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Question 8. Inverter based resources (IBRs) utilizing the grid following technology need a certain level of system strength to maintain stable operation and, *per se*, do not contribute to system strength. Whose responsibility should it be to provide enough system strength services to ensure stable operations– transmission service provider or the generators? If the latter, then how does the generator provide this and how are costs recovered? Does making the generator responsible for system strength requirements create an entry barrier for renewable generators?

Contribution

Often the transmission network service providers is better placed to identify and implement efficient system strength solutions.

The transmission network service provider may be better able to foresee the need for system strength services in an area of the power system than an individual generator and this may allow the network service provide to identify cost effective centralised solutions. In these situations it may be more cost effective for the network service provider to determine the appropriate remediation options and implement those options.

It will not always be the case that the network service provide can implement a more costs effective solution. This is likely to be true where the IBR is connecting to a more remote area of the transmission network and the most effective solution is one implemented within the generating system eg extending the generating system to include remediation measures such as a grid forming battery or a synchronous condenser. I t is therefore appropriate to allow for either transmission network service provider or the generator to implement the system strength remediation measure.

Not all generators have the same need for system strength so appropriate allocation of costs is important.

To maintain stable operation some types of generation require a minimum level of system strength at the point of connection to the grid, while other types of generation actually contribute system strength and do not rely on the power system to supply system strength.

Inverter based resources such as solar and wind farms commonly use grid following inverters and this form of generation requires a minimum level of system strength be maintained at the connection point. Put another way, for this type of generation to operate stably and ride through disturbances there must be sufficient system strength to maintain a stable voltage waveform.

Generators utilising grid forming inverters can operate stably even with very low levels of system strength and synchronous generators inherently contribute system strength.

Power systems of the future are likely to incorporate a variety of generation technologies and the correct allocation of system strength costs will avoid free rider issues and will also help to encourage the optimal selection of generation technology. Allocating system strength costs appropriately will also service to encourage technology innovations.

Allocation of costs should recognise the various factors driving the system strength requirement.

A revised framework for managing system strength has recently being introduced into the Australian National Electricity Market. Those changes include the introduction of a system strength standard that recognises the two key factors that drive the requirement for system strength as illustrated in Figure 1. The total system need for system strength is specified by:

- A minimum fault level requirement which defines the system strength required to provide robust operation of protections systems and thereby contribute to a secure power system.
- Additional system strength required to maintain a stable voltage waveform which in turn allows IBR utilising grid following inverters to operate stably.

It is appropriate for system strength costs to shared between customers and generators using grid following IBR. The NEM framework seeks to recover the additional costs to maintain a stable voltage waveform from generators utilising grid following inverters with other system strength costs recovered from customers via network charges. Figure 1 indicates that the system strength requirement is allowed to evolve overtime to keep pace with technology changes.

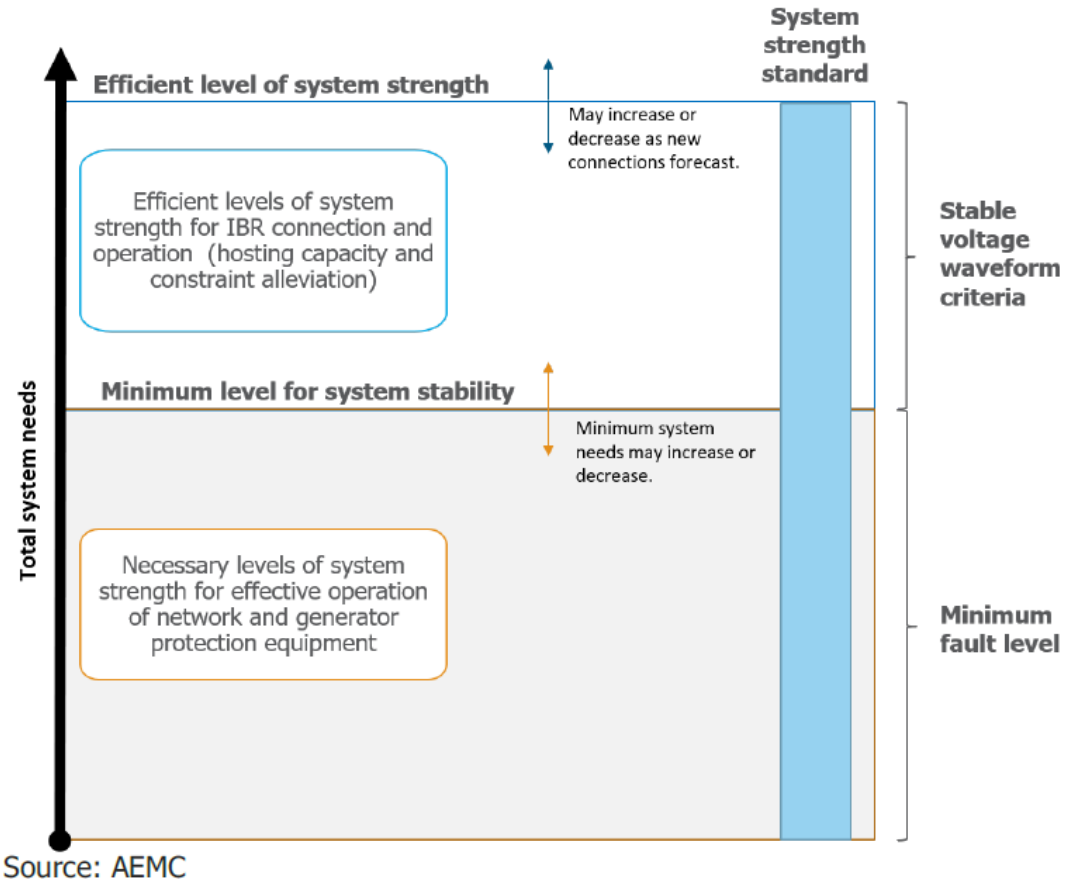

Figure 1 Components of the NEM system strength standard