

Activity Area Overview Presentation: Environmental Research

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FY21 Peer Review – Activity Overview

Activity Summary:

- Challenge: Impacts of wind energy development on wildlife can result in project cancelation, delays, or alterations to normal operations
- Challenge: Cost of monitoring and mitigation measures present substantive economic, and permitting/regulatory hurdles for projects, particularly offshore

- Strategic Focus:
- Data Collection & Experimentation – understand factors that drive risk
 - Monitoring & Mitigation Technologies – develop tools to reduce risk
 - Information Synthesis & Sharing – disseminate research

- Key Activity Partners:
 - NREL, PNNL, DOI, universities, industry, conservation and environmental NGOs

FY19 - FY20 Budget Under Review (Labs):

\$6,597,770

FOA Project Budget: \$2,885,337

- Total DOE: \$1,832,338
- Total Cost Share: \$1052,999

Current budget (FY21): \$8,397,922

Number of projects under peer review: 6

Activity Objective(s) 2019-2020:

- Develop and test systems to enable monitoring in the offshore wind environment
- Advance development of bat impact mitigation options
- Develop model for predicting eagle flight based on landscape/atmospheric conditions
- Collecting, synthesizing, and sharing latest state of the science research

Overall Activity Objectives (life of Activity):

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



Projects Under Review – Environmental Research

Project	Speaker	Organization
E13 - Wind Operational Issue Mitigation (WOIM)	Cris Hein	National Renewable Energy Laboratory
E14 - Wind Operational Issue Mitigation (WOIM)	Alicia Gorton	Pacific Northwest National Laboratory
E15 - Passive Ultrasonic Deterrents to Reduce Bat Mortality in Wind Farms	Anupam Sharma	Iowa State University
E16 - Bat Smart Curtailment: Efficacy and Operational Testing	Christine Sutter	Natural Power Consultants, LLC
E17 - Advanced Collision Detection and Site Monitoring for Avian and Bat Species for Offshore Wind Energy	Matthew Johnston	Oregon State University
E18 - Coastal Acoustic Buoy for Offshore Wind (SMRU)	Kaitlin Palmer	SMRU Consulting

Research Priorities & Impact: Bats

The Wind Power Program currently envisions supporting future research:

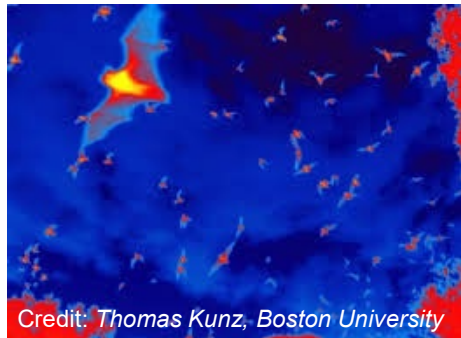
- To improve understanding of the **factors that drive risk** to bats at wind turbines, including research to better understand the underlying relationship between bats and wind turbines
- To develop and assess potential **monitoring and minimization measures**, including refinements to curtailment strategies and development of deterrent devices, and
- To develop and assess **potential compensatory mitigation measures** as needed in the future

R&D Mechanism:

NREL – Bats and Wind Energy Collaborative (BWEC), Technology Development & Innovation (TD&I) Program

PNNL – Direct Research

2018 DOE FOA – Bat Smart Curtailment & Deterrent Advancement



Research Priorities & Impact: Eagles

The Wind Power Program currently envisions supporting future research:

- To improve accuracy and **reduce uncertainty around estimates of take** at wind farms,
- To develop and assess **potential impact avoidance and minimization measures**, and
- To develop and assess potential **compensatory mitigation measures**

R&D Mechanism:

NREL – Direct Research: Eagle Behavioral Modeling
2016 DOE FOA – Eagle Impact Mitigation



Research Priorities & Impact: Prairie Grouse

The Wind Power Program currently envisions supporting future research:

- To evaluate the **potential impact of wind turbines** on prairie grouse species, and
- To develop and validate **compensatory mitigation options**, as needed

R&D Mechanism:

NREL – Workshops and expert elicitation supported by the American Wind Wildlife Institute



Credit: BLM



Credit: Jeanne Stafford / USFWS

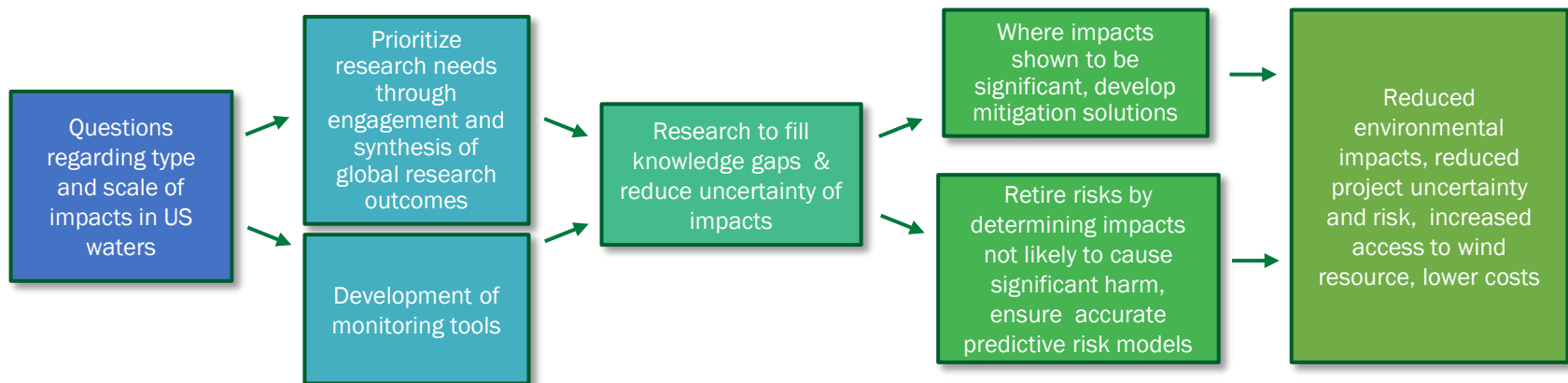


Credit: U.S. Fish and Wildlife Service

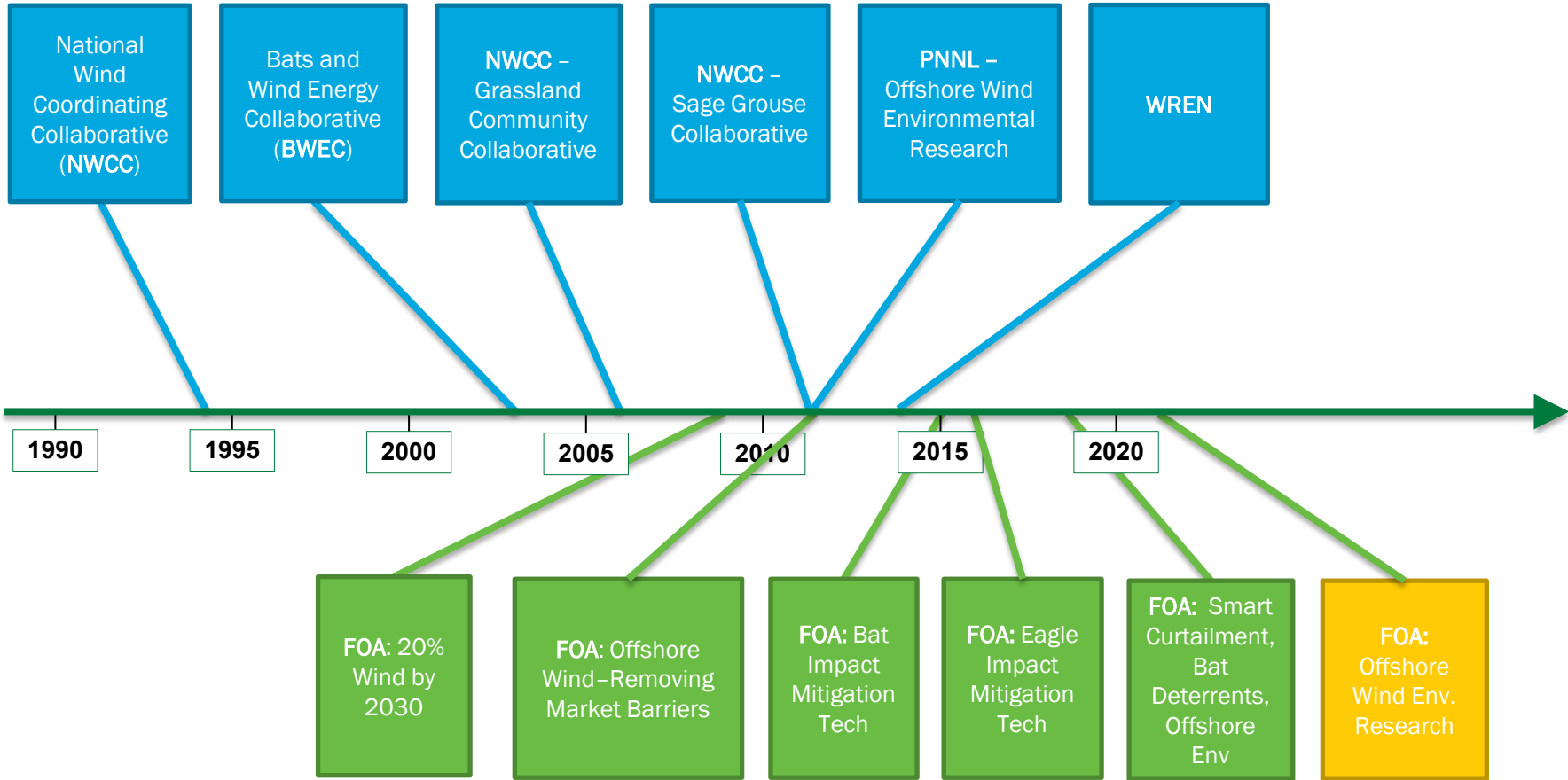
Research Priorities & Impact: Offshore Wind

To address the various environmental offshore wind concerns, DOE developed several approaches under the following general research themes:

- Collect **environmental impact data** (avian collision, acoustic impacts & habitat use) to understand risk,
- Support development and validation of **monitoring and mitigation technologies** at first-generation projects, and
- **Synthesize environmental impact data** and **validate predictive models**



Accomplishments & Progress: US DOE Research Funding Timeline



Environmental Research Accomplishments (2019 to 2020)

Land Based Wind Accomplishments:

Bats

- **NREL TD&I:** One new award: a self-powered, blade mounted ultrasonic deterrent
- **NREL Publication:** An Investigation into the Potential for Wind Turbines to Cause Barotrauma in Bats
- **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

Eagles

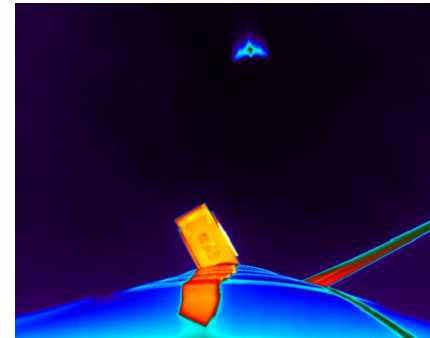
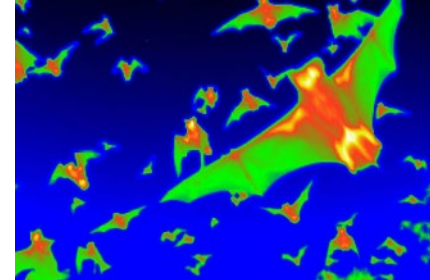
- **NREL:** Initiated development of a computational framework for predicting eagle presence near wind farms
- **2016 FOA:** 2 eagle physiology projects completed (Purdue, UMinn): assessing eagle hearing and sight to inform impact minimization tools

Grouse

- **NREL:** Technical Report: Behavioral Response of Grouse to Wind Turbines
- **NREL:** Initial draft of the State of the Science on Prairie Grouse & Wind Energy Development

Stakeholder Engagement/Information Sharing

- **NREL Workshops:** Prairie Grouse & Wind Energy Development, Bat Impact Minimization Technology State of the Science



Environmental Research Accomplishments (2019 to 2020)

Offshore Wind Based Wind Accomplishments:

- NREL and PNNL: SEER project: Engaged stakeholders, developed project workplan, established Advisory Committee
- PNNL: Thermal Tracker project: Developed species database, Technology Readiness Level advanced from 4 to 6, published peer-reviewed manuscript
- SMRU: Exclusion zone monitoring method selected, instrument design completed, buoys built
- OSU: Development of sensor modules, validation of components, lab-based system-level validation

Cross Cutting Accomplishments:

- NREL and PNNL: WREN: Paper on how to move from assessing impacts on individuals to populations, two international workshops, fact sheets and webinar series (Over 600 live views and 3,700 recording views)
- NREL and PNNL: WREN/Tethys Database: 500 new documents added to Tethys, 52 Tethys blasts with over 800 new Tethys blast subscribers
- PNNL: Strategic WETO Support: Stakeholder engagement strategy, engaged in regional policy and planning dialogues



Highlighted Future Work (FY21 and Beyond)

Land Based Wind

- **Bats**
 - Field testing for bat smart curtailment projects
 - Advancing early-stage data collection and monitoring technologies (tags, thermal tracking)
- **Eagles**
 - Field testing for eagle monitoring and impact minimization tools
 - Flight behavior modeling with atmospheric conditions
- **Grouse**
 - Assessing opportunities for addressing impact evaluation research

Offshore Wind

- **2021 FOA** – Offshore Wind Energy Environmental Research and Instrumentation Validation
- Topic Area 1) Offshore Wind Energy Impacts on Wildlife in US Atlantic Waters
 - Topic Area 2) Offshore Wind Impacts on Commercially Fished Species
 - Topic Area 3) West Coast Offshore Wind Environmental Research and Tool Development
- **Field deployments and testing** – multiple projects
- **Information synthesis** – SEER summaries release, webinars, and workshops

Crosscutting

- **Wildlife Impact Mitigation Tool Database** – NREL/PNNL

Environmental Research: Near Term Future Priorities (FY21 and beyond)

Strategic Area	Future Priorities
Bats	<ul style="list-style-type: none"> • Further research to understand the drivers of risk • Further work to develop and assess minimization solutions, lower their costs, ensure they work across species and regions
Eagles	<ul style="list-style-type: none"> • Further research to understand the drivers of risk and tools to model risk • Further improve impact minimization tools
Grouse	<ul style="list-style-type: none"> • Research gaps prioritization • Impact evaluation research
Offshore Wind	<ul style="list-style-type: none"> • Research to assess impact • Develop impact monitoring and mitigation tools • Research synthesis and dissemination
Emerging Issues	<ul style="list-style-type: none"> • Explore/understand potential environmental impacts of development in regions that will be made accessible through the use of taller towers • Develop solutions to challenges arising from larger rotors (e.g.,ersonifying the entire rotor swept zone with deterrents, cost of curtailment)
Analysis	<ul style="list-style-type: none"> • How to integrate environmental variables into wind resource models • Cost and deployment implications of environmental compliance (e.g., curtailment) and cost and deployment impacts of solution development