



# IEA Wind Task 50

## Hybrid Wind Power Plants

Jennifer King, National Renewable Energy Laboratory & Kaushik Das, Technical University of Denmark

# Agenda – Day 1

- Overview of hybrid plants and tasks
- Lightning talks from the participants – focused on relation to other IEA tasks and TCPs:
  - What type of hybrids your task/TCP cares about?
  - What are the biggest challenges?
  - What are you hoping to get out of this task?
- Break – 15 min
- Work package 1 – expectations, goals, etc.
- Work package 2 – expectations, goals, etc.
- Work package 3 – expectations, goals, etc.
- Wrap up

# Logistics

- To be decided by an survey to be sent out after the kick-off
  - Bi-annual meetings
    - Preferably physical
    - In conjunction either with IEA Ex-Co or flagship conferences
  - Regular communication via Slack
  - File sharing platform - Google Drive/dropbox/sharepoint/onedrive/???
- WP meetings organised quarterly by WP leads
- Surveys to be sent for finalising participant vs observer role
- We will send Letter of Commitment/Notice of participation templates to the participating country representatives after the kick-off
  - We need email confirmation as participant/observer from each institution by **end of April 2022**
  - Financial commitments from each country depends on number of country participating

# Website

<https://iea-wind.org/task50/>



## Task 50 - Hybrid Power Plants

Why Hybrid Power Plants?

The purpose of the proposed IEA Wind Task is to coordinate international research and development in the field of hybrid wind power plants. Technology to be considered within this Task will cover a broad range but will focus on design and operation of wind based hybrid power plants.

By gathering ongoing research results as well as state-of-the-art industrial practices, we aim to create an overview of best practices on hybrid plant design, operation, and regulation. We will explore how uncertainties affect the performance and potential for adopting hybrid power plants. Specifically, the aim is to support the strategic initiatives of IEA Wind TCP by:

- Maximizing the value of wind energy in systems and markets by increasing the capacity of hybrid power plants and the ability to play a role in grid services.
- Accelerating the development and deployment of hybrid power plants in various markets across the globe through availability of data, advanced models and tools, and test methods.
- Determine viability of other end-use products powered by wind-based hybrid power plants including electricity, hydrogen, desalination, carbon capture, and other renewable-based alternative fuels.
- Foster collaborative research and the exchange of best practices and data by developing benchmarks and best practices for realistic hybrid power plants and ensuring easy access to the most up-to-date knowledge, algorithms, and ideas for hybrid power plants.

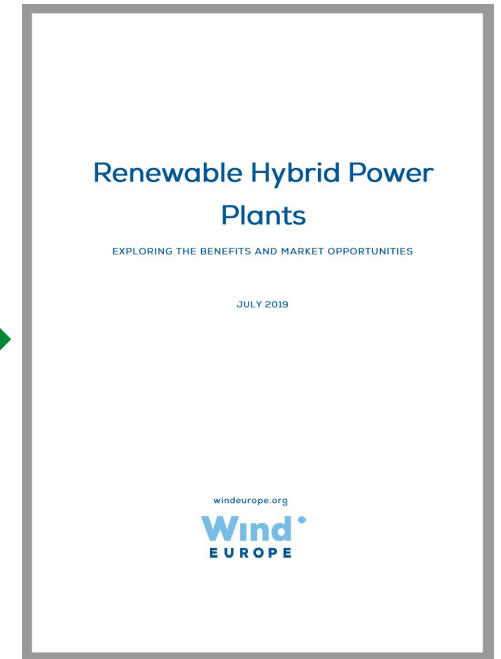
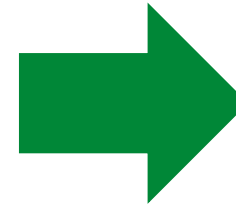
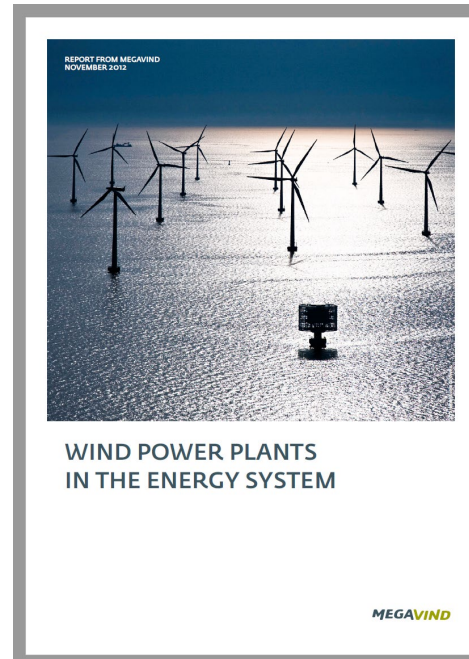
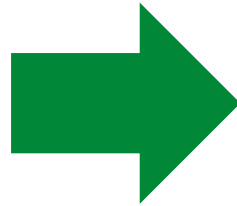
The task is aimed at the Advanced Technology priority area, but also affects Resource and Site Characterization by making flow conditions controllable and Energy Systems with High Amounts of Wind, and other resources such as solar, by making power production more controllable, predictable and dispatchable.

The result is guidance for the industry, lawmakers, regulators and researchers on the current modeling efforts, control/optimization approaches, requirements, test and standards, impediments to adoption, future directions and expected benefits of hybrid power plants.

# Format

- Roles
  - Participant/Observer/Informed about
  - Participant vs observer role - Observers will have a limited role in the execution and reporting of IEA Wind Task 50, such as access to data and contributions to IEA Wind reports and deliverables. Observers may attend most of the meetings and contribute to external publications (papers, conferences, news articles etc.).
- If you are interested in leadership of any WP, please let us know.

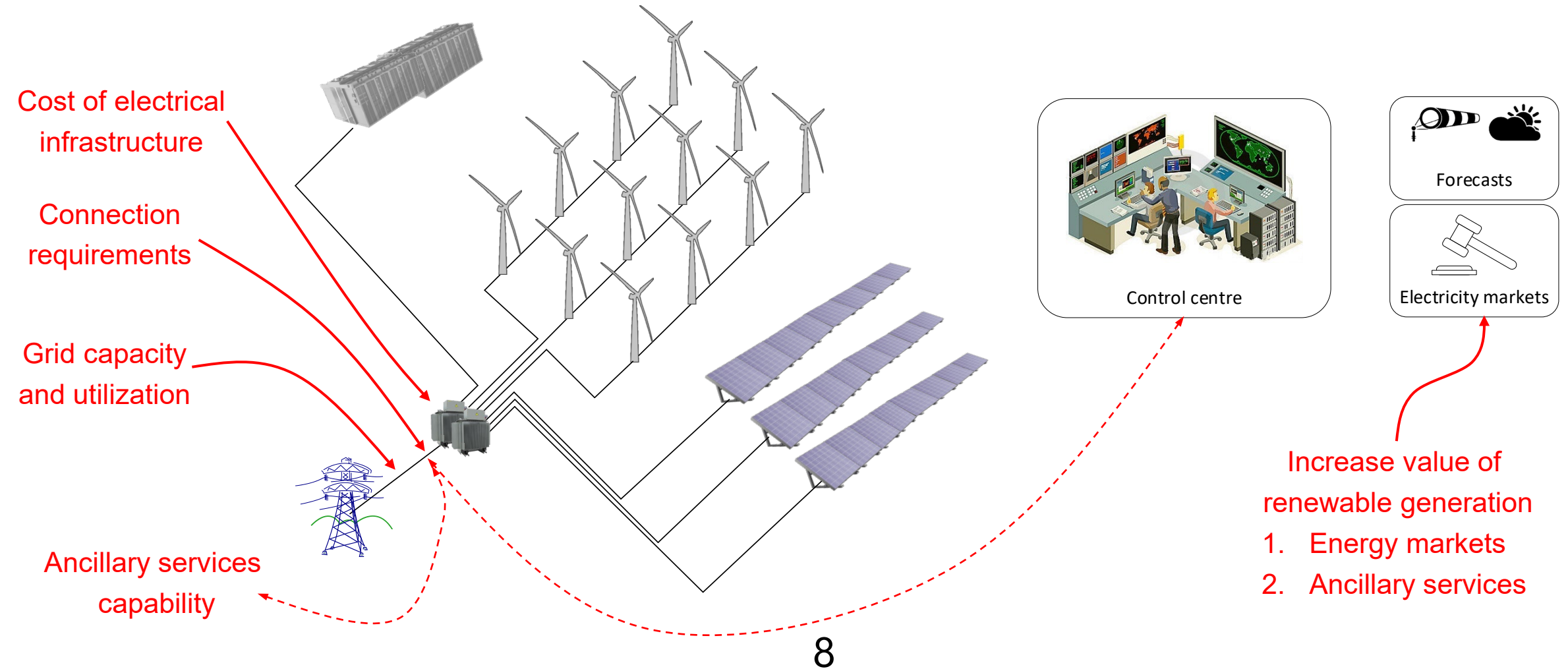
# From wind turbines to wind power plants to hybrid power plants – system integration agenda



# Scope of Hybrid Power Plants

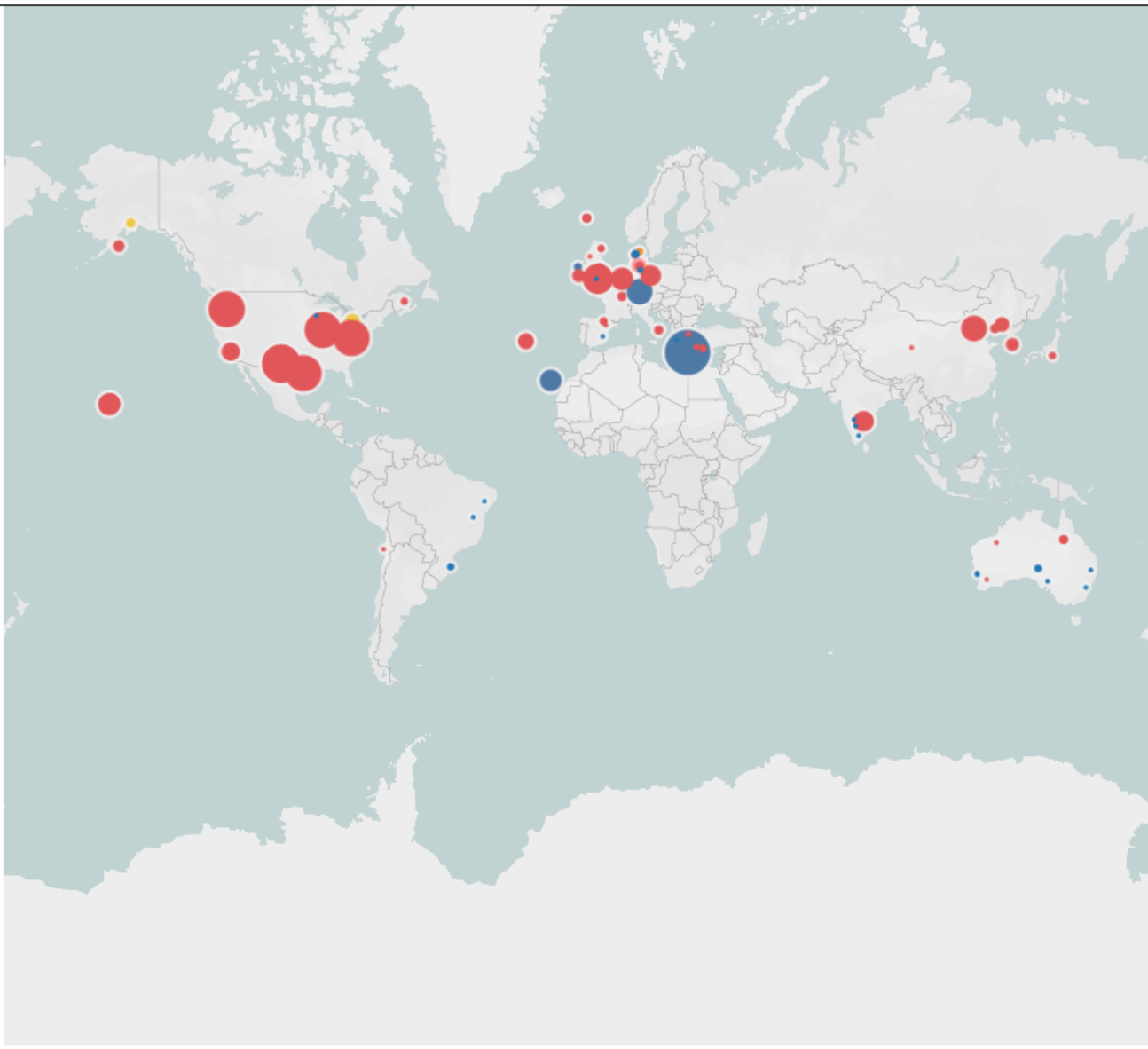
- Utility-scale (tens to hundreds MW)
- Wind Power +/- Other RES +/- Storage(s)
  - with single point of connection typically connected to MV or HV grid
    - AC or DC or Hybrid collection system is possible
- Driver for design and operational objectives is maximizing the value for owner
  - Market based services
  - Grid code requirements
- Coordinated control between different technologies
- Shared land allowing for physical interaction between technologies
- Sector-coupled with other energy productions especially Wind+H2 systems is also considered

# Hybrid power plant – unmet needs and challenges

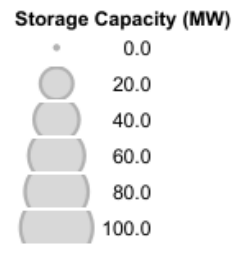


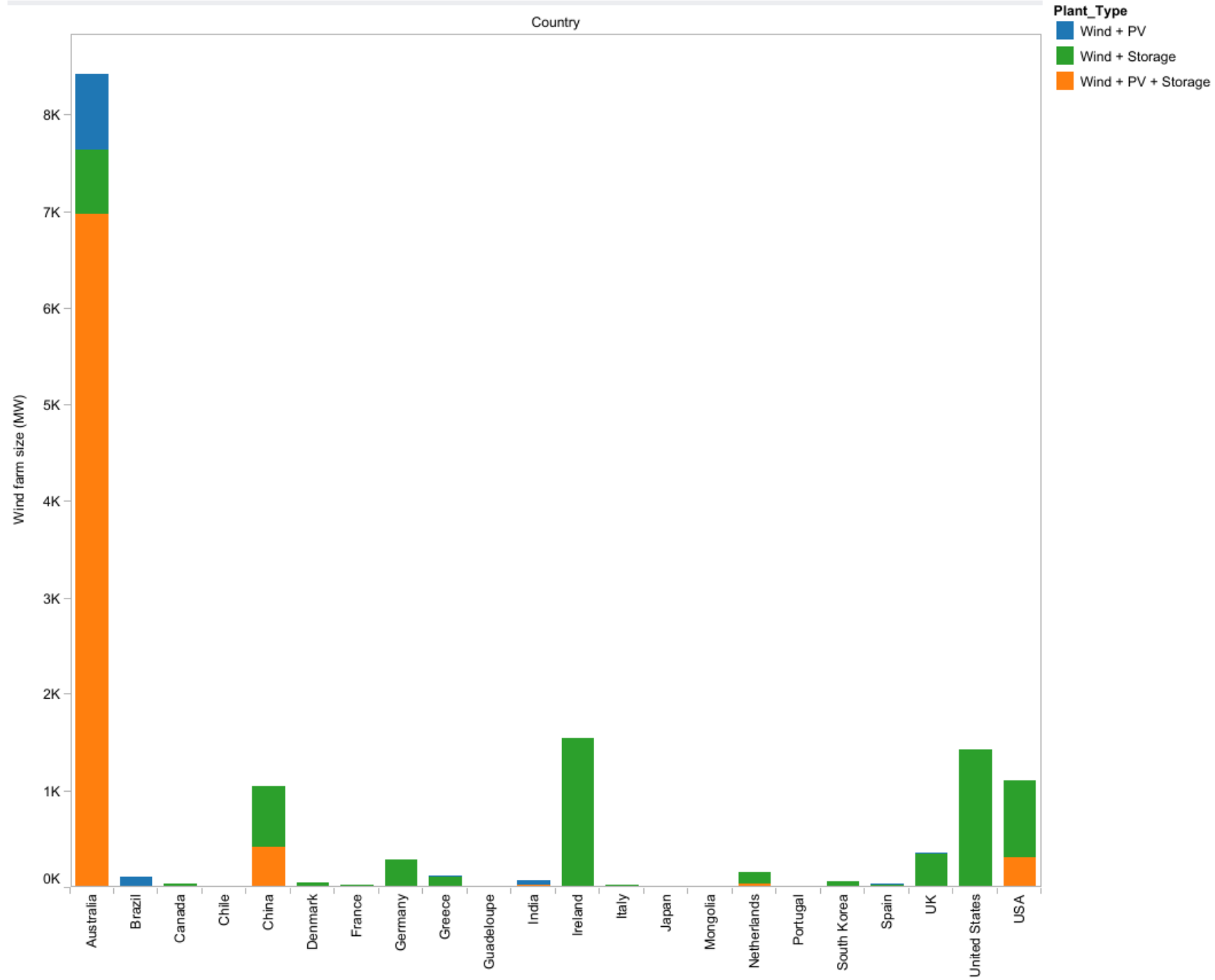






- Type**
- Null
  - Battery
  - Flywheel
  - Hybrid (battery & P2G)
  - Power to gas
  - Pump hydro





# Motivations for HPP – System Operators/Society

- Optimal utilization of land
- Delayed requirement for grid infrastructure reinforcement / maximize utilization of existing infrastructure
- Improved grid stability and security
- More RES integration with same grid connection
- More flexibility allows for decommissioning of fossil-fuel based generators
- Reduced curtailment -> more value of renewables/ improved capacity factors / utilization factors

# Motivations for HPP – Plant Owners

- Increased Performance and Revenue
  - Energy Arbitrage
  - Reduced penalty
  - Flexibility for capacity, balancing, ancillary service markets
  - Increased availability
  - Maximum use of grid interconnection
- Cost reduction
  - Infrastructure
  - Reduction in land cost
  - Optimal use of electrical and other infrastructure
  - Project development costs reduction including resource assessment, site development, permitting



***Goal: Accelerate the development and deployment of hybrid power plants***

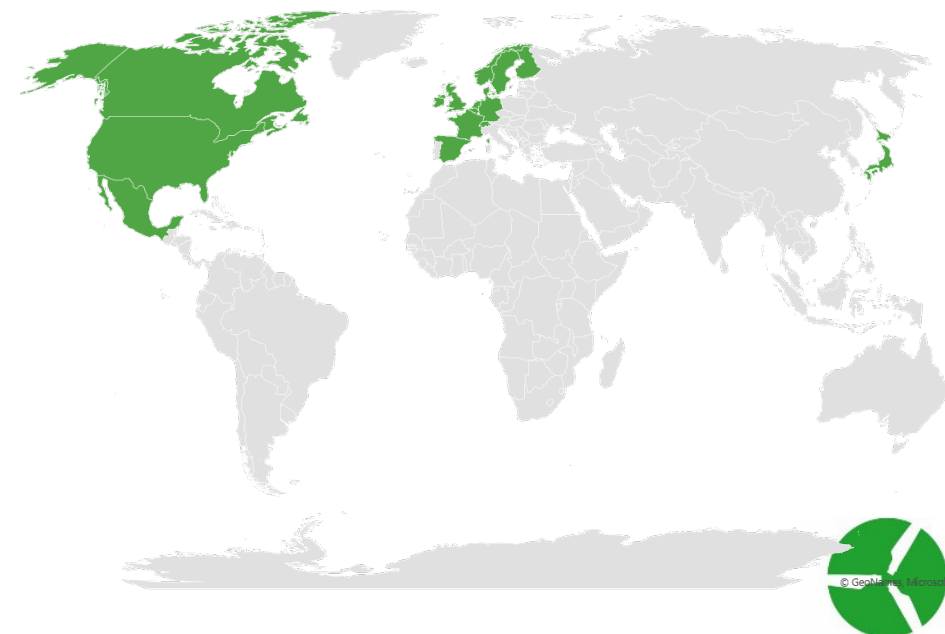
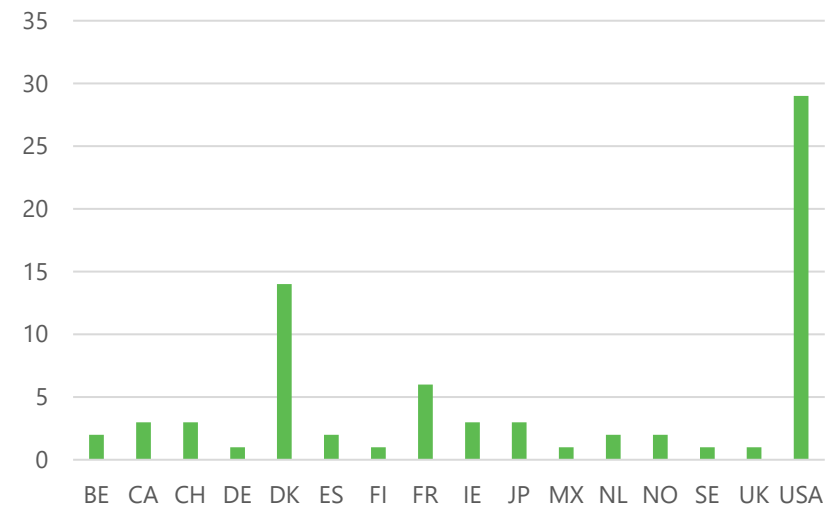
Challenge: Highly complex systems that must be customized to a given application/location (primarily focused on co-located)

# Hybrid Power Plants (HPP): Topical Experts Meeting

To realize accelerate the deployment of hybrid power plants, important work to be done, which requires active involvement of the stakeholders: OEM, developers, owner/operators, consultants and researchers

Organized a virtual **Topical Experts Meeting (TEM)** in August 2020 to begin the process

Approx. 74 participants over 3 days from 16 countries



# Results from the TEM

Question	Agree	Disagree
Only HPP should be developed in the future	40%	60%
Markets are sufficient for HPP participation	12%	72%
Providing grid services as an essential HPP capability	70%	30%
Prioritize experimental validation	76%	12%



# Results from the TEM: Market Barriers

- Demonstration and economic value
- Lack of validation data
- Validated models
- Optimization, control, modeling tools

Basis for our work packages

# Highest Impact Tasks for IEA Wind Task 50

- **Maximize the value** of wind energy in systems and markets
- **Accelerate the development** and deployment of hybrid systems
- Determine the viability of other **end-use products** by wind-based hybrids
- Foster **collaborative research** and exchange best practices

*Expected to be a four-year effort.*

WP0: Management and coordination

WP1: Collection of research results and interaction with other projects

WP2: Reference hybrid plant

WP3: Overview of technology and design/operation algorithms

WP4: Electrical design and grid service provision

WP5: Outreach and Collaboration with TCPs, Tasks, and R&D

# Lightning Talks

- 15:15 Stephan Barth, IEA
- 15:20 Seamus Garvey, IEA TCP ECES
- 15:25 Atle Harby, IEA TCP Hydro
- 15:30 Katherine Dykes, IEA Wind Task 37
- 15:35 Ian Baring-Gould, IEA Wind Task 41
- 15:40 Jason Fields, IEA Wind Task 43
- 15:45 Jan-Willem van Wingerden / Paul Fleming, IEA Wind Task 44
- 15:50 Gregor Giebel, IEA Wind Task 51
- 15:55 Jen King, NREL
- 16:00 Kaushik Das, DTU

# Thank you.

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