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31 October 2017

Mr John Pierce
Chairman
Australian Energy Market Commission
PO Box A2449
Sydney NSW 1235

Lodged online via: www.aemc.gov.au

Dear John,

EPR0222 Consultation Paper: Generator technical performance standards

TransGrid welcomes the opportunity to respond to the AEMC's consultation paper on the Generator technical performance standards rule change request proposed by AEMO.

TransGrid is the operator and manager of the high voltage transmission network connecting electricity generators, distributors and major end users in New South Wales and the Australian Capital Territory. TransGrid's network is also interconnected to Queensland and Victoria, and is instrumental to an electricity system that allows for interstate energy trading.

TransGrid supports amendments to the current generator access standards to facilitate the ongoing security of the power system. It considers that improvements to generator access standards is a more efficient approach to addressing system security needs than relying solely on network based measures such as synchronous condensers.

TransGrid is also supportive of AEMO's proposed changes to the negotiating framework and the proposal to include all generators, irrespective of the size and dispatch category, to perform active power control.

Our detailed comments on the rule change request are attached. We appreciate the opportunity to comment on the rule change request and look forward to engaging on this matter with the AEMC further. If you would like to discuss this submission, please contact Rebecca El-Khoury on 02 9284 3299 in the first instance.

Yours sincerely,

Anthony Meehan
Executive Manager, Regulation

Attachment: TransGrid submission to AEMC consultation paper on Generator Technical Performance Standards rule change request

Introduction

This submission contains 3 parts. The first part sets out some general comments on the key aspects of the rule change request. The second part provides some specific comments on the generator technical performance standards proposed by AEMO. Finally, the third part of this submission proposes some additional specific changes to the current generator technical performance standards in the NER.

General comments

Access standards

Based on recent experiences with a large number of generator connections, and in particular renewable generator connections, TransGrid supports amendments to the current generator access standards to facilitate the ongoing security of the power system.

TransGrid considers that improvements to generator access standards is a more efficient approach to addressing system security needs than relying solely on network based measures such as synchronous condensers.

This is because, TransGrid's experience is that:

- generators, in particular asynchronous generators with inverter based technologies, can operate at higher levels of performance at a minimal additional cost compared to what they presently commit to under current generator access standard requirements.
- most new renewable generators are connecting to weak parts of the network away from the main transmission network.
- without improvements to generator access standards significant network investment would be required to maintain system security.

TransGrid considers the NER clauses and associated technical standards that AEMO has identified for amendment are appropriate. It also supports the introduction of a new generator performance standard on system strength. We look forward to further clarification from AEMO on the metrics used in specifying this access standard.

On a related but more specific matter, AEMO proposed to include all generators, irrespective of the size and dispatch category, to perform active power control in its rule change request.

TransGrid supports this proposal. A controlled rate of change of active power will be important with very high levels of renewable penetration in certain parts of NEM (e.g. South Australia, south-west NSW, western Victoria). There could be significant frequency and voltage control issues due to high rate of change of active power if appropriate measures are not incorporated.

More generally, TransGrid notes that the level of generator technical standards is closely linked to other rule changes that are underway or have recently completed. For example, the system security final rule determinations: *Managing the rate of change of power system frequency* (ERC0214) and *Managing power system fault levels* (ERC0211). It is important that the AEMC considers the issues holistically relating to system security holistically.

Negotiating framework

In its rule change request AEMO proposed changes to the framework for negotiating access standards in the NER. In particular AEMO proposed a requirement on connecting generators to target the automatic access standard as opposed to the minimum access standard.

TransGrid is supportive of this proposed change. Our experience is that generators may currently aim for the minimum access standard. This standard may not be adequate into the future given the rapidly changing nature of the power system.

Transitional arrangements

The rule change request included arrangements for transitioning to the new requirements.

Given the large number of generator connections expected in the next few years, it is important to implement changes to the generator technical performance standards as soon as possible.

TransGrid proposes that the new rules should apply for new connections beyond a certain date while existing and near future connections should be grandfathered. Where existing generators are modified or refurbished they should be required to follow the new requirements.

TransGrid does not support the retrospective application of changes to generator obligations, as proposed and note that the AEMC has indicated that it does not have the authority to make such changes.

Comments on specific technical standards proposed by AEMO

Clause S5.2.5.1 Reactive power capability

TransGrid agrees with AEMO that the existing minimum access standard of no reactive power capability is not appropriate. However, under c*lause S5.2.5.13 Voltage and reactive power control*, TransGrid's interpretation of 'controllable range' is that it relates to control system capability in terms of voltage set-point range. It is not interpreted as generating system reactive power capability, which is required to regulate the agreed location voltage to the set-point voltage range.

Under c*lause S5.2.5.1 Reactive power capability*, TransGrid proposes that the NER specify the minimum requirement to achieve a capability such that the agreed location voltage is regulated within ±0.05 pu of normal voltage. Any access standard requirement should be specified within this *clause S5.2.5.1 Reactive power capability* itself, rather than linking to the c*lause S5.2.5.13 Voltage and reactive power control*, which outlines the technical specifics of the control systems.

Clause S5.2.5.13 Voltage and Reactive power control

In relation to the automatic standard:

- TransGrid interpretation of clause "allows the *voltage* set point to be continuously controllable in the range of at least 95% to 105% of *normal voltage* at the *connection point* or the agreed location, without reliance on a *tap-changing transformer*" is to describe control system capability in terms of voltage set-point range, rather than generating system reactive power capability required to regulate the agreed location voltage to set-point voltage range. Therefore, TransGrid suggests removal of the text "without reliance on a tap-changing transformer" from this clause.

- The power system stabiliser requirement has been excluded for asynchronous generating systems from the proposed rule change. TransGrid considers retaining this requirement in the NER will provide the flexibility to request such control systems from a generator, where deemed necessary.
- With regards to voltage regulation requirements in (2A)(i) of rule-change-request, TransGrid proposes the following change: "to within 0.5% of the ~~setpoint~~ target voltage", where target voltage is defined from voltage set-point and voltage-reactive power droop. TransGrid's understanding of the 0.5% requirement is to specify the accuracy of the control system, not to describe voltage regulation requirements.
- TransGrid further proposes that (2A) includes the need for facilities for all generating systems to regulate reactive power and power factor, in addition to voltage control facilities.

In relation to the minimum standard:

Referring to "Rule-change-request.pdf":

- (3)(i): TransGrid suggest the following change "to within ~~2%~~ 1% of the ~~setpoint~~ target voltage". TransGrid believes that 2% of control system accuracy is not adequate.
- (3)(iii): TransGrid suggests removal of the text "without reliance on a *tap-changing transformer*" from this clause.
- (3)(v): TransGrid believes it is more appropriate to exclude the wording "embedded". TransGrid proposes changes as follows: "~~may~~ have *facilities* to regulate *voltage* or *reactive power* or *power factor*"
- (4)(3)(A), (5)(I)(A) - TransGrid believes that the settling time without operation of limiters should be relaxed for the present minimum requirement of 7.5 sec, as applicable for synchronous and non-synchronous generating plants.

Additionally, TransGrid proposes the following be added in to the proposed rule for *clause S5.2.5.13 Voltage and reactive power control*:

- Performance requirements (settling time with and without limiter operation, reactive power rise time, control accuracy, set-point range etc.) for reactive power / power factor control modes and the criteria for assessing settling and rise times (e.g. for step change in reactive power / power factor set-point that result in 5% change in voltage).
- Similar to the proposed change made in *clause S5.2.5.11 Frequency control* in defining frequency droop, the following terminologies should be defined as part of *S5.2.5.13 Voltage and reactive power control:* voltage-reactive power droop and target voltage.

Clause S5.2.5.5 Generating system response to disturbances following contingency events

Based on system incident records available to TransGrid for severe system incidents (in particular during bushfires), TransGrid considers that fifteen disturbances within any five-minute period for a combination of faults listed in the rule clause is appropriate. For example,

during bushfires in NSW in December 2002, there were as many as 10 transmission system faults within certain 5 minute periods.[1]

Referring to "Rule-change-request.pdf":

- Subclause (1) in Automatic and Minimum standards:

  In some instances, fault clearance times (include primary and circuit breaker fail) and particularly in the distribution networks, can exceed 2,000 ms. If even one such event is present in the 15 events included (which is highly likely for some generator connections), the total time of 1,800 ms can be easily exceeded.

  TransGrid suggests reviewing this proposed rule clause also taking these distribution system faults or shallow faults as seen by a generator into account.

- Subclause (2)(i)(A) Minimum standards:

  Proposed rule change specifies reactive current injection requirement for connection point voltage below 90% for both Automatic and Minimum standards. TransGrid proposes that voltage threshold of 90% connection point voltage in the minimum standard should include flexibility to select within a range of e.g. 80-90%.

- Subclause (2)(i)(B), Minimum standards:

  The proposed rule change specifies inductive current injection requirement for connection point voltage above 110% for both Automatic and Minimum standards. TransGrid proposes that voltage threshold of 110% connection point voltage in the minimum standard should include flexibility to select within a range of e.g. 110-120%.

  Further, Inductive current injection in the proposed rule change should include flexibility to select within a range in the minimum standard, rather than specifying the same 6% requirement referred in Automatic standard.

Clause S5.2.5.7 Partial load rejection

For better clarity, TransGrid proposes the following updates:

- For the purposes of this *clause S5.2.5.7 Partial load rejection:* **minimum ~~load~~ generation** means minimum *sent out generation* for continuous stable operation.

- Automatic access standard:

  (c) The *automatic access standard* is a *generating system* must be capable of *continuous uninterrupted operation* during and following a *power system load* reduction of 30% from its pre-disturbance level or equivalent impact from separation of part of the *power system* in less than 10 seconds, provided that the ~~*loading level*~~ *generator output* remains above minimum ~~load~~ generation.

- Minimum access standard:

  (d) The *minimum access standard* is a *generating system* must be capable of *continuous uninterrupted operation* during and following a *power system load* reduction of 5% or equivalent impact from separation of part of the *power system* in

[1] This excludes any faults in the distribution network during those periods.

less than 10 seconds provided that the ~~*loading level*~~ *generator output* remains above minimum ~~load~~ generation.

Clause S5.2.5.15 System Strength

TransGrid is interested in reviewing the final proposal, and have not specifically commented on this clause noting the expected changes to the present proposal.

Clause S5.2.6.1 Remote Control and Monitoring

TransGrid considers that network service providers should also be included for receiving Remote Control and Monitoring requirements.

Definition of continuous uninterrupted operation

TransGrid agrees with AEMO that the current definition of continuous uninterrupted operation raises issues with interpretation and affects maintaining power system security. The proposed definition in AEMO's supplementary material is appropriate. It will remove any uncertainty of the present definition and is important in ensuring system security and avoiding widespread interruptions. The additional costs expected will be only marginal compared to the expected impact on the power system and wider community if these capabilities are not provided.

Additional changes to technical standards proposed by TransGrid

In addition to the above comments, TransGrid identifies below items that may be incorporated into the NER:

- ***Clause S5.2.5.2 Quality of electricity generated and Clause S5.2.5.6 Quality of electricity generated and continuous uninterrupted operation:*** The NER refers to older version of Australian / IEC standards which have updated versions. TransGrid proposes that clause S5.2.5.2 should be amended to reflect the latest version of the Australian / IEC standards.
- ***Clause S5.2.5.10 Protection to trip plant for unstable operation:*** There is a significant confusion within the industry with regards to the type of protection systems that satisfy the present automatic standard. TransGrid proposes that the NER should include a definition of the protection systems that satisfy the present automatic standard.

  Further, under the NER, the current minimum standard refers to "voltage disturbance" levels specified in Table 7 of Australian / IEC standards 61000:3:7:2001. TransGrid proposes that clause S5.2.5.10 should be amended to reflect the latest version of the Australian / IEC standards. Further, the minimum standard should include specification of flicker levels in addition to the voltage disturbance levels presently specified in the minimum standard.
- ***Clause S5.2.5.8 Protection of generating systems from power system disturbances:*** The General Requirements of the present rule states: "(d) the access standard must include specifications of conditions for which the generating unit or generating system must trip and must not trip". TransGrid suggests that this clause should be updated as follows for better clarity: "(d) the access standard must include specifications of conditions for which the generating unit or generating system will trip and will not trip".

  The present general practice in formulating a performance standard in relation to this clause (in relation to General Requirements (d)) is to list protection systems that are

triggered by voltage and frequency. However, there are multitudes of other protection systems that can lead to the tripping of a Generator by these protection systems (e.g. voltage/current/angle asymmetries; rapid voltage swings; loss of phase-locked loop (PLL) tracking; harmonic/flicker and voltage fluctuation levels; rate of change of frequency (RoCoF); transient over voltage conditions etc.) These other protection systems are generally unknown to a network service provider or AEMO, as well as (in some cases) the Generator. Therefore, TransGrid suggests the NER facilitate listing of all protection systems in this regard.