U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

2021 PROJECT PEER REVIEW

U.S. DEPARTMENT OF ENERGY
WIND ENERGY TECHNOLOGIES OFFICE

Activity Area Overview Presentation: Regulatory & Siting

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FY21 Peer Review – Activity Overview

Activity Summary:

- Wind farms constructed within the line of sight of civilian and defense radar systems cause clutter and interference
- This degrades performance of radars for air traffic control, weather forecasting, homeland security, and national defense missions
- WETO works in collaboration with partners to identify and deploy technology and process improvements to mitigate impacts on radars. Partners include:
  - Sandia National Laboratories, LBNL, MIT/Lincoln Laboratory
  - Other Federal Agencies (FAA, DOD, BOEM, NOAA, DHS)
  - Wind & Radar Industries, OEMs, Project Developers, ACP

Activity Objective(s) 2019-2020:

- Improve capacity to evaluate the impacts of wind energy on sensitive radars
- Develop and deploy mitigation measures to increase resilience of existing radars to wind turbines
- Encourage the development of next generation radars resistant to wind turbine interference

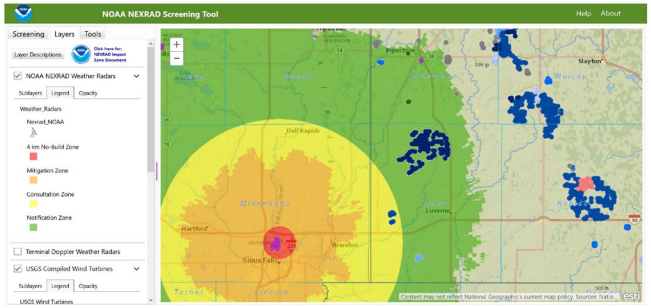
Overall Activity Objectives (life of Activity):

- Eliminate wind turbine radar interference as an impact to critical radar missions and remove radar interference as an impediment to future wind energy development.

FY19 - FY20 Budget Under Review: $2,260,000

Current budget (FY21): $1,826,495

Number of projects under peer review: 2+

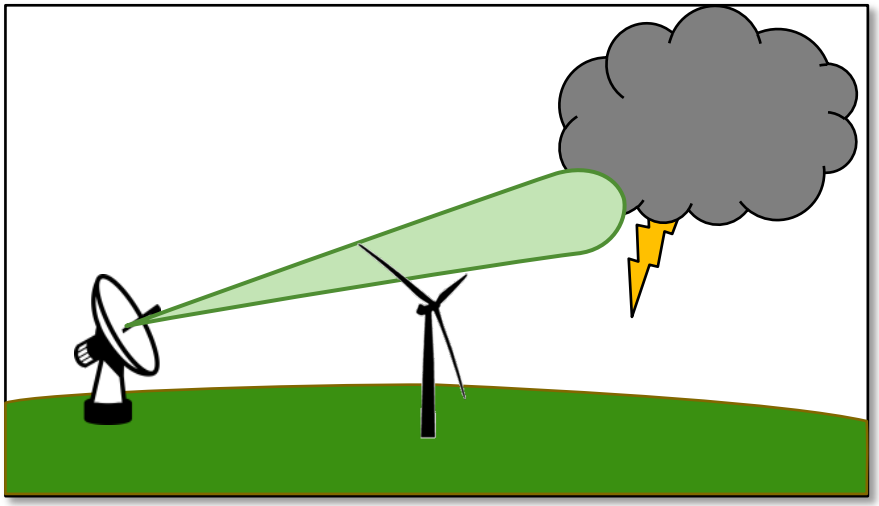


Projects Under Review

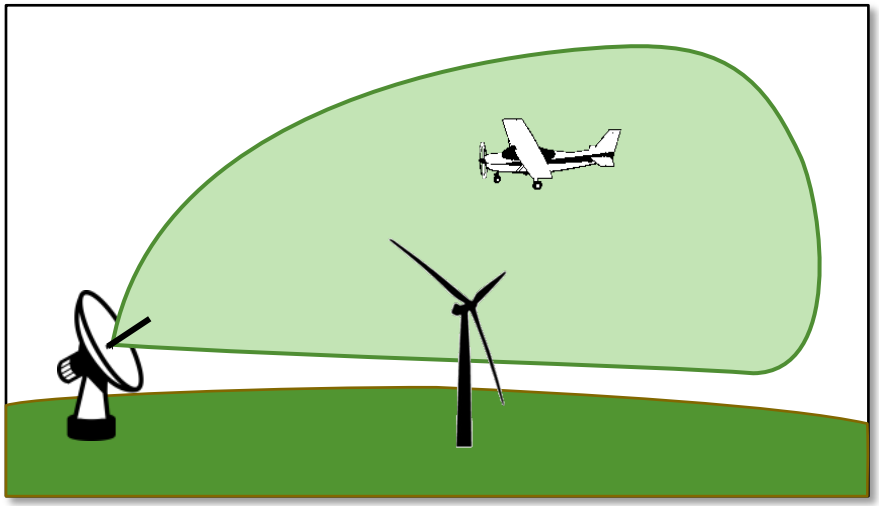
ESW&G – Regulatory & Siting: Wind Radar Mitigation	
E01 - Siting-Radar Wind Turbine Mitigation (4:15 PM Monday)	Ben Karlson Sandia National Laboratories
E02 - Siting-Radar Wind Turbine Mitigation (4:40PM Monday)	Jason Biddle MIT Lincoln Laboratory
E19 - United States Wind Turbine Database and Location Impacts R&D (1:30PM Wednesday - Stakeholder Engagement and Workforce Session)	Ben Hoen Lawrence Berkeley National Laboratory

Wind-Radar Interference Basics

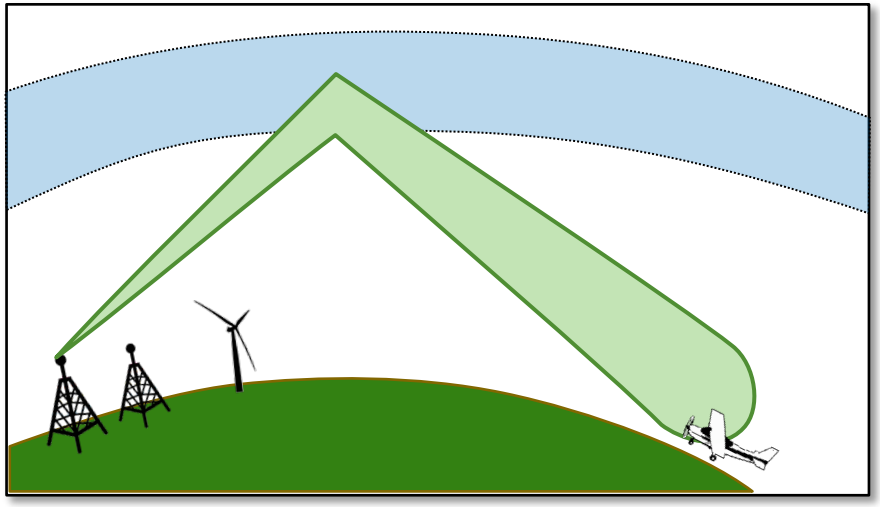
Weather Radar



Air Surveillance Radar



Over the Horizon Radar



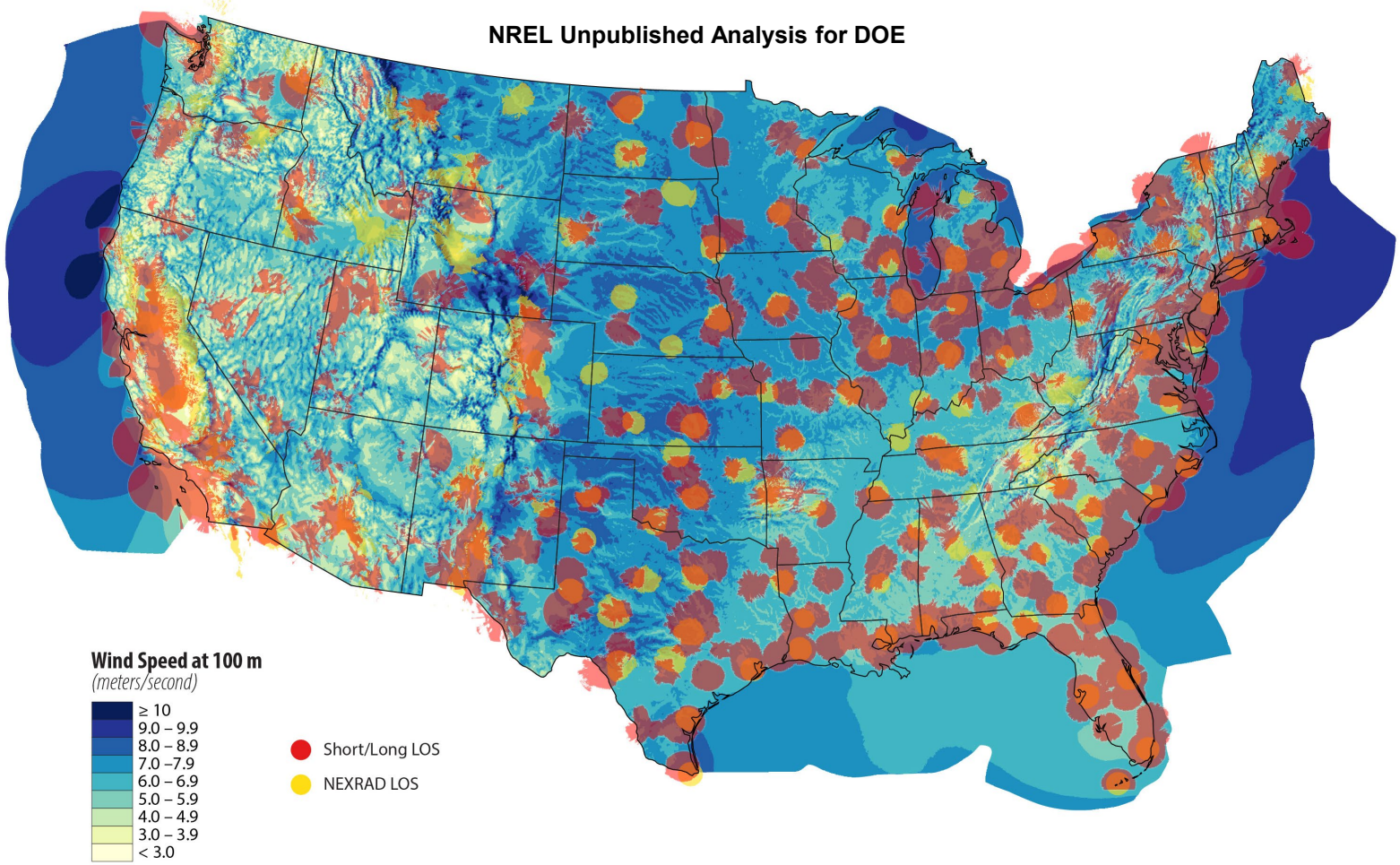
Technical impacts:

- Turbines present unique mix of moving and static clutter
- Decrease probability of target detection
- Increase false alarms
- Corrupt track quality

Mission impacts:

- Flight safety (FAA, DOD)
- Border protection, navigation, search and rescue (DHS)
- Homeland defense (DOD)
- Weather observation and warning, ocean observation (NOAA)

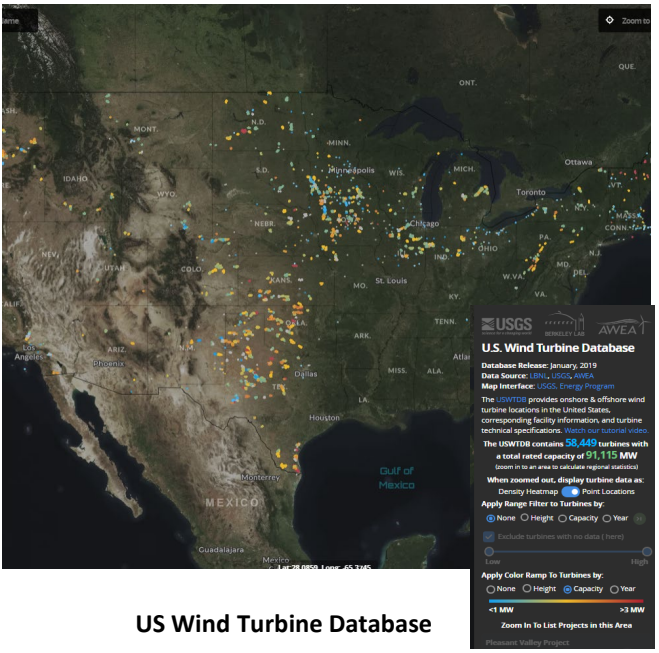
Why Address Wind-Radar Issues?



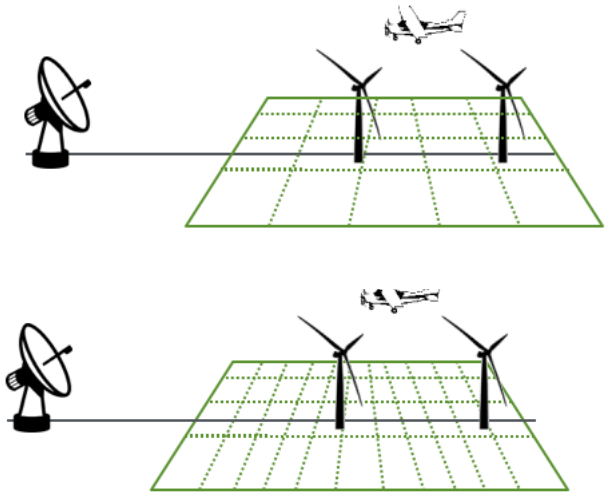
- 40%+ of land-based, 25%+ of offshore technical potential in radar line-of-site
- Wind development in LOS impacts mission performance—NORAD has identified 26 air surveillance radars at or near “saturation”
- Available mitigation measures are insufficient

Federal Wind Turbine Radar Interference Mitigation (WTRIM) Strategy

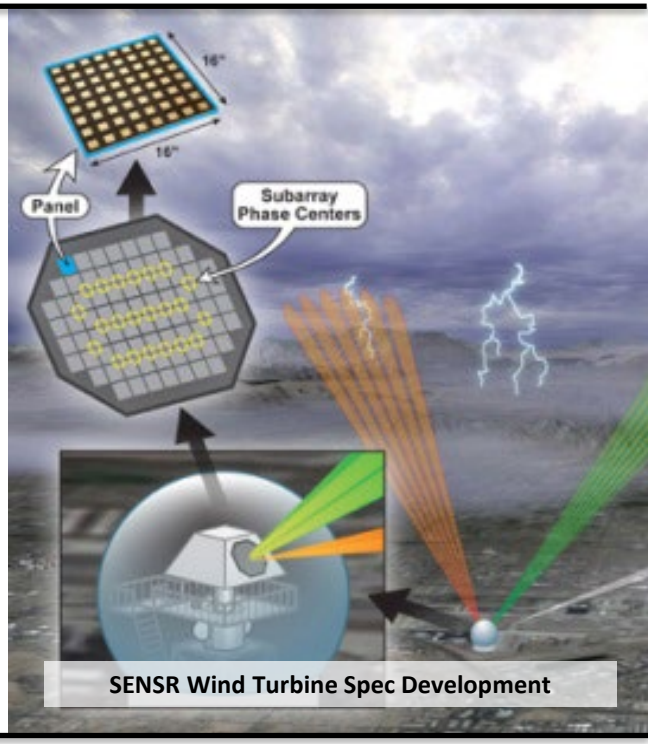
Strategic Objectives: Eliminate wind turbine radar interference as an impact to critical radar missions, ensure the long-term resilience of radar operations in the presence of wind turbines, and remove radar interference as an impediment to future wind energy development.



US Wind Turbine Database



MIT-LL Increased Range Resolution Algorithm



SENSR Wind Turbine Spec Development

Strategic Theme 1:	Strategic Theme 2:	Strategic Theme 3:
Improve capacity to evaluate the impacts of wind energy on sensitive radars	Develop and deploy mitigation measures to increase resilience of existing radars to wind turbines	Encourage the development of next-generation radars resistant to wind turbine interference

Highlighted Activity Accomplishments & Progress

Theme 1: Improve capacity to evaluate the impacts of wind energy on sensitive radars:

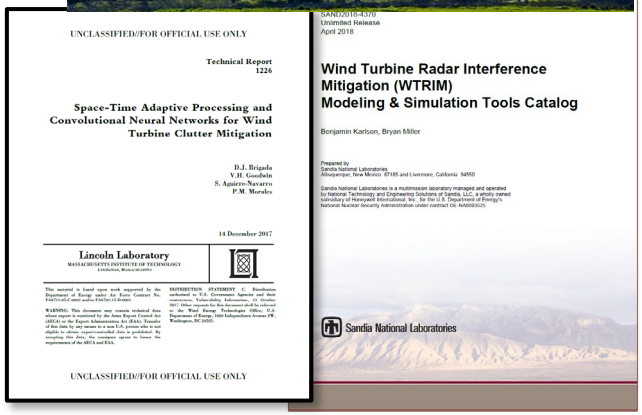
- Release of US Wind Turbine Database (LBNL) - recently passed 5 million hits
- Upgraded the database to better support NORAD's ability to identify potential impacts

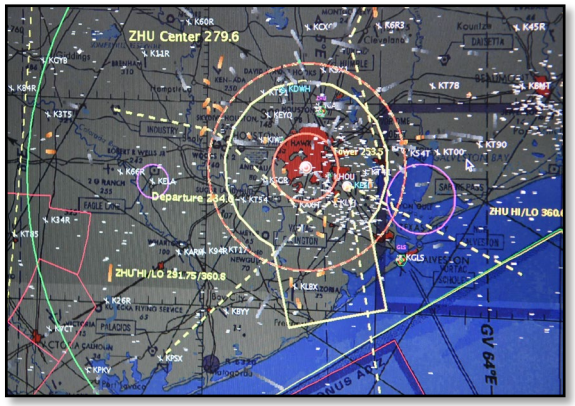
Theme 2: Develop and deploy mitigation measures to increase resilience of existing radars to wind turbines:

- MIT-Lincoln Lab Wind Siting Study
- Travis AFB PMP completion, support to FAA on certification framework

Theme 3: Encourage the development of next-generation radars resistant to wind turbine interference:

- Provide updates on turbine characteristics and radar impact specifications for Spectrum Efficient National Surveillance Radar (SENSR) program





Future Work (FY21 and Beyond)

- Reboot WTRIM working group Memorandum of Agreement
- Support new series of aircraft test flights on a variety of radar systems (NORAD/DOD)
- Implement new DOE-FAA interagency agreement to design and evaluate radar software mitigation solutions on FAA radars
- Support higher-TRL mitigation development/validation efforts through potential FOA
- Ensure all potential radar conflicts can be evaluated by developing, verifying, and improving modeling and simulation tools.
- Continue supporting certification framework for mitigation solutions
- Re-evaluate turbine-side mitigation development
- Continue engagement with SENSR - ensure next generation radars are resilient to wind development