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

2022 System Optimization Awardee: XFlow Energy Company

Project dates: March 23, 2023–Dec. 22, 2024

Project Overview

Rotor Optimization Could Increase Turbine Energy Production by 48%, Reduce Levelized Cost of Energy by 25%

Vertical-axis wind turbines offer several cost-saving advantages over traditional horizontal-axis wind turbines, including lower blade manufacturing costs and a simpler mechanical design. Unfortunately, until now, vertical configurations have not been able to match the power production and durability of more conventional horizontal-axis models.

XFlow Energy Company (XFlow Energy) plans to improve the design and reduce the production costs of its 25-kilowatt (kW) vertical-axis turbine to achieve a 25% lower levelized cost of energy (LCOE). XFlow Energy's efficient turbine also is designed to maximize power production and longevity. Two previous Competitiveness Improvement Project (CIP) awards funded XFlow Energy's development of a 10-meter vertical-axis turbine prototype.

Project Outcomes and Deliverable

XFlow Energy's primary goal is to increase turbine energy production by 48% while only raising total system costs by 9%. This will result in a 25% reduction in LCOE, creating a product that will be competitive in the marketplace and increasing the geographic areas where distributed wind is economically viable.

> "This CIP award allows us to refine technologies and reduce the cost of energy to unprecedented low levels. Previous rounds of CIP funding and access to NREL's world-class engineers have been critical to the development of this turbine."
>
> *—Ben Strom, CTO, XFlow Energy Company*

XFlow Energy's vertical-axis wind turbine prototype in Spanish Fork, Utah, will help the company to minimize costs, simplify drivetrain architecture, and optimize turbine design. *Photo from Jason Mavis, XFlow Energy*

> "XFlow Energy's optimization will mean its vertical-axis design can generate a significant amount of renewable energy while making this technology affordable to an even larger user base."
>
> —*Scott Dana, technical monitor, National Renewable Energy Laboratory (NREL)*

Project Approach

XFlow Energy will optimize the design of its 25-kW vertical-axis wind turbine using the aeroelastic model being validated with data from the company's 2021 CIP Prototype Testing and Installation award. Identifying the ideal rotor size to minimize LCOE without requiring changes to its electrical power conversion system will also simplify the drivetrain architecture and optimize the turbine design, increasing the rotor swept area by as much as 60% and reducing tower, drivetrain, and steel structure costs. In addition, XFlow Energy will explore using a custom permanent-magnet motor to reduce drivetrain complexity and maintenance requirements.

Project Financial Information

Award Amount: $400,000.00

Awardee Share: $171,231.45

Total: $571,231.45

System Optimization Award

One of nine types of CIP awards, System Optimization projects support improvements in existing wind generator designs to optimize the full system or a subsystem of components, leading to a reduced levelized cost of energy.

About the Competitiveness Improvement Project

The U.S. Department of Energy's (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.

The XFlow Energy prototype vertical-axis wind turbine will provide data to help determine optimum rotor size for the final design.
Photo from Jason Mavis, XFlow Energy

More Information

Visit NREL's website at www.nrel.gov/wind/competitiveness-improvement-project.html

XFlow Energy Company, SUB-2023-10296

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National Renewable Energy Laboratory
15013 Denver West Parkway, Golden, CO 80401
303-275-3000 • www.nrel.gov

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