

---

## Definition of Temporary Over-Voltage Limits Rule Change Proposal – Request for additional information

The AEMC's draft determination will involve making an assessment of the extent to which the Rule change is likely to provide benefit to the efficient operation of the market against any potential adverse consequences that may be involved. The AEMC must give consideration to the National Electricity Objective (NEO) and the long-term interests of consumers of electricity.

Currently, over-voltage limits at a connection point can be changed by changing the level of the *normal voltage*. The Rule change proposed by Hydro Tasmania is introducing a process that seeks to avoid the burden that is placed on participants through an increase in the continuous limits while allowing for an increase in the TOV limits. The Rule change would thereby increase the flexibility of the network service that could be provided to connected participants.

The Rule change proposal would not directly enforce a change to the TOV limits but would allow for those limits to be changed with the agreement of the Network Service Provider (NSP) and the Australian Energy Market Operator (AEMO). An application of the proposed Rule to effect an increase in TOV limits would reduce the need for an NSP to regulate the probability of voltage surges occurring through the provision of constraint advice to AEMO. This may have the potential to reduce capacity constraints on transmission lines at connection points. The ability to change the TOV limits would increase the flexibility of the network service and could potentially allow for a more efficient use of network infrastructure. This could potentially contribute to an increase in reliability and security of supply and minimise the requirement and costs of replacement network capacity, thereby minimising the long-term costs to consumers.

However, while the Rule change may promote flexibility in the provision of network services, these benefits need to be considered with respect to the potential costs imposed on market participants and ultimately consumers.

A greater level of flexibility in the provision of network service to connected participants is desirable if it allows for the maximum efficient use of network capacity. However, it is possible that an increase in flexibility also comes with an increase in the likelihood of a number of adverse outcomes. While the intention of the Rule change is to facilitate changes in limits, these changes must be weighed against the potential barriers to entry, the disincentives to invest, and the transaction costs that may occur as a consequence (refer to attachment B). While the potential for these detriments to arise already exists under the current Rules, with regard to changes to the level of the *normal voltage*, the increased flexibility of a change to TOV limits may act to increase the probability of these detriments occurring. However, with no significant additional adverse consequences beyond what exists under the current process for changing the *normal voltage*, the decision to make the Rule change is likely to depend on:

- If, and to what extent, the additional flexibility creates value for the efficient operation of the NEM;
- Whether, from a technical perspective, the determination of TOV limits can be separated from continuous limits with minimal adverse consequences; and
- If an increase in TOV limits at the George Town connection point is possible without adverse consequences on connected participants or system security.

**Does the additional flexibility add value to the efficient operation of the NEM?**

The constraints currently imposed on Basslink flow appear to be a result of the unique voltage surge pattern that occurs under low fault level conditions when Basslink flow is suddenly interrupted. Consequently, 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 AEMC understands that, at every other connection point in the NEM, the *normal voltage* is currently defined as *nominal voltage*. It therefore appears likely that the Rule change, if made, may rarely or never be applied at any other connection point in the NEM beyond George Town. However, while unlikely, the potential application of the proposed Rule at other connection points in the NEM cannot be disproved. Therefore, the AEMC is interested in understanding if the additional flexibility provided by the proposed Rule change has the potential to add value to the efficient operation of the NEM.

**Can the determination of TOV limits be separated from the determination of continuous limits from a technical perspective without adverse consequences on connected participants and system security?**

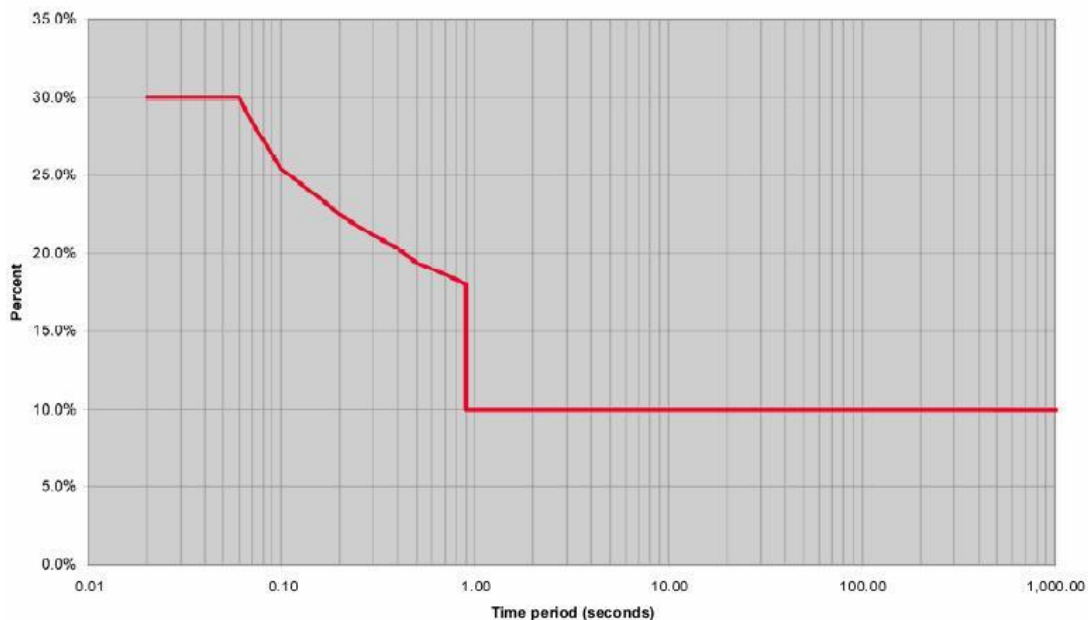
Under the current Rules, the TOV limits (<0.9 seconds) and continuous limits (>0.9 seconds) are related by their common reference point of the defined term *normal voltage*. An increase in the normal voltage will cause an increase to both TOV limits and continuous limits by the same margin. The AEMC is interested in understanding whether the determination of TOV limits can be separated from the determination of continuous limits from a technical perspective without incurring the potential for adverse consequences to connected participants or system security. There is an argument that, as long as robust frameworks are established to guide the NSP, then technical assessments could be undertaken on a case-by-case basis if and when the Rule is applied at different connection points. However, the AEMC believes that a decision to make a Rule that allows for greater freedom to adjust any aspect of the system standards should be sufficiently assessed from a technical perspective prior to making a Rule. The AEMC considers that it would not constitute good regulatory practise to make a Rule that allows for the possibility of significant adverse consequences to connected participants or system security, despite the additional condition of NSP and AEMO approval.

## Attachment A – Overview of the Rule change proposal

### Background

High voltage plant and equipment is designed to withstand maximum operating conditions which includes temporary over-voltages (TOV). Rule S5.1a.4 outlines the limits on TOV for a credible contingency event with reference to the *normal voltage* at a connection point. Figure S5.1a.1 (reproduced in Figure 1 below) outlines the over-voltage limits with reference to the *normal voltage* and sets out the given percentages. These percentages apply at every connection point in the NEM and are considered to be the limit of safe operating voltage for all equipment. The limits allow for voltage surges up to 30% above the *normal voltage* level. Voltage surges of this magnitude are only allowed for a brief period due to the extensive damage that can be caused to high-voltage equipment, particularly insulation coordination. The TOV limit represents the range of safe operating voltage levels up to 0.9 seconds. For longer durations, the voltage limit declines to a continuous level of 10% above the *normal voltage*. The continuous limit represents the maximum safe operating voltage beyond 0.9 seconds.

Figure 1



The principal means by which NSPs can regulate the probability of voltage surges occurring is through the provision of constraint advice to the AEMO to limit the power flow on transmission lines at connection points. Under low fault level conditions, a disconnection of a network line with high power flow can cause a sudden surge in voltage.

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.<sup>1</sup> However, such a change must be accompanied by approval from AEMO.

Through the operation of clause S5.1a.4 in its current form, 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 without the risk of exceeding limits.

<sup>1</sup> 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."

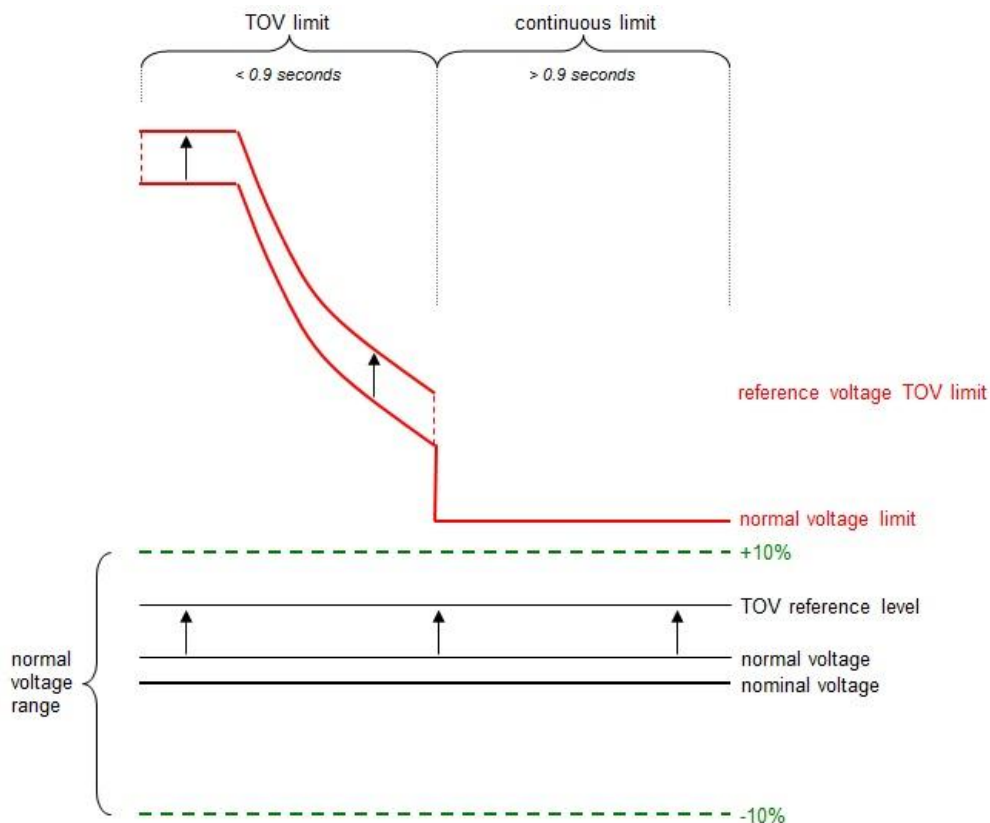
However, clause S5.2.5.4 of the system standards also employs the concept of *normal voltage* in consideration of high-voltage equipment design ratings in connection agreements between market participants and NSPs. This change to the Rules was undertaken through the *Review of Technical Standards for Wind Generation and Other Generator Connections* that was completed by the AEMC in March 2007. Since that time, any participants that connected to the network have a designated value of *normal voltage* included as part of their connection agreement to correlate with the level of network service provided at their connection point. If the level of the *normal voltage* is increased at any time 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.

### Hydro Tasmania's Rule Change Proposal

Hydro Tasmania proposes to disassociate the regulation of TOV limits from the level of *normal voltage* for durations less than 0.9 seconds. The proposed TOV reference voltage would replace the *normal voltage* for periods less than 0.9 seconds with the same  $\pm 10\%$  of *nominal voltage* restrictions applied. Continuous limits ( $>0.9$  seconds) would remain unchanged, avoiding the need for market participants to invest in more expensive high-voltage equipment with higher capability design ratings. While the Rule change has been proposed by Hydro Tasmania to allow for greater flows on Basslink at times of low fault level, the Rule change would allow for a change to the TOV limits at any connection point in the NEM. The proposal would only allow the possibility of change. Any actual change at a connection point would have to be approved by the NSP and AEMO.

The intended impact of the proposed Rule change on TOV limits is illustrated in Figure 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  $\pm 10\%$  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 2



## **Attachment B - Adverse consequences of increasing TOV limits**

While the potential for these detriments to arise already exists under the current Rules, with regard to changes to the level of the *normal voltage*, the increased flexibility of a change to TOV limits may act to increase the extent and probability of these detriments occurring.

### **First mover advantage and barriers to entry**

A change to TOV limits at one connection point may create network conditions that are better suited to existing connected participants. However, these same network conditions may not be optimal for participants that subsequently connect to the network. Future connecting participants may be required to invest in more expensive higher capability equipment to meet the higher limits. This has the potential to create barriers to entry for new connecting participants thereby reducing competition and efficient investment in the NEM. Submissions highlighted, through the first round consultation process, that this may be particularly relevant for wind generation systems, which have lower tolerances to over-voltages.

### **Disincentives for future investment**

The Rule change does not enforce a change to limits but allows for those limits to be changed with the agreement of the NSP and AEMO. Irrespective of whether the Rule change is used to change the level of the TOV limits, the ability to change the limits provides an additional degree of flexibility to the conditions of network service. While the ability to change the TOV limits may increase the flexibility of the network service, it could be argued that the existing standards have been established to provide a level of certainty to investors who have made substantial capital investments and that, through the making of the Rule change, this certainty in network service could be compromised, potentially resulting in disincentives for future investment.

### **Increased costs for the NSP**

The potential for the conditions of network service to be altered could lead to a number of additional costs imposed on NSPs in order to undertake significant analysis on the limitations of the network and the impact on connected participants should a change to the over-voltage limits be desired. The increased resource and cost burden placed on NSPs may either be absorbed by the NSP or ultimately recovered through increased flow on costs of supply to end consumers.