

American Wind Wildlife Institute

Developing and Evaluating a Smart Curtailment Strategy Integrated with a Wind Turbine Manufacturer Platform

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Overview of the VBPS Technology

- **Problem**
  - Blanket curtailment is a coarse and bio/ecologically uninformed strategy
- **Vestas Bat Protection System (VBPS) Technology**
  - Newly developed software module in Vestas turbines' Supervisory Control And Data Acquisition (SCADA) systems
  - Environmental data → Algorithm → Bat fatality risk estimate → SCADA → Smart curtailment orders
- **Solution**
  - Improved efficiency (less power production loss) and improved efficacy (reduced bat fatalities) better than Blanket curtailment

Project Goal and Objectives

- **Project Goals:**
  - Develop a VBPS smart curtailment strategy that minimizes bat fatalities more efficiently than does than blanket curtailment by minimizing power production loss
- **Project Objectives:**
  - Develop and evaluate a model-based smart curtailment strategy using VBPS based on bat activity, bat fatalities, and environmental variables
  - Evaluate the economic, power production, and other Annual Energy Production (AEP) implications of this VBPS smart curtailment strategy

Project Team and Roles

- American Wind Wildlife Institute (AWWI)
  - **Prime Award Recipient**
  - **Project Managers (Stu Webster and Katy Battle)**
  - **Principle Investigator (Taber Allison)**
- Bat Conservation International (BCI)
  - **Award Subrecipient**
  - **Field Study Principle Investigators (Winfred Frick, Michael Schirmacher, and Mike Whitby)**
- MidAmerican Energy Company (MEC)
  - **Host Site, Operations, and SCADA support (Jesse Leckband)**
- Vestas Americas (VA)
  - **Technology Vendor (Tom Allain)**
- Washington State University (WSU)
  - **Project Statistician and model developer (Leslie New)**

General Study Plan: Experimental Approach

- **Study Site:**
  - MEC's Orient windfarm in Adair County, Iowa
- **3 Phases:**
  - Phase 1: Environmental and biological data collection
  - Phase 2: Algorithm development for smart curtailment strategy
  - Phase 3: Experimental testing of selected curtailment strategies

General Study Plan: Experimental Approach

- **Phase 1: Environmental and Biological Data Collection**
  - 10 turbines operating under normal operator parameters
  - Biweekly SCADA data requests
  - Weather data (3 spatial and 3 temporal scales)
  - Bat Data
    - Acoustic Surveys
    - Thermal Videography
    - Carcass Searches

General Study Plan: Experimental Approach

- **Phase 2: Algorithm Development for Smart Curtailment Strategy**
  - Determine correlates between carcass/acoustic and between carcass/thermal data
  - Model bat fatality risk according to weather data and develop curtailment strategies. Inform algorithm with best-performing model
  - Estimate theoretical risk reduction and power loss resulting from curtailment strategies and compare against blanket curtailment

General Study Plan: Experimental Approach

- **Phase 3: Experimental Testing of Various Curtailment Strategies**
  - 18 turbines operating assigned strategy via Randomized Block Design (RBD)
    - 6 control, 6 blanket curtailment, 6 VBPS-programed smart curtailment strategies
  - Biweekly SCADA data requests
  - Fatality, acoustic, and thermal camera monitoring
  - Comparative analysis of blanket and smart curtailment strategies
  - AEP and strategy cost-to-implement comparative analysis

Expected Outcomes

- **Project Start: 09/01/2019 (awarded)**
  - **BP1: 09/01/2019 – 4/30/2021**
    - Year 1 field study: June - October 2020
    - Bat fatality risk model development: Spring 2021
  - **BP2: 05/01/2021 – 8/31/2022**
    - Power production stats: Spring 2021
    - Year 2 field study: June - October 2021
    - Final report to DOE: Summer 2022
    - Manuscript to journal: Summer 2022
- **Project End: 8/31/2022**

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For further information, DOE-EERE's program, please visit their webpage at: https://www.energy.gov/eere/wind/environmental-impacts-and-siting-wind-projects

Thank You! Questions?

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Acronyms Used

- AEP: Annual Energy Production
- AWWI: American Wind Wildlife Institute
- BCI: Bat Conservation International
- BP: Budget Period
- DOE: Department of Energy
- MEC: MidAmerican Energy Company
- SCADA: Supervisory Control and Data Acquisition
- VA: Vestas Americas
- VBPS: Vestas Bat Protection System
- WSU: Washington State University