

Microgrids, Infrastructure Resilience, and Advanced Controls Launchpad



Partnering to advance wind-hybrid distributed energy systems to provide flexibility, security, and resilience to distribution systems and microgrids.

Photo courtesy of David Nevala Photography for CROPP Cooperative

For individuals, businesses, and communities building resilient infrastructure, wind energy can provide an affordable, accessible, and compatible distributed energy resource (DER) option that also enhances the capabilities of local grid operations. The Microgrids, Infrastructure Resilience, and Advanced Controls Launchpad (MIRACL) project is designed to make this potential a reality through collaborative research between U.S. Department of Energy (DOE) National Laboratories and industry.

Enabling Wind-Centered DER Systems

Four DOE National Laboratories—the National Renewable Energy Laboratory, Pacific Northwest National Laboratory, Sandia National Laboratories, and Idaho National Laboratory—are joining forces to develop and improve the planning, design, and operation of wind-centered microgrids to complement solar, energy storage, and other DERs for grid-tied and isolated operation.

Funded by the DOE Office of Energy Efficiency and Renewable Energy's Wind Energy Technologies Office, the MIRACL project seeks to equip and validate wind technology as a plug-and-play resource with solar, storage, and other DERs in hybrid systems. Collaborative research under MIRACL

is enhanced by a new high-speed data platform that connects the data, models, and physical assets across the four laboratories needed to address research and development priorities.

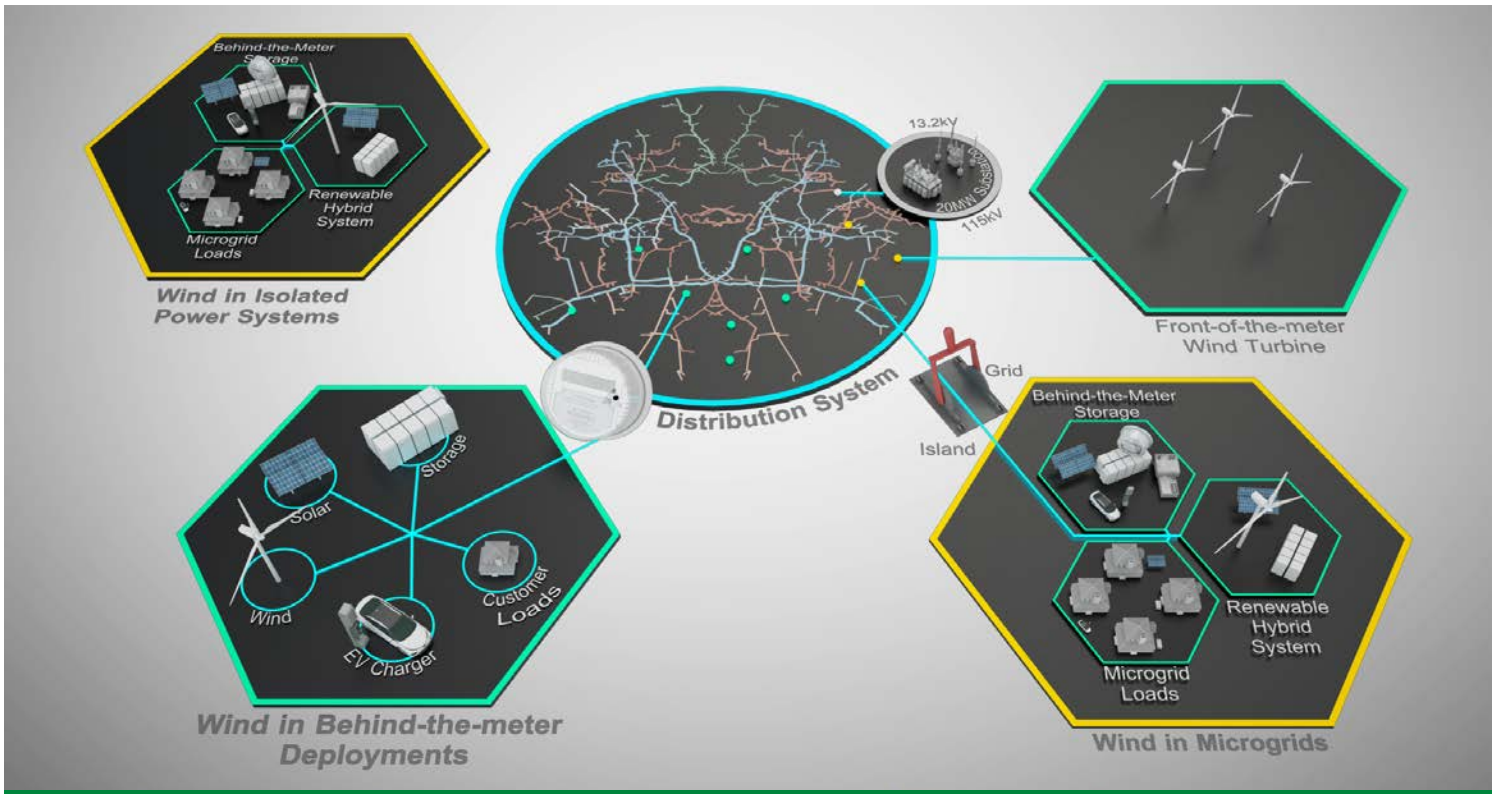
Three Primary Research and Development Priorities

- 1. Accurately Value Grid System Contributions from Wind as a DER:** Research and develop grid modeling tools to more accurately represent wind's techno-economic performance in, and value to, microgrids, hybrid DER installations, distribution grid systems, and energy markets.
- 2. Advance Controls for Wind-Hybrid DER Systems:** Develop and demonstrate the grid support functions of wind turbines in grid-connected

and isolated microgrids and increase the control and communications compatibility of wind turbines with other DERs.

- 3. Understand and Guard against Cyber Threats in Distributed Wind Applications:** Research and develop methodologies to understand cyber vulnerabilities, develop threat-resilient supervisory control, and achieve greater, measurable resilience in microgrids and distribution systems through wind integration.

MIRACL's R&D efforts will also provide a platform enabling validation of hybrid DER system technologies to maximize grid support, resiliency, and value for utilities and their customers.



Integrating wind with diverse technologies creates a larger system that provides a range of benefits, including improved resiliency and flexibility.

Graphic created by Josh Bauer, NREL

Collaborate with the MIRACL Project

A key component of the MIRACL project is collaborating with electric utility, wind, microgrid, and DER industries to advance the current state of the art. Industry representatives interested in collaborating are urged to connect with one of the DOE National Laboratory leads to:

- Identify industry challenges and opportunities for wind in microgrid applications to ensure MIRACL is impactful for industry and supports the advancement of wind-hybrid DER systems.
- Leverage National Laboratory research capabilities to develop and validate technologies prior to commercial deployment.
- Ask for a detailed technical design evaluation of wind-centered microgrid systems and components from leading technical experts at the National Laboratories.

DOE National Laboratory MIRACL Project Leads

National Renewable Energy Laboratory
Jim Reilly, james.reilly@nrel.gov

Idaho National Laboratory
Jake Gentle, jake.gentle@inl.gov

Pacific Northwest National Laboratory
Alice Orrell, alice.orrell@pnnl.gov

Sandia National Laboratories
Brian Naughton, bnaught@sandia.gov



Photo credit: iStock 173920325



Photo courtesy of Cliff Ryden, Blue Pacific Energy, LLC



Photo courtesy of Hank Doster, One Energy Enterprise, LLC

MIRACL is led by the U.S. Department of Energy's National Renewable Energy Laboratory, with funding from the DOE Office of Energy Efficiency and Renewable Energy's Wind Energy Technologies Office.