Annual Report 2024

Task 41

Photo: *A Pecos Wind Power PW85 distributed wind turbine project came online in 2024 in Kansas. (Photo credit: Pecos Wind Power.)*

Enabling Wind to Contribute to a Distributed Energy Future

Author: Ian Baring-Gould, National Renewable Energy Laboratory, United States of America

IEA Wind Task 41 is an international group of researchers from ten member countries dedicated to advancing wind technology as an accessible, cost-effective, and reliable distributed energy resource.

Our objective is to coordinate international distributed wind energy research around priority topics to increase the feasibility and visibility of wind technology as a distributed energy resource.

Calendar year 2024 continued efforts around four primary research themes: (1) informing standards and technical specifications for small, distributed wind turbines, (2) integrating distributed wind into evolving electricity systems with a focus on hybrid power systems, (3) analyzing human dimensions of distributed wind through valuation exercises and stakeholder engagement, and (4) disseminating information through collaboration, outreach, and socialization of Task 41 work products.

In 2024, researchers drafted a best practice guide for the siting and permitting for small wind turbines across member countries, providing actional recommendations for the siting of small and distributed wind turbines. Supportive research has also continued relative to the IEC small wind turbine standard, 61400-2 which is currently undergoing revision.

Task 41 members also implemented outreach and technical presentations at the 2024 TORQUE conference in Florence, Italy; the NAWEA/WindTech Conference in New Brunswick, United States; and the 9th International Conference on Small and Medium Wind Energy in Kammersgaardsvej, Denmark. Task 41 working group meetings were held in Florence and Kammersgaardsvej. Task members served as track leaders at all three conferences, ensuring the dissemination of distributed wind research by industry and academia.

Introduction

Task 41 was initiated in January 2019 and extended for a second phase through 2026. Task members work to advance wind technologies as accessible, cost-effective, and reliable distributed energy resources. See Table 1 for the list of participating countries. A recent study in the United States reported great economic opportunities for the use of distributed energy, including wind energy, to address rising costs, grid reliability, and increased energy demands through electrification [1]. Distributed wind can also provide an easy-to-deploy alternative to larger land-based and offshore wind projects to support rapid power system growth. Individuals, businesses, farms, and local governments install distributed wind technologies to offset retail power costs or secure long-term power cost certainty, support grid operations and local loads, and electrify remote locations and assets not connected to a centralized grid.

The objective of Task 41 is to coordinate international distributed wind energy research around priority topics that increase the feasibility and visibility of wind technologies as distributed energy resources. Anticipated results are expected to include technical reports, journal articles, and other products that highlight key research findings under the auspices of the task, including research to inform the fourth revision of the IEC 61400-2 standard; enable participation in conferences focused on small and medium wind turbines; and promote expanded collaboration and engagement in the distributed energy research fields.
Researchers from ten member countries participate in Task 41 and collaborate with researchers from several additional nations who participate as observers. Task members engage closely with national wind energy organizations and undertake outreach through technical conferences and other engagement opportunities.

Progress and Achievements

Work in 2024 focused on two areas: improved understanding of the impacts of higher turbulence on distributed-scale wind turbines and improved understanding of distributed wind turbine siting.

Results from research focused on turbulence and distributed wind turbines helped to inform the revision of the IEC 61400-2 ED.3.0. small wind turbine standard. The 2013 IEC 64100-2 standard assumed a standard turbulence coefficient for the design of small wind turbines.

COUNTRY/SPONSOR	INSTITUTIONS
Austria	University of Applied Sciences FM Technikum Wien
Canada	Nergica, University of Calgary
China	Inner Mongolia University of Technology
Denmark	Technical University of Denmark, DTU Wind and Energy Systems, Nordic Folkecenter
Greece	Centre for Renewable Energy Sources and Saving
Ireland	Dundalk Institute of Technology
Italy	University of Perugia, University of Genoa
Korea	Korea Institute of Energy Research
Spain	CIEMAT
United States	National Renewable Energy Laboratory, Pacific Northwest National Laboratory, Wind Advisors Team

Table 1. *Countries Participating in Task 41*

Although reasonable given that most small, distributed-scale wind turbines are installed in locations likely to have high turbulence, the revision committee requested an assessment of turbulence impacts on small wind systems below 150 kilowatts in size. Three key questions were considered:

- What is a valid turbulence value?
- How will a higher turbulence requirement impact turbine loads?
- Is this impact similar across turbine design archetypes?

Efforts in 2024 included cataloging data from operating wind turbines as well as implementing new testing programs and wind tunnel testing of turbines to better characterize the impacts of tail fins on turbine response. These efforts led to the refinement of the simplified load models for small wind turbines with conformation of results considered through wind tunnel and field tests on yaw behavior.

In addition to turbulence research, task members in 2024 developed best practices for international wind turbine siting and zoning rules by developing a simplified site assessment methodology for incorporating community impacts for distributed-scale projects (to be published in 2025). They also assessed siting and zoning requirements across Task member nations; see the Highlight section for more details on this work. IEA Task 41 members also conducted ongoing engagement to develop siting guidelines for distributed wind turbines in arctic climates and research on wind as part of hybrid or microgrid energy systems which are expected to be published in 2025.

Task members also worked to ensure opportunities for the publication of distributed wind technologies research by leading tracks at major wind energy conferences in Europe and the United States. Having platforms for academic students and researchers to present findings may help to encourage distributed wind energy research, which in turn can help to advance the technology and increase awareness of distributed wind as a viable renewable-based resource.

Highlights

The main Task 41 highlight for 2024 was researching best practices for the siting and permitting of distributed wind energy that can be used to better understand and support national deployment efforts. Researchers conducted interviews in five nations (Austria, Denmark, Ireland, Italy, and the United States) to identify key requirements to specific parameters, such as turbine height and allowable noise levels. The work will be published as a best practice guide in 2025. After assessing distributed-scale wind siting and permitting efforts, researchers concluded that the wide variety of requirements, most of which are not based on science or impacts, highlight the need for expanded research to justify distributed-scale siting requirements.

Another 2024 highlight for Task 41 was publishing three informational videos explaining (1) how wind energy technologies can be used effectively as distributed energy resources, (2) the purpose of Task 41, and (3) the impact that international collaboration has on distributed wind research. The videos feature interviews conducted with Task members during a Task 41 meeting in 2023 [2] and have been viewed almost 700 times. The most popular of these, which describes how wind energy technologies can be used effectively as distributed energy resources, is the most viewed of the IEA Wind TCP video series.

Outcomes and Significance

Acceptance of wind energy technologies varies from jurisdiction to jurisdiction across the globe. Task 41 members from Austria expanded their survey work around perceptions of small wind energy technologies, building on their baseline work understanding perspectives within the country. This effort supported the implementation of a broader survey of siting and permitting rules across five countries (Austria, Denmark, Ireland, Italy, and several locations in the United States) to better understand and develop a best practice guide for distributed-scale wind siting and permitting. The best practice guide will be published in 2025.

Task members have also participated in the revision of IEC standard 61400-2, serving on the technical committee while undertaking collaborative research to support some of the proposed revisions to the standards.

Next Steps

Task 41 members will continue to develop products related to the appropriate siting of distributed wind turbines. They will present their work at the 2025 Wind Energy Science Conference, including hosting a distributed wind-focused mini-symposium, as well as the International Conference on Small and Medium Wind Energy and the 2025 NAWEA/WindTech conference. In-person meetings will be held in combination with some of these events to support ongoing collaboration across task activities including turbulence research findings, best practices for high wind contributions in isolated hybrid power systems, and a capstone publication building from the publication Current Status and Grand Challenges for Small Wind Turbine Technology [3].

References

[1] McCabe, K., A. Prasanna, J. Lockshin, P. Bhaskar, T. Bowen, R. Baranowski, B. Sigrin, and E. Lantz. (2022). "Distributed Wind Energy Futures Study." Golden, CO: National Renewable Energy Laboratory. NREL/TP-7A4082519; *nrel.gov/analysis/distributed-wind-futures.html.*

[2] IEA Wind Task 41 (2024). Playlist of Distributed Wind and Task 41 Research; *youtube.com/playlist?list=PL2-7oFf-HOGR4lfhh7Un3O9136ZzAjo_sU.*

[3] Bianchini et. Al. (2022). "Current status and grand challenges for small wind turbine technology." Wind Engineering Science, 7, 2003-2037,2022; *docs.nrel.gov/docs/fy23osti/84624.pdf*

Task Contacts

Ian Baring-Gould
Operating agent
National Renewable Energy Laboratory
ian.baring-gould@nrel.gov

Danielle Preziuso
Operating agent
Pacific Northwest National Laboratory
danielle.preziuso@pnnl.gov

Website
iea-wind.org/task41/