understanding of the future needs of the power system, as well as the options available to address those needs.

- The Generator Technical Performance Standards (**GTPS**) should be seen as an integral part of the network planning ‘tool box’. As such, TasNetworks considers there is a need to set forward-looking standards that can address <u>reasonably foreseeable</u> future challenges. TasNetworks would therefore suggest that various aspects of the GTPS be considered in this light including increasing technical requirements for smaller *generating systems* and the management of system strength.
- The broad and extensive consultation process has clearly articulated the key drivers for change and has provided industry participants with ample opportunity to contribute to, and prepare for, the rule changes. TasNetworks therefore sees little benefit in delaying their implementation, e.g., by lengthening transition windows or further debating definitions such as *continuous uninterrupted operation* (**CUO**).

The responses to the questions discussed at the workshop held in Sydney on 26 June, as well as the list of specific questions subsequently distributed by the AEMC via email on 3 July, are provided below. Further observations pertaining to TasNetworks original November 2017 submission and other items of relevance are also included in this submission.

TasNetworks would welcome the opportunity to discuss this submission further with you. Should you have any technical questions relating to this submission, please contact Andrew Halley, Principal Operations Engineer, via email (andrew.halley@tasnetworks.com.au) or by phone on (03) 6271 6759.

Yours sincerely,

Wayne Tucker

General Manager Regulation, Policy and Strategic Asset Management

1. Negotiation framework

Should clause 5.3.4A(g) remain a civil penalty clause?

TasNetworks supports the intent behind changes to the negotiating framework to facilitate negotiated outcomes that are close as practicable to the *automatic access standard*. With specific regard to clause 5.3.4A, however, TasNetworks has no comment.

2. Active power control and remote monitoring and control

Would the proposed AGC capability requirements congest SCADA communication networks over time? Would this create extra costs over time for NSPs, AEMO and generators? In addition to impacts of increased AGC signals, will the other remote monitoring and control capabilities congest SCADA communication networks over time?

As network businesses continue to deploy various smart grid technologies in the context of broader industry developments, managing increasing communication and SCADA requirements have, or will, become a 'business as usual' function. This includes having the necessary capabilities to manage 'big data'. TasNetworks therefore considers it difficult to sight SCADA and communication impacts as a reason not to implement the proposed changes. In this regard, TasNetworks supports the rules as proposed and considers they would allow an efficient, sensible list of required telemetered variables to be developed which does not unnecessarily burden communication channels or SCADA systems.

With that said, in the context of S5.2.6.1, TasNetworks would only seek appropriate levels of visibility behind a generator's connection point so as to avoid unnecessary transmittal of information. As highlighted in TasNetworks November 2017 submission, the use of the word 'may' within S5.2.6.1(b) and (b1) is considered to provide sufficient flexibility for all parties to identify those parameters which are necessary for the management of power system security and are otherwise mutually beneficial to exchange, i.e. to improve operational efficiencies during planned or forced outage events.

Is there a need for smaller generating system to have ramp rate control capabilities? Can stakeholders provide evidence as to why these capabilities are required?

In answering this question, TasNetworks has interpreted 'smaller *generating system'* to mean *generating systems* of less than 30 MW capacity, therefore pertaining to the requirements under S5.2.5.14(a)(2) and (b)(2).

TasNetworks is supportive of S5.2.5.14(a)(2) and (b)(2) as currently drafted and considers that sufficient flexibility exists between the *minimum* and *automatic access standards* to develop pragmatic, cost effective solutions for new connecting generators that also address network security and operability issues.

However, as highlighted in TasNetworks earlier November submission, there is a growing trend for developers to undertake projects in the 5 MW to 30 MW range. For example, there are currently eight proposed projects in the Tasmanian region that have nameplate capacities of between 10 MW and 30 MW, two of which are active *connection applications*. Another four potential projects lie in the 5 to 10 MW range.

Most of these projects are intermittent in nature and several are situated within relatively close geographical proximity to one another. As such, they would not show significant diversity in response to changes in local environmental conditions. An inability to limit the active power response of such systems, which in aggregate could represent a significant generation block, could result in network voltage control issues and force network operation beyond the technical envelope for short periods of time. That is, until AEMO's dispatching system compensates for the changes to network operating conditions at the next dispatch interval.

While TasNetworks acknowledges the AEMC's observation that "under the current transmission framework, generators are only required to bear the costs directly related to their connection at the time of their connection", TasNetworks remains of the view that the generator technical performance standards are an integral part of the network planning 'tool box' and therefore need to set reasonable forward-looking requirements that address foreseeable future challenges. Although this over-arching principle is applicable to the rule change in its entirety, TasNetworks considers ramp rate control capabilities being introduced on smaller *generating systems* to be one specific, practical example.

3. Reactive power control

Are there any issues associated with requiring remote switching capability for voltage control mode?

Although being supportive of the requirements defined in S5.2.5.13(b)(2A), TasNetworks suggests a change be made to include flexibility in regards to remote switching capability requirements.

TasNetworks considers that the majority of synchronous machines connected to the transmission network will continue to operate in voltage control mode in the future. The likelihood of an alternate control mode being invoked is considered very low. It follows that the need to provide remote control equipment to change the mode of operation is likely to be superfluous in many cases.

Although it would be possible to agree on such an alteration during the connection process, a significant number of GPSs will likely end up with S5.2.5.13 being a *negotiated access standard* whereas in practice, the actual physical capability may be equivalent to automatic access. TasNetworks therefore proposes that the following bolded text be added to S5.2.5.13(b)(2A):

> … "in accordance with a procedure agreed with *AEMO* and the *Network Service Provider*. *Remote control equipment* to change the setpoint and control mode must be provided **unless otherwise agreed with *AEMO* and the *Network Service Provider*";**

The intent of the above is to enable generators, AEMO and NSPs to negotiate an appropriate outcome based on the generator location, type and surrounding network requirements, while still being able to achieve the *automatic access standard*. For clarity, an acceptable outcome may be that remote control capabilities to change the set point are required, but facilities to change the control mode are not.

In terms of making use of voltage set point remote control, it should be noted that TasNetworks has been operating its Northern Area Voltage (Control) Scheme (**NAVS**) and Southern Area Voltage (Control) Scheme (**SAVS**) for some time with significant success. Both schemes are analogous to Automatic Generation Control (**AGC**) for frequency regulation in that they automatically adjust the steady state voltage profile of the network by coordinating the reactive power output of participating generating units in conjunction with the switching of network capacitor banks. To facilitate this, Hydro Tasmania has provided access to the voltage set points of appropriately located synchronous machines via SCADA. The terminal voltage set point range available in the scheme is deliberately constrained to prevent operation of each machine outside of 'normal' limits. Various feedback signals are used to monitor the performance of the schemes and suspend their operation if measured outcomes are not as expected.

The NAVS and SAVS are positive, in-service examples of what can be achieved when a well-designed, coordinated system that makes best use of both generation and network assets is delivered. Based on the success of these schemes, TasNetworks will seek the participation of new entrant generators connecting in Tasmania to ensure that sufficient controllable reactive capability is retained as generation dispatch profiles change over time.

What kinds of issues and risks could arise in terms of actual operational switching processes? Can these issues be effectively managed through the development of procedures?

TasNetworks agrees with other participants of the Sydney workshop that changes to the operating mode of any controller in the power system should not be done flippantly or without due consideration. There is risk, to varying degrees, that an inappropriate selection may lead to adverse system outcomes.

Despite this, and as indicated above, TasNetworks experience is that it is possible to design, implement and successfully operate Wide Area Control Schemes (**WACS**) which may require operator interactions at various points in time. While there are risks to be managed, TasNetworks contends it is possible to mitigate such risks through standard controls including engineering design, access, training and documentation. For example, where there is a need to change a control mode to manage a particular set of circumstances, there is no reason why this process cannot be defined in a formalised operational procedure.

In this regard, TasNetworks considers the key success factors in operating such schemes to be:

- Robust and thorough design that delivers known outcomes for a broad range of potential operating scenarios.
- Limited access so that changes can only be initiated by appropriately trained personnel.
- High quality documentation that is readily available to those needing it.
- Ongoing review of actual outcomes (design review feedback loops).

What are the appropriate control settings for the performance requirements for operating in power factor and reactive control modes?

TasNetworks understands that the issue being considered by the AEMC is the description of regulation accuracy when operating in reactive power or power factor control mode.

Consider a 100 MVA generating unit rated at 85 MW (0.85 p.f). The rated reactive capability of such a machine is ±52.7 MVAr assuming that the actual reactive limits are symmetrical.

Depending on the assumed base reference, the following outcomes are possible when the *automatic* and *minimum access standards*, as currently drafted, are applied for reactive power control:

a.	With reference to rated MVA:	±0.5% x 100 MVA = ±0.5 MVAr
		±2.0% x 100 MVA = ±2.0 MVAr
b.	With reference to rated reactive capability:	±0.5% x 52.7 MVA = ±0.26 MVAr
		±2.0% x 52.7 MVA = ±1.05 MVAr

For compliance with the *automatic* and *minimum access standards* when operating in power factor control, the following outcomes occur if percentage is applied directly as a change in power factor:

a. 0.845/0.85/0.855 p.f = 53.8/52.7/51.6 MVAr = ±1.12 MVAr

b. 0.83/0.85/0.87 p.f = 57.2/52.7/48.2 MVAr = ±4.45 MVAr

In comparison, a 0.5% (0.005 p.u) change in terminal voltage is likely to alter the steady state reactive output of a machine of this size by at least several MVAr, up to around 5 MVAr. For consistency, a pragmatic approach would be to define regulation accuracy requirements for reactive power and power factor control that are comparable to the established *automatic* and *minimum access standards* for voltage control.

The following alternate rule drafting is offered for consideration:

Automatic access standard:

(c1) A *reactive power* or *power factor control system* provided under paragraph (b)(2A) must:

(1) regulate *reactive power* at the *connection point*, an agreed location in the *power system* or within the *generating system*, **to within a tolerance equivalent to ±4.0% of the rated MVA of the *generating system***;

(2) regulate *power factor* at the *connection point*, an agreed location in the *power system* or within the *generating system*, **to within ±0.02 of its p.f setpoint**;

Minimum access standard:

(d)(3) a *generating system's reactive power* or *power factor control system* must:

(i) regulate *reactive power* at the *connection point*, an agreed location in the *power system* or within the *generating system*, **to within a tolerance equivalent to ±8.0% of the rated MVA of the *generating system***;

(ii) regulate *power factor* at the *connection point*, an agreed location in the *power system* or within the *generating system*, **to within ±0.04 of its p.f setpoint**;

In terms of ease of drafting and eventual implementation, it is recommended that the regulation requirements for each control mode be described separately.

4. Reactive current response

Is a 2% magnitude of response in the minimum access standard practical?

The rigorous discussion, including analysis of overseas jurisdictions, provided on this topic by the AEMC give confidence to TasNetworks that the proposed alignment of the *minimum access standard* with the German Grid Code is practical and achievable.

What are the appropriate ride through threshold ranges?

TasNetworks supports the ride through thresholds as proposed in the Draft Determination. The proposed limits of 85% to 90% and 110% to 112% should provide sufficient margin between normal network operation and the point at which more aggressive reactive current contributions are invoked at a generating unit level, without unnecessarily delaying a response to counteract a network voltage disturbance.

On the occurrence of a fault, what is the appropriate limit on consumption of active power and reactive power?

In smaller power system like Tasmania, network frequency control and the Rate of Change of Frequency (**RoCoF**) in particular, are sensitive to the power balance that exists across the various timeframes of a disturbance. The 'energy deficit' introduced by the Fault Ride Through (**FRT**) characteristics of Power Electronic (**PE**) interfaced energy sources, including High Voltage Direct Current (**HVDC**) transmission, is already factored into RoCoF constraint equations as well as calculations to determine Frequency Control Ancillary Service (**FCAS**) requirements. As such, any increase in active power 'deficit' caused by an asynchronous generator reducing its output to the point of extracting energy from the network, is particularly problematic.

In this respect, TasNetworks agrees with AEMO that the overall severity of disturbances would be exacerbated if excessive levels of such response were allowed to occur, especially if the responses were sustained for significant periods of time. As such, TasNetworks supports limitations being imposed on active and reactive power absorption during faults. These limits should reduce the magnitude and duration of power absorption as far as possible, without imposing unrealistic barriers to entry for equipment suppliers.

With that said, TasNetworks is aware that practical limitations may exist within the design of certain inverter types which relate to the speed of response of measurement and control systems. TasNetworks agrees with the AEMC commentary on this issue and suggests that the limits as drafted be pursued in the absence of contrary advice that suggests that they are not readily achievable.

Are there physical limits that apply to the capability of generators to maintain total current at a given level on a fault at all times?

TasNetworks agrees with the AEMC discussion presented in Section 9.5.8 of the Draft Determination and supports the rule drafting as proposed in S5.2.5.5(i)(6) in the absence of alternative advice that suggests that it is not readily achievable.

For clarification, TasNetworks interprets the requirement in practical terms as follows:

- The control system of an asynchronous generating unit must be capable of providing a combination of active and reactive power output during a voltage disturbance, where that voltage disturbance does not fully consume the reactive capability of the equipment. For example, during a shallow voltage disturbance. The advantages of such a response include better management of FCAS and RoCoF, both of which can be a catalyst for other power system stability issues.
- The intent should be to avoid a ‘switched type’ response. That is, a situation where an inverter foregoes all, or the vast majority of, its active power generation as soon as voltage falls below some threshold value, and which may be just below normal operating limits, before starting to provide additional reactive power contributions.
- The amount of active power delivered under such circumstances should be negotiated to best match the overall requirements of the power system, taking into account specific local network conditions. Such considerations would be particularly relevant for distribution networks.

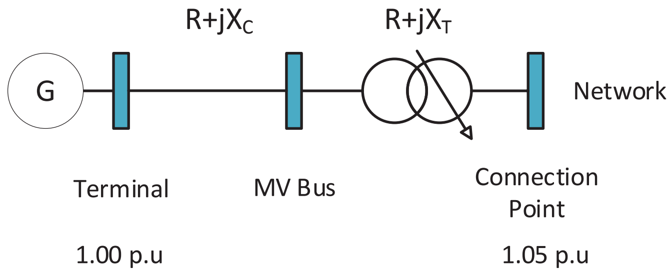
Do the requirements for asynchronous units established under S5.2.5.5 create barriers to the connection of type 3 wind generators, or other doubly fed induction machines?

TasNetworks has no comment on this question.

Is the proposed 2 second inverter ride through duration in the minimum access standard appropriate?

As it pertains to S5.2.5.5(b)(3)(i) and S5.2.5.5(c)(3)(i), TasNetworks contends that the requirement to sustain a response until *connection point* voltage recovers to between 90% and 110% of *normal voltage*, inherently requires an overlap between the response of individual *generating unit* controls and a Power Park Controller (**PPC**). This is because the initial voltage profile on either side of the main power transformer will be offset by the turns ratio applied by the tap changer. As a result, the voltage difference in p.u terms could be significant.

For illustrative purposes, consider a wind farm connected to a transmission system where the medium voltage collector network is operated close to rated voltage but where the HV network is operated at an elevated voltage. This is typical practice in TasNetworks’ experience.



As the voltage of the MV collector system may return to within the maximum threshold limits of 85% to 112% prior to the *connection point* being restored to 90% to 110%, the only mechanism to sustain a reactive response in accordance with S5.2.5.5 is via a PPC which has visibility of the *connection point* voltage. TasNetworks considers it is important that this fact be clearly communicated in the AEMC's final determination.

TasNetworks also suggests the final part of the requirement be reworded. The proposed rule drafting in its current form states:

> "…except for *voltages* below the relevant threshold identified in clause S5.2.5.5(i)(4), the reactive current response may be limited to two seconds duration…".

Direct application of the wording could be interpreted to suggest that the reactive current response must be continuous for under voltage events, but can be limited to two seconds for over voltage events. This does not appear to be consistent with the additional commentary provided in the Draft Determination. For purposes of clarity, the alternative wording below is suggested:

> "…the reactive current response must be sustained for not less than two seconds while the *generating system* and each of its *generating units* remains connected to the *network*".

Although TasNetworks acknowledges that certain distribution network faults may extend beyond two seconds in duration, a response of two seconds is likely to be sufficient for many situations. As a result, having two seconds as a *minimum access standard,* with the ability to increase the response duration to manage more onerous and specific circumstances relevant to individual connections and network characteristics, would seem reasonable.

5. Continuous uninterrupted operation

What is the appropriate definition of CUO? Is the definition proposed in the draft rule specific enough, or too specific? Does it impact on the ability of generators to meet other aspects of the access standards? How else might this definition be constructed?

TasNetworks acknowledges there has been considerable debate on this issue but sees risks to delaying implementation of the GTPS by further refining this point. TasNetworks considers that the current rule is reasonable and practicable and should be operationalised as drafted. The success, or otherwise, of this definition and its application can be weighed as part of future GTPS reviews.

Please note that in the draft rule as published for consultation, there appears to be an error in part (d) of the definition. It is suggested that the words "*so as to*" can be deleted.

6. System strength

Can stakeholders provide any further information about potential avoided costs for TNSPs and future connecting generators, if the system strength access standard were implemented? This could include case studies from specific parts in the network where material investment is likely to be required (e.g. in synchronous condensers) due to sub-optimal system strength withstand capability from existing incumbent or currently connecting generators.

TasNetworks acknowledges the arguments previously put forward by the AEMC with respect to system strength. However, given the potential for the Integrated System Plan (**ISP**) and Renewable Energy Zones (**REZs**) to shape future generation colocation and impact the hosting capacity of specific parts of the network, TasNetworks suggests that further consideration of equity issues pertaining to future generation access is warranted.

As outlined in TasNetworks November submission, TasNetworks considers there is reasonable justification, based on the principles codified in the National Electricity Objective (**NEO**), to require that connecting asynchronous *generating systems* be capable of operating at defined minimum levels of system strength. Moreover, TasNetworks contends that the recent Managing Power System Fault Levels Rule change does not sufficiently incentivise generators to proactively address this issue while there is sufficient system strength available. As such, TasNetworks continues to support the original AEMO proposal to include a *minimum access standard* to address this concern.

As highlighted above, the generator technical performance standards can rightly be viewed as an integral part of the network planning 'tool box'. Although certain sections of the network may currently be able to support equipment requiring a high Short Circuit Ratio (**SCR**) for stable operation, plant connected with such performance will dictate network operation, including what additional plant can be connected in proximity, for the next 20 to 25 years. As such, there is a need to set forward-looking standards that can address <u>reasonably foreseeable</u> future challenges and not restrict the overall hosting capability of the network.

In this respect, and in keeping with AEMO's original proposal on this matter, TasNetworks offers the following alternate drafting of Schedule 5.2.5.15 for consideration:

> The *minimum access standard* is a *generating system* and each of its *generating units* must be capable of *continuous uninterrupted operation:*
>
> (i) for any *short circuit ratio* to a maximum of 3.0 when the product of the *generating system nameplate rating* multiplied by the required *short circuit ratio* at the *connection point* is more than 10% of the available fault level that exists prior to the connection of the *generating system*, as determined in accordance with the AEMO *System Strength Impact Assessment Guideline*; otherwise,
>
> (ii) for any *short circuit ratio* at the *connection point* when the reduction in available fault level is not more than 10% of that existing prior to connection of the *generating system*.

TasNetworks considers that this proposal would have several advantages:

- In making a portion of the network hosting capacity available to smaller *generating systems* that have limited performance capabilities, it avoids unnecessary costs being incurred by developers.
- The ability to host 'less capable' *generating systems* would incrementally reduce as more asynchronous generation is connected. That is, as the available fault level reduces.
- It would still maintain a reasonable strength requirement for larger *generating systems* that consume more of the available fault level and have a bigger impact on network operation and the connection of future generation.

TasNetworks acknowledges the key element in the above proposal is the 10% value and would welcome further discussion with the AEMC on this aspect.

7. Consequential amendments

Would the changes to NER clause 5.3.9 prevent generators from making like for like changes of equipment, where the generator doesn't intend to change the level of performance?

Although TasNetworks considers this question is best answered by Generators, TasNetworks is supportive of the provisions of 5.3.9A(1A) which enable a negotiation to occur at or above the presently agreed levels of performance for an existing generator, rather than enforcing compliance with all new *minimum access standards*. This component of the rule drafting addresses the concerns raised in TasNetworks original November submission.

With respect to the table included in Chapter 5.3.9, TasNetworks suggested in its November submission that S5.2.5.1 (Reactive power capability) should be added to both excitation control and voltage control systems. TasNetworks acknowledges the comments provided by the AEMC on page 268 of the Draft Determination pertaining to this inclusion. However, TasNetworks notes that the changes were not reflected in the Draft Rule dated 31 May 2018 suggesting that the changes had been overlooked. It is recommended that the additions be included as part of subsequent updates prior to final publication.

8. Transitional arrangements

Are there any system security implications, or cost implications, associated with a longer transitional period?

TasNetworks does not favour extending the transitional period beyond the proposed eight week window as described in the Draft Determination. TasNetworks' concern is that participants with a lodged connection enquiry, and/or those who have submitted incomplete packages of information and are still being technically examined, will seek to accelerate the *connection application* process in an attempt to gain access under the existing technical performance standards. This is likely to dilute the benefits introduced by the rule change with respect to the ongoing operation and security of the power system.

As highlighted above, TasNetworks considers that the consultation process has been a significant and transparent one that has provided more than ample opportunity for participant engagement and management of the forward risk profiles. TasNetworks is committed to managing the transition to the new arrangements as described in the Draft Determination and, therefore, encourages the AEMC to minimise the transitional time period to reduce the impacts on internal connections processes.

9. Additional considerations

Connection enquiries

At the stakeholder workshop held on 26 June, a proposal to forward connection enquiry details to AEMO was raised. Due to the sheer number of applications received, and the way these typically vary as the connection process progresses, TasNetworks contends that the administrative cost of this proposal would far exceed the limited informational benefits. Further, TasNetworks considers that there are far greater benefits to be had from early engagement with customers.

TasNetworks' experience is that preliminary discussions, which pre-date a formal connection enquiry, provide an important opportunity to share initial project information as well as communicate potential issues about the proposed network connection point. This includes communication of the nuances of the Tasmanian power system as well as issues pertaining to ongoing Rules consultation processes. TasNetworks therefore favours a flexible, principles based approach to gathering and sharing relevant negotiation information outside of any specific provisioning within the Rules.

Strengthening of relationship between frequency and voltage disturbances

As noted at the Sydney workshop, the wording of S5.2.5.4 (Generating unit response to voltage disturbances) may benefit from additional strengthening which would highlight the need to achieve compliance in the presence of a combined voltage and frequency disturbance. Depending on the nature of the network disturbance, it is credible for both variables to simultaneously shift away from their nominal values. The suggestion offered was to describe the access standards in terms of percentage (p.u) flux rather than percentage voltage.

In practice, some transformer and generator protection systems are likely to use p.u flux (being the ratio of p.u voltage to p.u frequency) as their trigger variable. The issue is less relevant for the very high, short duration over voltages described in S5.2.5.4(a),(b),(1) and (2). However, it is relevant for over voltage conditions which last for more than a couple of seconds. As an example, in this timeframe, frequency may have fallen by up to 4% in the Tasmanian network, even for credible contingency events. TasNetworks therefore suggests that further consideration be given to this issue.

Normal voltage

TasNetworks considers that, in the context of S5.2.5.13(b)(2B)(iii) as well as the corresponding *minimum access standard*, changing the definition of *normal voltage* at a registered *connection point* is very difficult, if not impossible in many circumstances. As *normal voltage* is referenced throughout the rules, the flow on effect is significant. As an example, S5.1a.4 (Power frequency voltage) defines the continuous operating range to be ±10% of *normal voltage*. Lifting the *normal voltage* from 220 kV to 226 kV, as was attempted for a substation in Tasmania's north at one stage, now requires a capability for continuous operation at 226 kV x 1.1 = 248.6 kV, rather than 242 kV. Unless all plant and equipment extending across the NSP's asset base, as well as that of generators and HV connected customers, is capable of operating at these levels, the *normal voltage* must continue to equal nominal voltage.

Given that many buses in the NEM typically operate at off-nominal voltage levels, TasNetworks therefore proposes that the required control range discussed in S5.2.5.13(b)(2B)(iii), as well as the corresponding *minimum access standard*, be centred on an agreed target voltage as opposed to the *normal voltage*. TasNetworks has been successfully applying the concept of a target voltage based on the provisions of S5.1.4(b) and (c) when negotiating access standards and considers this approach is more in-tune with actual network operating requirements.

Clear description of capability (being 'capable')

TasNetworks considers that the requirement to 'be capable' should be further clarified, even if only within the AEMC final determination which will act as an ongoing reference for AEMO and NSPs.

Using 5.2.5.11 (Frequency control) as one example, TasNetworks is of the view that 'being capable' should mean that the *generating system* could be operated in *frequency response mode* at any time even if not a registered participant in the FCAS markets, e.g., as could occur if directed by AEMO for the purposes of maintaining power system security. This would mean that the capability has been commissioned and is represented within the dynamic modelling package provided to AEMO and the NSP. This differs from being 'theoretically capable' or 'capable if additional equipment is installed and commissioned' at some later point in time.

Recommended updates to referenced Australian Standards which are superseded

TasNetworks recommends that various references to superseded Australian Standards be updated as part of this review. These include:

- Schedule 5.a1.5 and Schedule 5.1.5 (Voltage fluctuations) which has an outdated reference to Australian Standard AS/NZS 61000.3.7:2001;
- Schedule 5.a1.6 (Voltage waveform distortion) which has an outdated reference to Australian Standard AS/NZS 61000.3.6:2001;
- Schedule 5.1.6 (Voltage harmonic or voltage notching distortion) which has an outdated reference to Australian Standard AS/NZS 61000.3.6:2001; and
- *Minimum access standard* of S5.2.5.10 (Protection to trip plant for unstable operation) which has an outdated reference to Australian Standard AS/NZS 61000.3.7:2001.