

Wind Operational Issue Mitigation

Project ID #M1

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Silver-haired bat (Photo by Cris Hein)



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

M1: Wind Operational Issue Mitigation

Project Summary

- Facilitate the reduction in environmental constraints to wind energy deployment
- Support advancement of early-stage technological solutions that reduce impacts to wildlife
- Oversee research-based collaboratives focusing on outreach and stakeholder engagement

Project Objective & Impact

- Leveraging national and global stakeholders to identify high-priority issues, conduct research, and disseminate science-based information about the environmental impacts of wind energy and how they can be reduced
- Reducing the levelized cost of energy and constraints to expanded wind energy development
- Conducting and disseminating science-based research

Project Attributes

Project Principal Investigator(s)

Elise DeGeorge
Cris Hein
Karin Sinclair
Bethany Straw

DOE Lead

Jocelyn Brown-Saracino

Project Partners/Subs

American Wind Wildlife Institute
Bat Conservation International
International Energy Agency
Pacific Northwest National Laboratory
U.S. Geological Survey
U.S. Fish and Wildlife Service
Bureau of Ocean Energy Management
National Oceanographic and Atmospheric Administration

Project Duration

FY 2016–FY 2020

Technical Merit and Relevance

Wildlife impacts can delay or prohibit development, or curtail operations

The project:

- Collaborates with key stakeholders to leverage expertise and identify research priorities
- Evaluates early to mid-level technologies to advance them toward commercial testing and implementation
- Disseminates scientifically based information to target audiences



Collaborative meeting discussing bat and wind research priorities (Photo by Cris Hein)



Thermal image of a bat at a wind turbine (Photo by Michael Schirmacher)



Construction of a wind turbines (Photo by Cris Hein)

Approach and Methodology

Technology Development and Innovation (TD&I)

The project:

- Identifies technology innovators through competitive funding solicitations
- Supports the advancement of emerging technologies using infrastructure at the National Wind Technology Center and expertise across NREL



Installation on GE 1.5 MW wind turbine at the NWTC (Photo by Bethany Straw)



Dim UV-light source (Photo by Dave Swartz)



Thermal video cameras installed at the base of a wind turbine (Photo by Bethany Straw)

Accomplishments and Progress

Technology Development and Innovation (TD&I)

The project has:

- Hosted two open-house events with potential technology providers
- Selected two projects (e.g., *Monitoring Strikes Using Radar and Ultraviolet Deterrents*), obtained NEPA approval, installed systems, and began monitoring
- Organized a webinar detailing goals and methodology of projects



Photo by Paul Cryan

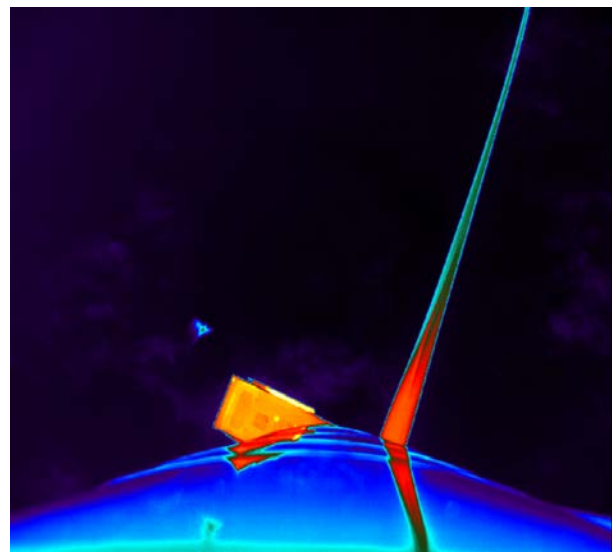


Photo by Michael Schirmacher

Approach and Methodology

Land-Based Collaborative (LBC)

The project:

- Supports leading collaboratives (e.g., National Wind Coordinating Collaborative and Bats and Wind Energy Cooperative) to identify priorities focused on bats, grouse, and eagles
- Convenes bimonthly calls and annual in-person meeting
- Oversees research, outreach and engagement



Hoary bat (Photo by Cris Hein)



Golden Eagle (Photo by John De La Rosa)

Accomplishments and Progress

Land-Based Wind Collaborative (LBC)

The project has:

- Supported science-based solutions to quantify and reduce the impact of wind turbines on bats, eagles, and grouse
- Completed the development of an unbiased mortality estimator
- Hosted the 5th Bats and Wind Energy Cooperative Science Meeting and sponsored the production of a proceedings document
- Supported the National Wind Coordinating Collaborative, including the 12th Wind Wildlife Research Meeting and webinar series



Photo by LuRay Parker

Approach and Methodology



Task 34: Working Together to Resolve Environmental Effects of Wind Energy (WREN)

The project:

- Coordinates activities among 11 international partners (Belgium added in 2019 increasing total nations to 12)
- Oversees production of work products (e.g., white papers)
- In partnership with the Pacific Northwest National Laboratory, facilitates information exchange through Tethys

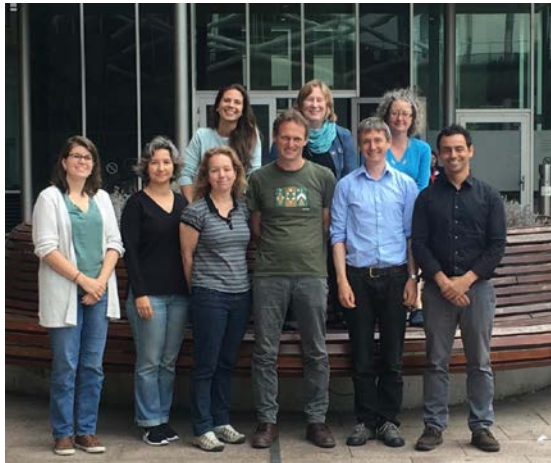
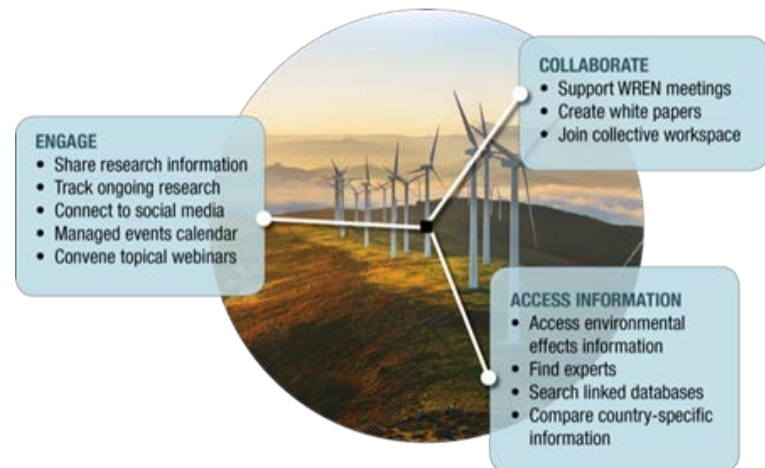


Photo by Karin Sinclair



Accomplishments and Progress



Task 34: Working Together to Resolve Environmental Effects of Wind Energy (WREN)

The project has:

- Increased member nations from 10 to 12 (at beginning of FY19)
- Sinclair et al. 2017. *Resolving environmental effects of wind energy*. WIREs Energy and Environment.
- May et al. 2018. *Considerations for upscaling individual effects to population-level impacts*. Journal Environmental Management
- 1st Expert Forum—*Bats and Barotrauma*
- Organized 6 webinars, including *Adaptive Management*, *Smart Curtailment*, and *Environmental Impacts of Offshore Wind Energy*



Accomplishments and Progress

	FY 2017				FY 2018			
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q
TD&I			Solicitation		Selection		Preparation and Installation	
LBC	Planning	Year 1					Year 2	
WREN	Phase II							

- **Slipped milestones and schedule - All milestones were completed.**
 - **FY17:** Summarized objectives for field research related to bat behavior at wind turbines; Developed fact sheet for National Wind Coordinating Collaborative
 - **FY18:** Selected 2 subcontracts and hosted an open house for TD&I; Identified research priorities for the Bats and Wind Energy Cooperative
- **Go/no-go decision points**
 - FY17: Work with collaborators to develop 4-year plan (i.e., LBC) with collaborative that aligns with DOE's Environmental Strategic Plan. **GO**
 - FY17: WREN extension for Phase II? **GO**
 - FY18: Determine whether to release a second solicitation for TD&I. **GO**

Communication, Coordination, and Commercialization

Technology Development & Innovation

- Advance technologies beyond early- to mid-Technology Readiness Levels
- <https://www.nrel.gov/wind/technology-development-innovation.html>

Land-Based Collaborative

- Coordinate with collaborators on outreach and engagement activities to industry, government agencies, researchers, and other stakeholders
- National Wind Coordinating Collaborative (www.nationalwind.org) and the Bats and Wind Energy Cooperative (www.batsandwind.org) websites

Working Together to Resolve Environmental Impacts of Wind Energy

- Tethys (<https://tethys.pnnl.gov/about/about-wren>) and International Energy Agency (<https://community.ieawind.org/task34/home>) websites

Publishing and Conferences

- Documents published in various outlets to a variety of audiences
- Conference on Wind Energy and Wildlife Impacts
- National Wind Coordinating Collaborative's Wind Wildlife Research Meeting

Upcoming Project Activities

The plans for upcoming tasks and completion of the project:

- Technology Development and Innovation
 - Completing data collection and analysis for existing projects
 - Announcing second request for proposals
- Land-Based Collaborative
 - Initiating year 3 (of 4) to support activities by the National Wind Coordinating Collaborative and Bats and Wind Energy Cooperative
 - Planning workshops for the Generalized Fatality Estimator



GENEST
Generalized Mortality Estimator

Learn to use GenEst

GenEst is a free fatality estimator available in a user-friendly software that carries out complex calculations. GenEst accommodates a spectrum of study designs, provides low-bias results, and offers the potential to perform analyses not previously possible.

The developers of GenEst are pleased to offer a series of two-day workshops designed to provide users with hands-on learning that will advance their knowledge around planning projects, implementing field methods, interpreting reports, and—of course—using GenEst. Instructors will lead discussions and activities on topics including:

- **Introduction to Estimating Fatality**
- **Hands-on Training with the GenEst Software**
- **Interpreting Proposals and Reports**
- **Comparing Common and Rare Fatality Events**

Upcoming Project Activities

The plans for upcoming tasks and completion of the project:

- Working Together to Resolve Environmental Impacts of Wind Energy
 - Completing white paper on *Risk-Based Management*
 - Conducting webinars—*Multiple Uses for Offshore Space, and Griffon Vultures and California Condors*
 - Conducting expert forums —*Offshore Wind and Birds: Collision Risk vs. Avoidance*
- Finalizing short science summaries on European wolves, bats, soaring birds, and European grouse

WORKING TOGETHER TO RESOLVE ENVIRONMENTAL EFFECTS OF WIND ENERGY

Bat Interactions with Land-Based Wind Energy: A European and North American Perspective

INTRODUCTION
Wind turbine-related fatalities of bats were first observed over 40 years ago, but it was not until the early 2000s when unexpectedly high numbers of fatality events were discovered at wind energy facilities in the eastern U.S. that the impacts of wind turbines on bats became a concern. Fatality rates vary dramatically and can range from zero to more than 100 bats/turbine/year at individual wind energy facilities. However, certain patterns are evident across the northern hemisphere. For example, fatalities are most frequent during late autumn and autumn and are often concentrated during nights with warm temperatures and low wind speeds. Understanding these patterns helped in developing the first strategies to reduce fatality by altering turbine operations during the timing and conditions bats were most vulnerable.

Estimates of fatality indicate hundreds of thousands of bats are killed annually at wind turbines both in Europe and

North America. Given bats are long-lived and typically only have 1 to 2 pups per year, existing fatality rates may not be sustainable for certain species. Recent studies indicate population-level declines are possible, particularly given the anticipated growth of wind energy development. However, demographic and population data are limited for most bat species, making it difficult to determine population sizes and trends. In the European Union, all bats are protected under the Habitats Directive and several species are on the IUCN Red List of threatened species. In contrast, only a few species are afforded legal protection in North America under either the United States' Endangered Species Act or Canada's Species at Risk Act.

FLYING AT HUB HEIGHT
As a group, bats are the most vulnerable animals at wind energy facilities. However, wind turbine-related fatality affects relatively few species. Those most at risk are adapted for relatively low and straight flight to the open air, and energy high-frequency echolocation for long-range detection of insects. At northern latitudes, winter species are also long-distance migrants and tend to roost in trees. The impacts may comprise 20–50% of the fatalities in some areas. Examples are species of *Myotis* in Europe and *Lasiurus* in North America. Certain species are attracted to wind turbines and this increases the magnitude of the problem. However, why bats interact with wind turbines remains

