



With its 2021 Competitiveness Improvement Project award, Intergrid LLC is working to certify this Bergey Windpower-built inverter to open more market opportunities for distributed wind turbine manufacturers. *Photo courtesy of Bergey Windpower*

U.S. Department of Energy Competitiveness Improvement Project (CIP)

# 2021 Small Turbine Certification Awardee: Intergrid LLC

*Project Dates: Oct. 11, 2021–July 10, 2023*

## Project Overview

### Developing Market-Enabling Products for Manufacturers of Distributed Wind Turbines

Currently, there are no U.S., fully certified inverters for wind turbines in the 10–15-kilowatt (kW) range. The federal government’s Competitiveness Improvement Project (CIP) and Small Business Innovation Research programs present the most viable paths for manufacturers in the distributed wind energy industry to conduct research, develop their products, and, ultimately, commercialize them.

Through CIP, [Intergrid LLC](#) is reducing the cost, size, and weight of its legacy inverter for distributed wind turbines while increasing efficiency, reliability, and serviceability.

To accomplish this, Intergrid will address three areas related to power electronics for distributed wind turbines:

1. Software verification and functional safety certification
2. Simulation for grid-interconnecting testing
3. Component alternatives that reduce cost and improve reliability and serviceability.

The first two areas relate to long-term management of inverter software, which, for grid-connected inverters, must comply with three standards—one issued by Underwriters Laboratories (UL) and two issued by the Institute of Electrical and Electronics Engineers.

“CIP has helped advance Intergrid’s inverter from concept to reality so that we can meet the needs of U.S. wind turbine manufacturers.”

*Robert Wills, President, Intergrid LLC*

The third area analyzes the initial design of Intergrid LLC’s IG25 25-kW inverter, now several years old, because new components have become available. These new components have the potential to reduce the cost, size, and weight of the inverter while improving efficiency and reducing supply chain challenges.

## Project Outcomes and Deliverable

The primary outcome of this project is practical, cost-effective, and maintainable solutions for distributed wind turbine original equipment manufacturers to achieve UL 1741 certification.

The deliverable is an improved version of Intergrid LLC’s inverter for the [Bergey Windpower](#) 15-kW wind turbine.



## Project Approach

Intergrid will approach this project in three steps.

1. Put the company's inverter software and controller hardware through the UL 1998 software verification process to enable future software updates without the need for complete grid-interaction testing.
2. Develop a simulator for testing Intergrid LLC's inverter control code. The simulation code will accelerate testing timelines and enable parallel testing, which should reduce the time required to fully verify the inverter technology from 400 hours to a matter of minutes. While simulations will not replace the requirement to completely verify the device on actual hardware, it will greatly increase the likelihood of Intergrid LLC's technology to pass certifications—and will likely also contribute to the UL 1998 verification process.
3. Address component improvements and alternatives by focusing on press-fit silicon carbide power modules, alternate output inductors, and output filter topologies. These may lead to other possible changes, including smaller heat sinks, general mechanical redesigns, more modern digital signal processing chips, and alternate inverter control methods.

## Project Collaborators

Current and future project partners include:

- **Bergey Windpower**—the main collaborating partner and supplier of the primary testing product, the Bergey Windpower 15-kW wind turbine
- **Intertek**—a testing lab for the UL 1998 work
- **RE Innovations**—a consultant for the UL 1998 work
- **Windurance**—a collaborator focusing on alternate component choices
- **Matric Manufacturing**—a collaborator focusing on alternate component choices
- **QED Wind Power**—a collaborator on inverter prototype design and testing.

## Project Financial Information

**Award Amount:** \$200,000

**Awardee Share:** \$50,000

**Total:** \$250,000

“By working to certify an inverter designed for the distributed wind industry, Intergrid will open many more market opportunities for these companies.”

*Lee Jay Fingersh, NREL technical monitor*

## Small Turbine Certification Award

One of eight types of CIP awards, Small Turbine Certification projects specifically evaluate turbines with a rotor swept area less than or equal to 200 square meters, applying the International Electrotechnical Commission 61400-2:2013 standard, American Wind Energy Association SWT 1 standard, or both. Certification can also include listing to Underwriters Laboratories standards.

## About the Competitiveness Improvement Project

DOE's CIP supports U.S. leadership in distributed wind technologies. Managed by NREL on behalf of DOE's Wind Energy Technologies Office, CIP supports innovation to advance wind energy as a low-cost, distributed generation technology option.

## More Information

Visit NREL's website at [www.nrel.gov/wind/competitiveness-improvement-project.html](http://www.nrel.gov/wind/competitiveness-improvement-project.html)

Intergrid LLC SUB 2022-10004