



Facilitating Evaluation of Impact Minimization Technologies - Eagles

Wind-Wildlife Mortality and Mitigation Strategies

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Overview

- Introduction to Wind Wildlife Research Fund (WWRF)
- Operational Curtailment
 - **Informed Curtailment**
- Deterrent Technologies
 - **Detection and Deterrent Technologies**
- Offsetting Practicably Unavoidable Impacts (Compensatory Mitigation)
- Activities Supporting Development of Technology Solutions



The Wind Wildlife Research Fund is an industry-led initiative that provides funding to advance research for solutions to wind-wildlife issues.

Endorsed by AWEA Board

Housed under AWWI umbrella

○ **AWWI Board resolutions August 2018:**

- Approved creation of Fund within AWWI to be incorporated into workplan and budget
- Approved Fund Advisory Council to identify projects and ensure projects align with AWWI's National Research Plan guidelines



2019 Partners

- Apex Clean Energy
- Avangrid Renewables
- Berkshire Hathaway Energy Company
- Clearway Energy Group
- Duke Energy Renewables
- EDF Renewables
- EDP Renewables
- Enel Green Power
- Invenergy
- NextEra Energy
- Pattern Energy Group
- Siemens Gamesa
- Southern Power
- Tradewind Energy

2019 Friends

- American Wind Energy Association
- ConnectGen
- DTE Energy
- IdentiFlight
- Innogy
- Engie
- Leeward Energy
- MAP Energy LLC
- NRG Systems
- Orion Renewable Energy Group
- Portland General Electric
- Puget Sound Energy
- RES Americas
- sPower
- Scout Clean Energy
- Vestas

2019 Projects

- **Refining Smart Curtailment Practices for Bats**
 - Using local and regional weather data to improve smart curtailment strategies for bats
 - Comparing the effectiveness of curtailment strategies in reducing bat fatalities
- **Enhancing Understanding of Bat Activities and Fatalities**
 - Relationship between bat acoustic activity and collision fatalities
 - Reducing fatalities of migratory tree bats at wind energy facilities
- **Refining Curtailment and Fatality Estimates for Eagles**
 - Using eagle behavior to refine turbine curtailment strategies
 - Improving raptor carcass persistence estimates
- **Evaluating Habitat-based Impacts for Grouse**
 - Lesser prairie-chicken response to a wind energy development

Results are scheduled for fall 2019

- **3rd party peer review research**
- **Published results**



Summer 2019:

- Proposals for research projects beginning in 2020 received in response to RFP
- Following peer review, fund leaders will set priorities and raise funds to support the highest priority projects for 2020 and beyond

We are reaching out now to new Partners, Friends, and Supporters!



AWWI Technology Evaluation



Outcomes:

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



Pooling knowledge/resources to find best solutions

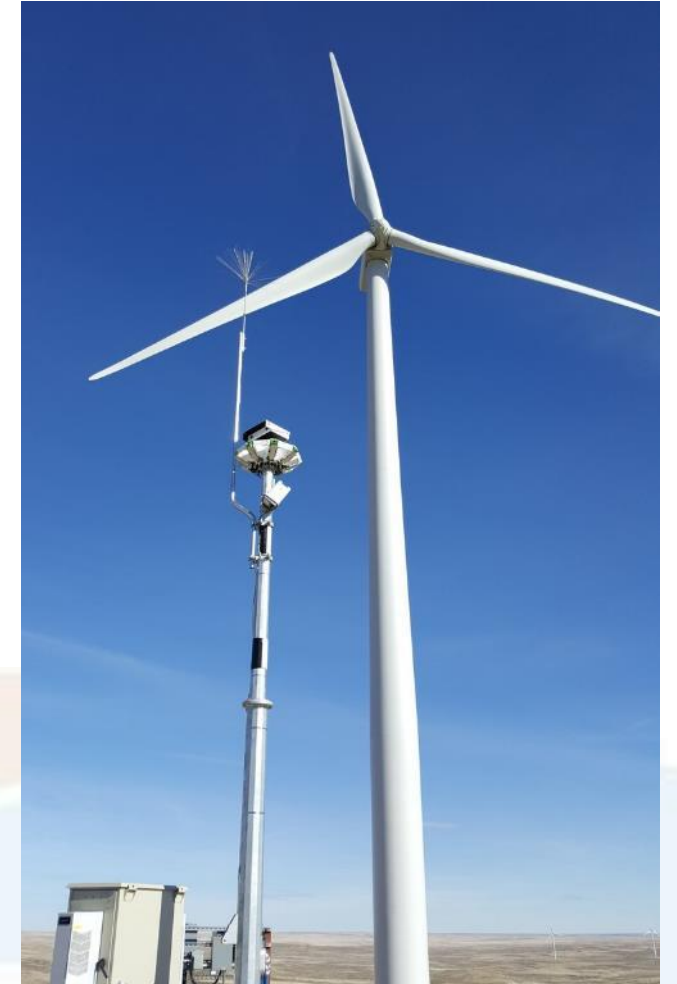
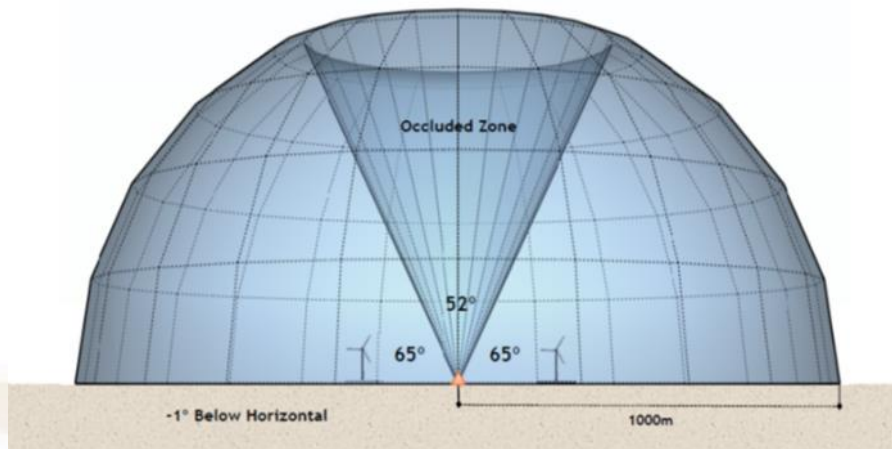
Operational Curtailment: Informed Curtailment

- “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**

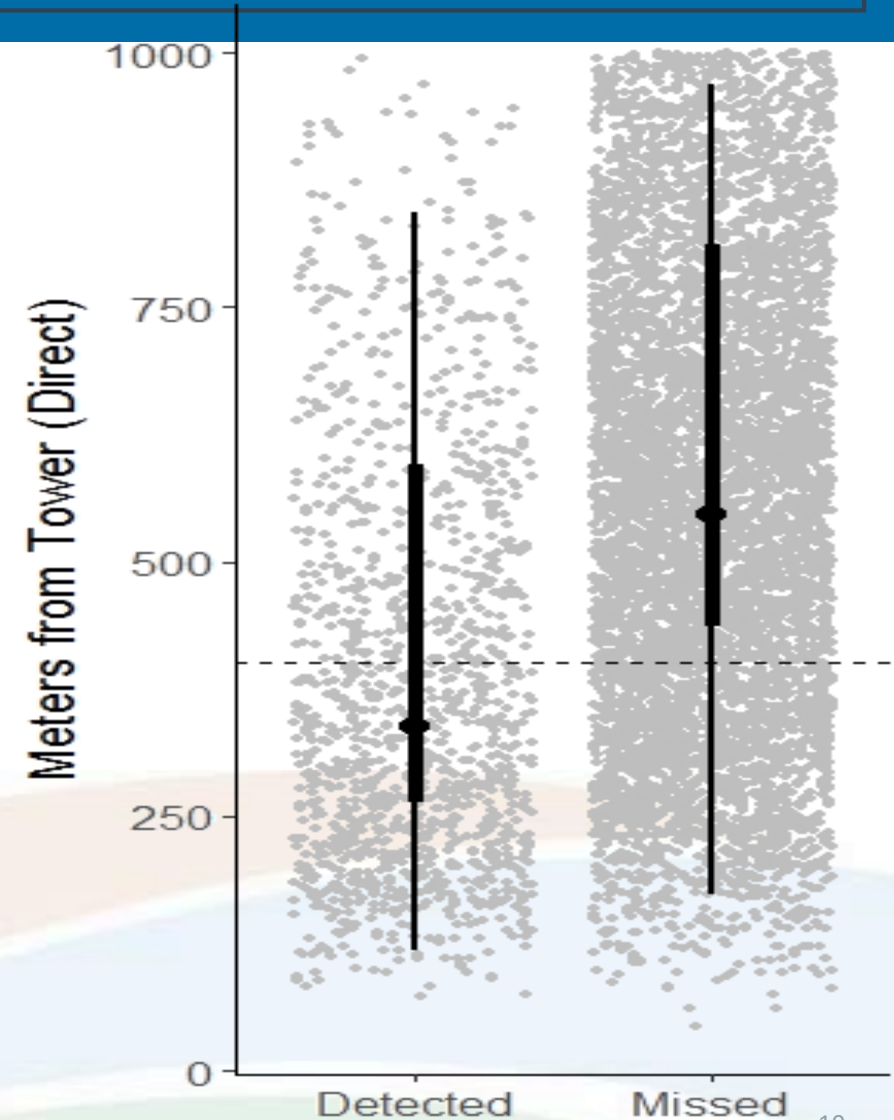
Informed Curtailment Strategies: Detection-Based

- Informed curtailment system: IdentiFlight – used for species active during daylight hours (e.g., eagles, condors)
 - Utilizes machine learning technology
 - Mounted on free-standing tower
 - Wide field of view & high-resolution stereo cameras
 - Hemisphere of visual coverage



Results of AWWI's IdentiFlight Pilot Study

- Rapid classification at substantial distance from the towers
- Detection reliability
 - **Detected 96% of eagles detected by human observers**
 - **Non-conditional analysis part of DOE-funded project**
- Accurate classification
 - **Low false negatives (6%; humans = 26%)**
 - **Higher false positives (28%; humans = 2%)**
 - **Classification independent of distance from the cameras**
- Published in Biological Conservation: McClure et al 2018



Deterrence Strategies: Eagles

- Acoustic Bird Deterrence – tower-mounted
 - **DTBird (camera-detection; speaker broadcast audio functions)**
 - **Birdvision (camera-detection; speaker broadcast audio functions)**
 - **Other?**
- Visual Bird Deterrence – ground-mounted
 - **Wind Dancer (currently under evaluation) by Oregon State University (R. Albertani)**

Do raptors react to UV light?

- **Published in the Journal of Raptor Research: Hunt et al., 2015**

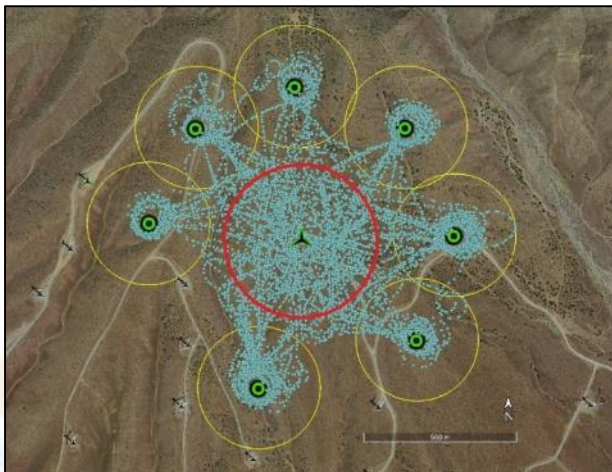
DTBird – Liquen Consultoria Ambiental

- Automatic bird detection and/or deterrent system at land-based and offshore wind turbines
- Operation:
 - **Video cameras detect eagle-sized birds**
 - **Activation of alert signal a ~245 meters**
 - **Activation of dissuasion signal at 175 meters**
 - **Stop control function (not being evaluated)**



Results of DTBird Pilot Study

- Detection rate from UAV flight trials: 63% \pm 10%
- Deterrence rate of *in situ* golden eagles: 52-83%
- Sun glare, variable cloud cover reduced detection
- False positive detections: airplanes, small birds, insects, etc.
- Published as AWWI Technical Report:
www.awwi.org/dtbird-technical-report/



Offsetting Unavoidable Impact: Compensatory Mitigation

- Mitigate unavoidable impacts to listed or protected species
- Compensation: what limits species populations?
 - **Eagles**
 - Power pole retrofits
 - Voluntary lead abatement (AWWI publication)
 - Roadkill removal (AWWI publication)
 - Habitat enhancement and nest exposure (AWWI models – in progress)

Refining Curtailment and Fatality Estimates for Eagles



Using eagle behavior to refine turbine curtailment strategies

This project will use data collected by IdentiFlight to improve curtailment algorithms to reduce unnecessary turbine shutdowns by factoring eagle behavior patterns.



Improving raptor carcass persistence estimates

This project will evaluate game bird and raptor carcass persistence simultaneously to determine if a consistent scalar can be reasonably used to estimate eagle fatalities for eagle permit applications.

Evaluation of Non-Biological Elements

Installation

- **Physical installation, network and power needs of equipment**
- **Costs and coordination with host site, turbine OEM, SCADA**
- **Compatibility of technology across turbine platforms**

Integration

- **Signal types, pathways, and destinations in compatible language**
- **Data storage, transfer, and bandwidth requirements**
- **Remote access for real-time and diagnostic interactions**

Operations and Performance Reliability

- **Lifespan and durability of hardware and software**
- **Troubleshooting, maintenance requirements and operational logistics**
- **Service contract, warranty, and supply chain assurances**

<https://awwi.org/resources/technology-integration-white-paper/>

Questions?



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