

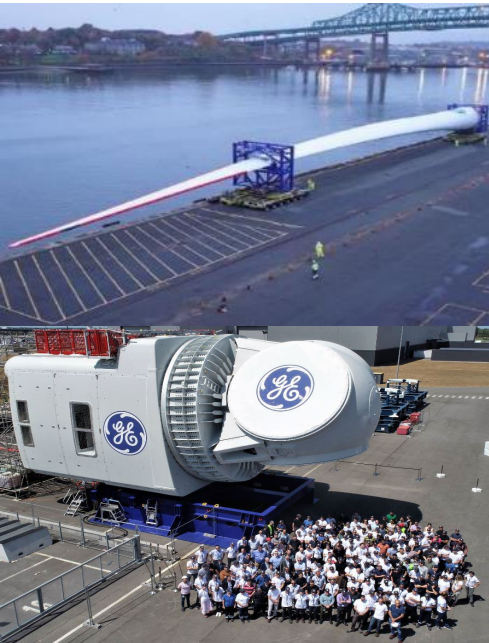
# E12 - Wind Grid Integration Stakeholder Engagement

Mitigate Market Barriers – Grid Integration

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NREL

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# FY21 Peer Review - Project Overview

## Project Summary:

Wind grid integration stakeholder engagement focuses on disseminating key results from NREL analysis to regulators, policy makers, utilities, transmission system operators, and the power system industry. This helps ensure that study results are made available to power system stakeholders so that they are well-informed, and so the value of DOE'S research can be leveraged

- Key project partners - ESIG

## Project Objective(s) 2019-2020:

- Leadership and participation in ESIG
- Participation in National Electric Reliability Corporation (NERC) and Federal Energy Regulatory Commission (FERC) technical meetings and task forces, participation in IEEE P2800, and engagement with other key power system stakeholders on wind integration
- Participation in International Energy Agency Task 25 Design and Operation of Power Systems with Large Amounts of Wind Power

**Overall Project Objectives (life of project):** To reduce grid integration barriers and enable wind energy to reach high penetrations such as 50% energy by region and greater than 100% instantaneous wind power generation, it is essential that analysis and results on grid integration methods reach utilities and other stakeholders to increase their confidence and provide needed tools and data for them to study high wind penetration on their power systems.

Project Start Year: 08/19

Expected Completion Year: FY22

Total expected duration: 3 years

FY19 - FY20 Budget: \$1,050,000

Key Project Personnel: Dave Corbus, Bethany Frew, David Dunn, YC Zhang, Andy Hoke, Bri Mathias-Hodge, Shahil Shaw, Jessica Lau, Greg Brinkman, Barry Mather NREL

Key DOE Personnel: Jian Fu



# Project Impact

The impacts of NREL's stakeholder project on wind energy grid integration and wind commercialization can be seen across many different areas and institutions and include:

- Support and leadership in ESIG, the most influential institution on wind and energy systems integration in the world and a leader in wind energy integration for two decades
- Technical contributions of NREL collaborations with NERC and FERC that impact regulatory development and allow these key stakeholders to better understand wind energy integration
- Leadership in IEEE standards that directly impact the wind industry and enable the development of next-generation wind turbines
- IEA Task 25 leadership that enable the best grid integration practices to be shared around the world
- Provide support to WETO on the development of a DOE WETO wind grid integration roadmap

# Program Performance – Scope, Schedule, Execution

All project milestones were met on time, and the go-no/go was successful and include the following:

Milestones completed include:

- Provide slide deck and report to WETO on the wind grid integration roadmap
- Complete joint IEA Wind Task 25 grid integration paper
- Participate and lead workshop session in the ESIG Spring Technical Workshop
- Presentation for National Electric Reliability Corporation (NERC) Probabilistic Planning working group
- Go/No-Go - Approve continued funding and support for ESIG

# Program Performance – Accomplishments & Progress

NREL engages with policy makers, regulators, international groups, and regional planning and reliability organizations to deliver timely and objective information about wind energy. Below is partial summary of impactful work that was completed in the 14-month duration of this project

- **Participation and leadership in ESIG**

- Board of Directors, including regular meetings with advisory committee, strategic planning sessions, and co-leading early career and diversity initiative
- Chairing the Offerings Committee to help shape the content and speakers for the technical meetings and working groups
- Chairing and presenting technical content in spring and fall meetings, as well as side meetings (e.g., Towards 100% Renewables, annual Forecasting and Markets workshop)

# Program Performance – Accomplishments & Progress

- **Leadership in NERC and FERC working groups**
  - Work closely with NERC on their Reliability Services Working Group to ensure that key reliability issues are addressed for America's future power grid
  - Participate in NERC's Inverter-Based Resource Performance Task Force (IRPTF) including review of draft IRPTF document
    - NREL researchers providing technical input to Ryan Quint of NERC including coordination at ESIG topical sessions
  - Presented at NERC Probabilistic Assessment Working Group's Probabilistic Analysis Forum on Probabilistic Resource Adequacy Suite: NREL's collection of tools for studying unserved energy risk in electric power systems, across space and time
  - Presentation of A2e2g project at FERC Technical Conference on Increasing Market and Planning Efficiency and Enhancing Resilience through Improved Software

# Program Performance – Accomplishments & Progress

- **Lead role in the development of IEEE Std P2800 *Inverter-Based Resources Interconnecting with Transmission Electric Power Systems***
  - NREL tracking impact of standard on wind needs (industry participants leading much of this task force, with inverter manufacturers, some ISO participation)

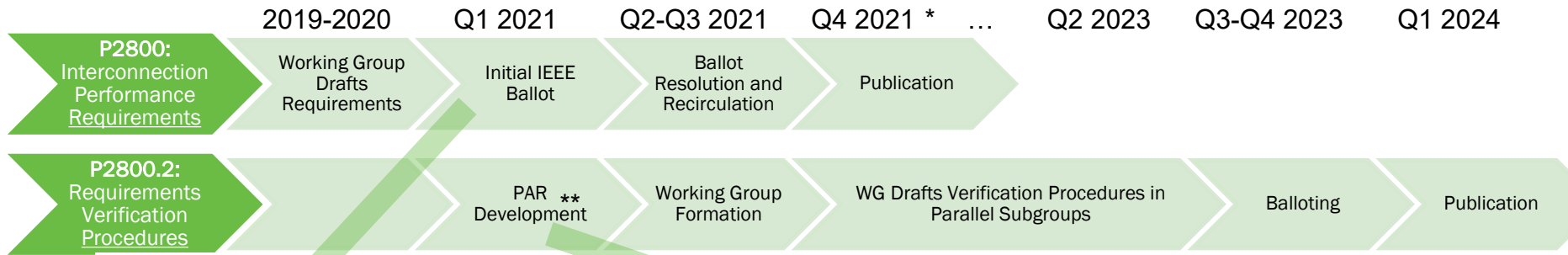
# Program Performance – Accomplishments & Progress

- **Leadership in the International Energy Agency (IEA) Task 25 Design and Operation of Power Systems with Large Amounts of Wind Power** – Paper contributions in various journals with IEA team members include the following papers:
  - *Grand challenges of Wind energy Science – the Grid*
  - *Impact of Operating Reserve Rules on Electricity Prices with High Penetrations of Wind and Solar*
  - *Including operational aspects in the planning of power systems with large amounts of variable generation: A review of modeling approaches*
  - *Addressing technical challenges in 100% variable inverter-based renewable energy power systems*
  - *Review of wind generation within adequacy calculations and capacity markets for different power systems*
  - *Simulating wind power forecast error distributions for spatially Aggregated wind power plants*
- Leadership in the development of a new IEA Wind Hybrids Working Group



# Project Performance - Upcoming Activities – IEE P2800 Highlight

## Preparing for Extremely High Levels of Wind and PV: Standardizing Interconnection Performance Requirements and Verification



P2800/D6.0, March 2021  
Draft Standard for Interconnection and Interoperability of Inverter-Based Resources Interconnecting with Associated Transmission Systems

- 1 **P2800™/D6.0 (March 2021)**
- 2 **Draft Standard for Interconnection and**
- 3 **Interoperability of Inverter-Based**
- 4 **Resources Interconnecting with**
- 5 **Associated Transmission Systems**
- 6 Developed by the
- 7 Wind and Solar Plant Interconnection Performance Working Group (WSPi-P) – [website](#)
- 8 of the
- 9 Energy Development and Power Generation Committee, the Electric Machinery
- 10 Committee, and the Power System Relaying Committee
- 11 of the
- 12 IEEE Power and Energy Society

**IEEE SA** STANDARDS ASSOCIATION

**P2800.2**

Submitter Email: andy.hoke@nrel.gov  
 Type of Project: New IEEE Standard  
 Project Request Type: Initiation / New  
 PAR Request Date: 18 Mar 2021  
 PAR Approval Date:  
 PAR Expiration Date:  
 PAR Status: Submitted

1.1 Project Number: P2800.2  
 1.2 Type of Document: Recommended Practice  
 1.3 Life Cycle: Full Use

2.1 Project Title: Recommended Practice for Test and Verification Procedures for Inverter-based Resources (IBRs) Interconnecting with Bulk Power Systems

3.1 Working Group: P2800.2 - Test and Verification of BPS-connected Inverter-Based Resources (PE/EDPS/P2800.2 - Test and Verification of BPS-connected IBRs)  
 3.1.1 Contact Information for Working Group Chair:  
 Name: Anderson Hoke  
 Email Address: andy.hoke@nrel.gov  
 3.1.2 Contact Information for Working Group Vice Chair:  
 None  
 3.2 Society and Committee: IEEE Power and Energy Society/Energy Development & Power Generation (PE/EDPG)  
 3.2.1 Contact Information for Standards Committee Chair:  
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 3.2.2 Contact Information for Standards Committee Vice Chair:  
 None  
 3.2.3 Contact Information for Standards Representative:  
 None  
 3.3 Co-Stds Committees(s):  
 3.3.1 IEEE Power and Energy Society/Transmission and Distribution (PE/T&D)  
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 3.3.3 IEEE Power and Energy Society/Analytic Methods for Power Systems (PE/AMPS)  
 Contact Information for Standards Representative:  
 Name: Chris Dent  
 Email Address: chris.dent@ed.ac.uk  
 3.3.4 IEEE Power and Energy Society/Power System Relaying and Control (PE/PSRCC)

\* Future dates are targets  
 \*\* P2800.2 PAR pending IEEE SASB approval

# Stakeholder Engagement & Information Sharing

- The project team engages key audiences as appropriate throughout the project to get feedback on the methods, data, and results, with special emphasis and partnership with ESIG
- Stakeholders include regional and state grid operators, utilities, academic institutions, and other power grid stakeholders
- ESIG, NERC, FERC, IEA Task 25, IEEE
- Through ESIG: every independent system operator (ISO) in North America Investor owned utilities including PG&E, SCE, SDG&E, Hawaiian Electric Company, APS, Duke, Southern Co, Xcel Energy, TEP, MidAmerican, NextEra, OG&E, PNM, DTE, ITC Transmission, Oncor; Public Power including BPA, NPPD, LADWP, Platte River, SMUD, WAPA, Lincoln Electric; Rural Coops including Basin Electric, Tri State G&T, GRE, Golden Spread, AVEC, Iowa Lakes; Corporate including ABB, GE, Vestas, Siemens, Iberdrola, S&C Electric