Distributed wind stakeholders' workshop

Nordic Folkecenter's 3rd International Conference on Small and Medium Wind energy

30.04.2020

This document presents a brief overview of the distributed wind (DW) stakeholders' workshop, organized by DTU Wind Energy together with Nordic FolkeCenter on 30.04.2020 within the 3rd International Conference on Small and medium Wind Energy. The workshop, hold online, due to the pandemic Corona, has had particular relevance for small and medium wind turbine manufacturers and other users of the Danish Test and Resources Center.

The workshop has been funded by the EUDP project IEA Task 41. This project aims to build 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. As in IEA Wind TPC Task 41, DW technology refers to wind turbines deployed in a distributed application, connected at a distribution voltage (nominally 70 kV) or below and behind the meter, in front of the meter, or in an off-grid application. In this context, DW is inclusive of all scales of wind turbine technologies and is agnostic to business model, although in some instances, such as technology standards, more specific industry segregation is included. By supporting the work of the IEA Wind TPC Task through various publications, data sets collections and reports, the EUDP IEA Task 41 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.

This workshop is the first workshop out of three annual DW stakeholders' workshops planned over the next three years, being important milestones the EUDP project IEA Task 41. The goal of the workshops is to initiate good discussions and interactions with relevant Danish players and stakeholders within the area of DW technology and thus to build up and strengthen the stakeholders' network of relevant Danish players within the area of DW technology and to organize and strengthen the Danish influence and participation in IEA collaborations. The goal is also to present and promote results of particular Danish interest and to exchange the achieved knowledge and expertise from IEA international collaborative work to relevant players and stakeholders, and especially those who are not directly involved in the IEA work. Through such forums we target to disseminate information that can be used by both Danish industry, researchers and society at large.

In order 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, this first workshop has been organized in two parts. In the first part, DTU Wind Energy has had four presentations, disseminating DTU Wind previous project results within different relevant DW topics, i.e. DW standards, DW integration and DW open data. In the second part three break-

out DW stakeholders' sessions with predefined questions to the stakeholders have been organized in order to initiate good interaction/discussions with the stakeholders and to identify their needs and challenges related with relevant topics like DW standards, DW integration and DW open data sharing. The main take-away messages from these three break-out sessions are:

- There is a need for improving small- and medium-size wind standards with regard to turbulence classes in urban areas and alike. The mismatch between the turbulence classes that can be found in the standards nowadays and the high turbulence experienced in such areas is believed to be a root cause for many turbine failures.

- It will take time to accept the Open Data Sharing culture. The people's awareness and interest about is slightly increasing. Furthermore, the industry needs standards and the whole wind energy community must be continuously reminded on the advantages of data sharing for taking a cultural change step.

- Different DW regulatory rules in different countries are challenging both big and small companies.

- Accurate prediction of the power production from small wind turbines power output is still a big need.

In the following, the presentations of the workshop as well as the questions, discussions and summary minutes from all three break-out sessions are included, respectively.

Distributed Wind Stakeholders' Workshop
IEA Wind TPC Task 41

Anca Hansen

Distributed Wind stakeholders' workshops – overall goals

- **Build up a strong stakeholder network within the area of DW technology**
  - organize and strengthen the Danish influence and participation in IEA collaborations
- **Present** and **promote results** of particular Danish interest and **exchange the achieved knowledge and expertise** from IEA Wind 41 international collaborative work to relevant players
  - disseminate information that can be used by both Danish industry, researchers and society at large
- **Have expanded discussions of relevance for the Danish players and stakeholders**
  - influence the research and development in the field of DW on a national level.
- **Receive input/feedback** both from Danish wind energy industry and research community
  - resulting in new project ideas and project collaboration
- **Ensure closer collaboration** between **private** and **public** actors, **national** and **international** DW players

Workshop today - goals

- **Identify the NEEDS and CHALLENGES DW stakeholders have on relevant topics:**
  - DW standards
  - DW Integration
  - DW open data sharing
- DTU Wind Energy and Nordic FolkeCenter represent Denmark in IEA Wind Task 41 - our role today is to find out **what are the needs of Danish DW stakeholders and how to improve their business model**
- Recently funded EUDP project on IEA Wind Task 41 - **identify DW players and stakeholders willing to collaborate** in ongoing EUDP project by being involved in dialogs for delivarables
- **Gather INFORMATION / INPUTS / FEEDBACKs on how research can support / improve your business**
  - create new project ideas with collaboration between industry and research community

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

Workshop program

9.40 – 9.50	Welcome	Anca Hansen
9.50 – 10.10	**IEA Task 41 presentation**	Anca Hansen
10.10 – 11.00	**DW research at DTU Wind**	
	- DW Standards	Witold Skrzypinski
	- DW Integration	Kaushik Das
	- DW Open data sharing	Anna Maria Sempreviva
11.00 – 11.05	**Presentation of breakup DW stakeholders' sessions**	Tom Cronin
11.05 – 11.20	**Coffee break**	
11.20 – 12.00	**Break-out DW stakeholders' sessions**	
	- DW Standards	Witold Skrzypinski
	- DW Integration	Tom Cronin
	- DW Open data	Anna Maria Sempreviva
12.20 – 12.35	**Wrap-up in plenum**	
12.35 – 12.45	**Final remarks**	Anca Hansen

IEA Wind TPC Task 41

Danish EUDP project

Anca Hansen

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!

IEA Wind Task 41 - five areas of technical collaboration

- Research to support an update of existing wind standards, expanding consumer confidence while allowing needed technology innovation → **WP1**
- Technical data sharing in both process and practice, providing researchers and the wider industry access to global information → **WP2**
- Expanded research and collaboration around the integration of DW technologies, focusing on new and advancing markets such as off-grid, microgrids, and advanced distribution networks → **WP3**
- Outreach and expand collaboration of ongoing R&D activities that could address specific challenges associated with DW technologies → **WP4**
- DW innovation and downscaling of utility scale technology → **WP5**

EUDP project funding

- 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.

EUDP 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 5 work-packages closely following the IEA Wind TPC Task 41 planned work-packages

EUDP 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).

EUDP project - delivarables

DW players and stakeholders willing to be involved in dialogs for some delivarables ?

No.	Delivarables	Delivery date
D1.1	Report on recommendations for potential standards changes that will be used to drive additional national and international research	Nov 2021
D1.2	Compendium on recommendations for potential conformity assessment requirements	Aug 2020
D2.1.	Report on the adopted metadata and taxonomies specific for DW and metadata catalogue.	Oct 2020
D2.2	Guideline for best practices for compiling DW distributed object catalogues. Data Management Plan Template, for Danish actors.	May 2021
D2.3	Report on suggested improvements for time series simulation tools when working with DW.	Nov 2021
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
D3.2	Contribution to the D14 delivarable report of IEA Task 41	May 2020
D3.3	Contribution to the D16 delivarable report of IEA Task 41	Nov 2020
D3.4	Contribution to the D17 delivarable report of IEA Task 41	Nov 2021
D4.1	Report describing specific DW aspects/gaps relevant for the Danish players and stakeholders.	Nov 2022

Thank you

IEA Task 41 Workshop
Distributed Wind
Standards

Witold Skrzypiński
wisk@dtu.dk

Table of contents

- What is the problem in big picture?
- How can we solve it?
- What has been done?
- Specific identified problems.
- Questions for YOU.

Problem formulation by IEA

Design-and-testing standards for distributed wind are:

- A barrier to innovation.
- Source of increased cost of energy.

Certification of turbine models, especially those above 200 m^2:

- Hinders bringing advanced technologies to the market in a timely fashion.
- So expensive that it outweighs the value that it provides.

Possible solution

- IEC 61400-2 standard generally serves as a baseline for small wind turbines.
- IEC 61400-2 open to revision in early 2022.

- To allow a revision of the standard, efforts need to be undertaken now to:
  - Understand the key concerns with the existing standard.
  - Conduct the needed research to document a problem.
  - Conduct research to allow justification for any potential revisions.

Requires a strong international effort.

What has been done?

Two international meetings were held in 2019:

- **February – USA**
  - Companies from USA.
  - Focused on US standards: AWEA 9.1, SWT.
- **June – Ireland**
  - Participants from: Austria, Denmark, Germany, Ireland, Korea, Spain, and Taiwan.
  - Focused on the IEC 61400-2.
- **Two additional meetings planned…**

The following problems were identified:

1. **Meeting test-duration requirements slows innovation and time to market.**

   Number one challenge for international companies.

2. **Use of Simplified Loads Methodology (SLM) made the design heavier due to high safety factors. SLM does not address fatigue – a common failure mode for small turbines.**

   Need VAWT SLM with fatigue case.

3. **Tower dynamics are not well addressed in IEC 61400-2.**
4. **Power performance results are rarely matched at consumer sites, leading consumers to assume that small wind does not work.**

   A typical small wind turbine site has higher wind shear than that assumed.

The following problems were identified:

5. **Medium turbines are kept out of the market for certified turbines because of the limit in IEC 61400-2 of rotor swept area, i.e., 200 m^2.**

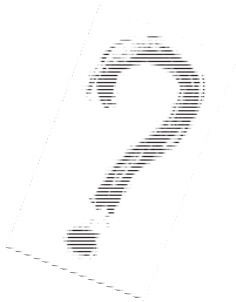
   Need certifications for small wind turbines up to 100 kW or 500 m2 and classifications for micro wind with reduced requirements.

6. **Many of the current requirements, e.g., normal turbulence model or turbulence intensity, do not reflect the reality that micro and small turbines are installed in, i.e., locations with high turbulence intensity due to human clutter.**

7. **Acoustic testing is considered the most difficult of all the small turbine test methods, and the output data are not self-explanatory to consumers.**

Three questions for you:

1. *What problems related to standards/certification/legislation have you experienced in your daily business?*
2. *Which of the listed issues are relevant to your daily business?*
3. *What would you like us to focus our work on?*



Kaushik Das, Tom Cronin, Anca D Hansen

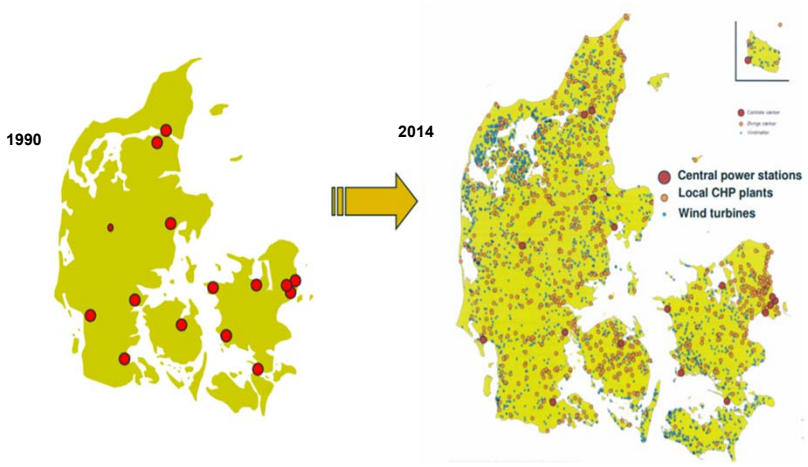
Integration of Distributed Wind to the Power System

Definition of Distributed Wind in IEA Task 41

- Wind turbines deployed in a distributed application
- Connected at a distribution voltage (nominally 70 kV) or below
- Behind the meter, in front of the meter, or in an off-grid application.
- In this context, DW is inclusive of all scales of wind turbine technologies and is agnostic to business model, although in some instances, such as technology standards, more specific industry segregation is included.

RES generation in distribution systems

Centralized Plants Vs Distributed Generations



Henning Parbo, "Distributed Generation Trends and Regulation: The Danish Experience", EPRG Workshop on Distributed Generation and Smart Connections

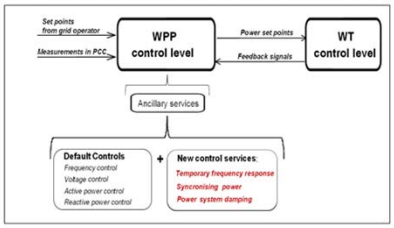
Integration Challenges/Opportunities for DW stakeholders

- **From System Operator's perspective:**
  - Loss minimization, TSO/DSO co-ordination, voltage profile management etc.
  - Might also be (market) opportunities for DW turbines owners
- **From DW Turbine Manufacturers' Perspective:**
  - Stricter requirements for DW turbines in grid connection code
    - In terms of frequency support, volt/var control, harmonics etc.
  - Evolving system support capabilities for all wind turbines such as grid forming capabilities, blackstart, load following, power oscillation damping etc.
    - Many of these services are relevant and useful for DW mainly with respect to minigrid, microgrid and islanded systems
  - Evolving global markets for DW turbines connected to weak grids
    - Advanced control and operational strategies need to be developed
  - Evolving technologies such as hybrid systems with storage and/or solar

A project case study from System Operator's perspective

System Service Capabilities of Wind Turbines

EaseWind - Enhanced Ancillary Services from Wind Power Plants



RePlan- Ancillary Services from Renewable Power Plants

- develops controllers for the delivery of ancillary services from WP and PV plants , incorporating **communication** properties
- the services with great concern in the future include **voltage**, **frequency** and **rotor angular stability support**.
- uses state-of-the-art methods for simulation of renewable generation patterns and wind power forecast methods
- suitability **to coordinate** the provision of the services from WP and PV plants, identifying and analyzing their strengths and limitations
- impact of **communication** and **power availability forecast error** in providing coordination and ancillary services
- investigates and verifies ancillary services provision from WP and PV plants in **laboratory facilities** (large or real small power systems)

Deliverables and publications at http://www.replanproject.dk/

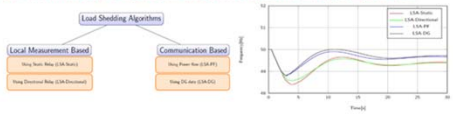
iTesla - Innovative Tools for Electrical System Security within Large Areas

WP6: To review and assess the potential for more robust defence and restoration plan (led by DTU)

Improved Underfrequency Load Shedding (UFLS) Scheme Considering Distributed Generation

Impacts of high penetration of distributed generation on UFLS:
- Unintentional disconnection of DG
- Not disconnecting required amount of load
- Poor frequency response

"IEEE Guide for the Application of Protective Relays Used for Abnormal Frequency Load Shedding and Restoration" - tripping feeders that have active DG certainly diminishes the beneficial affect of load shedding, and can even have negative impact by eliminating sources of generation that supports system inertia.



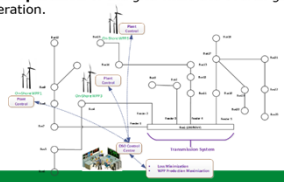
Kaushik Das, A Nitsas, M Altin, A Hansen, P Sørensen, "Improved Load Shedding Scheme considering Distributed Generation", IEEE Transactions on Power Delivery, 2016

NetVind project

- Achieve **effective integration** of renewable energy in the MV grid
  - Minimizing unnecessary losses due to the new production
  - Use already installed power electronics in the wind turbine.
- The aim of the project is to exploit the connected wind turbines regulation capabilities **to obtain optimal operation** of the grid while the overall grid stability is taken into consideration.

Partners:
ENIG Forsyning A/S (leader)
DTU Wind Energy
Danish Energy Association

Project period:
Sep, 2016 – Sep, 2018
Ongoing



NetVind project

Using wind power plant control in distribution grid operation

Objective

- to improve the operation of a real distribution network with a high penetration of wind power by exploiting the WPP control capabilities.

DSO's challenges

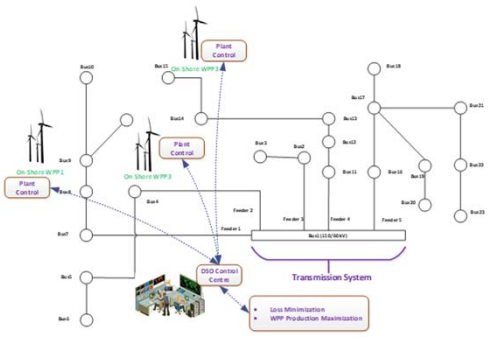
- how to operate the distribution systems by using WPPs as controllable components

Partners

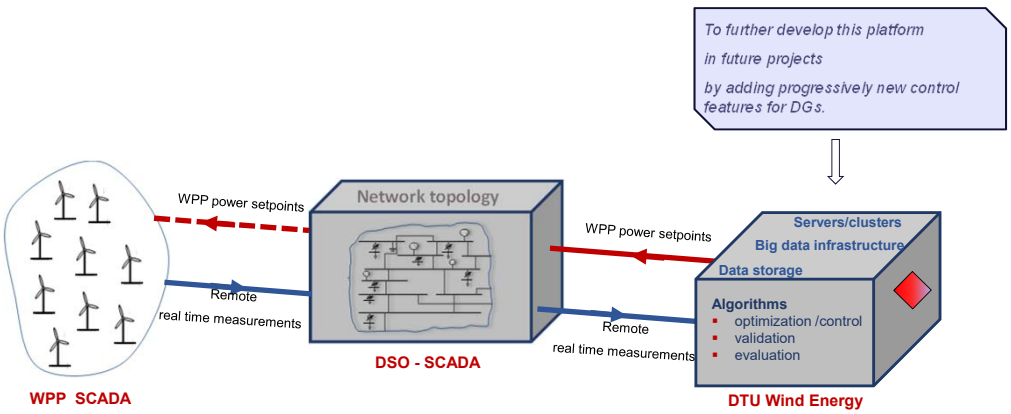
ENIIG Forsyning A/S (leader)
DTU Wind Energy
Dansk Energi

Project period:

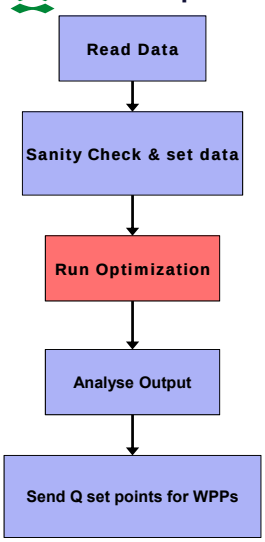
Sep, 2016 – Sep, 2018



Architecture



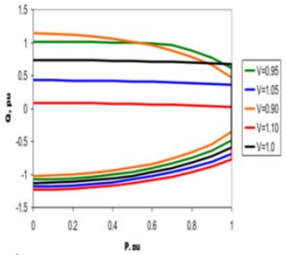
Optimization

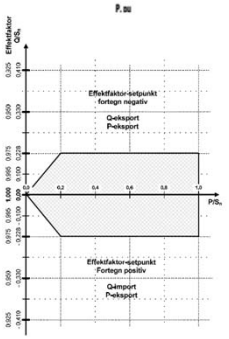


- **Control variables:**
  - Reactive power set point of WPPs
- **Objective:**
  - Minimize active power loss in 60 kV feeders
- **Constraints**

  Network constraints
  - Reactive Power Flow Limit to the Transmission Network
  - Power loading limit of the feeders
  - Power loading limits of the transformers
  - Voltage Limits

  WPP constraint
  - WPP capability / Grid code requirements





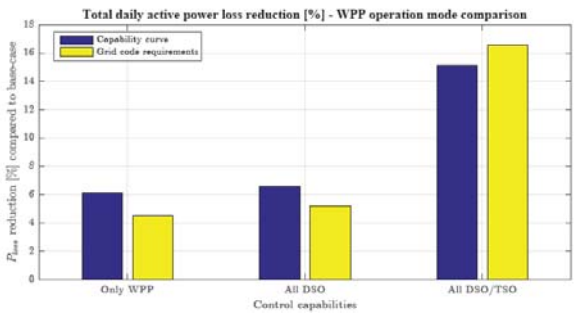
Loss Minimization Results

Without Optimization			With Optimization		
			Loss reduction [%]		Energy Saving [MWh]
Power loss [MW]	Number of Hrs	Energy loss [MWh]	Mean	Uncertainty	
0-500	6321	949	6.18%	0.25%	58.6 ± 2.38
500-1000	967	695	1.42%	0.10%	9.9 ± 0.69
1000-1500	674	833	2.93%	0.11%	24.4 ± 0.92
>1500	798	1539	4.63%	0.08%	71.3 ± 1.23
Sum	8760	4016			164.2 ± 2.92

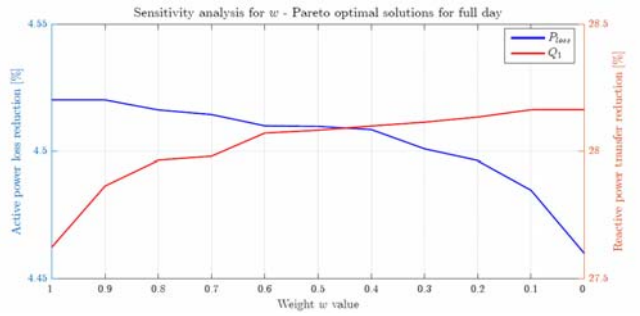
Using optimization method, estimated energy saving is 164.2 + 2.92 MWh for 1 year based on the representative data only using reactive power capability of DW

Looking Beyond

What is the impact of co-ordinating the control of tap-changing transformers together with DW?



Does loss minimization impact the reactive power transfer between TSO and DSO?



Observability and Controllability of all the voltage levels are required considering all the assets

Ongoing PhD project within EU Marie Curie WindGrid :

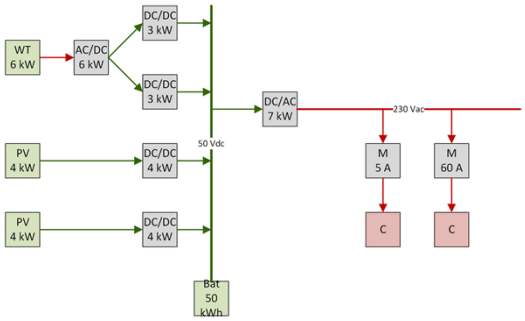
- Incorporate forecast uncertainty from weather dependent generation & loads (using weather data/models, AMR, SCADA) in observability of the distribution network
- Investigate the impact of forecast uncertainty for WPPs and loads on the performance of the whole distribution networks
- Develop enhanced control method for controlling the DW to improve performance of the whole distribution network

A project case study from DW Turbine manufacturer's perspective

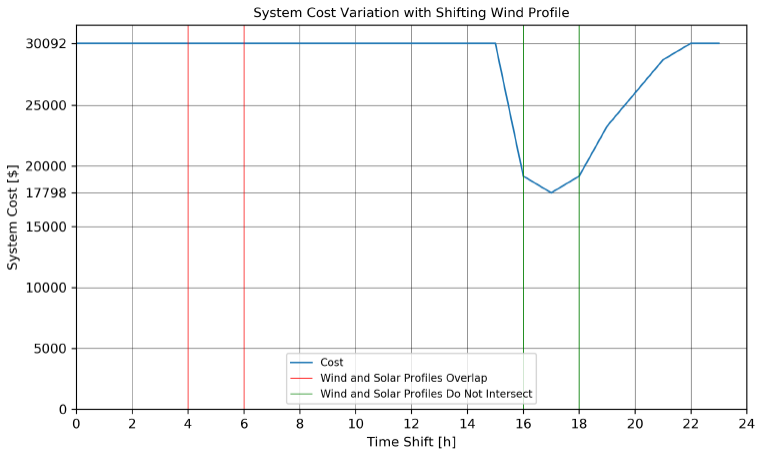
The concept of a mini-grid

A collection of components in a power system:

- Consumption (consumers)
- Generation
  (conventional and renewable)
- Balancing components
  (e.g. dump load and storage)
- Control system
  (local and supervisory)



Simulation results for system costs



Breakout stakeholders' sessions - DW integration

- What is the biggest challenge seen by you in order to integrate more distributed wind into the power system?
- Which support (tool, knowledge, seminars) from IEA Task 41 /DTU Wind Energy would help your business?
- Which specific grid services, do you think, distributed wind can provide and in which markets?

IEA Wind Energy Task 41: Distributed winds

WORK PACKAGE 2:
DATA CATALOG

Danielle Preziuso
Pacific Northwest National Laboratory

FAIR DATA Principle: The culture of sharing.

Findable **A**ccessible **I**nteroperable and **R**e-usable data

Anna Maria Sempreviva
Technical University of Denmark
DTU Wind Energy

PURPOSE

- Disseminate the sharing culture in wind energy sector
- Inform on the opportunities from adopting the FAIR data principle

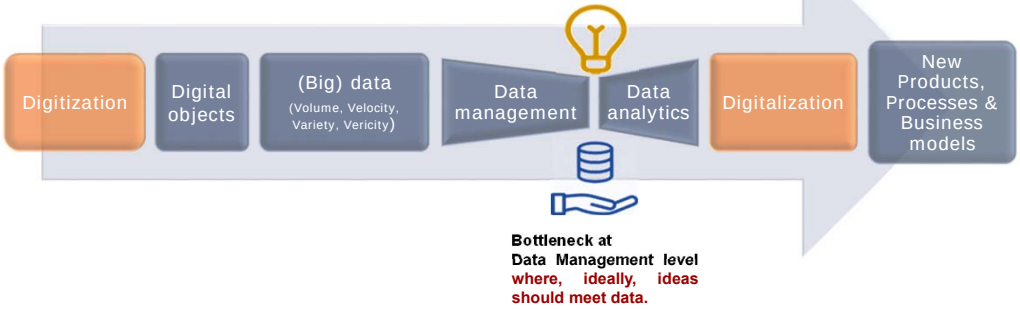
CONTENT

- Context:
  - The digital transformation: the pathway to innovation
  - FAIR, the culture of sharing: other's ideas meet your data
- Data Catalogue: collecting information on data availability on key topics
- Existing data platforms: metadata and taxonomies
- Conclusive remarks

Equivalences of terms in different environment

RESEARCH DATA	
(Academia)	Data, Codes, Workflows
(Research Data Alliance)	Digital Objects
(Industry)	Assets

From digitization to digitalization (innovation)



Bottleneck at Data Management level where, ideally, ideas should meet data.

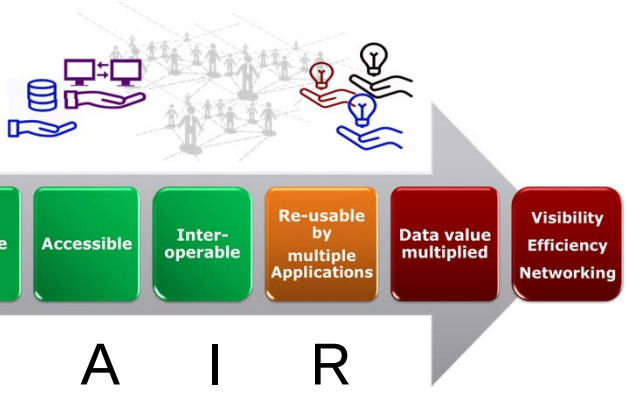
FAIR supports innovation: Find the data

- 2014 H2020 Open Data
- 2016 H2020 FAIR Data Principle changes the focus: **From Available to Findable data**

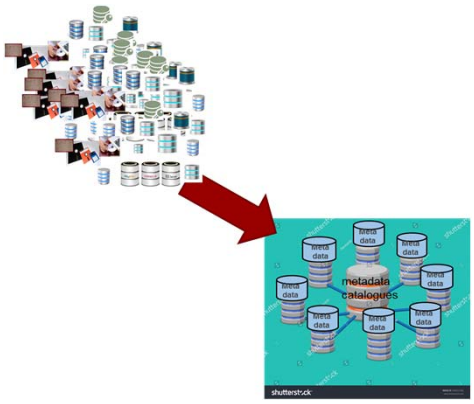
ISSUE: How to make data findable but safe?

SOLUTION: Create a searchable data catalogue for **distributed** data

Other's ideas meet your data



FIND THE DATA



Issue: data findability

- Datasets are distributed in the "cloud", saved in and organized in different ways
- Datasets often miss **documentation (Metadata)**

Action: 3 ingredients

- Create **metadata** and
- Assign to metadata relevant controlled vocabularies (**Taxonomies**) to tag data
- Design **a data portal** for metadata catalogues

IRPWind Project 2014-2018 - Metadata & taxonomies

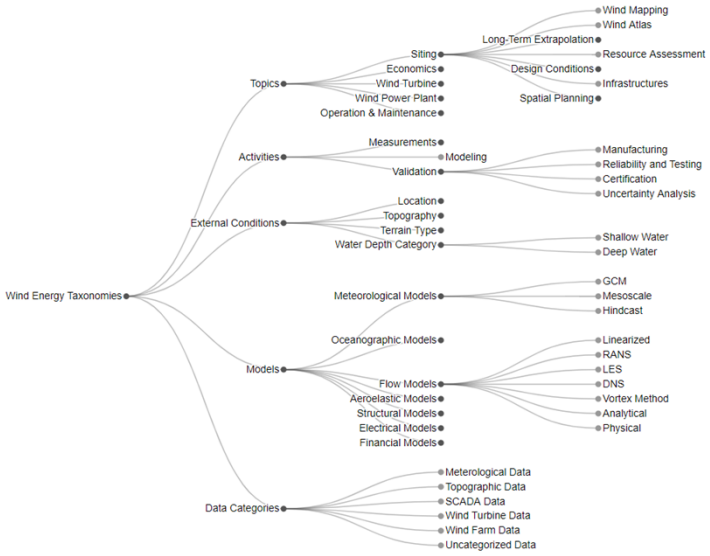
Metadata element set
Dublin Core (DC) Standards

Metadata card

DC elements:
Title:
Creator:
Topic*: taxonomy
Description:
Publisher:
Contributor:
Date:
Type*:
Format:
Identifier:
Source:
Language:
Relation:
Coverage:
Rights:

6 specific taxonomies as **Controlled Vocabularies to describe the Wind Energy data**

Non-DC elements:
Variables*: taxonomy
External conditions*: taxonomy
Activity*: taxonomy
Instrument*: taxonomy
Model*: taxonomy



IEA Task 41 WP2 data catalog: Find the data

Deliverable D11:

- Fall 2020: Development of **data sharing**, **storage** and if needed **security protocols** for metadata to be stored on the platform. Specification of a potential **data sharing portal** that expands on the catalog.

Goals

Identify:

- Data contributors and users
- Needed shared resources
- Data availability on key topics
- Recommended practices for data collection, reporting, accessing, and storage

Catalog and Make Available:

- Metadata for distributed wind data sets

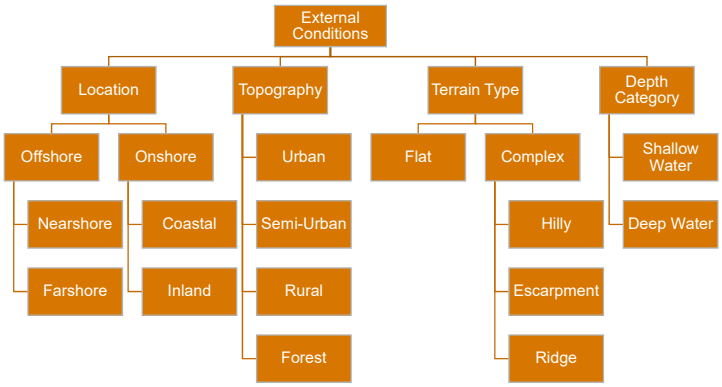
Consider:

- Including a catalog of data processing and decision support tools

PNNL-SA-152844

Taxonomy

- For some of the metadata elements, PNNL expanded the wind energy taxonomy developed by IRPWind to include some terms specifically relevant to the distributed wind energy community.



This is an example from the wind energy taxonomy. The full taxonomy is in Wind Energy Taxonomy Excel file.

Existing Databases, Portals, and Catalogs

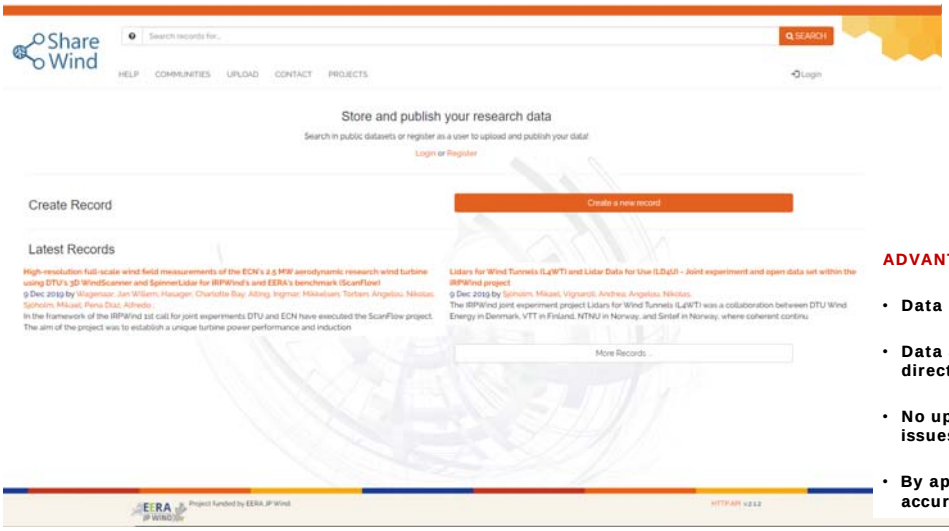
- Work to Date:
  - Establish and evaluate wind-related databases and catalogs that already exist
  - Identify opportunities for collaboration or to build upon existing work
  - Lessons learned from previous work
  - Outline a process for metadata collection and options for hosting Task 41 catalog

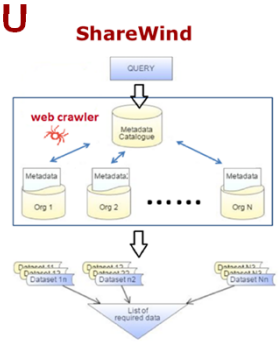
Tethys	Data Archive and Portal (DAP)	OpenEI	ShareWind

PNNL-SA-152844

9

IRPWind Project 2014-2018. ShareWind.EU
Data portal and metadata catalogue





ADVANTAGES

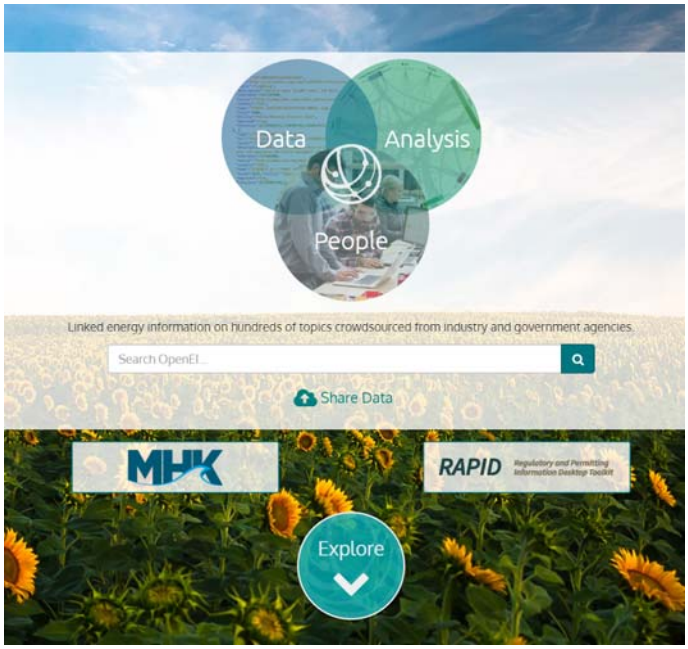
- **Data are kept at the owner premises**
- **Data are visible without being directly accessible**
- **No uploading data and storage issues**
- **By applying filters users can accurately locate needed data**

Date 30 Aprile 2020 DTU IEA Wind Task 41 Workshop WP2 Data catalogue 10

Pacific Northwest
NATIONAL LABORATORY

Open Energy Information (OpenEI) - Overview

- A wiki platform for the energy community, including policymakers, developers, and researchers
- Renewable energy and energy efficiency focus
- Sponsored by US DOE, NREL, and a third party renewable energy search engine, reegle



PNNL-SA-152844

11

DTU

Conclusive remarks

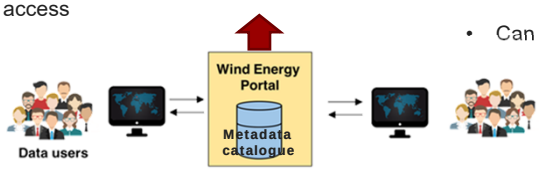
A web data portal with a data catalog has a two-fold purpose

- **To connect safely users to data owners**
- **Give information on the availability of shared resources and of Data on key topics**

Data owner /creator

- Can make visible data via metadata
  - without uploading any data, and
  - maintain control on data access

Data
Market Place?
€ £ $?
Services?
Co-creation?



Data user

- Can find data accurately by searching the same terms used by the data owner
- Can retrieve information on available data
- Can save time dedicated to the task

Thank you for your attention!

NEXT

Would you share your data?

BREAKOUT SESSION

- Have you a data catalogue Visible/Findable from outside your company?
- If no, would you use an established taxonomy to tag your data?
- If yes, how did you tag your data?

Could you please describe using three keywords the FAIR data principle

(e.g. ambitious, innovative, interesting, impossible, appealing, not-applicable, …..

Under which conditions would you share your data?

- Against a fix/variable amount of money;
- Against services;
- Against involvement in projects; for free if data is not used in competitive goals.

PESTEL Analysis

Political, Economic, Social, Technological, Environmental, Legal

- **Barriers/obstacles and framework conditions affecting FAIR impact**
- Sharing data, tools and workflows: a strategy to inspire efficient collaboration - Metadata catalogue: **Distributed data bases.**

	Barriers/Obstacles/Risks	Methods to resolve issues
Political	*Governmental funding agencies demand open data but at the same time Governments cut funding to universities demanding universities providing business models to support research.* *IPR and Patents are success criteria for universities*	Take actions to communicate that FAIR data is a good balance between Open data and IP protected data
Economic	*Data as competitive advantage*	Communicate the benefits of open data as a way of lowering project costs, enabling a faster project progress and enhancing replication in other markets
Social	*Managerial practices and skills, culture of open data*	Implement training programs for both early stage researchers and senior researchers.
Technological	*Lack of interoperability: access to data, data and software compatibility, lack of metadata*	Establish agreed standards to support interoperability and secure a better quality of data
Environmental	*Critical mass of data available*	System for recognition/ rewards to for their work. Ensures awareness and thereby generates interest in protecting the environment by being able to conduct research with open access data and develop innovative solutions.
Legal	*Constraints to the access to nationally funded research infrastructures by international consortia,* *Copyright and ownership* *Variety of EU directives, regulations and national laws and policies, as well as multinational initiatives, not fully coordinated such as the Research Data Alliance*	Greater coherence to the incentive, legal and regulatory frameworks governing research data and tools. Establish an information base of guidelines and instructional materials to secure legal reuse of data Delegate a body e.g. the EOSC, to play a coordinating role, of active initiatives

IEA Task 41 online workshop, Denmark, April 30th 2020.

Break-out session on distributed-wind standards, certification and legislation.

Session host: Witold Skrzypiński

Minutes:
The list of problems mentioned by the small-wind stakeholders during the break-out discussion on distributed-wind standards, certification and legislation. Comments on issues unrelated with the aforementioned subjects were not included in the minutes. The comments that appeared to be of the highest priority are written in bold:

- **Turbulence in urban areas is characterized by a large variance in wind direction relative to the variance in wind speed. A specific way of modelling turbulence could help with this issue.**
- **Current small-wind turbulence classes are not sufficient** (Task-27 report includes information on this issue – see the IEA website).
- **High turbulence seems to have been the main reason for failures of small wind turbines so far.**
- Differences in national regulations make it difficult to expand operations internationally.
- Direct heat generation from small wind, e.g. water brake, may have a large potential but requires more research and should be addressed in the standards (*but is it really a standard-related issue).*
- Faulty small wind turbines create bad publicity and scare off potential clients.
- Potential customers pay very little attention to whether a turbine is certified. They rely on customer reviews and track record.
- German stakeholders complain about low feed-in tariffs.
- The cost of testing and certification is too high.
- Test facilities do not necessarily reflect the real-life conditions.
- Wind shear in the standards does not necessarily reflect real-life.
- Standardization of lighting protection for small wind requires more attention.

DW standards

Room 2 - IEA Workshop

What problems related to standards/certification/legislation have you experienced in your daily business?	Votes
The standards related to the grid connection regulations, and also standards related to the new type and innovative VAWT designs.	1
Experimental wind turbines must be tested to improve them, can that happen in a safe area? Paul Brouyere, Belgium	1
There is a problem with the TI used in the design and the one SWT has to work with. SWT performance varies a lot in urban areas. Luis C.	1
1. Clear answers of when we do and do not qualify for certification exemptions (different stds for different countries, even within EU) 2. Cost of certifications (6m2, 1kW wind turbine) - Brooke Spreen, Anerdgy AG	0
Niels: Lack of international uniformity of standards. Small details in standards and code can make a big difference.	0
Immanuel Dorn: Whats the real advantage of certification if it is not compulsary all over the world? (independend of being certified having a design-standard is very important)	0

Which of the issues addressed by the IEA Task 41 are relevant to your daily business?	Votes
Click on the green plus to add your answer (max 140 characters). If you need more, please use more sticky notes. Remember to put your name	0

What would you like DTU to focus on if you could choose?	Votes
reducing the costs of certifications, and also focus on innovative and cost effective swt designs, like new vawt designs.	4

IEA Task 41 online workshop, Denmark, April 30th 2020.

Break-out session on distributed-wind integration.

Session host: Tom Cronin & Kaushik Das

Brief Minutes:
The session was attended by around 15-20 participants. We used the following three questions to start the discussions:

1) What is the biggest challenge seen by you in order to integrate more distributed wind into the power system?
2) Which support (tool, knowledge, seminars) from IEA Task 41/DTU Wind Energy would help your business?
3) Which specific grid services do you think distributed wind can provide and in which markets?

- Planning permits for small wind are disproportionately difficult to obtain.
- Make the grid codes for small wind turbines more relaxed
- Biggest challenges for SWT are regulatory and economic: do consumers of electricity from SWT have to pay the real cost? A paradigm shift is needed in SWT to get the price down.
- Market for distributed wind is so dispersed around the world that it is very difficult to know and fulfill all the different requirements.
- Lack of general purpose converters for SWT – most on the market are meant for solar and then some arrangement needs to be done for SWT.
- Fast power fluctuations, particularly in mini-grids: difficulty of other components to follow/compensate but Lithium Ion batteries are promising much better performance so that simpler, asynchronous SWT generators can be used without a problem.
- Lack of controllability of turbine Type 1 and Type 2
- Difficulty in predicting the energy yield from a small wind turbine, both from a wind resource point of view and influence of obstacles: refinement of MyWindTurbine.com? Better siting tools for SWT.
- Ancillary services are more effectively provided by the larger turbines: more controllable and power injected into the grid at a common point.
- Wind turbines for low wind resources need a larger rotor but then have to be able to withstand greater loading
- There is a need for seminar(s) on the successful application of SWT and distributed wind: Task 41 should organize this.
- Getting rid of the need for a diesel generator in small grids, so that they can be 100% based on renewable energy: need grid-forming units which makes SWT more expensive but it can be done.
- Provision of services to various markets: best done with hybrid systems at small scale. Not really a market yet for grid-connected turbines to provide services

Export | Login

What is the biggest challenge seen by you in order to integrate more distributed wind into the power system?

Click on the green plus to add your answer (max 140 characters). If you need more, please use more sticky notes. Remember to put your name
+ 0

and surname. We will use the post-its for the discussion.
+ 0

Luis Arribas: the biggest challenges are regulatory and economical.
+ 0

Luis Arribas: the lack of general purpose inverters for Small Wind Turbines
+ 1

Lennart Petersen: fast wind power fluctuations, particularly in off-grid systems with small wind
+ 0

Lennart: lack of controllability of low cost WTGs which are type 1 or 2
+ 0

Immanuel Dorn: the difficulty in predicting the production of energy (especially for smaller hub heights) -> very dificult to find investors!
+ 0

Javier de la Cruz. Subsidies for domestic and rural electricity users.
+ 1

Nizar Al-Rifai: as developers of SWTs for low wind speeds our main challenge so far is getting financing and official support in Ukraine.

Which support (tool, knowledge, seminars) from IEA Task 41 /DTU Wind Energy would help your business?

Click on the green plus to add your answer (max 140 characters). If you need more, please use more sticky notes. Remember to put your name
+ 0

and surname. We will use the post-its for the discussion.
+ 0

Tools for better estimation of production from small turbines, especially wrt obstacles. Help to site a wind turbine. MyWindTurbine software??
+ 1

Luis: Seminar / knowledge on Success Experiences
+ 2

Vi manger 2 ting, vind data i lav højde, men også loaddata fra små generator anlæg, så vi kan se hvad er behovet egentlig De Loaddata jeg h
+ 0

Immanuel Dorn: Drone based siting procedures to make expansive site visits and expert-knowledge unneeded
+ 0

Which specific grid ser... wind can provide and in which markets?

Click on the green plus to add your answer (max 140 characters). If you need more, please use more sticky notes. Remember to put your name
+ 0

and surname. We will use the post-its for the discussion.
+ 0

Data Catalogue

Questions concerning the IEA Task 41 WP2. Data Catalogue

1. Have you a data catalogue Visible/Findable from outside your company? If no, would you use an established taxonomy to tag your data? If yes, how did you tag your data?	**Votes**
I take part in several citizen projects that generate open source data Frits Ogg. e.g. www.hackair.eu and http://smartemission.ruhosting.nl/visitors/ The data of the smart emission project is now collected and stored by the Dutch land registry.	3
No, but I would use an established taxonomy to tag my data. Akinmolayan Peter	1
write an answerWould be nice to see citizen science data included - Frits Ogg Some of these data is hold back/owned by a company that provides also the equipment	1
Good day	1
Jeg har bla. data fra ca 150 vindmøller rundt i DK, i mintut opløsning, men de er ikke frie for andre firmaer. Men, kan man lave en bytte handel ? Anker Mardal	1
Click on the green plus to add your answer (max 140 characters). If you need more, please use more sticky notes. Remember to put your name	0

2. Could you please describe using three keywords the FAIR data principle (e.g. ambitious, innovative, interesting, impossible, appealing, not-applicable, …..	**Votes**
Click on the green plus to add your answer (max 140 characters). If you need more, please use more sticky notes. Remember to put your name	2
Frits Ogg; open source, reliable, easy to find	1
Feks. lige som Thinksgiveres, til 3D printere, enten koster det, eller også får man adgang ud fra hvor meget man deler. Mvh Anker Mardal	1
Immanuel: interesting, important, innovation-accelerator	1
and surname. We will use the post-its for the discussion.	0
Hvis man kunne have en bytte ordning, land for land i samme data kvalitet. Anker	0

3. Under which conditions would you share your data? Against a fix/variable amount of money; Against services; Against involvement in projects; for free if data is not used in competitive goals.	**Votes**
Frits Ogg; privacy guaranteed. inter operable formats, continuity of data stored guaranteed. Payed for commercial use. Permission to use the data in case of commercial use. Regulation and supervision by government organization.	2
I will share my Data for free if the data is not used in a competitive goals. Akinmolayan Peter	1
Frits Ogg; I want to know if i'm sensed, by whom and what happens with the data.	1
Click on the green plus to add your answer (max 140 characters). If you need more, please use more sticky notes. Remember to put your name	0
and surname. We will use the post-its for the discussion.	0
Mangler en mere kvalitet af disse data, er det fra vindmøller, bag rotor, er det fra mtro master med godkendt og valideret udstyr. Anker Mardal	0
Frits Ogg; Data could be combined with other government open data.	0