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TACKLING ELECTRICAL TRAFFIC JAMS IN MICROGRIDS

Jacqueline Llanos, Daniel E. Olivares, John W. Simpson-Porco, Mehrdad Kazerani and Doris Sáez

Microgrid managers face a big challenge: ensuring the smooth flow of electricity between intermittent energy sources (such as wind, solar and hydro), storage systems and energy users. WISE researchers want to help. John Simpson-Porco, Mehrdad Kazerani and their Chilean colleagues have developed a distributed control system that overcomes many of the weaknesses of existing models.

Distributed control systems serve as automated checkpoints and traffic police that help regulate frequency, manage power flow and more. However, that's more difficult in isolated microgrids, where there are fewer interconnected components to share control functions. This can lead to voltage and overloading problems, causing power outages and damaging distribution lines and transformers.

To address those issues, the researchers proposed a new distributed inverter-control formula that helps control frequency, optimize operations and prevent grid congestion caused by too much electricity flowing into a transmission line.

Their proposed controller relies on several key elements. Local voltage and frequency measurements provide crucial data. A communications network allows the two-way exchange of information between neighbouring generators. Voltage and frequency regulators keep levels within safe limits. Current measurements in selected distribution lines trigger congestion alerts.

The researchers ran simulations to see how well the controller handled sudden changes in power loads and congested lines. Those tests revealed it could successfully restore frequency to its nominal value and resolve congestion issues, removing overloading within a few seconds.

The improved distributed control strategy promises to help managers unlock the full potential of their microgrids — and the renewable energy sources powering them.

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