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NREL releases major update to wind-energy dataset

A massive amount of wind data was recently made accessible online, greatly expanding the amount of information available on wind flow across the continental United States.

The data from the Energy Department's National Renewable Energy Laboratory (NREL) enables anyone considering building a wind plant, or even erecting a single turbine, to understand how strong breezes tend to blow across a particular area and how energy from the wind can be integrated into the electrical grid.

Originally released in 2015, the Wind Integration National Dataset — also known as the WIND Toolkit—made 2 terabytes of information available, covering about 120,000 locations identified using technical and economic considerations. The newly released subset holds 50 TB, or 10 percent of the entire database, covers 4,767,552 locations, and extends 50 nautical miles offshore. Small sections of Canada and Mexico are included as well.

"The entire dataset is 500 terabytes," said Caleb Phillips, a data scientist at NREL. "This is far and above the largest dataset we work with here at NREL."

The data was always available, just not easily or in a simple, usable form. To make the information readily accessible, NREL used its ongoing relationships with Amazon Web Ser-



NREL is making available massive amounts of data that can help determine where to install wind turbines, such as these in Iowa. (Courtesy: Dennis Schroeder/NREL)

vices (AWS) and The HDF Group. Having the dataset hosted on AWS will remove previous limitations on the amount of information that can be accessed readily online.

"What we've tried to do is make this really easy, so folks can play with the data and use it to better understand the potential for wind resources at a greater number of locations," Phillips said. "They can download only the data they want."

An interactive online visualization lets users interact with the data.

The HDF Group developed the Highly Scalable Data Service (HSDS) using the AWS cloud to provide users with easy access to the data, which is stored as a series of HDF5 files. The information can be narrowed to a specific site or time and analyzed using either a custom

software solution or the Amazon Elastic Compute Cloud (Amazon EC2).

"We are very excited to work with both NREL and AWS to make their large, technical data sets more accessible through our new scientific data platform, HDF Cloud," said David Pearah, CEO of The HDF Group. "Our work aims to pave the way for large repositories of scientific data to be moved to the web without compromising query performance or resources."

The WIND Toolkit provides barometric pressure, wind speed and direction, relative humidity, temperature, and air density data from 2007 to 2013. These seven years of data provide a detailed view of the U.S. wind resource and how it varies minute to minute, month to month, and

year to year. These historical trends are essential for understanding the variability and quality of wind for power production. The simulated results were computed by 3Tier under contract for NREL using the Weather Resource Forecast model.

“Now that we have a data platform that supports release of large data sets, we hope to use this capability to release other big data as well that were previously considered too large to make publicly available,” Phillips said. “We are thrilled to make these datasets available, allowing researchers to more easily find and use the data, as well as reducing costs for the national laboratory.”

Coming online next are solar irradiance data and wind data for Mexico, Canada, and potentially other countries.

While measurements across the rotor-swept areas are the best way to determine wind conditions at a site, that’s not always possible. The WIND Toolkit provides an estimate, but actual conditions can be validated using on-site measurements as required.

The first release of data prompted regular calls from people in academia, industry, and government wanting additional information. The federal Bureau of Oceanic Energy Management contracted with NREL to provide additional information for offshore areas. The WIND Toolkit Offshore Summary Dataset was made publicly available last year.

The original work to develop and release the WIND Toolkit was funded by the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Wind Energy Technologies Office. ↵

Source: NREL

For more information, go to nrel.gov

New research addresses ice accumulation

Ice accumulation is a serious problem for industries including aerospace, wind energy, power utilities, telecommunications, commercial fishing, and marine activities. Icing leads to material loss, reduced performance, and interference with normal operations. Icing often leads to injuries and, in some instances, fatal accidents. Current methods of ice prevention and removal are mostly active methods that include energy-intensive heating, labor-intensive mechanical removal, and environmentally unfriendly chemical de-icing fluids. Thus, a need exists for effective passive methods such as low ice-adhesion coatings that provide easy release of accumulated ice.

Use of the term “ice-phobic,” which suggests prevention of ice formation, is incorrect as no coating or surface prevents ice formation under all icing conditions. Because of the broad range of affected industry sectors, there is no universal solution to prevent ice accumulation. Depending on the application, the desired outcome may be the prevention of ice accumulation through easy removal at an early stage of accretion by “natural” forces including wind, vibration, or centrifugal force.

The extent of accumulation that can be tolerated varies greatly, as does the degree to which ice can be removed from a surface by “natural means.” For example, a coating technology that seeks to remove ice by centrifugal force from a wind-turbine blade must take into account slower movement of the blade close to rotor hub than the tip of the blade. Power and cable lines are fixed, but they undergo flexing and vibration due to wind that can facilitate ice release with a suitable coating. The most demanding application requirements are those of the aerospace industry. It is well known that airfoil icing disrupts airflow, reduces lift, and jeopardizes control. These applications have strict requirements for maximum tolerable mass and for uncompromised reliability. Currently, the aviation industry broadly employs active anti-icing (e.g., heating, de-icing chemicals, and boots) to mitigate icing related problems.

Based on findings from an NSF funded study carried out in the Virginia Commonwealth University (NSF DMR Polymer Program funding), a fundamentally different ice-removal model was established with considerations from multiple factors that contribute to ice-adhesion. It is important to note that VCU findings in soft surface science and engineering, which are being transitioned to PEG LLC, depart from conventional thinking that focuses on water repellant superhydrophobic/low surface energy surfaces.

Rather, fundamental studies provided the knowledge basis for the development of a novel coating system that takes into account multiple contributions: (1) nanosurface work of adhesion, controlled by surface energy, (2) mesosurface (approximately 1,000 nm) that controls frontier mechanical properties, and (3) bulk, that defines coating thickness and overall mechanical properties. Transitioning these new findings to commercial applications, Polymer Exploration Group LLC (PEG LLC) has developed a low-cost easy-release coating (ER-Coat) with engineering materials. This easily tailored coating also features good toughness and durability.

With the Small Business Innovation Research (SBIR) funding to PEG LLC, fast throughput in-house ice-release test methods and instrumentation were used for the development of ER-Coat materials. Good adhesions of the ER-Coat on various substrates including aluminum, steel, polyethylene, PVC, and fiber-reinforced composite

materials have been achieved with or without primers and substrate surface treatments. Recent results indicate that ice adhesion strength of 100 kPa is a critical value for any practical use.

And less than 10 kPa force is required to remove ice from ER materials by gravity only. Third-party testing

has confirmed the results obtained from PEG LLC’s in-house testing findings. ↴

Source: Dr. Wei Zhang

For more information, contact Dr. Wei Zhang at wzhang@pegllc.org

Dulas completes 100-meter met mast installation for Force 9 Energy

Dulas, a leading renewable energy consultancy, has completed the installation of its tallest meteorological (met) mast in Western Scotland. The 100-meter guyed lattice mast, installed on behalf of U.K. wind farm developer Force 9 Energy, will provide measurement data for a major post-subsidy project in the southwest of Scotland.

While the removal of U.K. government support for onshore wind has led to a severe slowdown in new site development, the publication of the Scottish Government’s own Energy Strategy — which aims to generate 50 percent of all energy demand from renewables by 2030 — and onshore wind policy statements has given renewed hope for a post-subsidy resurgence in the sector. As a result, a number of developers are engaging in early-stage site prospecting and resource assessment activity, ahead of anticipated greenfield development in the future, and Dulas has seen increased demand for its mast installation services from developers and utilities operating in Scotland.

At the remote project site in West Argyll, Dulas carried out installation of the mast and its accompanying instrumentation, with challenging site conditions and the need to measure resource at heights up to 100 meters dictating the choice of a lattice rather than tilt-up tubular mast. The site itself was constrained by nearby forest, deep bogs, and steep slopes, while challenging ground conditions consisting of deep peat and bedrock added a further layer of complexity to the installation.

However, with installation experience across the U.K., Dulas’ technicians successfully installed mast anchors in place before completing the installation in stages to allow for periods of adverse weather. In addition to supplying the mast and instrumentation, Dulas designed and installed aviation lighting and a satellite communication system that facilitates easy data collection.

“As the last few projects to benefit from U.K. subsidy support are completed, developers are increasingly looking to carry out early, accurate wind measurement campaigns at complex sites and at great height in order to maximize the chances of success of these future projects,” said Alistair Marsden, commercial director with Dulas. “Despite the adverse weather conditions and difficult terrain, our technicians delivered a bespoke solution in the form of our tallest ever met mast.”

“Dulas’ experience in met mast design and erection was invaluable when it came to this particular site,” said Nick Mackay, head of legal and commercial at Force 9 Energy. “Their bespoke design and instrumentation services ensured they were able to plan for the constraints of the site itself, identify the best solutions in terms of the technology and instrumentation, and complete the installation to a high standard.” ↴

Source: Dulas

For more information, go to www.dulas.org.uk



The 100-meter guyed lattice mast will provide measurement data for a major post-subsidy project in the southwest of Scotland. (Courtesy: Dulas)

Acciona receives grid-scale energy storage certificate by DNV GL

Acciona Energia, the biggest global operator exclusively in renewable energies, recently received the first ever prototype certificate for a grid-scale energy storage solution by DNV GL, the world's largest resource of independent energy experts and certification body. The handover of the certificate was at the American Wind Energy Association's 2018 Windpower Conference in Chicago.

To explore the possibilities of grid-scale storage, Acciona Energia started up a hybrid plant for storing electricity in batteries as part of its grid-connected wind farm at Barásoain in Navarra, northern Spain.

The plant in Barásoain is equipped with a storage system that consists of two batteries in separate containers: one fast-response battery of 1 MW/0.39 MWh (capable of maintaining 1 MW of power for 20 minutes) and another slower-response battery with greater autonomy (0.7 MW/0.7 MWh, maintaining 0.7 MW for 1 hour). Both have Samsung SDI Li-ion technology connected to a 3-MW AW116/300 wind turbine of Acciona Windpower (Nordex Group) technology, from which they capture the energy to be stored. The wind turbine is one of five that make up the experimental wind farm at Barásoain, operated by the company since 2013. The entire system is managed by control software developed in-house by Acciona Energia and is monitored in real time by the company's Renewable Energies Control Center (CECOER).

The storage plant introduced by Acciona has now become the first in the world to undergo system-level certification. The certification process was carried out in line with the GRIDSTOR Recommended Practice, which is based on industry standards and considers safety, performance and reliability for grid-connected energy storage systems.

Energy storage is a key element



The Barásoain experimental wind farm. (Courtesy: Acciona Energia)

in the transition to a more sustainable energy mix. It allows renewable sources such as wind and solar power to operate at full capacity during peak generation periods by storing excess energy until it is needed to meet later demand. While many energy storage technologies are well established at smaller scales, their application at grid-scale is still in its early days.

"The market for grid-scale energy storage systems is relatively unexplored, but we see rapid developments," said Kim Mørk, executive vice president, Renewables Certification at DNV GL. "Certifying new systems like Acciona's grid-scale storage plant demonstrates that pioneering projects like this are meeting the required safety, performance, and reliability standards and providing the industry with confidence in the quality of emerging new technologies."

"As part of our commitment to helping the industry transition to a low-carbon energy mix while maintaining safety and reliability of supply, we focus our efforts to develop industry guidelines on grid-scale energy storage to help designers, manufacturers, investors, insurers, and authorities mitigate risks and control costs in energy storage projects,"

Mørk said.

"Our company is at the forefront of the energy transition through our solutions to facilitate the integration of variable-generation renewables into the grid and manage the power produced," said Rafael Esteban, CEO Acciona Energy USA Global LLC. "Adding the energy storage plant to our Barásoain experimental wind farm will improve the quality of energy sent to the grid, allow us to explore other applications for balancing supply and demand, and create a path for commercial storage solutions in our wind power projects."

"With any emerging technology, technology qualification, and certification is essential in understanding and managing risk," Esteban said. "In the near future, the bodies involved in the approval and financing of storage systems worldwide will demand these certificates. Acciona also wants to be a pioneer in this area. By applying for certification from such a solvent entity as DNV GL, we can guarantee that our plant fulfils all the conditions to operate with full confidence." ↵

Source: Acciona Energia

For more information, go to www.acciona.com