Clean Technology

Non-Inverter-Based Distributed Energy Resource for Use in a Dynamic Distribution System

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a method that enables effective autonomous control of non-inverter based power generation in a system that includes other classes of DER units.

Overview

Distributed energy resources (DER), the combination of distributed power generators, energy storage devices and renewable sources of energy, are frequently located at customer sites where the energy resources are used. Small DER offer a promising alternative to meet the rapidly growing demand for more reliable power.

When power demands spike, individual DER units may respond by providing more energy to the system but may also cause problems with other DER units. A key enabling technology is the use of local autonomous control of DER based on measured information at the point of connection. However, methods are not currently available for the autonomous control of some types of DER units, including those that don't use inverters.

Many DER use power inverters to convert DC current from power electronic front ends to the AC current present in the other parts of the system. However, it is possible to eliminate the need for an inverter if the rotation speed of the shaft is kept approximately equal to a fixed value. This reduces cost, due to the absence of an electronic power front-end, but past technology did not allow the dynamics of the prime mover to be decoupled from the output of the generator.

The Invention

UW-Madison researchers have developed a method for effective autonomous control of non-inverter based generation in a system that includes other classes of DER units. The method relies on controllers that use local information to regulate rotation of the shaft of the microsource generator. The controller calculates an operating frequency for the generator based on a comparison between a power set point and a measured power flow. A requested speed for the shaft of the generator (prime mover) is calculated by combining a maximum frequency change, a minimum frequency change and the calculated operating frequency. The system then uses this information to calculate a shaft speed adjustment and implements the change by regulating a fuel command for the prime mover. This keeps the AC output voltage at a desired frequency, eliminating the need for a front-end inverter to couple the DC front end and the remaining AC components.

Applications

- Distributed energy resources

Key Benefits

- Reduces cost over systems with power electronic front ends, such as a permanent magnet generator, which require an inverter to interface with the AC system

- Relies solely on local information to provide voltage regulation and power vs. frequency droop (used to measure varying power demands and regulate microsource response)
- Non-inverter-based microsources easily integrate into existing microgrids.
- DER power systems add reliability to utility-provided power.
- Conforms to CERTS microgrid criteria

Tech Fields

- Clean Technology : Energy storage, delivery & resource efficiencies
- Engineering : Power electronics & control systems

For current licensing status, please contact Emily Bauer at emily@warf.org or 608-960-9842