U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

Wind R&D Newsletter

OCTOBER 2019

IN THIS ISSUE

National Consortium Poised To Make a Splash

Momentum builds for partnership advancing R&D for the U.S. offshore wind industry

With a host of new partners and an open call for research proposals, the National Offshore Wind R&D Consortium—established with $41 million initial funding from the U.S. Department of Energy (DOE) Office of Energy Efficiency and Renewable Energy (EERE) Wind Energy Technologies Office (WETO) and the New York State Energy Research and Development Authority (NYSERDA)—is ready to make a splash.

Data on the potential offshore wind resource suggest more than 2,000 gigawatts (GW) could be accessed along the coasts of the United States and the Great Lakes. In New York State alone, leaders have committed to 9,000 megawatts (MW) of offshore wind energy development by 2035—enough energy to power up to six million homes.

Continued on page 3

Bigger Equals Better When It Comes to Wind Energy Potential

Researchers do the math on innovative blade configurations

Scientists at DOE's National Renewable Energy Laboratory (NREL) and Sandia National Laboratories (Sandia) are searching for ways to maximize the advantages of large-scale rotors and their potential for increased energy generation. Their work as part of DOE's Big Adaptive Rotor (BAR) project aims to develop 5-MW land-based turbines with 206-meter (m) rotors.

Basic math can easily explain the benefits of larger turbines. To sum it up, bigger equals better.

Continued on page 4

Letter from the Wind Energy Technologies Office Director

Robert C. Marlay

As the new director of the Wind Energy Technologies Office, I am pleased to join a superb team of professionals at DOE and our National Laboratories in working to advance the prospects of wind energy—on land, offshore, and distributed throughout the country. There are huge opportunities for wind energy, as well as challenges, and we have exciting plans for the future to address them. I am eager to get out and about and meet with many of you who are joining with us in this bold endeavor.

The catchphrase "any way the wind blows" has both literal and figurative meanings across our industry and here in WETO. For example, the industry has found cost-effective ways to capture the wind "any way it blows," growing tremendously in the past several years in terms of capacity, deployment, and investment. In fact, the Energy Information Administration predicts that wind will surpass other sources of renewable power generation this year. United States wind power has more than tripled over the past decade and today is one of the largest sources of renewable generating capacity in the country.

The industry has found cost-effective ways to capture the wind "any way it blows," growing tremendously in the past several years in terms of capacity, deployment, and investment.

Offshore wind project development continues to thrive and the American Wind Energy Association (AWEA) gives us a chance to exchange valuable information on what factors make these successes possible, where we want to take things next, and making sure that, whichever way the wind blows, this healthy growth continues. Connect with us at the WETO booth (#303) or see the schedule on the WETO website for details on sessions that will be sharing results from projects we've funded.

DOE's newly released publication, the *2018 Offshore Wind Technologies Market Report,* states that the overall size of the U.S. offshore wind pipeline grew to 25,824 MW in 2018. Clearly, companies see potential in developing offshore wind projects.

Be sure to download two other recent publications from DOE. The *2018 Wind Technologies Market Report* and the *2018 Distributed Wind Market Report* provide a snapshot of the industry through the end of last year. These publications can be found on the WETO website.

Energy science research and development (R&D) sponsored by WETO sparks breakthroughs in technology innovation, addresses market and deployment barriers, and drives down the cost of wind energy to deliver more efficient, more reliable, and more predictable wind energy systems. Inside this R&D newsletter, you'll find highlights of WETO's latest and greatest wind energy science research, development, and validation activities.

This edition spotlights developments in offshore wind research with articles on the National Offshore Wind R&D Consortium, innovations in floating offshore wind systems, an offshore wind data portal, and the Offshore Wind Resource Characterization Workshop. In addition, you'll find information applicable to the broader wind power community, with topics that include visualization software for wind forecasting, large rotor manufacturing, and the global market for distributed wind energy resources.

And a flurry of funding opportunities from WETO and other EERE offices is helping launch several new research initiatives. It's not too late to submit an application for $18.5 million in offshore wind R&D funding from the National Offshore Wind R&D Consortium. This year alone, the Energy Department has put millions of dollars on the table for offshore wind research. To learn more about individual projects, visit the WETO website.

Wind continues to pick up momentum and, any way it blows, it brings opportunity and growth to all sectors of our industry.

Sincerely,

Robert C. Marlay, Ph.D., P.E.
Director, Wind Energy Technologies Office

National Consortium *continued from page 1*

The consortium, designed to promote U.S. offshore wind industry development, is a collaboration among DOE, NYSERDA, the Carbon Trust, Renewables Consulting Group, DOE's NREL, the Advanced Energy Research Technology Center at Stony Brook University, and other organizations. Its goal is to support initiatives that remove technical barriers to offshore wind development across the nation. And, thanks in part to Walter Musial from NREL, it has a plan to guide the way there.

"The overarching goal of the consortium is to fund research that is relevant to the developers of offshore wind power plants," Musial said. "The consortium has a number of advisory panels designed to help gain insight into various sectors of the industry, so we can steer our R&D investments in the direction that will deliver the greatest impact."

Last year, the consortium surveyed industry to develop an initial R&D roadmap outlining priorities for the U.S. offshore wind industry. Musial, a principal engineer who leads the offshore wind research effort at NREL, spearheaded roadmap development as technical director for the consortium.

"My role is to guide the consortium in the technical aspects of how it prioritizes research," explained Musial. "This roadmap does just that—outlining what technology innovations will be needed to address the challenges in each of the five U.S. offshore regions, with the end goal of making offshore wind cost competitive in the United States."

The roadmap also guided development of the consortium's first solicitation for R&D proposals, which is open through the end of December 2019 and aims to fund projects related to three pillars of offshore wind technology research:

- Offshore wind power plant technology advancement, which includes optimizing the performance of wind plants, reducing the costs of turbine support structures, 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
- Offshore wind power resource and physical site characterization, which includes comprehensive wind resource assessment and the development of a meteorological and oceanographic reference site
- Solutions to improve and accelerate supply chain, installation, and operations and maintenance, including using advanced data analytics to optimize the efficiency of offshore wind components.

The 30-MW Block Island Wind Farm off the coast of Rhode Island is currently the only operational commercial offshore wind farm in the United States, but with the help of the National Offshore Wind R&D Consortium, the industry is poised for major growth. *Photo by DOE*

Consortium Members and Strategic Partners

- DOE and its National Laboratories
- NYSERDA
- Advanced Energy Research and Technology Center at New York State University at Stony Brook
- Anbaric
- Avangrid
- EDF Renewables
- EDP Renewables
- EnBW North America
- Equinor
- GE Renewables
- Innogy
- Maryland Energy Administration
- MassCEC
- Northland Power
- Ørsted
- Renewables Consulting Group
- Shell
- The Carbon Trust International, Inc.
- Vineyard Wind
- Virginia DMME

"The solicitation points the research community toward the consortium's highest-priority topics and the most impactful results the industry needs to move forward," said Musial. "Not only will this research inform the industry's near-term projects, but at the same time, it will advance longer-term WETO program goals to accelerate the development of new wind energy technologies, which is a win-win."

The consortium is accepting proposals on a rolling basis through December 31, 2019, and plans to offer additional competitive solicitations over the next three years based on additional R&D priorities identified in the roadmap.

In New York State alone, leaders have committed to 9,000 MW of offshore wind energy development by 2035—enough energy to power up to six million homes.

In 2019, seven new partners—Commonwealth of Virginia Mines Minerals & Energy Department (Virginia DMME), Maryland Energy Administration, and Massachusetts Clean Energy Center (MassCEC); offshore wind plant developers Energie Baden-Württemberg AG (EnBW) North America and Vineyard Wind; transmission developer Anbaric Development Partners; and turbine manufacturer GE Renewables—joined the consortium, which further signals the momentum of offshore wind industry growth and boosts the potential funding available for industry-relevant R&D.

"With partners making contributions to the consortium in addition to the core funding commitments from DOE and NYSERDA, the amount of available research funding continues to grow," added Musial.

Looking ahead, Musial said the consortium aims to transition from a partially federally funded effort to a self-sustaining nonprofit fully funded by research partners. The consortium has hired a full-time executive director to help make this happen.

"State commitments to procure offshore wind have grown from zero to about 20,000 MW in the last few years, so there's a new sense of urgency among developers and leaders across the nation to reduce uncertainty in key technical areas," Musial said. "The timing is perfect for the consortium to provide a relevant and long-lasting platform to guide innovations that truly serve the industry. It's an exciting opportunity for everyone to come together and focus collaboratively on the most critical R&D issues." ■

DOE's Big Adaptive Rotor project aims to develop 5-MW land-based turbines with 206m rotors, which will capture more wind and drive down the cost of energy. The project also addresses challenges, including transportation and manufacturing, that prevent scaling turbines up to sizes needed to deliver cost-of-energy advantages. *Photo by NREL*

Bigger Equals Better *continued from page 1*

Bigger blades can sweep larger areas and access faster wind speeds available at higher heights above the ground. Capturing more of the wind and tapping into better wind resources help drive down the cost of energy. Rotor growth may also increase capacity factors, or the amount of power a turbine outputs on average over the course of a year. In some circumstances, higher capacity factors may increase the value of wind energy to the electricity system.

Yet, bigger blades also face transportation and manufacturing challenges that prevent scaling turbines up to sizes needed to deliver additional cost-of-energy advantages.

"One of the major constraints we're dealing with when creating larger rotors is the weight of the blades," said Nick Johnson, an NREL research engineer and principal investigator on the five-year, multilab BAR project. "Longer blades are heavier, and more weight translates into more cost."

A BAR study led by Lawrence Berkeley National Laboratory and DNV GL worked to address the relationship among bigger blades, weight, and transportation. The study identified the development of innovative transportation modes, segmented blades, and on-site manufacturing methods as critical needs in advancing the next generation of large rotors.

This foundational study guided NREL and Sandia researchers in their exploration of five promising rotor design options. The first concept features a nacelle that has been rotated 180 degrees to operate the rotor downwind of the tower. This configuration allows for increased tower clearance and lower blade mass, because more flexible blades are possible when the wind pushes the blades away from the tower.

Capturing more of the wind and tapping into better wind resources help drive down the cost of energy.

The BAR team is exploring another weight-reducing strategy referred to as distributed aerodynamics control. This design approach mechanically changes the shape of the blades, much like an airplane wing during take-off and landing, to reduce both fatigue and extreme loads. While offering a potential solution for flutter issues on longer, more flexible blades, this concept introduces challenges in relation to factors such as controls, manufacturing, and reliability.

The multielement airfoil and the 4-/5-bladed rotor move further away from conventional turbine designs to address transportation limitations. The multielement airfoil, which bears some resemblance to old biplane wings, could improve aerodynamic performance, boost structural integrity, and come together using a segmented approach. The 4-/5-bladed option allows for thinner, lighter blades with reduced loading and presents transportation advantages.

At the extreme end of the lightweight spectrum, the BAR team is also exploring a blade concept that involves an inner structure that can be segmented or manufactured on-site, potentially incorporating advanced manufacturing techniques similar to 3D printing, and filled with a suitable material, such as rigid foam, to achieve the desired aerodynamic profile.

The BAR team is using NREL's primary turbine design models, OpenFAST and WISDEM®, which model turbine performance and turbine system-level interactions respectively, to evaluate each concept.

After determining the two or three top options through computational analysis, BAR researchers will undertake detailed design studies to determine how supersized blades of the future could add up to sizable cost savings. ■

Downwind turbines like the one shown here could allow for taller turbines and longer blades because the wind pushes the blades away from the tower, enabling increased tower clearance. *Graphic by NREL*

SpiderFLOAT Innovation Puts a New Spin on Offshore Wind

System offers potential to reduce costs and increase economic viability of deepwater offshore wind

U.S. offshore wind installations in ocean waters deeper than 60 m could supply more than 1,200 GW of electric-generating capacity to the nation's electricity system. At the same time, relatively high capital expenditures for deepwater wind—approximately 35% of which can be attributed to substructure and installation expenses—challenge the economic viability of this resource. Innovative technology developed by researchers at DOE's NREL has the potential to reduce costs by simplifying construction and maintenance logistics for deepwater wind systems in challenging offshore marine environments.

Shown here, WindFloat by Principle Power, Inc., is one example of the platform systems developed from oil and gas technology currently available to offshore floating wind project developers. The objective of the SpiderFLOAT system is to make it possible to tap more than 1,200 MW of U.S. deepwater wind resources more effectively than is possible with existing technologies. *Photo by NREL*

The new scalable offshore floating wind system, named "SpiderFLOAT" for its modular components that resemble spider legs, is designed to substantially reduce expenses for deepwater substructures, driving down the cost of deepwater wind energy. Ultimately, researchers hope this could make deepwater systems competitive with fixed-bottom offshore wind power plants.

Designed as a support platform for wind turbines ranging from 6 to more than 20 MW, SpiderFLOAT's radical new approach could enable high-volume manufacturing and overcome transportation constraints that might otherwise lead to design compromises. SpiderFLOAT is also designed to reduce material content and related substructure costs, while its simplification of routine maintenance requirements supports lower operation and maintenance costs.

"Historically, floating substructures have drawn heavily on designs for oil and gas projects. We realized that an opportunity existed to completely rethink the current approach and tailor the design to the challenges of floating offshore wind, enabling more effective capture of the planet's abundant deepwater wind resources," said NREL Research Engineer and SpiderFLOAT Principal Investigator Senu Sirnivas.

SpiderFLOAT is designed to substantially reduce expenses for deepwater substructures, driving down the cost of deepwater wind energy.

SpiderFLOAT's innovative substructure design and use of materials best suited for the requirements of each component—combined with modular elements, local supply chains, automated and on-site manufacturing, and reduced materials requirements—can help make offshore systems more cost competitive. This could help tap the vast energy potential of deepwater markets, including the United States' West and Northeast Coasts, the Gulf of Mexico, and Hawaii, as well as locations in Europe and Asia.

The SpiderFLOAT substructure reduces costs and improves performance by minimizing the use of steel and limiting transmission of wave motions to the wind turbine. The flexible technology can also be paired with a range of turbine designs and anchoring methods to accommodate numerous system configurations.

SpiderFLOAT's modularization and simplified mooring allow for partial on-site manufacturing and easy towing of the entire system for installation and maintenance. In addition, by minimizing construction activities at the installation

site, SpiderFLOAT helps reduce pile driving and other environmentally sensitive activities typically associated with fixed-bottom installations.

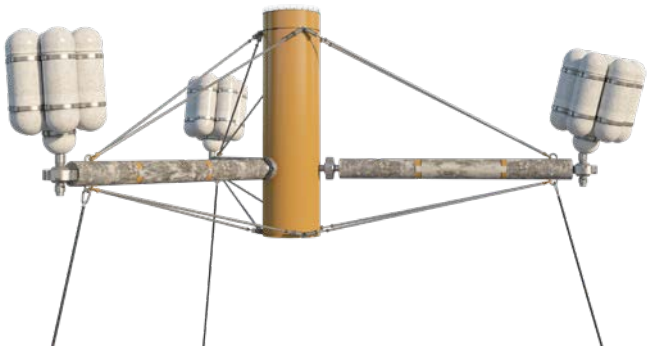
The NREL research team that developed the SpiderFLOAT technology is now working with industry partners to prepare the system for commercialization. SpiderFLOAT began as an internal NREL Laboratory Directed Research and Development project, with funding designated by lab leadership to launch innovative technical and scientific projects.

WETO then selected the project for participation in the DOE Energy I-Corps and Technology Commercialization Fund programs, which accelerate the commercial deployment of national lab-developed technologies by helping build industry partnerships and bring prototypes to market. Energy I-Corps industry mentor and offshore wind developer Trident Winds helped identify developers' performance parameters and cost requirements related to floating wind systems and pathways to commercialization.

"I-Corps allowed us to interview nearly 75 stakeholders within the floating wind community," said NREL Senior Research Engineer and SpiderFLOAT design team member Rick Damiani.

His colleague, NREL Research Engineer Fabian Wendt, a fellow SpiderFLOAT collaborator, added, "It provided us with terrific insight about the challenges and needs of the industry."

The work on details of the modular design and manufacturing strategy continues with the aim of future certification and licensing. Subsequent research will consider new options for system controls. As part of the Technology Commercialization Fund phase of the project, in the coming months the team will conduct a subscale model evaluation of the patent-pending technology at a wave basin in the United States. ■



Three-dimensional model of the slender, multibody SpiderFLOAT platform configuration. *Graphic by NREL*

Portal Makes Secure Access to Validated Data a Breeze

Wealth of Atmosphere to Electrons data informs wind industry decisions

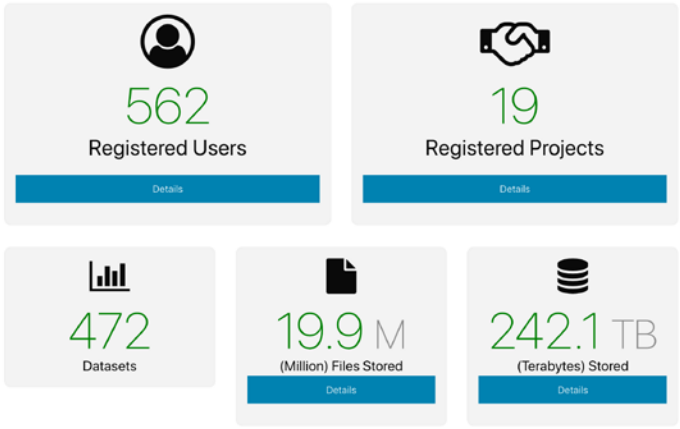
The Data Archive and Portal is part of the A2e initiative, which focuses on optimizing electrical power production of wind plants. *Illustration by NREL*

More than 6% of electrical power in the United States comes from wind plants. As a variable energy resource, wind power requires accurate forecasts to integrate with the electrical system efficiently and ensure grid reliability.

Existing forecast models have advanced in recent years, but they often still exhibit errors that can create losses for generators and challenge grid stability. To improve the accuracy and reduce the uncertainty of the models, researchers involved in the DOE Atmosphere to Electrons (A2e) initiative are conducting data-intensive numerical and field studies.

A2e research focuses on optimizing electrical power production of wind plants, while lowering the associated risk and cost. As part of this program, WETO established the Data Archive and Portal (DAP), managed by DOE's Pacific Northwest National Laboratory (PNNL). The DAP gives users easy and secure access to validated laboratory data, field and benchmark model data, and offshore data from A2e research activities.

"This ultimately results in improved model accuracy and more reliable intelligence for decision making related to wind power research and development," said Will Shaw, PNNL wind energy program manager.



The Data Archive and Portal provides users—ranging from researchers to wind power plant operators—with historical studies and model output. *Figure from PNNL*

Data collected in the DAP provides researchers, wind technology manufacturers, wind plant operators, and industry consultants with information needed to make decisions about factors such as location, wind collection optimization, and evaluation of the impacts of wake effects of sites. Since its inception, more than 550 users have accessed the DAP's 472 data sets, including 19.9 million files and more than 242.1 terabytes of historical field studies dating back to 2000.

Researchers are able to access data related to instruments like sodar, radar, and lidar used at wind power plants and review measurements involving pressure, wind direction, speed, temperature, and turbulence. Over the next five years, researchers plan to collect and monitor DAP data for a field study off the coast of Maine in preparation for developing advanced offshore wind technology.

The DAP collects, stores, and disseminates A2e data using state-of-the-art technology through the secure cloud-services platform from Amazon Web Services and PNNL's research-computing resources. The standardized data sets can be accessed by the scientific community for instant validation and easy analysis, allowing users to reduce individual requirements for storage and operational tools.

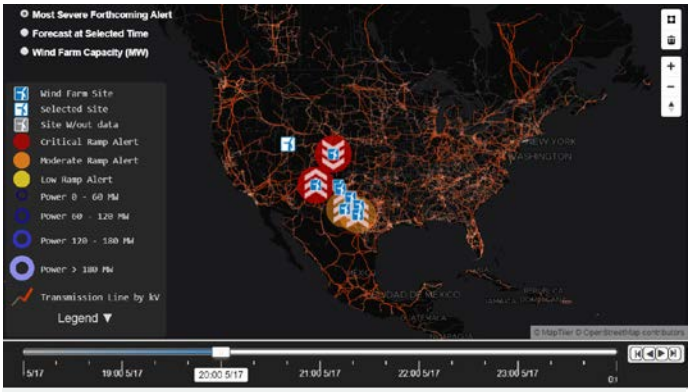
More than 550 users have accessed the DAP's 472 data sets, including 19.9 million files and more than 242.1 terabytes.

Data from the DAP framework feed not only WETO research, but projects for other offices and agencies as well. The National Oceanic and Atmospheric Administration (NOAA) used DAP meteorological data as the basis for its High-Resolution Rapid Refresh model, facilitating improvements to National Weather Service operational forecast models. These modifications have already yielded quantitative improvements in short-term operational forecasts, with more than 200 terabytes of model output produced by NOAA stored on the DAP. The DAP framework is also being used to build similar platforms for the Energy Department's EERE Vehicle Technologies Office, such as Livewire Data Platform.

The DAP's secure data management capabilities are increasing the willingness of the wind industry to share its proprietary data while maximizing access to large field data sets—all of which has the potential to accelerate time to market and reduce costs for new wind technologies. Users can access the DAP by registering at https://a2e.energy.gov/data. ■

New Tool Keeps Wind Power on Course

Software unites forecaster and visualizer to make system operation intuitive



WindView's beta release is now available for exploration online. A benefit of mapping wind power forecasts geographically is that system operators will gain an understanding of how nearby plants react to conditions. *Figure by NREL*

Similar to how a 16th-century sailor interpreted changes in the sky and sea to most effectively harness wind power and keep a ship on course, wind energy system operators now have a tool that makes interpreting wind data more intuitive.

Today's utility operators need the ability to flex generation to meet load whichever way the wind blows—whether on land or at sea. As wind energy expands both on and offshore and is integrated with other energy systems, its operation is becoming even more complex.

Meeting these challenges requires access to easily navigable and visually coherent forecasts in real time. DOE's NREL and Argonne National Laboratory (ANL), along with the University

of Texas-Dallas, created WindView, a wind power forecast visualization tool that extends the planning capabilities of power system operators and increases their understanding of the dynamics that drive their unique energy systems.

"The important thing for system operators is to develop an intuitive feel for what the wind on their system typically does," said Bri-Mathias Hodge, chief scientist at NREL. "WindView gives them as much information as possible to make decisions."

WindView's visualizations of real-world data support sound judgment, making it possible for operators to take rapid, intuitive action based on scientific fact. The tool combines the cutting-edge machine-learning forecasting techniques (deterministic and probabilistic) of M3, a free forecaster, with a clear presentation of wind data from around the world. WindView users can customize and visualize forecasts, tailoring a dashboard to meet their individual system needs.

"Operators can't afford to waste time writing a query to find wind power data. WindView gives them the information they need in real time; you can see the wind events as they unfold," said Erol Chartan, NREL researcher and principal investigator for WindView.

The breakthrough visualization tool allows users to leverage much more actionable information from wind power data. System operators can select the most relevant data points and rapidly interpret them for time-sensitive decisions. Above all, WindView's forecasts complement an operator's fast-paced and information-intensive responsibilities.

WindView's visualizations of real-world data support sound judgment, making it possible for operators to take rapid, intuitive action based on scientific fact.

"Imagine that a transmission line suddenly goes out," explained Chartan. "The power system operator then needs to focus on the wind power of that specific area. The user can select that area using WindView's polygon tool, as well as view the total wind in the aggregated chart at the bottom of the map. Plus, the user can see time and ramping leading to a potential overgeneration event in that region."

Although there are other forecasting and visualization tools, none offer the features and functionality provided by WindView. Existing wind forecasting tools are often limited in use, with designs that do not allow for intuitive use in the full range of situations encountered by utility operators. WindView's combination of a map and surrounding charts with user-defined visuals is a game changer on top of its new high-powered forecasting tool.

WindView is a new tool for helping system operators understand dynamics on their wind power plant. It unites a newly developed forecaster with a visualization platform, allowing users to customize how they interpret wind forecast data. *Photo by NREL*

DOE's Grid Modernization Lab Consortium joined forces with WETO to sponsor the development of WindView by NREL and its partners. As project leads, NREL researchers guided the development of WindView. The team elicited feedback from industry contacts, integrated the M3 forecaster, and designed the user-friendly front end of WindView.

In addition to their support in developing WindView's multichart forecast comparison, ANL tailored a forecasting tool called ARGUS-PRIMA—which assesses and compares different wind power prediction algorithms—to be compatible with WindView. The University of Texas-Dallas created the M3 machine-learning-based wind power forecaster and worked with NREL to integrate it into WindView's user interface.

Chartan came to NREL after working on a previous generation of wind power visualization software for Great Britain's National Grid. Soon, WindView may find its first real-world use in exactly the same control room where Chartan worked.

"From this earlier work, I can so clearly see the strides we've made with WindView," said Chartan. "The map really sets it apart as a forecasting tool. It helps to understand the spatial element, especially alongside up-to-date graphs that are displaying the data you want."

The DOE's EERE Solar Energy Technologies Office plans to adapt WindView to meet the forecasting needs of wind's variable-resource cousin, solar energy. In the meantime, WindView is ready for use by utilities, system operators, researchers, or forecast providers, with a tutorial providing easy instruction on how to use it. See the tool at https://windview-beta.nrel.gov/. ■

Offshore Wind Workshop Addresses Industry Challenges

Key topics included cost reductions and improving resource and site characterization

Participants identified long-term observations as critical to capturing the full range of atmospheric conditions and describing them with statistical significance. *Photo by Nicholas Doherty*

The National Offshore Wind Strategy developed by DOE and the U.S. Department of the Interior identifies the need to reduce costs and technology risks through improved offshore wind power resource and site characterization. Offshore wind representatives met this spring to discuss meteorological and oceanographic research with the potential to advance these strategic goals.

Held in Alexandria, Virginia, the "Research Needs for Offshore Wind Resource Characterization" workshop was jointly led by researchers from DOE's PNNL, ANL, Lawrence Livermore National Laboratory, and NREL. Participants included representatives from WETO, the U.S. and European offshore wind industries, federal agencies, DOE National Laboratories, and the academic research community.

The workshop highlighted the need for a better understanding of the meteorological, ocean, and seafloor conditions unique to offshore wind development sites in the United States. Discussions provided valuable updates on state-of-the-art resources and techniques for assessing and forecasting wind energy offshore. Topics also included wind-wave coupled models, wakes from wind power plants and clusters, blade leading-edge erosion by precipitation, spatial wind speed gradients, and wind and wave loading on offshore structures.

Participants identified long-term observation as critical to capturing the full range of atmospheric conditions and describing them with statistical significance, especially for assessing the impact of extreme weather events, such as hurricanes. The group also considered the potential for airborne measurement systems, including drones, aircraft, and radiosondes, to complement existing measurement capabilities for intensive observation of specific physical processes.

Participants identified long-term observation as critical to capturing the full range of atmospheric conditions and describing them with statistical significance.

In addition, workshop attendees identified possible unmanned and autonomous platforms—such as surface vehicles, wave gliders, and automated systems—that could provide meteorological and oceanographic "metocean" information. These include wind- and solar-powered unmanned surface vehicles equipped with metocean sensors, semiautonomous research platforms to gather physical properties of the upper ocean and lower atmosphere, low-cost spar buoys for air-sea flux measurements, marine-profiling microwave radiometers, and lidar buoys for metocean measurements.

This input will inform DOE regarding decisions about potential R&D efforts related to offshore wind energy. ■

The workshop highlighted the need for a better understanding of the meteorological, ocean, and seafloor conditions unique to U.S. offshore wind development sites. *Photo by NREL*

DOE News

Offshore Wind Rides Wave Toward Accelerated Growth

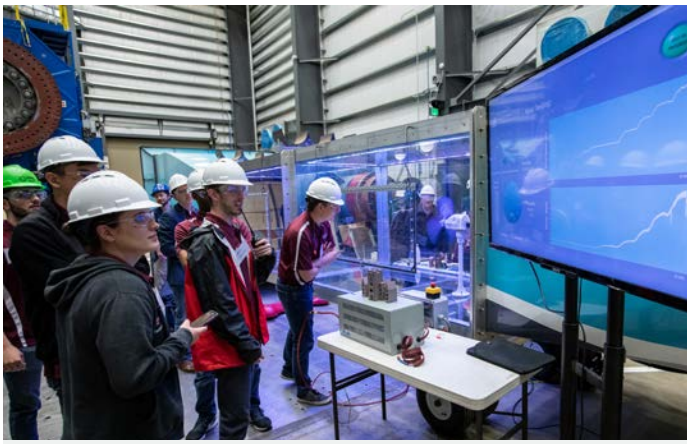
The U.S. offshore wind market is expected to see massive growth in the next decade. DOE's *2018 Offshore Wind Technologies Market Report* estimates a potential generating capacity of 25,824 MW in the project development pipeline at the end of 2018. The report also outlines top trends—including larger turbines, higher-voltage array cables, and floating and hybrid platform systems—that are leading the offshore wind market into a decade of unprecedented growth.

Top 10 Things You Didn't Know About Offshore Wind Energy

Part of DOE's "Top Things You Didn't Know About Energy" series, this blog contains key facts about offshore wind energy that might surprise you. For example, nearly 80% of the nation's electricity demand occurs in the heavily populated coastal and Great Lakes states—where offshore wind resources are plentiful.

Collegiate Wind Competition Continues To Make News

Penn State took home first place in the 2019 Collegiate Wind Competition (CWC), and the program has remained in the news. Stories have looked at how participation helped prepare one student for career success, how Team Juracán from Puerto Rico survived Hurricane Maria, how the Chico State team competed despite the California wildfires that closed their campus, and how KidWind students benefit from CWC student involvement. The 2020 Collegiate Wind Competition will be held at the AWEA WINDPOWER Conference in Denver, Colorado, June 1–4, 2020, and NREL issued a request for proposals from 2021 CWC teams this September.



DOE's Collegiate Wind Competition prepares students to enter the wind energy workforce by offering real-world experience. *Photo by NREL*

INDUSTRY EVENTS

Energy Systems Integration Group
2019 Fall Technical Workshop
October 28–30, 2019
Charlotte, North Carolina

Distributed Energy Conference
October 30–November 1, 2019
Denver, Colorado

Resilience Week 2019
November 4–7, 2019
San Antonio, Texas

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

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

Funding News

Technology Commercialization Funds Awarded for Autonomous Wind Plant and Drivetrain Reliability R&D

Two wind projects were recently awarded funding by DOE's Office of Technology Transitions Technology Commercialization Fund, which promotes partnerships between DOE's National Laboratories and industry to bring technologies to market, with private sector partners providing matching funds. NREL is working with RES Group to enable autonomous wind plants through consensus control and is collaborating with WindESCo on wind turbine drivetrain reliability.

Five Wind Projects Receive Small Business Innovation Research Awards

DOE's EERE Small Business Innovation Research (SBIR) program has awarded grants to two wind energy projects for their first phase of research:

- An energy-saving process to repurpose waste from end-of-life wind turbine blades (Carbon Rivers)
- A system for offshore wind plant operators to monitor turbines and diagnose problems remotely (Qualtech Systems).

Three more SBIR grants were awarded to wind energy projects that demonstrated commercial feasibility for the second phase of research:

- A new blade coating that will reduce damage to wind turbine blades caused by lightning (Aquanis)
- A low-cost marine atmospheric boundary layer measurement system (Helios Remote Sensing Systems)
- A profiling microwave radiometer for offshore wind farms (Boulder Environmental Sciences & Technology).

National Offshore Wind R&D Consortium Makes Initial Awards, Continues To Accept Proposals

The National Offshore Wind R&D Consortium continues to make funding available for offshore wind R&D. Topics include offshore wind plant technology advancement; offshore wind resource and physical site characterization; and installation, operation, and maintenance, and supply chain. Proposal submissions will continue to be accepted until December 31, 2019, or until all funds are committed.

Projects Receive Funding To Minimize Impact of Wind Installations on Wildlife

DOE selected 10 projects totaling $6.8 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 awardees include American Wind Wildlife Institute, Electric Power Research Institute, General Electric Renewable Energy, Iowa State University, NREL, Natural Power, Oregon State University, SMRU Consulting, Stantec Consulting Services, and Western EcoSystems Technology.

DOE Selects Advanced Wind Turbine Generator Projects

Three projects have been selected to develop the next-generation direct-drive and superconductor wind turbine drivetrain technologies needed for continued growth of land-based and offshore wind turbines. Each team will create a more efficient, smaller, and lighter-weight wind turbine generator designed to make wind power more affordable while capable of being scaled up to at least 10 MW. Awardees include American Superconductor Corporation, General Electric Research, and WEG Energy Corporation.

U.S. DEPARTMENT OF ENERGY
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