Competitiveness Improvement Project (CIP)

Brent Summerville, NREL

Tuesday, Feb. 28, 2023

Distributed Wind 2023 National Laboratory–Industry Discussion Session

Photo by Dennis Schroeder, NREL 55200

CIP Overview

Siva 250/50 distributed wind turbine. Photo by Padma Kasthurirangan, from PNNL Distributed Wind Photo Gallery

Through the Competitiveness Improvement Project (CIP), the U.S. Department of Energy (DOE) supports small businesses who design and manufacture small or medium wind turbine technology through cost-shared subcontracts awarded via a competitive process.

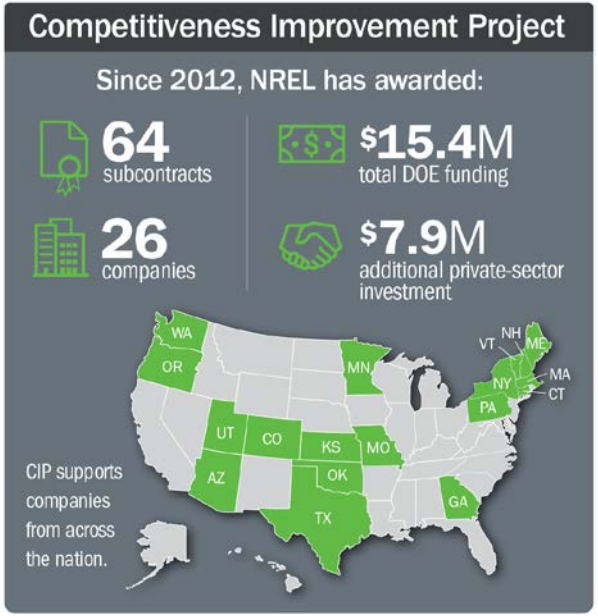
The goals of the CIP are to:

- Improve **cost competitiveness** with other distributed generation technology through **optimized designs** and **advanced manufacturing processes**
- Increase the number of **certified** small and medium wind turbine designs across a wide range of sizes
- **Accelerate deployment** of improved, certified distributed wind energy technology.

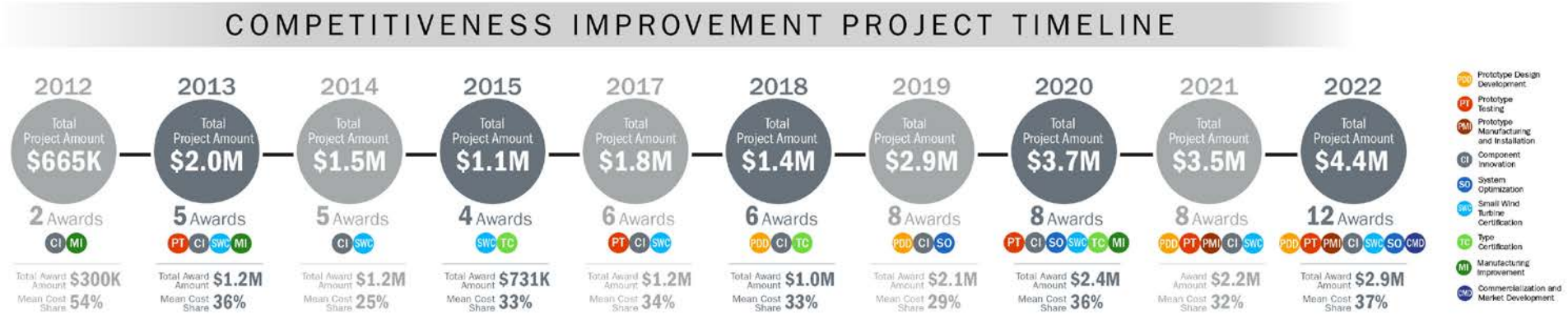
NREL manages the projects through a defined period of performance subcontract, providing technical monitoring and coordinating technical assistance from DOE labs.

CIP History

- NREL has held 10 CIP solicitations since 2012.
- NREL has awarded 64 CIP subcontracts to 26 companies in 18 states, totaling $15.4 million of DOE funding, while leveraging $7.9 million in additional private sector investment.



Images from NREL



2022 CIP Topic Areas


Eocycle EO25, *from PNNL Distributed Wind Photo Gallery*

Prototype Design Development
Moving original concepts from the preliminary design phase to development of a production prototype.

Prototype Manufacture and Installation
Construction and installation of a production prototype of the wind turbine system for field or dynamometer testing.

Prototype Installation and Testing
Validating a prototype wind turbine to determine the commercial readiness of the turbine system.

Component Innovation
Innovation in existing wind turbine designs to improve component(s), leading to a reduced levelized cost of energy.

System Optimization
Improvements in existing wind turbine designs to optimize the full system or a subsystem, leading to a reduced levelized cost of energy.

Small Turbine Certification and/or Listing
For turbines with a peak power up to 150 kW, this focuses on certification to the American Clean Power Association's (ACP) 101-1-2021 standard and can also include listing to electrical safety standards.

Type Certification and Listing
Wind turbine type certification through the IEC System for Certification to Standards Relating to Equipment for Use in Renewable Energy Applications (IECRE) and can also include listing to electrical safety standards.

Manufacturing Process Innovation
Designing, building, and validating improved manufacturing processes for a defined production wind turbine, leading to a reduced levelized cost of energy.

New: Product Commercialization and Market Development
Development of markets for new products or existing products into new markets and assistance in addressing cost barriers to commercialization and rapid, large-scale deployment of improved, certified distributed wind energy technology.

Continuous Innovation Through CIP

Lazard (2021) reports rooftop residential solar power cost of energy as 14.7-22.1 cents/kWh

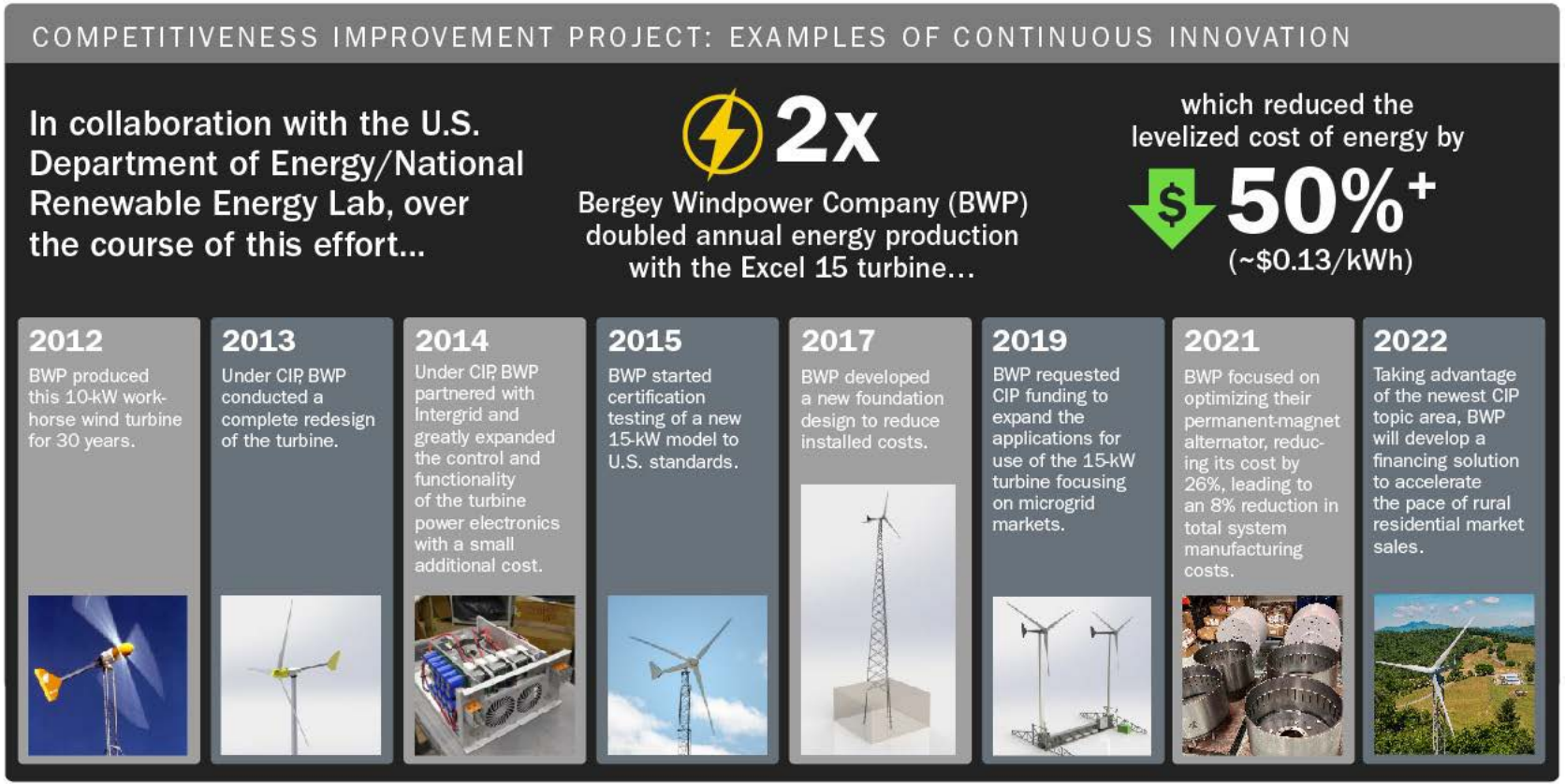


Image from NREL

2022–2023 Project Selections

The U.S. Department of Energy and NREL announced the 12 projects selected from the November 2022 request-for-proposal submissions for 2022–2023 CIP awards.

These historic funding levels and number of projects were made possible by combining fiscal year funding from 2022 and 2023. For this reason, NREL will not open a CIP solicitation in 2023, and the next request for proposals is being planned for 2024.

See NREL CIP (2023) for more details.

Bergey Windpower Company, Norman, Oklahoma: Product Commercialization and Market Development award to develop an innovative financing solution to reduce up-front costs for residential customers.

Carter Wind Turbines, Wichita Falls, Texas: Component Innovation award to develop a 20% taller 60-m tower that will increase energy production and lower costs for its modernized 300-kW wind turbine.

Eocycle America Corporation, Swanton, Vermont:

- Product Commercialization and Market Development to partner with large corporate agricultural organizations to develop business models for expanding the deployment of distributed wind energy across their properties
- Small Turbine Certification and/or Listing award to complete electrical safety listing of the company's Eocycle EOX S-16 turbine system to the UL 6142 standard.

NPS Solutions, Darien, Connecticut: Small Turbine Certification and/or Listing award to complete the UL 1741-SA power converter (inverter) electrical listing required for the U.S. market.

Pecos Wind Power, Somerville, Massachusetts: Component Innovation award to develop the design and tooling for the fabrication of a 14.5-m wind turbine blade that will lead to a lower-cost 85-kW wind turbine.

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Primus Wind Power, Lakewood, Colorado: Small Turbine Certification and/or Listing award to test and certify all six of its micro wind turbine models to standards set by the American National Standards Institute, American Clean Power Association, Underwriters Laboratory, and Federal Communications Commission.

RRD Engineering, Arvada, Colorado: Prototype Design Development award to begin developing BladeRunner, a 150-kW wind turbine that reduces technology costs through a simpler manufacturing process of blades and support structures and by using readily available materials.

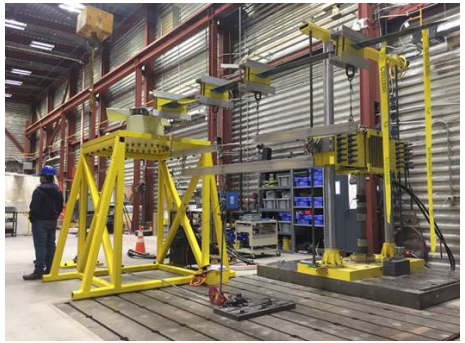
Sonsight Wind, Grayson, Georgia: Prototype Manufacturing and Installation award to manufacture a permanent-magnet generator for its prototype 3.5-kW distributed wind turbine, advancing toward the goal of manufacturing a certified and cost-competitive small-scale distributed wind turbine.

Windurance LLC, Coraopolis, Pennsylvania: Component Innovation award to design a modular energy storage solution that will be certified by a third party to the UL 1741 standard. The innovative, scalable design presents a solution for a wide range of distributed wind turbine sizes (about 15–160 kW) and applications.

Windward Engineering, Spanish Fork, Utah: Prototype Installation and Testing award to install and test a prototype 60-kW, three-bladed, downwind, horizontal-axis wind turbine with independent pitch-to-stall control.

Xflow Energy Company, Seattle, Washington: System Optimization award to optimize its 25-kW, three-bladed, vertical-axis wind turbine to make it suitable for a wide range of customers in the U.S. grid-connected market.

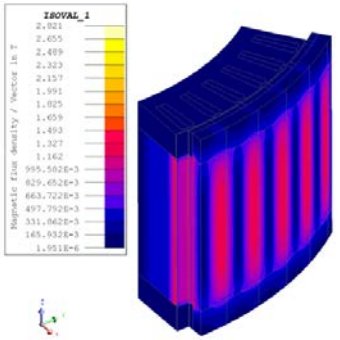
CIP Technical Assistance Examples



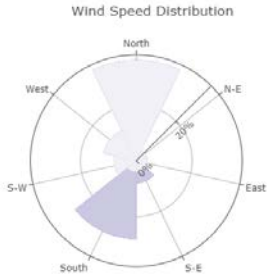
Blade testing for the Bergey Excel 15 at NREL's Flatirons Campus
Photo by Scott Hughes, NREL

NREL/Sandia VAWT modeling support for Xflow Energy
Image from Xflow Energy

Aeroelastic modeling support for QED Wind Power
Image from QED Wind Power



Magnet modeling and optimization for the Bergey Excel 15 alternator
Image by Hannes Labuschagne, Latha Sethuraman, NREL



Multi-lab Tools Assessing Performance (TAP) assistance for wind resource assessment
More information at NREL TAP (2023)

dGen

NREL Distributed Generation Market Demand (dGen™) modeling assistance
More information at NREL dGen (2023)

Next Steps in CIP Evolution

Expand Technical Assistance Across DOE Labs

- Promote opportunities such as Microgrids, Infrastructure Resilience, and Advanced Controls Launchpad (MIRACL), Tools Assessing Performance (TAP), Distributed Generation Market Demand (dGen), Wind Hybrid Integration Platform (WHIP), and Distributed Integrated Energy Laboratory (DIEL) .

Develop Scoring Criteria Beyond LCOE

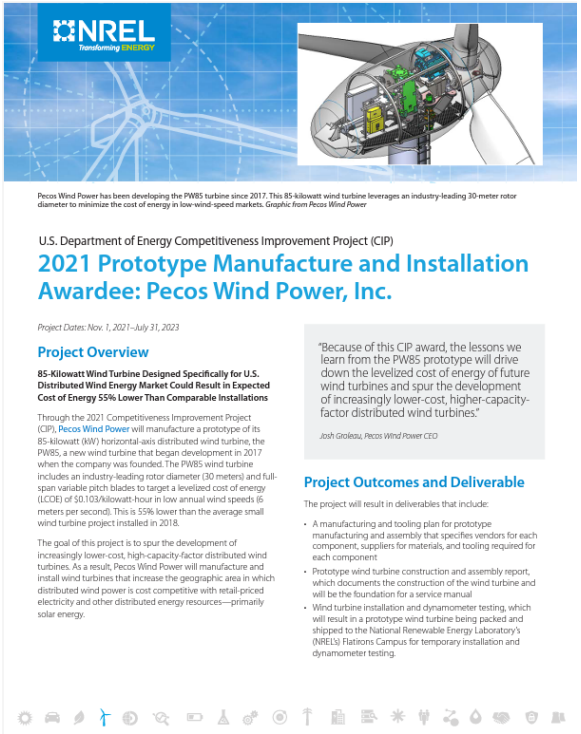
- Value projects directed at market development and commercialization including underserved communities and populations
- Host industry workshop to gather input on CIP innovation.

ICC-SWCC Project for Certification Readiness

- No-cost preliminary reviews funded by NREL to become a prerequisite for CIP applications (*see NREL ICC-SWCC [2023] for more information).*

Diversity, Equity, and Inclusion

- Expand support for women- and minority-led businesses.



NREL Transforming ENERGY

Pecos Wind Power has been developing the PW85 turbine since 2017. This 85-kilowatt wind turbine leverages an industry-leading 30-meter rotor diameter to minimize the cost of energy in low-wind-speed markets. *Graphic from Pecos Wind Power*

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

2021 Prototype Manufacture and Installation Awardee: Pecos Wind Power, Inc.

Project Dates: Nov. 1, 2021–July 31, 2023

Project Overview

85-Kilowatt Wind Turbine Designed Specifically for U.S. Distributed Wind Energy Market Could Result in Expected Cost of Energy 55% Lower Than Comparable Installations

Through the 2021 Competitiveness Improvement Project (CIP), Pecos Wind Power will manufacture a prototype of its 85-kilowatt (kW) horizontal-axis distributed wind turbine, the PW85, a new wind turbine that began development in 2017 when the company was founded. The PW85 wind turbine includes an industry-leading rotor diameter (30 meters) and full-span variable pitch blades to target a levelized cost of energy (LCOE) of $0.103/kilowatt-hour in low annual wind speeds (6 meters per second). This is 55% lower than the average small wind turbine project installed in 2018.

The goal of this project is to spur the development of increasingly lower-cost, high-capacity-factor distributed wind turbines. As a result, Pecos Wind Power will manufacture and install wind turbines that increase the geographic area in which distributed wind power is cost competitive with retail-priced electricity and other distributed energy resources—primarily solar energy.

"Because of this CIP award, the lessons we learn from the PW85 prototype will drive down the levelized cost of energy of future wind turbines and spur the development of increasingly lower-cost, higher-capacity-factor distributed wind turbines."

Josh Groleau, Pecos Wind Power CEO

Project Outcomes and Deliverable

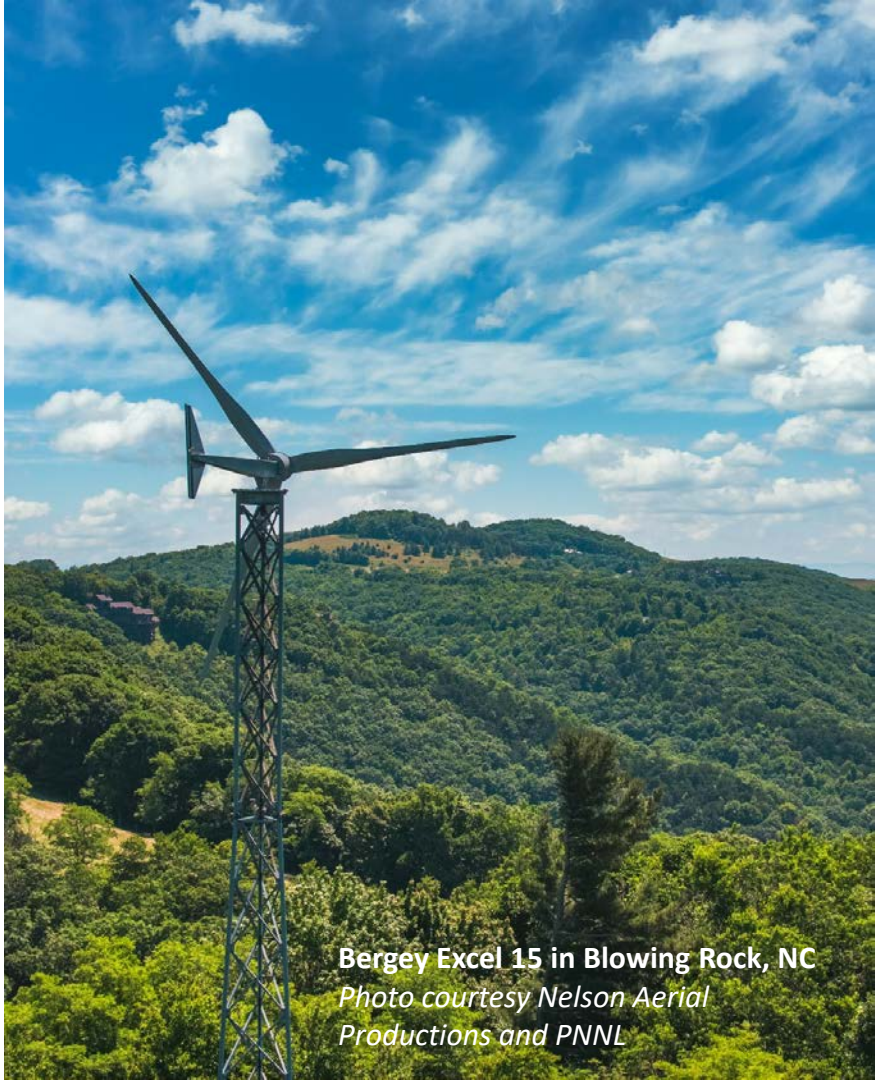
The project will result in deliverables that include:

- A manufacturing and tooling plan for prototype manufacturing and assembly that specifies vendors for each component, suppliers for materials, and tooling required for each component
- Prototype wind turbine construction and assembly report, which documents the construction of the wind turbine and will be the foundation for a service manual
- Wind turbine installation and dynamometer testing, which will result in a prototype wind turbine being packed and shipped to the National Renewable Energy Laboratory's (NREL's) Flatirons Campus for temporary installation and dynamometer testing.

CIP project fact sheets are available on the NREL CIP website for 2020 and 2021 projects.

NREL CIP (2023)

Questions?



Bergey Excel 15 in Blowing Rock, NC
Photo courtesy Nelson Aerial Productions and PNNL

Thank you

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