INNOVATION

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ENORMOUS BLADES COULD LEAD TO MORE OFFSHORE WIND ENERGY IN THE U.S.

Todd Griffith shows a cross-section of a 50-meter blade, which is part of the pathway to the 200-meter exascale turbines being planned under a DOE ARPA-E-funded program. The huge turbines could be the basis for 50-MW offshore wind energy installations in the years ahead.

A new design for gigantic blades longer than two football fields could help bring offshore 50-MW wind turbines to the United States and the world.

Sandia National Laboratories' research on the extreme-scale segmented ultralight morphing rotor (SUMR) is funded by the Department of Energy's

ALSO IN THIS SECTION

(DOE) Advanced Research Projects Agency-Energy program. The challenge is to design a low-cost offshore 50-MW turbine requiring a rotor blade that is more than 650 feet (200 meters) long — two-and-a-half times longer than any existing wind blade.

The team is led by the University of Virginia and includes Sandia and researchers from the University of Illinois, the University of Colorado, the Colorado School of Mines and the National Renewable Energy Laboratory. Corporate advisory partners include Dominion Resources, General Electric Co., Siemens AG, and Vestas Wind Systems.

"Exascale turbines take advantage of economies of scale," said Todd Griffith, lead blade designer on the project and technical lead for Sandia's offshore wind energy program.

Sandia's previous work on 13-MW systems uses 100-meter blades (328 feet) on which the initial SUMR designs are based. While a 50-MW horizontal wind turbine is well beyond the size of any current design, studies show that load alignment can dramatically reduce peak stresses and fatigue on the rotor blades. This reduces costs and allows construction of blades big enough for a 50-MW system.

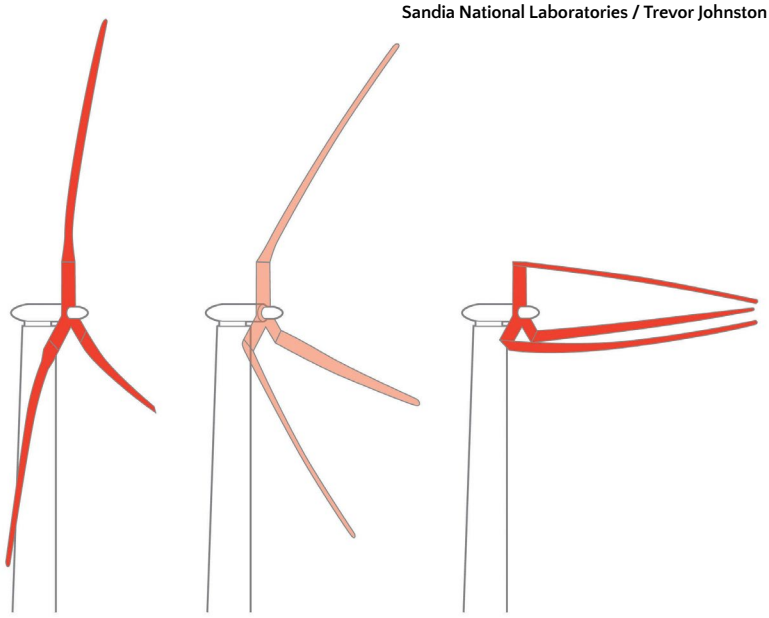
Most current U.S. wind turbines produce power in the 1- to 2-MW range, with blades about 165 feet (50 meters) long, while the largest commercially available turbine is rated at 8 MW with blades 262 feet (80 meters) long.

"The U.S. has great offshore wind energy potential, but offshore installations are expensive," Griffith said. "Larger turbines are needed to capture that energy at an affordable cost."

Barriers remain before designers can scale up to a 50-MW turbine — more than six times the power output of the largest current turbines.

"Conventional upwind blades are expensive to manufacture, deploy, and maintain beyond 10 to 15 MW," Griffith said. "They must be stiff to avoid fatigue and eliminate the risk of tower strikes in strong gusts. Those stiff blades are heavy, and their mass — which is directly related to cost — becomes even more problematic at the extreme scale due to gravity loads and other changes."

Sandia National Laboratories / Trevor Johnston



Sandia's 100-meter blade is the basis for the SUMR, a new low-cost offshore 50-MW wind turbine. At dangerous wind speeds, the blades are stowed and aligned with the wind direction, reducing the risk of damage. At lower wind speeds, the blades spread out more to maximize energy production.

According to Griffith, the new blades could be more easily manufactured in segments, making them more cost-effective and avoiding the unprecedented scale of equipment needed for transport and assembly of blades built as single units.

The exascale turbines would be sited downwind, unlike conventional turbines that are configured with the rotor blades upwind of the tower.

SUMR's load alignment is bio-inspired by the way palm trees move in storms. The lightweight, segmented trunk approximates a series of cylindrical shells that bend in the wind while retaining segment stiffness. This alignment radically reduces the mass required for blade stiffening by reducing the forces on the blades using the palm tree-inspired load-alignment approach.

Segmented turbine blades have a significant advantage in parts of the world at risk for severe storms, such as hurricanes, where offshore turbines must withstand tremendous wind speeds of more than 200 mph. The blades align themselves to reduce cantilever forces on the blade through a trunnion hinge near the hub that responds to changes in wind speed.

"At dangerous wind speeds, the blades are stowed and aligned with the wind direction, reducing the risk of damage," Griffith said. "At lower wind speeds, the blades spread out more to maximize energy production."

Moving toward exascale turbines could be a key way to meet the DOE's goal of providing 20 percent of the nation's energy from wind by 2030, as detailed in its recent Wind Vision Report.

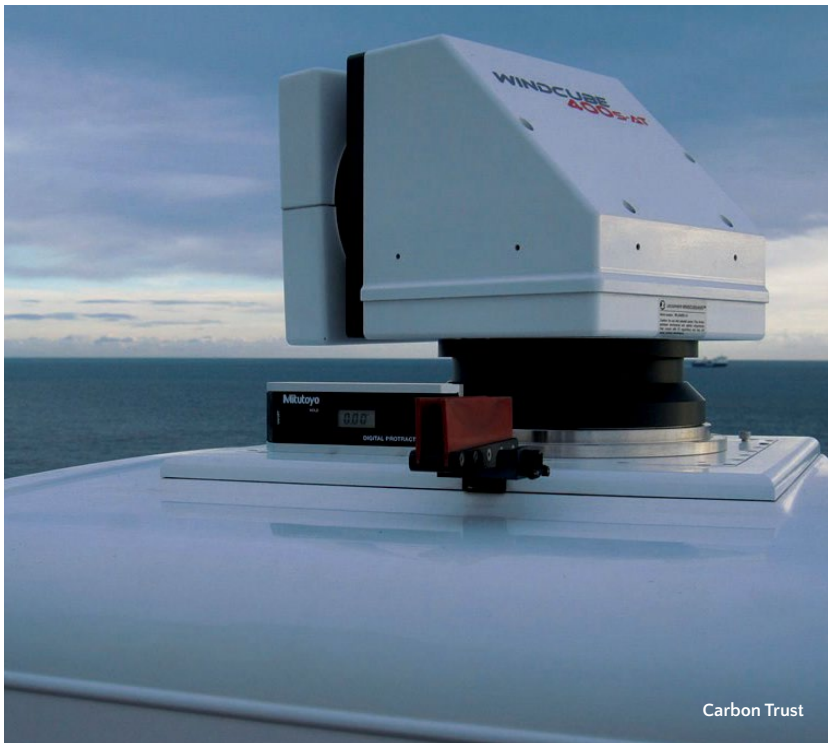
— Source: Sandia National Laboratories

For more information, go to www.sandia.gov.

CARBON TRUST LAUNCHES TECHNOLOGY TRIAL TO CREATE 3-D WIND MAPS FOR OFFSHORE WIND FARMS

The Carbon Trust recently announced the start of the world's largest trial of scanning light detection and ranging (LiDAR) technology taking place in Dublin Bay, Ireland. This is the latest offshore wind accelerator (OWA) project designed to help reduce the cost of energy from offshore wind.

Over the next three months, the most comprehensive test of scanning LiDAR technology will take place where four different scanning LiDAR systems will be put through their paces alongside three vertical profiling LiDARs for validation purposes. The project is being supported by the independent renewable energy company Renewable Energy Systems (RES) and the maritime safety organization Commissioners of Irish Lights.



Carbon Trust

Accurate wind resource measurements are critical to wind farm development because they are used to calculate the potential energy yield from a wind farm, which dictates the terms of the project financing. This can be a significant proportion of the overall project cost, accounting for around 45 percent for an average wind farm.

Scanning LiDAR is not a new technology. Conventionally, it is used by the defense and aerospace industries to monitor for oncoming weather fronts, but it doesn't have a proven track record in offshore wind.

Wind resources are typically measured using large steel towers called met masts, which require a large capital investment incurred at risk before a project is approved adding significant upfront costs that could inhibit the exploration of new sites. The OWA project aims to test how accurately scanning LiDAR technology can measure wind resources for potential wind farm sites, which could deliver significant cost savings in the early stages of wind farm development.

The OWA project has been working for the past few years to support more cost effective solutions and focusing on the development and commercialization of a number of floating LiDAR systems to significantly reduce upfront capital expenditure. However, measurements taken by both masts, and floating LiDAR are limited in that they only provide a measurement of the wind resource at a single point in space. For an offshore wind farm covering an area of up to 200 km^2, this can create uncertainty on the wind speed at locations far from the measurement point. This is known as spatial variation, where measurements may not be representative of the entire site. It is translated into risk incurring additional financing costs to wind farm development.

Scanning LiDAR technology has the potential to reduce the risk associated with spatial variation. These systems are capable of scanning with a usable range of between 10 to 30 km, to impressive levels of detail, taking over 100 measurements per minute. This allows developers to build a much more detailed picture of a site, not only significantly reducing uncertainty of spatial variation, but also allowing developers to better plan the layouts of the turbines to best exploit the individual wind conditions at the site. Increasing confidence on spatial variation could reduce risk to minimal levels, potentially saving money on a project and reducing the cost of energy from offshore wind.

A difference of only 0.2 mph in wind speed can result in significant variation of yield calculations over

the lifetime of a wind farm. Therefore, it is critical that the industry has confidence in scanning LiDAR devices being sensitive enough to detect such small variations. The OWA trial aims to test the sensitivity of the devices to picking up these variations in wind resource.

The units involved in the trial are:

- Three Leosphere windcube vertical profiling LiDARs
- One Leosphere windcube 400s scanning LiDAR
- One Leosphere prototype scanning LiDAR
- Two Lockheed Martin WindTracer scanning LiDARs

"Many factors can impact available wind resources at a potential wind farm site, including its proximity to shore, neighboring wind farms, and as a result of tidal currents," said Megan Smith, project manager for Wakes Research at the Carbon Trust. "This project forms a really important stage of the OWA's efforts to increase the industry's understanding of wind resource measurement and validate the technologies capable of delivering results. Project financing is a significant proportion of cost, so anything we can do to get a deeper understanding of yield will increase investor confidence and lower the cost of financing. Scanning LiDAR has the potential to take our understanding to a completely new level. It is the difference between taking a still photo compared to having a 3-D video with full sound. The need to test the sensitivity of the technology is the next frontier in getting industry acceptance."

The Leosphere windcube 400s will be installed at the Baily lighthouse on the north side of Dublin Bay.

— Source: Carbon Trust

For more information, go to www.carbontrust.com.

Carbon Trust

KINEWELL KLOC SOFTWARE BRINGS ECONOMIC VALUE TO OFFSHORE WIND MARKET

Kinewell Energy recently demonstrated that its new software, KLOC, could have saved an operating offshore wind farm approximately $2.5 million had the technology been available when the wind farm was designed. The northeast England-based company launched the KLOC software in November 2015 following two years of research and development. The innovative software optimizes the geographical layout of offshore wind electrical cables that collect the energy before it is sent to shore.

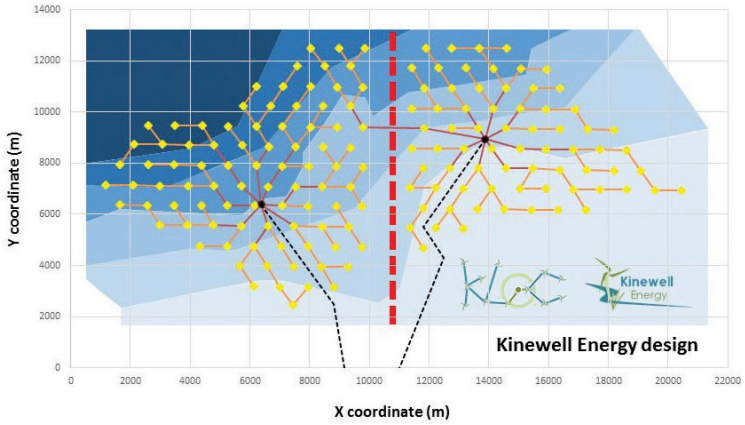
The 576-MW Gwynt-y-Môr offshore wind farm was redesigned in a case study to indicate the vast savings that could be achieved. During the study, Kinewell Energy found that approximately $2.5 million, or 3 percent of the installed cable cost, could be saved by utilizing KLOC compared to traditional design techniques. The savings were realized by reducing the overall cable length by 1.7 km and through the reduction of electrical losses — some 1.2 GWh per year.

"We are very excited by the results of this case study," said Andrew Jenkins, Kinewell Energy's managing director. "It demonstrates the economic impact our innovative KLOC software will have on the U.K. energy market,

which will ultimately lead to savings on household utility bills. If our technology is used for all future U.K. offshore wind farms, we would expect an extra 70 GWh of electrical energy to reach the U.K. each year. That would negate around 27,000 tons of CO2 emissions annually while powering around 16,000 homes — energy that would otherwise be wasted heating the sea."

— Source: Kinewell Energy

For more information,
go to www.kinewell.co.uk.



ANTAIRA RELEASES INDUSTRIAL 8-PORT GIGABIT-MANAGED SWITCHES

Antaira Technologies, a global leading developer and manufacturer of industrial device networking and communication product solutions for harsh environments, recently announced its expansion in the industrial networking infrastructure family with the LMX-0804G-SFP series.

Antaira's new industrial gigabit-managed Ethernet switch series (LMX-0804G-SFP) has been designed to fulfill wind farm applications where demanding operating conditions require that on-site technicians perform maintenance or collect data that can be costly.

Antaira Technologies' LMX-0804G-SFP series is a cost-effective, eight-port industrial gigabit-managed Ethernet switch designed with four 10/100/1000Tx RJ45 ports and four 100/1000 dual rate SFP slots for flexible fiber transmissions so that turbines can communicate over widely dispersed wind farm networks.

Four built-in fiber ports allows for redundancy and failover via ring topologies, making them ideal for wind farm environments in which downtime cannot be afforded. Multiple fiber ports on each switch provide two connections to the redundant ring, plus one additional fiber port to run fiber to the top of the turbine, assuring EMI immunity and network uptime. Redundancy is also strengthened by dual-power inputs on the LMX-0804G-SFP Ethernet switch series that facilitate connections to both the DC power interface and the backup power system.

This industrial-managed Ethernet switch series boasts gigabit speeds and other advanced functionalities such as LAN traffic prioritization capabilities to efficiently handle data-intensive streams such as surveillance cameras, sensors, and network video recorders, which are all integral to today's wind farm operations.

In addition, the LMX-0804G-SFP switch series supports a variety of useful management functions that are an important component of remote monitoring of turbines, which, in many situations, are only occasionally visited by people. When field switches are connected with the SCADA system and network management servers of the control center, the management software helps operators monitor network status by automatically discovering the network topology, displaying real-time alarm information, and presenting traffic statistics and event logs for troubleshooting.

The LMX-0804G-SFP series is backed by a five-year warranty and the units are IP30 rated, compact, fanless, DIN-Rail and wall mountable.

— Source: Antaira Technologies

For more information,
go to www.antaira.com.

Antaira Technologies

KEY CONDITIONS THAT ARE CONDUCIVE TO NEW INNOVATIONS IN WIND ENERGY

By Gordon Moran

Twenty years ago, onshore wind was a minor player that only had specific niches for roles such as small-scale off-grid installations. It now generates 10 to 20 percent of electricity supply in many countries with offshore wind capacity growing rapidly around the globe. Many countries plan to increase their electricity generated from wind power to improve energy security and lower CO2 emissions. The largest growth area has been in Europe, although both China and the United States now account for the majority of installed turbines worldwide. Interest in and the deployment of wind energy has also grown in other parts of the world, including India and South America.

Innovation has played a crucial role in making this achievable, and new developments in wind technology have helped the sector mature over the past 30 years. The basic design of most turbines has remained constant over this period – primarily horizontal axis turbines on top of a tower with variations on scale and installation techniques between offshore and onshore. A range of innovations have helped improve this basic design and move the sector forward, leading to substantial inroads in conventional power generation. Some innovations included the development of sophisticated design software that enables wind farms to be built more cost effectively and maximize their efficiency. Research on effective engagement strategies with the public has also streamlined planning processes, and well-situated turbines have improved levels of public acceptance of the technology. More cost- and time-efficient methods to erect turbines and the capacity necessary to build larger turbines have also reduced costs through larger economies of scale and by having machines that can generate larger amounts of power.

There are a number of factors that will affect the specific technological developments that may arise within a market. The geography of a country is one that can affect the nature of innovation. For example, China is currently increasing its wind energy generation capacity for a combination of energy security and environmental reasons. As a physically large country, it is primarily installing onshore wind farms using widely tested technologies on a large scale in sparsely populated regions. Japan is also looking to increase the proportion of its energy generated from renewables for environmental and energy security reasons, but it is far more densely populated. Japan also lacks large areas for onshore wind farm development or shallow seas in its territorial waters in which to build offshore wind turbines. As a result, Japan has become one of the nations that is pioneering research into floating offshore wind turbines to exploit the resource despite its geographical restrictions.

Countries can also become innovative in certain technologies for somewhat counterintuitive reasons. The United Kingdom, for example, is a leading developer of offshore wind power. Though the country has ideal topography for onshore wind installations, offshore currently receives far greater government support due to concerns such as the aesthetic impact of onshore installations.

Government support for technology is key in most situations. The development of innovative products requires a policy landscape where copyright law is enforced in order for companies to invest and make new technologies commercially viable. There also needs to be a suitable domestic or international market for a company to be investing in, wherever it is on the supply chain. Due to the time and money that is required for a new innovation to become established and adopted in the field, such factors are pivotal.

If a company is able to overcome such hurdles and commercialize a product, it may lead to substantial changes in the sector. One such innovation is a newly developed bladeless turbine from Portugal, which may make installations easier in urban areas of the U.S. and in countries with low levels of social acceptance of bladed onshore turbines. If such a technology can be adopted internationally, innovations that initially served a relatively small domestic market may have substantial development opportunities.

Companies need to be mindful of the factors involved in the development of new innovations in the field, whether they are bringing their own ideas to market or incorporating ones that improve the efficiency and profitability of their business. Innovations can occur at any stage of a supply chain, from more effective planning or manufacturing methods to the repair and decommissioning of turbines. The nature of a market is also important, as some countries such as China work much better with existing technologies while others such as the U.S. may benefit from new cutting-edge technologies to make wind power possible in new locations. It pays to consider the contextual nature of innovative development and accompanying factors that affect it, including copyright law enforcement, the requirements of the country, government support, interconnectedness with other markets, and developed supply chains.

To learn more about renewable energy and energy efficiency through training courses, visit www.euenergycentre.org.

CYBERHAWK CELEBRATES DOUBLE SHORTLISTING FOR ENERGY INNOVATION AWARDS

Cyberhawk Innovations Ltd. recently announced that it has been recognized as a finalist in the 2016 U.K. Energy Innovation Awards in the categories for best offshore renewable innovation and best electricity network improvement.

As a world leader in remotely operated aerial vehicles (ROAV), otherwise known as UAVs or drones, Cyberhawk continues to pioneer the use of this technology for inspection and survey, leading the way in converting ROAV captured data into powerful asset information used to inform strategic asset management decisions.

The company has been named as a finalist for best offshore renewable innovation as a result of the significant cost, time, and safety benefits it offers to both onshore and offshore wind turbine inspection.

Similarly, the shortlisting for best electricity network improvement also draws upon these benefits that Cyberhawk has demonstrated in projects around the world.

A critical part of the company's offering, covered within both categories, is iHawk. This cloud-based asset management software plays a key role in the company's service offering. Designed in-house, it allows clients to intuitively access the valuable asset management information that has been collected by Cyberhawk's ROAVs and analyzed by Cyberhawk's engineers using iHawk software. The unique software uses a map-based interface and displays asset status using a traffic light color-coding system, allowing users to drill into findings to view high definition images and engineering commentary.

"We are extremely proud to have been recognized for the powerful combination of ROAV data collection and asset management software in two categories at this year's U.K. Energy Innovations Award," Craig Roberts, CEO at Cyberhawk. "Cyberhawk conducted the very first ROAV industrial inspection in 2010 and has since built an unrivalled track record in the utilities, wind, oil and gas, and rail sectors based on safe flight operations and on the conversion of drone-captured data into actionable asset management information in the cloud. This shortlisting is testament to our skilled and dedicated team and the progressive, innovative focus of our business."

Cyberhawk is headquartered in Livingston, Scotland, with bases in the Middle East and Southeast Asia. The company has completed more than 25 world firsts, with blue-chip customers in more than 20 countries on four continents.

Now it its seventh year, the Energy Innovation Awards recognize the ideas and technologies developed by pioneering businesses that have the potential to shape the future of the energy sector. Winners will be announced at a prestigious awards ceremony on April 28 at the Hilton Manchester Deansgate in the U.K.

— Source: Cyberhawk Innovations

For more information, go to www.thecyberhawk.com.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