U.S. DEPARTMENT OF
ENERGY

Office of
ENERGY EFFICIENCY &
RENEWABLE ENERGY

Wind R&D Newsletter

MAY 2019

IN THIS ISSUE

Wake Steering Performance Evaluated at Scale

Initial wind plant control field trials validate increased power production, revenue potential

Commercial field trials led by the National Renewable Energy Laboratory (NREL) are providing insight into the benefits of wind power plant control. In partnership with NextEra Energy and the University of Colorado Boulder, NREL measured the impacts of wake steering on a subsection of a commercial wind plant. The field trials were consistent with simulated predictions, which suggest that annual energy production gains of 1%–2% are achievable for existing facilities implementing wind-plant-level controls.

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Study Assesses How To Break Barriers To Supersized Wind Turbine Blades

Research helps inform and prioritize DOE R&D opportunities for long blades

The move toward progressively longer wind turbine blades has been a lasting trend in the industry and has helped reduce the cost of wind energy. But without additional innovation, transportation challenges could curtail further blade growth opportunities.

Lawrence Berkeley National Laboratory partnered with DNV GL Energy USA, Inc. (DNV GL) to study key design, manufacturing, and transportation options to advance long, "supersized" blades for cost-competitive land-based wind energy and to inform U.S. Department of Energy (DOE) prioritization of potential R&D opportunities. These larger blades make it possible to increase energy capture, potentially reducing the overall cost of wind energy nationwide and opening up lower wind-speed sites for potential development.

Continued on page 3

Letter from the WETO Acting Director

Valerie Reed

The U.S. wind industry is booming! As 2018 data continue to roll in, a few things are clear—wind is becoming more affordable, while industry growth is creating jobs and boosting rural economies, and offshore wind is scaling up.

At the DOE Wind Energy Technologies Office (WETO), we're excited about trends that are crucial to our clean energy future. No one predicted that 2018 would set a record for the volume of signed power purchase agreements, driven largely by brand-name corporations and nonutilities. A number of states and federal agencies—DOE, the U.S. Department of the Interior, and the Bureau of Ocean Energy Management—are working to make the U.S. offshore wind industry a reality. There are still challenges ahead, but most offshore projects are moving beyond the planning stages.

You'll hear more about these trends and others at this week's American Wind Energy Association (AWEA) WINDPOWER Conference. WETO is here, of course. Be sure to check out the listings in this newsletter for details on our activities.

I'm always excited to introduce our R&D newsletter, because it showcases such prime examples of WETO's global leadership in fundamental wind energy science research, development, and validation activities. You can read about the potential of longer blades and taller towers, how the first field trials of wind energy controls demonstrate the possibilities for increased power production and revenue, how WETO-funded research is helping to safeguard bat populations, and more.

We at WETO are dedicated to advancing wind energy technologies, research, and development. We, along with our national laboratories and industry partners, are committed to conducting exceptional wind energy R&D in 2019.

Sincerely,

Valerie Reed
Acting Director
Wind Energy Technologies Office

Wake Steering *continued from page 1*

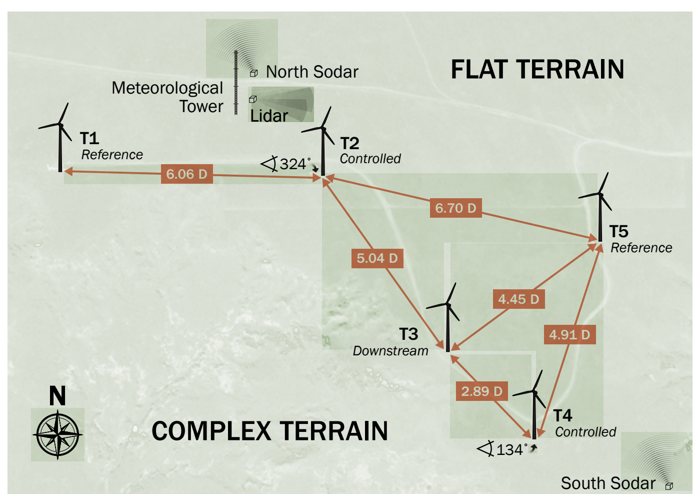
"Efficiency improvements associated with wake steering can increase annual profits by as much as $1 million, depending on the plant size and design," said Paul Fleming, an NREL researcher and the project's principal investigator. "These data unlock a different level of confidence for developers who are estimating how much energy a new facility can produce."

With funding from DOE's Atmosphere to Electrons initiative and Technology Commercialization Fund, NREL and NextEra brought increased clarity to wind plant control research by deploying a range of sensing equipment for the field trial, including a ground-based lidar, meteorological tower, and two sodars. The resulting data allowed researchers to compare actual energy production gains with predicted FLOw Redirection and Induction in Steady State (FLORIS) models. The findings from the field trial are published in *Wind Energy Science*.

> *Efficiency improvements associated with wake steering can increase annual profits by as much as $1 million.*

"A successful field trial leads to next steps," said Fleming. "Now we see how atmospheric conditions impact the effectiveness of wake steering, so we can incorporate that into next-generation control modeling."

NREL provides a suite of open-source tools that perform optimizations of turbine interactions. Models such as the Simulator for Wind Farm Applications, FLORIS, developed



NREL measured the impact of steering individual turbine wakes away from downstream turbines at NextEra Energy Resource's Peetz Table Wind Energy Center. These field trials demonstrated increased overall energy production at the commercial scale. *Figure by Paul Fleming, NREL*

NREL's experimental design for the NextEra field campaign incorporated lidar measurements of atmospheric conditions. *Photo by Andrew Scholbrock, NREL*

with Delft University of Technology, and Wind Plant Integrated Systems Design and Engineering Model (WISDEM®) allow academics, investors, wind developers, and manufacturers to implement control scenarios.

The recent wake steering field validation campaign with NextEra identified several pathways for refining controller designs. In fact, the report authors state that the results, given these opportunities for improvement of performance, might "represent a worst-case baseline for the possibility of gains from wake steering." Given that a 2% gain at a typical 300-megawatt (MW) wind plant could represent $1 million per year in additional profits, it's no surprise that the industry is expressing widespread interest in implementing optimized controls.

As a next step, NREL Senior Researcher Jennifer King is leading development of a more accurate set of wake models based on these findings, which will be released as the fourth iteration of FLORIS. NREL plans to release additional open-source tools and make their recommended methods for controller design, optimization, analysis, and visualization widely available to the industry in the future.

"We have been able to learn by doing with NextEra and several other companies, and the final phase is giving everyone the ability to implement a dynamic controller," said Fleming. "Then we've come one step closer to realizing DOE's efficiency and cost goals." ■

Supersized Wind *continued from page 1*

The study focused on blades with lengths of 75 to 115 meters (m), compared to the current U.S. average of 55 m for newly installed wind projects. Currently, blades up to 67 m can be transported over rail and roads using typical transport methods.

Building on input gathered by DOE in a workshop and via a public request for information, researchers analyzed four possible innovative design, manufacturing, and transportation pathways that might enable these supersized blades:

- Rail and truck transportation of full blades that, with longer blade lengths, includes controlled bending of the blades
- Air transportation of full blades with lighter-than-air cargo airships
- Traditional rail and truck transportation of segmented blades with on-site assembly
- Full on-site manufacturing of complete blades.

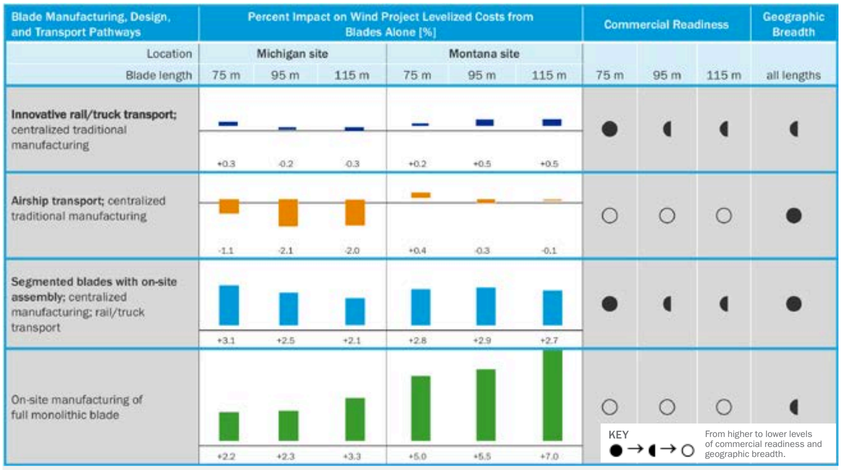
Based on available data and two hypothetical project sites, each pathway was assessed quantitatively, estimating the cost of delivered blades (considering the cost of the equipment and transportation) and the contribution of the blades to system-level levelized cost of wind energy (LCOE). Trade-offs related to commercial readiness and the geographic breadth of applicability were also discussed.

Larger blades make it possible to increase energy capture, potentially reducing the overall cost of wind energy nationwide and opening up lower wind-speed sites for potential development.

The analysis results summarized in the figure show that the use of lighter-than-air cargo airships or controlled blade bending (i.e., bending of blades to navigate curves) in rail transport may present the most promise for delivery of supersized blades to project sites at a neutral or reduced overall system LCOE. Because lighter-than-air airships are not yet commercially available, the analysis of that option is speculative. Moreover, rail transport with blade bending—required for rail transport with blade lengths on the higher end of the spectrum—has yet to be attempted, and there are also geographic limitations on where it might be viable.

While other pathways studied increase blade-related LCOE, requiring cost reductions in other aspects of the wind system to decrease total LCOE, segmented blades offer the unique ability to deploy supersized blades across the entire United States. In addition, turbine manufacturers already have some experience with this solution. On-site (mobile) blade manufacturing, meanwhile, faces challenges such as low equipment utilization and the expense and complexity of commissioning and operating mobile manufacturing plants.

Based on the study, industry insight, and familiarity with national laboratory capabilities, DNV GL identified a number of R&D activities that could make valuable contributions to the viable development of supersized blades. These recommendations are feeding into the DOE-funded multiyear, multilab "Big Adaptive Rotor" project to assess and prioritize technology needed to develop a cost-competitive land-based 5-MW turbine with 100-meter-long blades. ■



Summary of supersized rotor analysis findings, highlighting key results and trade-offs among the four pathways assessed. *Figure by DNV GL*

Wind Energy Grows Up

Research assesses tall turbine tower energy production, cost, and viability

Back in the day, parents would record a child's growth with fresh pencil marks on a door frame. As wind technology grows in scale and productivity, researchers continue to look for ways to boost the energy captured while driving down costs. A forthcoming NREL study, *Increasing Wind Turbine Tower Heights: Opportunities and Challenges*, explores opportunities for increasing the height of wind turbine hubs—where the turbine drivetrain and rotors attach—and the conditions and locations where these taller towers would have the most impact..

Higher hub heights make it possible to cost-effectively tap wind resources beyond the reach of today's turbines. *Photo by Dennis Schroeder, NREL 27196*

Innovations from DOE, other research institutions, and industry have allowed wind turbine hub heights and sizes of rotors (blades) to grow and increase energy production. Since the 1980s, new pencil notches have been added to the door frame for wind turbine growth, as average U.S. commercial wind turbines' hub height has quadrupled (from 20 to 88 m) and rotor diameter has expanded fivefold (from 20 to 116 m). Average wind turbine nameplate capacity—or the amount of power a turbine can output under ideal conditions—has also increased leaps and bounds, from less than 100 kilowatts per turbine to approximately 2.4 MW per turbine in nameplate capacity in 2018.

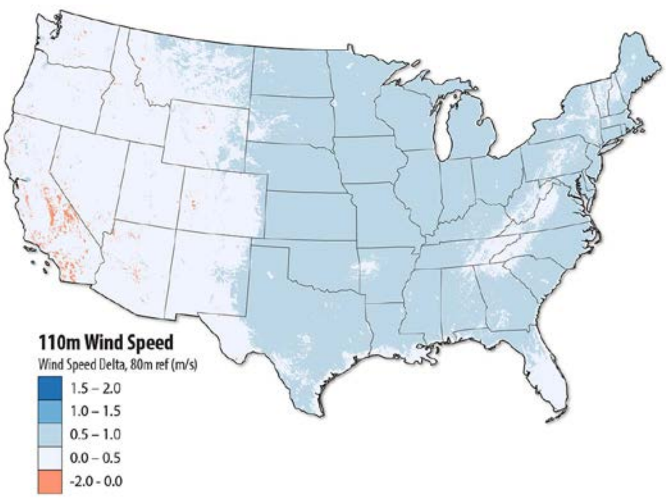
Taller towers make it possible to cost-effectively tap the stronger wind resources that exist at higher levels, beyond the reach of today's typical turbines and above interference from trees, buildings, and landscape or topographical features. Taller wind turbines also provide the additional clearance needed for longer blades that increase energy capture per turbine.

"Over the past four decades, wind turbine scaling has been critical to wind power cost reduction. Looking ahead, scaling continues to offer potential cost savings, but new innovations are needed to enable scaling while effectively managing capital expenditures and the logistics of moving equipment to the plant site," says NREL Group Manager and Researcher Eric Lantz.

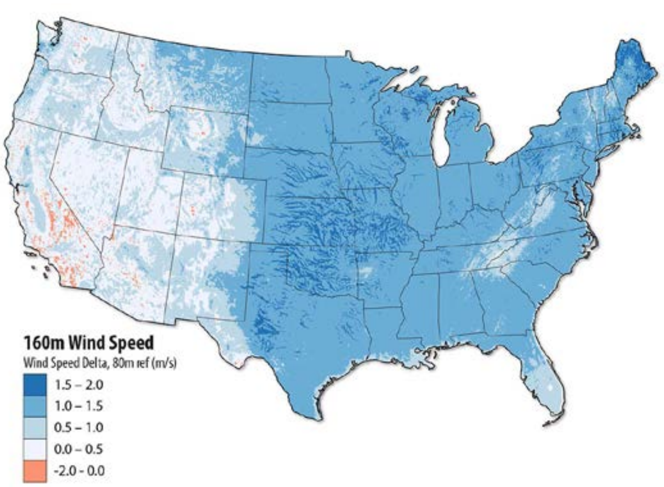
Recent NREL analysis assessed how increased hub heights could impact key indicators of wind energy viability across the nation. Research looked at factors of wind speed, capacity factor, and LCOE, as well as incremental costs that could be incurred for increases in turbine hub height. The team also used WISDEM to examine how innovation in materials, design, transportation, and installation might overcome limits to tower base diameter and hub height. (See the separate news item on WISDEM for more details on this innovative modeling tool.)

"These innovations could span an array of materials, controls, manufacturing, and transport solutions," says Lantz. "For this effort, we sought to characterize and weigh the interplay of these factors with the amount of additional energy that might be extracted in order to inform the design and innovation of tall tower technologies that could deliver tangible new benefits."

The analysis indicated that there are many areas that could warrant the pursuit of technology enabling higher hub heights. Growing hub heights to 110 m for the three modeled conceptual turbines in the 3-MW to 5-MW size class led to capacity factor increases of about 10 percentage points (e.g., from 35% to 45%) in many locations, with continued capacity factor improvement with hub heights of 140 m.



Difference in mean annual wind speed 110 m above ground level minus 80 m. *Figure by NREL, based on the Wind Integration National Dataset Toolkit*



Difference in mean annual wind speed 160 m above ground level minus 80 m. *Figure by NREL, based on the Wind Integration National Dataset Toolkit*

Hub heights of 110 to 140 m could also offer LCOE advantages relative to today's common turbines, particularly in locations where wind shear is relatively strong, including much of the eastern United States. Another notable aspect of tall tower technology is the impact that system innovations can have on opportunities to increase hub height. As one example of more system-focused innovations, advanced controls have greatly increased the viability of tubular steel towers for economically achieving higher hub heights in recent years.

Growing hub heights to 110 meters…led to capacity factor increases of about 10 percentage points in many locations.

Around the world, the push continues for higher and higher hub heights. In Germany, to maximize the value of that country's lower quality wind resources and relatively smaller area available for wind development, turbine hub heights are on average approximately 50% higher than those found in the United States. Ongoing research at NREL and other national laboratories will help guide future research to reduce the cost of wind energy and increase the contribution of wind to the electrical grid. ■

Mammal Mia! It's Bat Tags Again

Tag development expertise creates smaller, lighter, wide-range bat tracking technology

DOE is promoting the advancement of efficient and clean wind energy production, but it is also committed to safeguarding wildlife populations, including bats, from potential issues presented by wind turbine installations.

Bats are agricultural rock stars. They eat insects, which reduces the amount of pesticides that farmers need to safeguard their crops. And bats pollinate over 700 plants—many of which are used for food and medicine. In fact, research suggests that without bats, annual North American agricultural losses could total more than $3.7 billion.

Wind turbines impact several species of bats, especially tree roosting hoary, eastern red, and silver-haired bats. It appears as though some bat species may be attracted to wind turbines, but questions remain about this relationship, such as how far away bats are attracted by the turbines and why. While endangered species of bats are affected much less by wind power plants than

A new PNNL project will develop and evaluate smaller, longer-lasting tags for migratory bats. *Photo courtesy of Shutterstock*

some other species, more information and tools are needed to research bat behavior around turbines to help design solutions to protect them.

One such tool is the radio frequency (RF) transmitter. Although these transmitters are not new to bat tracking research, the technology has been limited by transmitters that are relatively large compared to the size of bats. Biologists have recommended that transmitters be less than 5% of the bat's body weight. For example, the smallest currently available transmitter weighs 0.22 grams (g), but some species of the endangered Myotis bat weigh in at as little as 4 g—so transmitters to track those bats should weigh less than 0.2 g. Current RF transmitters also have a short service life of typically less than 2 weeks.

To address these size and service-life challenges, in January 2019 Pacific Northwest National Laboratory (PNNL) began a 3-year, DOE WETO-funded project to dramatically improve RF transmitters with multiple versions tailored to hoary, eastern red, and silver-haired bats, as well as the Myotis species. These state-of-the-art transmitters will be paired with a three-dimensional localization algorithm to provide high-resolution behavioral information about flight patterns, which will help answer questions about how bats respond to turbines on the landscape.

Three new tag technologies are being developed and evaluated. The first minimizes the transmitter size and achieves a weight of only 0.15 g—small enough for the little Myotis bat. The second lengthens the service life for tags that track migration habits of the hoary, eastern red, and silver-haired bats, while keeping tag weight within 5% of body weight for each of these species. The third improves detection range while also maintaining weight recommendations. The detection range improvements are expected to be useful for studying the attraction of bats to wind turbines, as well as for observing their movements across one or more wind plants.

This is not PNNL's first foray into wildlife tagging. The lab's research team has vast expertise in tag development, including transmitters and batteries small enough to be injected into tiny young fish, eliminating stress caused by surgical tag implementation. More than 100,000 fish in the United States, Australia, Brazil, Germany, Belgium, and East Asian countries have been tracked and studied using versions of PNNL tags.

Going forward, PNNL's new bat tagging and tracking tools could help wind energy developers and operators realize shortened permitting time and reduced costs—while also benefiting the bat population, agriculture, and the environment. ■

Did You Know?

- There are more than 1,300 species of bats worldwide.
- Bats can be found on nearly every part of the planet, except in extreme deserts and polar regions.
- Not all bats hibernate—some, like the spotted bat, migrate to warmer areas in search of food.
- Over 300 types of fruit—like bananas, avocados, and mangos—depend on bats for pollination.
- Bats are also important to chocolate, helping spread seeds for cacao (chocolate's main ingredient).
- Each night, insectivorous bats can eat their body weight or more in insects, numbering in the thousands for each bat.
- Bats are the only flying mammal.

This information is courtesy of the U.S. Department of the Interior.

CFD Code Increases Accuracy of Turbine Wake Simulation

Computer modeling of interactions between turbines, turbulence, and wakes holds potential for wind plant improvements

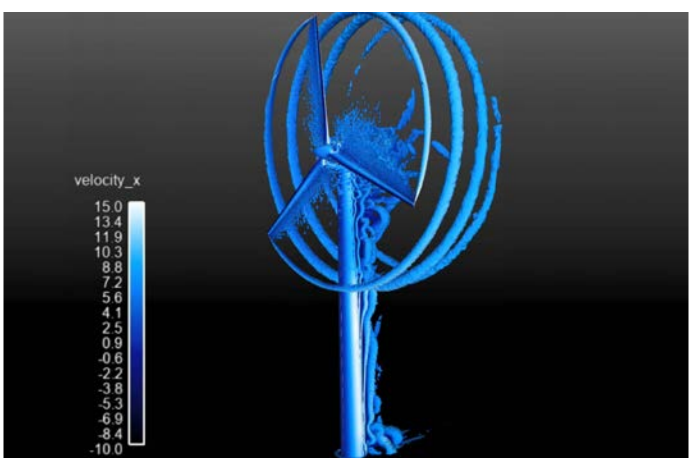
Researchers at Sandia National Laboratories (Sandia) and NREL are using cutting-edge national supercomputing resources to develop an open-source computational fluid dynamics (CFD) code that simulates wind plants with greater accuracy than previously possible. This Nalu-Wind code is emerging as the foundation for next-generation wind power plant flow modeling,

SpinnerLidar instrument installed on a SWiFT turbine. *Photo by Sandia*

enabling operators and developers to predict blade health, power production, and plant costs more accurately to ultimately reduce the overall cost of wind energy.

A recent test used high-resolution wind plant data from the Sandia Scaled Wind Farm Technology (SWiFT) facility to validate a Nalu-Wind simulation. The test indicated that Nalu-Wind can effectively model the turbulence in the air between and around wind turbines—an important step toward simulating wind plants. Simulations performed using Nalu-Wind could also make it possible to explore new technologies more quickly and cost-effectively than traditional field testing, translating R&D into high-value wind plants across the country.

More accurate, validated models could improve wind plants' performance, efficiency, and reliability while lowering the cost of wind energy. By validating that Nalu-Wind accurately simulates how turbines interact, Sandia and NREL's research is the first step toward a tool that could be used by industry.



Wind turbine velocities modeled with Nalu-Wind. *Image by Matt Barone, Stefan Domino, and Chris Brune, Sandia*

"Nalu-Wind is about optimization to lower the cost and improve efficiency," explained Brian Naughton, a field experiment engineer at Sandia. "The SWiFT site provides us with the unique measurements capabilities needed for Nalu-Wind validation."

The SWiFT facility, located at Texas Tech University's National Wind Institute Research Center in Lubbock, Texas, is the first public facility to measure performance of multiple research-scale turbines in a wind plant environment. Each turbine at the SWiFT site has a controller that allows researchers to look at how downwind turbines respond to the wake of their upwind neighbors and compare experimental results against Nalu-Wind simulations.

Nalu-Wind is about optimization to lower the cost and improve efficiency.

This test was the first time the Nalu-Wind code was used to simulate the behavior of the SWiFT wind turbines. Future simulations will compare the potential wake characteristics produced by two different wind turbine rotors before being confirmed through experiments.

Results of this collaborative undertaking will be presented at the American Society of Mechanical Engineers Joint Fluids Engineering conference in July. The Nalu-Wind work is part of DOE's Atmosphere to Electrons initiative, a multiyear, multi-stakeholder R&D effort focused on improving wind plant performance and mitigating risk and uncertainty to achieve substantial reduction in the cost of wind energy production. ■

Research Reduces Uncertainty of Wind Plant Energy Production Estimates

Increasing investor confidence could drive more investment, lower the cost of energy

Predicting the future is inherently challenging. The same applies to assessing wind resources, which creates challenges for wind power plant operators and owners. That's because wind resources vary from year to year, and the variability of wind speed is a key part of the overall wind resource assessment process. This variability creates uncertainty in estimating wind plant energy production. Who can really say when—and how much—the wind will blow?

One of the outcomes of this uncertainty is what it does to wind investments. The uncertainty of wind plant energy production increases investment risks. Furthermore, evidence from wind

NREL researched more accurate ways to evaluate wind speed variability and average wind farm energy production to help reduce investment risk. *Photo by Deb Lastowka, NREL 54460*

plant owners and financiers suggests that the fleet of U.S. wind projects is underperforming compared to the preconstruction energy estimates that provide the basis of investment decisions. As a result, financiers are applying conservative adjustments or "haircuts" to financial risk models—sometimes without understanding the fundamental drivers of uncertainty—potentially leading to valuations with inaccurate risk probabilities. This raises the likelihood of increased costs associated with risks and represents a barrier to entry for investors without wind project experience.

Despite the significant effects of long-term variability, the wind energy industry lacks robust methods to quantify this uncertainty. To search for more accurate ways to evaluate wind speed variability and average wind farm energy production under different conditions, researchers at NREL examined 27 different metrics across 607 wind plants in the United States. Their work, which is part of the WETO-funded Performance Risk, Uncertainty and Finance (PRUF) project, investigated the impact that different variability metrics have on the accuracy of risk estimation.

By applying several common approaches for calculating variability to the same 37-year monthly wind-speed and energy-production time series and then correlating the wind-speed variability estimates to the variabilities of actual wind farm energy production, researchers determined the accuracy of the variability calculations. Their findings included:

- Of the 27 different metrics explored, robust coefficient of variation (RCoV) proved to be the most useful metric in quantifying long-term variability. RCoV is statistically robust, remains effective for practically all kinds of data sets, and leads to a more accurate depiction of wind-speed variabilities than other metrics.

Estimates of energy-generation variability require about 10 years of monthly mean wind speed records to achieve a 90% statistical confidence.

- Although widely used to calculate interannual variability, annual mean wind speeds mask signals from seasonal changes and diurnal cycles of wind, leading to unreliable representations of long-term wind-speed variability.
- Wind resource assessments need to consider both the magnitude of wind speed and its variability, rather than focusing solely on wind speed.
- Over the 37-year period, the central United States (the Plains and the Upper Midwest) recorded high wind speeds and low wind-speed variability, making the region ideal for wind energy development.

Researchers also found that estimates of energy-generation variability require about 10 years of monthly mean wind speed records to achieve a 90% statistical confidence.

Results of this research, which underscore the advantages as well as the importance of using a statistically robust and resistant method, were published in *Wind Energy Science*.

Future NREL research under the PRUF project will assess variations using high-resolution wind speed and energy production data, quantify the wind resource relationship with long-term energy production, and explore the influence of climatic cycles on energy production. This research will improve the certainty of wind farm annual energy production estimates, provide a sound basis for industry decision-making, increase certainty for investors, and could bring new capital into the wind energy space. ■

New Model To Support the North American Renewable Integration Study

The United States, Canada, and Mexico collaborate to enable economic competitiveness and reliability

For the past 3 years, researchers across the United States, Canada, and Mexico have been collaborating on the North American Renewable Integration Study (NARIS), an analysis of the pathways to modernize the North American power system through efficient planning.

To support this effort, NREL has developed a new model to demonstrate reliability in a variety of future scenarios, including those with higher penetrations of meteorologically driven energy sources, such as wind and solar. The new model will help identify potential renewable energy development zones for the most cost-effective resources in all three countries and quantify potential

Together with extensive NREL wind, solar, and load data sets, this model will help industry plan a long-term, cross-border grid that is reliable and maintains system adequacy.

benefits from changes in operational and planning practices. The model can also produce visualizations of high-stress periods and an impact analysis of capacity expansions. Together with extensive NREL wind, solar, and load data sets, this model will help industry plan a long-term, cross-border grid that is reliable and maintains system adequacy.

"This new model is just one step in a long-term plan to create a detailed analysis of cross-border and interregional integration that will help inform power systems planners and operators, government agencies, and regulators," said NREL Researcher Greg Brinkman.

This research will be helpful for future analyses of extreme weather events and understanding resilience, as well. Once this research is complete, the team will publish the results of the study showing how NARIS could impact future energy collaboration among the United States, Canada, and Mexico. ■

Workshop Explores Potential of Wind Innovations for Rural Economic Development

Stakeholders share information on distributed wind's unique opportunities and challenges

Distributed wind systems connect directly to the distribution grid on the customer side of the meter or at an off-grid location to support local loads or grid operations. It is estimated that there are gigawatts of economically viable distributed wind potential, and these systems do not require new transmission capacity construction, relying instead on the capacity available on local distribution grids. The quality wind resources, retail rates, and population densities needed for distributed wind development are often found in rural regions of the United States.

In late 2018, the WETO Wind Innovations for Rural Economic Development workshop brought together representatives from the U.S. government, national laboratories, rural electric utilities, national associations, the wind energy industry, and the financial community to share information about needs, challenges, and experiences unique to distributed energy resources and distributed wind energy systems in rural areas.

The quality wind resources, retail rate, and population densities needed for distributed wind development are often found in rural regions of the United States. *Photo courtesy of Organic Valley*

The resulting report summarizes perspectives from participants and key takeaways including:

- Win-win-win solutions must benefit rural electric customers and distribution utilities, as well as rural generation and transmission utilities.
- Information resources such as communications toolkits and online videos, combined with forums for knowledge exchange, could help effectively address financial and technical issues specific to distributed wind co-ops.
- Hybrid wind-solar-storage systems, microgrids, beneficial electrification, and commercial and industrial applications could help simultaneously advance distributed wind and rural economic development.
- Despite complex legal and contractual obligations, generation and transmission co-ops and distribution co-ops can find ways to work together on mutually beneficial distributed generation opportunities.
- Education and outreach on distributed wind can help counter misinformation by debunking myths and providing accurate information about environmental impacts.
- Challenges to further development of distributed wind include lack of a clear value proposition and granular data, particularly on reliability.

Future WETO activities will investigate these recommendations in greater detail, as well as explore opportunities for demonstration projects, identify key factors in public acceptance, and research possible cost-reduction measures. ■

Funding News

DOE Awards $6 Million in Wind Energy Research Projects

DOE selected nine projects totaling $6.2 million that will reduce the impacts of land-based and offshore wind energy on bats, birds, and other wildlife. In turn, this will lead to less “curtailment,” when wind turbines need to be shut down, resulting in greater annual energy production and lower wind energy costs. “Advanced Wind R&D to Reduce Costs and Environmental Impacts” Funding Opportunity Announcement (FOA) awardees include American Wind Wildlife Institute, Electric Power Research Institute, General Electric Renewable Energy, Iowa State University, NREL, Oregon State University, SMRU Consulting, Stantec Consulting Services, and Western EcoSystems Technology.

DOE Selects Four Projects To Develop High-Efficiency, Lightweight Wind Turbine Generators

DOE selected four projects totaling $8 million to develop lightweight, efficient turbine drivetrain systems for tall wind and offshore applications. These projects minimize the use of rare earth materials and contribute to the scaling of wind turbine power capacities beyond 10 MW. The teams will develop direct-drive permanent-magnet generators and superconducting generators.

Request for Proposals To Address Wind-Wildlife Operational Challenges

NREL has released a request for proposals (RFP) to develop wind-wildlife impact mitigation technologies that detect and deter the activities of birds and bats in proximity to wind energy facilities, as well as increase the understanding of bat and eagle behavior and physiology.

Funding Opportunity Announcement for Wind Energy R&D

WETO has issued a $28-million multitopic FOA aimed at enabling wind energy nationwide across all sectors: land-based, offshore, and distributed. The funding covers four topics:

- Wind Innovations for Rural Economic Development (WIRED)
- U.S. Offshore Wind Test Facilities R&D and Upgrades
- Project Development for Offshore Wind Demonstrations
- Tall Towers for U.S. Wind Power

Request for Proposals for Offshore Wind R&D

The National Offshore Wind R&D Consortium, which receives funding support from WETO, has announced release of its first RFP. The consortium’s RFP is related to offshore wind plant technology advancement, which includes optimizing the performance of wind plants; reducing the costs of turbine support structures (e.g., foundations); developing innovative mooring and anchoring technologies for floating wind; and reducing the cost and risk associated with the transmission and distribution of electricity from offshore wind.

U.S. Department of Energy News

How Much Can Wind Plant Operators Save? WISDEM Counts the Ways

Wind plant developers and operators have typically relied on proprietary manufacturer software to optimize energy production at the component, equipment, and plant levels, but lacked a fully integrated systems-scale perspective—until now. With funding from WETO, NREL developed WISDEM, an open-source modeling software that helps wind plants increase efficiency, energy capture, and revenue in nearly every facet of operation.

Rhode Island’s Clean Energy Industry Grows by 72% Since 2014

Rhode Island is well on its way to achieving a goal of 20,000 total clean energy jobs by 2020, with the state’s Executive Office of Commerce 2018 Clean Energy Jobs Report detailing how the clean energy industry has grown by 72% in the state since 2014. A recently announced 400-MW offshore wind farm is projected to support more than 800 new construction jobs and 50 permanent jobs.

Initial Roadmap Released for $41-Million National Offshore Wind R&D Consortium

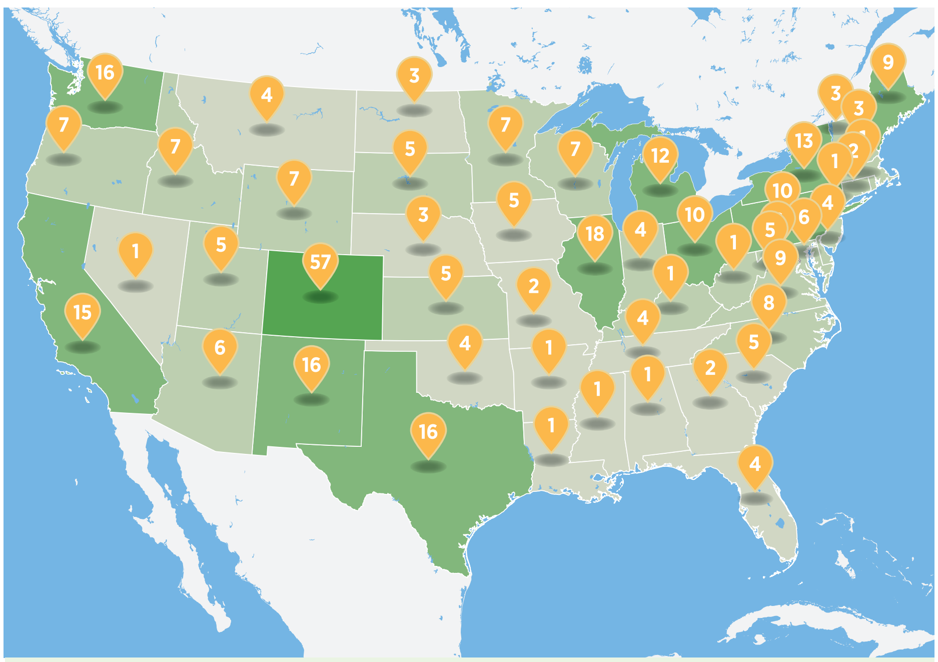
WETO is supporting a $41-million national offshore wind R&D consortium to facilitate the development of the U.S. offshore wind industry through wind plant technology advancement; wind resource and physical site characterization; and installation, operation and maintenance, and supply chain technology solutions. In 2018, DOE competitively selected the New York State Energy Research and Development Authority (NYSERDA) as administrator of the consortium, with members including NREL, Deepwater Wind, Shell, Ørsted, the Carbon Trust, and Renewables Consulting Group. An initial R&D roadmap has been developed and can be found on NYSERDA’s website.

2020 Collegiate Wind Competition Participants Announced

On February 20, 2019, DOE announced the 12 collegiate teams selected to participate in the 2020 Collegiate Wind Competition:

- California State University, Chico
- California State University Maritime Academy
- James Madison University
- University of Maryland
- University of New Haven
- Northern Arizona University
- The Pennsylvania State University
- Texas Tech University
- Tuskegee University
- Virginia Polytechnic Institute and State University
- Washington State University-Everett with Everett Community College
- University of Wisconsin-Madison.

The selected colleges and universities will compete in multidisciplinary challenges to develop a project plan based on wind energy market and siting considerations, design and build a model wind turbine, and test their turbine against a set of rigorous performance criteria. Students will earn valuable real-world experience as they prepare to enter the workforce. The 2020 competition will take place at AWEA's WINDPOWER Conference in Denver, Colorado, on June 1–4, 2020.



WETO Projects Map

WETO leads the nation's efforts to research and develop innovative technologies, lower the costs, and enable and accelerate the deployment of wind energy throughout the nation. Learn more about WETO's R&D portfolio through an interactive map that allows users to search by state, types of partner organizations, and areas of research: *www.energy.gov/eere/wind/wind-energy-technologies-office-projects-map*.

EVENTS

U.S. Offshore Wind
June 10–11, 2019
Boston, Massachusetts

IEEE Power & Energy Society General Meeting
August 4–8, 2019
Atlanta, Georgia

North American Wind Energy Academy/WindTech 2019 Conference
October 14–16, 2019
Amherst, Massachusetts

AWEA Offshore WINDPOWER Conference and Exhibition 2019
October 22–23, 2019
Boston, Massachusetts

ESIG 2019 Fall Technical Workshop
October 28–30, 2019
Charlotte, North Carolina

Composites World 2019 Carbon Fiber
November 19–21, 2019
Knoxville, Tennessee

AWEA Clean Energy Executive Summit 2019
November 19–21, 2019
Carlsbad, California

WETO AND NATIONAL LABORATORY PARTICIPATION AT AWEA WINDPOWER 2019

TUESDAY May 21

1:00 p.m.–2:00 p.m.
Executive Panel on Public Acceptance: Confronting the Reality on the Ground
Speaker: Maggie Yancey, DOE Wind Energy Technologies Office (Moderator)
Location: Thought Leader Theater

1:00 p.m.–2:15 p.m.
U.S. Wind Outlook: Where, When, and How Much?
Speaker: Ryan Wiser, Lawrence Berkeley National Laboratory (Berkeley Lab)
Location: Power Station

2:15 p.m.–2:40 p.m.
Understanding the Community-Level Economic Impacts Supported by the Rush Creek Wind Farm
Speaker: Jeremy Stefek, National Renewable Energy Laboratory (NREL)
Location: Fast Track

2:30 p.m.–3:45 p.m.
The Future with Larger Blades and Turbines
Speaker: Josh Paquette, Sandia National Laboratories and Mark Bolinger, Berkeley Lab
Location: Tech Innovation Station

3:50 p.m.–4:15 p.m.
Interview with Incoming DOE Deputy Assistant Secretary for Renewable Power
Speaker: Dave Solan, DOE Office of Energy Efficiency and Renewable Energy
Location: Thought Leader Theater

WEDNESDAY May 22

1:15 p.m.–1:45 p.m.
A Vision for the Power System of the Future with Wind Energy Abundance, from IEA Wind
Speaker: Eric Lantz, NREL (Moderator)
Location: Tech Innovation Station

1:45 p.m.–2:10 p.m.
The Costs and Benefits of Transmission for Wind Integration Across the U.S.
Speaker: Will Gorman, Berkeley Lab
Location: Fast Track

2:45 p.m.–4:45 p.m.
Wind Power and Cybersecurity—Managing the Winds of Change
Speaker: Sarah Freeman, Idaho National Laboratory
Location: Collaboration Station

3:15 p.m.–3:40 p.m.
Accessing DOE Debt Capital for Wind Power
Speaker: John Sneed, DOE Loan Programs Office
Location: Fast Track

3:45 p.m.–4:30 p.m.
The Role of Wind in a Distributed Energy Future
Speaker: Ian Baring-Gould, NREL
Location: Thought Leader Theater

THURSDAY May 23

AWEA Workforce Pavilion
Stop by the AWEA exhibit and workforce pavilion to learn more about workforce-related issues, educational opportunities, and engage leaders from the wind industry, DOE, the national laboratories, and more!

***For the most up-to-date program information, please visit** https://www.windpowerexpo.org*

U.S. DEPARTMENT OF ENERGY | *Office of* ENERGY EFFICIENCY & RENEWABLE ENERGY

For more information, visit:
energy.gov/eere/wind/wind-rd-newsletter

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