U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Systems Engineering Workshop – DOE's Perspective

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Introduction

- Welcome
- DOE's Mission
- DOE's Role
- Wind Power Program Priorities

Administration & DOE Priorities

White House
- Generate 80% of the nations' electricity from clean energy sources by 2035
- Reduce carbon emissions 80% by 2050
- Stimulate jobs and economic recovery through RE development

DOE
- Promote energy security through reliable, clean, and affordable energy
- Strengthening scientific discovery and economic competitiveness through science and technology innovation

EERE
- Invest in clean energy technologies that strengthen the economy, protect the environment, and reduce dependence on foreign oil

WWPP
- Improve the performance, lower the costs, and accelerate deployment of innovative wind and water power technologies

The ***mission*** of the Wind Power Program is to enable U.S. deployment of clean, affordable, reliable and domestic wind power to promote national security, economic growth, and environmental quality

Wind Program Strategic Overview

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Program Mission

- Enable U.S. deployment of clean, affordable, reliable, and domestic wind power to promote national security, economic growth, and environmental quality

Program Priorities

- Aerodynamics and wind complex flow analysis to improve overall plant performance
- Offshore wind technology and deployment
- Wind manufacturing defects analysis
- Mesoscale data acquisition
- Wind turbine inflow characterization
- Turbine to turbine interaction analysis
- Grid integration analysis
- Institute regional wind resource centers

Key Focus Areas

- Maximize wind plant performance to reduce LCOE
- Establish a competitive U.S. offshore wind industry
- Optimize grid integration and transmission for wind systems
- Mitigate market barriers

Targeted Outcomes

- Reduce the unsubsidized market LCOE for utility-scale land wind energy systems from a reference wind cost of $.071/kWh in 2010 to $.057/kWh by 2020 and $.042/kWh by 2030
- Reduce the unsubsidized market LCOE for offshore fixed-bottom wind energy systems from a reference of $.225/kWh in 2010 to $.167/kWh by 2020 and $.136/kWh by 2030
- 47 GW of total U.S. wind installed capacity in 2011 to 125 GW of wind capacity by 2020 and 300 GW by 2030

DOE's Role

Importance of EERE Wind Program's Unique Role

- **RDD&D not being undertaken by the U.S. wind industry**
- **High risk, transformational technological innovations**
- **Different time-scales and/or engage comprehensive competencies**
  - NWTC
- **Inter- and intra-governmental agency issues**
  - The Department of Defense, Department of Health and Human Services, Department of Transportation, Department of Interior, and other agencies.

DOE Wind Industry Role

Interagency government coordination to accelerate deployment

- Collaboration on Permitting barriers with BOEM, FWS, DHS/DOD/FAA, others
- Collaboration on transmission planning and integration with FERC and OE

Funding to benefit Industry

- National Testing Facility infrastructure
- Certification and standards for small wind
- Publicly available national datasets for wind resource data

Perceived High Risk/Long-term R&D Projects

- Offshore Demonstration project
- Next Generation drive-train
- Next Generation wind plants

Accelerate Administration priorities

- Investments in Manufacturing Innovation /U.S. Competitiveness
- R&D targeted on addressing renewables integration and transmission planning challenges

Wind Program Portfolio
Transformational Technology Innovation

The Wind Program performs **Research and Development of Transformational Technology Innovation** in three markets:

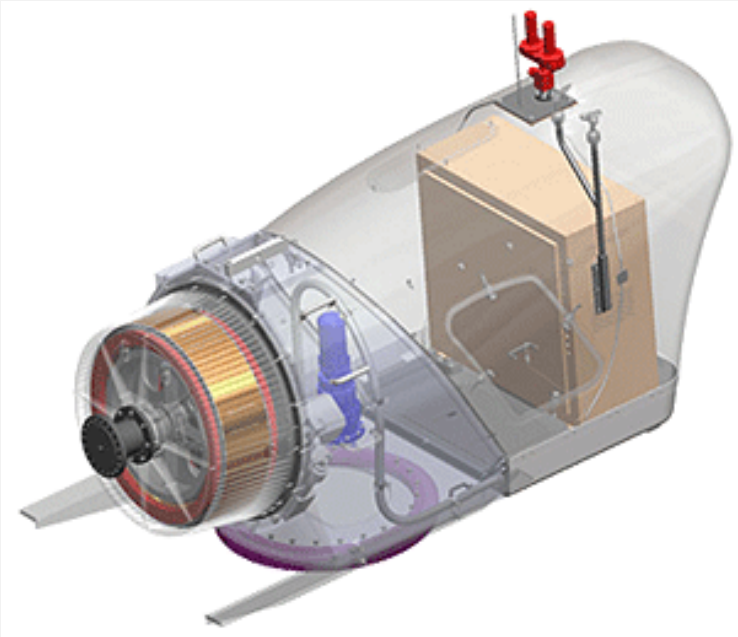
Land Based Utility Wind
- 1-5+ MW turbines
- R&D Focus: Next generation turbine cost reductions, improved energy capture & conversion at an "Integrated Wind Plant" level, advanced controls, extended useful life of components

Offshore Wind
- 3-10+ MW turbines
- R&D Focus: Floating platforms (access higher winds); integrated systems designs (reduce full plant LCOE); optimized O&M strategies (reduce costs, extend life); turbine innovations (less constraints than on land) including rotor, next generation drivetrain and control systems

Distributed Wind
- < 1 MW turbines, Grid connected on the customer side of the meter
- R&D Focus: Optimized for low Class 3/Class 2 wind speeds, very low maintenance, LCOE reduction to compete with retail

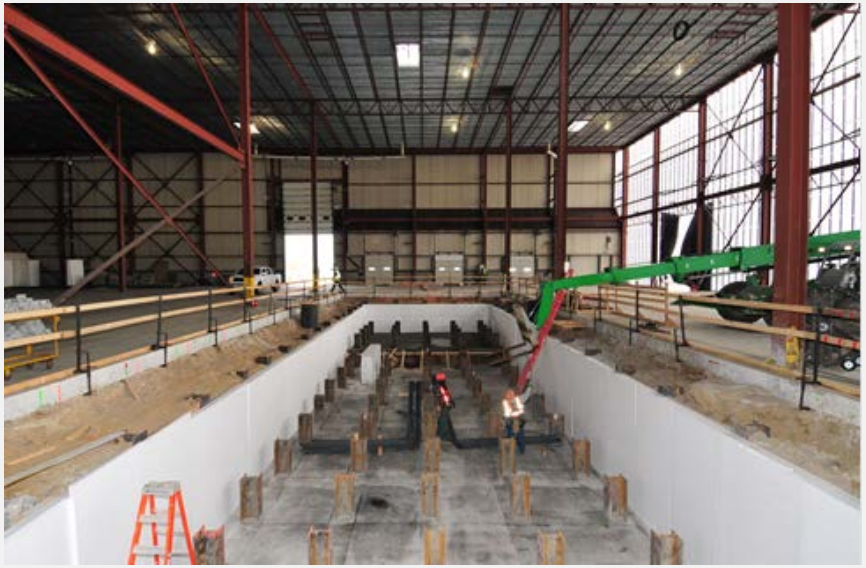
Past Wind Program Projects

- National Wind Technology Center (NWTC) Drive Train Testing Facility (2009)
  - $10M DOE investment
  - 5MW capacity
  - Grid simulator
- Next Generation Drivetrain (2012)
  - Mid-speed drivetrain (NREL)
  - Fully superconducting generator (Advanced Magnet Lab)



Past Wind Program Projects

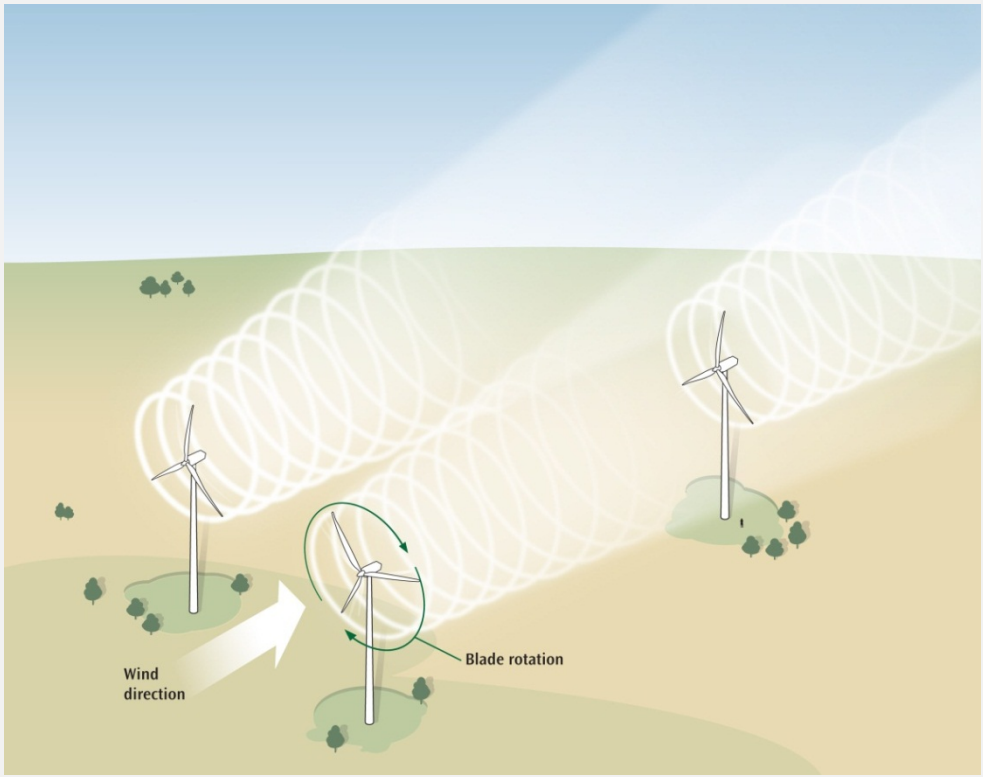
- Clemson University Restoration Institute (CURI) Drive Train Test Facility (2009)
  - $45M investment from DOE
  - 7.5MW and 15MW capacity
  - Grid simulator



Past Wind Program Projects

- Offshore Wind Demonstration FOA projects (2013)
  - 7 projects
  - Achieve large cost reductions over existing offshore wind technologies

- Scaled Wind Farm Technology (SWIFT) facility (2013)
  - 3 Vestas V27 turbines
  - Turbine to turbine interaction



Wind Program Going Forward

Building Blocks

Prior Year Priorities		FY 14-18 Priorities
Component optimization (turbine LCOE)	→	System-level wind plant performance optimization (plant LCOE)
American Reinvestment and Recovery Act investments (ARRA)	→	Leverage U.S. manufacturing and U.S. domestic component production
Begin offshore wind initiative	→	Focus on major offshore wind demonstration project and creating a sustainable U.S. offshore wind industry
Grid integration and resource characterization	→	EERE-level cross-program collaboration on optimizing grid integration for RE sector
Barriers, siting and permitting (stakeholder engagement)	→	Increased effort on reducing barriers impacting wind class, including radar-related barriers, to reduce LCOE