

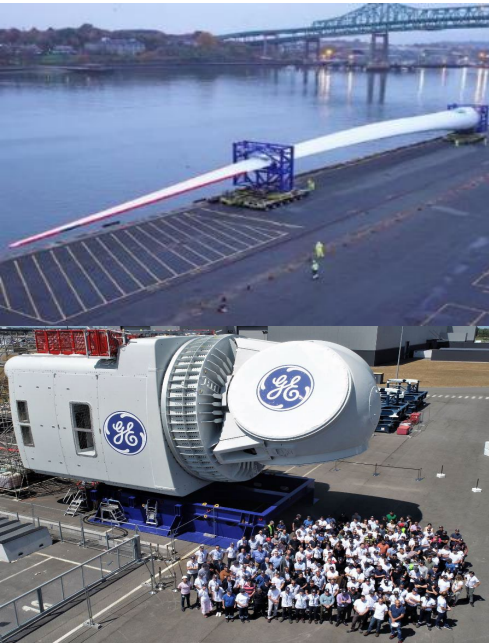
E13 - Wind Operational Issue Mitigation

Mitigate Market Barriers – Environmental Research

Cris Hein

National Renewable Energy Laboratory (NREL)

August 2, 2021



FY21 Peer Review - Project Overview

Project Summary:

- Impacts of wind energy development on wildlife can result in project cancelation, delays, or alterations to normal operations.
- NREL collaborates with a variety of stakeholders to identify high priority issues, conduct science-based research, and disseminate information.
- American Wind Energy Association (now American Clean Power Association), American Wind Wildlife Institute, Bat Conservation International, Bureau of Ocean Energy Management, Conservation Global Science, Defenders of Wildlife, Duke Energy Renewables, Midé, Pacific Northwest National Laboratory, NextEra Energy Resources, Texas State University, Texas Christian University, Western EcoSystems Technology, U.S. Fish and Wildlife Department, U.S. Geological Survey

Project Start Year: FY2015

Expected Completion Year: FY2020

Total expected duration: 5 years

FY19 - FY20 Budget: \$7,503,214

Key Project Personnel: Cris Hein (PI), Sam Rooney, Karin Sinclair, Elise DeGeorge, Jason Roadman, Bethany Straw, Jeroen Van Dam)

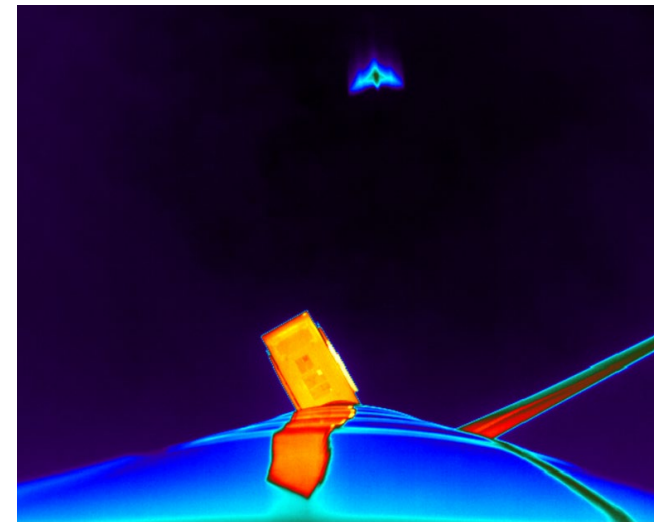
Key DOE Personnel: Jocelyn Brown-Saracino

Project Objective(s) 2019-2020:

- Develop cost-effective solutions to reduce wind energy and wildlife interactions through 1) research and development of monitoring and minimization technologies, 2) domestic engagement and outreach, and 3) international engagement and outreach.

Overall Project Objectives (life of project):

- To minimize the levelized cost of wind energy and reduce barriers to expanded wind energy deployment



Thermal image of a bat and wind turbine. By S. Weaver

Project Impact

- Technology Development & Innovation

- Unique combination of infrastructure & expertise to support technology innovators
- Advancing early to mid-level technologies or applications toward late-stage development and commercialization



Dim UV-light source installed at Flatirons Campus. By B. Straw (left) & D. Swartz (right).

- U.S.-based Collaboratives

- Bats & Wind Energy Cooperative (BWEC), National Wind Coordinating Collaborative (NWCC), Land-based Collaborative, Offshore Wind Energy Synthesis of Environmental Effects Research (SEER)
- Engage stakeholders to identify priority research & conduct/support research focused on those priorities

Project Impact Cont'd

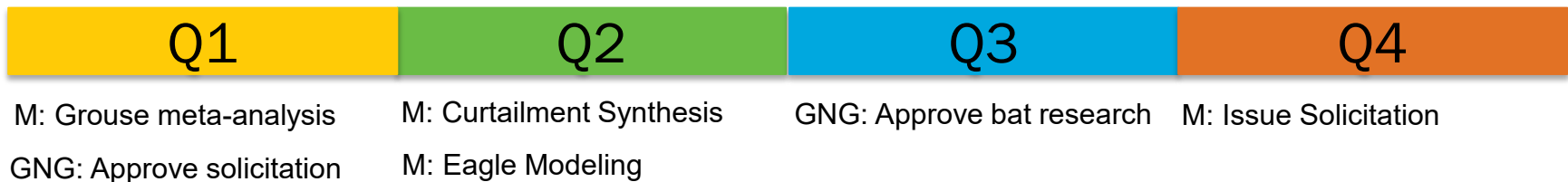
- Working Together to Resolve Environmental Effects of Wind Energy (WREN)
 - Coordinate with international partners to leverage global research & share lessons learned
 - Aggregate & synthesize science research
 - Disseminate results to assist decisionmakers on siting & operational considerations



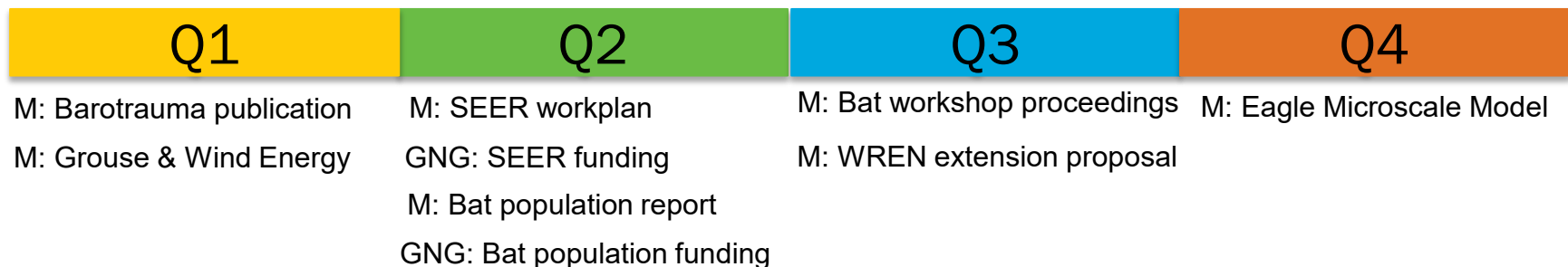
Program Performance – Scope, Schedule, Execution

- NREL completed Milestones (M) & Go/No-Go Decisions (GNG) as scheduled
- Study designs for research are developed with statistical rigor
- All reports/publications are peer-reviewed by subject matter experts prior to dissemination

FY2019



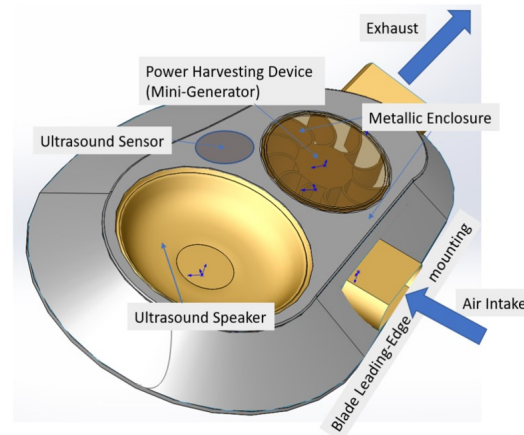
FY2020



Program Performance – Accomplishments & Progress



Silver-haired bat. By C. Hein.



Prototype blade-mounted deterrent. Courtesy of Midé

Bats:

- TD&I: Advance an energy harvester for blade-mounted ultrasonic deterrent
- Publication: An investigation into the Potential for Wind Turbines to Cause Barotrauma in Bats
- Submitted for review to the BVEC
 - Technical Report: State of the Science & Technology for Minimizing Bat Impacts at Wind Turbines
 - Technical Report: Acoustic & Genetic Approaches for Informing Population Status & Trends of Migratory Tree Roosting Bats
 - Technical Report: State of the Science on Operational Minimization to Reduce Bat Fatality at Wind Energy Facilities

Program Performance – Accomplishments & Progress Cont'd

- Prairie Grouse:
 - Technical Report: Behavioral Response of Grouse to Wind Turbines
 - Initial draft of the State of the Science on Prairie Grouse & Wind Energy Development
- Eagles:
 - Initiated development of a computational framework for predicting eagle presence near wind farms – 4 presentations at Wind Wildlife Research Meeting
- Received a 4-year extension for WREN
- Developed workplan & initiated research briefs for environmental effects of offshore wind energy development (SEER)



Sage Grouse. By L. Parker.



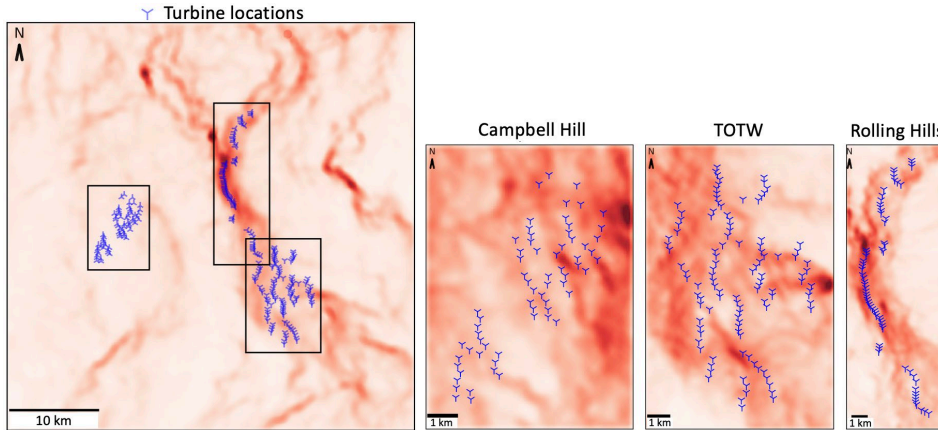
Golden Eagle. By D. Schoeder.



Northern Gannet. Credit iStock

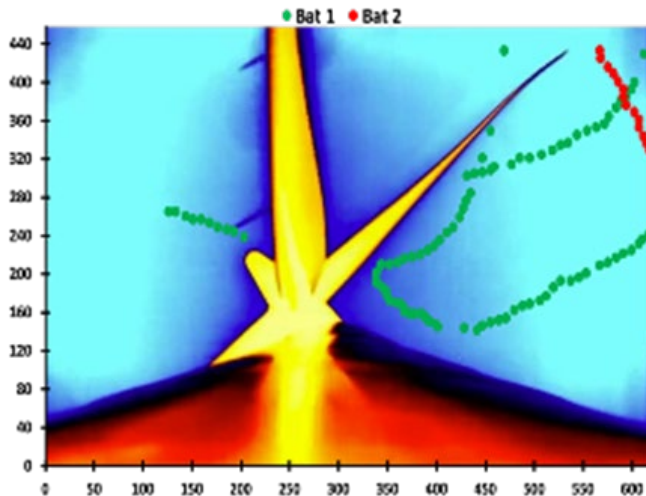
Project Performance - Upcoming Activities

- Modeling eagle flight behavior with atmospheric conditions

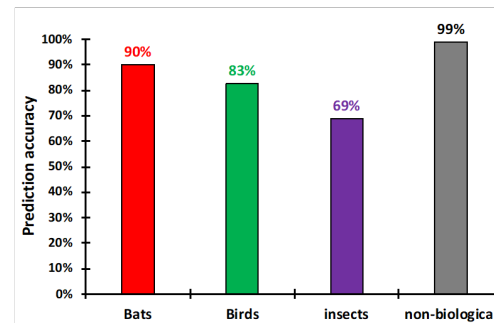


Relative density for southbound migration of eagles in autumn. Darker shading represents higher density. Courtesy of NREL.

- Advancing thermal video classification & tracking



Left: Thermal image of a wind turbine with 2 individual bats flying (indicated by green and red tracks). Below: Accuracy of the machine learning algorithm in identifying biological objects from thermal video. Courtesy of NREL.



Stakeholder Engagement & Information Sharing

- NREL employs a variety of outlets (e.g., websites, webinars, newsletters, workshops, & reports) to engage stakeholders & disseminate research.
 - www.batsandwind.org
 - www.nationalwind.org
 - <https://tethys.pnnl.gov/about-wren>
- Examples include
 - Workshop: ‘State of the Science & Technology for Minimizing Impacts to bats from Wind Energy’
 - 9-part webinar series: Land-based wind energy & wildlife
 - Interview, webinars, & feedback forms for offshore wind topics
 - Virtual workshop: Prairie grouse & wind energy development



Meeting of stakeholders. By C. Hein



Key Takeaways and Closing Remarks

Project Impact:

- NREL possesses a unique combination of infrastructure & expertise to advance technologies from early/mid to late stages of development

Project Performance:

- Support/conduct scientifically rigorous research & disseminate peer-reviewed findings to inform the wind-wildlife community on the state of the science

Stakeholder Engagement:

- Actively engaged stakeholders to identify priority research & conduct/support research towards those priorities



Preliminary testing of the IdentiFlight System at NREL's Flatirons Campus. By D. Schroeder.