SMOOTHING RENEWABLE ENERGY CONNECTIONS

Prof. Sahar Pirooz Azad

The transfer of power from offshore wind farms and other converter-interfaced renewable energy sources (RESs) to remote loads may rely on direct-current (DC) transmission lines. The integration of RESs in the grid via converters and power transfer over DC lines result in the connection of multiple converters to a shared DC point in large-scale power systems.

The neighbouring converters interact with one another and cause instability and an undesirable transient response in the power grid.

WISE researchers Sahar Pirooz Azad and PhD student Fatemeh Ahmadloo set out to tackle the problem. The two electrical engineers began by modelling a group of voltage-sourced converters that share a common DC connection point. Next, they studied how the converters interacted with each other, assessing the effects of the different control modes used to regulate DC and AC voltages.

Their analysis revealed that the highest levels of interaction occur when all the converters simultaneously use AC-voltage control mode. In contrast, stability improves when several converters are in reactive-power control mode.

The researchers then used those insights to develop a method for designing controllers of voltage-sourced converters, using a stability criterion to help mitigate the effects of interactions among them. Finally, they validated the design using a test system with three converters that shared a common connection point.

As the addition of more converter-interfaced renewables to the grid requires greater use of converters, stability issues are poised to grow. Azad and Ahmadloo's research helps address those concerns, providing mathematical blueprints for designing better converter controllers that will smooth the transition to greener grids.

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