



Autonomous Control of Inverter-Based Storage in Dynamic Distribution Systems

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing methods of controlling energy storage devices in a system that includes other DER units.

Overview

Distributed energy resources (DER), which include small-scale, distributed power generators, energy storage devices and renewable sources of energy, are frequently located near the consumer's "load," where the energy is used. DERs offer a promising alternative to meet the rapidly growing demand for more reliable power across the United States.

When power demands spike, individual DER units may respond by providing more energy to the system, but they may also cause problems with other DER units. A key enabling technology is the use of local autonomous control of DERs based on measured information at the point of connection.

The Invention

UW-Madison researchers have developed methods for effectively and autonomously controlling energy storage devices in a system that includes other DER units. Specialized power electronics control charge/discharge of an energy storage device (like a battery or flywheel) using locally available information. Electronic sensors analyze variables, such as power flow, operating frequency of a power inverter and level of charge in the storage device, to control the frequency of the output power of the inverter, and thus the rate of charge or discharge. The controls use power vs. frequency droop to track power demand when the DER is isolated from the utility grid and voltage vs. reactive power droop to ensure stability between DER components.

These methods work with other DER units to increase reliability, bring down costs and provide precise control over energy storage. They also reduce custom engineering, promote plug-and-play concepts and ensure stable operation of a DER system that includes energy storage devices.

Applications

- Distributed energy resources

Key Benefits

- Provides autonomous control using solely local information
- Offers precise control over energy storage
- Energy storage devices respond to extra load demands from local power consumers, enabling the amount of energy required from the utility grid to remain constant.
- Allows the exploitation of energy price differentials by charging DER storage when power costs are low and discharging DER storage when power costs are high.

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- DER systems add reliability to utility-provided power.
- Increases efficacy of green generation technologies (wind, solar, hydroelectric) by discharging when those renewable energies are low and storing excess energy at peak production times
- Conforms to CERTS microgrid criteria

Tech Fields

- [Engineering : Power electronics & control systems](#)

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