U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

Wind Standards Development

Project ID: T18

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National Renewable Energy Laboratory

FY17–FY18 Wind Office Project Organization

"Enabling Wind Energy Options Nationwide"

Technology Development

- Atmosphere to Electrons
- Offshore Wind
- Distributed Wind
- Testing Infrastructure
- Standards Support and International Engagement
- Advanced Components, Reliability, and Manufacturing

Market Acceleration & Deployment

- Stakeholder Engagement, Workforce Development, and Human Use Considerations
- Environmental Research
- Grid Integration
- Regulatory and Siting

Analysis and Modeling (cross-cutting)

Project Overview

T18: Wind Standards Development

Project Summary

- This project provides funding to participate in and, where logical, lead the development of domestic and international standards. The project also supports the education and engagement of the U.S. industry in the process.

Project Objective & Impact

- Standards provide clear expectations for all industry stakeholders, reduce risk and uncertainty, and create a level paying field for U.S. industry. They also provide a quick path to industry and real-world applications for the knowledge developed in other parts of the U.S. Department of Energy Wind Program.

Project Attributes

Project Principal Investigator(s)
Jeroen van Dam Brian Smith (IEA ExCo)
DOE Lead
Michael Derby
Project Partners/Subs
NA
Project Duration
Multiyear, ongoing

Technical Merit and Relevance

Wind standards development provides clarity, consistency, and predictability while also:

- Creating consensus
- Leveling the playing field for U.S. industry to compete globally
- Expanding the impact of DOE labs' broad knowledge of modeling and validation methods, impartiality, and central position in the U.S. industry
- Allowing direct adoption of research and development knowledge by industry
- Providing a forum for collaboration with all relevant industry stakeholders
- Assuring compliance through the conformity assessment process

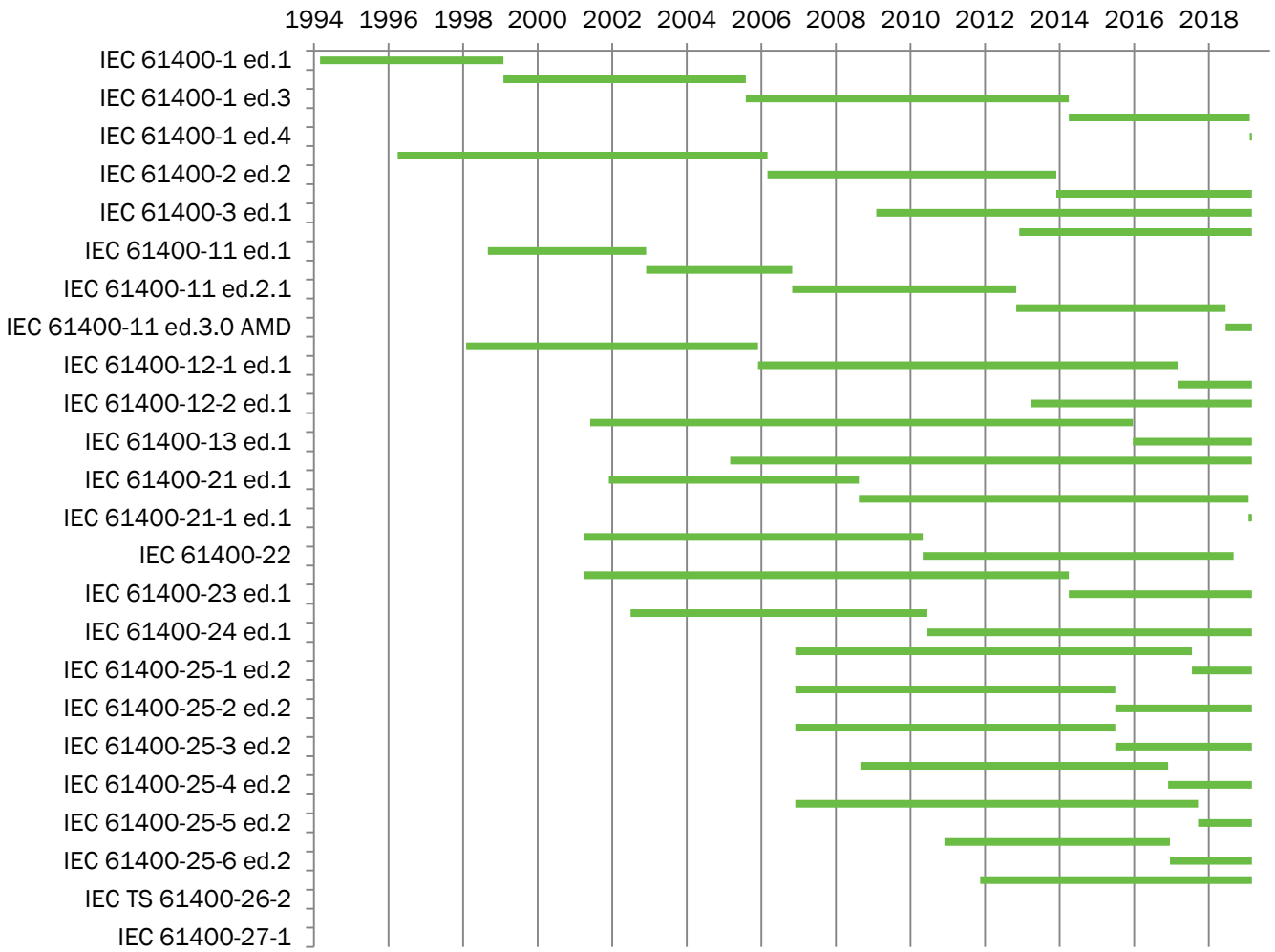
Approach and Methodology

- **Strive to have standardization at a level with maximum impact—international, supplemented by domestic if needed, minimizing conflicts.**
- **Guide, actively participate in, and, when it makes sense, take a leading role in the development of international and domestic standards related to wind energy.**
- **Support development of the global conformity assessment system.**
- **Play a central role in the U.S. industry to engage and inform stakeholders.**
- **Disseminate knowledge developed in other parts of the program through the standards development work; DOE funding mainly covers preparation for, travel to, and attendance of meetings.**

NREL involvement is prioritized as follows:

- Design standards: These have the largest potential impact on technology through the cost of energy and reliability. Well-suited to identifying key research and development needs.
- Standards that impact the program (e.g., A2e): These are related to turbine performance, measurement of atmospheric conditions, and wind power plant performance.
- Standards where the program has major contributions to make (e.g., Drivetrain Reliability Collaborative).
- Areas where NREL has capability and there is a lack of other U.S. participation.

Accomplishments and Progress



- The project is an ongoing, multiyear activity; subactivities start and finish on a typical 3- to 5-year cycle.
- Due to the highly collaborative and consensus-based work, there is no complete control of progress. The budget plan is laid out for the schedule as anticipated at the beginning of the year.

Accomplishments and Progress

Standard	Content
IEC 61400-101	General requirements for wind turbine plants
IEC 61400-1 (S)	Design requirements
IEC 61400-3-1	Design requirements for offshore wind turbines
IEC 61400-3-2	Design requirements for floating offshore wind turbines
IEC 61400-4	Wind turbine gearboxes
IEC 61400-5 (S)	Wind turbine rotor blades
IEC 61400-11-2	Acoustic noise measurements in receptor position
IEC 61400-12-1	Power performance measurements of electricity producing wind turbines

Standard	Content
IEC 61400-12-4	Power performance verification of electricity producing wind turbines based on numerical site calibration
IEC 61400-15 (S)	Assessment of site-specific wind conditions for wind power stations
IEC 61400-23	Full-scale blade testing
NEC	National Electrical Code
AWEA Offshore standards (C)	Offshore wind
IEEE 1547	Standard for interconnecting distributed resources with electric power systems
AGMA 6006	Design and specification of gearboxes for wind turbines
IECRE	~~Marks where NREL provided convener and/or secretary~~

(C), (S) indicates NREL-provided convener and/or secretary

Accomplishments and Progress

- U.S. maintained the International Electrotechnical Commission (IEC) TC 88 chair.
- Leading AWEA offshore standards development
  - Chaired by Walt Musial
  - Five working groups:
    - Offshore Compliance Recommended Practices Maintenance (WG1)
    - Floating Offshore Wind Systems (WG2)
    - Offshore Wind Metocean Conditions Characterization (WG3)
    - Geotechnical and Geophysical Investigations and Design (WG4)
    - Offshore wind submarine cables (WG5)
  - Cosponsored by the Bureau of Ocean Energy Management
  - Contracted with the Business Network for Offshore Wind for administrative tasks

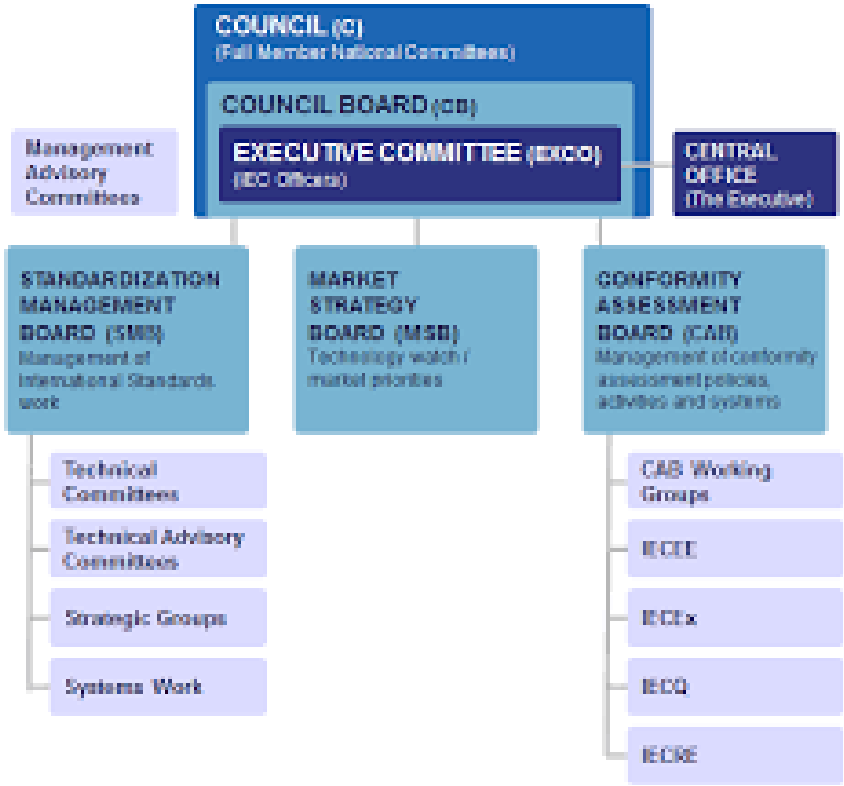
Accomplishments and Progress

Conformity assessment:

- Assures that products are designed and validated per the required standards
- Provides transparency in the process
- Maximizes impact through mutual acceptance at a global level
- Includes all stakeholders to ensure the system meets their needs and addresses their interests.

NREL involvement is mainly focused on:

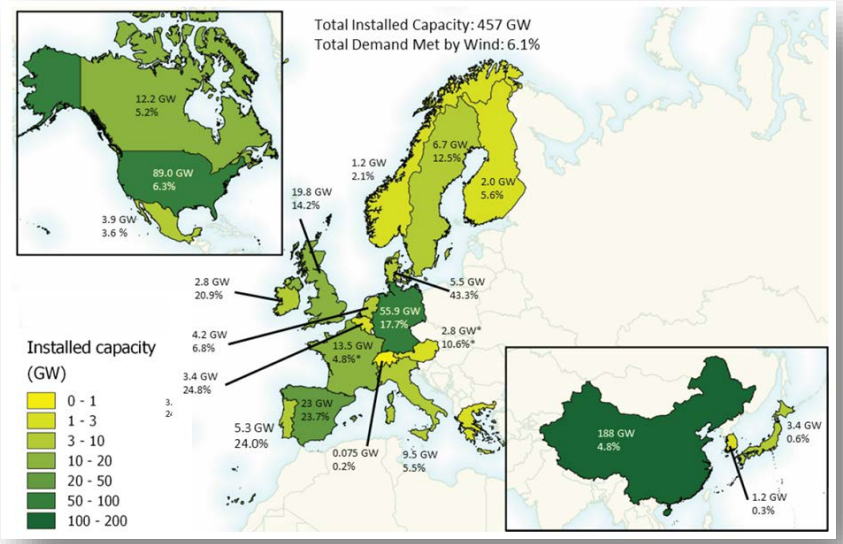
- The test laboratory stakeholder group, which worked to develop peer assessment and proficiency testing on a global basis
- Customer test facilities, which have approved 8 certification bodies and 22 test labs for wind



IEA Wind Technology Collaboration Programme

- IEA Wind ➡ global framework for collaborative research, development and deployment
- 42 Years of Collaboration RD&D ➡ 24 Countries and Sponsors ➡ 15 Active Tasks
- 16 Recommended Practices ➡ Pre-normative basis for international standards
- U.S. Member of Executive Committee ➡ DOE, Alternate Member ➡ NREL
- NREL serves as Vice Chair and Treasurer, and Operating Agent for 6 Active Tasks
- Benefit to DOE ➡ collect latest wind RD&D information worldwide, engage technical experts, provide feedback to U.S. industry, and further research innovation

Membership Represents 85% of Global Capacity



Research Priorities 2019-2024


Resource and Site Characterization


Advanced Technology


Energy Systems with High Amounts of Wind


Social, Environmental, and Economic Impacts


Communication, Education, and Engagement

Communication, Coordination, and Commercialization

- **U.S. Wind Energy Standards Summit:**
  - Educates industry stakeholders regarding the international standards development and certification processes
  - Provides updates on domestic and international standards development, including points of contact for detailed follow-on discussions
  - Provides opportunities for discussion of U.S.-specific positions and needs regarding standards
  - Broadens U.S. industry participation
  - Typically draws 30–40 people
- **Standards assure DOE/NREL knowledge is readily accessible to and used by industry stakeholders**

Upcoming Project Activities

- The standards development project is a multiyear, ongoing activity.
- New activities related to new standards or revisions of existing standards start throughout the year as standards organizations approve the projects.
- NREL reevaluates the priorities of the standards activities annually and adjusts the criteria based on the priorities of DOE's Wind Energy Technologies Office.