

Four ways the electric system can better integrate microgrids

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The U.S. electric system is adapting to a new wave of distributed energy resources, such as solar panels and energy storage. Some of these work together in localized networks known as microgrids—nearly 2,000 are now operating or planned across the country, according to one estimate.

Prized for their flexibility, microgrids can run in an "island" mode or connect to the main grid. Although microgrids can potentially enhance reliability, the current electric system needs upgrading in order to synchronize with them properly.

Researchers at the U.S. Department of Energy's (DOE) Argonne National Laboratory study the impact of microgrids and analyze ways to assimilate them smoothly within the larger electric system. Part of this work focuses on the distribution system—the last leg of electricity's journey from [energy](#) source to outlet.

"Traditionally, distribution systems have operated as passive networks, with one-way [power](#) flow from bulk energy sources to individual customers," says Ning Kang, a scientist in Argonne's Energy Systems division, who works on microgrid interconnection, integration and control strategies with colleague and Principal Distribution Engineer Ravindra Singh.

"But a [microgrid](#)—with its own distributed [energy resources](#), like solar panels—can now inject power back into the grid. If that power flow isn't properly managed, it can disrupt protection systems and other aspects of the distribution network."

New strategies are needed to capitalize on this added power while avoiding problems. Here are four recommendations, based on prior research findings and Kang and Singh's analysis:

Define microgrid generation within the power market

Microgrids need a structured way of selling their power back to the grid. One way would be to define pools of microgrids that can transact with each other and the larger grid; another would be to create power purchasing contracts between different microgrids. In either scenario,

dispatch rules need to be set so that microgrids send power to the right place at the right time.

Update distribution protection systems

Devices that protect the distribution system from excessive current are typically set up to serve a legacy grid with one-way power flow. The distribution system should deploy a real-time setting update mechanism for all of its protection devices to head off potential problems.

Improve monitoring for power quality

Our proliferating electronic devices can be sensitive to variations in power quality. Integrating microgrids at a large scale will require online monitoring systems that provide high-resolution data on voltage and power quality. At certain points in the distribution system, it may make sense to add sensors and analytical tools that can help assess and solve any problems.

Build better controls

Increasingly, grid operators use distribution system operation and control software to monitor and diagnose problems on the grid and make prompt adjustments to ensure reliable, efficient grid operation. These systems use applications, just like a smartphone does, to tackle a number of tasks. Some of the applications require upgrades to handle a world with increasing numbers of microgrids.

Provided by Argonne National Laboratory

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