Scientists propose method to improve microgrid stability and reliability

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The power it takes to bring a Boeing 747 from a resting state on the airport tarmac to speeding across the sky is enormous. The jet can continue in its active state for as long as its fuel lasts. A Frisbee, by contrast, takes far less energy to go airborne, but with no energy supply, it falls almost immediately.

The same principle can be extended to the traditional power system and decentralized microgrids. The power grid has a large reserve of energy to continue in an active state, while a microgrid quickly spends its reserve. The microgrid's renewable reserve, however, makes the microgrid system an attractive power prospect worth pursuing, and a collaborative team of researchers have proposed a way to better control the easily spent microgrids. They published the potential solution in *IEEE/CAA Journal of Automatica Sinica* (*JAS*), a joint publication of the IEEE and the Chinese Association of Automation.

"The microgrid concept is a big step towards solving the controllability problems of distributed resources," wrote Won-Sang Im, a postdoctoral researcher at Lehigh University. "...For a microgrid to work autonomously, it must maintain its own supply-demand balance."

If the supply rate is too low, the microgrid will fall short of demand as the system's inertia depletes. This becomes all the more complicated with microgrids powered by renewable energy resources such as solar panels or wind turbines. Storage systems are costly, but sunshine and wind strength are largely unreliable for consistent use.

The solution, Im and his team wrote, lies in a computer-based algorithm that can mirror the microgrid's inertia as needed by alternating the system's direct current over specific ranges. The researchers also noted that the microgrid's photovoltaic system can also be adjusted to boost or lower the current's inertia influence.

"In traditional power systems, supply-demand imbalance changes system frequency at a rate determined by the total system inertia," Im wrote. The idea works with the microgrid, just in multiple. "The solution tries to make [the] microgrid work like a large power grid with large inertia."

The solution does work as intended, according to simulations performed by the scientists. However, Im and his team wrote that the larger inertia limits the flexibility and fast response times. Their future work will focus on making microgrid controllers that are quicker and more accurate.

More information: Fulltext of the paper is available: ieeexplore.ieee.org/stamp/stam … number=7738325&tag=1

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