Environmental Research– Eagle Funding Opportunity Announcement Projects

2019 Wind Program Peer Review

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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: Eagles

The Wind Power Program currently envisions supporting future research:

- To improve accuracy and **reduce uncertainty around estimates of take** at wind farms,

- To develop and assess **potential impact avoidance and minimization measures**, and

- To develop and assess potential **compensatory mitigation measures**

Credit: Politico

Golden Eagle © Klosz007 StockFreeImages

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

Workshop on Eagle Detection and Deterrent Technologies & Request for Information

Workshop (2015)

Brought together experts from a range of fields <u>to discuss research gaps and solutions</u> for existing and novel detection and deterrent technologies.

Identified priority research needs:
- How do eagles perceive and respond to visual and auditory stimuli? Can specific deterrent stimuli be identified?
- Integrated system components
- Independent field testing and validation of systems
- Better understanding of when and under what conditions strikes occur

Report:
Eagle Detection and Deterrents Research Gaps and Solutions Workshop Summary Report

Request for Information (2016)

DOE released RFI laying out proposed structure for FOA and seeking input

Photo credits: NREL

Technology Readiness Levels

TRL 1	**Basic Research:** Initial scientific research has been conducted. Principles are qualitatively postulated and observed. Focus is on new discovery rather than applications.
TRL 2	**Applied Research:** Initial practical applications are identified. Potential of material or process to solve a problem, satisfy a need, or find application is confirmed.
TRL 3	**Critical Function or Proof of Concept Established:** Applied research advances and early stage development begins. Studies and laboratory measurements validate analytical predictions of separate elements of the technology.
TRL 4	**Lab Testing/Validation of Alpha Prototype Component/Process:** Design, development and lab testing of components/processes. Results provide evidence that performance targets may be attainable based on projected or modeled systems.
TRL 5	**Laboratory Testing of Integrated/Semi-Integrated System:** System Component and/or process validation is achieved in a relevant environment.
TRL 6	**Prototype System Verified:** System/process prototype demonstration in an operational environment (beta prototype system level).
TRL 7	**Integrated Pilot System Demonstrated:** System/process prototype demonstration in an operational environment (integrated pilot system level).
TRL 8	**System Incorporated in Commercial Design:** Actual system/process completed and qualified through test and demonstration (pre-commercial demonstration).
TRL 9	**System Proven and Ready for Full Commercial Deployment:** Actual system proven through successful operations in operating environment, and ready for full commercial deployment.

Eagles: 2016 Eagle Impact Minimization FOA

The goals of this FOA are to 1) better understand eagle physiology and behavior to optimize deterrent systems, 2) advance eagle detection, identification, and deterrent technologies by testing them in the lab and in the field, and 3) to validate the effectiveness of near-commercial detection, identification, and deterrent systems at operational wind farms.

Topic Area 1: Support research on <u>eagle ability to sense and respond to stimuli</u>, in an effort to identify signals that will serve as optimal deterrents

Topic Area 2: Further the technical readiness of <u>Technology Readiness Level (TRL) 5-6 detect and deter and informed curtailment systems</u> through technical improvement and testing activities

Topic Area 3: Support the demonstration of a proposed <u>TRL 7+ detection and/or minimization technology at two operational wind facilities</u> at a scale sufficient to provide an accurate demonstration of efficacy through a statistically significant reduction of impact at a reasonable cost

Eagle Impact Minimization Technology Development FOA Selected Projects Under Review

Topic Area 1: Eagle Physiology and Behavior

University of Minnesota - *Detection and Perception of Sound by Eagles and Surrogate Raptors*

Purdue University- *Understanding the Golden Eagle Sensory World to Enhance Detection and Response to Wind Turbines*

Topic Area 2: Prototype Advancement and Testing

Laufer Wind Group, LLC - *Eagle Take Minimization System*

Oregon State University - *A Heterogeneous System for Eagle Detection, Deterrent, and Wildlife Collision Detection for Wind Turbines*

Topic Area 3: Validation at Operational Wind Farms

American Wind Wildlife Institute & Renewable Energy Systems- *Evaluating the Effectiveness of a Camera-Based Detection System to Support Informed Curtailment and Minimize Eagle Fatalities at Wind Energy Facilities*

American Wind Wildlife Institute & Liquen Consultoria Ambiental - *Evaluating the Effectiveness of a Detection and Deterrent System in Reducing Eagle Fatalities at Operational Wind Facilities*

Accomplishments to Date

- $3.2m in funding that leveraged $2.2m in cost share

- Deeper understanding of acoustic and visual stimuli that may make effective deterrents

- Deeper understanding of how eagles sense and perceive the world, and how this might affect their risk at wind farms

- Advanced prototypes for monitoring and informed curtailment

- Initial testing and planning for validation studies

Research Priorities: Eagles

Proposed Non-DOE Actions

Factor	Research Priorities
1) Understand Population and Habitat Use	a) Spatial/temporal avian habitat use and habitat variation studies to characterize how eagles use their environment, and important habitat conditions re: hunting, migration, nesting, wintering, etc. b) Develop robust monitoring protocols for eagle nest surveys, and conduct annual surveys of breeding pairs to assess nest success, and fledgling survival. Study natal dispersal of golden and bald eagles c) Assess population trends, and genetic diversity/variability utilizing DNA to understand relationships between eagle populations d) Assess climate change impacts to Bald and Golden eagle habitat - including vegetation and prey base – and consequent population effects
2) Understand Anthropogenic 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 eagle fatalities; hypothesize predictor variables

Research Priorities: Eagles

Proposed DOE Research Partnership Focuses

Factor	Research Priorities
1) Improve Take Estimates and Risk Models	a) Work to develop and refine models used for predicting risk at wind farms, including exploring the potential to couple with CFD modeling. Continuously refine estimates of eagle fatalities and risk at wind energy facilities as new data become available for integration.

2) Develop Impact Minimization Tools	a) Develop, test, and evaluate impact minimization tools, such as informed curtailment and/or deterrent technologies to minimize risks at operational wind farms
	   I. Systematic testing of species specific behavioral response to deterrents and deterrent redesign based on results.
	   II. Continued improvements hardware and software for detection, tracking and identification, including advancements in computer learning
	   III. Analyze consistency in effectiveness across species and regions
	   IV. Potential for habituation
	   V. Long term survivability, O&M, system health monitoring
	   VI. Analyze cost of both deterrent and informed curtailment approaches

3) Evaluate Compensatory Mitigation Tools	a) Evaluate, quantify and test additional options for compensatory mitigation such as lead abatement and carcass removal