AUSTRALIAN ENERGY MARKET COMMISSION

STRONGER FUTURE FOR RENEWABLES IN NATIONAL GRID

Investigation into system strength frameworks in the national electricity market

Final report 15 October 2020

As the energy sector decarbonises we are working intensively with stakeholders to design long-term solutions to keep the power system working well.

Three years ago we put measures in place to keep the lights on as weather-driven generation connected to the grid at accelerating speed and old, thermal generators started to close. Today we release proposals for a new evolved framework that backs up the changing generation mix well into the future – providing the voltage stability required to keep power flowing to consumers.

This work is consistent with the Energy Security Board's market development initiative on essential system services in Australia's post 2025 electricity market.

Why we need system strength services

Synchronous generators like coal, biomass, gas and hydro operate with large spinning turbines that help maintain consistent frequency and voltage which keeps the system stable. They create their own voltage waveform as a by-product of energy production.

Non-synchronous generators like wind and solar connect to the grid using inverters which do not create their own voltage waveform. Systems with lots of these generators are weaker and harder to control. So as we shift to new technologies that don't have system strength embedded in their way of operating, we need a new approach.

The new-look system strength framework

System strength is all about keeping the voltage waveform stable. Today's proposals are a turning point for power system security. We are making it simpler, faster and more predictable for renewables to connect to the grid and keep supply as secure as possible.

- New planning standard
- New technical standards
- · System strength zones created
- Generators must arrange their own system strength outside those zones
- Generators and consumers will share the cost of keeping the system

How system strength is delivered

There are a range of options to make the power system stronger. Options are increasing as technology innovates.

Non network solutions – contract direct with generators that can supply strength or utilising new technologies like grid forming inverters and techniques such as the collective retuning of existing generators' control responses.

Network solutions – building new network assets like synchronous condensers



Number of AEMO directions

*Incomplete year; data current at 5 March 2020.

Note: values above each column represent number of directions issued

This chart shows how since 2015, AEMO has been intervening in the market. It used to not intervene very much at all, only in emergencies. It is now intervening up to 230 times a year and rising. The important thing is these interventions are almost 100% concerned with system security. They are not concerned with any shortage of capacity.



AT A GLANCE: EVOLVING THE SYSTEM STRENGTH FRAMEWORK

Investigation into system strength frameworks in the national electricity market

Final report 15 October 2020

A coordinated approach



New access

standards to

manage need for

system strength

on the demand

side

Establish a network planning standard for higher levels of system strength

New technical standards on generator access to the grid

Plan

Stage 1

AEMO releases an annual system strength report using ISP inputs to assess nodes where the planning standard applies.

Stage 2

Transmission network businesses use existing planning processes to detail procurement solutions.

Procure

Transmission network businesses must put solutions in place to meet higher system strength standard. Solutions are coordinated by AEMO through central dispatch process to keep system safe and secure.

Price

Australian Energy Regulator (AER) sets investment allowance under the prevailing economic regulation framework.

Pav

Prescribed transmission services including system strength are paid for by consumers and regulated by the AER.

We will continue

with industry.

to work closely

Coordinating system strength supply and demand

The new system strength mitigation requirement will establish system strength zones to help create clearer price signals for generators based on their relative demand for system strength services. This requirement will replace the existing do no harm arrangements to better coordinate the supply and demand of system strength and share the costs of these service between generators and consumers.

Generators that connect inside a system strength zone will face a charge reflective of the services

Generators that connect outside a system strength zone will have to provide their own system strength required for their stable operation.

Short circuit ratio measurements

New connecting generators must have capability for stable operation even in lower system strength conditions (will reduce the amount of system strength that networks have to pay for)

Voltage phase shift New connecting generators

that impact the system this way must be able to maintain continuous operation following a large shift in the phase of voltage.

Specific values for these standards are being considered under the TransGrid rule request on efficient management of system strength on the power system.

AEMO and other technical experts they require. in determining the specifics of these new access standards.

Australia is at the cutting edge of managing power systems with high levels of renewables.

2016

In 2016 the AEMC accelerated its security and reliability work to give **AEMO** more tools to integrate renewables.

2017

Two immediate actions were taken to keep the system secure

- 1) Do no harm framework where new connecting generators must deliver system strength to offset their disruption to local fault current as a result of connection.
- 2) Minimum strength framework where transmission network businesses must address strength shortfalls identified by AEMO.

To date

Intensive program of rule changes and reviews has been undertaken to address all key aspects of system strength maintenance. Here is our latest action plan update.

2019 to date

ESB starts its post 2025 electricity market redesign project including focus on essential system services. As a member of the board we are assisting with that work and considering a package of seven rule changes.

AEMC starts investigation into system strength frameworks in the national electricity market.

2020

Investigation into system strength frameworks in the national electricity market - final report.

Rule request: efficient management of system strength on the power system (TransGrid) - draft determination due December.