3 Distributed wind stakeholders' workshop 2

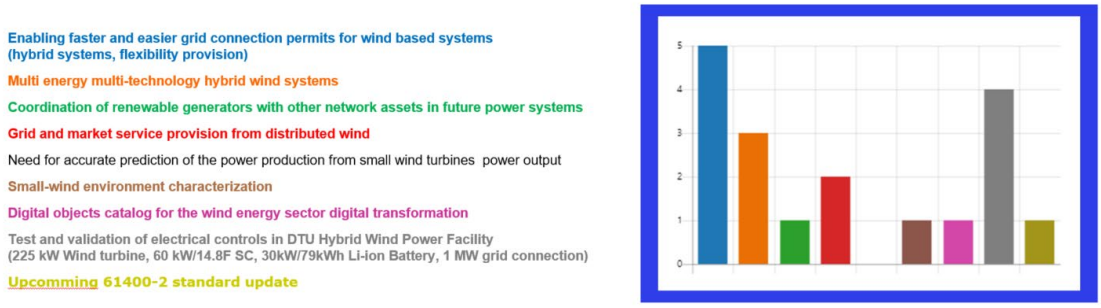
This workshop, organized by DTU Wind and hold online on 23 March 2021, due to the pandemic Corona had a particular target to identify how research can support and strengthen the Danish industry to deploy more wind power and renewable energy at distribution grid to meet the Danish vision of green transition. The workshop supported the work in the IEA Wind TPC Task 41 and provided results anchored in Denmark, thus creating added value for Danish players.

This workshop targeted to generate, define, and discuss potential new collaboration ideas/projects of particular Danish interest in various relevant distributed wind (DW) topics, for example, DW standards, DW integration, support of DW in MV-LV networks, and DW open data.

To initiate good and expanded discussions of relevance for the Danish players and stakeholders and thus influence the research and development in the field of DW on a national level, prior the workshop the participants were asked to fill in a *form* easily to approach, where they could directly indicate & suggest which topics they were interested in, which were their preferences for the workshop type and for their availability. The following topics were presented for discussions:

- Enabling faster and easier grid connection permits for wind-based systems.
- Multi-energy multi-technology hybrid wind systems
- Coordination of renewable generators with other network assets in future power systems
- Grid and market service provision from distributed wind
- Power curves and rating of small turbines
- Small-wind environment characterization
- Catalog of available digital objects (data, workflows, algorithms, models) supporting the digital transformation of the wind energy sector
- Test and validation of electrical controls in DTU hybrid Wind Power Facility

The results of the survey are depicted in the following.



The main take-away messages from the workshop discussions are:

- There is a clear need to enable faster and easier grid connection permits for wind-based systems (hybrid systems, flexibility provision).

- Testing and validation of electrical controls in DTU hybrid Wind Power Facility are of high relevance for the Danish stakeholders.

- Hybrid power plants do not bring a high value to grid operators in Danish perspective, i.e., EnergiNet sees large PV plants as valuable. Furthermore, the grid capacity is a strong limiting factor.

- Small wind power market is more active outside Denmark as well as in small islands, even though small wind turbines can be in general integrated in the existing grid, without grid strengthening. The cost of small wind turbines is higher than their benefits, i.e., using new technologies is quite expensive compared with the limited benefits. In this respect a decreasing cost of component would be beneficial.

- Coordination of renewable generators inside or between hybrid wind systems could be a solution for improvement of the wind business in distribution grids. Furthermore, a TSO/DSO co-ordination in Denmark could be a short-term solution avoiding transmission grid reinforcements.

- There is a lack of public awareness for community wind / solar hybrid power plants.

- The regulatory restrictions in respect to distributed wind & hybrid power plants are challenging both big and small companies.

- There is a potential in increasing the value of small, distributed wind and hybrid power plants for communities, i.e., small wind *can* support electric heating, EV charging is already a bottleneck in CPH, control the small networks rather than adding to transmission network loads, local power consumption in MV possible minimizing TSO/DSO interaction.

One of the most important conclusions of this workshop was that a demonstration project for the value of hybrid in the grid could push the regulation in the right direction.

In the following, the presentations of workshop 2 are included.

2nd Danish Distributed Wind Stakeholders Workshop

IEA Wind TPC Task 41

Anca Hansen

Workshop program

14.00 – 14.10	Welcome Short presentation of the participants	Anca D. Hansen
14.10 – 14.25	IEA Wind TPC Task 41 & Danish EUDP project	Anca D. Hansen
14.25 – 14.50	Discussions on perspectives & challenges	Kaushik Das
14.50 – 15.00	Coffee break	
15.00 – 15.25	Discussions on potential solutions/ approaches	Tom Cronin
15.25 – 15.50	Wrap-up and action tasks	Mark Kelly
15.50 – 16.00	AoB	

Distributed Wind stakeholders' workshops – overall goals

- **Build up** a strong stakeholder network within the area of **distributed wind (DW) technology**
  - organize and strengthen the Danish influence and participation in IEA collaborations
- **Identify** how research can support and strengthen the Danish distributed wind (DW) players and stakeholders.
  - have **expanded discussions** of relevance for the Danish players and stakeholders
  - generate and define **potential new collaboration ideas** of particular Danish interest in various relevant DW topics, i.e. DW standards, DW integration, support of DW in MV-LV networks, and DW open data.
  - **receive input/feedback** both from Danish wind energy industry and research community - influence the research and development in the field of DW on a national level.
- **Ensure** close collaboration between **private** and **public** actors, **national** and **international** DW players
- **Result** in new project collaborations
- **Support** the work in the IEA Wind TPC Task 41

DTU Wind Energy expertise within DW

- **Expertise**
  - wind turbine standards
  - integration of wind power
  - modelling weather dependent generations and assessing their impacts on power and energy systems
  - wind power variability and predictability
  - resource assessment modelling.

- **Projects**
  - PSO Netvind project
  - PSO Replan project
  - EUDP Small wind marked project
  - EUDP Online WAsP project
  - EUDP IEA Task 41
  - Danida funded project Kenya MiniWind
  - IEA Wind TPC Task 27 Small Wind Turbines in High Turbulence Sites
  - COST Action TU1304 WINERCOST
  - FP7 Integrated Research Programme in Wind Energy, IRPWind
  - WindGrid H2020-MSCA-ITN 2019 project

- **Mutidisciplinary tools:**
  - Global Wind Power DataStation
  - Strider platform
  - FAIRdata catalogue

- **Participate in IEA Wind Tasks:**
  - Task 19: Cold Climate
  - Task 25: Integration of Large Amounts of Wind
  - Task 28: Social Acceptance
  - Task 36: Forecasting
  - Task 41: Distributed Wind

About IEA Wind Task 41

Operating Agent

National Renewable Energy Laboratory

Pacific Northwest National Laboratory

Period

2019-2023

No annual fee needed

Website

https://community.ieawind.org/task41/home

Distributed Wind (DW) Technology

Wind turbines deployed in a distributed application, connected at a distribution voltage (nominally 70 kV) or below – located behind the meter, in front of the meter, or in an off-grid application.

Task 41 Participants	
Austria	Fachhochschule Technikum Wien
Belgium	Vrije Universiteit Brussel
Canada	Canada Natural Resources Canada
CWEA	China Wind Energy Association (CWEA), China General Certification (CGC), Goldwind, and Inner Mongolia University of Technology
Denmark	Denmark Technical University (DTU) & Nordic Folkecenter for Renewable Energy
Ireland	Dundalk Institute of Technology
Japan	New Energy and Industrial Technology Development (NEDO)
Korea	Korea Institute of Energy Research
Spain	CIEMAT
USA (OA)	National Renewable Energy Laboratory Pacific Northwest National Laboratory

IEA Wind Task 41 – motivation

- DW has become a growing portion of the energy supply - expansive pontential for DW markets
- The costs of DW systems have not yet decreased in the similar way as the cost of large utility scale and offshore wind technologies, as well as of solar PV
- Need to understand and answer many questions
  - whether the advances, that have lowered the cost for utility scale turbines, are valid if applied to DW?
  - which of the technological innovations are most appropriate for distributed technologies?
  - why has the DW industry not applied these innovations?
  - which additional research may be needed to understand their applicability?

IEA Wind Task 41 - collaboration

Overall objective

coordinate international research on DW technology, technology development or assessment to allow DW to integrate into future markets, and processes or procedures to support the cost effective development of DW technologies.

IEA Task 41 collaboration

- **accelerate the development & deployment** of DW technology
- **improve** small and distributed turbine standards
- **address** integration challenges
- **share** cost reduction experiences
- **allow** for the expanded sharing of research innovation
- **increase** the competitiveness of wind and accelerating the replacement of fossils fuels

IEA Task 41 outcome will lead to the **expanded global use** of wind energy with focus on DW applications!

EUDP funding

Danish IEA Task 41 project

- Essential for **DTU Wind Energy for being part** of the IEA Wind TPC Task 41
- Support **DTU Wind Energy** work in the IEA Wind TPC Task 41 to create common publications in peer-reviewed journal based on the results and experiences stemming from other past and ongoing research.
- **Strengthen collaboration** between DTU Wind Energy, Danish stakeholders and international partners
- Participation in international collaboration also helps promote Danish acquisition of knowledge about the newest trends and methodologies.
- Attract the best international players to project consortia with Danish partners, providing that results are anchored in Denmark and create added value for Danish players.

Danish IEA Task 41 project

Period: 2020 – 2023

Website: https://www.vindenergi.dtu.dk/english/research/research-projects/iea-wind-tcp-task-41

Overall objectives

- identify and explore studies of **particular Danish interest of DW** for cost effective technology development and integration into an continuously evolving Danish electrical system.
- strengthen the **Danish players and stakeholders**, contributing to further increasing the penetration of wind power into the electricity, while still maintaining the high level of security of supply.

This will done by DTU Wind Energy by collaborating and contributing to the IEA Wind TPC Task 41 international activities through communication, exchanging information, sharing results and carrying out concrete analyzes and investigations in the shape of reports and publications.

Project is organized into 4 work-packages closely following the IEA Wind TPC Task 41 planned work-packages

Danish IEA Task 41 project – overall targets

- build up a stakeholder network of relevant Danish players within the area of DW technology
- organize and strengthen the Danish influence and participation in IEA collaborations
- achieve and consolidate the Danish knowledge and experience within DW area
- promote and disseminate the results of IEA Wind Task 41 activities to the Danish stakeholders
- provide recommendations and guidelines to IEA deliverables that can be used by both Danish industry, researchers and society at large
- form the basis for eventually new Danish standards aligned to international efforts, set of specifications of DW data sharing catalog and support the integration of DW into Danish electrical system
- collaborate with ongoing IEA Wind Task activities that address specific challenges associated with DW technologies (Task 19, Task 25, Task 26, Task 28, Task 36).

Danish EUDP IEA Task 41 project

- **WP0**: Management, coordination and dissemination
- **WP1:** DW technology design standards for small and mid-sized wind turbines
- **WP2:** Data information catalog for DW research
- **WP3:** Integration of DW into evolving electricity systems
- **WP4:** Outreach and expand collaboration of ongoing R&D DW activities

Milestones

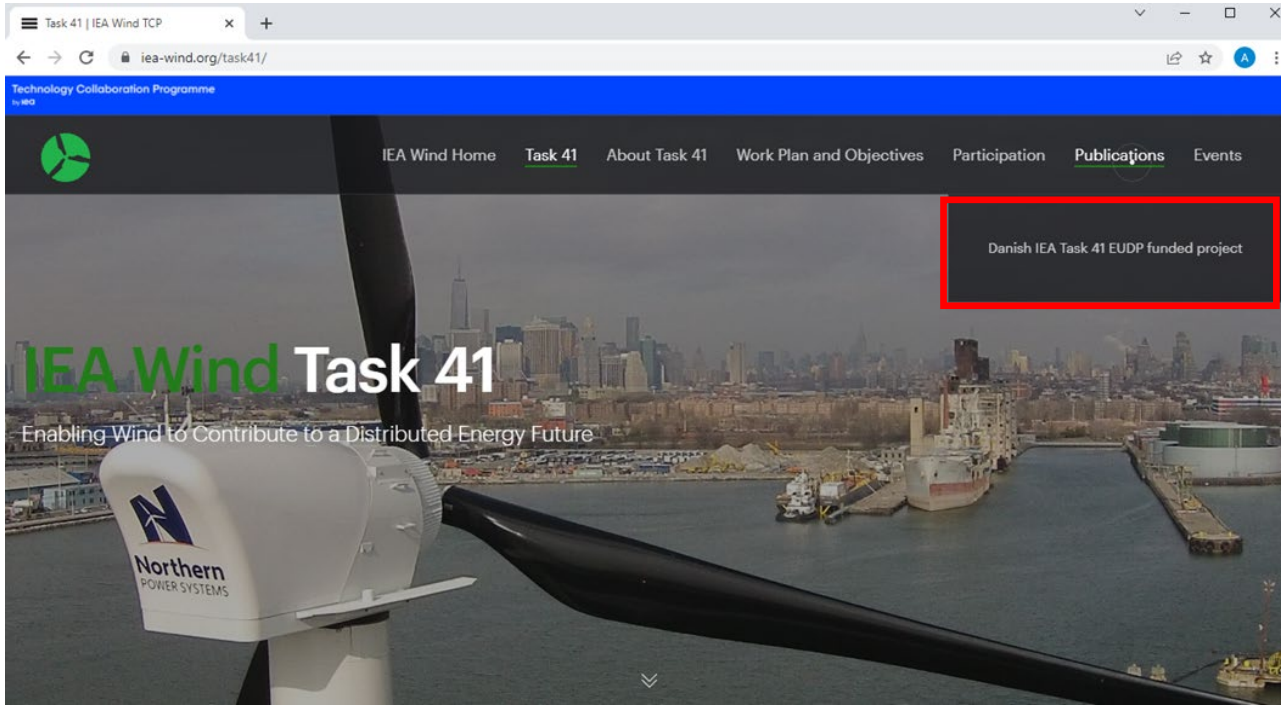
Manpower / WPs		No.	Milestones	Delivery date
Anca	WP0	M1	Project description & visibility on Vindenergi.dtu.dk, Twitter, LinkedIn	March 2020
Anca	WP0	M2	1st (kick-off) Danish stakeholders workshop	May 2020
Mark	WP1	M3	Small and medium size wind turbine standards assessment	March 2021
Mark	WP1	M4	Technical justification for the changes proposed in M3 developed	Nov 2022
Mark	WP1	M5	Conformity assessment for DW suggested	Dec 2022
Anna Maria	WP2	M6	Data catalogue specification	June 2020
Tom	WP3	M7	Completion of review of micro-grid modelling tools	May 2020
Aeishwarya	WP3	M8	Distribution system model for control strategy assessment	June 2021
Anca	WP0	M9	2nd annual Danish stakeholders workshop	Oct 2021
Anca	WP0	M10	3rd annual Danish stakeholders workshop	Oct 2022
Anca / All	WP0	M11	Final report summarizing the project results	Dec 2022

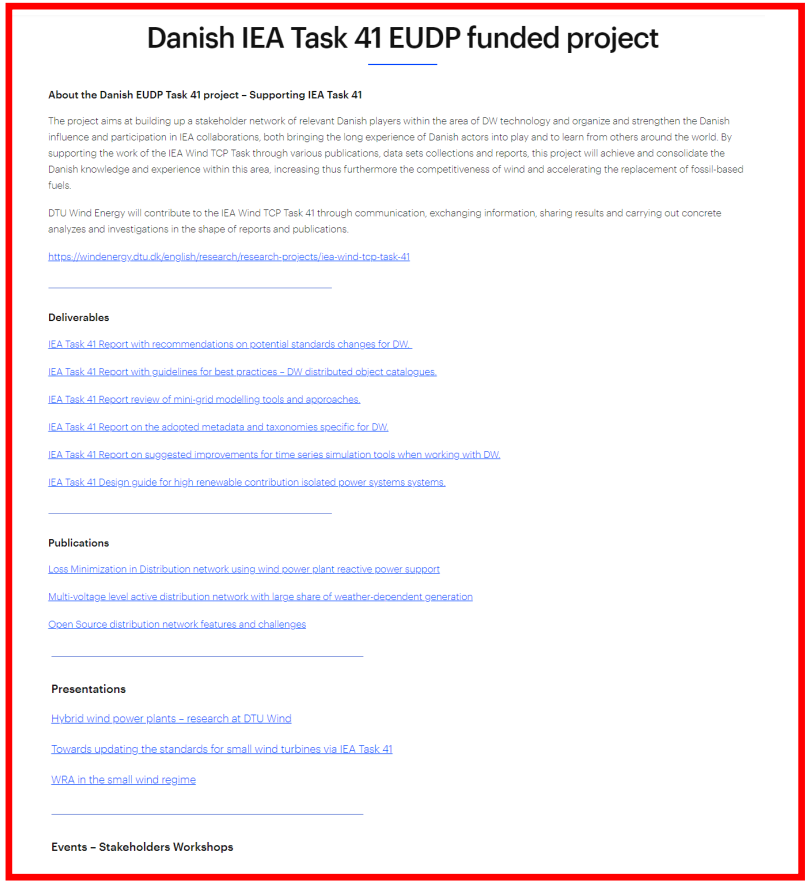
Delivarables

Manpower / WPs		No.	Delivarables	Delivery date
Anca	WP0		1st EUDP reporting	July 2020
Anca	WP0		2nd EUDP reporting	July 2021
Anca	WP0		3rd EUDP reporting	July 2022
Mark	WP1	D1.1	Report on recommendations for potential standards changes that will be used to drive additional national and international research	March 2021
Mark	WP1	D1.2	Report on suggested changes to the current standards, and suggested conformity assessment	Dec 2022
Anna Maria	WP2	D2.1.	Report on the adopted metadata and taxonomies specific for DW and metadata catalogue.	Oct 2020
Anna Maria	WP2	D2.2	Guideline for best practices for compiling DW distributed object catalogues. Data Management Plan Template, for Danish actors.	May 2021
Matti	WP2	D2.3	Report on suggested improvements for time series simulation tools when working with DW.	Nov 2021
Aeishwarya	WP3	D3.1	Report on control strategies of wind turbines in future distribution systems based on the delivarable D15 of IEA Wind Task 41 and tailored to the requirements of Danish stakeholders.	Nov 2022
Tom	WP3	D3.2	Contribution to the D14 delivarable report of IEA Task 41	May 2020
Tom	WP3	D3.3	Contribution to the D16 delivarable report of IEA Task 41	Nov 2020
Tom	WP3	D3.4	Contribution to the D17 delivarable report of IEA Task 41	Nov 2021
All	WP4	D4.1	Report describing specific DW aspects/gaps relevant for the Danish players and stakeholders.	Nov 2022
Anca / All	WP0		Final report summarizing the project results	Dec 2022

Danish EUDP IEA Task 41 project

- https://windenergy.dtu.dk/english/research/research-projects/iea-wind-tcp-task-41
- http://iea-wind.org/task41/





Danish IEA Task 41 EUDP funded project

About the Danish EUDP Task 41 project – Supporting IEA Task 41

The project aims at building up a stakeholder network of relevant Danish players within the area of DW technology and organize and strengthen the Danish influence and participation in IEA collaborations, both bringing the long experience of Danish actors into play and to learn from others around the world. By supporting the work of the IEA Wind TCP Task through various publications, data sets collections and reports, this project will achieve and consolidate the Danish knowledge and experience within this area, increasing thus furthermore the competitiveness of wind and accelerating the replacement of fossil-based fuels.

DTU Wind Energy will contribute to the IEA Wind TCP Task 41 through communication, exchanging information, sharing results and carrying out concrete analyzes and investigations in the shape of reports and publications.

https://windenergy.dtu.dk/english/research/research-projects/iea-wind-tcp-task-41

Deliverables

IEA Task 41 Report with recommendations on potential standards changes for DW.

IEA Task 41 Report with guidelines for best practices – DW distributed object catalogues.

IEA Task 41 Report review of mini-grid modelling tools and approaches.

IEA Task 41 Report on the adopted metadata and taxonomies specific for DW.

IEA Task 41 Report on suggested improvements for time series simulation tools when working with DW.

IEA Task 41 Design guide for high renewable contribution isolated power systems systems.

Publications

Loss Minimization in Distribution network using wind power plant reactive power support

Multi-voltage level active distribution network with large share of weather-dependent generation

Open Source distribution network features and challenges

Presentations

Hybrid wind power plants – research at DTU Wind

Towards updating the standards for small wind turbines via IEA Task 41

WRA in the small wind regime

Events – Stakeholders Workshops

Topics open list

- Enabling faster and easier grid connection permits for wind based systems(hybrid systems, flexibility provision)
- Multi energy multi-technology hybrid wind systems
- Coordination of renewable generators with other network assets in future power systems
- Grid and market service provision from distributed wind
- Need for accurate prediction of the power production from small wind turbines power output
- Small-wind environment characterization
- Digital objects catalog for the wind energy sector digital transformation
- Test and validation of electrical controls in DTU Hybrid Wind Power Facility (225 kW Wind turbine, 60 kW/14.8F SC, 30kW/79kWh Li-ion Battery, 1 MW grid connection)

Result of hour survey

Enabling faster and easier grid connection permits for wind based systems (hybrid systems, flexibility provision)

Multi energy multi-technology hybrid wind systems

Coordination of renewable generators with other network assets in future power systems

Grid and market service provision from distributed wind

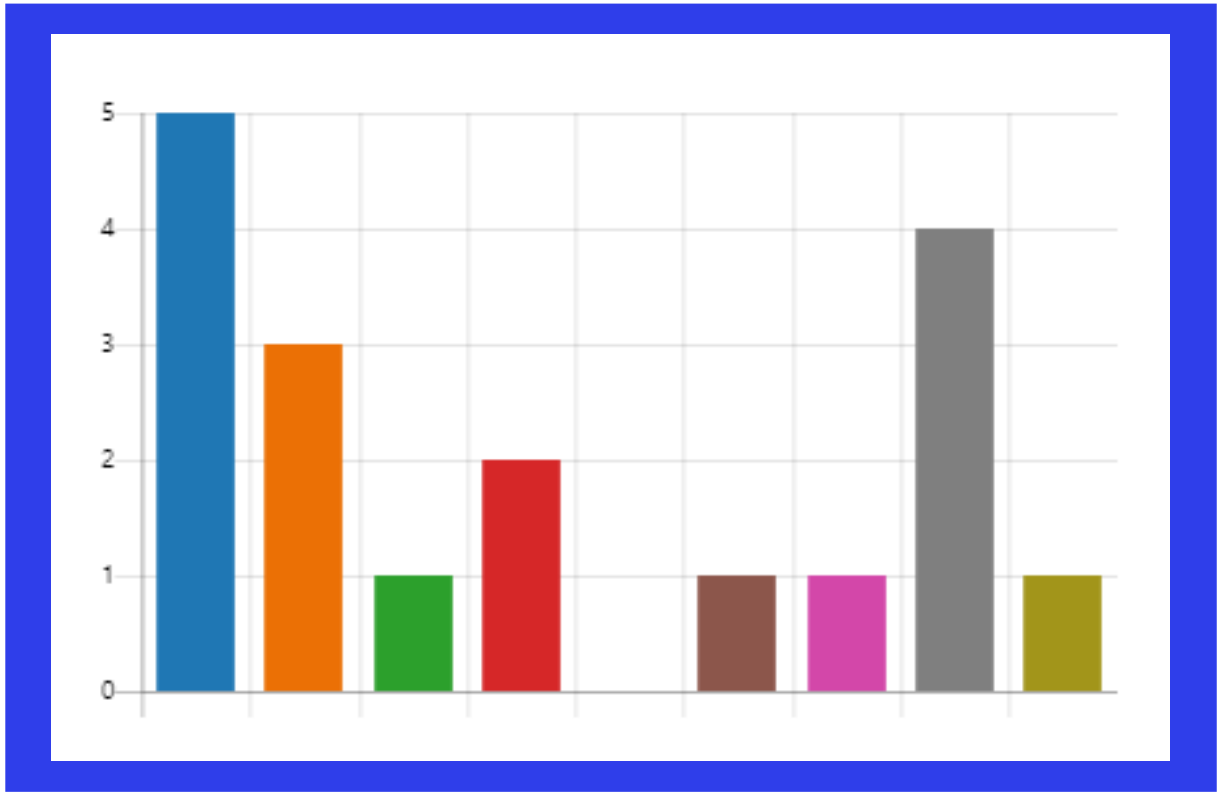
Need for accurate prediction of the power production from small wind turbines power output

Small-wind environment characterization

Digital objects catalog for the wind energy sector digital transformation

Test and validation of electrical controls in DTU Hybrid Wind Power Facility (225 kW Wind turbine, 60 kW/14.8F SC, 30kW/79kWh Li-ion Battery, 1 MW grid connection)

Upcomming 61400-2 standard update



Thank you

Acknowledgments to EUDP

Small-wind environment characterization

Objectives

- metrics for characterization of obstacle/environment-affected turbulent flow ;
- filling in details of proposed high-turbulence classes and/or confirming it.

Description:

Many small turbines sit in turbulent flow conditions, due to their relatively low hub-heights compared to nearby built structures and terrain; their performance and lifetime (loads) can be heavily impacted. From syntheses of obstacle modelling and validation, engineering turbulence parameterizations, basic turbulence, micrometeorology, and scaling analysis—along with evaluating more performance and associated wind measurements, we aim to identify site-dependent (potentially turbine-dependent) metrics for characterizing the flow environment.

This supports the update and pre-validation of new small turbine/turbulence classes, as well as power-performance measurements, reporting, and requirements.

Stakeholders

Various small turbine manufacturers; Nordiske Folkecenter for turbines, NREL, IECRE

Potential funding source(s):

Innovation Fund/Small-Scale

Digital data catalogue for wind energy sector

Objective

To establish a catalog of the digital objects needed to make the wind energy sector at the forefront of the digital transformation.

Description

Data, models, workflows and data science tools created by the digitization of assests and in research processes are spread within several organizations and in each organization sometimes are stored in differen places. Organise data in catalogs is a much painless process than create huge databases because it needs only ttThis can be done at Organization level and inter – organization level: for the former the goal is the internal efficiency of an organization and for the latter is a innovation/research process efficient and fast by share data with other stakeholders and join force to co-create solutions.

Stakeholders

Various wind turbine manufacturers

Potential funding source(s)

Horizon Europe has calls about digitalization