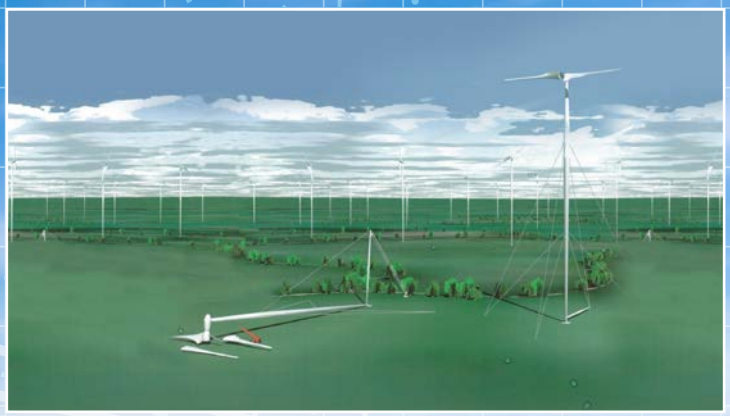

A rendering of Carter Wind Turbines' modernized-concept turbine for land-based wind farms. *Image from Carter Wind Turbines*

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

2020 System Optimization Awardee: Carter Wind Turbines

Project Dates: November 23, 2020–August 22, 2022

Project Overview

Carter Wind's Turbine Model 300 Upgrades Will Increase Energy Production by 18% and Expand Deployment Scenarios

Carter Wind Turbines aims to lower the cost of distributed wind technology and expand deployment. To do so, the company will improve the cost-effectiveness and reliability of midsize wind turbines for remote, off-grid power applications, creating new wind energy deployment opportunities worldwide. Many isolated communities rely on diesel fuel, which is expensive, volatile, and fluctuates with oil prices and fuel transportation costs. For remote locations, transportation costs alone account for a very high percentage of the overall cost of fuel.

Distributed wind, like Carter Wind's 300-kilowatt (kW), two-bladed, horizontal-axis, downwind wind turbine, can help lower energy costs and provide clean, renewable energy for remote communities. Carter Wind pairs its 300-kW turbine with a remote-controlled, variable-speed drive and energy storage system. If the combination of technologies works as intended, it can provide low-cost, rapidly deployable energy to off-grid island and village communities that lack infrastructure like railways, pipelines, roads, transmission lines, or waterways.

> "Carter Wind is excited to partner with the U.S. Department of Energy and the National Renewable Energy Laboratory to develop a portable, rapidly deployable, medium-size, hybrid wind energy with integrated storage solution for isolated communities currently using expensive diesel fuel."
>
> Matt Carter, President and CEO of Carter Wind Turbines

Project Outcomes and Deliverables

Carter Wind Turbines' modernized electrical design may enable 21% more energy production than previous models (517 megawatt-hours per year compared to the 429 that comes with a 23-meter rotor at 6 meters per second average wind speed). This will result in an expected 41% levelized cost of energy reduction to 4.9¢ per kilowatt-hour, which will also allow locations with lower wind energy resources to adopt the technology and increase the number of economically viable projects nationwide.

With upgraded methods, including a programmable logic controller and energy shift module, operators can control the wind turbine from afar. These methods can enable wind energy "time shifting," storing excess power during times of low energy demand (and low energy costs) that can be used later, during peak demand. This improves off-grid operation and makes distributed wind a cost-effective energy source during periods of peak demand when energy prices soar.

Project Approach

With its Competitiveness Improvement Project System Optimization Award, Carter Wind will enhance baseline performance and capabilities of its existing CWT Model 300-23 wind turbine. This product targets diesel electricity markets in developing regions of the world. To achieve the goals of this award, Carter Wind will:

- Design an integrated electrical system and controls
- Evaluate the performance of a variable-speed inverter and energy storage system
- Modernize and test the Carter Model 300 electrical control system's programmable logic controller for remote access and upgrades
- Integrate and bench-test the Carter Model 300 programmable logic controller with converters and energy storage system
- Evaluate, confirm, and verify the electrical system design and loads for certification
- Establish and confirm the manufacturability of the integrated electrical system, programmable logic controller, variable-speed drive, and Cat Energy Shift module, including their engineering design and production plans
- Prepare for field testing and certification.

Project Collaborators

- *ABB*—Inverters, generator, and programmable logic controller
- *Holt-Cat*—Energy storage
- *Invention House*—Inverter design
- *Landes Engineering*—Turbine controls

Project Financial Information

Award Amount: $400,000
Awardee Share: $133,333
Total: $533,333

System Optimization Awards

One of eight types of Competitiveness Improvement Project awards, System Optimization Awards are designed to:

- Optimize a turbine system, like adding a new drivetrain that includes storage, for an existing turbine platform, or
- Develop a new wind energy application like a deployable turbine system.

> "By incorporating energy storage directly into on-site distributed generation, Carter's innovative approach could provide the resiliency critically needed in today's energy systems and will help position distributed wind technology to meet future energy needs."
>
> Dave Snowberg, National Renewable Energy Laboratory Technical Monitor

About the Competitiveness Improvement Project

The U.S. Department of Energy's (DOE) Competitiveness Improvement Project supports U.S. leadership in distributed wind technologies. Managed by the National Renewable Energy Laboratory on behalf of DOE's Wind Energy Technologies Office, the Competitiveness Improvement Project 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*

Download the *DOE fact sheet*.

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