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BREAK THE GRIDLOCK!
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SAWEA

21 - 23 OCTOBER 2025
8:00 am – 5:00 pm

CAPE TOWN, SA
CTICC 2

2025 PRESENTATION

WEST Optimized Smart Curtailment™ (OSC ™) for Bats: Boosting Energy Production while Maintaining Conservation Goals

Dr. Amanda Hale

23 October 2025

SPEAKER OVERVIEW

Dr. Amanda Hale

Western EcoSystems Technology, Inc (WEST)

Principal Biologist

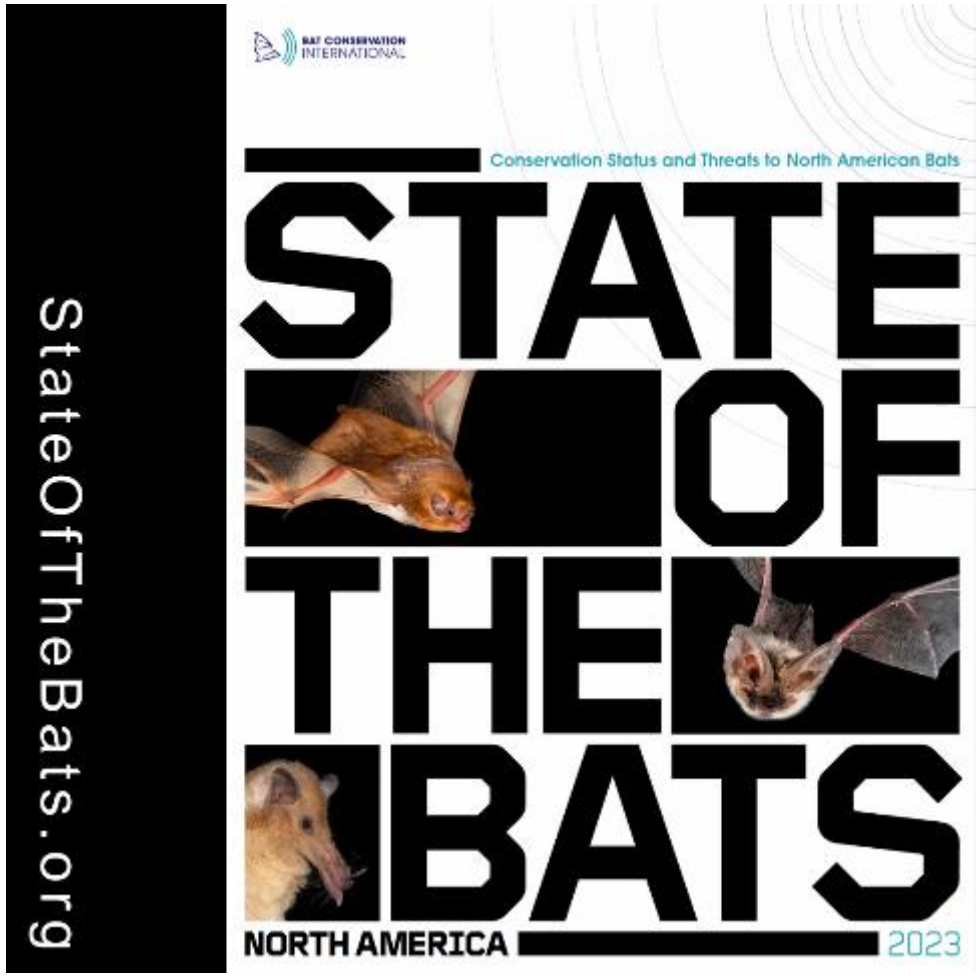
Co-authors

WEST

Michael True, Paul Rabie, Rhett Good, and Kevin Heist

Wildlife Imaging Systems

Brogan Morton and Jon Ritter

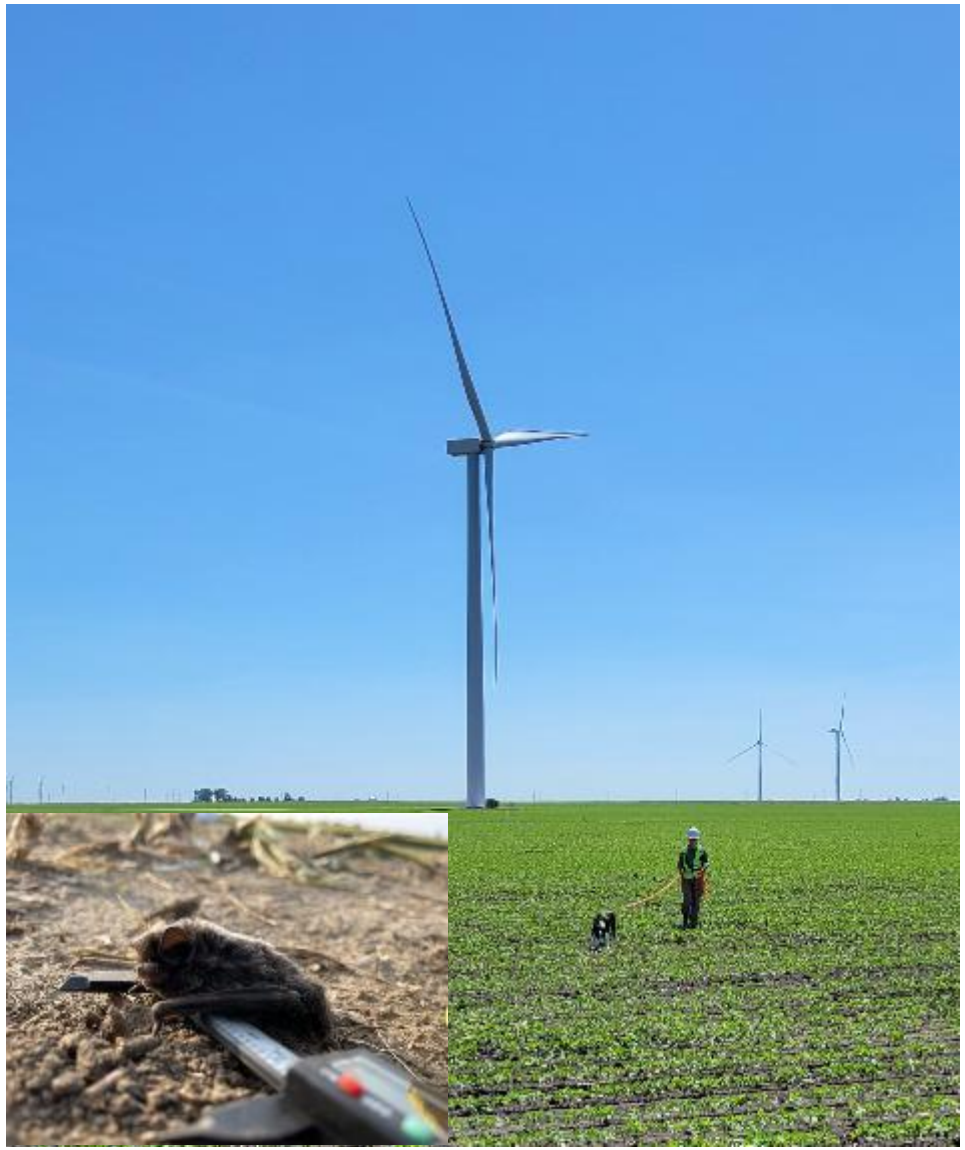


https://digital.batcon.org/state-of-the-bats-report/2023-report/

- Bats face many threats
  - Climate change
  - Habitat loss
  - Emerging diseases
  - Destruction of bat roosts
  - Wind energy
- Extinction risk is rising
  - 52% of species need conservation action

BATS AND WIND ENERGY

- Mortality occurs world-wide
  - Common species
  - Threatened and endangered species
- Most fatalities are migratory bats
  - Late summer and early fall
- Challenges predicting risk pre-construction



PROVEN MINIMIZATION TECHNIQUE

- # Blanket Curtailment
  - Raising turbine cut-in speed reduces risk to bats

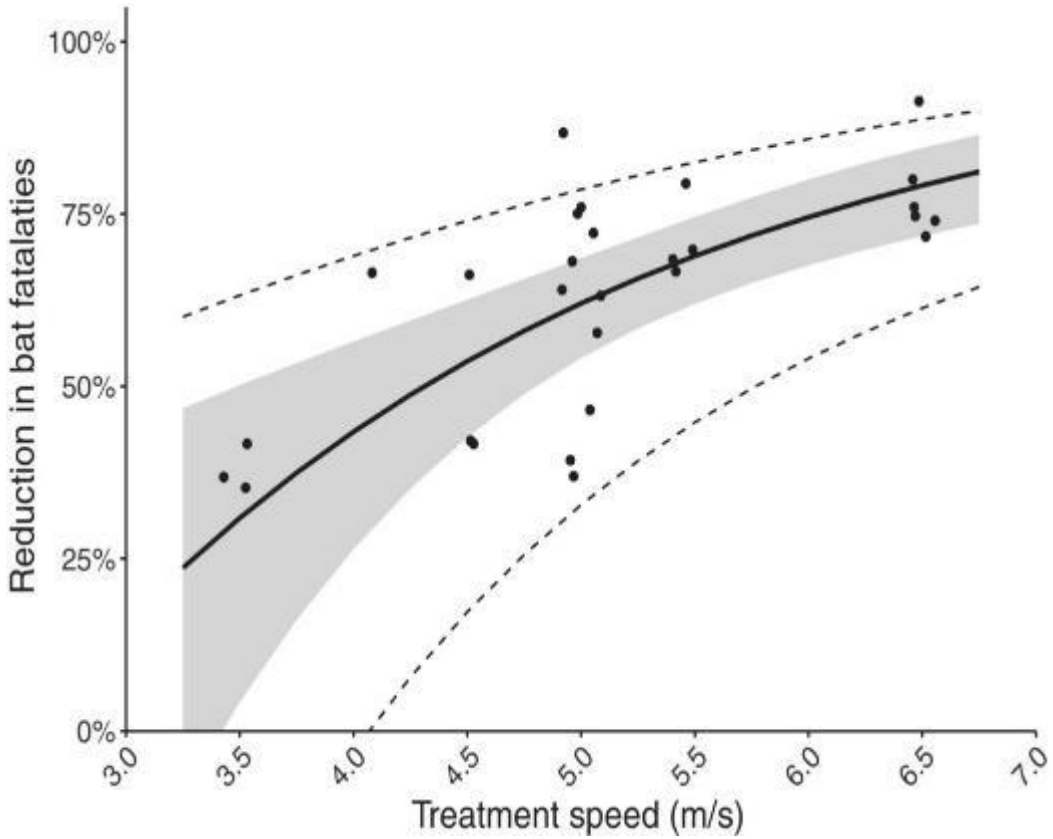
Received: 3 January 2024 | Accepted: 11 July 2024
DOI: 10.1002/2688-8319.12371
Ecological Solutions and Evidence
RESEARCH ARTICLE
Special Feature: Global Energy Transition

A decade of curtailment studies demonstrates a consistent and effective strategy to reduce bat fatalities at wind turbines in North America

Michael D. Whitby[1] | M. Teague O'Mara[1,2,3,4] | Cris D. Hein[5] | Manuela Huso[6,7] | Winifred F. Frick[1,8]

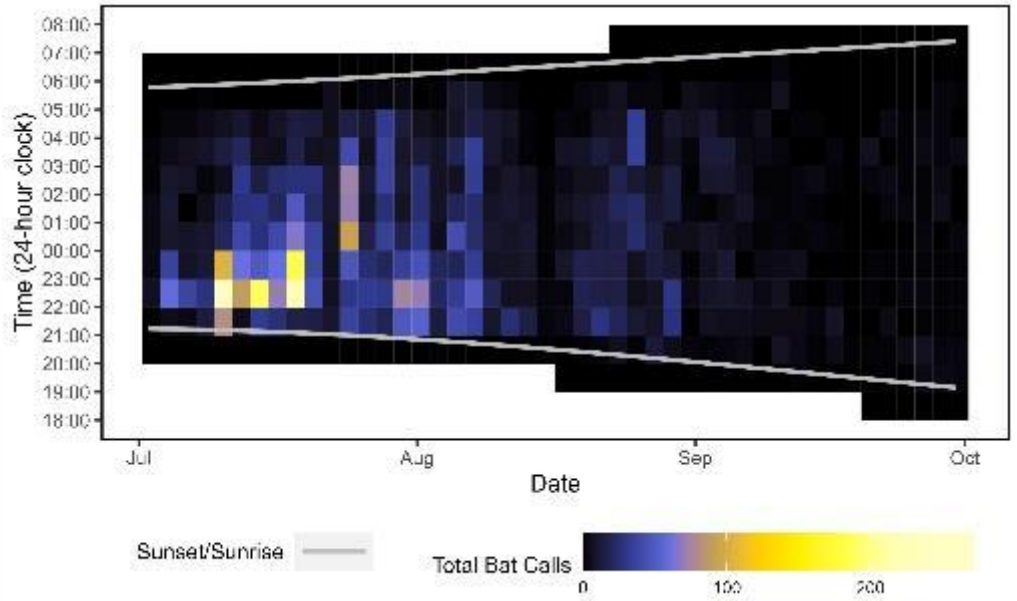
[1]Bat Conservation International, Austin, Texas, USA; [2]Southeastern Louisiana University, Hammond, Louisiana, USA; [3]Max Planck Institute of Animal Behavior, Radolfzell, Germany; [4]Smithsonian Tropical Research Institute, Panama, Republic of Panama; [5]National Renewable Energy Lab, Golden, Colorado, USA; [6]U.S. Geological Survey, Forest and Rangeland Ecosystem Science Center, Corvallis, Oregon, USA; [7]Statistics Department, Oregon State University, Corvallis, Oregon, USA and [8]University of California Santa Cruz, Santa Cruz, California, USA

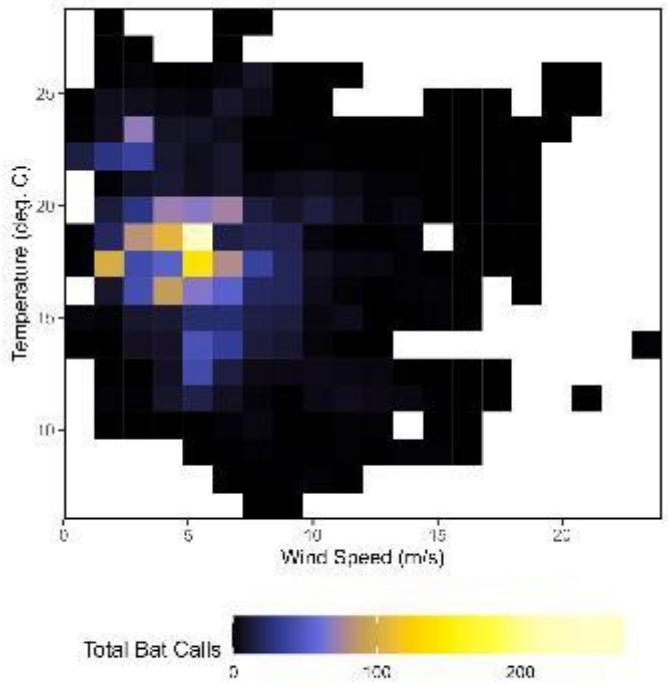
Diminishing returns at higher wind speeds



BLANKET CURTAILMENT IS INEFFICIENT

Bat activity changes with wind speed, but also with season, time of night, temperature, and other factors

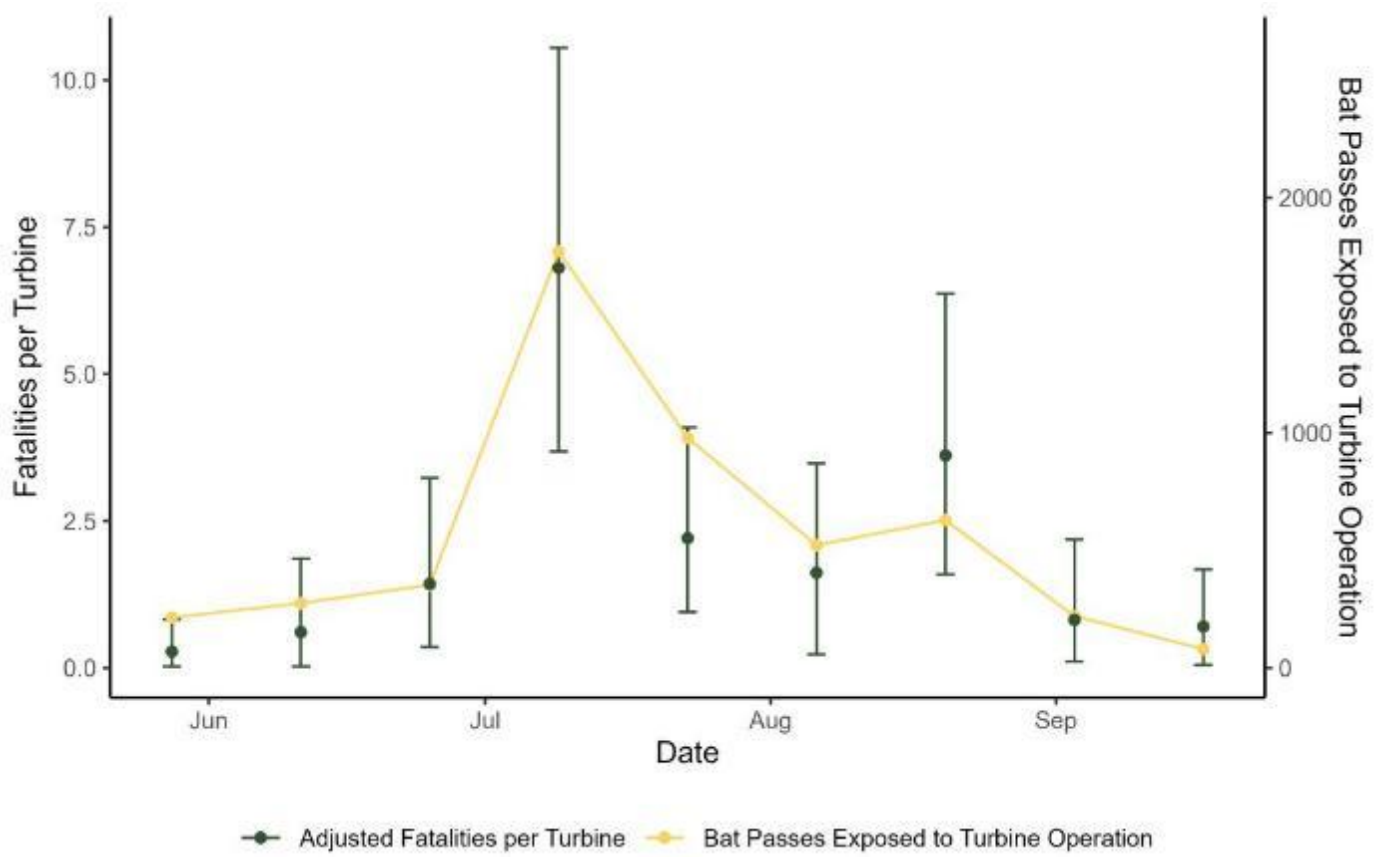




Relative risk is measurable through acoustic activity

- Acoustic bat passes during rotor movement (exposed to turbine operation) is correlated with fatality estimates through the season
- Provides the basis for using acoustic data to understand risk patterns

Data from a Wind Farm in Minnesota, US



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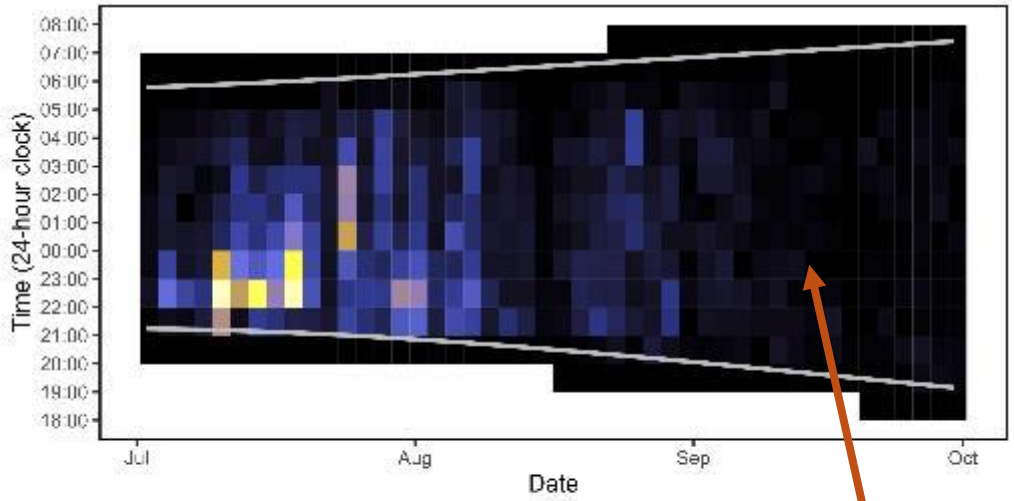
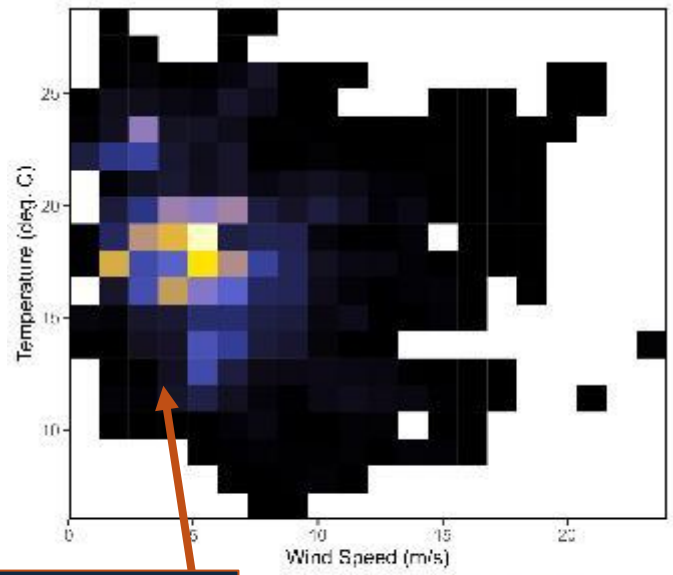
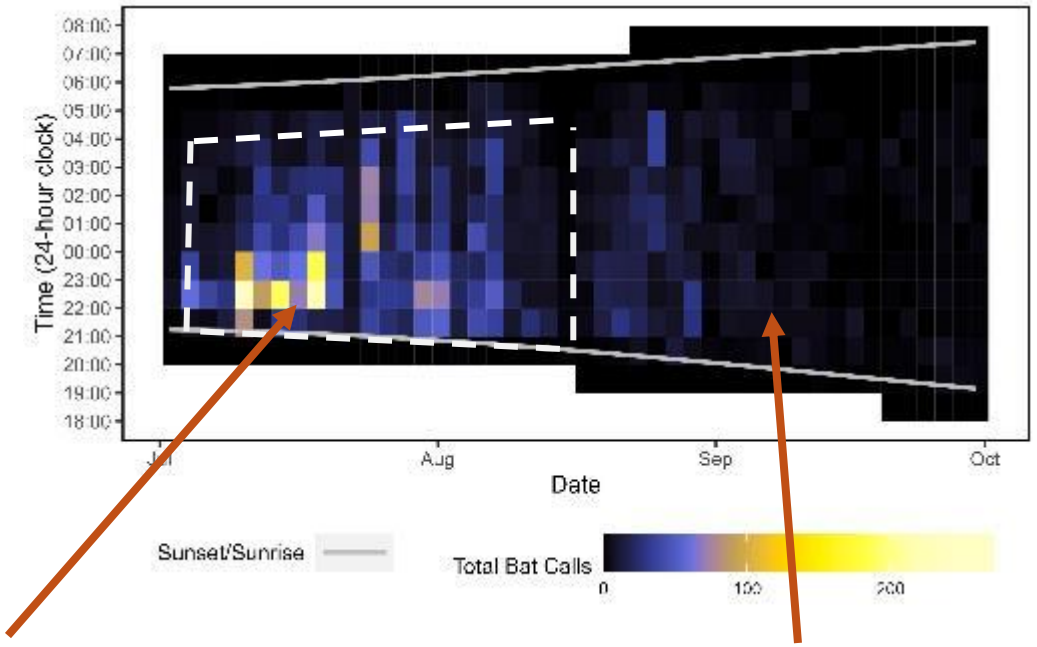




5.0 m/s
cut-in speed
applied all night,
every night

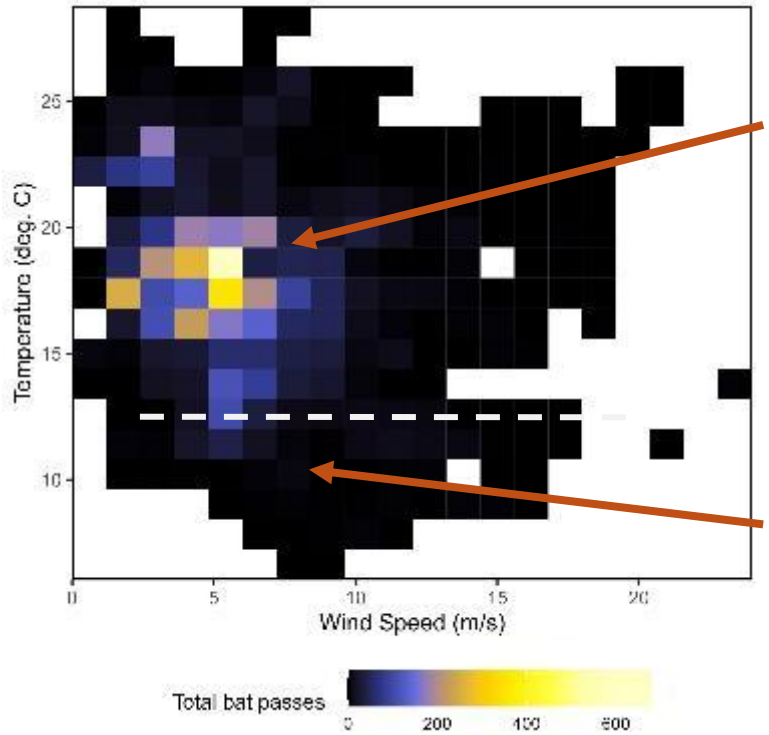
SMART CURTAILMENT IS MORE EFFICIENT

Smart curtailment - Setting a curtailment schedule according to bat activity patterns



Higher cut-in

Lower cut-in



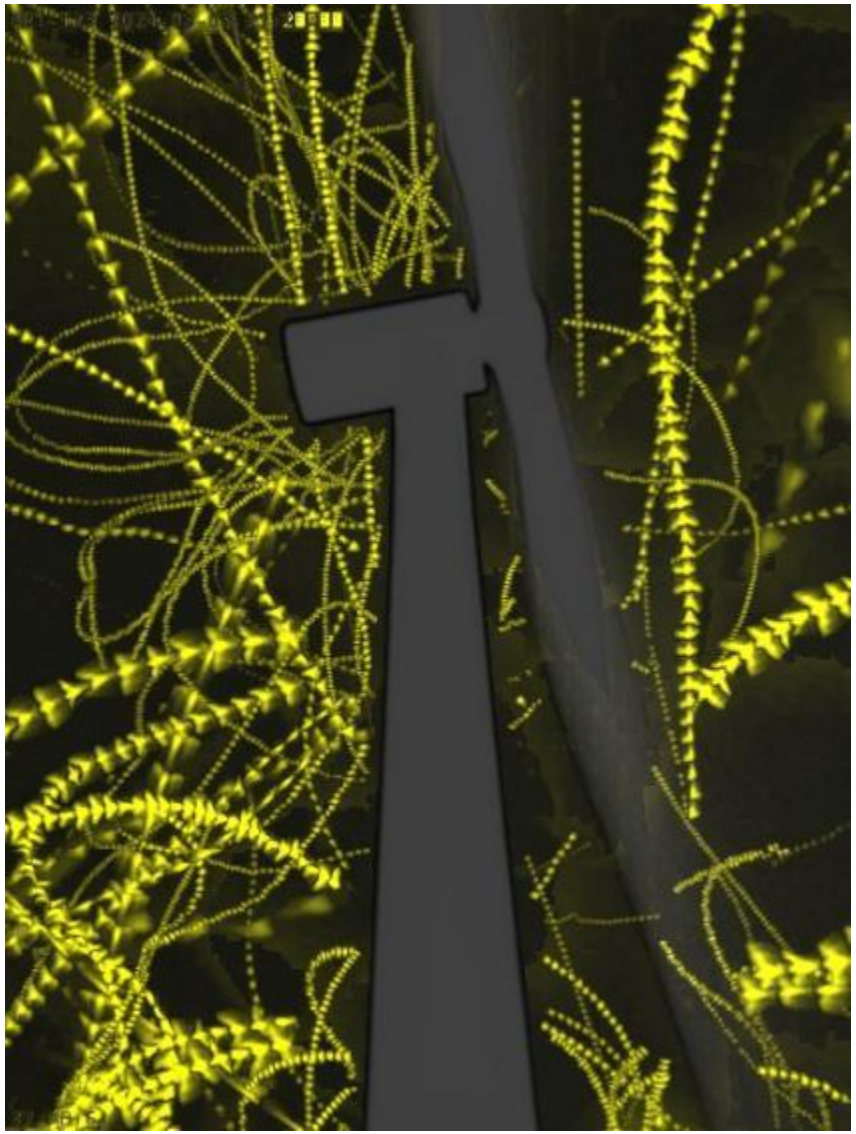
Higher cut-in

Lower cut-in

ADVANCES IN FATALITY MINIMIZATION

Smart or Informed Curtailment

- Uses other sources of information, in addition to wind speed and time of year/night, to trigger curtailment
  - Temperature
  - Barometric pressure
  - Wind direction
  - Bat activity



Smart/Informed Curtailment

Blanket curtailment

- One uniform cut-in speed is applied

Algorithm-based curtailment

- Bat activity data are collected at operational turbines
- Used to inform a curtailment schedule
- Cut-in speed varies

Real-time curtailment

- Bat activity data are collected in real-time at operational turbines
  - Acoustic detectors
  - Thermal cameras
- Bat detections trigger curtailment

OPTIMIZED SMART CURTAILMENT™

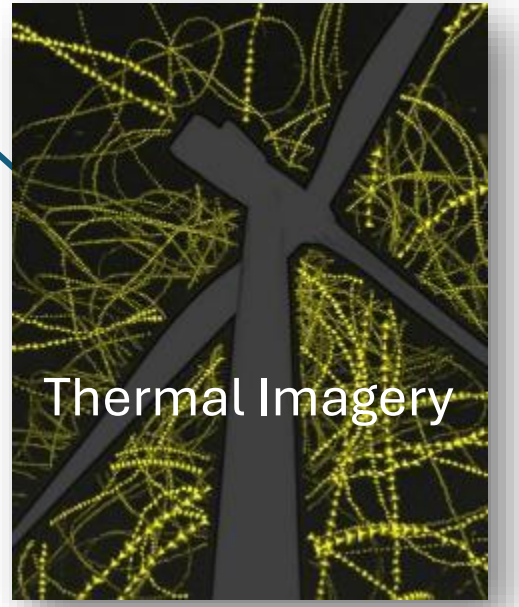
powered by WEST

Optimized Smart Curtailment (OSC™) is a Bayesian decision tree model that produces site-specific algorithms to optimize power production and fatality reduction.

What data sources are needed to inform OSC?

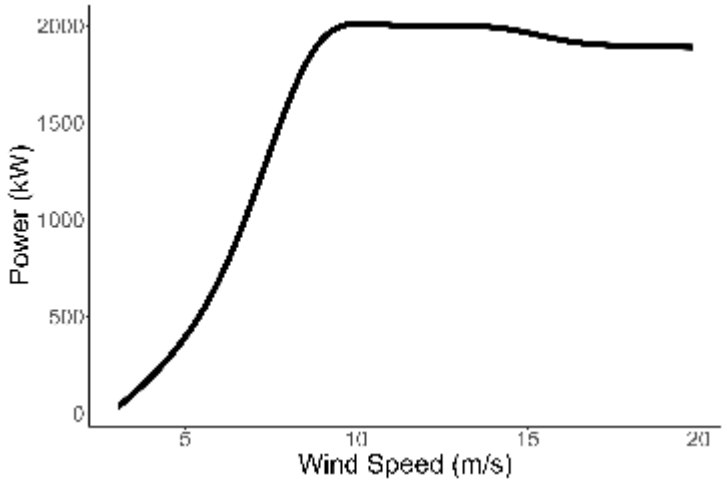
+

Bat Activity Data



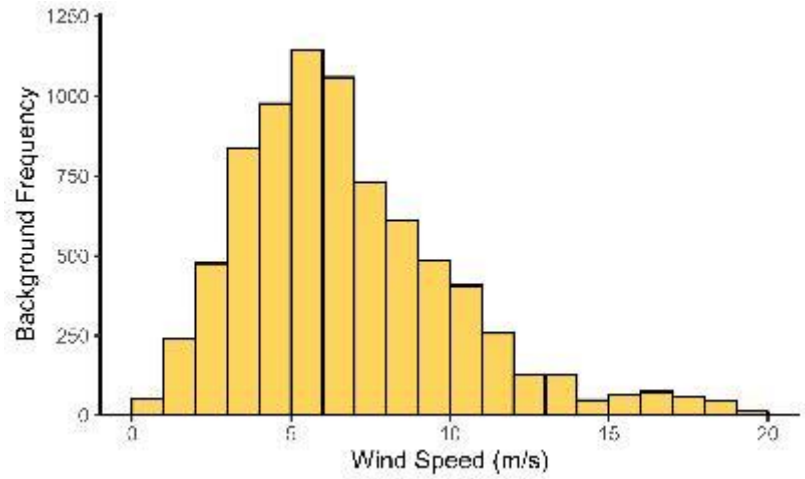
SCADA Power Production Data

Weather and Power Production Data



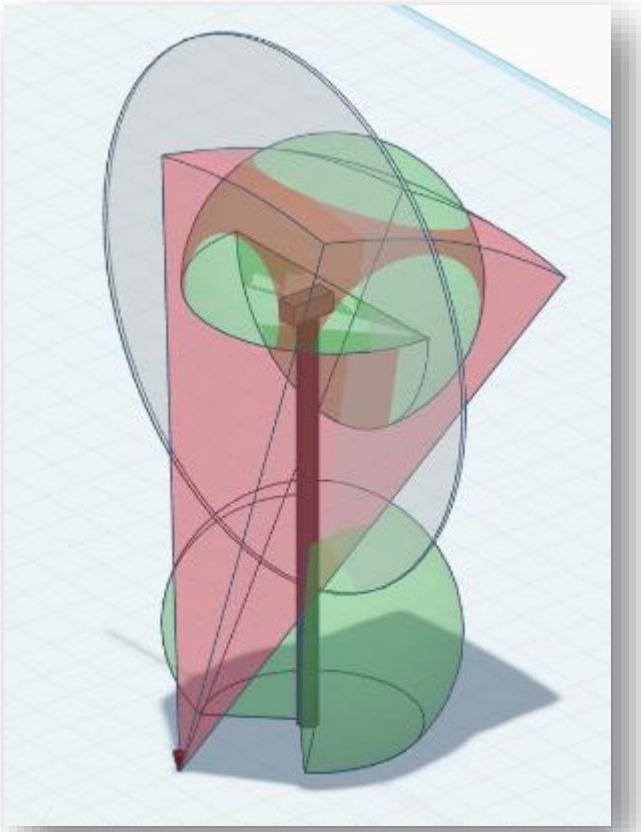
Power Production Data

- Power production potential also changes with date, time, etc.
- Higher wind speeds occur often
- More costly to curtail at higher wind speeds than lower wind speeds



Activity Data: Thermal Video vs. Acoustics

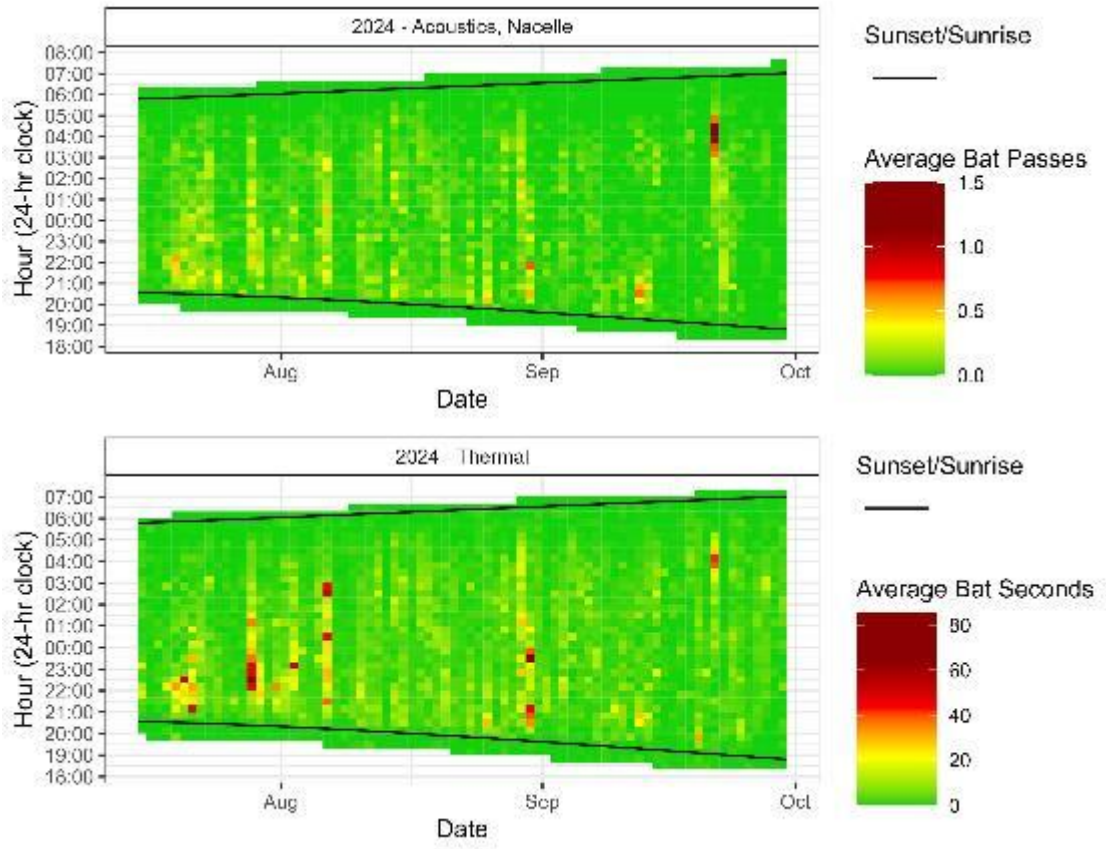
RENEWABLE ENERGY WILDLIFE RESEARCH FUND



Pro: Greater detection volume

Con: No species identification is possible

Acoustic activity and thermal activity are highly correlated (r = 0.75)



Thermal System Set-up

- Robust
- Small footprint
- No turbine integration

OSC PERFORMANCE EVALUTION

Measure performance through scenario-based calculations relative to a blanket curtailment alternative

Power Recovery

- The percent of power loss from blanket curtailment reduced by using OSC

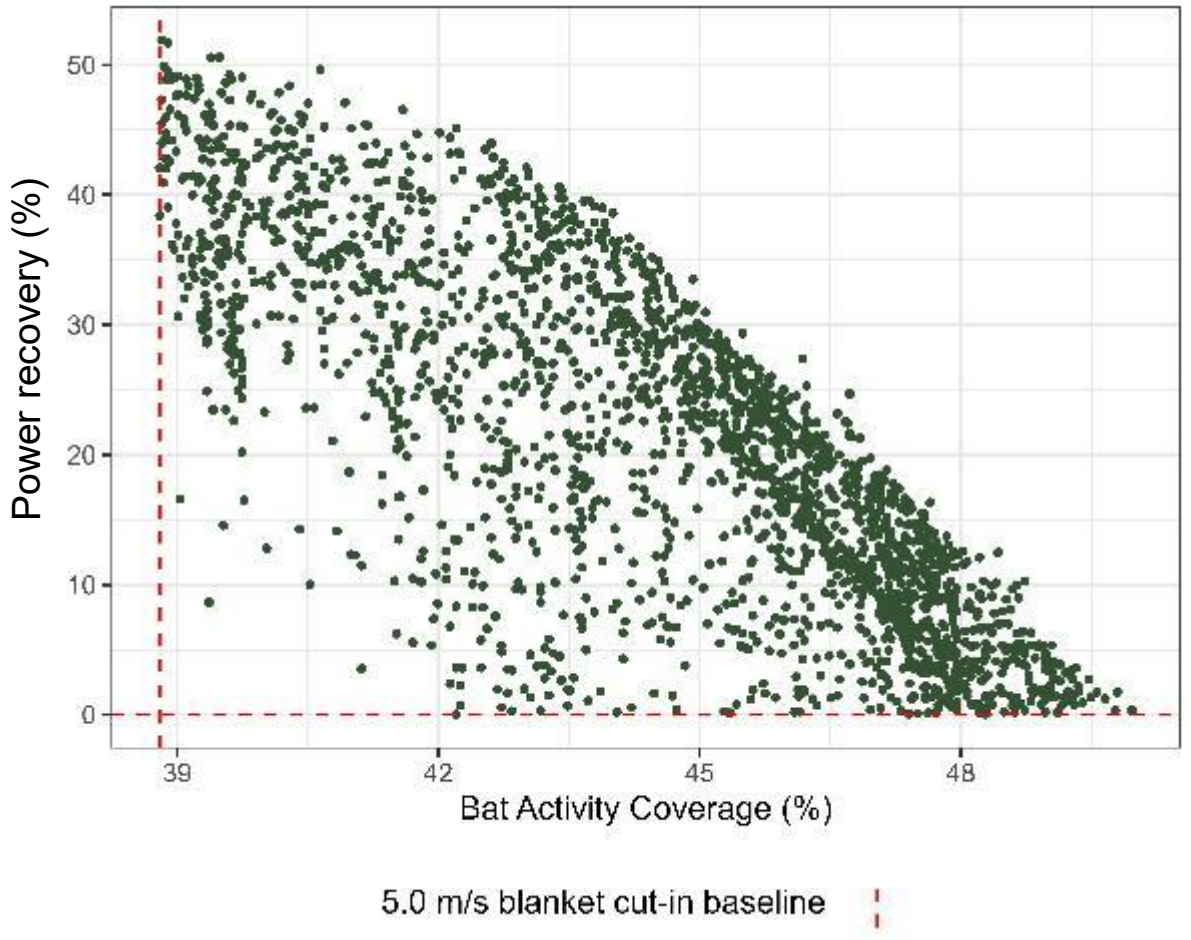
Bat Activity Coverage

- The percent of bat activity that occurs during turbine downtime (curtailment)

OSC PERFORMANCE DEMONSTRATION

- Power recovery
- Bat activity coverage
- OSC provides many options with one model run

Data from a Wind Farm in Minnesota, US



OSC PERFORMANCE DEMONSTRATION

- Power recovery
- Bat activity coverage
- OSC provides many options with one model run
    1. Similar risk, maximize power recovery

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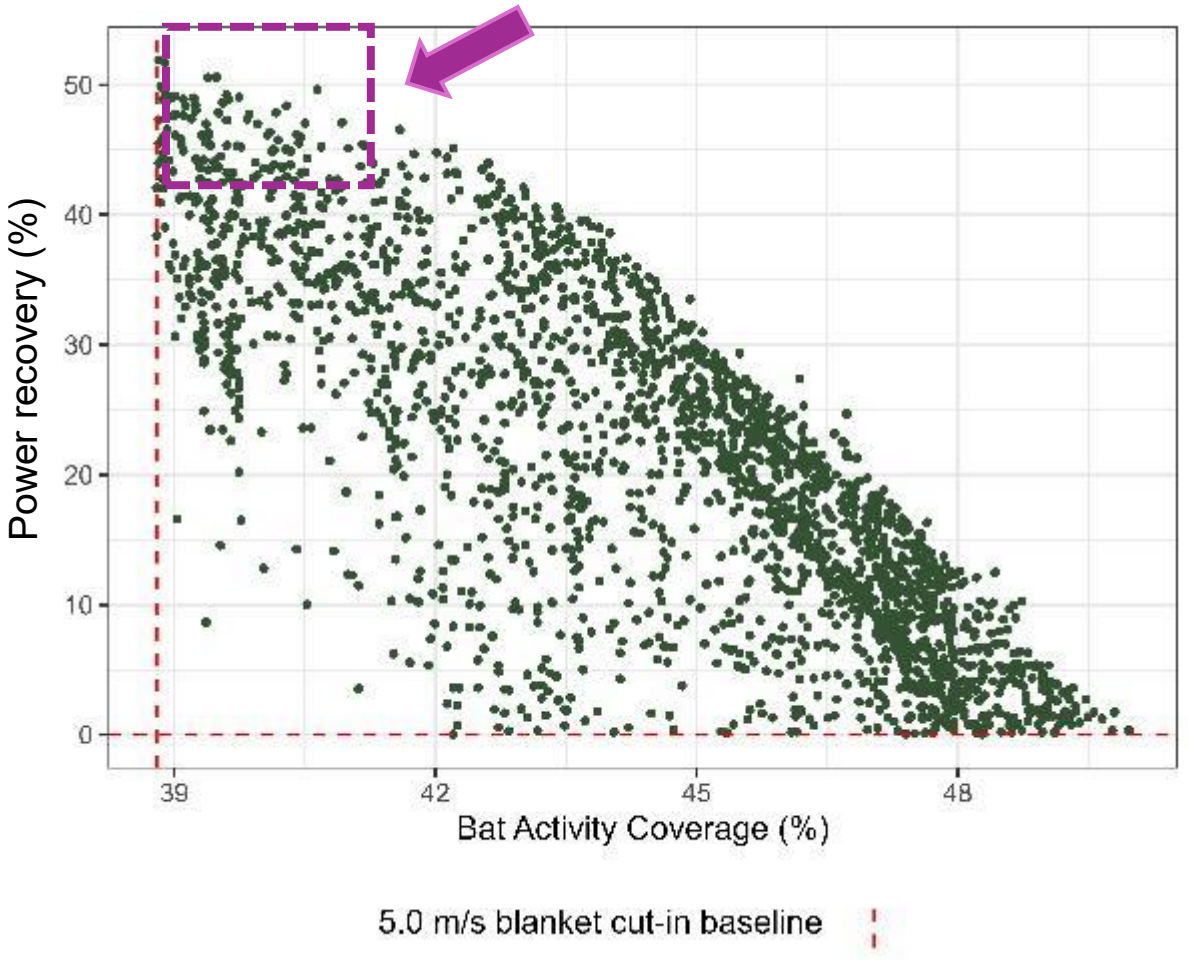

OSC PERFORMANCE DEMONSTRATION

- Power recovery
- Bat activity coverage
- OSC provides many options with one model run
    1. Similar risk, maximize power recovery
    2. Maximize risk reduction, slight power recovery

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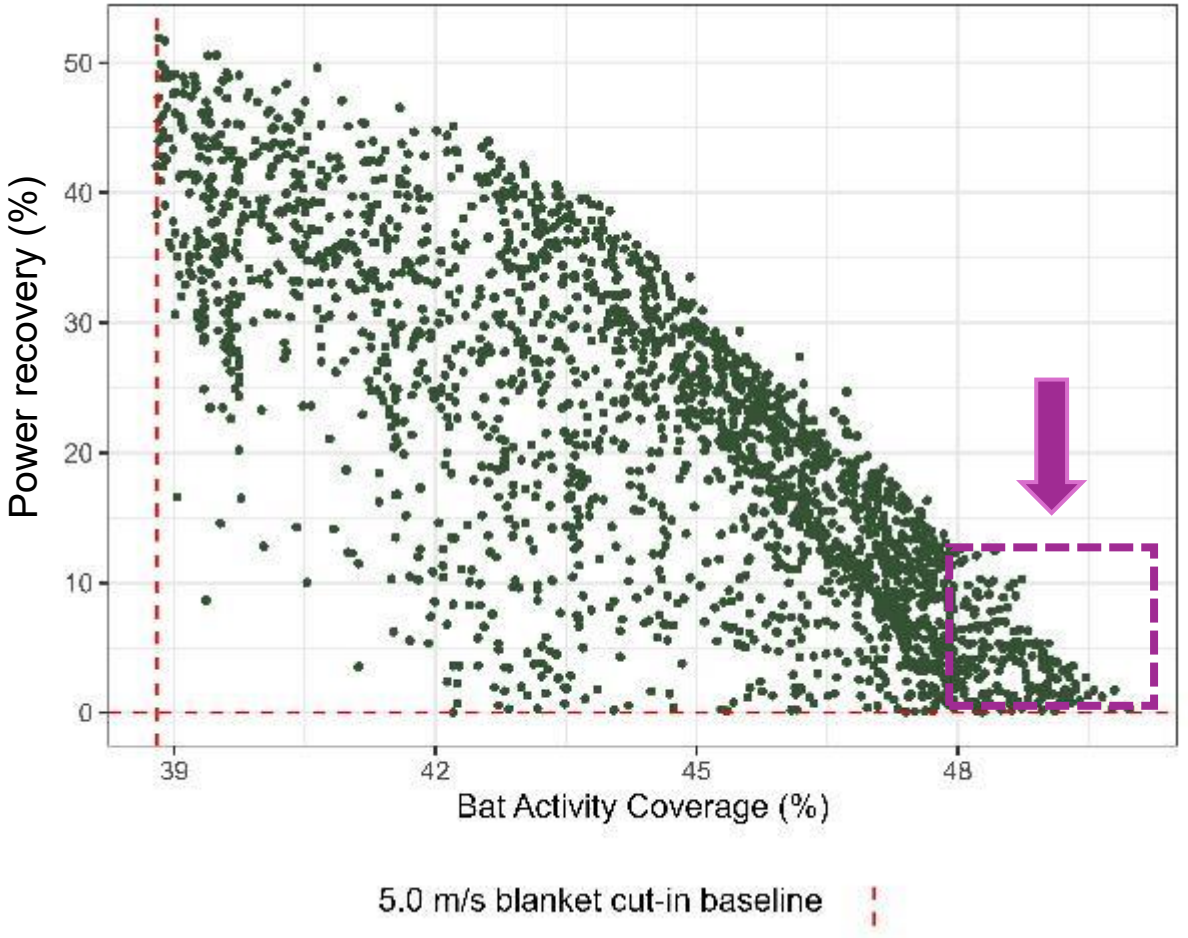
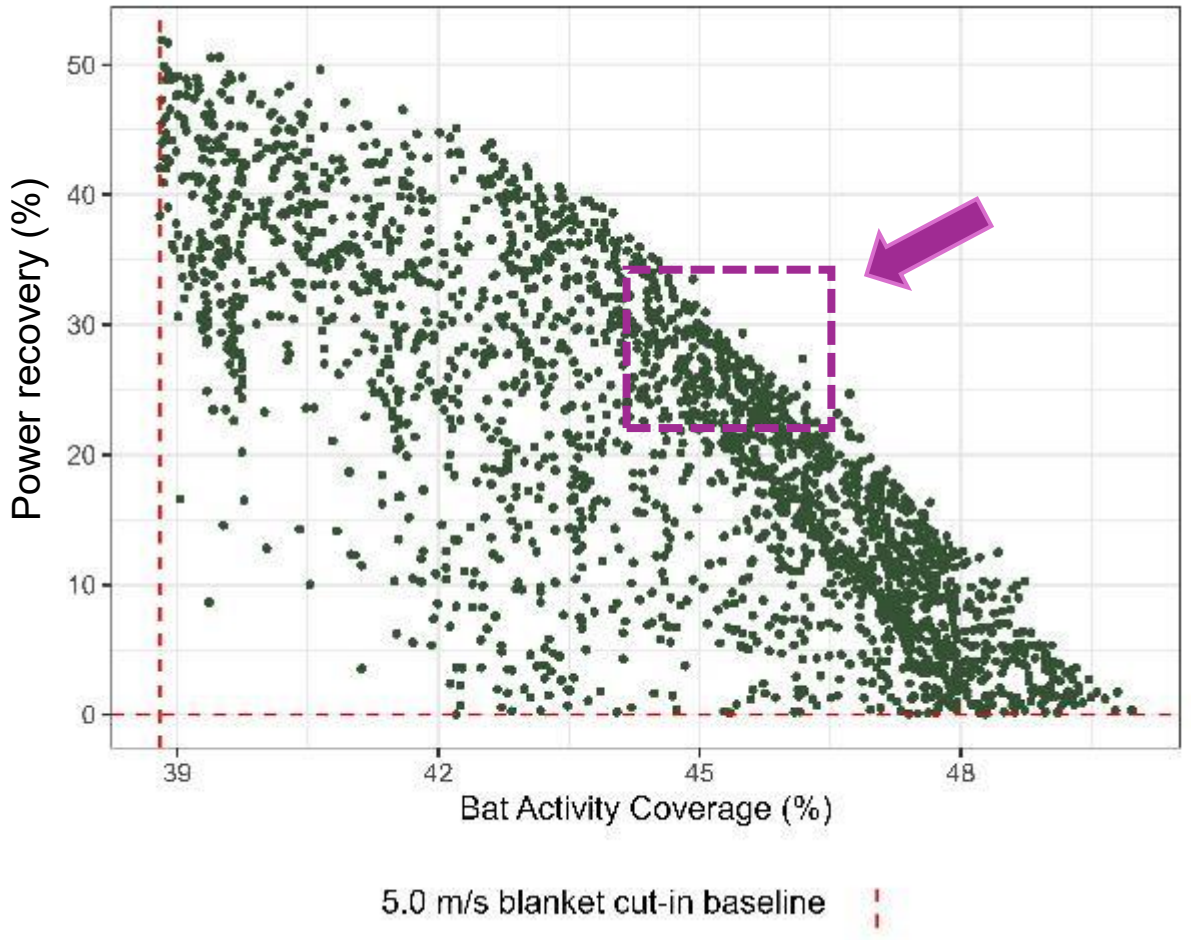


OSC PERFORMANCE DEMONSTRATION

- Power recovery
- Bat activity coverage
- OSC provides many options with one model run
    1. Similar risk, maximize power recovery
    2. Maximize risk reduction, slight power recovery
    3. Balance between power recovery and risk reduction

Data from a Wind Farm in Minnesota, US



Research Objective: Validate OSC for Risk Reduction to Bats at Three Wind Energy Facilities

RENEWABLE ENERGY WILDLIFE RESEARCH FUND

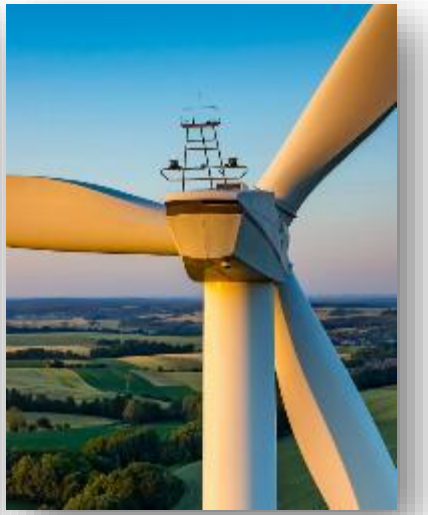
Data Sources

PCM

Acoustics

Thermal Video

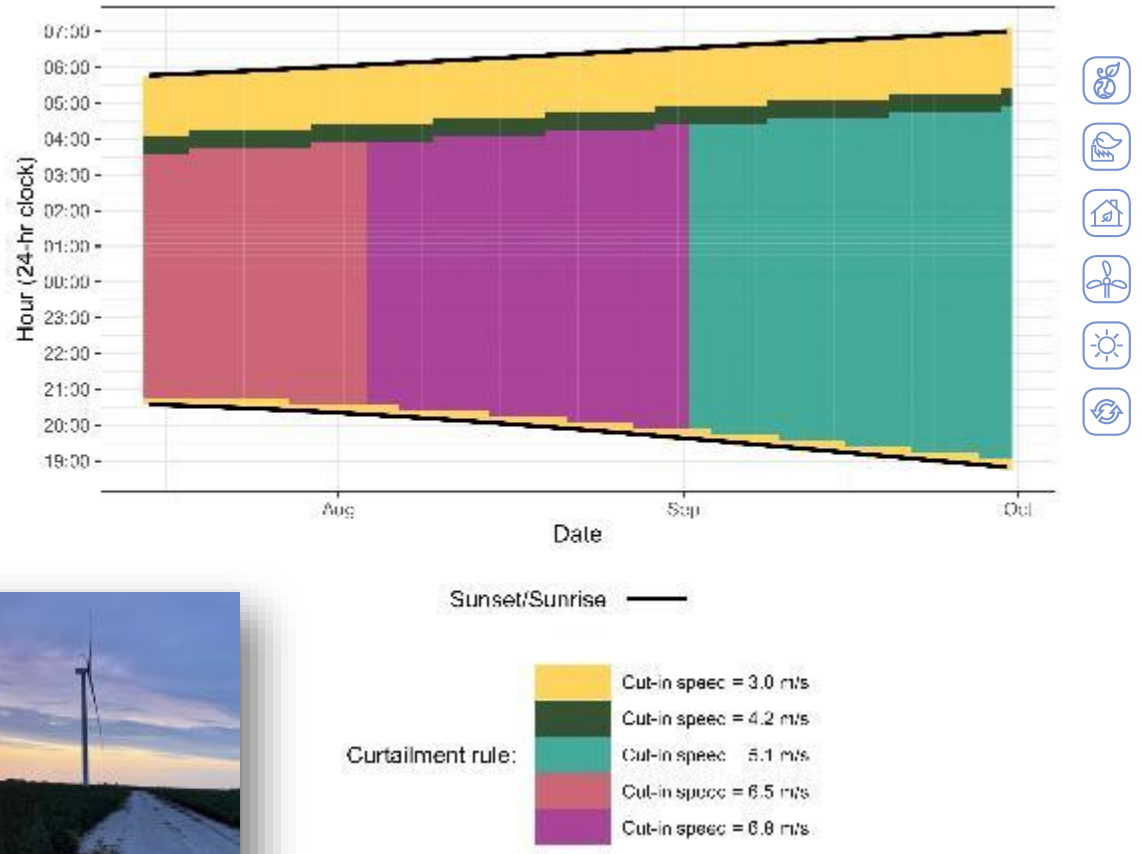
Weather and Power Production



Project #2

RENEWABLE ENERGY WILDLIFE RESEARCH FUND

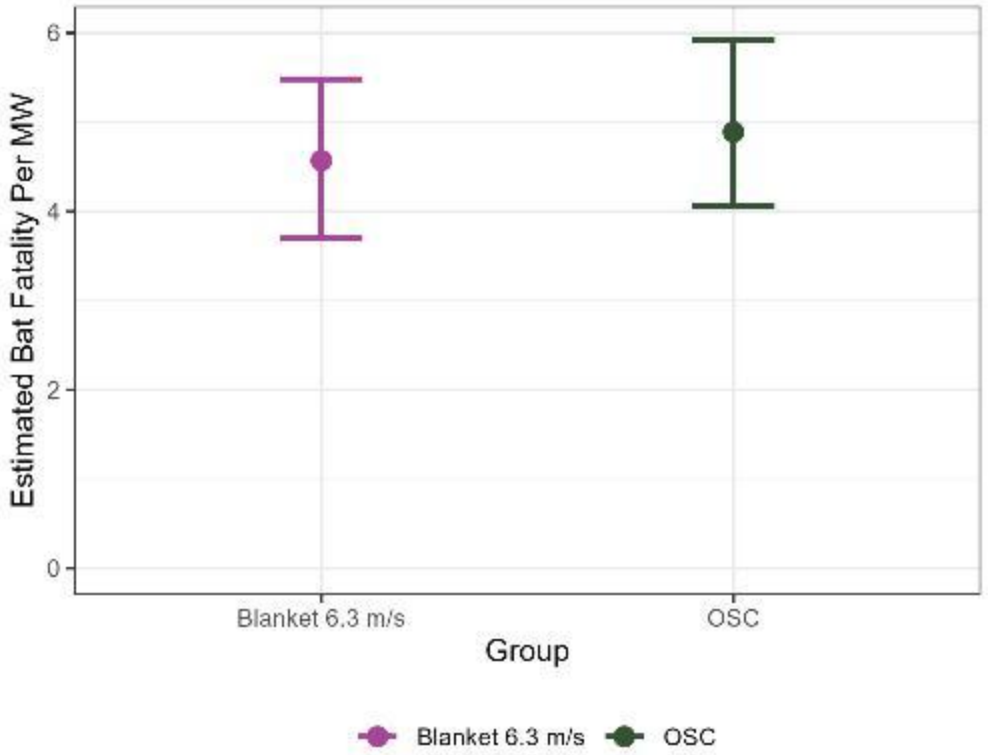
- **Project Goal:** Reduce power losses while maintaining bat conservation objectives
- OSC and blanket curtailment designed to provide at least 60% risk reduction
- July 15 – September 30, 2024
  - 30 OSC turbines
  - 30 6.3 m/s blanket turbines



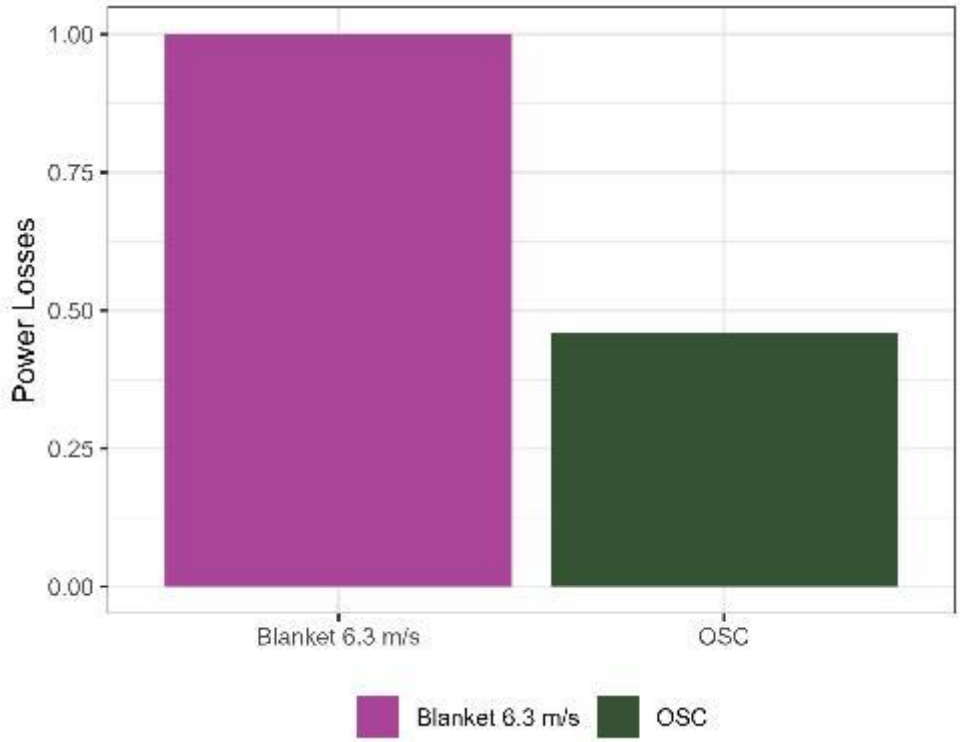
2024: OSC vs. Blanket Curtailment

RENEWABLE ENERGY WILDLIFE RESEARCH FUND

- Fatality rates did not differ between the two groups



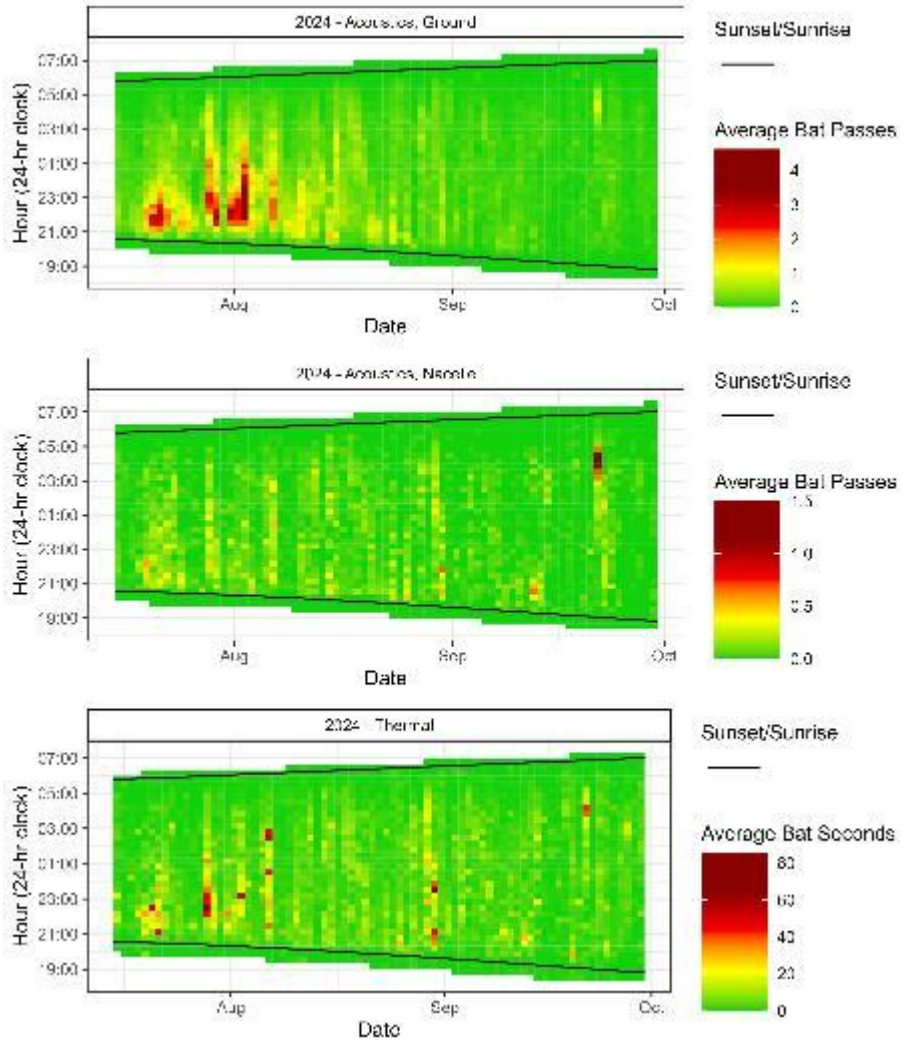
- 54% reduction in power losses in the OSC group



RENEWABLE ENERGY WILDLIFE RESEARCH FUND

Activity Data

- Twelve ground and six nacelle acoustic stations (two stations were paired)
- Six thermal cameras

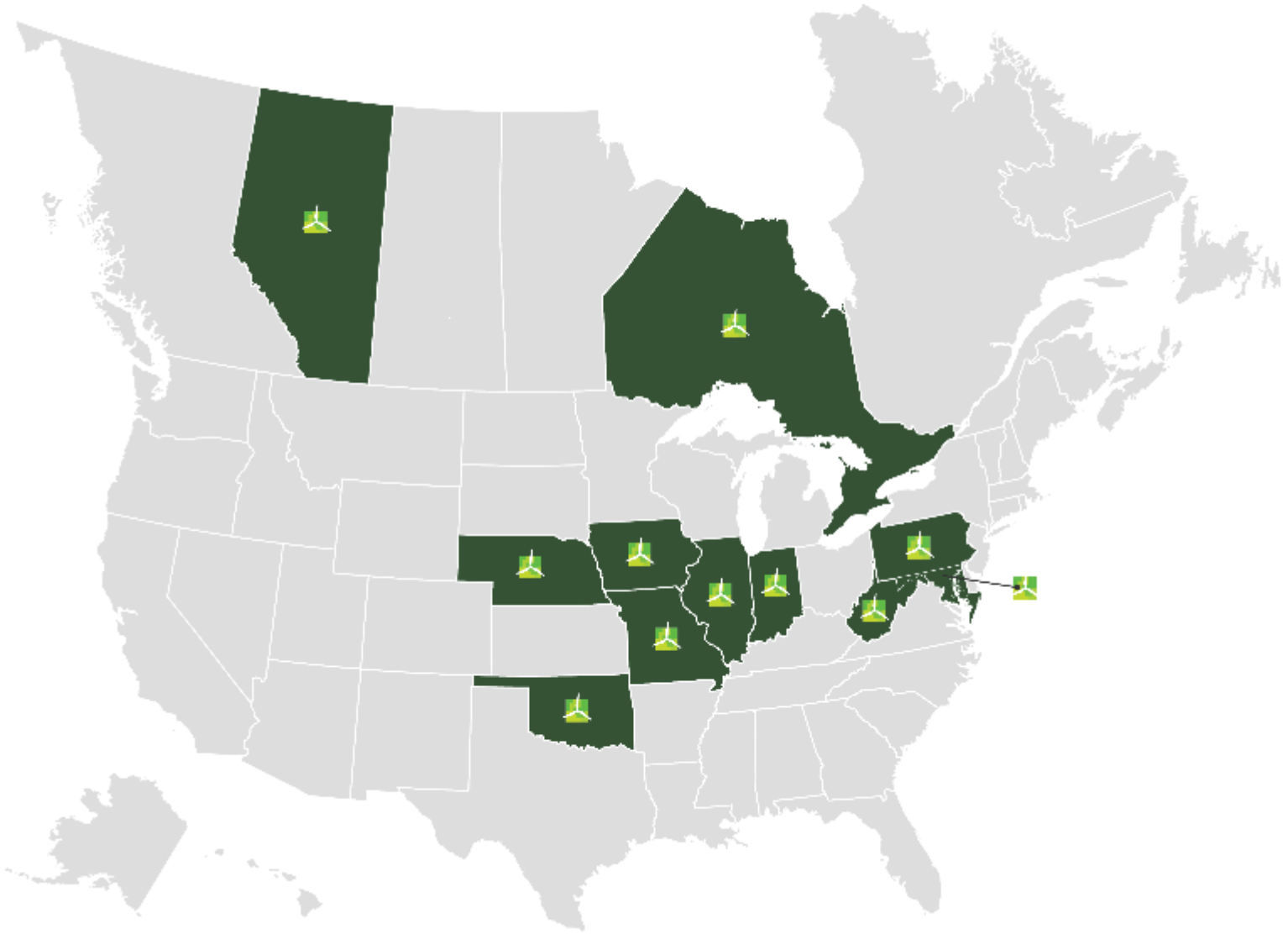


What We Are Working on Now

RENEWABLE ENERGY WILDLIFE RESEARCH FUND

- Continued OSC validation in 2025
- Exploring the relationships between activity datasets at each Project
- Comparing species composition of exposed ground and nacelle acoustics to fatalities

OSC Projects Implemented or in Development



OSC vs. Acoustic Activated Systems

	WEST OSC	Acoustic Activated Systems
Successfully implemented in US and Canada	Yes	No
Does **not** require a third-party sensor to integrate into the turbine SCADA system	Yes	No
Does **not** require lifelong maintenance and replacement of acoustic detectors and other equipment	Yes	No
Total cost to operator	Lower	Higher

**Solutions are not mutually exclusive

Timeline for Development and Implementation of OSC

Pre-construction

1. Collect pre-construction activity data
2. Develop “Smarter than Blanket” algorithm for implementation in Year 1

Year 1

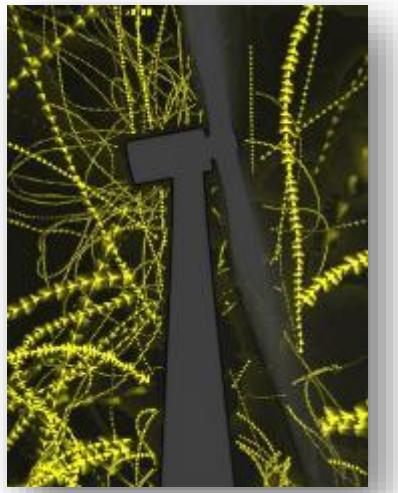
1. Implement “Smarter than Blanket” algorithm
2. Collect post-construction activity data
3. Develop OSC

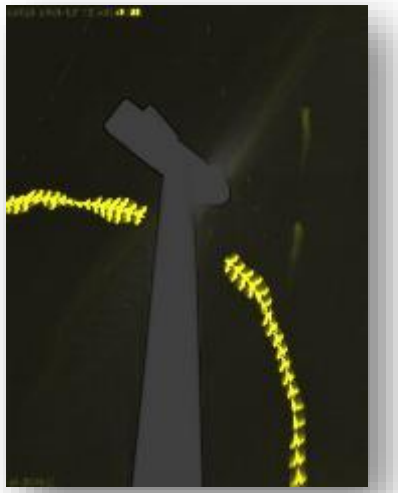
Year 2 and Beyond

1. Implement OSC
2. Collect additional year(s) of activity data to update model with new data

Thank you!

Please stop by and visit us at Booth 32





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THANK YOU FOR LISTENING!

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