



**Submission on Draft Rule:  
Generator Technical  
Performance Standards**

13 July 2018



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## 1 This Submission

This Submission from Tilt Renewables is in relation to the Draft Rule Determination “Generator Technical Performance Standards” as published by the AEMC.

The document is structured around the Draft Rule published by the AEMC and considers the Draft Rule Determination, also published by the AEMC. Each clause commented on has two sub-sections:

- a Summary of Concerns detailing areas that Tilt Renewables thinks the AEMC should consider, and
- a Proposal of how the concerns could be alleviated.

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## 2 General Comments

Tilt Renewables supports the intention of ensuring the long term stability and security of the power system. Tilt Renewables notes that the required stability and security must be achieved whilst also considering the NEO, and is concerned that the wording in a number of clauses will act contrary to the NEO. In this submission, Tilt Renewables has attempted to explain its concerns and, for each concern raised, suggested a means to alleviate them.

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## 3 S5.2.5.1 – Reactive power capability

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### 3.1 Summary of concerns

#### (a) Minimum Access Standard

The AEMC re-wrote the *minimum access standard* (MAS) to be structure so that it mirrored the *automatic access standard* (AAS) but with no intended change in the meaning.<sup>1</sup> Tilt Renewables is concerned that the wording has unintentionally changed the meaning.

Under the existing MAS, it is possible for a connecting generator to have “no capability”. That means a connecting generator may have a reactive capability of between 0.93 to 0.99 inductive and no capability to reach unity power factor (0 MVar or no reactive power) or to operate capacitively. The draft MAS requires an amount of reactive power “...of at least the amount equal to zero” which would preclude the situation above as such a generator would not be able to achieve zero reactive power.

#### (b) Negotiated Access Standard

The NAS states that when negotiating, the generator and the Network Service Provider:

must subject to any agreement under paragraph (d)(4), ensure that the *reactive power capability* of the *generating system* is sufficient to ensure that all relevant *system standards* are met before and after *credible contingency events* under normal and planned *outage* operating conditions of the *power system*, taking into account at least existing projects and *considered projects*;

Tilt Renewables is aware of the words “at least” (proceeding the words “existing projects and *considered projects*”) being used by a TNSP to require reactive support at a level much higher than required by the

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<sup>1</sup> “Draft Rule Determination”, p. 114



connecting generator because that TNSP was considering all future generation (both committed and as yet unplanned) that might one day be connected to the system.

The AEMC has stated that it considers "...that imposing costs or regulatory requirements on connecting generators in order to help facilitate future connections is contrary to the principles behind the transmission framework in operation in the NEM"<sup>2</sup>. Tilt Renewables considers that the TNSP's interpretation of the NAS is contrary to the AEMC's stated opinion and the NEO.

Tilt Renewables is willing to confidentially discuss this further with the AEMC if required.

Tilt Renewables recommends tightening up the language of this section so that negotiations can be confined to a reasonable time frame and not considering future generator connections. This will assist in connecting parties avoiding paying costs to facilitate future connections, meeting the NEO and the AEMC's stated position.

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### 3.2 Proposal

Tilt Renewables proposes the following wording for S5.2.5.1(b):

- (b) The *minimum access standard* is a *generating system* operating at any *voltage* at the *connection point* within the limits established under clause S5.1a.4 without a *contingency event* has no capability to supply or absorb *reactive power* continuously at its *connection point*.

Tilt Renewables proposes deleting the words "at least" from S5.2.5.1(c)(1), resulting in the following wording:

- (1) must, subject to any agreement under paragraph (d)(4), ensure that the *reactive power capability* of the *generating system* is sufficient to ensure that all relevant *system standards* are met before and after *credible contingency events* under normal and planned *outage* operating conditions of the *power system*, taking into account existing projects and *considered projects*.

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## 4 S5.2.5.4 – Generating system response to voltage disturbances

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### 4.1 Summary of concerns

Tilt Renewables considers that the proposed rule is contrary to the intent of the NER. The proposed rule seeks to change the AAS so that a connecting generator would need to ride through voltages in excess of the system standards. Below, Tilt Renewables demonstrates that the intent of the NER is that connecting parties should only be expected to maintain *continuous uninterrupted operation* when the system is operating within the system standards. Tilt Renewables also outlines below a specific concern with the drafting of this change.

The commission states that "... all generating systems need to be capable of continuous uninterrupted operation for voltage disturbances that can be reasonably expected to occur"<sup>3</sup>. That position is consistent with the intent of the NER and the NEO, as evidenced below.

Schedule S5.1.4 (describing the system standards) provides guidance on the voltage disturbances that can be reasonably expected to occur. It requires that a Transmission Network Service Providers (TNSP) "...must plan and design its transmission system and equipment for control of voltage such that the

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<sup>2</sup> "Draft Rule Determination", p. xiii

<sup>3</sup> "Draft Rule Determination", section 10.4.7, p.209

minimum steady state voltage magnitude, the maximum steady state voltage magnitude and variations in voltage magnitude are consistent with the levels stipulated in clause S5.1a.4 of the system standards". Essentially the system standards are what can and should be reasonably expected to occur. Tilt Renewables notes the use of the words "must" (not "may") and "stipulated" (not "recommended") in S5.1a.4, words that further emphasise that the system standards are to be reasonably expected. Tilt Renewables also notes that the requirement includes voltage variations (i.e. voltages due to disturbances), not just steady state compliance.

Other sections of the NER also require that the Automatic Access Standard (AAS) for S5.2.5.4 be set to the system standard, adding support to the contention that the intent of the NER is to impose *continuous uninterrupted operation* for levels up to the system standards and not beyond. For example, schedule S5.1.4(a) requires that the "...Network Service Provider must determine the automatic access standard for the voltage of supply at the connection point such that the voltage may vary in accordance with S5.1a.4 of the system standards", not in excess of S5.1a.4.

Schedule S5.1a.1(a) states that the system standards are necessary or desirable for the safe and reliable operation of the facilities of registered participants. Generators are registered participants and expect their connection points to provide a power system that would allow such safe and reliable operation whilst avoiding the imposition of undue costs (S5.1a.1(d)). By increasing the AAS for S5.2.5.4 beyond the system standards, the requirements for TNSPs maintaining system voltages have effectively been abrogated and the costs transferred to generators, contrary to the intent of the NER.

Tilt Renewables is very concerned that setting the AAS to exceed the system standards also flows down to any *negotiated access standard* (NAS). Any NAS requires that the AAS be met except where AEMO and the NSP agrees that the total reduction of generation as a result of such voltage excursion would not exceed 100 MW. Should the amount of generation in a region (or the level of the proposed generator itself) exceed 100 MW, the AAS voltages would apply and the connecting generator would need to design and pay for a system that can withstand voltages that would not be reasonably expected to occur as defined in the system standard.

Tilt Renewables recommends that the AAS be that for voltages in excess of 110%, a generator should ride through the system standards defined in clause S5.1a.4.

Tilt Renewables has a specific concern with the drafting in clause S5.2.5.4(a)1. The clause Requires that the generator maintain operation for 0.02 seconds for voltages over 130% of normal voltage. This is open ended and imprecise and could be interpreted to mean 130.1% or 150% or any other level in excess of 130%. Should the AEMC continue with its proposed changes to S5.2.5.4, the wording in S5.2.5.4(a)1) needs to be made precise.

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## 4.2 Proposal

Tilt Renewables recommends that Network Service Providers continue to be responsible for the planning and design for voltage control. If they fail to do so, the AER may take action, or not, as it sees fit.

Tilt Renewables recommends that the wording for S5.2.5.4(a) be:

The *automatic access standard* is a *generating system* and each of its *generating units* must be capable of *continuous uninterrupted operation* where a *power system* disturbance causes the *voltage* at the *connection point* to vary within the following ranges:

- (1) over 110% for the durations after T(ov) permitted in the *system standards* for power frequency voltage defined in clause S5.1a.4;
- (2) 90% to 110% of *normal voltage* continuously;

- (3) 80% to 90% of *normal voltage* for a period of at least 10 seconds after T(uv); and
- (4) 70% to 80% of *normal voltage* for a period of at least 2 seconds after T(uv),

Where T(ov) means the point in time when the *voltage* at the *connection point* first varied above 110% of *normal voltage* and T(uv) means the point in time when the *voltage* at the *connection point* first varied below 90% of *normal voltage*.

If the AEMC elects to continue with the changes proposed in its draft wording, Tilt Renewables recommends that the wording for S5.2.5.4(a)(1) has the word “over” deleted and the wording be:

- (1) 130% of normal voltage for a period of at least 0.02 seconds after T(ov);

If the AEMC elects to continue with the changes proposed in its draft wording, Tilt Renewables recommends that the AEMC makes changes to S5.1.4(a) to ensure that it is consistent with the new intent and new S5.2.5.4 rule. As Tilt Renewables believes the draft rule is contrary to the intent of the NER, Tilt Renewables recommends the AEMC undertakes a comprehensive review of the NER to ensure that there are no further inconsistencies (such as that noted in S5.1.4(a)) as a result of changing the intent before it makes the rule final.

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## **5 S5.2.5.5 – Generating system response to disturbances following contingency events**

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### **5.1 Summary of concerns**

#### **(a) Multiple disturbances**

Tilt Renewables agrees that it is important to understand how the power system will respond to multiple disturbances. However, Tilt Renewables considers that in attempting to deal with that issue the draft rule appears unmanageable.

Section 5.8 of the NER requires that a Registered Participant undertake commissioning tests to demonstrate that its plant complies with any relevant Australian Standards, the NER and its connection agreement. Tilt Renewables notes that it is not practical to test for such events as part of the commissioning phase and great reliance will be placed on models to demonstrate compliance. It is unlikely that a series of 15 repeated disturbances will occur within the lifetime of the plant so long-term monitoring over its life would still not demonstrate compliance. This makes the Rule impractical to assess or police in practice.

The caveats that limit the impact of multiple disturbances will prove intractable to model and predict real behaviour of the connecting generators. In summarising the AAS, of the 15 disturbances:

- a) At most 2 may be 3 phase faults (or 1 if there is no automatic recloser and the voltage drops below 50%) [S5.2.5.5(b)(1A)(ii)],
- b) All other faults must be other than three phase [S5.2.5.5(b)(1A)(vi)],
- c) At most 1 disturbance is cleared by a breaker fail system [S5.2.5.5(b)(1A)(iii)],
- d) At most 6 may have the connection point voltage drop below 50% [S5.2.5.5(b)(1A)(i)],
- e) At most 1 may have the connection point voltage drop to between 70%-90% [S5.2.5.5(b)(1A)(iv)], and
- f) Successive disturbances may occur with no break between them (0 ms) [S5.2.5.5(b)(1A)(v)].

It is clear from the above that the clause intends to consider asymmetric faults (i.e. not three-phase faults). It is not uncommon during such faults for the voltage on each phase to be different. As an example, a remote single phase to earth fault could result with voltages such as:

- V1 = 45%,
- V2 = 68%, and
- V3 = 73%

This one disturbance would have one voltage below 50%, one voltage between 50% and 70% and one voltage between 70% and 90%. As there is no physical concept of “averaging” the three phases in an asymmetric situation to come up with a single voltage level that could assign a fault to a single category, this event would increase the counter for BOTH items d) and item e) above.

If V2 had been 71%, the counter for e) would have reached 2 for a single fault, allowing the generator to disconnect immediately if it chose to after the first event (not after 15 events).

Tilt Renewables believes it is also conceivable that fifteen severe events could, if they were just right, need to be ridden through.

Tilt Renewables considers that there is such variability between possible “allowable” sequences of events that the rule will be quite random in its application and highly dependent on the manifestation of actual faults on the network.

Tilt Renewables also believes that the amount of modelling required to demonstrate compliance with this clause when trying to negotiate the performance standards is immense. Assessing “any combination of the events described in subparagraph (b)(1)” when the total number of disturbances is 15 results in an intractable number of studies. Even limiting it to 6 events for the MAS, the number of studies is unmanageable.

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## 5.2 Proposal

Tilt Renewables recommends that the multiple disturbance ride-through be written as an equipment standard rather than as a network interaction standard. This would allow generator manufacturers to demonstrate that their product can withstand disturbances within a test environment before connection to the grid. This will provide significantly more confidence in the capability of the generator to the Network Service Providers compared with installing the generators and waiting for a multiple-contingency event. Tilt Renewables recognises that such a clause would need to be written with respect to the generator unit terminals rather than the connection point but considers that this more than compensated for by the simplicity of the wording. The wording also allows for on-site testing should the generator turbine not be a type-testable product.

Tilt Renewables proposes that S5.2.5.5(b)(1A) be written as:

- (1A) each *generating unit* must be designed and tested (either as a type test or a routine test) such that it can remain in *continuous uninterrupted operation* for a series of up to 15 voltage disturbances within a five minute period caused by faults applied at its terminals to simulate any combination of:
- (i) a maximum of three phase faults,
  - (ii) two phase to ground,
  - (iii) phase to phase, and
  - (iv) phase to ground (maximum of 13),

where:

- (v) one fault, other than a three phase fault, may have a *fault clearance time* of 430 ms to represent a *breaker fail*,
- (vi) all other faults have a *fault clearance time* of 120 ms,
- (vii) the *generating unit's* terminal voltage remained between 50% and 70% for at least 8 disturbances in the series,
- (viii) the *generating unit's* terminal voltage remained 50% or below for at most 6 disturbances in the series, and
- (ix) the cumulative time that the *generating unit's* terminal voltage remained below 90% does not exceed 1800 ms.

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## 6 S5.2.5.7 – Partial Load Rejection

### 6.1 Summary of concerns

Tilt Renewables considers that any significant trip of system load will cause a variation in the system frequency. Generators are required to ride through frequency changes as defined in clause S5.2.5.3, so Tilt Renewables does not consider that this clause is of relevance to asynchronous generators. Its original wording was designed to describe how a thermal unit should trip to house load, again something not relevant to asynchronous generators.

Tilt Renewables considers that the re-drafting of this clause will not add value to the NER.

### 6.2 Proposal

Tilt Renewables recommends that section S5.2.5.7(b) remain and not be deleted from the rules.

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## 7 10 Glossary

### 7.1 Summary of concerns

Part (d) of the clause is not grammatically consistent with the other sections

### 7.2 Proposal

Tilt Renewables recommends that part (d) of the continuous uninterrupted operation definition be reworded as follows:

not operate so as to exacerbate or prolong the disturbance or cause a subsequent disturbance for other connected *plant* except as required or permitted by its *performance standards*.