Improving Cost Competitiveness of Small and Medium Wind Turbines and the Competitiveness Improvement Project (CIP)

Summary

- Small- and medium-size wind turbines generally have a higher levelized cost of energy compared to large-scale turbines.
- The U.S. Department of Energy's *Competitiveness Improvement Project* (CIP) aims to increase the cost-competitiveness of the small- and medium-size turbines by optimizing their design and performance.
- The project has helped small businesses to improve design, performance, and certification and has successfully led to increased energy production and cost reduction in some small size wind turbines.

Background

This advisory is a resource of the *Rural Area Distributed Wind Integration Network Development* (RADWIND) project,[1] which aims to understand, address, and reduce the technical risks and market barriers to distributed wind adoption by electric cooperatives and other rural utilities.

Cost Competitiveness for Small and Medium Size Wind Turbines

Levelized cost of energy (LCOE) is often used as a metric to compare different generation technologies. It also indicates if there are potential energy savings for a consumer-member when they install behind-the-meter (BTM) generation over the same billing period. It includes the expected installation cost and the operation and maintenance cost for the project's lifetime in a price per unit of energy (e.g., cents/kWh).

Since 2010, deployment of small-scale (100 kW or less) wind turbines has accounted for most of the distributed wind projects installed annually. However, they account for only modest capacity as compared to larger size turbines. In addition, the LCOE is higher for the small- and medium-scale wind turbines in comparison to the large-scale turbines and other competing technologies like solar PV. These cost challenges currently hinder the potential for wide-spread adoption of small- and medium-size wind energy. While there are some cost benefits of larger turbines that cannot be realized with smaller energy systems, there are some improvements pioneered on large-scale turbines that can be realized in smaller devices and help improve the LCOE.[2]

[1] ***This material is based upon work supported by the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE) under the Wind Energy Technologies Office Award Number DE-EE0008958.***
[2] Orrell, A., Kazimierczuk, K., & Sheridan, L. (2021). *Distributed Wind Market Report: 2021 Edition* (PNNL-31729). Pacific Northwest National Laboratory, available here.

What is the Competitiveness Improvement Project?

The *Competitiveness Improvement Project* (CIP) is a U.S. Department of Energy (DOE) funded project, administered by the National Renewable Energy Laboratory (NREL), to fund contractors and manufacturers through a competitive process and has been in place since 2012. The DOE Wind Energy Technology Office (WETO)'s *Distributed Wind Research Program* has set objectives to increase the competitiveness of the small- and medium-size wind turbines in comparison with other distributed energy resources (DER), which align with CIP goals using LCOE as a metric to measure the increase in competitiveness.[3]

The technical objectives of CIP include increasing the performance and the capability of the small- and medium-sized wind turbines, reducing the hardware cost, and supporting testing and certification for performance and safety. The support of the project has been focused on wind turbines less than 1 MW to achieve the following:

- Design Optimization,
- Manufacturing Processes Advancements,
- Perform Turbine and Component Testing and Certification, and
- Accelerating Pathways for Commercialization.[4]

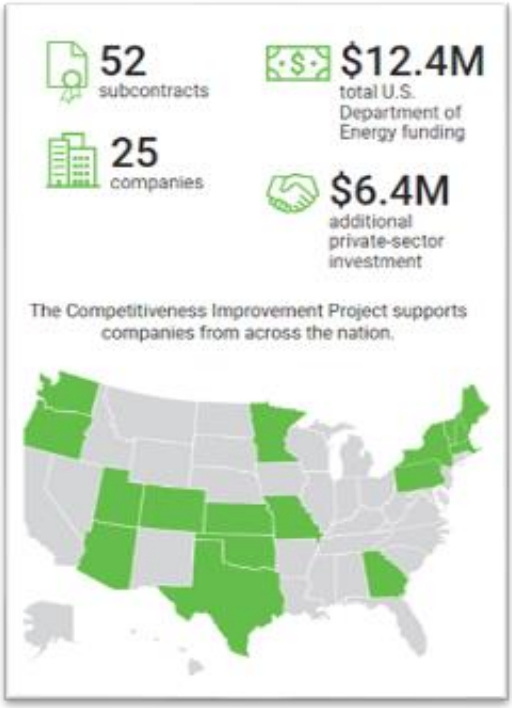

Figure 1: Since 2012, CIP has awarded 52 sub-contracts to 25 companies across the US, totaling $12.4 million of DOE funding[4]

What has been the impact of CIP?

Since starting the project in 2012, CIP has helped several small businesses across the country identify innovative solutions to distributed wind technology challenges. See Figure 1. Awarding project CIP grants has helped distributed wind energy become more cost-competitive, improved its integration and interoperability with DER technologies, and increased the number of small and medium-sized wind turbine designs tested to national and international standards.

One featured example in the CIP website is the Bergey Windpower (BWP) Excel 15 turbine that has double the annual production with a reduction of LCOE by more than 50% (13 cent/kWh) compared to the company's Excel 10 turbine model design. More information is available in the project website.[4]

[3] Distributed Wind Competitiveness Improvement Project fact sheets, available here and here.
[4] Competitiveness Improvement Project, NREL website, available here.

NRECA America's Electric Cooperatives

What do Cooperatives Need to Know?

Unlike large-scale wind turbines deployed as distributed generation, which are most often installed front-of-the-meter, small- and medium-scale wind turbines are generally used behind-the-meter to serve a local residential, commercial, or institutional load. Due to this use-case, the LCOE and potential cost savings of these turbines are generally measured against retail electric costs rather than wholesale. Electric cooperatives and other rural utilities are less likely to use these smaller turbines for their owned or contracted projects, but as Trusted Energy Advisors they may want to help educate interested member-owners about these technologies, optimize their deployment on their grid, or in some cases offer services around them.[5] Along with certification,[6] the use of wind turbines and associated technologies that have been through the CIP process can provide additional assurance about the quality and cost-effectiveness of a particular turbine and its manufacturer.

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Additional Information on NRECA Research's RADWIND Project

For more information on the RADWIND project and additional resources, please visit the project landing page at www.cooperative.com/radwind.

Want to stay informed of our progress with the RADWIND project, and provide your input and feedback? We welcome all NRECA voting members to join the project as advisors. Contact our team at: RadwindProject@nreca.coop.

[5] For more discussion of behind-the-meter business models, see Section 6 of the RADWIND Business Case Report, available here.
[6] There is going to be another advisory that address small and medium sized wind turbines certification.

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