

NREL Report Redefines Wind as a Grid Stabilizer, Not a Liability

Highlights in
Modeling & Analysis

Study explores how wind power can support power system reliability, and do so economically.

The National Renewable Energy Laboratory (NREL), along with partners from the Electric Power Research Institute and University of Colorado, embarked on a comprehensive study to investigate a mitigation strategy that is not often discussed and is in some ways counter-intuitive: the use of wind power to support power system reliability by providing active power control (APC) at fast timescales.

Various forms of APC can help stabilize the grid by enabling generating sources to increase or decrease power output to meet the constantly fluctuating load demand and avoid events that can cause brownouts and power failures. Traditional thermal and hydropower generators provide this control, but until recently, APC was rarely considered for wind generators.

The study includes a number of different power system simulations, control simulations, and actual field tests using turbines at NREL's National Wind Technology Center (NWTC). In order for APC to work for wind power, it must support system reliability, increase revenue from ancillary services power markets, and have negligible effects on the structural impacts of the turbines. The study's key takeaway is that wind power can act similar or superior to conventional generation when providing APC, supporting the system frequency response and improving reliability.



The research team performed automatic generation control and primary frequency control field tests at the NWTC using the 650-kilowatt 3-Bladed Controls Advanced Research Turbine. Photo by Dennis Schroeder, NREL 21893

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Key Research Results

Achievement

NREL completed a comprehensive study to understand the ways in which wind power technology can assist the power system by providing control of the active power output being injected onto the grid.

Key Result

By analyzing timeframes ranging from milliseconds to the lifetime of wind turbines, and spatial scopes ranging from turbine components to regional grid interconnections, NREL researchers have shown that wind turbines providing active power control can increase power system reliability in a way that's economical for both consumers and wind owners, while having negligible structural impact on the wind turbine.

Potential Impact

Wind is typically viewed as a variable and uncertain energy resource. However, this report provides a logical evolution for wind to start providing faster forms of active power control by transitioning from a non-dispatchable resource to a grid enabler.

NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.

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