INTRODUCTORY NOTE

IEA WIND TASK 11 TOPICAL EXPERT MEETING

November 2, 2023

ON

INSTRUMENTATION DEVELOPMENT

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1. VALUE FOR IEA WIND TCP

1.1 BACKGROUND

The current instrumentation for observing the complex flowfields in and around wind plants struggles to match the fidelity of existing simulation tools. As a result, these measurement limitations create a hurdle for validating and assessing the quality of the wind plant numerical models. Additionally, improved measurements are needed to enable innovative concepts for wind turbine and wind farm operation and prototyping. Two large field experiments in the U.S. (AWAKEN and RAAW) are both being limited in scope by the currently available instrumentation for wind energy physics measurements. These limitations are on our ability to reliably measure pressure, blade deformation, and high-resolution velocity. Others in the international wind energy community have expressed interest and pursued development of instruments to capture these quantities of interest. The gaps in instrumentation have motivated the development of an instrumentation development roadmap and offshore validation experiment planning documents to address these gaps for future experiments. The results of these roadmap and offshore experiment planning have made it clear that broad international collaboration is needed to address the instrumentation needs across the wind energy community. Investment in instrumentation development is a large undertaking that will require international collaboration and coordination to be more effective at creating these measurement capabilities to enable validation campaigns to reduce uncertainty in model simulation and turbine design. Additionally, this collaboration will help with the coordination of industry with sensor developers to help with development of sensors that can be widely deployed for integration in wind turbine operation.

1.2 MOTIVATION

The development of new instrumentation to address the gaps in current and future field campaigns is a large undertaking that will require international collaboration to be successful. It will require expertise and investment from numerous institutions across multiple countries and coordination to ensure development on the highest priority instruments without unnecessary duplication of efforts. The Wind Energy Instrumentation Development Roadmap and Offshore Validation Experiment Roadmap efforts and documents provide a starting place to coordinate with the international community to share the current state-of-the-art development and input on priorities of development for the next five years to enable the next set of validation experiments. The goal of this technical experts meeting is to assess communicate the current measurement capabilities, measurement needs and gaps, agree on a path forward to create an IEA task for developing instruments to fill in those gaps. This task will coordinate with current lidar, rotor aeroelasticity, simulation and validation, and wind plant control tasks to coordinate the instrumentation needs across these tasks and suggests paths for development. This TEM will likely lead to the creation of a new task that meets the need to coordinate across tasks to create instrumentation that will help address the needs of the other IEA tasks.

1.3 ADDED VALUE OF COLLABORATION

There is currently a gap in this type of collaboration on instrumentation development. To date, organizations plan their field campaigns and work with instrumentation and sensor developers as best they can to meet their needs with iterative improvements on the instrumentation development to meet the goals of the campaign. There is not a formal process on collaborating internationally to determine instruments gaps and address them for future campaigns. This collaboration is required to move the industry and research community forward. The meetings, workshops, and reports through this collaboration will coordinate instrumentation needs for researchers, turbine manufactures, and turbine operators, sharing the current standing of technologies, technologies, that with development, can provide the necessary quantities of interest, and hep bridge the instrumentation development process from new concepts to commercialization.

1.4 ALIGNMENT WITH IEA WIND STRATEGY

The highest priority future wind experiments require instrumentation development that is beyond what any single country can do. This can be tied to any science challenge that requires experimental discovery, model validation, or system testing.

Innovative technology is hindered by the limited accuracy of commercial turbine measurement systems, novel measurement systems are needed that can be compatible with commercial turbine requirements: reliable, affordable, and scalable.

2. MEETING FORMAT AND GOALS

2.1 OBJECTIVES

Creation of a new research task
Collaboration with other TCPs

Dissemination of priorities and multi-nationals collaboration needs
Setup future virtual meetings
Identify what instrumentation needs are, which are needed when to enable experiments or turbine improvements, identify who is already working in each instrumentation area,
Identify organizational structure if there is to be a future TEM (such as meso air, micro air, water, structures blade-turbine, structures platform-mooring, soil, grid)
Identify who would commit to a new TEM, task, or activities in existing TCPs

The meeting will be held in person and there will be an additional follow-on meeting virtually to help coordinate with people that were not able to make the in-person meeting.

2.2 SPECIFIC OUTCOMES

Development of items for a task proposal

Roadmap for instrumentation development

Form a group to create a Task to collaborate on instrumentation development.

2.3 INTENDED PARTICIPATION

Likely but not confirmed: DTU, ForWind, Fraunhofer, DLR, TNO, TU Delft, NOAA, PNNL, LLNL, Cornell University, University of Wyoming, UT Dallas, Texas Tech University, University of Oklahoma, Lumibird, Vaisala, ZXLidars, and LUNA

2.4 TENTATIVE PROGRAM

Date: Thursday November 2, 2023

Location: Broomfield, Colorado USA.

Omni Hotel (same location as NAWEA 2023 conference)

We will have a lead on meeting prior to November 2nd to discuss the Instrumentation Development Roadmap and the Offshore Validation Experiment Roadmap, as well as collect information on existing instrumentation under development to share with the group.

Agenda:

8:30: Instrumentation gaps

9:30: Instruments under development that we are using/having challenges with

10:00 to 10:20 break

10:20 to 11:00: Continue previous discussion

11:00: Instruments technologies we would like to be using

12:00: Lunch

1:00: Example of successful instrument development

2:00: Steps on coordinating an IEA task

3:00 Laying out actions for report and IEA task creation