Australian Energy Market Commission

RULE CHANGE

RULE DETERMINATION

Definition of Temporary Over-Voltage Limits Rule Proposal

Rule Proponent

Hydro Tasmania

Commissioners

Henderson
Spalding

19 January 2012

Inquiries

Australian Energy Market Commission
PO Box A2449
Sydney South NSW 1235

E: aemc@aemc.gov.au
T: (02) 8296 7800
F: (02) 8296 7899

Reference: ERC0120

Citation

AEMC 2012, Definition of Temporary Over-Voltage Limits, Rule Determination, 19 January 2012, Sydney

About the AEMC

The Council of Australian Governments, through its Ministerial Council on Energy (MCE), established the Australian Energy Market Commission (AEMC) in July 2005. The AEMC has two principal functions. We make and amend the national electricity and gas rules, and we conduct independent reviews of the energy markets for the MCE.

Summary

On 5 May 2011, Hydro Tasmania (proponent) submitted a rule change request to the Australian Energy Market Commission (AEMC or Commission) in relation to the definition of the limit allowed for temporary power frequency voltages at a connection point (rule change request). The Commission has determined not to make the rule proposed by Hydro Tasmania.

Summary of the rule change proposal

Hydro Tasmania submitted a rule change request concerning the limits allowed for temporary over-voltages (TOV) at a connection point. Voltage surges, commonly referred to as TOV, may be brief in duration but can be extreme in impact. For example, they may cause damage to high-voltage equipment and could compromise the security of the national electricity system. The National Electricity Rules (NER or Rules) outline the TOV limits with reference to the *normal voltage* at a connection point. These limits range from 10% to 30% above the level of the *normal voltage*.[1] The rule change request proposes that TOV limits be able to be increased to allow for greater power flow on transmission lines under certain conditions.

A principal means by which Network Service Providers (NSP) can minimise the probability of voltage surges exceeding TOV limits is through the provision of constraint advice to the Australian Energy Market Operator (AEMO) to limit the power flow on transmission lines at connection points. Under low fault level conditions, a disconnection of a line with high power flow can cause a sudden surge in voltage.[2]

An increase in *normal voltage* would increase TOV limits and allow for greater power flow on transmission lines. However, this increase in *normal voltage* may require participants to invest in more expensive high-voltage equipment with higher capability design ratings in accordance with the minimum access standards.

Hydro Tasmania proposes to:

- separate the regulation of TOV limits from the level of the *normal voltage*; and
- set a reference voltage from which TOV limits can be determined while maintaining *normal voltage* at its current level.

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1 Chapter 10 of the rules defines normal voltage as - "In respect of a connection point, its nominal voltage or such other voltage up to 10% higher or lower than the nominal voltage, as approved by AEMO, for that connection point at the request of the *Network Service Provider* who provides connection to the power system.

2 Low fault level conditions exist at a connection point when it is not close to a large source of generation. At George Town the fault level is low when the AETV generating units are not operating as it is located in the north-east of Tasmania while most other Tasmanian generation is located in the south and west.

While the proposed rule change would apply to the whole market, Hydro Tasmania is principally concerned with the impact of the rule on the Basslink interconnector. An increase in TOV limits at the George Town connection point would reduce the potential for constraints on Basslink that restrict power flow during periods of low fault level in Tasmania.

Commission's final rule determination

There are potential benefits associated with the rule change request. It would provide for TOV limits to be varied, independently of continuous limits, thereby potentially increasing the flexibility and the efficient use of the National Electricity Market (NEM) network infrastructure. Potentially this could contribute to a marginal increase in reliability and security of supply and may reduce the need to replace or augment the network over time, thereby lowering the long-term costs to consumers.

However, the Commission is not satisfied that the proposed rule will, or is likely to, contribute to the achievement of the National Electricity Objective (NEO). The potential benefits of the proposed rule are outweighed by the following considerations:

- the probability of the proposed rule's application effecting a barrier to entry for new connecting participants and imposing additional costs on existing participants; and

- technical limitations that would appear to prevent an effective application of the proposed rule at the George Town connection point, the only current likely application that the Commission has been advised of.

The Commission has determined not to make the rule proposed by Hydro Tasmania.

The Commission notes that the submissions on the rule change request have revealed a potential lack of clarity in the current rules concerning the processes for making changes to the *normal voltage* at a connection point. The Commission has not addressed this matter as it is considered to be outside the scope of the rule change request.

Contents

1 Hydro Tasmania's rule change request

1.1 The rule change request

On 5 May 2011, Hydro Tasmania (proponent) made a request to the Australian Energy Market Commission (AEMC or Commission) to make a rule regarding the definition of the limit allowed for temporary power frequency voltages at a connection point (rule change request).

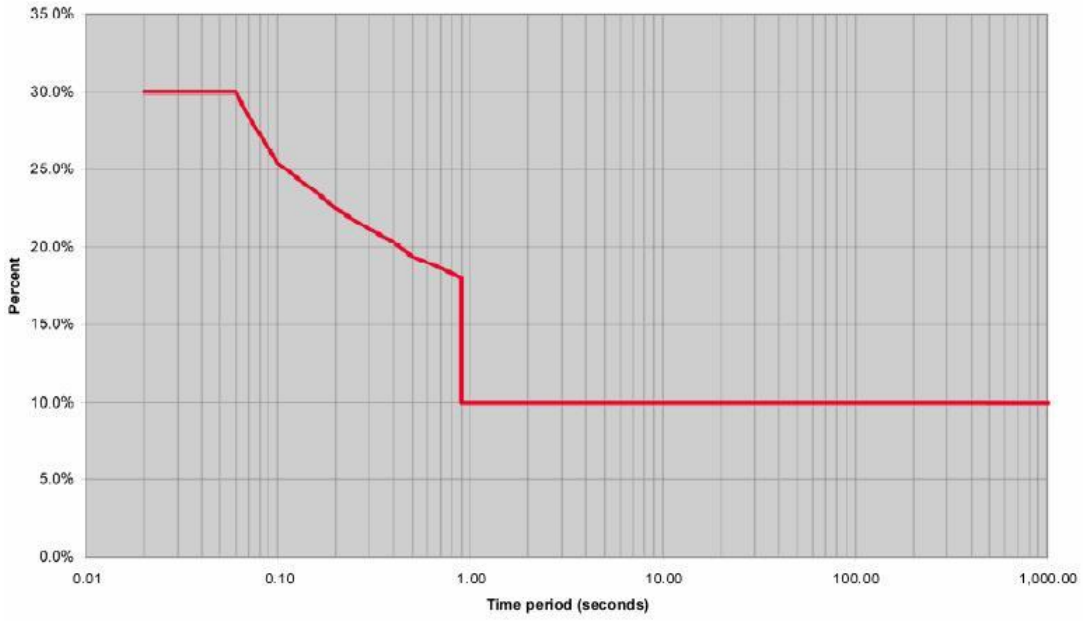
1.2 Rationale for the rule change request

Schedule S5.1a of the rules sets out the system standards that are, amongst other things, necessary or desirable for the safe and reliable operation of equipment.[3] In this rule change request the proponent seeks to amend one of the system standards set out in clause S5.1a.4 of the rules, being the power frequency voltage requirements as a consequence of a *credible contingency event*.[4] Under the proposal, the proponent wishes to change the definition of the limit allowed for temporary power frequency voltages at a connection point as a consequence of a *credible contingency event*. Participants can ascertain the minimum required design ratings of high voltage equipment from the power frequency voltage determined in accordance with the rules. The limits on over-voltage levels are shown in Figure 1.1 and are determined with reference to the level of the *normal voltage*.

3 Clause S5.1a.1 of the NER

4 A credible contingency event is an event that has a reasonable possibility of occurring and for which AEMO takes into consideration in power system security planning. Examples of a credible contingency event include the unexpected disconnection or unplanned reduction in capacity of one operating generating unit, or the unexpected disconnection of one major item of transmission plant. This is in contrast to a non-credible contingency event which has a low probability of occurring and would be prohibitively arduous for AEMO to take into consideration for the purposes of power system security planning.

Figure 1.1 Percentage Over-Voltage - Figure S5.1a.1 from the NER



Voltage surges, commonly referred to as temporary over-voltages (TOV), may be brief in duration but can be extreme in magnitude. For example, they may cause damage to high-voltage equipment and could compromise the security of the national electricity system.

A principal means by which Network Service Providers (NSPs) can regulate the probability of voltage surges occurring is through the provision of constraint advice to the Australian Energy Market Operator (AEMO) to limit the power flow on transmission lines at connection points. Under low fault level conditions, a disconnection of the line with high power flow can cause a sudden surge or drop in voltage.

While constraints can be applied to any transmission lines in the National Electricity Market (NEM) to limit power flow, the proponent is principally concerned with the impact of clause S5.1a.4 on the Basslink interconnector. Under low fault level conditions in Tasmania, Basslink interconnector flow may be constrained in order to reduce the risk of voltage exceeding the TOV limits.

Under the definition of *normal voltage* in Chapter 10 of the rules, the NSP can change the level of the *normal voltage* at a connection point.[5] Such a change must be approved by AEMO.

Through the operation of clause S5.1a.4, an increase in the *normal voltage* would increase the level of the allowable over-voltage. With a higher limit on over-voltages, the market operator would be able to increase power flow on transmission lines

5 Chapter 10 of the rules defines normal voltage as - "In respect of a connection point, its nominal voltage or such other voltage up to 10% higher or lower than the nominal voltage, as approved by AEMO, for that connection point at the request of the Network Service Provider who provides connection to the power system.

without the risk of exceeding limits. However, under clause S5.2.5.4, if the level of *normal voltage* is increased by the NSP then new connecting market participants must ensure that new high-voltage equipment is designed to meet this requirement under the connection agreement. Participants would be required to invest in more expensive high voltage equipment to meet higher steady-state voltage limits.

1.3 Solution proposed in the rule change request

Under the rule change request, the proponent wishes to change the definition of the limit allowed for temporary power frequency voltages at a connection point as a consequence of a *credible contingency event*.

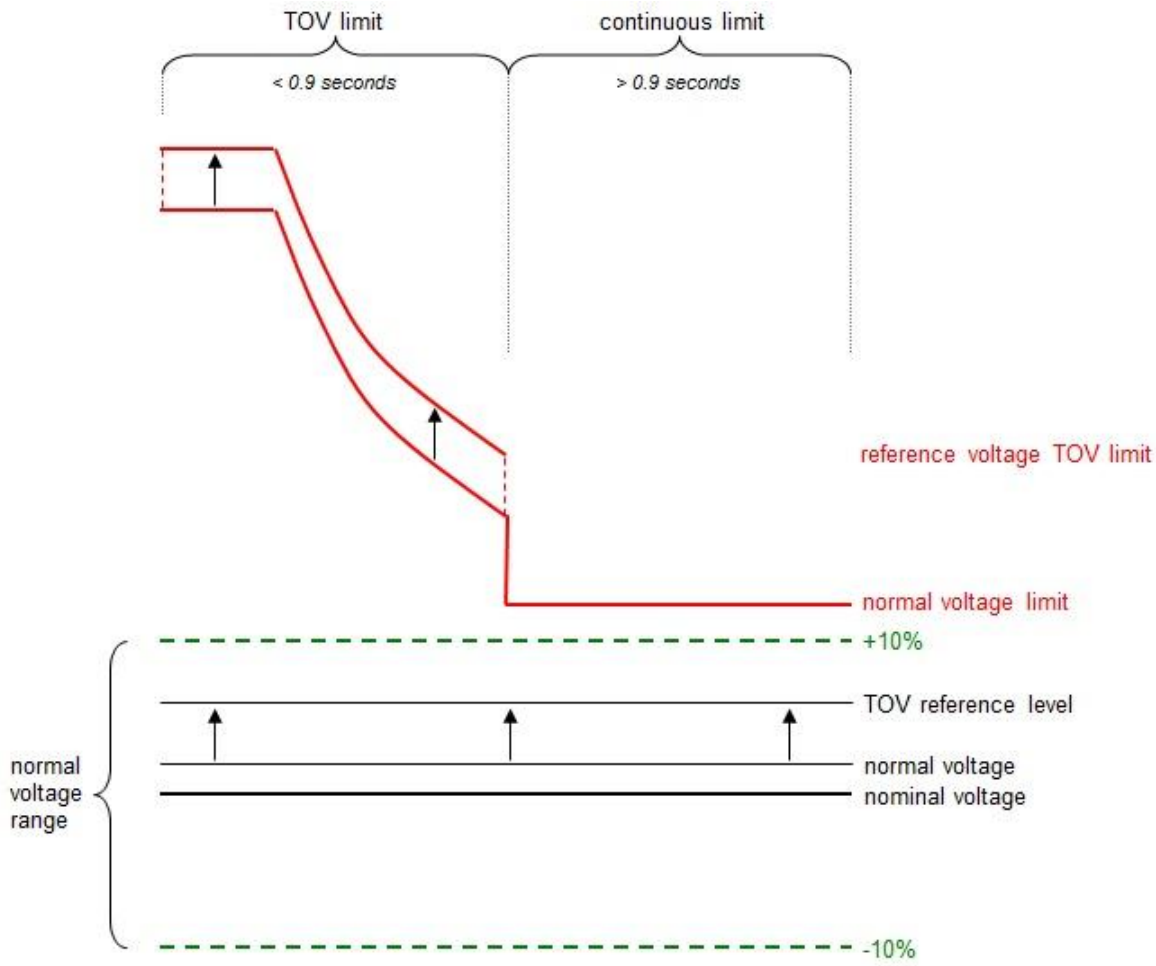
Specifically, the proponent proposes to:

- separate the regulation of TOV limits from the level of *normal voltage*; and
- set a new TOV reference level from which TOV limits can be determined while maintaining *normal voltage* at its current level (proposed rule).

The proponent has provided new drafting for clause S5.1a.4 of the rules to create a reference voltage that is independent of *normal voltage* and does not exceed the upper limit previously permitted by the rule.

The intended impact of the proposed rule is illustrated in Figure 1.2. The *normal voltage* and the TOV reference level have been arbitrarily positioned above the *nominal voltage* with the latter higher than the former. Both the *normal voltage* and the TOV reference level are contained within ±10% of the *nominal voltage*, represented by the green dashed lines. The distance between the *normal voltage* and the TOV reference level is equal to the distance between their respective TOV limits, represented by the red lines.

Figure 1.2 Impact of rule change on TOV limits



The intention of the proposed rule is to allow for an increase in the TOV limits under clause S5.1a.4 without increasing the continuous voltage limit requirements under clause S5.2.5.4 (where the concept of *normal voltage* is also relevant). This would avoid the need for market participants to invest in more expensive high-voltage equipment with higher steady-state voltage capability design ratings.

Clause S5.2.5.4 places obligations on connecting participants to design and build their plant capable of continuous operation at 110% of the level of the *normal voltage*. As such, the proponent proposes to modify Figure S5.1a.1 (see Figure 1.1) to remove the continuous limit so as to only represent the TOV limit as a function of the TOV reference level.

While the proposed rule would apply to the whole market, the proponent is principally concerned with its impact on the Basslink interconnector. The impact of increasing the *normal voltage* on Basslink, and consequently the TOV limit, is that export could be increased on the interconnector at certain times of low fault level in Tasmania.

Looking at the clause in its entirety, based on the rule change request, clause S5.1a.4 would be amended as follows:

"Except as a consequence of a *contingency event*, the *voltage* of *supply* at a *connection point* should not vary by more than 10% above or below its *normal voltage*, provided that the *reactive power* flow and the *power factor* at the *connection point* is within the corresponding limits set out in the *connection agreement*.

As a consequence of a *credible contingency event*, the *voltage* of *supply* at a *connection point* should not rise above ~~its *normal voltage*~~ the *TOV reference level* by more than a given percentage of ~~*normal voltage*~~ the *TOV reference level* for longer than the period shown in Figure S5.1a.1 for that percentage.

As a consequence of a *contingency event*, the *voltage* of *supply* at a *connection point* could fall to zero for any period."

To facilitate this change the following definition of TOV reference level is proposed to be added to Chapter 10: Glossary of the rules.

"TOV reference level: The reference level determined by the NSP and approved by AEMO for the purposes of setting temporary over-voltage limits. The default reference level shall be *normal voltage*."

The proponent proposes to modify Figure S5.1a.1 from the rules (reproduced below in Figure 1.3).

Figure 1.3 Proposed modification to Figure S5.1a.1 from the rules

1.4 Commencement of rule making process

On 30 June 2011, the Commission published a notice under section 95 of the National Electricity Law (NEL) advising of its intention to commence the rule making process and the first round of consultation in respect of the rule change request. A consultation paper prepared by AEMC staff identifying specific issues for consultation was also published with the rule change request. Submissions closed on 12 August 2011.

The Commission received four submissions on the rule change request as part of the first round of consultation. They are available on the AEMC website.[6] A summary of the issues raised in submissions and the Commission's response to each issue is contained in Appendix A.1.

The proponent requested that the Commission consider expediting the rule change request on the basis that the rule change request was non-controversial. The Commission considered that the rule change request did not constitute all the requirements for a non-controversial rule and therefore decided not to expedite the rule change request under sections 96(1)(b) and (c) of the NEL.

1.5 Publication of draft rule determination

On 27 October 2011 the Commission published a notice under section 99 of the NEL and a draft rule determination in relation to the rule change request (draft rule determination).

Submissions on the draft rule determination closed on 9 December 2011. The Commission received one submission on the draft rule determination. The submission is available on the AEMC website.[7] A summary of the issues raised in the submission and the Commission's response to each issue is contained in Appendix A.2. There are no further substantive issues raised in the submission beyond those considered in the first round consultation. The submission is supportive of the Commission's draft rule determination.

6 www.aemc.gov.au

7 www.aemc.gov.au

2 Final rule determination

2.1 Commission's determination

In accordance with section 102 of the NEL the Commission has determined not to make the rule proposed by Hydro Tasmania.

The Commission's reasons for making this final rule determination are set out in section 2.4.

2.2 Commission's considerations

In assessing the rule change request the Commission considered:

- the Commission's powers under the NEL to make the rule;
- the rule change request;
- the fact that there is no relevant Ministerial Council on Energy (MCE) Statement of Policy Principles;[8]
- submissions received during first and second rounds of consultation;
- the Commission's analysis as to the ways in which the proposed rule will or is likely to, contribute to the achievement of the National Electricity Objective (NEO); and
- technical advice received from AEMO and Transend.

2.3 Commission's power to make the rule

The Commission is satisfied that the proposed rule falls within the subject matter about which the Commission may make rules. The proposed rule falls within section 34 of the NEL as it relates to the activities of persons (including registered participants) participating in the national electricity market under section 34(1)(a)(iii). Further, the proposed rule falls within the matters set out in Schedule 1 to the NEL as it relates to item 11: "The operation of generating systems, transmission systems, distribution systems or other facilities".

2.4 Rule making test

Under section 88(1) of the NEL the Commission may only make a rule if it is satisfied that the rule will, or is likely to, contribute to the achievement of the NEO. This is the decision making framework that the Commission must apply.

The NEO is set out in section 7 of the NEL as follows:

> "The objective of this Law is to promote efficient investment in, and efficient operation and use of, electricity services for the long term interests of consumers of electricity with respect to:
>
> (a) price, quality, safety, reliability and security of supply of electricity; and
>
> (b) the reliability, safety and security of the national electricity system."

For the rule change request the Commission considers that the relevant aspect of the NEO is the impact on the promotion of efficient investment in electricity services and the long-term costs to consumers through ensuring the safety and security of supply of electricity.[9]

There are potential benefits associated with the proposed rule. The proposed rule would provide for TOV limits to be varied, independently of continuous limits, thereby potentially increasing the flexibility and the efficient use of the NEM network infrastructure. Potentially this could contribute to a marginal increase in reliability and security of supply while reducing the need to replace or augment the network over time, thereby lowering the long-term costs to consumers.

However, the Commission is not satisfied that the proposed rule will, or is likely to, contribute to the achievement of the NEO. The potential benefits of the proposed rule are outweighed by the following considerations:

- the probability of the proposed rule's application effecting a barrier to entry for new connecting participants and imposing additional costs on existing participants; and
- technical limitations that would appear to prevent an effective application of the proposed rule at the George Town connection point, currently the only likely application that the Commission has been advised of.

If made, it is likely that the proposed rule would result in inefficient investment and reduced competition. A change to TOV limits at one connection point may create network conditions that are better suited to some existing connected participants while potentially being detrimental to others, thereby increasing their plant and equipment costs. In addition, a change to the TOV limits may not be optimal for participants that subsequently connect to the network, and may increase the costs of new connections, thereby potentially creating a barrier to entry. As drafted, the proposed rule could result in this occurring without an open and transparent consultation process.

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8 Under section 33 of the NEL the AEMC must have regard to any relevant MCE statement of policy principles in making a rule.

9 Under section 88(2), for the purposes of section 88(1) the AEMC may give such weight to any aspect of the NEO as it considers appropriate in all the circumstances, having regard to any relevant MCE statement of policy principles.

With regard to the proponent's intended application of the proposed rule change, the Commission notes that technical limitations at the George Town connection point, including specific limitations of equipment at the Aurora Energy Tamar Valley (AETV) power station and potential voltage impacts at adjacent connection points, may prevent an increase to the TOV limits above current levels. Therefore, an application of the proposed rule to increase TOV limits at the George Town connection point may not be possible without incurring unacceptable risks to system security.

Further, the Commission notes Grid Australia's submission that, beyond George Town, there are no other connection points where TOV issues give rise to dispatch constraints, and that the proposed rule may rarely or never be applied at any other connection point in the NEM.[10]

10 Grid Australia letter to AEMC - Additional information on Hydro Tasmania TOV rule change proposal, 23 September 2011

3 Commission's assessment approach

In assessing the rule change request, the Commission has considered the requirements set out in the NEL. This has included consideration of the NEO, and section 88(2) of the NEL, which allows the AEMC to give weight to any aspect of the NEO as it considers appropriate in all the circumstances.

In assessing this rule change request, the Commission has considered the following issues:

- the extent to which the proposed rule increases the flexibility of the provision of network services. The Commission has assessed the extent to which the potential for the proposed rule to increase market efficiency through an increase in reliability and security of supply is likely to be offset by the creation of barriers to entry for new connecting participants and higher costs and externally imposed risks to connected participants' plant;

- the extent to which TOV limits could be practically increased at the George Town connection point to allow for greater Basslink flow at times of low fault level; and

- the extent to which the proposed rule establishes an open and transparent process for decision making and maintains protection and certainty to investors under the existing system standards.

4 Flexibility of network services

Through the operation of clause S5.1a.4, the limit on the level of over-voltages is determined with reference to the level of the *normal voltage*. Over-voltage limits constitute both the TOV limits (periods less than 0.9 seconds) and the continuous limits (periods greater than 0.9 seconds). Both limits are related by their common reference point of the defined term *normal voltage*. An increase in the level of the *normal voltage* at a connection point would therefore impose a proportional rise in both of these limits.

The proponent proposes to introduce a process that would allow for TOV limits to be changed independently of continuous limits. The rule change request seeks to separate the regulation of TOV limits from the level of the *normal voltage* and set a new TOV reference level through which TOV limits may be determined. This decoupling would permit TOV limits to be shifted independent of continuous limits and an increase in TOV limits would be possible without the additional burden on connected participants to meet higher steady-state voltage requirements due to an associated increase in continuous limits.[11]

The rule change request would not directly force a change to the TOV limits but would instead provide a process by which the limits could be changed, with the agreement of the NSP and AEMO. An application of the proposed rule to effect an increase in TOV limits would allow for higher voltage disturbances to occur over periods less than 0.9 seconds and would reduce the need for the NSP to provide constraint advice to AEMO to regulate the probability of voltage surges occurring.

4.1 Proponent's view

The proponent outlined the added flexibility in the context of the application of the proposed rule to the Basslink interconnector. The proponent considers that the proposed rule would, or is likely to, promote more efficient trading between NEM regions by reducing the incidence of premature binding of the Basslink interconnector. The anticipated higher levels of unconstrained export on Basslink should translate to improved spot market and generation sector efficiency.[12]

Regarding the general application of the proposed rule to the wider NEM, the proponent considered that the proposed rule would allow for, but not necessarily oblige, changes to other connection points in the NEM where the current limits may not be considered appropriate. In the case where a change to limits is warranted, the proponent saw benefits to market participants from constraints on the network being more reflective of true technical limitations, thereby resulting in increased trade.[13]

11 Hydro Tasmania, rule change proposal, 5 May 2011, pp. 3

12 Ibid, pp. 6

13 Ibid

4.2 Stakeholder views

4.2.1 First round of consultation

Stakeholders contended that there are a number of adverse consequences that are associated with the rule change request and the move to increase flexibility of TOV limits in the provision of network services in the context of the NEM. Broadly, stakeholders see an increase in TOV limits as potentially creating barriers to entry for future connecting participants and the possible creation of additional costs for existing participants.

First mover advantage and barriers to entry

Grid Australia commented on the possibility that a change to the process through which TOV limits are determined would increase the likelihood of the creation of barriers to entry for new connecting participants.[14] This concern stems from the fact that the new process would allow for both:

- an absolute increase in the TOV limits; and
- the ability to decouple TOV limits from continuous limits and shift them independently.

Grid Australia noted that a change to TOV limits at one connection point may create network conditions that are better suited to some existing connected participants, and that these same network conditions may not be optimal for participants that subsequently connect to the network.[15]

Origin Energy suggested that there is potential to increase the cost of new connections to the network if a higher TOV limit is imposed.[16] Higher TOV limits would require equipment of higher voltage capability. This would raise the costs of connection and place a greater cost burden on participants.

Grid Australia noted that the ability to withstand TOVs varies by equipment and plant type.[17] Wind turbines, in particular, have very limited ability to withstand TOVs, whereas synchronous generating units can withstand far higher TOVs.[18] Depending on technology type, future connecting participants may be required to invest in more expensive, higher capability, equipment to meet the higher TOV limits allowed at the connection point. This has the potential to create barriers to entry for new connecting participants, thereby reducing competition and efficient investment in the NEM. Grid Australia contended that the ability to shift TOV limits independently of continuous

14 Grid Australia, first round submission, 12 August 2011, pp. 3

15 Ibid

16 Origin Energy, first round submission, 12 August 2011, pp. 1

17 Grid Australia, first round submission, 12 August 2011, pp. 3

18 Ibid

limits is conceptually possible but would need to be assessed on a case-by-case basis and may create barriers to entry that are particularly strong for wind generation systems.[19]

Grid Australia stated that it was not aware of TOV issues giving rise to dispatch constraints at any other connection point in the NEM and that the current constraints imposed on Basslink appear to be the result of the unique voltage surge pattern that occurs when Basslink is disconnected under low fault level conditions at George Town.[20] Grid Australia contended that, at connection points beyond George Town, the more likely application of the proposed rule would be at the request of new connection applicants wishing to minimise the cost of their own equipment, rather than an application by existing connected participants wishing to change existing limits.[21] Therefore, Grid Australia was unable to conceive of a situation in the NEM, beyond the George Town connection point, where the proposed rule would add value and consider that the probability of the rule's application effecting a barrier to entry is greater than the probability of the rule adding value to the efficient operation of the NEM.[22]

Increased costs to existing participants

The proposed rule would create a new TOV reference level to replace the *normal voltage* in the determination of over-voltage limits for periods less than 0.9 seconds. A change to the TOV reference level would be subject to the same processes and limitations as a change to the *normal voltage*. International Power GDF Suez raised concern that the only limitations currently imposed on the determination of *normal voltage* for a connection point are that it must be within 10% of the *nominal voltage*, and that it must be agreed between the NSP and AEMO.[23] Neither of these parties is required to consider the changed risk that may be imposed on other market participants, or to consult with affected participants, as a result of such a change to the *normal voltage*, and this would equally apply to changes to the proposed TOV reference level.[24]

Origin Energy noted that a lack of consultation with affected participants could have two potential outcomes:[25]

19 Grid Australia letter to AEMC - Additional information on Hydro Tasmania TOV rule change proposal, 23 September 2011

20 Ibid

21 Ibid

22 Ibid

23 International Power GDF Suez, first round submission, 12 August 2011, pp. 3; International Power GDF Suez submitted on behalf of AGL Energy, International Power GDF Suez, TRUenergy, Energy Brix, InterGen and LYMMCo

24 Ibid

25 Origin Energy, first round submission, 12 August 2011, pp. 1

- plant modifications may be necessary to allow for higher voltage disturbances at significant cost to the participant to minimise potential plant damage and ensure a safe operating environment for staff; and

- if the participant is not informed or does not modify its plant then network stability issues could result as well as damage to equipment and operational safety concerns.

Origin Energy asserted that the rule change request could adversely affect the stability of the network while also imposing costs on existing participants without any prior notification or consultation.[26] This view was supported by International Power GDF Suez.[27]

AETV Power noted that in setting either *normal voltage*, or in the event that it is introduced, TOV reference level voltages, a NSP would need to take into account existing connection agreements and agreed performance standards and maintain compliance with associated provisions.[28] AETV Power suggested that the proposed TOV reference level should be included in connection agreements as it would be reasonable to assume that NSPs would not change the effect of agreement provisions without consultation with connected participants.[29]

AETV Power proposed in its submission that the TOV reference level be included in connection agreements in order to provide guidance to the NSP in a technical assessment of the impacts from a change to TOV limits.[30] AETV Power suggested that the TOV reference level could be included in connection agreements similar to *target voltage* in clause S5.1.4(c) of the rules, which specifically requires consultation with connected participants prior to any adjustment.[31]

4.2.2 Second round of consultation

One second round submission was received from International Power GDF Suez.

The submission supported the draft rule determination and agreed with the Commission's consideration that the proposed rule change would potentially impose additional costs on existing participants and introduce a barrier to entry.[32]

26 Ibid

27 International Power GDF Suez, first round submission, 12 August 2011, pp. 3

28 AETV Power, first round submission, 10 August 2011, pp. 3

29 Ibid

30 Ibid

31 Ibid

32 International Power GDF Suez, second round submission, 25 November 2011, pp. 1

4.3 Commission's considerations and conclusions

The ability to change the TOV limits, independently of continuous limits, could increase the flexibility of the network service and promote a more efficient use of the NEM network infrastructure. The proposed rule would allow participants to increase the capability of network infrastructure at connection points in the NEM that are subject to dispatch constraints caused by a potential breach of TOV limits.

However, a change to TOV limits at one connection point may create network conditions that are better suited to some existing connected participants. These same network conditions may not be optimal for participants that subsequently connect to the network or for other existing connected participants. Higher costs to new connecting participants create barriers to entry, reducing competition and efficient investment in the NEM. In addition, the Commission recognises the additional costs that may be imposed on other existing connected participants who are required to invest in higher capability plant and equipment to meet the increased limits.

The process for changing over-voltage limits already exists in the rules through the ability to change the level of the *normal voltage*. Therefore, the potential for these detriments to arise already exists under the current rules, with regard to changes to the level of the *normal voltage*. However, it is the Commission's view that the increased flexibility of a change to TOV limits, brought about through the ability to maintain the continuous limits at existing levels, may increase the extent and probability of these adverse consequences.

4.3.1 Barriers to entry

The Commission recognises stakeholders' concerns that a change to the TOV limits may create conditions that are more suitable for some existing participants, and that these same conditions may increase connection costs for new connecting participants.

The existing rules already allow for a change to TOV limits through a change to the *normal voltage*. Therefore it is already possible that a new connecting participant could request a change to the *normal voltage* to a level that is optimal for them and thereby effect higher costs and barriers to entry for subsequently connecting participants. However, the proposed rule would remove the unintended consequence of changing the continuous limits. Therefore, with such a restriction removed, under the proposed rule, a change to TOV limits would more likely be applied at connection points where the capability of network infrastructure is subject to dispatch constraints. Therefore the Commission considers that the proposed rule could increase the probability of creating higher network connection costs and barriers to entry.

It may be possible to incorporate a condition in the rules that forces a reversion of the limits to previous levels if an increase in TOV limits is found to be creating higher costs of connection for new entrant participants. The Commission recognises Grid Australia's submission that there are no other connection points in the NEM where TOV issues give rise to dispatch constraints and that the current constraints imposed on Basslink appear to be the result of the unique voltage surge pattern that occurs

when Basslink is disconnected under low fault level conditions at George Town. Consistent with this, Grid Australia has pointed out that, if made, the more likely application of the proposed rule would be at the request of new connection applicants wishing to minimise the cost of their own equipment, rather than an application by existing connected participants wishing to change existing limits.[33] Therefore, a reversion of limits to previous levels would be problematic if the levels had been increased on the basis of a new participant connecting to the network. Substantial barriers to entry could be created for any additional participants wishing to connect. A condition on reversion of limits would be unlikely to provide the necessary means to avoid the creation of barriers to entry.

George Town is the only connection point in the NEM where the *normal voltage* has been previously increased in order to increase the over-voltage limits and allow for a greater use of network capacity. The Commission understands that, at every other connection point in the NEM, the *normal voltage* currently is, and always has been, defined as *nominal voltage*. Grid Australia highlighted that, other than George Town, it is not aware of TOV issues giving rise to dispatch constraints at any other connection point in the NEM.[34] Therefore, while impossible to prove, it appears likely that the proposed rule, if made, may rarely or never be applied at any other connection point in the NEM beyond George Town. In support of this, Grid Australia could not conceive of a situation where the proposed rule would add value and considered that the probability of the proposed rule's application effecting a barrier to entry was greater than the probability of the rule adding value to the efficient operation of the NEM.[35]

4.3.2 Costs to existing participants

The Commission recognises stakeholders' concerns that a change to TOV limits, without prior consultation with connected participants, may create conditions that are suitable for some existing participants while being detrimental for others (by potentially increasing plant and equipment costs).

The ability to change the TOV limits, independently of continuous limits, could increase the flexibility of the network service and could potentially lead to an increase in the likelihood of requests for changes to the TOV limits. An increase in requests to change the TOV limits without proper process to guide the NSP, such as no requirement to consider or consult with affected participants, may result in externally imposed risks to participants' plant and the potential requirement for new plant investment.

Existing participants may be protected to an extent, as the NSP would need to take into account existing connection agreements and agreed performance standards and maintain compliance with associated provisions before effecting a change to TOV

33 Grid Australia letter to AEMC - Additional information on Hydro Tasmania TOV rule change proposal, 23 September 2011

34 Ibid

35 Ibid

limits. However, this protection may not be sufficient without participant consultation and the potential inclusion of the proposed TOV reference level in connection agreements.

4.3.3 Conclusions

The Commission notes that the ability to change the TOV limits, independently of continuous limits, could increase the flexibility of the network service and promote a more efficient use of the NEM network infrastructure. However, the Commission is not satisfied that these benefits are likely to be in the long-term interests of consumers when also taking into account the potential increase in the extent and probability of creating barriers to entry and additional costs to existing connected participants.

5 Application of the proposed rule at the George Town connection point

While clause S5.1a.4 applies to the whole market, the rule proponent is principally concerned with the impact of the rule on the Basslink interconnector. Under low fault level conditions in Tasmania, Basslink interconnector flow may be constrained in order to reduce the risk of the voltage at George Town exceeding the TOV limits following a sudden disconnection of Basslink when it is exporting to the mainland. Under the proposed rule, the creation of a new TOV reference level to replace *normal voltage* in the determination of TOV limits would allow for higher voltage disturbances to occur over periods less than 0.9 seconds and would reduce the need to restrict Basslink flows to Victoria in order to manage voltage surges at the George Town connection point.

The rule change request proposes a universal change to the process for the determination of TOV limits and therefore the Commission's determination is guided by the impact of the rule change on the entire NEM. However, the Commission also considers it necessary to assess the feasibility of the rule's application in specific circumstances to achieve the proponent's desired outcomes. This involves a consideration of the extent to which TOV limits could be practically increased at the George Town connection point to allow for greater Basslink flow at times of low fault level.

5.1 Proponent's view

The proponent argued that the *normal voltage* at the George Town connection point was increased from its initial value of 220 kV to 231 kV for a period of three years and was only reverted back down to 220 kV in 2009 due to the connection of AETV power station. AETV Power would have had to design and build its plant to be capable of continuous operation at 254 kV (231 kV + 10%).[36] Clause S5.1a.4 links the *normal voltage* to both TOV and continuous limits, which has created the more restrictive limit. The proponent argued that TOV limits may be changed independently of continuous limits and that the previous application of 231 kV as the *normal voltage* was acceptable from a technical (system security) perspective without any adverse system or connected equipment impact.

5.2 Stakeholder views

5.2.1 First round of consultation

A number of stakeholders commented in submissions on the specific application of the proposed rule to the George Town connection point and the ability of the proposed rule to achieve the proponent's intended outcomes. Specific concerns were raised with regard to the impact on power system security, as a result of the presence of AETV

36 This is considered to be unusually high relative to the *nominal voltage* of 220 kV.

power station at the George Town connection point, and the ability to increase over-voltage limits given the propagation effect of voltage surges to adjacent points in the network.

System security in relation to AETV power station

The *normal voltage* at George Town was rerated back down to 220 kV in October 2009. In addition, it was determined by Transend at the time that the presence of the recently commissioned AETV power station, whilst in operation, provided a large fault level contribution and acted as a localised "sink" for reactive power thereby limiting the likelihood of over-voltages at the George Town 220 kV bus.

AETV Power highlighted in its submission that the protection operating settings on AETV's combined cycle gas turbine and the steam turbine transformer protection were agreed between AETV Power, Transend and the manufacturer. The protection operating settings were determined on the basis that the permitted TOV is based on *nominal voltage*, i.e. *normal voltage* is set equal to *nominal voltage*.[37] AETV Power has contended that only a small margin exists between the protection operating settings and the existing TOV and any increase in the allowable TOV would result in a high risk of protection operation and disconnection of the power station.[38]

The AETV power station shares the same George Town connection point with Basslink. The most likely cause of a TOV event would be the sudden interruption of Basslink flow. AETV Power suggested that a sudden disconnection of the AETV power station caused by a failure in the Basslink interconnector would represent a severe Tasmanian power system disturbance.[39] An increase to the TOV limits at the George Town connection point would therefore represent an increased risk to system security to the extent that it could cause consequential tripping of the AETV power station.

TOV limits in a meshed network

Grid Australia noted that an over-voltage event that occurs at one point in the network will also flow through to nearby points in the network, and a technical study of the George Town connection point cannot therefore be considered in isolation.[40] As such, it may not be possible to allow an increased TOV limit at one connection point in the network without also allowing an increased TOV limit at adjacent points in the network.[41] It is therefore likely that an application of a rule to enforce an increase to TOV limits would mean that:

- the TOV reference level could only be increased by a marginal amount; or

37 AETV Power, first round submission, 10 August 2011, pp. 3

38 Ibid

39 Ibid

40 Grid Australia, first round submission, 12 August 2011, pp. 4

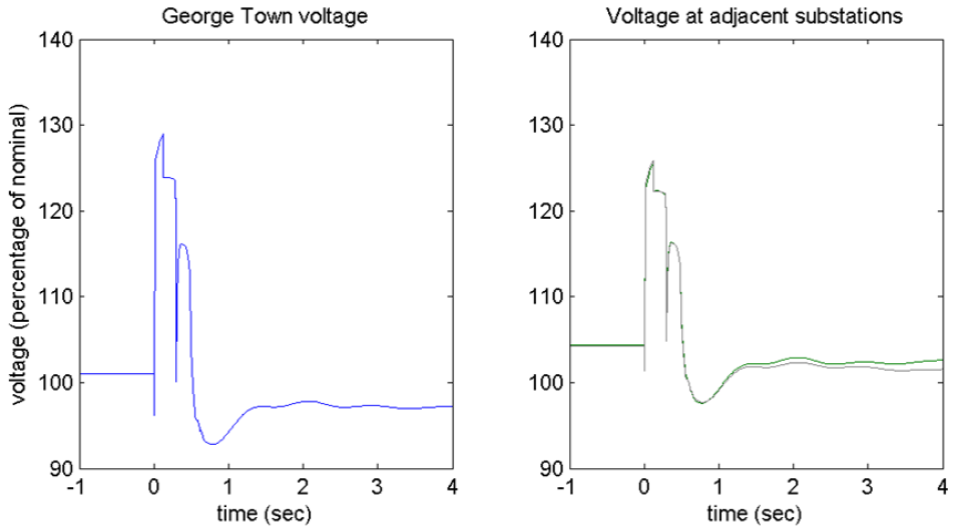
41 Ibid

- the TOV limits would also need to be increased to higher levels further out into the network.

With regard to the George Town connection point, Grid Australia noted that there may be participants both locally and connected further out in the network who cannot withstand higher TOV limits than presently exist.[42]

An example of this flow on effect is demonstrated in Figure 5.1. A Basslink induced TOV event is also seen at other points in the network. The George Town connection point voltage is on the left and the voltages at the two nearest substations, Hadspen and Sheffield, are shown on the right.[43]

Figure 5.1 Effect of a TOV event at adjacent substations



5.2.2 Second round of consultation

The second round submission from International Power GDF Suez agreed with the Commission's consideration in the draft rule determination that technical limitations would appear to prevent the application of the rule change at George Town, the only likely location that the rule change would be applicable.[44]

5.3 Commission's considerations and conclusions

Little efficiency is expected to be added to the wider NEM through the proposed rule change. Based on the evidence before the Commission, the ability of the rule change to

42 Grid Australia letter to AEMC - Additional information on Hydro Tasmania TOV rule change proposal, 23 September 2011

43 Grid Australia, first round submission, 12 August 2011, pp. 4. This figure is taken from Grid Australia's submission to the first round consultation process and is not part of a proper Transend review into TOV limit increases at the George Town connection point.

44 International Power GDF Suez, second round submission, 25 November 2011, pp. 1

increase efficiency, when applied to the George Town connection point is an important consideration.

On the basis of submissions received by Grid Australia and AETV Power, the Commission is of the view that technical limitations at the George Town connection point, including specific limitations of equipment at AETV power station and potential voltage impacts at adjacent connection points, may prevent the occurrence of TOV events of greater magnitude than currently exist under the rules. The Commission therefore queries whether an effective application of the proposed rule, if made, to increase TOV limits at the George Town connection point would be possible without incurring unacceptable risks to system security. If not, an application of the proposed rule will not achieve the proponent's intended outcomes.

6 Existing framework for changes to the normal voltage

The proposed rule would create a new TOV reference level to replace the *normal voltage* in the determination of over-voltage limits for periods less than 0.9 seconds. Therefore, a change to the TOV reference level would be subject to the same processes and limitations as a change to the *normal voltage*. This involves considering the extent to which the processes in the rules that apply to a change to the *normal voltage* can be effectively applied to a change to the TOV reference level.

6.1 Proponent's view

The proponent suggests that a change to the TOV reference level would follow the same process as a change to the *normal voltage*, which is currently allowed under the rules through the agreement of the NSP and AEMO. The proponent states that, similar to the treatment of *normal voltage*, the TOV reference level would cap the maximum TOV at a magnitude corresponding to a reference voltage of 10% higher than *nominal voltage*, and therefore the ability of the NSP to change the *normal voltage*, as outlined in the rules, implies an equal ability to change the TOV reference level.

6.2 Stakeholders' views

6.2.1 First round of consultation

Stakeholders are concerned that the existing framework in the rules that guides changes to the *normal voltage* provides inadequate protection to participants and insufficient guidance to NSPs, and this would therefore equally apply to the new TOV reference level. This view was supported in submissions by International Power GDF Suez, AETV Power, Origin Energy, and Grid Australia.[45]

International Power GDF Suez suggested that the lack of process concerning changes to the *normal voltage* represents a wider issue in the rules that is beyond the issues raised in opposition to the rule change request.[46] International Power GDF Suez noted that, despite there being no formal requirement in the rules to consider the changed risk imposed on participants or to consult with affected participants, the *normal voltage* applicable to a connection point has previously been changed materially. They believe this points to an existing deficiency of good regulatory practice in the relevant parts of the rules.[47]

International Power GDF Suez requested that the AEMC give consideration to the process for consultation with connected participants that should occur before a change

45 International Power GDF Suez, first round submission, 12 August 2011, pp. 3; AETV Power, first round submission, 10 August 2011, pp. 3; Origin Energy, first round submission, 12 August 2011, pp. 1; Grid Australia, first round submission, 12 August 2011, pp. 3

46 International Power GDF Suez, first round submission, 12 August 2011, pp. 3

47 Ibid

in *normal voltage* is applied at a connection point.[48] This view was supported in submissions from Grid Australia and AETV Power.[49]

6.2.2 Second round of consultation

The second round submission from International Power GDF Suez supports the Commission's comments in the draft rule determination regarding a potential lack of due process in the current rules in relation to making changes to the *normal voltage* at a connection point.[50]

6.3 Commission's considerations and conclusions

A number of submissions identified a lack of clarity in the rules around the process for changing the *normal voltage*. Stakeholders perceive that the rules do not clearly define a formal process that the NSP must pursue when considering a change to the *normal voltage* and that this would equally apply to the TOV reference level under the proposed rule. The issues outlined by stakeholders in relation to the treatment of *normal voltage* in the rules have not been considered as part of the final rule determination as they are outside the scope of this rule change request. The second round submission from International Power GDF Suez outlines an intention to submit a rule change request on this matter in the near future.

Some of the issues raised by stakeholders in relation to *normal voltage* have been considered in the context of the proposed TOV reference level. The Commission recognises that there is considerable uncertainty regarding the treatment of the proposed TOV reference level.

The form of the proposed rule does not establish an open and transparent process for NSPs to follow. For example, it would not require the NSP to consult with affected participants or consider the impact of a change to TOV limits on those participants. This could result in externally imposed risks to participants' plant, thereby impeding the safety and security of the supply of electricity, reducing incentives for investment, and increasing costs to connected participants and consumers.

In addition, the Commission considers that the form of the proposed rule has the potential to disrupt the certainty provided under the system standards and could potentially increase disincentives for future investment. The existing standards have been established to provide a level of certainty to investors who have made substantial capital investments. The proposed rule would enable NSPs to change the level of network service without strict compliance obligations and without proper guidance of the impacts on connected participants.

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48 Ibid

49 Grid Australia, first round submission, 12 August 2011, pp. 3; AETV Power, first round submission, 10 August 2011, pp. 3

50 International Power GDF Suez, second round submission, 25 November 2011, pp. 1

Abbreviations

AEMC or Commission	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AETV	Aurora Energy Tamar Valley
MCE	Ministerial Council on Energy
NEL	National Electricity Law
NEM	National Electricity Market
NEO	National Electricity Objective
NER or Rules	National Electricity Rules
NSP	Network Service Provider
proponent	Hydro Tasmania
TOV	temporary over-voltages

A Summary of issues raised in submissions

A.1 First round of consultation

Stakeholder	Issue	AEMC response
Grid Australia, International Power GDF Suez	Lack of clarity regarding the processes for setting TOV limits and revision of those limits at some future time	The Commission considers that greater clarity may be required with regards to the process to change the TOV reference level and TOV limits.
International Power GDF Suez, AETV Power, Origin Energy	The proposed process for changing the TOV reference level and the current process for changing the *normal voltage* only require agreement between the NSP and AEMO. Neither of these parties is required to consult with connected participants, potentially resulting in unintended consequences to plant.	The Commission considers that, while participants are afforded some protection through their connection agreement with the NSP, greater clarity may be required with regards to the process to change the TOV reference level and TOV limits to ensure clear guidance for NSPs and to avoid unintended consequences on connected participants.
International Power GDF Suez, Origin Energy	The rule change proposal does not include a comprehensive risk assessment addressing the potential impacts of the proposed change on the network, power system security and market participants.	The Commission considers that a comprehensive risk assessment is unnecessary as long as there is a process to guide the NSP's assessment on a cases-by-case basis that is clearly defined in the rules.
International Power GDF Suez	The rule change proposal does not include a technical case outlining whether appropriate risk management against damage to participant's plant through over-voltage can be provided without maintaining the close relationship between TOV limits and continuous limits that currently exists through the common reference of *normal voltage*.	The Commission understands that a shift in TOV limits independently of continuous limits is conceptually possible but would need to be assessed on a case-by-case basis by NSPs and may be more problematic for wind generation systems. The Commission considers that greater clarity and guidance would be required, if the rule

Stakeholder	Issue	AEMC response
		were made, to inform the NSP on the appropriate method of assessment.
AETV Power	A small margin exists on the protection operating settings at AETV power station and the allowed TOV. Any increase in the allowed TOV would result in a high risk of protection operation and disconnection of AETV power station. When combined with a trip of the Basslink interconnector, this would represent a severe Tasmanian power system disturbance.	The Commission considers that the protection operation settings at AETV power station form part of AETV Power's confidential connection agreement with Transend. The Commissions agrees with AETV Power that the simultaneous trip of the Basslink interconnector with AETV power station would represent a severe Tasmanian power system disturbance.
Grid Australia, Origin Energy	Plant constructed at a new segment of the network would see it fair that a TOV limit is applied that is most suitable for them. However, this TOV limit may not be optimal for subsequent plant that connect and therefore may create barriers to entry.	The Commission considers that the potential creation of barriers to entry already exists through the current ability to adjust the *normal voltage*. However, the Commission also recognises that the increased flexibility to adjust the TOV limits under the proposed rule may lead to an increase in the probability of the creation of barriers to entry.
Grid Australia	Any requested changes to the TOV limits will require the NSP to undertake extensive testing and investigation. This will increase the resources and cost burden on the NSP.	The Commission agrees and considers that the introduction of a new TOV reference level to determine TOV limits would remove the guidance provided through the references to *normal voltage* under existing connection agreements. Each request to change the TOV limits will place a resource and cost burden on the NSP due to the requirement to undertake extensive testing and investigation on risks to equipment and power system security through consultation with connected participants.
Grid Australia	The proposed rule change request does not address the question of who pays for the	The Commission agrees that greater clarity would be required with regards to the process to change

Stakeholder	Issue	AEMC response
	investigation that an NSP will need to undertake if a proponent requests a TOV limit which is different from the default value. Further, it does not address the question of who pays for the costs of any equipment required to be upgraded to implement increased TOV limits.	the TOV reference level and TOV limits.
AETV Power	The provisions of the rules in relation to voltages are currently quite complex and can be difficult to interpret. The introduction of another provision relating to voltage further increases this complexity.	The Commission considers that an increase in complexity is justifiable if this improves the potential achievement of the NEO. However, the Commission considers that a case exists for greater clarity in the rules regarding the treatment of voltage levels.
Grid Australia, AETV Power	A TOV event that occurs at one point in the network will also flow through to be seen at nearby points in the network and therefore it may not be possible to allow an increased TOV limit at one connection point in the network without also allowing an increased TOV limit at adjacent points in the network.	While a change to TOV limits would need to be assessed by the NSP on a case-by-case basis, the Commission recognises that TOV flow-on effects may restrict the ability to change TOV limits at a single given connection point.
Grid Australia, AETV Power	TOV flow-on effects could cross jurisdictional boundaries for TOV events occurring close to interconnectors, requiring input from more than one TNSP, or could flow into the distribution network requiring input from DNSPs.	Greater clarity would be required with regards to the process to change the TOV reference level and TOV limits.
Grid Australia, International Power GDF Suez, Origin Energy, AETV Power	The rule change request document intends that the TOV reference level be limited to -10% to +10% of *nominal voltage*. However, neither the draft rule change wording nor the proposed definition of the TOV reference level reflects this.	The Commission's requirements for the submission of a rule change request do not comprise a mandatory inclusion of a proposed rule. The Commission considers the description of the rule change intention alone as sufficient to make a

Stakeholder	Issue	AEMC response
		determination on the proponent's request.
Grid Australia, AETV Power	The proposed rule change amends figure S5.1a.1 in the rules and is now undefined beyond 900ms. Whilst it can be inferred from the proposed text of clause S5.1a.4 that the steady-state voltage limits would apply beyond the time period for which figure S5.1a.1 is defined, this is not explicitly stated.	Clause S5.1a.4 is incorporated in the automatic access standards for inclusion in connection agreements. The automatic and minimum access standards both also include the requirement for the participant to maintain equipment capable of meeting 110% of the *normal voltage* continuously. This is defined in clause S5.2.5.4(a)(2). The Commission therefore considers that clause S5.1a.4 need only define the TOV limits, should the rule be made.
Origin Energy	The AEMC figure 3.1 in the consultation paper suggests a different impact from figure S5.1a.1 in the rule proponent's rule change proposal. The AEMC figure suggests a compounded percentage increase on the TOV limit whereas the rule change proposal suggests the intent is a step change with no impact to the TOV limit curve.	The proposed rule change, if made, would allow for the TOV limit to be set based on the TOV reference level. A change to the TOV reference level would result in a proportional change to the level of the TOV limits.
AETV Power	The reference to clause S5.1a.4 in clause S5.3a.8 relating to target voltage should be S5.1.4.	The Commission considers that the current reference in the rules is correct. System standards are included in S5.1a, in particular the voltage ranges that are allowable are specified in schedule S5.1a.4. S5.3a.8 requires *market network services* to meet the system standards and S5.1.4 requires NSPs to achieve the system standards. Both of these clauses should refer to the system standards outlined in S5.1a.

A.2 Second round of consultation

Stakeholder	Issue	AEMC response
International Power GDF Suez	International Power GDF Suez supports the Commission's decision not to make the rule change and agrees with the Commission's considerations relating to the proposed rule change request, that: • the proposed rule would potentially impose additional costs on existing participants and introduce a barrier to entry; • technical limitations would appear to prevent an effective application of the rule change at George Town, the only likely location that the rule change would be applicable.	The Commission notes the support of the decision that was outlined in the draft determination.
International Power GDF Suez	International Power GDF Suez intends to propose a new rule change request relating to the potential lack of due process in the current rules in relation to making changes to the *normal voltage* at a connection point.	The Commission notes the intention to propose the rule change request.