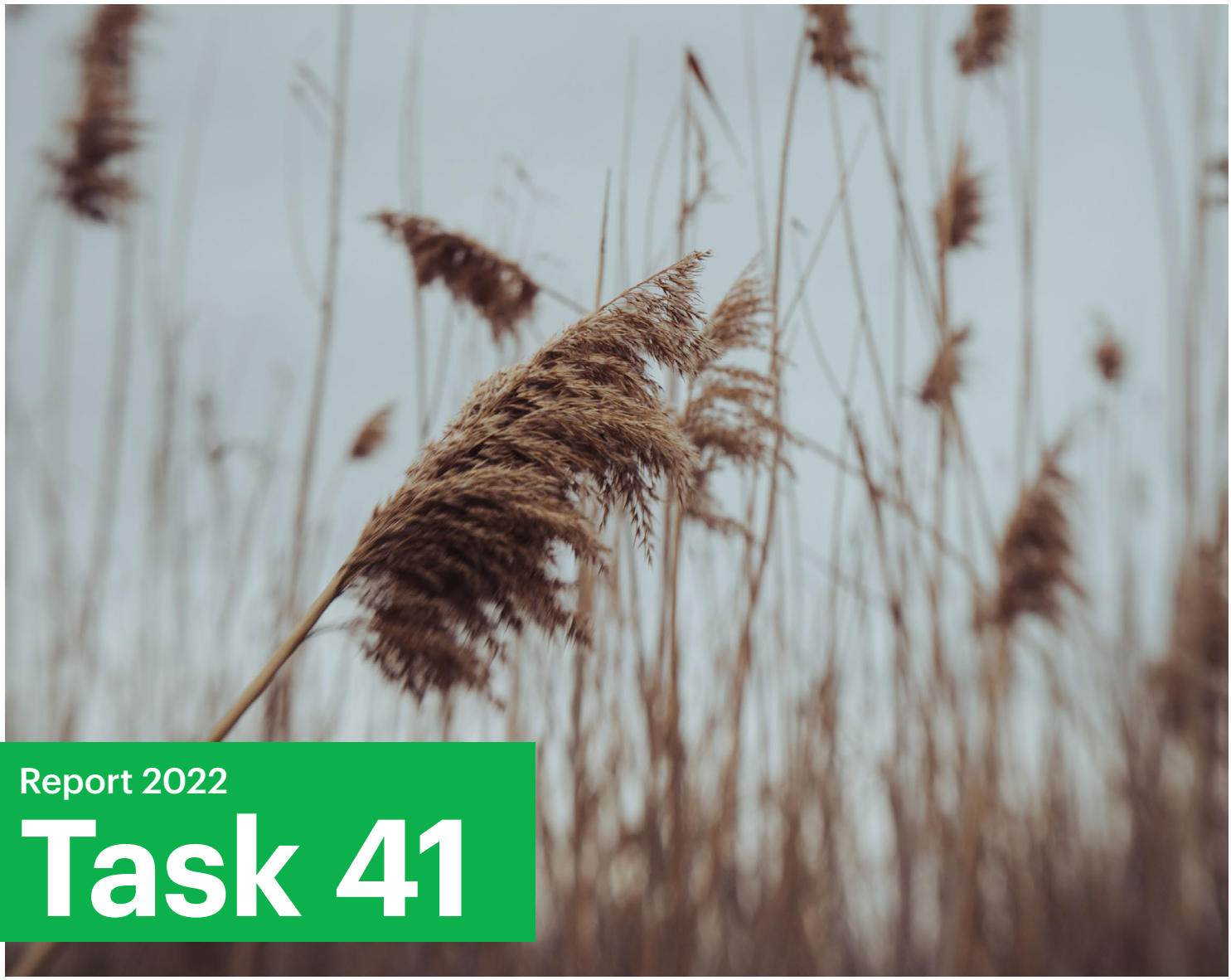

Report 2022

Task 41

Photo: Stanislav Kondratiev / Pexels.

Enabling Wind to Contribute to a Distributed Energy Future

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Task 41 aims to coordinate international distributed wind energy research around priority topics to increase the feasibility and visibility of wind technology as a distributed energy resource. In October 2022, the Task published the "Current status and grand challenges for small wind turbine technology"paper.

Summary

IEA Wind Task 41 is an international group of researchers from eleven member countries and associations dedicated to advancing wind technology as a 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.

The calendar year 2022 was a transition year for Task 41, as Task members completed research planned for the initial phase of the Task and prepared to begin the next phase under a four-year extension. The new work

plan is organised around working relationships developed among Task members during the initial phase and their shared research goals at the national level.

A notable highlight from the past year is the publication in October 2022 of the "Current status and grand challenges for small wind turbine technology" paper. The paper was led by the European Academy of Wind Energy Small Wind Committee and included many members of Task 41 as authors.

Introduction

Task 41 was initiated in January 2019 to advance wind technology as a cost-effective and reliable distributed energy resource. Individuals, businesses, farms, and communities install distributed wind to offset retail power costs or secure stable long-term power costs, support grid operations and local loads, and electrify remote locations and assets not connected to a centralised grid. The objective of Task 41 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.

Results to date include the following:

- Research to support updates to design and testing standards for small and mid-sized wind turbines.
- The creation of a distributed wind metadata catalogue.
- Research to enable efficient and reliable integration of wind into distribution systems, isolated grids, and microgrids.
- Outreach and collaboration with other IEA Tasks, international organisations, and universities.
- Research on applying advances of large-scale wind technology innovations to smaller-scale wind technology.

Table 1 provides a list of participants and their organisations. Task 41 employs members from 11 countries and includes the participation of Singapore as an observer.

Progress and Achievements

In the United States, the implementation of the Infrastructure Investment and Jobs Act (IIJA) and the Inflation Reduction Act (IRA) in 2022 presents unprecedented opportunities for clean energy deployment, including distributed wind. With stable, long-term policies now in place, the U.S. distributed wind industry expects to see significant market expansion in the United States. Comparable policies could accelerate distributed wind deployment in other countries as well.

Nevertheless, each Task 41 member-country faces similar technical, economic, market, and performance barriers to distributed wind market expansion. As such, an international group of authors published a comprehensive paper about these challenges for small wind, of which many are applicable to distributed wind in general.

The "Current status and grand challenges for small wind turbine technology" paper was published by Wind Energy Science in October 2022. Members of the European Academy of Wind Energy Small Wind Committee led the paper development with many Task 41 members as authors.

The grand challenges identified in the paper are as follows:

1. Improve energy conversion of modern small wind turbines through better design and control, especially in the case of turbulent wind.
2. Improve prediction and reliability of long-term turbine performance despite limited resource measurements.
3. Improve the economic viability of small wind energy.
4. Facilitate the contribution of small wind turbines to energy demand and electrical system integration.
5. Foster engagement, social acceptance, and deployment for global distributed wind markets.

The key enablers needed to address these challenges are shown in Figure 1.

Some specific examples of barriers to deployment in member countries include the following:

- New inverter regulations in Austria (Grand Challenge #4).
- Social acceptance issues in Korea, particularly around sound (Grand Challenge #5).
- Lack of medium-size turbines (~500 kW) suitable for cold climates in Canada (Grand Challenge #5).

However, some promising developments include:

- Off-grid development in Canada to reduce diesel dependency.
- Increasing electricity costs in Spanish islands driving interest in wind energy.
- New possibilities for distributed wind with the 2021 Renewable Energy Communities Italian Decree.
- Special incentives for energy communities in Greece with up to 6 MW of wind capacity.

The lack of knowledge that wind technology can be an effective distributed energy resource is a deployment barrier and hindrance to market expansion. Task 41 research is helping to address challenges,

Table 1. Countries Participating in Task

COUNTRY	PARTICIPANT	ORGANISATION
Austria	Alexander Hirschl Daniel Österreicher	University of Applied Sciences FM Technikum Wien
Belgium	Mark Runacres	Vrije Universiteit Brussel
Canada	Mauricio Higuita Cano Dominic Bolduc Imen Romdhane	Nergica
	David Wood	University of Calgary
China	Keqilao Meng Jia Yan	Inner Mongolia University of Technology
Denmark	Anca Hansen Tom Cronin Kaushik Das Mark Kelly David Rudolph	Technical University of Denmark
	Tonny Brink	Nordic Folkecenter for Renewable Energy
Greece	Nikolaos Stefanatos Eftihia Tzen	Center for Renewable Energy Sources and Saving
Ireland	Raymond Byrne Paul MacArtain	Dundalk Institute of Technology
Italy	Francesco Castellani Linda Barellli	University of Perugia
	Luisa Pagnini	University of Genoa
South Korea	Seokwoo Kim	Korea Institute of Energy Research
Spain	Ignacio Cruz Luis Cano Beatriz Ramos Rafael Carnicero	CIEMAT
United States	Alice Orrell Bethel Tarekegne Danielle Preziuso Sarah Barrows	Pacific Northwest National Laboratory
	Ian Baring-Gould Brent Summerville Ruth Baranowski	National Renewable Energy Laboratory
	Trudy Forsyth	Wind Advisors Team

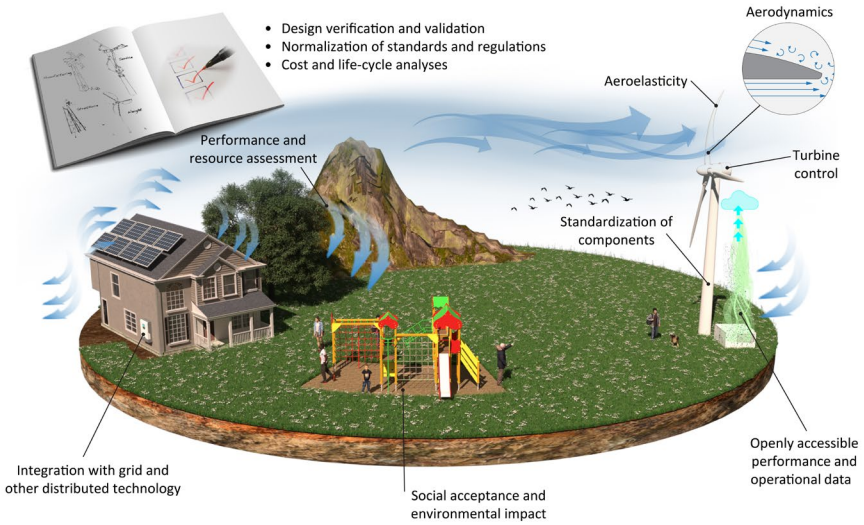

Figure 1. To catalyse significant deployment of small wind turbines worldwide, the key enablers shown in the figure are needed to address existing challenges. *Figure 1 credit: National Renewable Energy Laboratory.*

promote promising developments, and provide resources to increase the feasibility and visibility of wind technology as a distributed energy resource.

Highlights

After two cancellations due to the COVID-19 pandemic, Task 41 members joined members from Task 52 (Large-Scale Deployment of Wind Lidar) and Task 54 (Cold Climate Wind Power) at the University of Applied Sciences FM Technikum Wien in Vienna, Austria for three days in October 2022 for a joint meeting. The Task members held both separate working group meetings in parallel and collaborative meetings together to explore how the Tasks could further engage with each other. During the joint meeting, the Task members heard presentations from four student researchers at universities in Austria, Australia, the Netherlands, and Denmark as part of the University Research Collaborative sponsored by Task 41. The Austrian Wind Energy Association (IG Windkraft) also organised a co-timed industry event the day before the meetings started at which Task members were invited to present their research.

Outcomes and Significance

The desired outcome of Task 41 is to enable wind as a cost-effective and reliable distributed energy resource in a world increasingly reliant on distributed energy resource-generated electricity. While much research has already been conducted on solar photovoltaics and battery storage systems as distributed energy resources, wind can offer additional, and to some extent, unrealised resource diversity and resilience benefits to distribution systems, microgrids, and isolated grid systems. Through collaborative research, Task 41 members intend to unlock these benefits to increase wind technology's effectiveness as a distributed energy resource. These efforts in turn will allow distributed wind to play a significant role in the decarbonisation of our economies.

Next Steps

Task 41 will continue with a 4-year Task extension that was initiated in January 2023. Task members will impact. The four primary research themes of the new work plan are standards and technical specifications, integration, social science, and information dissemination. The expected results are technical reports, journal articles, and other products that highlight key research findings; research results that can inform the fourth revision of the IEC 61400-2 standard; established participation in conferences focused on small and medium wind turbines; and expanded collaboration and engagement in the wider distributed energy research fields.

References

[1] Bianchini, A., Bangga, G., Baring-Gould, I., Croce, A., Cruz, J. I., Damiani, R., Erfort, G., Simao Ferreira, C., Infield, D., Nayeri, C. N., Pechlivanoglou, G., Runacres, M., Schepers, G., Summerville, B., Wood, D., and Orrell, A. (2022), *Current status and grand challenges for small wind turbine technology* (Wind Energ. Sci., 7, 2003–2037). https://doi.org/10.5194/wes-7-2003-2022.

Photo 1. IEA Wind TCP Members from Tasks 41, 52, and 54 held a joint meeting at the University of Applied Sciences FM Technikum Wien in Vienna, Austria in October of 2022. *Photo credit: Alex Hirschl / University of Applied Sciences FM Technikum Wien.*

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