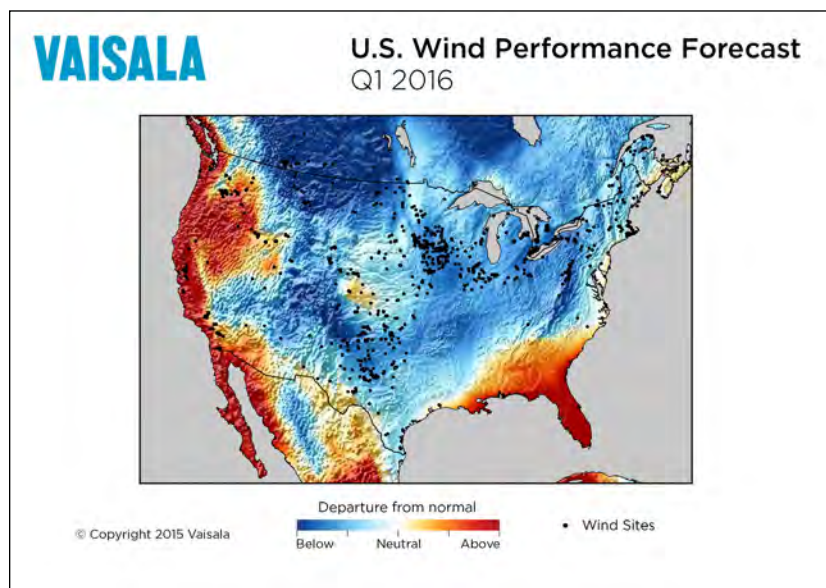


INNOVATION

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VAISALA FORECASTS EL NIÑO WILL CONTINUE TO IMPACT U.S. WIND IN Q1 2016



A strengthening El Niño weather pattern is expected to boost wind energy performance for West Coast investors and operators in the first quarter of 2016 while many regions of the United States will continue to feel the impact of below-average wind speeds into next year. This is according to a forecast released by Vaisala, a global leader in environmental and industrial measurement.

With record low wind speeds in 2015 continuing to raise concerns among U.S. wind investors and operators, particularly in California and Texas, Vaisala has been monitoring U.S. wind performance closely. In response to growing industry demand, Vaisala has now released a map illustrating expected wind conditions for Q1 2016.

The study anticipates that key wind operating areas such as Texas, the Midwest, and the Northeast will see low wind conditions that are much less severe than the same period in Q1 2015, but will nonetheless fall below long-term averages. Western states including California, Oregon, and Washington, which is home to 11.8 GW of wind capacity, will see a marked increase in wind speeds.

Following the impact of an irregular first quarter in 2015, during which wind production in southern California fell to just 64 percent of 2014 levels, Vaisala's latest forecast suggests that the California independent system operator (CA-ISO) energy market should see a major recovery in wind power deliveries. The same is true of Bonneville Power Ad-

ministration (BPA), the Pacific Northwest power market that encompasses Washington, Oregon, Idaho, and portions of other nearby states. This is due to the larger number of storms that typically sweep through the region during a strong El Niño, which could also help ease drought conditions in California.

Wind speeds are expected to remain lower than the historical average for the first quarter of the year in ERCOT (Texas) and the Southwest Power Pool (Nebraska, Kansas, and Oklahoma) where a high concentration of wind capacity has been installed. However, compared to the same period in 2015, wind speeds are expected to be 10 to 20 percent higher than last year during the same financial period.

Energy markets in the Midwest and Northeast (MISO, PJM, NY-ISO, and NE-ISO) are not expected to see a large improvement in wind conditions over last year. However, the warmer and milder winter conditions El Niño is expected to bring could also drive down energy demand and place less of a burden on the transmission system.

For investors, large-scale changes in wind speeds can lead to cash flow fluctuations that threaten profitability and the perception of wind energy as a low-risk investment proposition. For capital providers seeking stable returns through YieldCo structures in the

U.S. market, the events of the past year as well as predictions for next year serve as a strong reminder to better diversify portfolios by geography and technology in order to account for the underlying variability of the climate.

“Now is the time to start building climate resilient portfolios,” said Pascal Storck, global manager of energy services at Vaisala. “This reduces the risk of low performance in any one region or technology. As the old adage goes, you don’t want to have all of your eggs in one basket. For example, you don’t want to have all of your assets in Texas and not have some mitigation strategy for when wind speeds dip below average for a period of time.”

Vaisala’s forecast is based on the wide agreement of the atmospheric research community and all the major global weather models that the current El Niño climate signal will continue and strengthen into next year. The forecast was created by examining several similar events from three of the leading reanalysis datasets, each representing 35 years, then generating a composite prediction based on the historical information. *✍*

— Source: Vaisala Corporation

NREL AND STATOIL COLLABORATE TO MAKE THE FIRST MULTI-TURBINE FLOATING OFFSHORE ARRAY A REALITY



A Hywind floating offshore wind turbine off the coast of Norway in the North Sea

A recent study performed by the National Wind Technology Center (NWTC) at the National Renewable Energy Laboratory (NREL) is helping Norway-based Statoil analyze key issues related to the installation of what has the potential to be the world’s first multi-turbine floating offshore array.

Statoil deployed the first spar-based system called Hywind Demo in 2009, which is still operating today. The company partnered with NREL from March 2013 to March 2015 to analyze the Hywind technology as applied to U.S. waters.

Floating offshore wind turbine technology has significant potential for being a clean, sustainable source of energy. The technology is feasible above transitional water depths of 50 meters, where fixed-bottom structures are economically challenged. Floating wind turbines have the unique ability to access robust wind resources that are often higher and more available than in shallower water — thereby lowering the cost of energy by increasing power production.

Senu Sirnivas, a principal engineer at the NWTC, has thoroughly enjoyed the opportunity to collaborate with a leading developer in an emerging industry.

“Working with Statoil has been an incredible experience,” Sirnivas said. “At NREL, we have developed several tools to evaluate offshore wind system performance and costs. Our team was very encouraged to know that Statoil saw value in our work, and that these NREL tools and analyses were helping inform what can be the first multi-turbine floating wind turbine array. Developing software tools that are at the cutting edge was thrilling.

“Through this unique experience, we were able to get practical and experience-based feedback, which is going to inform our future work.”

The original study in budget period 1 used a 3-MW Hywind system and focused on design and analysis, turbine size-up scaling, the mooring system, instrumentation, data acquisition, and economic analysis. During budget period 2, the focus shifted to a 6-MW Hywind system and included design and analysis, wake modeling, and geo-spatio-economic assessment.

Design and Analysis

NREL researchers and University of Colorado-Boulder interns conducted multiple design analyses of Hywind's technology. Using Statoil's 6-MW turbine design and control algorithm, NREL built a model of the same size in FASTv7 (FAST7), an NREL software program that models the dynamic forces of wind turbines. The researchers investigated four design load cases: power production, power production plus occurrence of fault, parked (standstill or idling), and parked plus fault conditions. This work found limiting loads for all of the studied cases for the Hywind technology, which Statoil may use to compare against their own findings.

Wake Modeling

The wake modeling portion of the study focused on how the wakes of multiple turbines in an array affect the fatigue loads on downstream turbines. NREL used the FAST7 model built for the design and analysis work package with NREL's high-fidelity simulation tool, Simulator for Wind Farm Applications. The simulations were performed using two high-performance computing systems: Peregrine at NREL and Hexagon at the University of Bergen.

The researchers found that the effect of wake-generated turbulence on the fatigue loads on turbines' mooring lines persisted even at 10 rotor diameters downstream, whereas the load intensities for the turbine blades and the tower decayed with the wake. In addition, researchers used a reduced-order model for wind plant optimization to investigate optimally fixed yaw angles for a 10-by-10 turbine array with 7-rotor-diameter spacing and discovered a 2.4 percent improvement in overall power generation based on a mean hub-height wind speed of 8 meters per second. Such an improvement could mean a

significant increase in revenue or a savings to customers for a full-scale wind plant.

Resource Assessment

NREL also conducted a national economic analysis for Statoil to provide them with information to help understand the market for the Hywind technology in the U.S. The analysis used a new geo-spatio-economic methodology that NREL developed to assess how resource variability in different water depths can influence the levelized cost of energy for different offshore wind technologies. The results of the analysis suggest that there are many suitable U.S. locations where Hywind technology could be deployed, and that innovative logistics strategies under consideration by Statoil could open additional areas to development.

NREL presented Statoil with a report on each of its work packages, and the company may use the results of the collaboration to guide its future projects. NREL researchers have also presented Statoil with proposals for future collaborative efforts. ✎

— Source: NREL

VESTAS INTRODUCES NEW LARGER-ROTOR, HIGHER PERFORMING 3-MW TURBINE VARIANT

The V136-3.45-MW turbine is the newest variant of the proven 3-MW platform, which Vestas continuously optimizes to strengthen its product offerings. Raising the bar for low-wind site performance, the V136-3.45 MW combines Vestas' largest onshore rotor diameter, the Vestas-patented Large Diameter Steel Tower technology, and an advanced blade design. It enables Vestas to increase annual energy production by more than 10 percent compared to the V126-3.3 MW while simultaneously decreasing sound emission levels.

"Combining advanced technology and the proven performance of the 3-MW platform enables the V136-3.45 MW to reduce the cost of energy even further,"

said Anders Vedel, executive vice president for Technology and Service Solutions. "The bigger rotor, taller tower, and advanced aerofoil blade design make this new turbine variant ideal for low-wind sites, which comprise an increasingly important market segment in some countries."

The first V136-3.45-MW turbine is expected to be installed at the Osterild National Test Center for Large Turbines in Northwestern Denmark during 2016. It is expected to be ready for serial production in the second half of 2017. ✎

— Source: Vestas

NREL INDUSTRY GROWTH FORUM ATTRACTS CLEAN ENERGY STARTUPS AND INVESTORS

Thirty clean energy companies will present their business cases to a panel of investors and industry experts November 3 and 4 in Denver, Colorado, as the Energy Department's National Renewable Energy Laboratory (NREL) hosts its annual Industry Growth Forum.

The 30 emerging clean energy startup companies were selected through an application and review process and will compete for the 2015 NREL Clean Energy Venture Awards. For more than 20 years, NREL's Industry Growth Forum has been the nation's premier clean energy investment event. NREL's unique approach and interactive format make the forum a must-attend event for the clean energy business and investment community. Since 2003, presenting companies have raised more than \$5 billion in investment.

In addition to business case presentations, NREL's two-day forum will offer an array of organized networking opportunities and will present a program that highlights clean energy technology and business developments with an agenda



featuring leaders who will address the most important topics in the industry today.

"NREL's Industry Growth Forum creates critical opportunities to connect the various players in the clean energy business community," said William Farris, NREL associate lab director for innovation, partnering, and outreach. "Using the convening power of the laboratory, we bring entrepreneurs directly together with financiers, policymakers, and

technologists. In doing so, we help build the foundation for future conversations, partnerships, and business decisions that strengthen the industry as a whole."

For more information, including the agenda, a list of participating companies, a list of sponsors, and registration details, go to the NREL Industry Growth Forum website, www.industrygrowthforum.org. ↗

— Source: NREL

CONSUMERS ENERGY KEEPING ELECTRIC COSTS AFFORDABLE, ADDING RENEWABLE ENERGY FROM NEW WIND FARM

Consumers Energy is supporting a Michigan-first approach that keeps costs competitive for customers, announcing an agreement today to purchase renewable energy from a new 100-MW wind farm to be built in Michigan's Thumb.

"We are committed to providing electricity that is affordable, reliable, and sustainable, especially as seven of our coal plants will be retired by April 15 next year," said Tim Sparks, Consumers Energy's vice president for energy supply operations. "This new agreement demon-

strates that we will enter into contracts with qualified independent third parties when projects like this one contribute to keeping our business rates competitive and our residential bills affordable."

Consumers Energy has entered into a long-term agreement with Geronimo Energy to buy electricity from the Apple Blossom Wind Farm located in Huron County, which plans to start construction next year. As part of this agreement, Consumers Energy will have a future option to purchase the wind farm.



Consumers Energy is a leader in developing and sustaining renewable energy sources. When this project goes online, Consumers Energy will exceed Michigan's renewable energy portfolio mandate for utilities, having already reached its target of obtaining 10 percent of its electricity from renewable sources a year ahead of schedule.

The company also was named an "environmental champion" in an independent national survey of energy providers last year.

Today, Consumers Energy purchases power from seven Michigan wind farms and owns and operates two wind farms. The company opened the Lake Winds® Energy Park in Mason County in 2012 and the Cross Winds® Energy Park in the Thumb last fall. Consumers Energy also is developing its first community solar program, called Solar Gardens and could start generating electricity as early as next year from potential solar

locations at Grand Valley State University and Western Michigan University to supplement its portfolio of hydro, biomass, landfill gas, and other renewable energy sources.

"Our company has a long history of making investments in wind, solar, and other renewable energy sources on our own when they make sense for the Michigan residents we serve," Sparks said. "Our agreement with Geronimo Energy shows that Consumers Energy is working toward a Michigan-first energy solution powered by renewable resources right here in our state."

Consumers Energy, Michigan's largest utility, is the principal subsidiary of CMS Energy, providing natural gas and electricity to 6.6 million of the state's 10 million residents in all 68 Lower Peninsula counties. ↗

— Source: Consumers Energy

ONSHORE WIND LEADS THE FIELD AS LOWEST COST ENERGY TECHNOLOGY

RenewableUK has welcomed a report by Policy Exchange that demonstrates that onshore wind is on course to be cheaper than new

gas generation, so it needs to be central to the UK's efforts to decarbonize our electricity supply at lowest cost to the consumer.

According to the Policy Exchange's report "Powering Up," the future of onshore wind in the UK estimates that the cost of onshore

wind should fall to £60/MWh by 2020 as a result of using technology advances and a focus on sites in high wind speed areas of the country, predominantly Scotland. This continuing cost reduction make onshore wind cost competitive with new gas plant and significantly cheaper than other options, including nuclear.

The report recommends ways for onshore wind to continue on a subsidy free basis as part of the UK's Contract for Difference scheme.

"The case is clear. Onshore wind is the lowest cost option for Government if we are to decarbonize and replace old capacity set to close over the next few years," said Maf Smith, RenewableUK's Deputy Chief Executive. "Onshore wind is supported by a clear majority of the British public and is a great British success story, delivering high UK content and investment into the UK economy. The



further north we go in our economic powerhouse, the greater the economic importance of onshore wind."

The industry shares Government's ambition to end subsidy, and this report confirms that onshore wind has now arrived at the point where

it can compete head-to-head with high carbon alternatives like gas. The challenge is how Government supports onshore wind moving into a competitive marketplace. ✎

— Source: RenewableUK

THE CURRENT STATE OF ENERGY TECHNOLOGY

When it comes to energy, you can read about what's new on the device that's in your pocket. That's because the Department of Energy (DOE) recently released the second Quadrennial Technology Review (QTR), which explores the current state of technologies in key energy sectors and the R&D opportunities available in the mid-term.

The QTR provides a blueprint for the Energy Department's energy-technology development and for enabling the science that will make future technology breakthroughs possible. But the QTR also makes it clear that it's up to us to carry these opportunities through and make them a reality.

Global climate change, which

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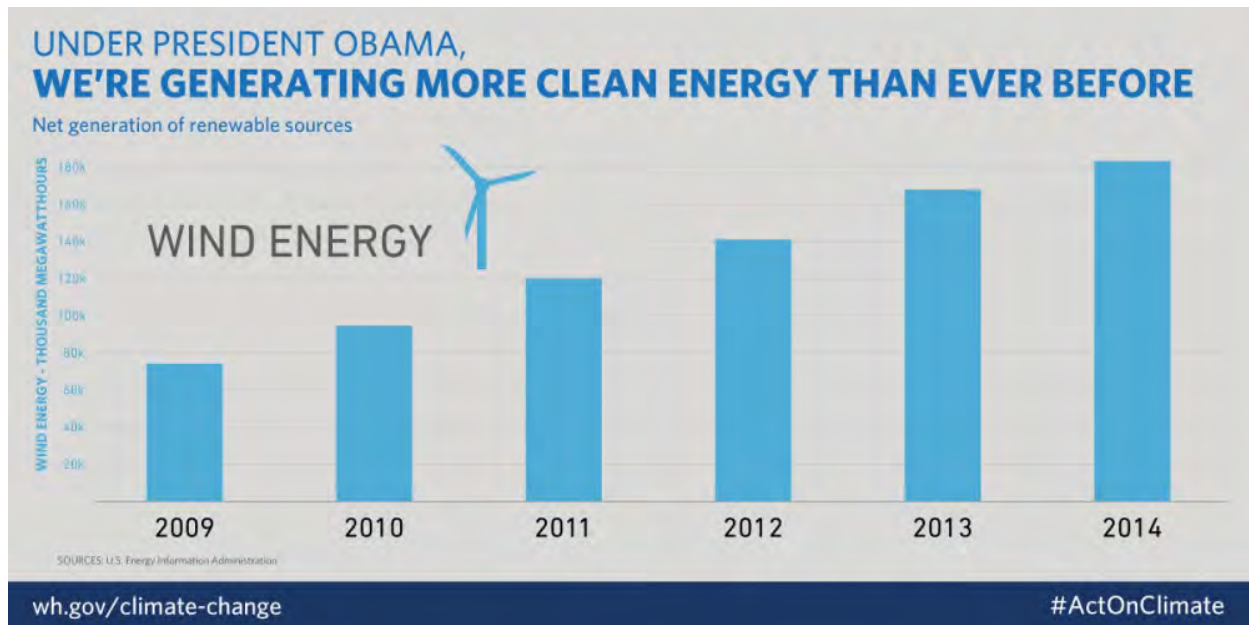
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- 1,800 between the Ages of 19 & 49
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RAILROADS

- Burlington Santa Fe
- Union Pacific
- Rail Lines Cross 30 Miles to the Northeast in Bowie

MAJOR HIGHWAYS

- US Hwys 281 & 380 Intersect in Jacksboro
- State Hwys 114, 119, 59, 148



is caused primarily by carbon pollution from energy use, is one of the most significant threats to the well-being of people living now as well as to that of future generations. The QTR identifies game-changing clean and efficient energy technologies that will reduce emissions of the offending substances. The more of these clean-energy options we deploy — in the transportation sector, in industry, in buildings, in electric power generation — the better our chances of avoiding an unmanageable degree of climate change.

Since the last QTR was published in 2011, the number of large-scale carbon capture and storage demonstration projects has doubled globally. A combined construction and operating license regulatory framework, plus Federal help with financing, is enabling the construction of first four new nuclear reactors in more than 30 years. And renewable energy technologies have dramatically reduced costs and gained market share. And since that first QTR, generation of electricity from solar power has increased tenfold and wind generation of electricity has increased by 50 percent.

But it's not just about the energy we produce. It's about the energy we save. The nation has embraced energy efficiency as a way to reduce energy use and costs, but substantial efficiency opportunities remain untapped. For example, DOE and the wind energy industry are working on tomorrow's efficient refrigerators that will be able to react to signals from utilities and use sensors to control changing temperatures while eliminating the need for polluting refrigerants.

Breakthroughs in next-generation high-tech tools, including x-ray light sources and supercomputers, are helping scientists find new ways to deliver cheaper, faster clean-energy innovation. For example, new neutron imaging techniques at DOE laboratories are helping American companies such as Morris Technologies, now GE Aviation, develop fuel efficient, 3D-printed turbine blades for jet engines.

As the American energy landscape transforms, the QTR provides the DOE, the private sector, and research institutions a foundation to inform decisions about the portfolio of R&D investments to explore in the years to come.

As the U.S. heads into the international climate negotiations this fall, the nation is serious about its ambitious commitment to reduce carbon emissions by 26 to 28 percent by 2025. Technologies catalogued in the QTR will be an essential component of making these reductions a reality.

The range of options available to meet our energy needs is increasing, and this diversification creates a more dependable system and offers consumers new choices. For example, rooftop solar power combined with next-generation energy storage will help consumers cut electric bills while supplying the grid clean power during outages. The QTR helps us see what is possible. We can now see what our clean energy future looks like, but we have to keep the momentum going. ↴

— Source: DOE

IBERDROLA ONCE AGAIN INCLUDED IN THE DOW JONES SUSTAINABILITY INDEX

Iberdrola has again been nominated for the prestigious Dow Jones Sustainability Index (DJSI), the main international benchmark for measuring how companies contribute toward sustainable development.

On the basis of an effective strategy that makes sustainability one of the pillars underpinning its operations and with an overall score of 87 points in the 2015 edition, the company continues to strengthen its position at the forefront of its sector in this new review of the ranking announced today.

The DJSI has acknowledged Iberdrola for its policies, which are geared toward combating climate change, developing human capital, protecting biodiversity, engaging stakeholders, managing the chain of supply, and attracting and retaining talent. The company was also commended for the codes of conduct it has implemented.

It has also once again been ranked among the eight most sustainable electric utilities in the world because of its strategic approach based on international growth and the development of renewable energies. Iberdrola has 25,000 MW from renewable electricity generation sources and it is the world leader in wind power with an installed capacity of over 14,600 MW.

Iberdrola is the only European electrical utility to have been included in all 16 editions of the DJSI. This proves its firm commitment toward sustainability and the effectiveness of its strategy in responding to the main economic, environmental, and social challenges facing energy policy in the domestic and international spheres.

Given the characteristics of its generation mix, its investment profile and the commitments it has undertaken, Iberdrola is poised to

become a reference in the electricity sector's contribution to the decarbonization of the world economy and reducing greenhouse gases with a view to combating climate change.

Iberdrola will be actively involved in the Paris climate summit, where it will be presenting its commitment to reduce the intensity of its CO2 emissions by 50 percent by 2030 compared to the 2007 levels and to be carbon-neutral by 2050. The company's emissions per kWh are currently 30 percent lower than the average of the European electricity sector.

The new goal set by Iberdrola follows other recent initiatives by the Group, such as endorsing an open letter to world leaders, in which the CEOs of 43 major corporations urge

concrete action in order that an ambitious agreement may be reached at the World Climate Summit. The signatory companies, which belong to 20 different economic sectors with operations in over 150 countries, have committed to taking measures aimed at helping control global warming.

Iberdrola was the first Spanish company and one of the first in the world to obtain AENOR certification according to the UNE ISO 14064-1:2006 standard for its greenhouse gas emissions inventory, a catalogue at Group level that covers all its activities in Spain, the UK, the U.S., and Latin America. ✎

— Source: Iberdrola

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