# Inertia and the power grid: A guide without the spin

29 May 2020

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The power grid is evolving to include ever-higher levels of wind and solar generation—which do not provide inertia, historically a key source of grid reliability. Should system planners and operators panic? A new video and guidebook from the National Renewable Energy Laboratory (NREL) explain why not.

**What Is Inertia in the Power Grid?**

Inertia in power systems refers to the energy stored in large rotating generators and some industrial motors, which gives them the tendency to remain rotating. This stored energy can be particularly valuable when a large power plant fails, as it can temporarily make up for the power lost from the failed generator. This temporary response—which is typically available for a few seconds—allows the mechanical systems that control most power plants time to detect and respond to the failure.

**Why Does Grid Inertia Matter?**

Historically, in the U.S. power grid, inertia from conventional fossil, nuclear, and hydropower generators was abundant—and thus taken for granted in the planning and operations of the system. But as the grid evolves with increasing penetrations of inverter-based resources—e.g., wind, solar photovoltaics (PV), and battery storage—that do not inherently provide inertia, questions have emerged about the need for inertia and its role in the future grid.

**New Guide Gives the Full Story**

To educate policymakers and other interested stakeholders, NREL researchers have released "Inertia and the Power Grid: A Guide Without the Spin," which provides an overview of inertia's role in maintaining a reliable power system, why inertia may decrease with increasing deployment of wind and solar generation, and how system reliability can be maintained in the evolving grid.

"We find that replacing conventional generators with inverter-based resources, including wind, solar PV, and certain types of energy storage, has two counterbalancing effects," said Paul Denholm, NREL principal energy analyst and lead author of the guide. "First, it's true that these resources decrease the amount of inertia available on the system. But second, these resources can reduce the amount of inertia actually needed—and thus address the first effect. In combination, this represents a real paradigm shift in how we think about providing the grid services that maintain system reliability."

Among other key takeaways and detailed illustrations, the guide also explains how inverter-based resources can use power electronics to reduce the need for inertia, including how power system operators in Texas are already doing this to achieve high penetrations of wind energy while maintaining reliability.

"Ultimately, although growth in inverter-based resources will reduce the amount of inertia on the grid, there are multiple existing or possible solutions for maintaining or improving system reliability," Denholm said. "So, declines in inertia do not pose significant technical or economic barriers to significant growth in wind, solar, and storage to well beyond today's levels for most of the United States."

**More information:** Inertia and the Power Grid: A Guide Without the Spin,: www.nrel.gov/docs/fy20osti/73856.pdf

Provided by National Renewable Energy Laboratory

APA citation: Inertia and the power grid: A guide without the spin (2020, May 29) retrieved 22 September 2021 from https://techxplore.com/news/2020-05-inertia-power-grid.html

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