

Facilitating Evaluation of Impact Minimization Technologies - Bats

Wind-Wildlife Mortality and Mitigation Strategies

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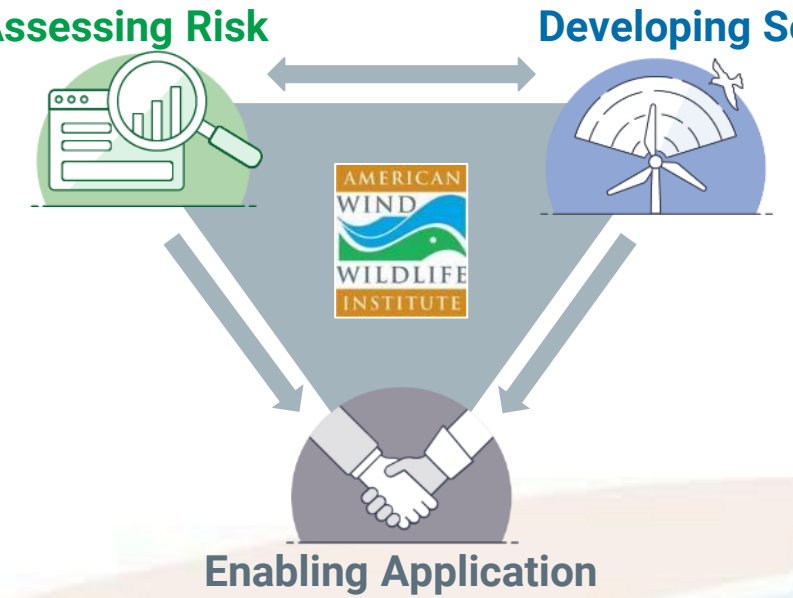
Overview

- Introduction to American Wind Wildlife Institute (AWWI)
- Operational Curtailment
  - **Blanket Curtailment**
  - **Smart Curtailment**
- Deterrent Technologies
  - **Detection and Deterrent Technologies**
- Offsetting Practicably Unavoidable Impacts (Compensatory Mitigation)
- Activities Supporting Development of Technology Solutions

American Wind Wildlife Institute

Independent nonprofit collaboration of industry, conservation/science, regulators:

Facilitate timely and responsible development of wind energy while protecting wildlife and wildlife habitat



Optimizing conservation AND wind energy production

National Research Plan

What We Need To Know

What We Know Now

National Research Plan

What's Most Needed to Reach Solutions

Published June '17

ROI Assessment

What is Relative Value

Prioritized, Collective Investment

Efficient, Effective Solutions

Technology and Strategy Based Risk Minimization

AWWI Technology Evaluation

Wind Industry

Streamlined Testing at Appropriate Number of Sites

Tech Vendors

Peer Review

Evaluated Minimization Technologies and Strategies

Outcomes:

- ✓ Operational Tools
- ✓ Avenues for Compliance
- ✓ Published Studies

Pooling knowledge/resources to find best solutions

Operational Curtailment: Blanket Curtailment

- "Blanket Curtailment" – increasing cut-in wind speed on seasonal basis
  - **Feathering blades below manufacturer cut-in speed - AWEA Best Management Practice**
  - **Elevating cut-in speed; usually to 5 or more m/s**
  - **Implementing 6.9 m/s as a de minimis level of potential take (regulatory 'avoidance' measure for ESA-listed species)**
- Blanket curtailment represents an excessive amount of production loss as bats are not always present at threshold wind speeds.

Operational Curtailment: Smart Curtailment

- "Smart Curtailment" – bats
  - **Shut down turbines based on when species of concern might be present**
  - **Activity- or model-based strategies**
  - **Maintain fatality reduction benefit**
  - **Reduce unnecessary power losses**

- "Informed Curtailment" – eagles, condors, whooping cranes
  - **Shut down turbines based on actual detection of species**
  - **Maintain fatality reduction benefit**
  - **Reduce unnecessary power losses**

Smart Curtailment Strategies: Model-Based

- Identify meaningful predictors of bat collision risk
  - **Precipitation**
  - **Wind speed**
  - **Temperature – reduced activity at cold temperatures**
  - **Barometric pressure**
  - **Moon or anthropogenic illumination**
- Evaluating at a Midwestern wind facility; supported by acoustic and video monitoring
  - **Time stamp of fatality events by active camera monitoring**
- DOE-funded, 2019-2021 Evaluation of Vestas' Bat Protection System (VBPS) as a modeled smart curtailment system for bats (AWWI lead)

Smart Curtailment Strategies: Activity-Based

- Measure activity at the nacelle and/or tower, audio- and/or video-based
- Implement rules for level of activity necessary for turbine shutdown
- Example – TIMR tested at Wisconsin wind farm (EPRI, 2017)
  - **Curtailment actuated between 3.5-8 m/s and register of ≥1 bat call**
  - **Four acoustic sensors (82-turbine wind facility), zonal coverage of wind facility**
- Number of sensors and representative deployment within the wind facility and cost implications are areas of continuing research
  - **DOE-funded bat technology evaluation of activity-based smart curtailment strategy, EPRI/Normandeau's Turbine Integrated Mortality Reduction-"TIMR" (2019-2021)**

Refining Smart Curtailment Practices for Bats

Using local and regional weather data to improve smart curtailment strategies for bats

Scope the feasibility using 1) bat fatality models developed with machine learning technology, and 2) project/regional weather data to provide targeted, proactive turbine curtailments, resulting in reduced bat fatalities and reduced production losses

Comparing the effectiveness of curtailment strategies in reducing bat fatalities of Myotis and other migratory tree bat species

Compile data from post construction monitoring studies contributed to AWWIC to evaluate species-specific variation in bat fatalities among different curtailment regimes.

Deterrence Strategies: Bats

- Acoustic Bat Deterrence – nacelle- and/or tower-mounted
  - **NRG Systems (transducer-based function)**
  - **GE Deterrent (pneumatic-based function)**
- Acoustic Bat Deterrence – blade-mounted
  - **Frontier (energized, transducer function)**
  - **University of Massachusetts (passive, air pressure function)**
- Ultraviolet Bat "Deterrence" – U.S. Geological Survey (USGS)
  - **Enhance visibility of turbines, testing the turbine-tree attraction hypothesis and enable bats to differentiate from trees**

Bat Deterrent Technology

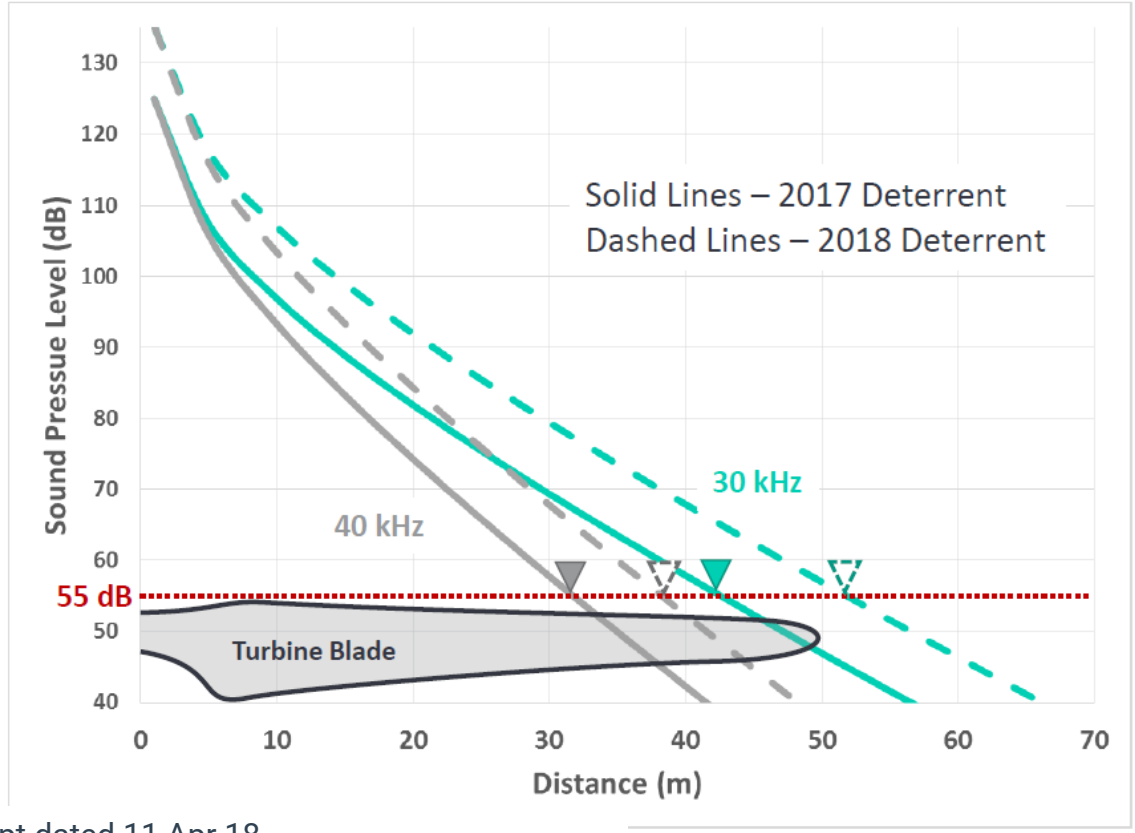
Ultrasonic Deterrent | Design

Use several nacelle-mounted deterrent units to generate an ultrasonic field in the rotor sweep

Source: NRG Systems .ppt dated 11 Apr 18

Improvements Field Testing Results (Rotor Area Coverage)

Longer Range | 10dB Increase



Source: NRG Systems .ppt dated 11 Apr 18

Combining of Strategies: Deterrent-Curtailment Evaluation

The potential additive effect of combining treatments of risk reduction strategies for bats

- Baseline Study: Estimate mortality reduction at 15 control and 15 treated turbines
  - **Dual treatments - bat deterrents and 5.0 m/s blanket cut-in speed**
  - **Results suggest an increase in fatality reductions due to a) deterrent technology improvements, and b) combining with blanket cut-in speed treatment**

- Expanded Study: Monitor for time-of-fatality and correlate with environmental conditions to additional predictor covariates
  - **Daily searches at 8 control turbines with night-time video imaging technology and advanced acoustic detection of bats within RSA**
  - **Testing conducted August to mid-October 2018**
  - **Peer-reviewed results of both studies planned for mid-2019 release**

NREL's Technology & Development Innovation

National Renewable Energy Lab's TD&I Program focuses on enabling early to mid-stage research and development efforts on promising risk monitoring and minimizing technologies and strategies

- 2018 TD&I Awardees:
  - **Dr. Paul Cryan, USGS: dim UV light bat deterrent**
  - **Dr. Robb Diehl, USGS: NEXRAD weather radar system**
- New RFP released 15 April 2019. Visit www.nrel.gov/wind/technology-development-innovation.html

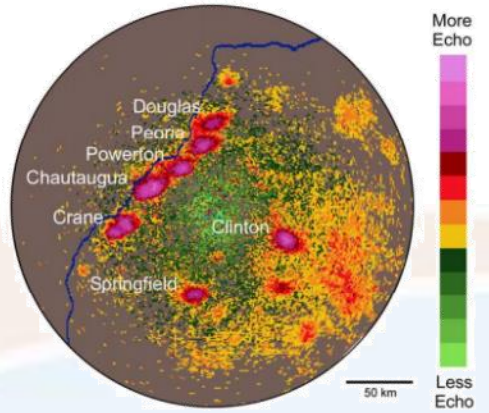


Figure 4. At the onset of migration, waterfowl depart cooling lakes (e.g., Clinton) and reservoirs along the Illinois River (e.g., Chautauqua NWR) at dusk (November 4, 2000, 5:54 p.m. CST). Known stopover habitats for waterfowl are labeled. By using these kinds of data, the relative use of different waterfowl stopover habitats can be comprehensively measured daily or seasonally.

Enhancing Understanding of Bat Activities and Fatalities

Relationship between bat acoustic activity and collision fatalities

This project will pair pre-construction bat acoustic activity surveys with publicly available fatality estimates from the same wind facilities to correlate regionally based acoustic activity with fatalities. If data are available, species-specific analyses will also be performed.

Reducing fatalities of migratory tree bats at wind energy facilities

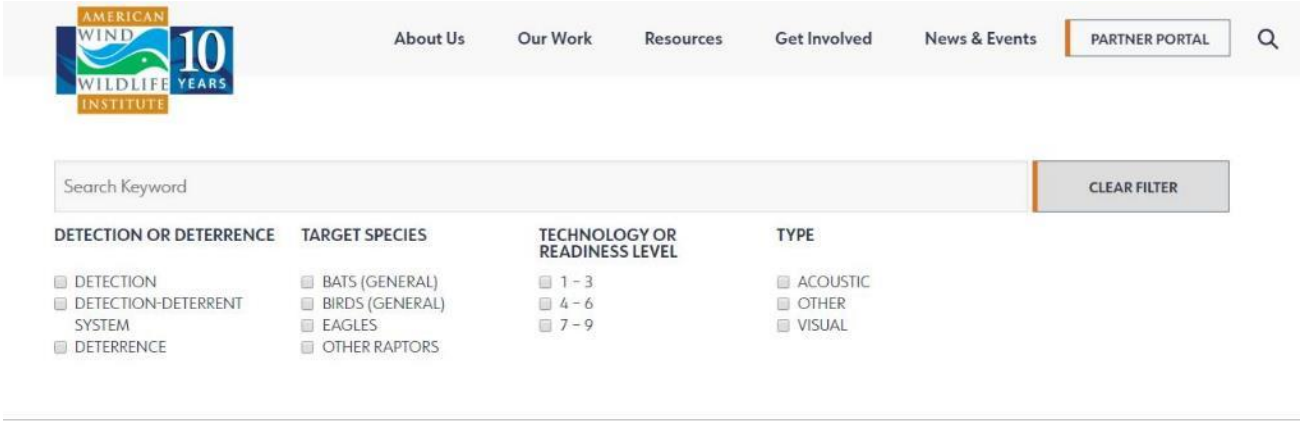
Evaluate AWWIC fatality data to further assess the relationship between landscape-level attributes and variation in fatalities of hoary bat and other tree bat species among wind energy facilities.

Technology Innovation Program Outreach

- Contracted with NREL to support their efforts on TRLs 1 – 6
  - **Technology Integration Forum**
    - June 2018 event in collaboration with NREL; planning Nov 2019 event
  - **Perspectives on technology integration from wind industry**
  - **Outreach to U.S. Fish and Wildlife Service**
- Technology Integration White Paper
  - **Evaluation of Non-Biological Elements**
- Guidance for Potential Hosts of Wind-Wildlife Technologies and Strategies (in progress)
  - **Series of considerations for temporarily (e.g., study or evaluation) or permanently employing a risk reduction technology**

Wind & Wildlife Technology Catalog

- A hub of information about technologies intended to minimize risk to wildlife at wind facilities
- 32 entries as of December 2018
- Catalog is available to Partners and Friends of AWWI
- Work in 2019 to bring vendors and end users together to enhance understanding of installation and integration challenges



Questions and Thank You!

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