U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

Environmental Research – Bat Deterrent Funding Opportunity Announcement

2019 Wind Program Peer Review

Jocelyn Brown-Saracino

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Wind Office Strategic Priorities

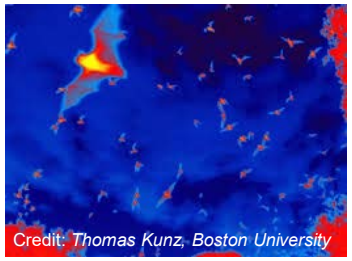
Clean, low-cost wind energy options nationwide

	Land-Based Wind	Offshore Wind	Distributed Wind
Technology Development & Scientific Research	Atmospheric Science & Wind Plant Systems Engineering	Atmospheric Science & Wind Plant Systems Engineering	Atmospheric Science
	Standards and Certification	Standards and Certification	Standards and Certification
	Technology Innovation	Technology Innovation	Technology Innovation
	World Class Testing Facilities	World Class Testing Facilities	
	Tech to Market Commercialization	Tech to Market Commercialization	
	Integrated Systems Design	Integrated Systems Design	
		Offshore Specific R&D	
		Advanced Technology Demo Projects	
Market Acceleration & Deployment	Advanced Grid Integration	Advanced Grid Integration	Advanced Grid Integration
	Workforce and Education Development	Workforce and Education Development	Workforce and Education Development
	Stakeholder Engagement	Stakeholder Engagement	Stakeholder Engagement
	Environmental Research	Environmental Research	
	Siting & Wind Radar Mitigation	Siting & Wind Radar Mitigation	
Analysis & Modeling	Evaluate and Prioritize R&D	Evaluate and Prioritize R&D	Evaluate and Prioritize R&D
	Model Development and Maintenance	Model Development and Maintenance	Model Development and Maintenance
	Techno-economic Analysis	Techno-economic Analysis	Techno-economic Analysis
	Electricity Sector Modeling	Electricity Sector Modeling	Electricity Sector Modeling

Research Priorities: Bats

The Wind Power Program currently envisions supporting future research:

- To improve understanding of the **factors that drive risk to bats** at wind turbines, including research to better understand the underlying relationship between bats and wind turbines
- To **develop and assess potential impact minimization measures**, including refinements to curtailment strategies and development of deterrent devices, and
- To **develop and assess potential compensatory mitigation measures** as needed in the future


Credit: *Thomas Kunz, Boston University*

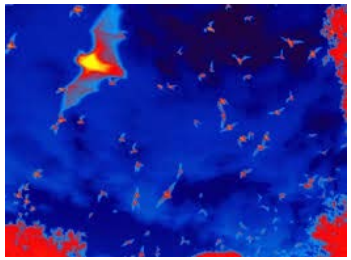

Credit: Brock Fenton


Credit: Humboldt University


Credit: Courtesy, Marine Corps Base Quantico

2014 Request for Information

- **Sought input from stakeholders on the status of Bat and Eagle Impact Minimization Technologies and Field Testing Opportunities with the goal of:**
  - Identifying priority species and technologies
  - Understanding which technologies were closest to market and could have the biggest impact in reducing the impact of wind energy on wildlife
  - Understanding the conditions under which a wind energy developer would consider partnering with a technology developer to conduct full-scale field tests needed to validate a technology's efficacy

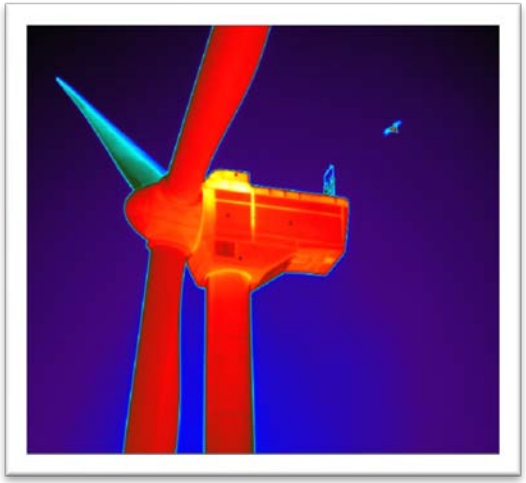



2015 Bat Impact Minimization Technology FOA

This FOA aimed to advance the readiness of impact mitigation technologies in order to expand the number of unique technologies available for development and testing (TA1), and to support field testing and evaluation of near-commercial technologies (TA2) to provide wind farm owner-operators with cost effective tools to reduce bat impact risks and ease regulatory uncertainty.

Topic Area 1: Prototype development and testing

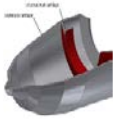
Topic Area 2: Demonstration at an operational wind facility



Bat Impact Minimization Technology Development FOA – Selected Projects Under Review

Topic Area 1: Prototype Development and Testing

Texas Christian University - *Texturizing Wind Turbine Towers to Reduce Bat Mortality*



University of Massachusetts – Amherst - *A Biometric Ultrasonic Whistle for Use as a Bat Deterrent on Wind Turbines*

Frontier Wind - *Mounted Bat Impact Deterrence System (co-funded with CEC)*

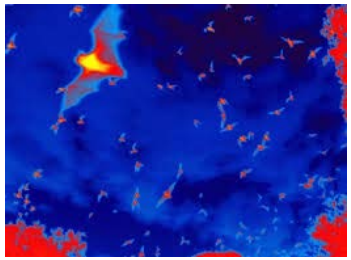
Topic Area 2: Demonstration at Operational Wind Facilities

General Electric Company - *Ultrasonic Bat Deterrent Technology*

Bat Conservation International - *Evaluating the effectiveness of an ultrasonic acoustic deterrent in reducing bat fatalities at wind energy facilities*

Accomplishments

- Provided $2m in federal funds, which leveraged $3.7m in cost share
- Unlocked development of R&D on deterrents
- Increased the technology readiness levels of novel solutions
- Developed important tools that improve our understanding of where to place deterrents and measure bat behavior around turbines
- Learned about key species gaps in functionality
- Gained insight into strengths and benefits of various technical approaches
  - e.g., GE decision to use a constant vs. pulse system
  - e.g., NRG decision to increase dB and try different mounting configuration, highly successful testing this summer




Learning Led to Next Solicitation

$6.2 million in Federal funding

Total project value of $9.5 m

9 selected projects

Land-Based Wind Topic Areas

Topic Area 1: *Advancing Smart Curtailment*

- ***Goal:*** Develop operational regimes that minimize the energy loss and bat mortality by minimizing curtailment to periods of greatest risk to bats.

Topic Area 2: Advancing Bat Deterrent Technologies

- ***Goal:*** Support the development and testing of bat deterrent technologies.

Offshore Wind Topic Area

Topic Area 3: *Development & Validation of Offshore Wind Monitoring & Mitigation Technologies*

- ***Goal:*** Support development and validation of monitoring and impact minimization technologies to increase permitting certainty.

Research Priorities: Bats

Proposed Non-DOE Action

Factor	Research Priorities
1) Understand Population and Habitat Use	a) Assess population status, trends, and genetic diversity (particularly for tree roosting bats with high wind mortality rates) [Reconsidering DOE role – input requested]
2) Understand Sources of Mortality	a) Conduct research to identify sources of mortality, assess effects of anthropogenic non-energy, and energy related activities, assess impact of environmental disease/contaminant factors, characterize importance of mortality agents b) Develop and operate a database of bat fatalities; hypothesize predictor variables

Research Priorities: Bats

Proposed DOE Research Partnership Focuses

Factor	Research Priorities
1) Improve Take Estimates and Risk Models	a) Design studies to document behavior around wind turbines to better understand the relationship between behavior/activity and risk, as well as elucidate patterns in timing of mortality, relationship to environmental conditions, and peak mortality events b) Systematic testing of hypotheses regarding the factors that drive risk through lab and field observation and experimentation for multiple species across a range of geographies, including questions of whether there is a landscape level attraction response for key species. c) Support meta-analyses to further explore the relationship between pre-construction bat activity levels and post-construction mortality rates d) Work to develop and refine models used for predicting risk at wind farms
2) Develop Impact Minimization & Monitoring Tools	a) Refine existing operational reduction measures to maximize mortality reduction while minimizing revenue loss. I. Evaluate environmental factors such as temperature, barometric pressure, and precipitation on bat activity into risk models. Explore activity-based approaches. a) Analyze consistency in effectiveness across species and regions b) Move towards an understanding of how different treatment regimes impact power loss and mortality II. Assess economic impact to wind farms, with an emphasis in emerging regions with lower class wind speeds, where cut-in speed adjustments will have a greater financial impact. III. Better understanding of effectiveness of cut-in speed adjustments on a species basis

Research Priorities: Bats

Factor	Research Priorities
2) Develop Impact Minimization & Monitoring Tools (continued from last slide)	b) Continue to support the development of deterrent technologies to minimize risks at operational wind farms. Ensure applicability to taller turbines, as turbine size increases over time. • Physiology studies around hearing and vision • Behavioral physiology studies • Systematic testing of species-specific behavioral response to deterrents and deterrent redesign based on results. • Increase system ranges • Novel approaches and configurations (e.g., blade mounting, additional stimuli, multiple stimuli deterrents) • Efficacy testing of new and improved designs and configurations • Analyze consistency in effectiveness across species and regions • Potential for habituation • Long term survivability, O&M, system health monitoring • Analyze cost respective to curtailment/smart curtailment c) Improve monitoring tools for understanding bat behavior in the near field and far field to inform understanding of risk relationship and development of solutions d) Develop and validate real time collision monitoring systems to use to inform smart curtailment regimes
3) Evaluate Compensatory Mitigation Tools	a) Evaluate, quantify and test additional options for compensatory mitigation, as needed in the future