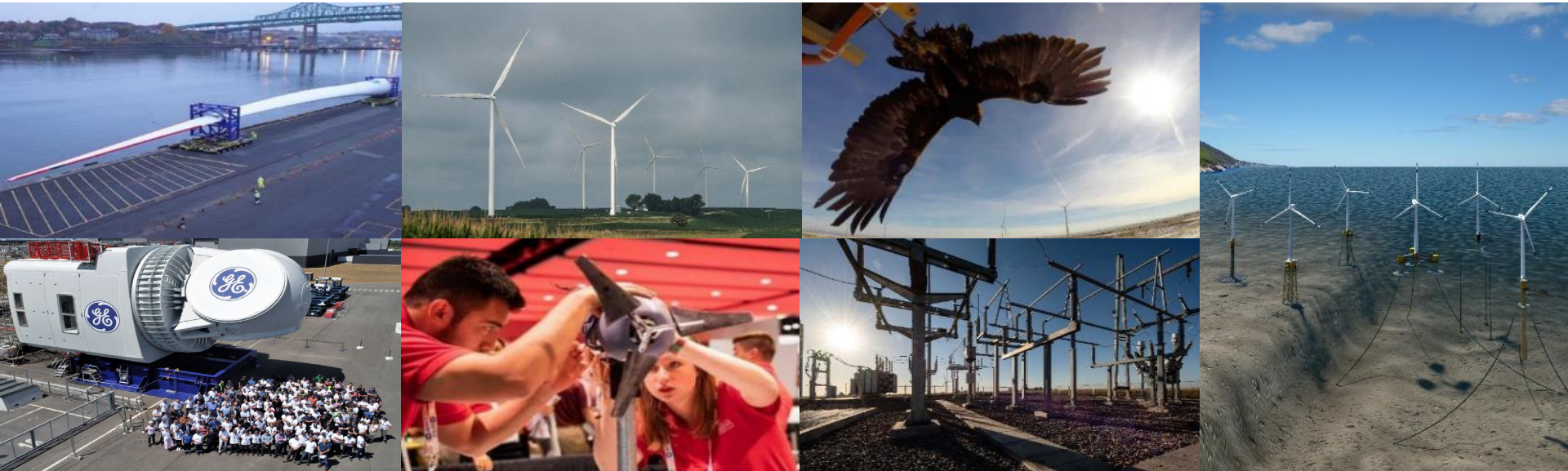


Program Area Presentation: Environmental, Siting, Workforce, and Grid (ESW&G)

Jim Ahlgrimm, Acting Program Manager

August 2-5, 2021



FY21 Peer Review - Program Overview (FY19-FY20)

Program Summary:

- Challenge: Costs and barriers to siting are limiting factors and present key challenges for wind and RD&D
- Opportunity: Deployment of wind projects can be an economic stimulus, especially in rural, coastal, and under-served areas
- Strategic Focus: The ESW&G program invests in R&D and information sharing/stakeholder engagement to address:
 - Workforce development, wildlife impacts issues, grid integration, military & civilian radar impacts

Key program partners:

- NREL, PNNL, INL, SNL, Universities, DOD, DOI, NOAA, Industry Groups, Conservation NGOs

FY19 - FY20 Budget Under Review (Labs):
\$34,526,681

FOA Project Budget: \$2,885,337
- Total DOE: \$1,832,338
- Total Cost Share: \$1,052,999

Current budget (FY21): \$23,340,891

Number of projects under peer review: 22

Total number of current projects: 60*
Projects making up the 38-project difference represent previously reviewed projects, lab support to FOA projects, and/or projects that started late in 2020 & have limited data to share, but will be reviewed in 2023

Program Objective(s) 2019-2020:

- Advance wind wildlife monitoring and mitigation technology, and advance information collection options in the offshore wind environment
- Address transmission access, develop wind controls for grid reliability and resilience, and ramp up wind cybersecurity research
- Evaluate radar impact mitigation solutions (infill radar, wind farm layout analysis)
- Develop a skilled, robust workforce to help meet the needs of a growing industry

Overall Program Objectives (life of program):

- Reduce market barriers to preserve or expand access to quality wind resources



How We Organize Our Work: Activity Areas

Community Impacts
Research &
Engagement -
Workforce
Development

- **Addressing community impacts and develop skilled workforce**
 - WINDEXchange
 - Social Science Research
 - Collegiate Wind Competition
 - Wind for Schools
 - Workforce analysis

Environmental
Research

- **Develop solutions to wildlife challenges**
 - Land-based and offshore wind environmental research

Grid Integration

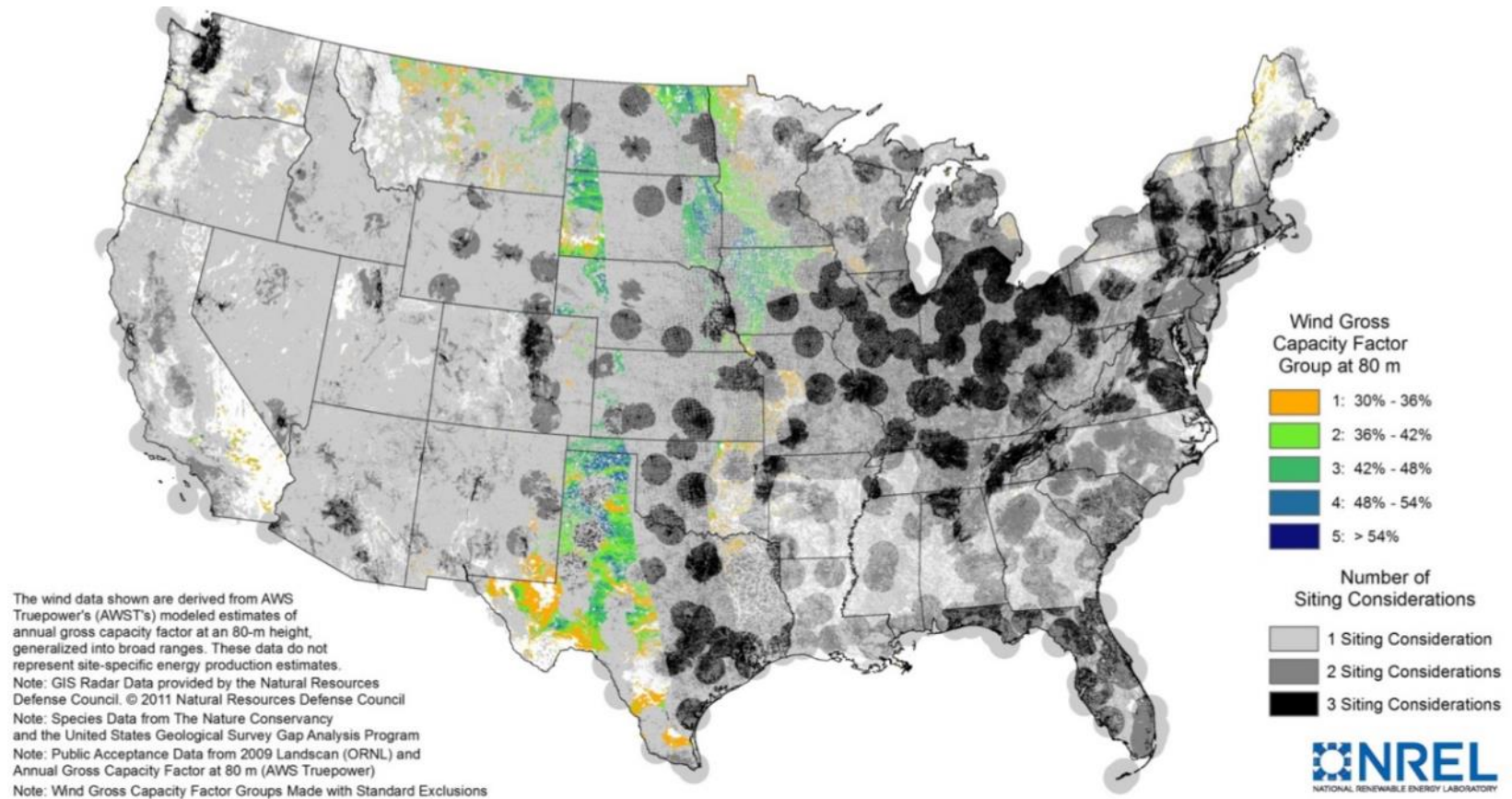
- **Enable high levels of wind penetration**
 - Transmission adequacy and utilization
 - Provision of grid services
 - Grid reliability and resilience
 - Wind cybersecurity

Regulatory and Siting

- **Accelerate the deployment of land-based, distributed and offshore wind technology**
 - Eliminate wind turbine radar interference with civilian and defense radar systems

Program Impact

- Siting and environmental constraints on wind development have the **potential to reduce wind deployment by over 4,940 gigawatts, or approximately 80%.**
- **Siting and developing projects is getting harder.**



NREL Unpublished Analysis for DOE

Stakeholder Engagement & Workforce

Objective: Enable well-informed decisions about wind energy deployment and ensure the availability of a robust workforce



A screenshot of the WINDEXchange website. The header includes the ENERGY.GOV logo, the Office of Energy Efficiency & Renewable Energy, and the WINDEXchange title. Navigation menus include Market Sectors, Project Development, Technical Assistance, and Education & Workforce Development. The main content area features a 'Wind information by state' section with a dropdown menu and a map of the United States. Below this are four categories: Utility-Scale Wind (Land-Based and Offshore) and Distributed Wind (Community and Residential). The 'Maps & Data' section lists various maps such as Land-Based Wind Resource Maps (80m), Installed Capacity Wind Maps, Wind Speed Maps (100m), Offshore Wind Maps (80m), and Wind Potential Resource Maps (110m, 140m). The 'Project Development' section offers resources for Site Selection, Economic Costs & Incentives, Wildlife Impacts, and Community Impacts. The 'Technical Assistance' section provides access to models, data, tools, and guidebooks for wind energy projects.

Stakeholder Engagement & Workforce - (2019 - 2020)

Strategic Area	Selected Accomplishments
<p>Land Based Wind</p>	<p>Social Science</p> <ul style="list-style-type: none"> • LBL: Completed the publishing of seminal research papers totally 6 on the national survey of 1,705 wind project neighbors resulting in over 300 citations by other published papers. • LBL: Supported programmatic social science development. <p>Engagement</p> <ul style="list-style-type: none"> • NREL: Conducted key customer research on understanding economic tools to inform future development of JEDI and released the online Economic Development Guide. <p>Workforce (Wind for Schools/RePowering Schools (REPs))</p> <ul style="list-style-type: none"> • NREL: Implemented State based wind workforce industry consortia in 9 of 12 WfS states. • NREL: Implementation of REpS through the creation of a new non-profit entity that provides avenues for transition of WAC and support educational programs nationwide, allowing engagement from new states and educational entities as financial contribution to existing university programs decreases. • Collegiate Wind Competition • NREL: All 12 2018 teams returned for the last biannual interim competition held at NREL. • NREL: 2020 hosted <i>the first virtual</i> but also the first ANNUAL competition with 12 universities including 3 new and 9 returning schools.
<p>Offshore Wind</p>	<p>Engagement</p> <ul style="list-style-type: none"> • NREL: Over 100K views of the Offshore Wind Floating Webinar. <p>Data Collection and Information Sharing</p> <ul style="list-style-type: none"> • NREL: Released WINDEXchange resource maps and updated state profile data for each of the 50+ states and territories.
<p>Cross-Cutting</p>	<p>Workforce - Wind for Schools</p> <ul style="list-style-type: none"> • NREL: Partnership and support with National Energy Education Development provides connection to land-based and offshore wind curriculum. <p>Social Science</p> <ul style="list-style-type: none"> • LBL/ NREL: Continued to expand DOE research internationally leading to the development of the successfully adopted plan for a new 4-year term for Task 28. • NREL: Completed the development and implementation of an engagement national strategy.

Environmental Research

Objective: Reduce wildlife barriers to wind deployment by developing informed technical solutions to wildlife impacts; expand access to quality wind resources

Data Collection &
Experimentation

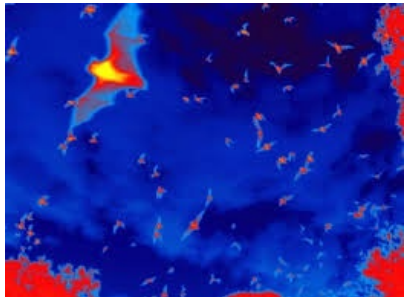
- **Conduct research to better understand species' exposure and the factors that drive risk** in order to inform siting and mitigation solutions

Monitoring and
Mitigation
Technologies

- **Advance technologies or measures to reduce fatalities** at wind energy facilities in an affordable manner

Information
Synthesis and
Sharing

- **Information synthesis and dissemination** to reduce redundancy, make sense of disparate studies, and catalyze solution development



Environmental Research (2019 - 2020)

Strategic Area	Selected Accomplishments
Land Based Wind	<p>Bats</p> <ul style="list-style-type: none"> • NREL/BWEC: 3 technical reports – status of minimization technologies, population trends, and operational minimization • PNNL: Bat Tag - completed designs, prototype fabrication, preliminary 3D analysis software. • 2018 FOA: 4 bat smart curtailment projects underway <p>Eagles</p> <ul style="list-style-type: none"> • NREL: Initiated development of a computational framework for predicting eagle presence near wind farms <p>Grouse</p> <ul style="list-style-type: none"> • NREL: Initial draft of the State of the Science on Prairie Grouse & Wind Energy Development
Offshore Wind	<p>Technology Innovation</p> <ul style="list-style-type: none"> • PNNL: Thermal Tracker project: Developed species database, Technology Readiness Level advanced from 4 to 6, published peer-reviewed manuscript <p>Data Collection and Information Sharing</p> <ul style="list-style-type: none"> • NREL and PNNL: SEER project: Engaged stakeholders, developed project workplan, established Advisory Committee
Cross-Cutting	<p>Information Dissemination</p> <ul style="list-style-type: none"> • NREL: 9 Part "Wildlife & Wind Energy" Webinar Series (available on Tethys) • NREL and PNNL: WREN/Tethys Database - 500 new documents added to Tethys, 52 Tethys blasts with over 800 new Tethys blast subscribers

Grid Integration

Objective: Enable cost-effective, reliable, resilient, and secure grid with large-scale wind deployment

Transmission Adequacy and Asset utilization

Understanding transmission needs and how best to utilize what we have

Provision of Grid Services From Wind

Being good stewards of the grid

Grid Reliability and Resilience

Evaluating grid reliability and resilience with increasing inverter-based resources

Wind Cybersecurity

Addressing wind specific cybersecurity needs



Grid Integration (2019 - 2020)

Strategic Area	Key Accomplishments	Collaborators
Transmission Access and Asset Utilization	<ul style="list-style-type: none"> Completed North American Renewable Integration Study and Interconnection Seams Study Developed uncertainty assessment tools for dynamic line rating 	<ul style="list-style-type: none"> NREL/INL NR Can/NOAA EPRI/BPA/WindSim
Provision of Grid Services	<ul style="list-style-type: none"> Led demonstrations that prove wind energy can provide a full array of essential grid services, in collaboration with industry, regulators, national laboratories, and a major electric utility Developed a theoretical basis of grid-forming operation and services by wind power and created grid forming models of Type 3 and 4 wind power plants Designed wind plant control that merges forecasting tools with aerodynamic and economic models to maximize a wind plant's value streams for energy and ancillary services 	<ul style="list-style-type: none"> NREL GE Avangrid/CAISO
Grid Reliability and Resilience Support	<ul style="list-style-type: none"> Developed impedance-based testing, modeling, and analytical tools to evaluate the stability impacts of wind generation Designed, developed, and conducted modeling scenarios and sensitivities of a Polar Vortex use case 	<ul style="list-style-type: none"> NREL OE, SETO, WPTO
Wind Cybersecurity	<ul style="list-style-type: none"> Published wind cybersecurity roadmap. Established co-simulation environment that can fully assess the effectiveness of cybersecurity defense. 	<ul style="list-style-type: none"> INL/SNL/NREL

Regulatory & Siting

Objective: Eliminate impacts on radar systems to accelerate the deployment of land-based, distributed and offshore wind technology

Evaluate Impacts

Improve capacity to evaluate the impacts of wind energy on sensitive radars

Increase Radar Performance

Develop and deploy mitigation measures to increase resilience of existing radars to wind turbines

Support Next Gen Radars

Encourage the development of next generation radars resistant to wind turbine interference



Regulatory & Siting (2019 - 2020)

Strategic Area	Selected Accomplishments	Collaborators
<p>Improve capacity to evaluate the impacts of wind energy on sensitive radars</p>	<ul style="list-style-type: none"> • Release of US Wind Turbine Database - recently passed 5 million hits • Upgraded the database to better support NORAD's ability to identify potential impacts 	<ul style="list-style-type: none"> • LBNL • SNL
<p>Develop and deploy mitigation measures to increase resilience of existing radars to wind turbines</p>	<ul style="list-style-type: none"> • MIT-Lincoln Lab Wind Siting Study and Travis AFB PMP Completion 	<ul style="list-style-type: none"> • MIT-Lincoln Lab • SNL
<p>Encourage the development of next-generation radars resistant to wind turbine interference</p>	<ul style="list-style-type: none"> • Advanced Signal Processing for Wind Turbine Clutter Mitigation for future systems (MIT LL) • Maintain contact with the SENSR Program team and provide updates on turbine characteristics and radar impact specifications for this long-range radar replacement project 	<ul style="list-style-type: none"> • MIT LL • SNL

Selected Program Upcoming Activities (FY21 and Beyond)

