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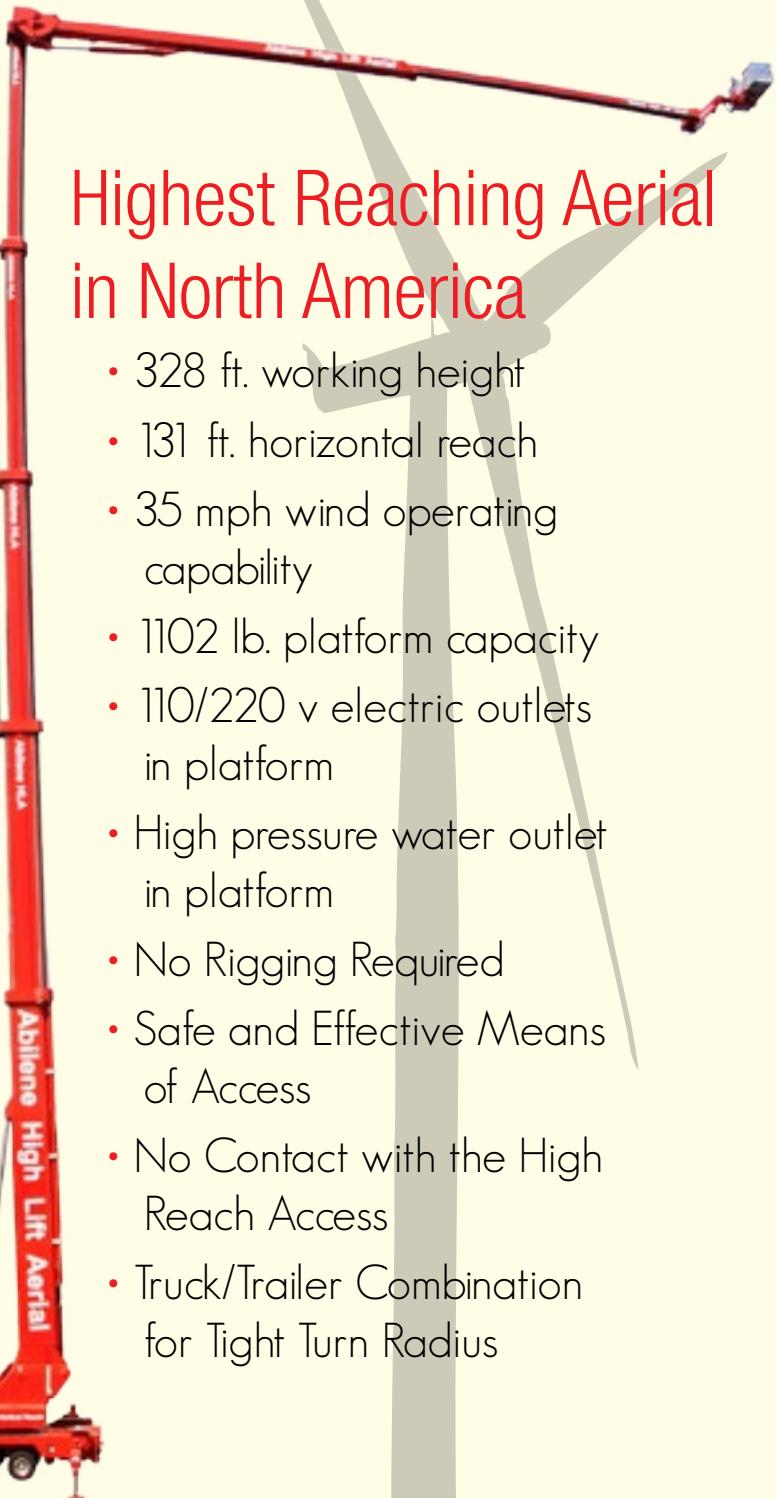
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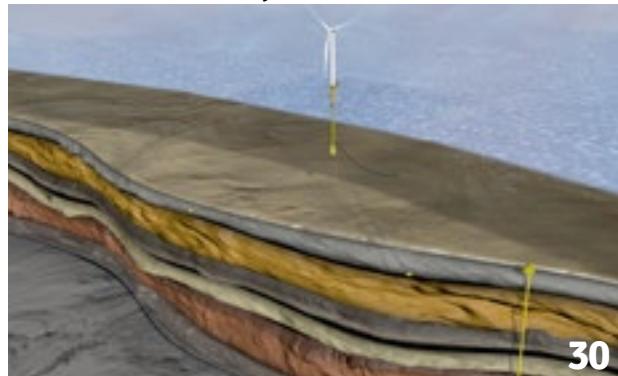
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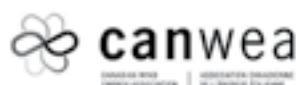


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# EDITOR'S DESK

JUNE 2016

As wind turbines continue to age, it's up to O&M service providers to keep the blades turning.

Welcome to the June issue of *Wind Systems* magazine! This month we're focusing on the maintenance side of O&M as well as condition monitoring, two key aspects of the wind energy industry. It's crucial for a wind turbine to reach the optimal level of its performance to maximize gains and cut operating costs. Wind turbine O&M services are important as they reduce the number of wind turbine breakdowns and losses caused due to downtime.

According to "The Wind Energy Operations & Maintenance Report 2016" by Wind Energy Update, the industry has advanced over the last 20 years in terms of turbine performance. This is attributed to a number of factors, including advanced controls for load mitigations, full power converters for improved grid code compliance, and better sensors for more accurate control and monitoring, among others. This strong growth in wind power capacity in recent years has led to a dramatic increase in the number of turbines approaching the end of the OEM's warranty period. Additionally, post-warranty service costs have fallen on increased competition and technological advances.

OEMs typically provide three-quarters of post-warranty service contracts. But in the United States where the wind industry market is extremely price competitive, a growing number of independent service providers (ISPs) are competing for a piece of that pie. Some operators are even opting to use in-house O&M services over the OEMs and ISPs.

A recent market research report published by Transparency Market Research estimated the total value of the global wind turbine operations and maintenance market to be \$9.3 billion in 2014. According to the report, the wind energy market will expand at a favorable 8.8-percent compound annual growth rate (CAGR) from 2015 through 2023, rising to a total value of \$20.6 billion.

For this month's company profile, we spoke with Michael Feldstein at Surface Technology Inc. to learn more about how his company is meeting the demands of the wind energy market with its composite electroless nickel (CEN) plating technology wherein the wind turbine components are made more durable and can withstand the extreme climates in which they operate. We also spoke with Ruben Guerrero from Lighthosue Global Energy for this month's conversation. There, you'll learn more about how the company entered the wind energy market and what the industry can expect from Lighthouse Global moving forward.

You'll also find two technical articles in this issue — one on the growth in the use of drones to inspect wind turbines by SkySpecs co-founder and CTO Tom Brady and the other by Patrik Ölund, the head of research and development at Ovako AB, that explores the advantages of using a stronger, cleaner class of steel in wind energy applications.

As always, thanks for reading!



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**Patrik Ölund** is the head of research and development at Ovako AB, a leading European producer and North American supplier of engineering steel for the bearing, transport, and manufacturing industries. In his article, he describes the development of super clean isotropic steels that can meet the exacting requirements of the wind power industry without incurring the high costs involved in the use of re-melted steels. For more information, go to [www.ovako.com](http://www.ovako.com).

**Tom Brady** is the co-founder and the CTO at SkySpecs, an Ann Arbor, Michigan-based drone technology startup focused on making drones viable tools for enterprises. Prior to SkySpecs and while pursuing his master's degree in aerospace engineering at the University of Michigan, Brady worked with Michigan Autonomous Aerial Vehicles (MAAV) on an autonomous drone that could map and navigate unknown buildings.



## FROM OUR ARCHIVES

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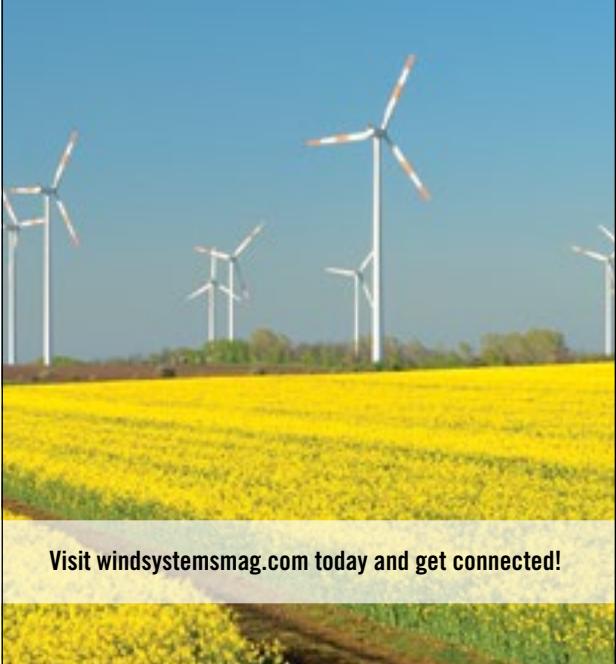
*Giving Wind Direction*

# WIND SYSTEMS

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# DIRECTION

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## AMERICAN WIND ENERGY GENERATION OFF TO A GOOD START IN 2016



According to the American Wind Energy Association (AWEA), the American wind power industry had its most productive first quarter for installations since 2012 as demand rises for wind's low-cost, zero-carbon energy.

Wind added 520 MW of new electric generating capacity to the power grid from January through March, according to AWEA's U.S. Wind Industry First Quarter 2016 Market Report. Construction started on another 2,000 MW, with a total of more than 10,100 MW of wind capacity now under construction.

"Our productive first quarter reflects the strength of American wind power entering 2016. We have a low-cost product that's in high demand," said Tom Kiernan, CEO of AWEA. "As the wind business builds momentum, we're prepared to double wind's contribution to America's electricity supply in the next five years."

There are now more than 48,800 wind turbines operating in 40 states plus Puerto Rico and, for the first time, Guam. This is enough to power 20 million average homes with 74,512 MW of total installed capacity. Turbines were installed at seven projects across six states this quarter. Oklahoma led the country with 270 MW of wind capacity installations, followed by Iowa (154 MW), Utah (62 MW), and New Mexico (32 MW).

According to AWEA, more wind power is on the way. Construction starts in the first quarter, bringing the total to 10,100 MW now under construction with an additional 5,100 MW in advanced stages of development and nearing construction.

Texas remains the leader for total installed capacity and reported construction activity, and it accounted for over 54 percent of construction underway during the first quarter. The Plains region of Oklahoma, Kansas, and Nebraska came next

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with 18 percent of construction activity, followed by the Midwest at 12 percent.

The Department of Energy (DOE) Wind Vision report shows that wind power can double in the next five years to supply 10 percent of U.S. electricity demand by 2020 and double again to reach 20 percent by 2030.

The newest quarterly market results follow the release of AWEA's 2015 U.S. Wind Industry Annual Market Report, which highlights the growing demand for wind energy in 2015. The cost of wind power has fallen by two-thirds since 2009, helping to make wind energy the electricity source of choice for American states, utilities, and other emerging buyers. Last year, wind installed the most new electric generating capacity nationwide at 41 percent, followed by solar at 28.5 percent and natural gas at 28.1 percent.

Low costs have prompted strong growth in wind investment by Fortune 500 companies and other emerging buyers through long-term power purchase agreements (PPAs). The Department of Defense joined Fortune 500 companies 3M and Salesforce, among others, to contract for 246 MW of wind in the first quarter, over a third of the capacity purchased in 2016's first three months.

Including traditional utility buyers, more than 660 MW of PPAs were announced during the first quarter of 2016, contributing to more than 4,500 MW of PPAs signed since the beginning of 2015.

Project developers and manufacturers are also investing in new technology to produce turbines that reach steadier, more powerful winds at greater heights, opening new areas to be developed economically. America's tallest operating wind turbine can now be found in Iowa. The 154-MW Adams wind farm, completed in the first quarter by MidAmerican Energy, includes one prototype wind turbine — designed and supplied by Siemens — that uses an innovative concrete tower design to reach a record-breaking hub height of approximately 115 meters with a rotor diameter of 108 meters.

"This is the first concrete tower project for Siemens in North America, we're proud to say the tower technology was conceived, designed, engineered, and constructed entirely in the U.S.," said Michael McManus, head of business development and strategy for Siemens Americas Onshore Wind. "This project marks another milestone in our successful partnership with MidAmerican Energy to expand clean, renewable wind power in Iowa and demonstrates Siemens' continuous dedication to innovation to drive down the cost of wind energy around the globe."

Turbine manufacturers reported over 800 MW of new orders in the first quarter. The wind industry supported 88,000 jobs in the U.S. at the start of the year — an increase of 20 percent from 2014 — including over 21,000 jobs in manufacturing wind turbine parts and materials at more than 500 factories across 43 states.

Many states and utilities are moving forward with their plans to cut carbon pollution despite the Supreme Court stay of EPA's Clean Power Plan. Wind energy is the biggest, fastest, and cheapest way for states to cut carbon pollution and comply with the plan, according to analysis of EIA data, and states that add wind energy now can benefit from increases in jobs and consumer savings ahead of the initial Clean Power Plan compliance period in 2022.

Building long-distance transmission infrastructure is another key part of America's clean energy future. Adding transmission capacity helps move low-cost wind energy to cities where it's needed most, saving consumers money and increasing the resilience of the electricity grid. Working with local authorities to develop clear siting laws is also vital to making sure that wind projects can be sited efficiently and to the benefit of local communities. ↗

Source: AWEA

For more information,  
go to [www.awea.org](http://www.awea.org).

## NREL DISTRIBUTES FOURTH ROUND OF FUNDING FOR COMPETITIVENESS IMPROVEMENT PROJECT

The United States Department of Energy (DOE) National Renewable Energy Laboratory (NREL) is awarding four subcontracts under the fourth round of funding through DOE's Distributed Wind Competitiveness Improvement Project (CIP).

The CIP aims to help manufacturers of small- and mid-size wind turbines improve their turbine design and manufacturing processes while reducing costs and improving efficiency as they work toward certification. Certification for these turbines is important because it demonstrates to consumers that they meet performance and safety requirements.

The DOE Wind and Water Power Program sponsors the CIP as part of its multifaceted wind energy research portfolio to help the U.S. wind industry develop competitive, high-performance technology for domestic and global energy markets. NREL implements all CIP awards, provides technical oversight of awards, and supplies technical assistance to CIP awardees during the technology advancement or certification process.

Two awardees were selected in the certification testing category, which is dedicated to turbines with a rotor-swept area less than 200 square meters. Primus Wind Power

Inc. of Lakewood, Colorado, will receive \$150,000 in funding to conduct certification testing on its 400-watt AIR30 model turbine. Bergey Windpower of Norman, Oklahoma, received an award for \$152,558 to conduct certification testing of the Bergey Excel 15 turbine.

Certification testing for wind turbines is conducted to either the International Electrotechnical Commission (IEC) standard or the American Wind Energy Association (AWEA) small wind turbine performance and safety standard. These certifications include power performance, acoustic emissions, safety and function, and duration tests. A design review of the structural components is also conducted.

Two awardees were selected in the type certification category, which is dedicated to turbines with rotor-swept areas between 200 and 1,000 square



The Distributed Wind Energy Association (DWEA)

meters. Northern Power Systems of Barre, Vermont, will receive \$447,000 to conduct type certification testing on its NPS100-24/37m IEC Class IIIA model wind turbine. The second awardee, Endurance Wind Power Inc. of Seattle, Washington, will receive \$450,000 to conduct type certification testing on its model X35 225-kilowatt wind turbine.

Type certification for wind turbines in this category is conducted to

the IEC standard. This certification begins with a rigorous design review and issuing a design certificate. Type testing and component tests are also required for the issuing of type certification. Type testing includes safety and function test, power performance test, load measurements, acoustic noise test, and blade test.

The awardees will complete their projects within an 18-month period of performance. With the announce-

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ment of the four new subcontract awards, NREL has awarded CIP funding to 16 subcontracts through this DOE program. The previous recipients of subcontracts in the first three rounds of funding were:

- Round 1: Bergey Windpower for component improvements and overall system optimization and Pika Energy (manufacturing process upgrades)
- Round 2: Endurance Wind Power (prototype testing), Northern Power Systems (component improvements and overall system optimization), Pika Energy (component improvements and overall system optimization and manufacturing process upgrades), and

Urban Green Energy (certification testing)

- Round 3: Intergrid (component improvements and overall system optimization), Pika Energy (component improvements and overall system optimization), Primus Windpower (certification testing), Ventera Wind (Certification Testing), and Wetzel Engineering (component improvements and overall system optimization) ↗

*Source: NREL*

For more information,  
go to [www.nrel.gov](http://www.nrel.gov).

## ENBRIDGE TO ACQUIRE 50-PERCENT INTEREST IN FRENCH OFFSHORE WIND DEVELOPMENT COMPANY

Enbridge Inc. recently announced it has agreed to acquire a 50-percent interest in Éolien Maritime France SAS (EMF), a French offshore wind development company, for an investment of \$282 million inclusive of transaction costs and past and future pre-final investment decision (FID) development costs. EMF will be co-owned with EDF Energies Nouvelles (EDF EN), a subsidiary of Électricité de France S.A. (EDF) dedicated to renewable energy.

Enbridge and EDF EN will co-develop three large-scale offshore wind farms off the coast of France that will produce a combined 1,428 MW of power. Development of the three projects is already underway, however, construction is subject to FID and regulatory approvals.

"This is a unique and strategic opportunity for Enbridge to further grow our investment in renewable power and build on our existing presence in European offshore wind generation," said Al Monaco, president and CEO of Enbridge. "This investment in EMF advances our priority to build new business platforms that will extend and diversify growth. The EMF development opportunities are underpinned by strong market fundamentals and a commercial framework that is well-aligned with our low-risk business model. Once fully operational, they are expected to generate attractive returns and accretion to available cash flow from operations."

Each of the three wind projects has been awarded a 20-year power purchase agreement (PPA) pursuant to which EDF, the power off-taker under the PPAs, will pay an indexed fixed price for 100 percent of the power generated by each facility, through which EMF will also be significantly insulated from variances in wind capacity. These three projects are in an advanced stage of development with a permitting process close to completion, as well as significant technical and environmental studies already performed. Front-end engineering and design have been completed, construction contracts have been tendered, and bids have been received.

The following are the three projects under development by EMF:

1. 498-MW Eoliennes Offshore des Hautes Falaises offshore wind farm located off the coast of Fecamp, France
2. 450-MW Eoliennes Offshore du Calvados project located off the coast of Courseulles-sur-Mer, France
3. 480-MW Parc du Banc de Guerande project located off the coast of Saint-Nazaire, France

Subject to Enbridge taking positive FID on each project individually, it would potentially invest up to \$4.5 billion in total for all three projects. Should the projects achieve FID, construction would start gradually from 2017 and continue on through the next five years through 2022.

The initial investment in EMF was included in Enbridge's secured growth program and will be funded from available liquidity. No incremental equity funding will be required. The incremental equity and debt required to construct the projects will be sourced once FIDs have been made. EMF is pursuing non-recourse project-debt financing for the debt component of the investment.

Enbridge is the co-owner, along with EDF Energies Nouvelles' Group, of four operating onshore wind projects in North America.

Enbridge has interests in 24 renewable energy facilities that are either operating, secured, or under construction with a net generating operating capacity of nearly 2,000 MW. The projects in operation produce enough gross power to supply power to more than 750,000 homes. During the past decade, Enbridge has invested nearly \$5 billion in renewable power generation and transmission. ↗

*Source: Enbridge*

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# inFOCUS

## The Growth of Drones in the Wind Energy Industry

By Tom Brady

**S**maller computers and sensors, better battery technology, and vastly improved algorithms for managing flight and safety have transformed drones from a niche hobby into a global craze over the last three to five years. Drones that once required a professional pilot to operate effectively are now essential tools for businesses spanning every industry from delivery to industrial inspection. However, drone technology is still at the tip of the iceberg in terms of what's possible. As such, many businesses have opted to wait to see what technologies and vendors emerge as leading providers of drone services and technology. Wind turbine operations and maintenance is one industry that is well-positioned to benefit in the near term from drone use in their operations.

### WIND ENERGY AND DRONES ARE AN EASY FIT

The primary purpose of any drone is to carry cameras and other sensors to places that are challenging (economically or physically) to access. In the wind sector, blade inspection operations benefit tremendously from drone use. Instead of up-tower or ground-based inspection methods, a drone-based blade inspection involves a drone carrying a high-definition camera along each of the four sides of each of the three blades on a given tower. A technician conducting a blade inspection with a drone will typically find it most efficient to examine the images after an inspection flight. However,

video and data-streaming products also make it quite simple to view the pictures or video on a mobile device in real time.

While pictures and video are most prevalent in terms of output from a drone inspection, drones are not limited to carrying cameras alone. Other sensors such as thermal cameras, ultrasonic sensors, and laser scanners are also useful in wind turbine blade inspections and can readily be configured to be carried and controlled by a drone. In fact, the type and variety of sensors that may be carried by a drone are limited only by its payload and, if applicable, its power storage and distribution capabilities.

### HOW TO STAY SAFE WHEN IT COMES TO DRONES

Safety is a primary concern for any operation in the wind energy sector. Drones are a new technology that come with their own set of hazards, as well as features and processes to mitigate

these respective risks. It's important for a drone operator to be familiar with these drone safety technologies and general aviation safety guidelines, in addition to all aspects of turbine inspection safety.

Anti-collision is a hot topic in the drone industry. As one might expect, anti-collision technologies prevent collisions, typically in the context of preventing collisions with things that the drone can see or observe using some sort of sensing technology. Sensors such as laser range finders or sonar are well-suit-



ed for identifying and avoiding wind turbines. Vision-based systems and radar, on the other hand, are better suited for detecting and avoiding other aircraft. There are a limited number of off-the-shelf drones that come equipped with these types of technologies; however, see-and-avoid sensing solutions will likely become standard with any off-the-shelf commercial drone purchase in the near future.



A technology known as “geo-fencing” keeps a drone within global positioning systems (GPS) boundaries prescribed by the user or as mandated by air traffic control laws. Some implementations of this technology allow the user to define no-entry zones in the exact same way as one would define a no-exit zone. Technologies like this can be used, for example, to demarcate an area surrounding a wind turbine where the drone should not

go inside. Geo-fencing is a complement and not a replacement for see-and-avoid. For example, imagine that your eyes are closed and that someone has asked you to take a picture at the edge of a cliff, which you’re told is 10 yards away from you. This scenario is like trying to do an inspection with geo-fencing alone. In the example of taking a picture at the edge of a cliff, you would probably be comfortable taking six or seven steps forward, but

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after that, it's probably not safe for you to proceed. See-and-avoid is the equivalent of opening your eyes. Just as opening your eyes gives you the ability to take those last few steps, so too does see-and-avoid allow the drone to get as close to a wind turbine blade as is safely possible.

### THE BUZZ ABOUT AUTONOMY

Autonomy, for better or worse, has become a marketing buzzword in the drone technology sector. The word autonomy can mean anything from autonomous stability control to full-fledged automated surveys or inspections. As a prospective buyer, this can be confusing.

Most commercial drones navigate throughout the world with GPS. For many of these drones, onboard software allows the drone to follow coordinates, or waypoints, that are defined by the user using Google Maps or a similar application. This mode of autonomous navigation is convenient for surveying large areas or any kind of flight plan where the waypoints are spaced far apart. High-precision navigation tasks like wind turbine blade inspection have different requirements both in terms of user input and navigation techniques.

Navigation solely based on GPS falls short in the same way as geo-fencing. After all, they are based on the same underlying GPS technology. Advanced techniques that take input from multiple sensors beyond just GPS have come to the forefront

as early adopters of drone technology in the wind energy sector begin to identify and adjust for the shortcomings of GPS. Combining multiple sensor inputs to achieve a unified understanding of the world and a robot's place within it is commonly referred to as sensor fusion. One example of a sensor fusion-based approach to navigation might involve the robot using GPS to make a guess at where the robot is located in the world, and then use a camera to hone in on its precise location. Humans regularly employ this type of approach to navigation. Any time you've ever been lost in a new city and come to a familiar intersection, your whole understanding of where you are falls into place. Visual cues can help both humans and drones navigate in this manner.

### ROOM FOR GROWTH

Drones are an affordable and efficient means for collecting wind turbine blade inspection data, but what their use implies for preventative maintenance is perhaps even more exciting. Conveniently, drones generally "know" where they are located when they take a picture or collect some other piece of data. This makes it trivial to query pictures from the exact same location on the same blade over the past several inspections to see, for example, how a crack is progressing through time. Also, because drone inspections can be completed faster than manual inspections, and some day without



human supervision, the sheer quantity of inspection data that will be available will be a launchpad for new approaches to analytics. ↗

# A STRONGER, CLEANER STEEL FOR APPLICATIONS IN WIND TURBINES

By Patrik Ölund

As demand for renewable energy grows and wind turbines become an ever-increasingly common sight, the nature of their application is forcing engineers to look for steels with exceptional properties to meet the extreme demands placed on components in wind turbines.

High-performance steel is used for fasteners to hold wind turbines to the ground, to assemble the modules of the tower, and to attach the blades. Steel bar is used to make the anchor chains in offshore applications, while steel tube and bar is used for cylinders, pistons, and pumps that control slewing and pitch. Tube, bar, and rolled rings are used for bearings, gears, shafts, and couplings.

These components are expected to perform continuously in remote locations and in some of the harshest environments. They have to cope with the power and unpredictability of the wind, which creates high, multi-directional transient loads as wind speed and direction change, in addition to the massive cost of downtime if components fail.

Steel of very high cleanliness with a consistent microstructure and high re-

sistance to fatigue and impact can be produced by advanced re-melting techniques, but the lengthy and complex processes involved — decarburization, vacuum induction melting, and vacuum arc re-melting — are expensive and have limited availability. However, advances in ladle metallurgy and testing procedures are now making it possible to produce low alloy air-melt steels that can compete with re-melt steels in terms of fatigue strength. With fatigue accounting for approximately 90 percent of all mechanical service failures, the potential benefits to the wind power industry are considerable.

## THE INFLUENCE OF INCLUSIONS

It is well-known that the intrinsic fatigue limit of steel increases with the strength or hardness of the steel by a factor of approximately 1.6. However, as the strength of the steel increases, the obtained fatigue limit is increasingly lower than the intrinsic limit. This is the result of material defects, such as inclusions, acting as stress raisers and promoting fatigue crack initiation (see Figure 1).

In rotating beam fatigue tests, inclusions found at the sites where fatigue was initiated were analyzed for chemical composition, size, and location. The results were used to construct the empirical curves as shown in Figure 2. This shows that higher-strength steels are more affected by the presence of inclusions. Steel with an intrinsic strength of 640 MPa (400 HV) will not show any further improvement in fatigue strength once oxide inclusions are less than 20  $\mu\text{m}$ . However, there is much greater potential for higher-strength steels to be improved and to get closer to the steel's intrinsic strength. For a steel with an intrinsic strength of 1120 MPa (700 HV), the critical inclusion size is just 6  $\mu\text{m}$ .

## LOADING DIRECTION AND VOLUME

Steel is typically anisotropic, so its fatigue strength will vary depending on the loading axis. This is exaggerated by the rolling process, during which inclusions are crushed and elongated in the direction of rolling (see Figure 3). The loaded volume also influences the likelihood of finding an inclusion of critical

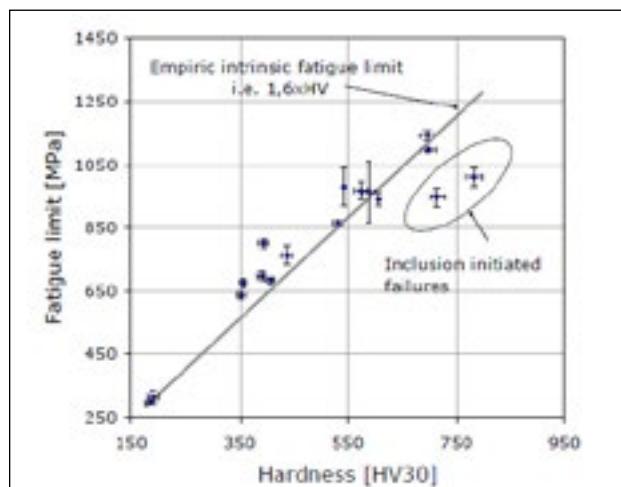


Figure 1: Fatigue limit defined as 107 cycles on rotating bending fatigue samples versus hardness.

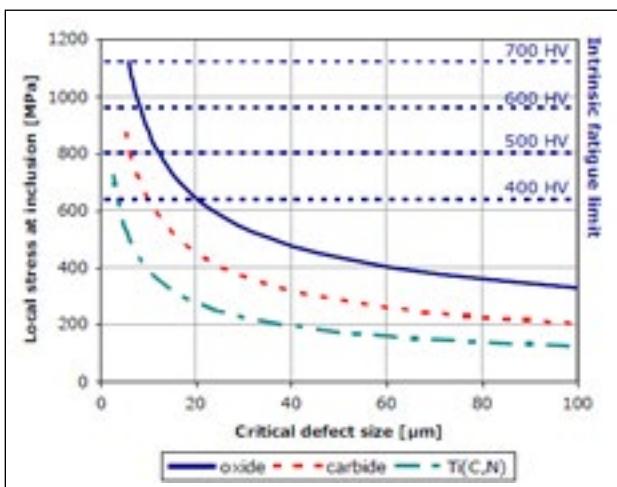


Figure 2: Expected applied stress that will cause a fatigue failure versus the critical defect size (equivalent circular diameter).

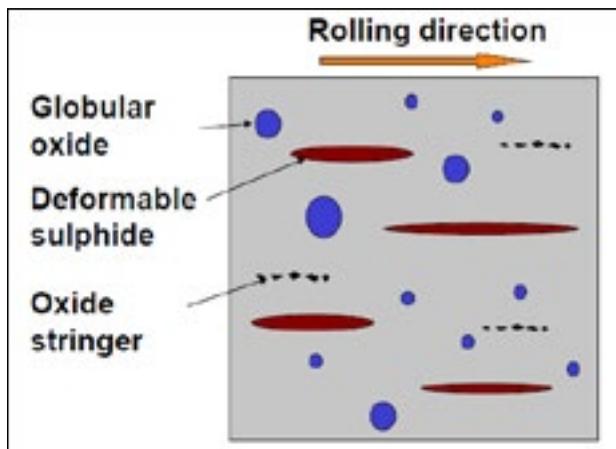


Figure 3: Schematic model of a conventionally processed steel with inclusions elongated in the rolling direction and with globular undeformable oxides.

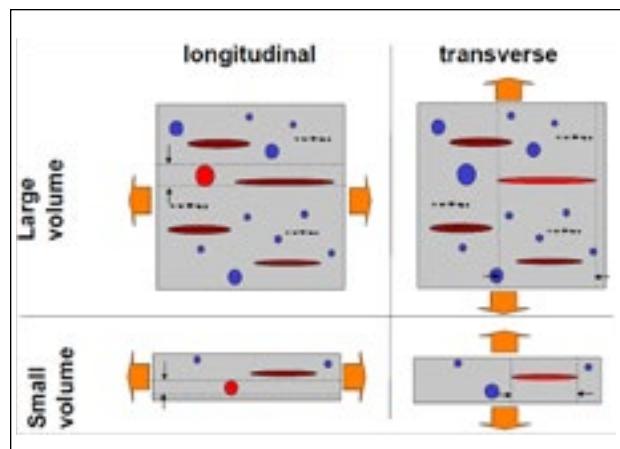


Figure 4: Influence of the loading direction and volume on the maximum projected area of an inclusion in the loaded volume.

size, therefore, a large volume that's loaded transversely to the rolling direction has a much higher probability of failure (see Figure 4).

Using current technologies, data can be collected on a material's morphology, chemical composition, and the position of inclusions. This data can be used to calculate the probability of finding inclusions of a certain size. Using the empirical relationship established in Figure 2, it is then possible to convert the inclusion size into the stress required to cause a fatigue failure.

Using this methodology, analysis of sulphide inclusions in a 100 m<sup>3</sup> volume of high sulphur 50CrMo4 steel, loaded in the direction of rolling, shows a 5-percent failure rate at a stress of 800 MPa. When the loading is transverse to the rolling direction, 5 percent will fail at a stress of 200 MPa.

## ISOTROPIC QUALITY PROCESS

This ability to quantify the inclusion population in standard steels has enabled Ovako AB, a leading European producer of engineering steel for the bearing, transport, and manufacturing industries, to make dramatic improvements in the steel-making process and to introduce new processes that are capable of producing steels that can match re-melt quality.

The isotropic quality (IQ) process is based on Ovako's standard ingot casting process for the production of bearing quality steel, and it has two key objectives — to improve structural fatigue properties and to produce a more isotropic steel.

The key differences in the process are in the selection of scrap and raw materials, increased desulphurization (down below 20 ppm), increased degassing time, the use of argon shrouding during ingot casting, increased soaking time to improve homogenization, and increased crop-off mass in bil-

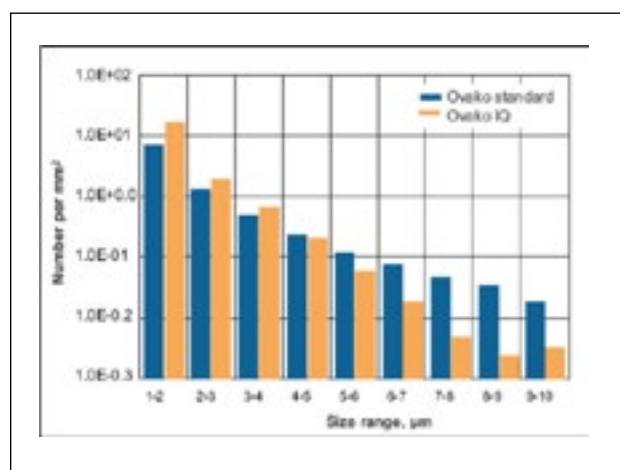


Figure 5: The graph shows the distribution of small inclusions in IQ-processed steel compared to conventionally processed low-sulphur, ball-bearing steel. The test dimension was a 90 mm steel bar.

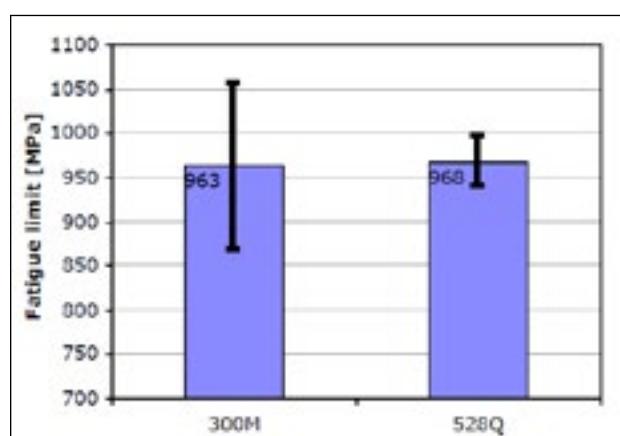
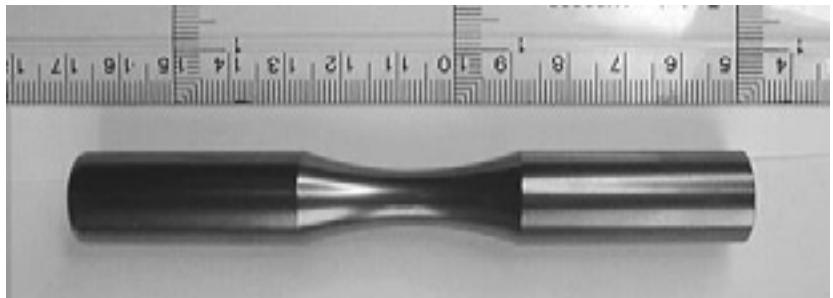


Figure 6: The graph shows the fatigue properties of an IQ-processed steel (528Q) compared to a steel produced through vacuum arc re-melting.

let production to reduce segregation and minimize the number of macro inclusions.

The IQ process does not remove the oxide inclusions, but based on the influence of inclusion size on fatigue, it creates a much finer distribution so that the number of inclusions below 4 µm is higher than in conventionally produced steel (see Figure 5). Inclusions that are smaller than 4 µm would require a very high stress to cause a fatigue failure (close to the intrinsic strength of the steel itself).

In rotating beam fatigue tests, the fatigue life of IQ-processed steel was found to increase by a factor of 10 over conventionally processed steel. When compared to a 300M steel (a low-alloy steel of very high strength) produced through vacuum arc re-melting (VAR), the determined fatigue limit and the size of inclusions that initiated fatigue



failures were almost identical (see Figure 6).

In order to measure improvements in isotropy, a conventionally produced 50CrMo4 steel was compared to an IQ-processed variant. In each case, billets were cross-rolled into a plate from which samples were machined, orientated both longitudinally and transversely to the initial rolling direction.

While the IQ-processed steel showed virtually no difference in fatigue limit between the longitudinal and transverse samples, the conventional steel could

A test sample for a rotating beam fatigue test.

only achieve half the fatigue limit when loaded into the transverse direction.

Selection of suitable clean steel produced through advanced ladle technology offers the desired fatigue strength for use in wind turbine applications. When making material selection for use in such demanding applications, detailed knowledge — not only of the magnitude of the applied stress, but also in loading direction and loaded volume — is crucial. ↗

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## RENEWABLE NRG AND VENTUS INSTALL WIND IRIS LIDAR AT FIRST URUGUAYAN WIND FARM

Renewable NRG Systems (RNRG) and Ventus Ingeniería recently announced the acquisition and installation of a Wind Iris nacelle-mounted Lidar at the 20-MW Caracoles wind farm in Uruguay. The Wind Iris will monitor turbine performance and offer optimization solutions for the project.

Located in the Sierra de Caracoles in the Maldonado region of the country, the project is composed of 10 Vestas V80 2-MW turbines. The wind farm is owned by UTE, Uruguay's national utility and electricity market regulator. UTE has the monopoly over all distribution and transmission activities across the country. It is also the off-taker of all private wind farms with private purchase agreements (PPAs).

The measurement campaign's objective is to evaluate and quantify the performance of one specific turbine with state-of-the-art Lidar technology and to propose solutions to improve the energy production. Based on the results reported by RNRG and Ventus, UTE will evaluate the success of the campaign and make a decision regarding the potential performance evaluation of the other wind turbines in the fleet.

Commissioned in 2010, Caracoles is the first wind farm commissioned in Uruguay. Since then, the country experienced a spectacular wind energy boom. With 850 MW already operating and more than 650 MW set to be installed in the next 12 months, Uruguay is taking a leading position in South America's energy transition.

"Uruguay has set a very ambitious national target for wind power," said Evan Osler, Sr., the technical lead for remote sensing at RNRG. "The country is on its way to achieving a staggering 45 percent wind penetration by the beginning of 2017. The installation of this first Wind Iris



in Latin America demonstrates the Uruguayan market maturity in benchmarking turbine performance and maximizing AEP with cutting-edge measurement technology."

Caracoles presents moderately complex terrain and ambient turbine wakes, which means that proper filtering and data treatment is critical. Fortunately, the Wind Iris yaw correction algorithm has already been validated in both waked and complex wind flow conditions — making it a strong fit for the job at hand.

"We offer independent performance evaluation packages to our clients, and to that purpose, Wind Iris is the best tool to get the job done," said Juan Pablo Saltre, founding partner of Ventus. "From our clients' perspective, the most important advantage of using Wind Iris is that the ROI of these campaigns is easily quantifiable using the standard equations and real data." ↗

*Source: Renewable NRG Systems*

For more information,  
go to [www.renewablenrgsystems.com](http://www.renewablenrgsystems.com).

## AWS TRUEPOWER ACQUIRES ENERGY-RELATED FORECASTING ASSETS FROM MESO INC.

AWS Truepower, an international leader in wind and solar energy consulting and engineering services, recently announced that it has acquired the energy-related forecasting assets of Meso, Inc., their long-term partner in renewable energy forecasting and grid services.

Meso, a founding partner of the former TrueWind Solutions, and AWS Truepower have collaborated for years in providing wind and solar power forecasting services to the utility and renewable energy industries around the world. Major clients include the California ISO, ERCOT, Hawai-

ian Electric, New York ISO, Ontario IESO, E.ON, and Enel. Thanks to this partnership, AWS Truepower has become the top wind and solar forecaster in North America with forecasts being provided for over 50,000 MW of capacity.

Meso and AWS Truepower have also worked closely together on numerous ground-breaking research projects around forecasting and grid integration, and Meso has provided key support for the development of AWS Truepower's wind mapping and modeling systems, which continue to lead the industry in accuracy.

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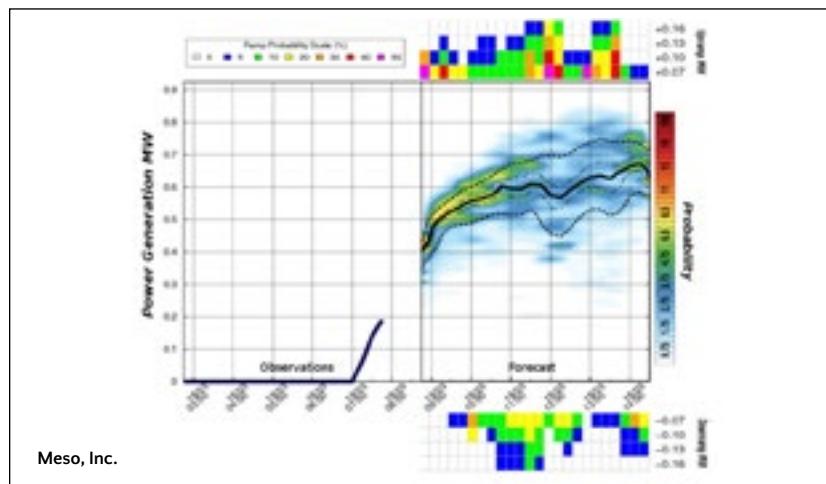
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"By joining together, we expect to achieve even more success in the future," said Bruce Bailey, CEO of AWS Truepower. "This move consolidates the Meso and AWS Truepower operations, enabling us to serve our clients more effectively and positioning us to invest in new markets for forecasting and other grid solutions."

Meso's staff joined AWS Truepower as part of the company's Grid Solutions business unit. John Zack, president of Meso, will lead the new unit as vice president for Grid Solutions. ↗

*Source: AWS Truepower*

For more information,  
go to [www.awstruepower.com](http://www.awstruepower.com).



Meso uses numerical weather prediction (NWP) model data, observations, and production data from wind or solar generation facilities as inputs into several statistical models that adjust the forecasts for specific locations.

## ALLIANZ RISK TRANSFER AND PARTNERS DEVELOP SWAP SOLUTION TO HEDGE VOLATILE REVENUES OF WIND FARMS

Allianz Risk Transfer Limited (ART) and partners have developed an innovative risk management solution for hedging wind volume risks for wind farms. ART has executed a 10-year proxy revenue swap with Capital Power's Bloom Wind Farm, which will be constructed near Dodge City, Kansas.

This new risk management tool for the wind energy industry was created and commercialized through a partnership among ART, Nephila Capital Limited, REsurety, Inc., and Altenex, LLC. The 10-year agreement will secure long-term predictable revenues and mitigate power generation volume uncertainty related to wind resources for the 178-MW Bloom Wind Farm.

"This new product line for the wind power industry will enable more efficient and cost-effective financing of wind generation projects," said Karsten Berlage, managing director of ART. "Due to the high upfront costs of modern utility-scale wind projects, it is important for investors in such projects to be able to secure long-term stable revenues to underpin the investment."

Traditionally, price-focused hedging solutions have been commonly used to try to address this, but this newly created proxy revenue swap offers an entirely new form of revenue risk management for the wind power industry. Similar

in concept to a tolling agreement or capacity payment, this novel structure swaps the floating revenues of a wind farm — those driven by the hourly wind resource and power prices — for a fixed annual payment. This transaction



is the first in a robust pipeline of future wind financings and would also be feasible in other wind farm markets globally beyond the United States.

The ART-led swap is unique in several aspects. According to Berlage, recent advances in data availability for the U.S. wind market as well as in risk assessment and modeling allowed this unprecedented scope of risk transfer within a single product, which is available for up to 10 years.

"In contrast to more short-term and price-focused hedging approaches, for the first time, price and wind volume risks of a wind farm have been managed at the tenor needed to support a project's capital structure and balance sheet," Berlage said. "The result is a level of revenue certainty never before available to the wind industry."

Each partner contributed highly specialized expertise to create this innovative swap solution. ART and Nephila leveraged their collective weather risk transfer expertise, risk capacity, underwriting sophistication, and

credit strength. REsurety has provided the specialized risk analyses relied upon for the structuring of the proxy revenue swap and delivers ongoing services as the calculation agent for the transaction. Altenex supports the management of power price-linked risk as part of the proxy revenue swap structure.

ART and Nephila have a long-standing partnership in the weather and catastrophe risk markets and have worked with REsurety since 2012 to develop risk transfer products for the wind power industry. More recently, through a partnership established between REsurety and Altenex in 2015, protection against low wind output has been expanded to include power price risk as well as generation volume-linked risk exposures. ↗

*Source: Allianz Risk Transfer*

For more information,  
go to [www.agcs.allianz.com](http://www.agcs.allianz.com).

## CYBERHAWK COMPLETES ROAV INSPECTIONS FOR FOREWIND'S DOGGER BANK METEOROLOGICAL MASTS

Cyberhawk Innovations, a world leader in remotely operated aerial vehicle (ROAV) inspection and survey, recently completed an operation and maintenance inspection project on Forewind's Dogger Bank meteorological masts using ROAVs.

The project required a team of three from Cyberhawk, including offshore ROAV pilots and a mechanical engineer, mobilize to the Round 3 development site to undertake ROAV inspections of the two meteorological masts. Dogger Bank is a particularly challenging offshore wind farm site because it is the furthest offshore wind project from United Kingdom shores at approximately 150 kilometers from the U.K. coast.

The inspections took just one day per met mast, which represents a dramatic time saving in comparison with traditional methods that could take at least double the time. The use of ROAV also significantly improved safety levels by reducing the requirement for personnel to climb the towers and work at great heights.

"We were delighted with this contract award as it demonstrated Forewind's confidence in our capabilities and experience, having successfully completed previous projects with the consortium," said Philip Buchan, commercial director at Cyberhawk. "Once again, our inspection solution has proven that professionally operated ROAV can capture equal, if not more, detailed results than sending in personnel."

According to Buchan, the safety benefits come hand-in-hand with reduced costs and quicker inspection time, all of which are being increasingly recognized by wind farm operators both onshore and offshore.

"Cyberhawk continues to demonstrate how ROAV can be safely and effectively used to carry out inspection work in the offshore wind sector," said Forewind's safety manager Nachaat Tahmaz. "We were extremely pleased with the inspection completed and in the quality of the detailed report provided." ↗

*Source: Cyberhawk Innovations*

For more information,  
go to [www.thecyberhawk.com](http://www.thecyberhawk.com).



Cyberhawk

# PROFILE

## Surface Technology, Inc.

*Since opening its doors amid the oil crisis in the 1970s, Surface Technology, Inc. has been a leading supplier of composite electroless coatings to many industries, including wind energy.*

By Anna Claire Howard

In the midst of the recession plaguing the United States following the Arab oil embargo with oil being both scarce and expensive, plastic became the new material of choice for many manufacturers who sought to replace heavy metal parts with lighter, less-expensive alternatives. However, there was one problem. There needed to be a way to apply metal coatings to these plastic nonconductors, and, at this point in time, the technology to do so was not yet well developed. That is, not until Surface Technology entered the market in 1973.

According to Michael Feldstein, the son of the company's late founder, Dr. Nathan Feldstein, and the current president and director of innovation, Surface Technology developed the key technology on how to more effectively activate plastic in order to achieve a metallurgical bond of a subsequent coating. This technology was of even greater use in the growing computer and electronics industries where new non-conductive materials like printed circuit boards needed to be coated with specialty metal plating.

"Our original focus on R&D of new methods of plating onto plastics and other nonconductors was vitally important in the 1970s as energy



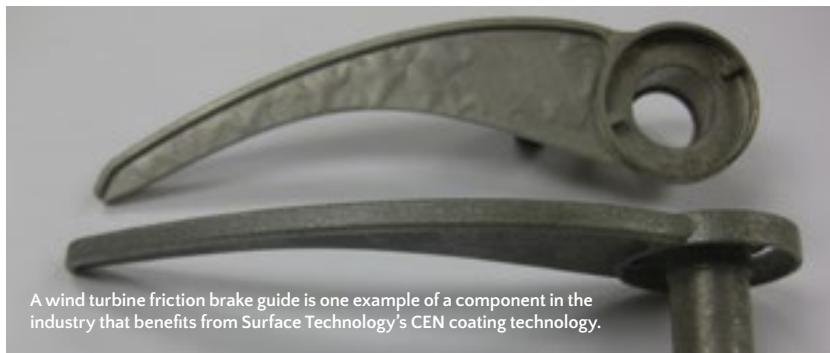
Surface Technology's new headquarters in Ewing, New Jersey.

prices soared," Feldstein said. "This work demonstrated the need for improvements in the plating itself, so we've evolved tremendously to pioneer important new varieties of electroless nickel (EN) and composite electroless nickel (CEN) coatings where fine particles are incorporated into the plating to add or enhance properties."

As the company became more involved in this industry-changing endeavor, it became apparent that in addition to the demand for coatings on nonconductors, there was also a growing need for advanced coatings. According to Feldstein, this meant that coatings didn't only need to have the properties of the metal in the



Dr. Nathan Feldstein and Michael Feldstein present a composite diamond-coated golf club to President Gerald Ford. This coating makes the ball travel 7 percent further.



A wind turbine friction brake guide is one example of a component in the industry that benefits from Surface Technology's CEN coating technology.



Surface Technology's chemical products.

coating — such as nickel, chrome, or nickel-phosphorous — but they also needed synergistic properties.

To address this need, Surface Technology optimized a process that incorporates fine diamond particles into the metal coatings for enhanced hardness, wear resistance, and heat transfer, as well as other materials such as ceramics and fluropolymers into coatings that required low friction or release features.

"The utility of such advanced electroless coatings is often most advantageous on more intricate parts with complex geometries," Feldstein said. "That required overcoming a number of significant inherent challenges, including stepping away from the age-old practice of coating metals by electroplating, which is when electricity is used to make the coating adhere to the metal object."

Coatings are essential in many applications for proper performance and protection. However, according to Feldstein, choosing the best coating for components in the wind energy industry can be challenging because these parts come in a wide array of shapes, sizes, and base metals and are used in an equally broad range of climates and usage conditions (e.g., gears, bearings, friction devices, and rotors inside of the gearbox and turbine).

"Applications in the wind energy industry are especially challenging," Feldstein said. "Wind turbines are used in countless environments, and demand high performance, and in-

volve costly downtime. This requires material and surface properties that are more advanced than the age-old coatings. These factors make the applications most suitable for our advanced composite electroless coatings that offer a synergy of properties."

One way that coatings can enhance wind industry applications is through CEN plating. According to Feldstein, EN is a reliable chemical process with many inherent features that are well-suited to the wind energy industry, including corrosion resistance and perfect conformity to complex geometries. Composites are formed with the addition of super-fine particles to the EN, which provide hardness, wear resistance, low friction, release, heat transfer, and high friction, as well as identification and authentication properties.

In other words, the CEN plating takes advantage of the synergies between EN and the added particles in order to enhance the metal's existing characteristics and potentially create new properties, thereby applying a class of coatings with a wide variety of performance and economic advantages to the diverse and demanding components used in the wind energy industry.

As a global leader in composite electroless coatings, Surface Technology sets itself apart in the industries it serves through its dedication to research and development, a legacy that was left behind by Nathan Feldstein and that the company continues to uphold today.

"Surface Technology engages in the greatest level of R&D for new coatings in our field, and the optimization of coatings to best serve customer needs," Feldstein said. "We enjoy the challenge of new applications, and the wind energy industry is outstanding in developing and fostering those."

One example of a new property that Surface Technology has added to its synergistic composite coatings as well as its traditional platings, paints, and powder coatings is the element of identification and authentication.

"Through a partnership with a company that manufactures forensic materials used to protect national currencies against counterfeiting, we are able to add these materials into our coatings, which allows companies to identify their parts for maintenance, warranty, and tracking purposes," Feldstein said.

One way Surface Technology accomplished this and applied it to wind industry applications was by incorporating particles with light-emitting properties into EN coatings. According to Feldstein, these coatings appear as normal EN under traditional lighting, such as sunlight or fluorescent light. However, under ultraviolet (UV) light, they emit a bright colored glow.



The uniformity of composite diamond coating around the edge of a wind turbine blade.

"A person only needs to shine a handheld, battery-operated UV light on the components to display the light emission of the specialized coating to confirm the authenticity of the parts," Feldstein said.

This technology can also be used to show wear and to avoid damage to the part itself.

"With a thin layer of a light-emitting coating between the sub-

strate and the functional coating, an operator can inspect the part periodically with a portable UV light while the part is still in use," Feldstein said. "If the colored light shows up, it is understood that the functional coating has worn away. The part can then be recoated and reused before substrate damage to the part itself occurs and before inferior product is produced."

According to Feldstein, this feature can be especially beneficial in the wind energy industry to allow the inspection of a component without the high cost of part removal or downtime.

"Aside from our specialized composite coatings, Surface Technology is uniquely able to work with customers in the wind industry to optimize coatings for their needs," Feldstein said. "We especially enjoy the opportunities wherein our customers' develop-

ment teams work with us to engineer new parts that take advantage of the performance benefits of our coatings, like when they are able to use lighter base materials that are coated with one of our wear-resistant coatings to save on overall weight and cost."

Moving forward and following the five-year extension of the federal production tax credit (PTC), Feldstein said that as the U.S. wind energy industry continues to grow, so will Surface Technology in order to meet its demands.

"We are proud to be moving to a new, much larger customized facility with even greater capacity," Feldstein said. "This will expand our ability to apply our specialized coatings to a greater number and size of parts for use in the wind industry." ↗

For more information, go to [www.surfacetechnology.com](http://www.surfacetechnology.com).

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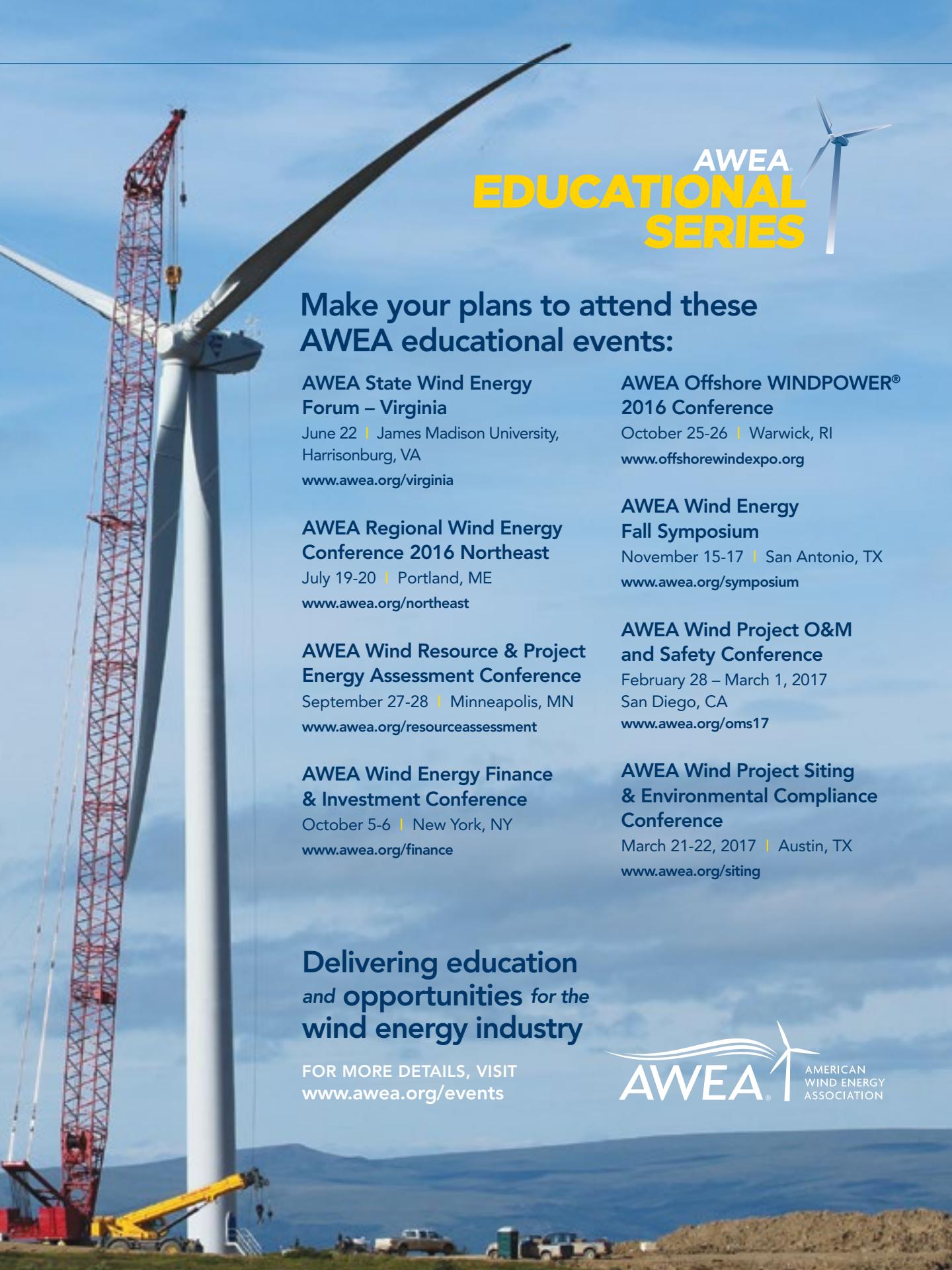
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# CONVERSATION

## Ruben Guerrero

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### Please tell us how you became involved in the wind energy industry.

In 2007, I sought a career that was exciting, challenging, and different from my previous years serving in the military. At that time, the wind energy industry was all three of those and then some. Transitioning from the military to wind was tough because of the infancy of the industry and the multiple growing pains between the European companies transitioning to the United States market. However, this experience has given me an appreciation and the perspective of how the industry has grown over the last nine years. Having a strong background in operations from working previously as a field technician, site manager, regional manager, and quality manager, the transition to sales at Lighthouse Global Energy

was smooth. I am excited to be with Lighthouse Global because I still feel like a part of the operations side through our customer interactions and through the distribution of the parts they need to help their wind farms produce high availability and reduce downtime.

### How was Lighthouse Global Energy started, and how did it make its way into the wind energy industry?

Lighthouse Global was created from Texas Aerospace Services, a leading aerospace component repair facility established in 1967 in Abilene, Texas. In 2013, the company decided to expand its experience in overhaul and repairs from the aerospace industry into the wind energy industry. Being strategically located in Abilene with close proximity to the largest wind farms in North America allowed Lighthouse Global to provide component repairs and distribution solutions for our customers' most complex needs.

### Tell us about the repair services Lighthouse Global offers the wind energy industry and what the company does to combat costly downtime.

We offer a range of complex repair services from pitch systems to yaw systems. To minimize downtime,

Lighthouse Global inventories replacement parts to allow quick turn-around times on the repair services. We also work with the customers to identify usage rates to minimize delivery and downtime.

### Could you give us an example of how you've worked with a customer to solve their specific problem?

Being transparent with our customers in communication generates trust, which is something we strive for at Lighthouse Global. For example, a customer came to us with a brake coil to repair. We notified our motor repair division and scheduled a couple of onsite meetings to identify the customers' expectations and failure rates. This repair was not our normal type of repair, so we utilized our machine shop capabilities to fabricate specialty tooling for winding and testing the coils. Once we completed the overhaul and testing of the coils, we delivered to the site for onsite testing. In the end, we were able to decrease the lead time of the unit, reducing turbine downtime and giving our customer approximately 50-percent cost savings versus new.

### What are some of the advantages of working with Lighthouse Global?

Lighthouse Global understands some of the tough wind farm challenges

that keep our customers up at night. We strive to deliver replacement parts on time; whether it's overhaul repairs, new parts, or machine work, our goal is to eliminate and reduce the customers' downtime. Lighthouse Global's partnership with component OEMs strengthens our repair and distribution to deliver original equipment parts and repairs. The benefit of partnering with OEMs is the technical support and staying current with component upgrades that we pass along to our customers.

### **What sets these services and the company apart from some of its competitors?**

Aligning our goals with our customers' expectations gives us the ability to service their needs and requirements. We believe in communicating with each customer on a one-on-one basis to identify their unique requirements and situations. Through our distribution partnerships, repair/overhauls, machine shop services, and motor repair division, we can offer more in-house support to minimize our customers' downtime.

### **Tell us about Lighthouse Global's manufacturing capabilities.**

Lighthouse Global has fabricated everything from oil containments to specialty wind tooling for the industry. Our in-house machines and manufacturing capabilities include waterjet cutting, lathes, mills, drilling, gear hobber, saws, pressing, welding, and grinding.

### **What are some issues wind farm owners and operators face when using or purchasing used or refurbished units?**

Long lead times and shorter warranty periods. Additionally, not all owner and operator units are economically repairable. Lighthouse Global con-

tinues to establish partnerships with component OEMs, and our in-house engineers communicate with them to develop final performance testing on all repairs. Working with the OEMs provides us with the opportunity to replace the non-repairable units with new units.

### **What can the wind energy industry expect from Lighthouse Global moving forward?**

We are committed to providing solutions to our customers in the areas of repair services and distribution of new components. We will continue to improve our processes through solid engineering practices and a commitment to high quality.

### **What is your view on the future of the wind energy industry, including Lighthouse Global's role in it?**

The industry has high energy right now due to the growth in new construction, and that will continue to grow with the recent production tax credit (PTC) extension. One certainty is that with the increasing age of installed turbines, the components' failure rate will increase as well. Lighthouse Global is committed to bridging the gap on new replacement parts through partnerships and warehousing while offering high-quality repairs when buying new is not an option. Lighthouse Global's research and development department's sole function is to evaluate new repairs and develop procedures and test equipment. This ensures that all repairs delivered to the wind farms are repaired and tested to the customer's approval and specifications. ↗

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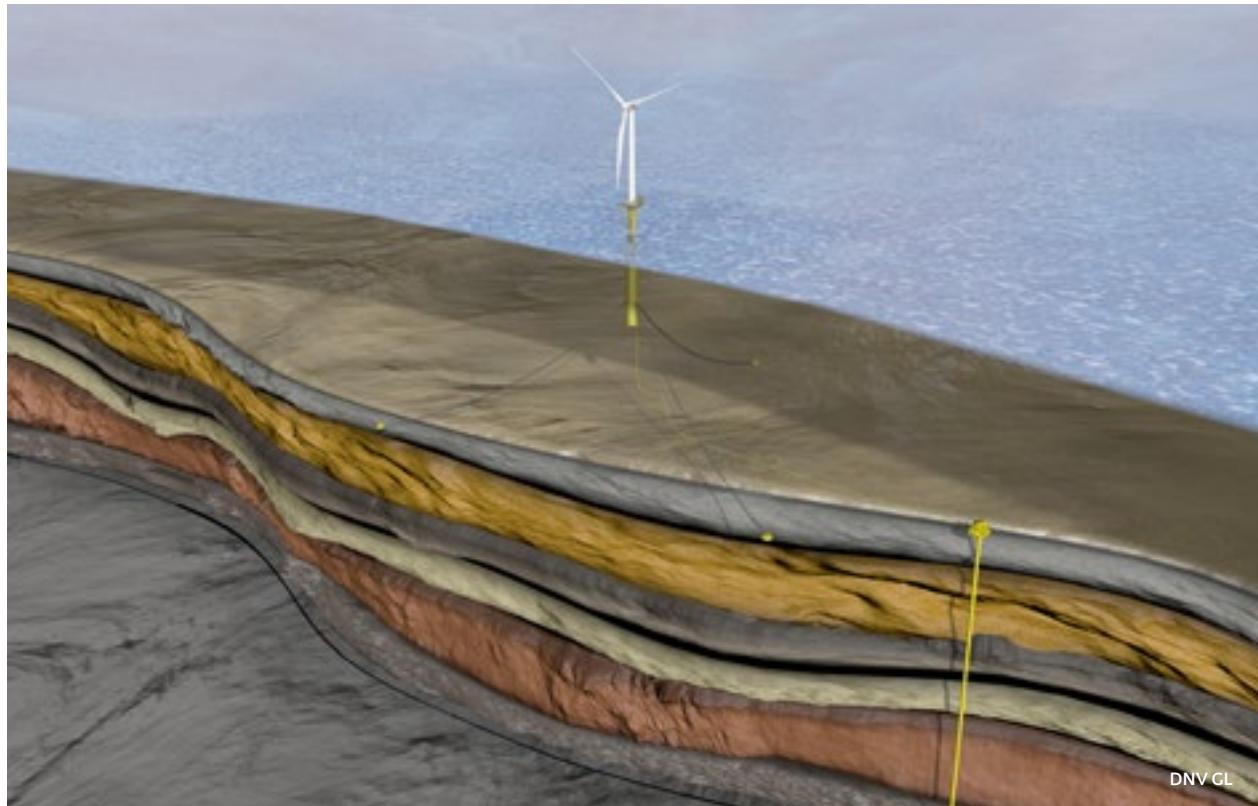
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## DNV GL-LED PROJECT GIVES GREEN LIGHT FOR WIND-POWERED OIL RECOVERY



The DNV GL-led wind-powered water injection (Win Win) joint industry project (JIP) shows that, for suitable fields, wind-powered water injection is technically feasible, capable of meeting performance targets, and offers a cost-competitive alternative to conventional water injection solutions.

For the past year, participants from both the renewable and oil and gas industries have worked together in the

DNV GL-led Win Win JIP to develop the concept of using floating wind turbines to power a water injection system in detail and assess its technical and commercial feasibility. Technical and operational aspects as well as costs have been assessed. The JIP partners include ExxonMobil, ENI Norge, Nexen Petroleum UK Ltd., Statoil, VNG Norge, PG Flow Solutions, and ORE Catapult.

### ALSO IN THIS SECTION

**33** Virtual Lidar Model Helps Researchers Plan for Wake Steering Experiment at SWIFT

**34** Ingeteam Improves DFIG's Fault Ride Through (FRT) Behavior with Crowbarless Solution

According to DNV GL, no major challenges have been identified through the JIP's study. Analyses of system performance examining site-specific cases from JIP partners have shown that Win Win is able to meet the operator's key performance requirements that include injection volume targets as well as reliability and minimized downtime.

"For the first time, we can now see renewable energy as a large scale source of power to offshore oil and gas operations," said Remi Eriksen, group president and CEO of DNV GL. "By utilizing the recent developments of floating offshore wind turbines, this concept can offer a clean, reliable, and cost-effective alternative for powering water injection in offshore locations. The Win Win project showcases that the oil and gas industry can become a creative force in solving the world's energy trilemma by driving the development of reliable, clean, and affordable technologies. This is a win for both the oil and gas and for the wind power industries."

According to Sara Ortwein, president of the Exxon-Mobil Upstream Research Company, such technological advances improve the economic feasibility for wind to contribute to the overall energy supply mix.

"We are encouraged by recent advances in wind technology, particularly for niche applications such as offshore oil and gas operations," Ortwein said.

The costs for wind-powered water injection have been

compared with a conventional alternative where water is injected through a flow line from the host platform. While the Win Win technology has higher operational expenditures (OPEX) compared to a conventional alternative, the significantly lower capital expenditure (CAPEX) means that it compares favorably over the long term. Therefore, Win Win is a commercially competitive alternative in a range of cases, particularly when host platform capacity is limited or injection wells are located far away.

"For the specific example assessed in the report, we are looking at a potential cost saving of approximately 20 percent compared to a conventional solution, and this will of course vary greatly between cases," said Johan Sandberg, project sponsor and segment leader of floating wind turbines at DNV GL. "To develop the concept further, a next step would be to test critical subsystems in a small-scale physical setup. The key objective would be to gain assurance that the components integrated in this configuration will offer satisfactory performance over time with a variable power input. A potential phase two of the JIP is being explored with some of the current JIP partners." ↗

Source: DNV GL

For more information,  
go to [www.dnvg.com](http://www.dnvg.com).

## SIEMENS INTRODUCES DIGITAL SERVICES FOR ENERGY POWERED BY SINALYTICS

The Siemens Power Generation Services Division has been advancing the development of digital trends, building upon its more than 20 years of experience collecting and analyzing data as part of its power diagnostics services. The company is deploying projects and devoting significant resources to unlock the full potential of this transformation. Siemens has developed a number of advanced, data-driven service offerings that combine big data with the company's comprehensive domain expertise to support its industrial, oil and gas, electric utility, and wind power customers. Siemens Digital Services for Energy powered by Sinalytics was officially unveiled at the Hannover Messe industrial fair in Hannover, Germany.

Siemens Digital Services for Energy are intelligent knowledge systems that are enabled by advanced algorithms, sophisticated data analytics, and pioneering machine-learning combined with domain know-how to create new business models that are continuously fed by as-operated and as-maintained fleet and unit-specific data. This approach

facilitates tailored service solutions designed to meet customer needs for operational flexibility, plant performance, condition-based maintenance, and more. These data analytics also contribute to the development of new and improved processes and provide valuable insights that can be used in future technology design.

"Big data is transforming our industry into a digitally driven, intelligent ecosystem," said Randy Zwirn, CEO of Siemens Power Generation Services. "Siemens is investing significant resources across its various businesses to successfully marry the physical and virtual worlds. With more than 300,000 devices already connected through our powerful Sinalytics platform architecture, we are able to put to work our vast experience and deep know-how to pioneer digital services that create game-changing value for our customers."

These advanced data-driven service solutions are enabled by Sinalytics — Siemens' secure, scalable, and industrial-strength analytics platform architecture, capable of inte-

grating huge volumes of complex data. Over 300,000 devices are connected company-wide through Sinalytics. Beyond simply collecting this data or providing customers with a standalone software platform, Siemens is integrating valuable, insight-driven analytics with field service data, global fleet performance data, and data from other diverse sources.

An important element of Sinalytics is Siemens' cyber security-by-design approach that not only allows confidential data to be collected, transmitted and analyzed in a secure way but also means that cyber security is consistently integrated throughout all life-cycle phases. Cyber security is a critical business driver at Siemens and is thoroughly implemented into the architecture of Sinalytics. Key aspects of cyber security in Sinalytics are the provision of confidentiality and the integrity and availability of infrastructure and data as well as processes. Supporting concepts include the configuration of hardware and software systems using state-of-the-art cyber protection technologies, explicit proof of identity of all kinds of users, strong authentication, strong confidentiality protection of data at rest and data in transit, secure execution of analytical jobs, and auditing of all security-related events.

Real-world outcomes with Siemens Digital Services for Energy are resulting from projects across the globe that are designed to support unique customer needs with innovative, data-supported service offerings, and digitalization projects continue to drive results for Siemens' wind service customers. Remote diagnostics services are the genesis of these digital offerings as the company closely monitors more than 10,000 wind turbines globally. Advanced analytics are constantly evolving and expanding at Siemens' Remote Diagnostic Center in Brøndby, Denmark, with new developments in areas such as vibration diagnostics and 24/7 alarms notifi-



**Siemens**

Siemens' wind service technicians use digital tablets on-site to access turbine data and manuals, as well as to communicate back and forth with Siemens' engineering experts.

cation and management. Siemens is able to remotely address 85 percent of alarms coming into its Remote Diagnostic Center without the need for a visit to the turbines, which translates into higher availability and operational efficiency. Additionally, data-driven upgrades such as Siemens' High Wind Ride Through, which is a software performance upgrade designed to allow turbines to continue operating at reduced power in higher wind speeds, are also providing measurable results. At the West Wind wind farm in New Zealand, the upgrade was installed on all 62 wind turbines at the site, resulting in a marked improvement of 2 percent in annual energy generation and a

reduction in high-wind speed losses of 80 percent.

Through advanced engineering analysis, increased data collection and analysis, and remote monitoring and diagnostics, Siemens Digital Services is providing unique insights that will help the customer better predict operational and maintenance performance for cost-effective and flexible operations. ↗

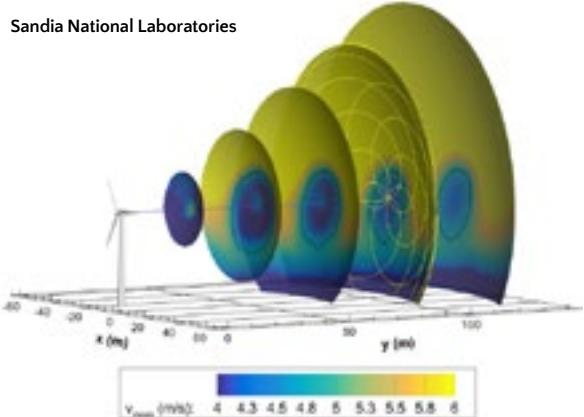
*Source: Siemens*

For more information, go to [www.siemens.com](http://www.siemens.com).

## VIRTUAL LIDAR MODEL HELPS RESEARCHERS PLAN FOR WAKE STEERING EXPERIMENT AT SWIFT

A team of researchers at Sandia National Laboratories (SNL) and the National Renewable Energy Laboratory (NREL) are planning a critical experiment at Sandia's Scaled Wind Farm Technology (SWiFT) facility to investigate the use of wind turbine yaw control to direct wakes, a promising approach to increase power production in wind plants. During the multi-month field campaign, researchers will collect data to improve both high-fidelity wind plant simulation software and demonstrate novel control concepts. The industry could then develop advanced controllers for deployment in commercial wind farms to increase power production.

Capturing detailed characteristics of the wake produced by the upwind turbine is a challenging requirement of the campaign. To confirm the model predictions, researchers need long-term continuous measurements of the wake velocity profile downwind of the turbine. The team partnered with the Technical University of Denmark (DTU) Wind Energy Department to leverage their wake measurement expertise and

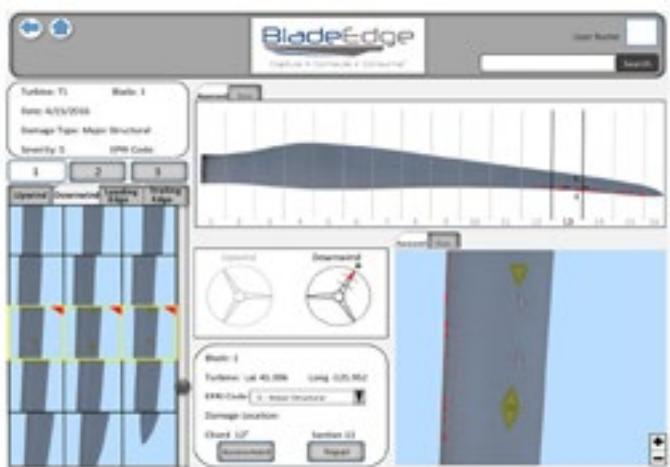


their custom-built SpinnerLidar. Lidar, or light detection and ranging, uses a scanning laser beam to measure wind velocity, and it does so at the resolution required for the SWiFT experiment.

Before deploying the SpinnerLidar, the research team scrutinized the instrument configuration and developed

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appropriate data analysis methods. To account for the many variables and complex calculations, the team developed a detailed virtual Lidar model to interrogate data sets from computational fluid dynamics (CFD) simulations of the SWiFT turbines. With the tool, the team is confident in its ability to reduce risk and uncertainty in the instrument, experimental configuration, and data processing before the instrument is deployed at the site, saving both time and money.

The animation depicted here in a screen-capture image was created from the virtual Lidar model and CFD simulation to depict the Lidar scanning pattern that will be used for the Wake Steering Experiment. The video depicts one of the SWiFT turbines operating in real time and scale while the DTU SpinnerLidar scans a rosette pattern at five distances downstream (1-5 rotor diameters). The contour surfaces at each scanning distance

represent the average line-of-sight velocity interpolated from the SpinnerLidar virtual model interrogation of the CFD simulation, estimating the resolution of experimental data that can be expected. The black irregular shape at each distance represents the output of an image-processing method used to determine the center of the wake produced by the turbine. This wake location in time and space will be a key data set to assess and improve the wake steering control model—one of the primary objectives of the experiment. All data from the upcoming experiment will be made public through the DOE Atmosphere to Electron (A2e) Data Archive Portal for other researchers to analyze for their own models and tools. ↗

*Source: Sandia National Laboratories*

For more information,  
go to [www.sandia.gov](http://www.sandia.gov).

## INGETEAM IMPROVES DFIG'S FAULT RIDE THROUGH (FRT) BEHAVIOR WITH CROWBARLESS SOLUTION

Ingeteam recently introduced its “crowbarless” solution, a modular fault ride through (FRT) system for power converters that will strengthen the grid compliance of doubly fed induction generators (DFIG). Thanks to the modular FRT system, the crowbarless solution offers superior capabilities compared to the active crowbar system traditionally used to protect the power converter from grid voltage transient.

Until recently, most grid codes allowed wind turbines to disconnect from the grid when transients in grid voltage could jeopardize the integrity of their elements, especially the power converter. Due to the ever-increasing wind power penetration around the world, this is no longer the case. Ingeteam has come up with a new way to deal with low capacity transmission lines, or weak grids, and FRT events to remain fully grid compliant.

“The traditional crowbar solution used in DFIG topology presents a poor response to the voltage sags,” said Ingeteam’s director of research and development, Carlos Gironés. “This is because the machine side converter is disabled when a voltage sag appears in the stator terminal until the inductor generator flux is stabilized. Thanks to new software and hardware implemented in our crowbarless solution, the machine side converter is available at all times during the voltage sag, achieving injection times required by the most restrictive grid codes.”

To date, the most widely used system to protect the power converters from voltage spikes is the so-called “active crowbar,” a shunt circuit composed of actively controlled switches and dissipation elements that are



Ingeteam

connected to shunt the high currents, avoiding damages to the converter. However, this system presents the limitation that, while the active crowbar is connected, the power converter is not in operation, the active and reactive power set points cannot be tracked, therefore, the

wind turbine is not being controlled. Ingeteam's crowbarless power converter, designed to operate in DFIG topology, uses a modular FRT system that removes the need for the active crowbar.

The crowbarless solution presents behavioral advantages in issues related to weak grids or grid fault events, allowing doubly fed induction gen-

erators to overcome previous technical constraints and comply with the strictest grid codes. Coupled to a suitable selection of grid filter and control loops tuning, it is able to keep the control of the wind turbine during these transients, achieving the controllability required in order to operate in weak grids.

In addition, the modularity con-

cept of the FRT system allows for a cost optimization for each application. The solution is flexible and offers a cost-optimal power converter option for each wind farm scenario. ↗

*Source: Ingeteam*

For more information,  
go to [www.ingeteam.com](http://www.ingeteam.com).

## ADWEN'S AD 5-132 OBTAINS TYPE CERTIFICATE FROM DNV GL

Adwen recently obtained the type certificate of its AD 5-132 offshore wind turbine awarded by the independent certification body DNV GL. This milestone marks the culmination of the turbine's certification process and confirms the platform's technology, which, in turn, bolsters the commercialization and industrialization processes.

The AD 5-132 has been designed and certified as special class, covering the most demanding offshore sites worldwide. This wind turbine is tailored for subtropical monsoon climates typical of Asian offshore markets, and it is designed to resist typhoons as well as harsh environmental conditions such as high temperatures and humidity.

This offshore wind turbine is one of the most cost-efficient of its class, allowing a high degree of customization

to adapt to customer needs. In addition, its modular design coupled with its high reliability minimizes operation and maintenance costs.

"This type certificate is an important step forward for Adwen as it confirms the technology performance of the AD 5-132, which has been designed to support extreme weather conditions while guaranteeing reliable performance and maximum energy output, thereby optimizing the levelized cost of energy," said Maite Basurto, Adwen's CTO.

According to Mike Wöbbeking, head of the renewables certification body at DNV GL, the wind industry is venturing further into geographic regions with special climates.

"We see a strong increase of new technologies being introduced to the latest turbine types," Wöbbeking said. "Our fact-based type certification pro-

cess verified that the innovative new system of the AD 5-132 is meeting the highest safety and reliability requirements to deliver high performance even in extreme weather conditions." ↗

*Source: Adwen*

For more information,  
go to [www.adwenoffshore.com](http://www.adwenoffshore.com).

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## GE REACHES MILESTONE WITH 50,000 MW IN GLOBAL WIND INSTALLATIONS



GE Renewables

GE Renewable Energy recently announced it currently has more than 50,000 MW of onshore wind turbines installed across the globe. The company reached the milestone in the first quarter of 2016, largely due to its recent acquisition of Alstom's renewable energy unit in November 2015. GE's global wind footprint, which now extends to more than 35 countries worldwide, represents enough energy to power the equivalent of approximately five cities the size of Hong Kong.

"Renewable energy has become a mainstream source of power generation," said Jérôme Péresse, president and CEO of GE Renewable Energy. "The industry is poised for continued global growth. At GE, we are excited to be reaching this milestone and look forward to adding our next 50 GW even faster."

The United States makes up the largest portion of GE's global installed base, but in recent years, the company has

### ALSO IN THIS SECTION

- 38** New Cable Connection Between Offshore Platforms

seen strong global growth in regions such as Europe, Asia, and Latin America. Following the acquisition of Alstom's renewable energy unit last year, GE expanded its European presence and added additional capacity in Brazil. GE Renewable Energy now has at least 1 GW of power installed in countries including Brazil,

Canada, China, Germany, Spain, and the U.S.

"Over the last decade, we have continued to invest in wind technology, and those investments have enabled us to drive steady growth while reducing production costs," said Anne McEntee, president and CEO of GE's onshore wind business. "We

feel like we are just getting started. The investments we are making today in regions all over the world are setting us up to deliver strong global growth in the years ahead." ↗

Source: GE

For more information, go to [www.ge.com](http://www.ge.com).

## SIEMENS INTRODUCES CONCRETE TOWER TECHNOLOGY TO REDUCE ENERGY COSTS

Siemens recently announced the commercial launch of a concrete wind turbine tower technology that is designed to capture stronger winds at higher altitudes, resulting in more potential energy production and increased project revenue for customers. This technology is part of an ongoing commitment to using innovation to expand wind power in the United States and around the globe.

Siemens partnered with Wind Tower Technologies of Boulder, Colorado, for engineering and construction methodologies. A unique feature of this patented tower system is the on-site match casting of annular precast tower segments, eliminating the need to grout the joints or provide other special surface treatments between tower sections.

On-site casting of the Siemens tower segments increases the use of local labor and materials and eliminates transportation costs associated with off-site fabricated tower sections. The benefits of match casting have been proven for 30 years in the construction of large bridge structures where qual-

ity and reliable speed of construction are highly important.

"As wind continues to establish itself as a mainstream energy source in the United States, Siemens remains focused on driving down the cost of wind power projects," said Michael McManus, Siemens' head of business development and strategy for Onshore Americas. "By match casting tower segments on-site, we are able to simplify and streamline the entire tower construction process, thereby reducing costs. Through our strong commitment to innovation, Siemens is revolutionizing the concrete wind turbine tower and delivering technology that will help deliver leaps in annual energy production."

Siemens' precast segmental concrete tower system was designed to be economically scalable to heights in excess of 115 meters using a unique modular formwork design. This concrete tower technology offers up to an additional 10 percent or more annual energy production compared to the typical 80-meter height, depending on climatic conditions.

Siemens developed its concrete tower technology through prototype testing in Texas and a subsequent single commercial turbine in Iowa. These efforts validated processes and paved the way to full commercial applications of the tower, including future taller towers.

In a separate undertaking, Siemens Corporate Technology has partnered with Iowa State University on the "Hexcrete Tower for Harvesting Wind Energy at Taller Hub Heights" led by Iowa State University and sponsored by the Department of Energy Office of Energy Efficiency and Renewable Energy.

Nearly 6,000 Siemens wind turbines are installed in the U.S. and capable of producing clean, renewable power for more than 4.2 million households every day. Siemens also recently achieved the 14-GW installed capacity milestone in the Americas with more than 7,300 installed wind turbines. ↗

Source: Siemens

For more information, go to [www.siemens.com](http://www.siemens.com).

## ADANI ENTERPRISES ENTERS WIND ENERGY MARKET WITH 70-MW WIND TURBINE ORDERS WITH INOX WIND

Adani Enterprises, one of India's leading conglomerates, has entered the wind energy industry after placing its first orders for wind turbine generators

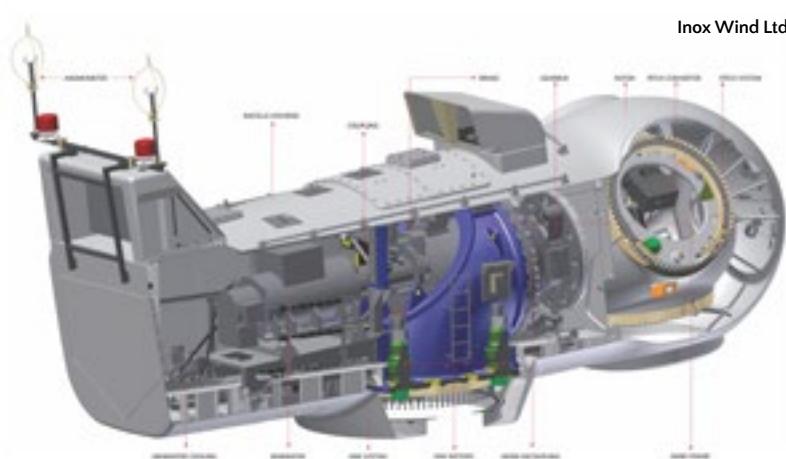
with Inox Wind Ltd. To strengthen its leading position in the Indian wind turbine industry, Inox Wind has signed two contracts for a cumulative

capacity of 70 MW with Adani Green Energy Ltd., a wholly owned subsidiary of Adani Enterprises Limited and a part of the Adani Group.

This agreement represents Adani Group breaking into the wind energy market and encompasses a 50-MW turnkey project to be set up in the Anantapur district in Andhra Pradesh and a 20-MW turnkey project at Inox Wind's Lahori site in Madhya Pradesh.

As part of the two turnkey orders, Inox Wind will deliver, install, and commission 35 units of Inox Wind's 100 rotor diameter turbines. It has also been contracted to undertake operations and maintenance services of the projects for a multi-year period post-commissioning.

Inox Wind provides its clients with complete solutions that include wind resource assessment, acquiring land, developing the entire site infrastructure, building the power evacuation system, supplying the wind turbine generators, erection and commissioning services, and long-term operations and maintenance services as well as post-commissioning support.



Inox Wind Ltd.

"Inox Wind is proud to be working with Adani Group, a global conglomerate and one of the country's leading business houses," said Kailash Tarachandani, CEO of Inox Wind Limited. "These are the first orders placed by Adani in the wind power space and reaffirm customers' faith in Inox Wind's ability to provide world-class technological solutions to its clients.

We are delighted to partner with Adani in their endeavor to become leaders in renewable power technologies and in our joint commitment toward providing clean and green energy in India." ↗

*Source: Inox Wind Ltd.*

For more information,  
go to [www.inoxwind.com](http://www.inoxwind.com).

## NEW CABLE CONNECTION BETWEEN OFFSHORE PLATFORMS

For the first time, two sister platforms in an offshore wind farm will be connected by a bridge system with the aid of a new flexible high-voltage cable with a conductor cross-section of 800 mm<sup>2</sup>, which increases the guaranteed energy feed-in for the wind farm operator. Pfisterer has received a major contract for this pilot project within the framework of the connection of the DolWin3 converter station. The electrical connector manufacturer already possesses the pre-qualification for the Feltoflex connecting cable with a conductor cross-section of 800 mm<sup>2</sup>. The onshore work to equip the converter station with medium-voltage cable systems has already begun, and completion of the HVDC offshore connection is planned by 2017.

In the southwestern area of the North Sea, the DolWin gamma converter platform with a capacity of 900 MW

is currently being constructed as the third connection within the DolWin cluster. Offshore converter platforms are normally connected directly to the mainland by means of a submarine cable. So far, any connections between platforms have been a rarity. This solution, which significantly raises the in-feed guarantee, is now being actively promoted with DolWin gamma. To be able to switch over between the converter stations when necessary, the two sister platforms — DolWin gamma and DolWin alpha — are sited close together, 80 kilometers offshore, and are linked by means of a bridge with a powerful high-voltage cable.

### UNIQUE OFFSHORE CABLE ROUTING

Pfisterer will lay all the high-voltage and medium-voltage cable systems within

the platform, as well as the cables on the connecting bridge. This major contract with a value of almost 6 million euros is being carried out as a turnkey project. The configuration also features a feasibility study, which includes the dimensioning and calculation of current carrying capacity.

"One particular challenge is laying the 4.5-kilometer-long, high-flexibility Feltoflex HV cable," said Vukasin Basara, project manager for HV cable projects at Pfisterer. "For this purpose, we have developed an extraordinary concept. The cable is routed from the upper deck of the DolWin alpha platform at a height of 35 meters by means of a rising ladder rack and a bridge of about 30 meters in length, to the DolWin gamma platform."

## HIGH FLEXIBILITY IN ROUGH SEAS

The connection between the platforms by means of a highly flexible 155 kV Feltflex cable will have an overall length of 250 meters, therefore, it will be the world's longest connection between two offshore platforms. The cable, comprising approximately 4,000 individual strands of wire, is insulated with a special mixture of high modulus ethylene propylene rubber (HEPR) instead of cross-linked polyethylene (VPE). The increased flexibility of this cable is a definite advantage in high winds. This allows the platforms to move by up to 800 mm relative to each other without causing any mechanical damage to the cable.

## TESTED AND SAFE

To ensure the construction of a cable connection with a power rating of 155 kV and the extraordinarily large cross-section of 800 mm<sup>2</sup> was initially possible, Pfisterer was included at the project development stage in 2011. In the course of prequalification, the company conducted numerous preliminary investigations for its solid-insulated Connex pluggable connection system. This successfully passed the contact aging test according to ICE 61238-1, as well as the electrical tests specified in IEC 60840 Section 12.4.

## MV INSTALLATION STARTED

The platform is currently being constructed in the dockyard at Rostock-Warnemünde.

The start of the onshore installation work in the medium-voltage range also marks the start of the execution phase for Pfisterer. The internal cable connections between the switchgear and the transformers will first be installed with MV cable — including the connections to the joint compartments with HV cable — before the offshore cabling stage. In the next stage, the 4,500-meter-long HV cables will be installed, as well as the



Connex connection system and Connex HV joints in various sizes.

"The DolWin3 order is consolidating our position as the leading manufacturer of cable assemblies in the offshore wind energy sector, as well as our expertise and ability to offer complete integrated systems," said Eduardo Santana, director of sales for cable accessories and systems at Pfisterer. ↗

*Source: Pfisterer*

For more information, go to [www.pfisterer.com](http://www.pfisterer.com).

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## NEW CONCRETE TOWER CONSTRUCTION METHOD FOR WIND TURBINES



A team led by Professor Johann Kollegger at the Institute of Structural Engineering at Technische Universität (TU) Wien has developed a new tower construction method wherein double-wall elements are joined together on the ground to form large double-walled concrete rings. These rings are then lifted up with a crane, stacked one on top of the other, and filled with concrete. This technique results in a construction method for wind tur-

bine towers that is faster and less expensive than traditional methods.

"In wind turbine construction, large precast concrete parts are usually delivered to the construction site," Kollegger said. "These are then assembled into a tower and then fixed to one another. This method is fast, but the costs associated with the special transportation of large precast parts can often be very high."

### ALSO IN THIS SECTION

- 42** Goldwind Americas Signs 160-MW Texas Deal with RES Americas
- 43** SgurrEnergy Supports Canadian Wind Portfolio to Financial Close

In addition, the tower construction method developed by TU Wien also features thinner walls and less reinforcing steel, which means that significantly fewer resources are being used compared to the familiar precast construction methods.

## A DOUBLE-WALLED STRUCTURE FILLED WITH CONCRETE

In recent years, Kollegger's team has repeatedly created a stir with their new and creative concrete construction solutions, for instance, with a folding bridge or even a concrete dome, which can be formed by inflating an air cushion beneath the concrete. And now a new concrete tower construction method has been developed and successfully tested.

Instead of heavy, solid concrete rings, hollow, rectangular double-walled elements are transported to the construction site. These double-walled elements are erected and joined together in a circle, so that they form a polygonal segment with an outer and inner wall.

"The segments are then stacked on top of one another, retaining the hollow space between the two walls," Kollegger said. "Only then is the inner space filled with concrete — one segment at a time. A monolithic concrete block is created, whereby the segments are joined together in an extremely stable way."

## THE DESIGN OF THE DOUBLE-WALLED SEGMENTS IS FLEXIBLE

"The individual elements are joined together to form a regular nonagon," said Ilja Fischer at TU Wien. "It is crucial to plan the segments in such a way that they remain stable throughout construction. Then, once they have been filled with concrete, stability is no longer a problem."

It is also important that the segments are packed closely together when the concrete is being poured in. Once they have been placed on top of one another using a crane and precisely aligned, the joints are sealed so that the concrete cannot flow out.



## PRESENTATION AT THE HANNOVER MESSE TRADE FAIR

TU Wien's tower construction method has already been successfully tested on a test site in Lower Austria.

"The new construction method is simple and fast," Kollegger said. "The double-walled elements can be transported without any issues. Taking into account all of our experience to date, our new method is expected to be economical and capable of establishing itself compared with the previous construction methods. We believe that our patented process offers benefits for very high wind power stations in particular." ↗

Source: TU Wien

For more information,  
go to [www.tuwien.ac.at](http://www.tuwien.ac.at).

## ENEL STARTS CONSTRUCTION OF NEW 150-MW U.S. WIND PROJECT

Enel S.p.A., through its subsidiary Enel Green Power North America, Inc. (EGPNA), has started construction of the Lindahl wind project, which will be Enel's first project to be built in North Dakota.

The wind project, which is owned by EGPNA subsidiary Lindahl Wind Project, LLC, will have a total installed capacity of 150 MW and, once completed, will be able to generate approximately 625 GWh annually

— equivalent to the energy consumption needs of more than 50,000 households in the United States — while avoiding the emission of approximately 450,000 tons of CO<sub>2</sub> each year.

"Lindahl underlines the strength of Enel's growth strategy in North America," said Rafael Gonzalez, head of the North American area for Enel's Global Renewable Energies division. "The new wind farm also marks

the group's entrance into a new state, North Dakota, further broadening our geographical footprint in the United States."

The construction of Lindahl, which is expected to be operational by 2017, will require an investment of over \$220 million, in line with Enel Group's current strategic plan. All of the power and renewable energy credits from the Lindahl wind project will be sold under a bundled, long-term power purchase agreement to Basin Electric Power Cooperative.

Lindahl is the fourth Enel renewable energy project to start construction in the U.S. in 2016, together with the 108-MW Drift Sand wind farm in Oklahoma, the 400-MW Cimarron Bend wind project in Kansas, and the 150-MW Aurora solar power project in Minnesota.

EGPNA is present in 22 U.S. states and two Canadian provinces



Tradewind Energy

with more than 2.5 GW of total installed capacity of which more than 2 GW comes from wind. ↗

*Source: Enel Green Power*  
For more information,  
go to [www.enelgreenpower.com](http://www.enelgreenpower.com).

## GOLDWIND AMERICAS SIGNS 160-MW TEXAS DEAL WITH RES AMERICAS

Goldwind Americas, a subsidiary of Xinjiang Goldwind Science & Technology Co., Ltd., recently announced that it has signed an agreement with Renewable Energy Systems Americas Inc. (RES) to acquire the 160-MW Rattlesnake Wind Project located in McCulloch County, Texas. Once operational, the project will become Goldwind's largest wind project in the United States to date.

"This investment in the Rattlesnake Wind Project highlights our long-term commitment to the U.S. wind market and represents our first step of a five-year growth strategy to capitalize on the extension of the production tax credit," said David Halligan, CEO of Goldwind Americas.

The Rattlesnake Wind Project located approximately 125 miles northwest of Austin will utilize 64 Goldwind 2.5-MW permanent magnet direct-drive (PMDD) wind turbines.

The 160-MW Rattlesnake Wind Project represents the first phase of an expected 300-MW wind project, which was developed and will be constructed under a balance of plant agreement by RES.

"We are proud to partner with RES, a leading renewable energy developer and constructor, on our first project together," Halligan said.

Goldwind Capital, a subsidiary of Xinjiang Goldwind Science & Technology Co., Ltd., provided bridge financing to acquire the project and is in the process of arranging a financing package in partnership with top-tier financial institutions that will include construction and tax equity financing and a long-term ERCOT fixed price hedge for power production. ↗

*Source: Goldwind Americas*  
For more information,  
go to [www.goldwindamericas.com](http://www.goldwindamericas.com).



Goldwind Americas

## SGURRENERGY SUPPORTS CANADIAN WIND PORTFOLIO TO FINANCIAL CLOSE

A portfolio of wind projects in Canada has reached financial close after SgurrEnergy provided lender's technical due diligence to support the financing process. SgurrEnergy, a Wood Group business, supported the project sponsor InstarAGF Asset Management Inc. with lender's technical due diligence on the zero emissions developments (ZED) wind energy portfolio. The scope consisted of an energy yield analysis and full review of site suitability, technology, design, construction contracts, and financial models. SgurrEnergy will also undertake construction monitoring services during the construction phase. The 30-MW portfolio consists of two sites in British Columbia, which will use five 3.2-MW Senvion wind turbines on each site. The projects will comply with the British Columbia Standing Offer Program (SOP), which encourages the development of small clean or renewable electricity projects up to 15 MW throughout the province.

"The SgurrEnergy team brought significant expertise to our process, thereby positioning InstarAGF to secure financing for these projects," said Stephen Simpson, vice president of InstarAGF. "SgurrEnergy is a global leader in renewable energy, and we look forward to their continuing support through the construction

phase of these projects."

Construction will begin in the next few weeks with commercial operations expected to commence by the first quarter of 2017.

"In a province that is dominated by hydropower, it is great to see wind energy projects come to fruition," said Matthew Irvine, senior consultant

at SgurrEnergy. "Having worked on these projects since 2014, the team is delighted to see them achieve financial close and move toward commercial operation." ↗

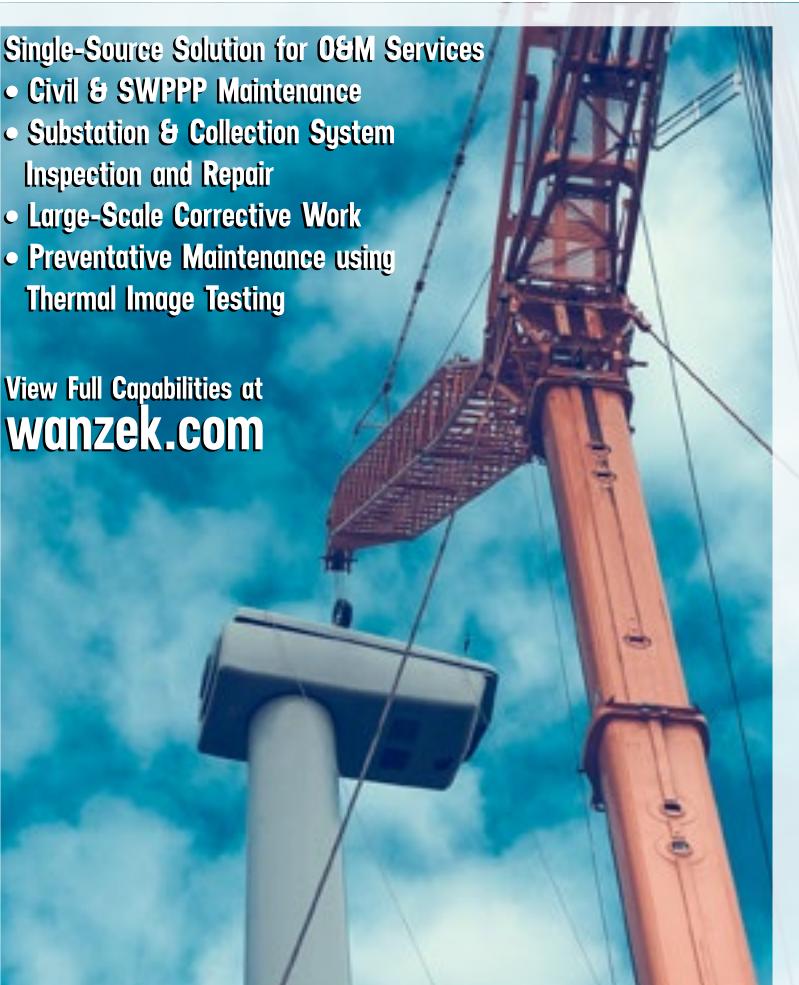
*Source: SgurrEnergy*

For more information, go to [www.sgurrenenergy.com](http://www.sgurrenenergy.com).

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## SENVION SECURES TURBINE ORDER IN JAPAN AND OPENS OFFICE IN TOKYO

Senvion, one of the world's largest and leading wind turbine manufacturers, recently announced the opening of its office in Tokyo to service the local market. Furthermore, Senvion has secured the go-ahead to deliver three turbines to a wind farm in Japan. The wind farm will use three Senvion MM92 turbines

designed to withstand extreme wind loads with a total generating capacity of over 6 MW.

These Senvion turbines will be some of the first wind turbines to comply with rigorous new construction standards introduced by the Japanese government last year. Senvion is working closely with the Meidensha Corporation, a leading electrical manufacturing company, to deliver the project, which is expected to start generating clean electricity in 2017. Senvion has been active in the Japan market since 2003 and has delivered 68 Senvion turbines with an installed capacity of 118 MW across 16 wind farms.

"While we are an international company, we put a very high value on local expertise," said Jürgen Geissinger, CEO at Senvion. "Our new office in Japan will ensure that our approach to delivering projects best meets the needs of both our clients and the local communities we work in."

Senvion has recruited an experienced local team to manage the Japanese office. The team brings several decades of wind energy and broader energy expertise to their new roles. Kazuhiro Tanaka, the new general manager for Senvion in Japan, has several decades of experience in the



Senvion

The Senvion MM92 model turbines

energy sector and has been working in the renewable energy industry since 2000, managing the sales, development, and operation of wind power plants. Prior to joining Senvion, he was Senvion's sales agent in Japan since 2001 and was responsible for the sale of 68 Senvion wind turbines with a total generating capacity of 118 MW in Japan.

"This is an exciting time for wind energy in Japan," Tanaka said. "The future market for new wind farms

looks very promising, and we are pleased that there will now be an established local Senvion presence. Senvion's turbine technology is well-suited to the Japanese market where high performance and reliability are valued." ↗

Source: Senvion

For more information,  
go to [www.senvion.com](http://www.senvion.com).

## O&M TAKES CENTER STAGE IN MORTENSON'S NEW WIND ENERGY STUDY

The wind energy industry looks to be making a major shift, according to data in Mortenson's new Renewable Energy Leadership Series study, "The 40-Year Turbine."

According to the study, now that the industry has begun to mature, owners and operators are beginning to face the challenge of turbines that are coming to the end of their design lives and are turning to more proactive strategies to increase both ROI and the lives of existing turbines. The results of Mortenson's survey indicate that these strategies rely on collecting more data.



"The industry is evolving into more predictive, proactive maintenance," said Mortenson wind executive Todd Bell. "Owners are starting to install all of these maintenance processes to collect data so they can start forecasting failures, to avoid having unexpected catastrophic failures."

This data is helping the industry at a time when critical decisions are being made.

As technology evolves, the strategies for prolonging turbine life are shifting at every level, from owners to manufacturers and EPCs. Standardization in parts and procedures as a way to extend turbine life appears as a recurrent theme in the study, as does the most significant challenge facing the industry — a challenge that has nothing to do with equipment or technology.

According to Bell, the largest challenge that the industry is cur-



rently facing is in finding, retaining, and developing qualified technicians, and how the industry responds will certainly drive the future of wind energy. ↗

*Source: Mortenson*

For more information,  
go to [www.mortenson.com](http://www.mortenson.com).

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## ABB TO SUPPLY SPECIAL TRANSFORMERS FOR THE WORLD'S MOST POWERFUL WIND TURBINES

ABB recently announced that it will deploy 40 transformers to equip wind turbines for an offshore wind farm in the Irish Sea. The MHI Vestas Offshore Wind turbines are 195 meters tall and weigh 1,000 metric tons. Its 80-meter rotor blades sweep through an area equivalent of three soccer fields and can produce up to 8 MW of power, making it the most powerful wind turbine in the world.

ABB received the order from MHI Vestas Offshore Wind for the Walney Extension Offshore Wind Farm located approximately 19 kilometers west of Walney Island off the coast of Cumbria, England. The offshore wind farm is owned by the Danish utility DONG Energy A/S. The order is a follow-up of one at the end of 2014 for 32 specialty transformers to equip similar turbines for the Burbo Bank Extension Offshore Wind Farm, also located in the Irish Sea.

The Walney Extension will provide additional generation potential of 660 MW to the existing offshore wind farm's 367 MW. The western part of this extension, for which ABB will supply the transformers, will account for half of the new capacity (330 MW). ABB has also been contracted to supply a high-voltage cable system that will bring power from the Walney Extension wind park to the mainland.

When completed, the Walney offshore wind farms will be capable of providing clean electricity to over 800,000 households, making a significant contribution to the United Kingdom's target of achieving 15 percent of its total energy production from renewable sources by 2020 and reducing carbon dioxide emissions.



An ABB transformer

The ABB transformer (9.7 megavolt ampere, or 34 kilovolt) will be installed inside the turbine tower with accompanying low-voltage products. ABB's specialty transformers meet the most stringent electrical and mechanical requirements that are prerequisites in an offshore environment where quality and reliability are critical. The transformer has customized design attributes and uses state-of-the-art raw materials and components. It is vibration and short-circuit resistant and has a compact footprint in order to accommodate the turbine doorframe. It also weighs around 30 percent less than a similar standard transformer.

"These transformers are specially designed to meet the specific application needs of the most powerful wind turbines and are a testimony to ABB's technology and innovation strength being a key differentiator

when it comes to creating value for our customers," said Claudio Facchini, president of ABB's Power Grids division. "We are pleased to continue with our contribution to the integration of more renewable energy into the grid, a key focus area of our Next Level strategy."

ABB offers a complete range of power and distribution transformers designed for reliability, durability, and efficiency. ABB is a major transformer manufacturer throughout the world and offers both liquid-filled and dry-type transformers as well as services for complete lifecycle support, including replacement parts and components. ↗

Source: ABB

For more information, go to [www.abb.com](http://www.abb.com).

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