INTRODUCTORY NOTE

IEA WIND TASK 11 TOPICAL EXPERT MEETING

ON

HYBRID POWER PLANTS CHALLENGES AND OPPORTUNITIES

Jennifer King, Vahan Gevorgian, Eric Lantz – National Renewable Energy Laboratory

Katherine Dykes, Kaushik Das – Technical University of Denmark

BACKGROUND

With renewable energy growing to 10%-20% or more of the overall electricity generation, design objectives for renewable power plants are shifting from producing energy at the lowest levelized cost to maximize profitability. Several research and commercial efforts have investigated how to size respective generation and storage assets together for hybrid power plant systems – including wind, solar, storage, and other technologies. This includes microgrids all the way up to utility-scale hybrid power plants.

However, even as many renewable industry companies are announcing and pursuing hybrid power plant commercialization strategies, many open-ended questions still exist related to their design, operation, and control. In many cases, solar and/or storage will be added to existing wind plants to increase the capacity/value. To inform the research needs on design, operation, and control of these hybrid power plants, NREL and DTU Wind Energy propose to hold a two-day IEA Wind Topical Experts Meeting in 2020.

MOTIVATION

Currently, hybrid technology at the utility-scale has been an underrepresented area of research in IEA Wind tasks. Several tasks have addressed design and operations of wind plants as a single technology that would be complementary to this IEA task including IEA Task 25 (Design and Operation of Power Systems with Large Amounts of Wind Power), IEA Task 37 (Systems Engineering in Wind Energy), and IEA Task 41 (Enabling Wind to Contribute to a Distributed Energy Future). However, co-located hybrid power plants are at the frontier of wind technology and community interest.

Many governments, industries, and developers are currently marching forward with pilot wind-solar-storage or wind-storage projects, but there are challenges and opportunities that are common to all countries. Because the wind industry is leading the commercialization of large hybrid plants, it makes sense for this to be explored under IEA Wind. The IEA Wind TCP can seize on the momentum for hybrid power plants and address some of these common issues in an international, collaborative setting. This work will be coordinated with the appropriate solar working groups.

OBJECTIVES

This topical expert meeting is intended for participants to exchange information and ideas that relate to the opportunities and challenges that are unique to hybrid power plants but shared by researchers or developers across the globe. The initial focus will be on wind/solar/storage plants, but could include other technologies such as geothermal, hydro, etc. This includes launching the international dialogue, exploring research gaps and identifying opportunities for HPP technologies in bulk and distributed power systems. The meeting is expected to advance development of research pathways. Topics that will be discussed include:

- Benefits of such multi-technology hybrid plants fully quantified
    - Generation cost
    - System reliability
    - Operational flexibility
- Set of use cases for multi-technology hybrid power plants
- Optimally size individual technology components in hybrid power plants
- Optimal control of hybrid power plants to provide economic, reliable, and resilient benefits

TENTATIVE AGENDA

The agenda of the online TEM#101 will be structured in four sessions spread over four days. The sessions will take place between 14:00 and 18:00 CEST (still to be confirmed).
Invitees will be asked to answer a survey prior to the meeting in order to complete and prioritize the list of topics. Please note that this agenda can therefore be adapted.

Monday, August 24

HPP role in high share variable RE systems (Chair: **Eric Lantz, Kaushik Das**)

- Grid Integration Perspective – Task 25
- Resource opportunities and correlations
- Market Opportunities – Task 26
- Frequency and voltage support
- Advanced energy management system

Tuesday, August 25

Lessons Learned from Microgrids (Chair: **Katherine Dykes)**

- From microgrids to utility-scale HPP
- Sizing and optimization of HPP for different objectives
- Microgrids and Islands
- Weak Grids – Common Operational Challenges
- Electrical Design and Control of Hybrid Systems

Wednesday, August 26

Sizing and Design Optimization (Chair: **Jen King,** NREL)

- Single technology plant design – Task 37
- Electrical Design and control of HPP
- Opportunities for co-locating technologies
- Metrics to consider beyond LCOE
- Perspectives on Data and HPP

Thursday, August 27

Controls and Operation of HPP (Chair: **Vahan Gevorgian**)

- Perspectives on Data and HPP Systems
- Forecasting
- Hybrid Plant Models
- Hybrid Plant Controls
- Stability Analysis
- Testing and validation

INTENDED PARTICIPATION

- Wind/Solar/Storage OEMs
- Wind/Solar/storage owners and operators
- Research institutions

- Funding agencies
- Cross-technology organizations: e.g. IEA PVPS TCP Task 14

EXPECTED OUTCOMES

A report will document the proceedings of the meeting. This report will provide:

- The state of existing hybrid power plant planning
- Challenges and opportunities for hybrid power plants common to all developers
- Scope for proposed IEA Wind Task for submission to IEA Wind Executive Committee for approval