COASTAL OHIO WIND PROJECT

PROJECTS: DE-EE0003871, DE-FG36-06GO86096

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COLLEGE OF ENGINEERING
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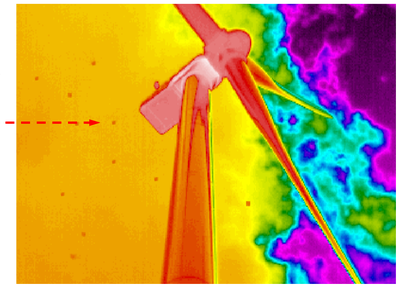
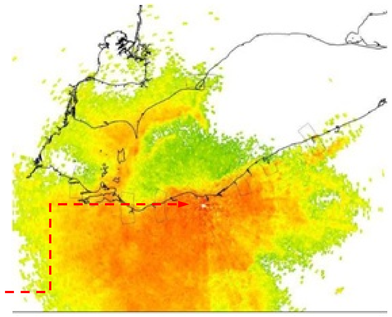
Combined Radar-IR Surveillance System

A FLIR thermal remote system for avian monitoring allows researchers to observe bird impact without physical presence at the wind turbine site. The camera transmits video to a recording server for subsequent video motion detection analysis.





A radio signal is generated and transmitted and an echo from a target is captured and processed by the radar system, providing information about range to the target

Project Objectives

The goal of the project is to establish the viability of wind turbines for the coastal and offshore regions of Northern Ohio.

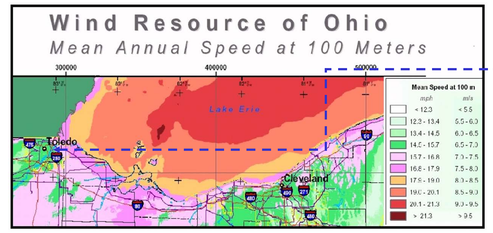
The project will evaluate a cost competitive offshore WTG design that has potential for reducing offshore wind farm installation and maintenance costs. The project will also evaluate the potential impact on avian species from offshore WTG's, and will explore and develop methodologies for offshore avian detection and collision mitigation. The specific objectives are:

- To perform an engineering analysis comparing the benefits of two and three bladed WTG's for offshore use. Two bladed machines are of significant interest for reducing installation and maintenance costs due to their
  - Lighter head and tower weights
  - Lower center of gravity
  - Lower drive train torque stemming from higher operating speeds
  - Simpler geometry that reduces the complexity of offshore construction and lends itself to more comprehensive onshore assembly where working conditions are more favorable

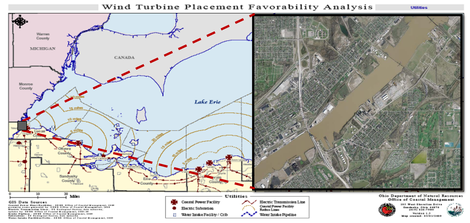
- To remove barriers slowing offshore development in the Great Lakes by examining
  - Avian issues, including methods for remote sensing to detect bird/bat strikes over water, in order to measure/mitigate environmental damage, and to develop operating protocols to address environmental risk reduction
  - Foundation issues related to ice damage in fresh water lakes in order to assure high reliability, long-term installations.

Acquisition of Turbine Operation Data

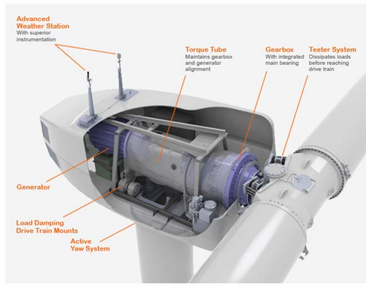
Acquisition of turbine data include wind resources and turbulence data as well as temperature and moisture to accurately and reliably document and monitor the wind loading environment and the effects of ice accretion on the turbine. UT will collaborate with the City of Toledo and it will have access to a highly instrumented Nordic N-1000 on land near the Lake Erie shoreline.



Offshore wind resources in Lake Erie could reasonably support over 10,000 MW of electrical generating capacity…. (Source: ODNR)

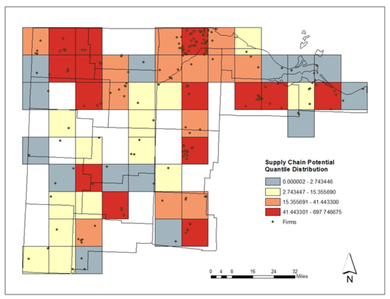


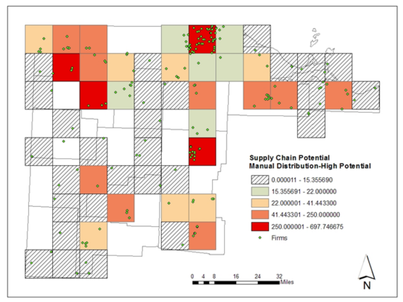
Nordic N-1000



Economic Feasibility Models

Assessment of pre-existing manufacturing is used to determine the potential of the area's wind energy supply chain. The selection of the firms is based on the North American Industrial Classification System (NAICS) codes where firms with proper existing equipment could be converted to produce wind turbine components. The identification of manufacturing clusters determines the strengths and weaknesses for supporting investments to resuscitate Ohio's dying automotive industry by revamping its manufacturing base and retooling it to accommodate other clean energy manufacturing jobs. Some of the economic feasibility studies include sensitivity analysis and what-if scenarios to identify potential sites based on the supply chain characteristics of existing establishments and ecological features of the local area.





Supply Chain Potential shown with quantiles and manual classification

Program Scope

Develop downwind, two-bladed teetered-hub design for optimal offshore use

Monopole/gravity foundation trade study for Lake Erie

Design/analyze/test optimized mounting structure for Lake Erie considering fresh water icing issues

Evaluate cost effective floating platform designs

Develop remote sensing techniques for avian interactions

Determine the timing/meteorological conditions of migratory events

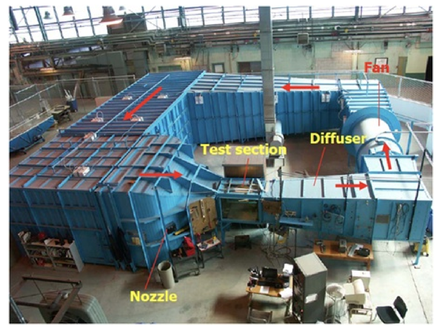
Develop geodatabases in support of offshore wind development

Use economic clustering models to support supply chain development

Innovate new uses for small turbines and workforce development using assembled expertise/infrastructure

Icing and Mitigation on WTG Systems

Wind turbines can accumulate ice under certain atmospheric conditions, such as ambient temperatures near freezing combined with high relative humidity, freezing rain, or sleet. UT will evaluate the effectiveness of the passive methods which take advantage of the physical properties of the blade surface to eliminate or prevent ice. Blades coated with different materials and special paint will be studied in controlled laboratory experiments in conjunction with icing research tunnels and field testing at the city of Toledo wind turbine.



UT 3x3 Low Speed Wind Tunnel and Wave Tank

MOD-5B Wind Turbine
(Two-bladed, teetered hub, 3.2 MW)