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JUNE 2018

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and **CONDITION MONITORING**



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www.awea.org/symposium



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WINNING THE BATTLE AGAINST BEARING WEAR

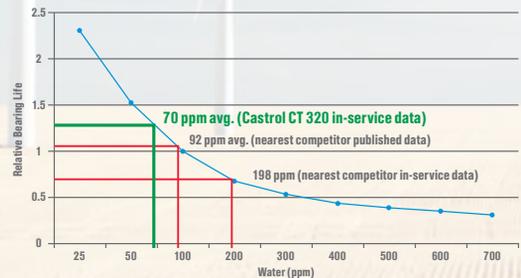
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*WEU Operations and Maintenance Report 2016.

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EDITOR'S DESK

JUNE 2018

WINDPOWER rocked the Windy City

I never got a chance to ask any AWEA official, but I would love to know how many times Chicago was called the Windy City during WINDPOWER 2018.

Another WINDPOWER show is in the books, and if the numbers of businesses on display and industry officials roaming the McCormick Convention Center were any indication, it was an amazing success.

My colleagues and I had a great time meeting all of you, both as I traveled from booth to booth and as you came by ours.

Of the people I talked to, if I haven't been in touch yet, rest assured that I will be hitting you up for your insights and knowledge to share with our readers. And, of course, feel free to touch base with me if you have an interesting article you would like to discuss. That's one of the reasons why I'm here and why I went to the show. (Chicago's amazing culinary options were just a fringe benefit.)



Ryan Hunn



Dan Olson



Angela Krcmar

Just like previous shows, *Wind Systems* partnered with Snap-on Tools to give away three incredible toolboxes.

Each day, *Wind Systems* held a raffle for the toolboxes, and judging by the crowds, it was a popular stop for the pre-lunch attendees.

Ryan Hunn of AkzoNobel, Dan Olson of GE Renewable Energy, and Angela Krcmar of Firetrace International became the proud winners of the sturdy, fire-engine-red toolboxes. I think they were as excited to win as we were to give them away.

The show was a great success for AWEA and the industry, and many of the industry's movers and shakers were on hand to express their support of wind and give a glimpse into its future both here and abroad.

But in the midst of our post-show excitement, take a look at what else you'll find in our June issue:

An article from Hansford Sensors talks about the need for vibration monitoring in turbines. We also have an article that looks at how tribology can help extend the service life of critical machinery.

And a submission from Bachmann electronic tackles the all-important subject of turbine security.

You'll read all that and more, and it just proves that it's an exciting time for wind. If I heard that once at WINDPOWER, I heard it a thousand times. Although, I may have heard "Windy City" more than that.

Thanks for reading!



Kenneth Carter, editor
Wind Systems magazine
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A handwritten signature in black ink that reads "Kenneth Carter".



Wind development still on the rise

Courtesy of AWEA

- 85 percent of U.S. adults support growing wind power, according to new data from the Pew Research Center.
- The new wind development pipeline is 40 percent larger than it was at this time last year.
- Project developers signed 3,560 MW of PPAs during the first quarter, the most since AWEA began tracking this activity in 2013.
- Corporate and other non-utility customers continue to be important new wind customers, signing more than 9,000 MW of PPAs to date.
- Landowners were paid \$267 million in lease payments in exchange for hosting wind turbines in 2017.

The American Wind Energy Association (AWEA) is the premier national trade association that represents the

interests of America's wind energy industry. For more information, go to www.awea.org



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DIRECTION

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GE Renewable Energy, Alliant Energy to add 470 MW in Iowa

GE Renewable Energy and Alliant Energy recently announced they are adding 470 MW of wind-power capacity to the state of Iowa with two projects.

The English Farms and Upland Prairie wind farms with respective 170 MW and 300 MW of installed capacity will be owned and operated by Alliant Energy's Iowa energy company and provide clean and reliable renewable sourced electricity to its customers in Iowa. This is part of a broader plan by Alliant Energy to install up to 1,000 MW in Iowa by the end of 2020.

Both wind farms will be equipped with a total of 190 of GE's 2 MW platform type turbines and will add to the 2,300 GE 2MW turbines already running in North America. These include the 2.3-116, the 2.5-116, and GE's newly introduced 2.5-127 turbine. The new 127-meter rotor combined with the robust 2MW electrical system enables the turbine to reach a best-in-class capacity factor and higher levels of Annual Energy Production.

"Both projects will provide power for the equivalent of 180,000 homes in Iowa," said Vikas Anand, general manager for GE's Onshore Wind Business in the Americas. "Alliant



The English Farms and Upland Prairie wind farms will be owned and operated by Alliant Energy's Iowa energy company. (Courtesy: GE Renewable Energy)

Energy and GE are making a real difference for consumers in Iowa, and we are delighted to be providing our 2MW class turbines, including our brand new 2x 127m model."

The Upland Prairie site, with 121 turbines planned, is the largest individual wind farm developed by Alliant Energy. Between Clay and Dickinson counties in Iowa, it is planned to be commissioned in late 2018 and early 2019. The English Farms site in Poweshiek County is planned to

operate 69 turbines, with the project being commissioned in early 2019.

"This cutting-edge technology will help us advance cost-effective clean energy for our customers," said Terry Kouba, Alliant Energy vice president of Operations in Iowa. "As we add more wind energy, we're working to keep Iowa a leader in renewable energy." ↵

Source: GE Renewable Energy

For more information,
www.ge.com/renewableenergy

Demand drives wind development to new heights in first quarter of 2018

Strong demand for affordable, reliable wind energy drove a busy first quarter for new U.S. wind farm announcements. Wind power's low cost and stable energy prices motivated utility and non-utility customers to sign contracts for 3,500 MW of U.S. wind capacity in the first quarter of 2018, a high-water mark in recent years, according to a new report released recently by

the American Wind Energy Association (AWEA). The U.S. Wind Industry First Quarter 2018 Market Report also reveals 5,523 MW in first quarter wind-project announcements, adding to a total of 33,449 MW of wind-power capacity in the combined construction and advanced development pipeline.

"Word is out that wind power is an excellent source

of affordable, reliable, and clean energy,” said Tom Kiernan, CEO of AWEA. “Our industry is consistently growing the wind-project pipeline as leading companies, including utilities and brands like AT&T and Nestle, keep placing orders. Strong demand for wind power is fueling an economic engine supporting a record 105,500 U.S. wind jobs in farm and factory towns across the nation.”

Utilities and Fortune 500 brands both continue to scale up investments in wind energy because it makes good business sense. The cost of wind power has fallen by two-thirds since 2009, making wind cost-competitive with other energy sources. In fact, in strong wind resource regions such as the Great Plains and Texas, wind is the most cost-effective source of new electricity. And because wind power has no fuel costs, buyers can lock in low rates for decades to protect against future fuel price spikes.

Wind-energy customers signed more than 3,500 MW in long-term contracts called power purchase agreements (PPAs) in the first quarter. That’s the highest volume of PPA announcements in any quarter since AWEA began tracking them in 2013.

Six companies including Adobe, AT&T, and Nestle signed wind PPAs for the first time, while Bloomberg, Facebook, Nike, and T-Mobile became repeat customers. In addition, utility buyers including PacifiCorp and DTE



The cost of wind power has fallen by two-thirds since 2009, making wind cost-competitive with other energy sources. (Courtesy: AWEA)

Energy made large-scale announcements to develop and own wind power.

Across the country, 36 wind projects representing a combined 5,523 MW announced they either began construction or entered advanced development in the first quarter. Construction started on 1,366 MW of wind capacity, and 4,158 MW entered advanced stages of development, which includes projects that have found buyers for their energy, announced a firm turbine order, or have been announced to proceed under utility ownership.

The full pipeline of wind farms under construction or in advanced development now totals 33,449 MW, a 40 percent increase over this time last year and the high-

est level since this statistic was first measured at the beginning of 2016.

Seven new wind farms came online across seven states in the quarter, totaling 406 MW. In total, there are now 89,379 MW of installed wind capacity in the United States.

That’s more than 54,000 wind turbines operating in 41 states plus Guam and Puerto Rico and enough installed capacity to power more than 27 million American homes.

Wind power is a 50-state industry supporting a record 105,500 U.S. jobs. ↵

Source: AWEA

For more information, go to www.awea.org

Windserve Marine, LLC to provide U.S. offshore wind support services

The Reinauer Group of Companies has added a new member company, Windserve Marine, LLC, to provide support services to the U.S. offshore wind industry. Joining its affiliate companies Boston Towing & Transportation, BTT Marine Construction, Erie Basin Bargeport, Reicon Group, Reinauer Transportation Companies, and Senesco Marine, Windserve starts a new chapter in the Group's rich history.

Windserve's mission: Windserve Marine seeks to be the premier offshore wind support services provider on the Atlantic Coast. Building upon more than 95 years in the maritime industry, Windserve is committed to providing excellence in all stages of the offshore wind farm lifecycle and supports industry stakeholders in project commencement and construction, operation and maintenance, and logistics.

The company intends to offer a range of services anticipating its ability to leverage the resources and synergies of its affiliate companies in the Reinauer Group. Capabilities will include personnel transfers, towing, escort and offshore support vessels, stores and equipment allocation and positioning, dive and survey operations, heavy equipment contracting and construction support, and engineering and logistics services.

Windserve is well-positioned to benefit from the expertise and coordination of its 24/7/365 operating platform.

"We are pleased to enter this burgeoning industry and capitalize on the depth of talent and infrastructure we already have in place," said Reinauer's Chief Executive Officer, Craig Reinauer.



Windserve Marine seeks to be the premier offshore wind support services provider on the Atlantic Coast. (Courtesy: Windserve Marine)

As a part of its unique value proposition, Windserve will be able to offer complete business solutions in addition to itemized services. Additionally, these offerings will be available at strategic locations in New York, Boston, and Rhode Island. ↗

Source: Windserve Marine

For more information, go to www.WindserveMarine.com

Monsoon wind speeds' impact on industry is mixed across Indian regions

Wind speeds during India's annual monsoon season have fallen by as much as 9 percent over the past two decades, with three of the past four years also below average. This is according to research by Vaisala, a global leader in environmental and industrial measurement. Vaisala's latest analysis, performed on global reanalysis datasets, highlights the impact of this decline, both on wind-energy production and on the suitability of long-term averages as a reference point for wind energy yield estimates.

Installed wind power capacity in India has rapidly expanded in recent years, currently totaling more than 32 GW and accounting for close to 10 percent of India's total power generation capacity, and the country typically sees its strongest winds during the southwest monsoon season.

However, it is clear that this fall in wind speeds pres-

ents challenges to the wind industry's ability to undertake accurate long-term forecasting and to asset-owners looking to effectively plan and budget on the basis of these forecasts.

Using data derived from NASA's MERRA-2 dataset, Vaisala has analyzed long-term wind speeds at seven significant regions for wind development in India. In each case, wind speeds trended downwards over a 20-year period up to 2017, but with significant variation in the extent of the decline — ranging from 9 percent at wind farms in Rajasthan to 2 percent at those in Karnataka. These results are partially corroborated by climate research from the Indian Institute of Tropical Meteorology, which shows a 40-percent reduction in surface wind speeds during monsoon season over the past four decades.

Despite this, analysis of performance over the past 12 months reveals above-average wind conditions in several regions, highlighting the importance of location when considering longer-term trends.

“It’s important to note that the declines didn’t happen across the board — for example, wind speeds were markedly higher than normal in parts of Uttar Pradesh during August and September, and higher in central India during July,” said Rajni Umakanthan, managing director of Vaisala subsidiary 3TIER India. “A scientific approach to both wind-resource assessment and energy forecasting can allow investors to minimize their risk and operators to budget effectively.”

Accurate long-term references are an important element in estimating energy production over the 20- to 25-year lifetime of a wind farm, and any adjustments to this reference can affect long-term energy production estimates by as much as 2 percent.

As a result of observed changes to the wind resource, a number of independent engineers have shifted their reference point from 20 to 10 years, but this creates additional challenges, as a shorter record will naturally introduce greater uncertainty into estimates and increase the possibility that they will not accurately reflect long-term energy production.

Vaisala’s Energy Risk Framework, developed in 2012,

was designed to account for the possibility that long-term trends or jumps in mean wind speed might occur due to climate change. Using re-analysis data, the Energy Risk Framework adjusts and refines long-term estimates by defining the likelihood that recent wind speeds are consistent with past data.

“Our analysis illustrates the stark decline in Indian monsoon wind speeds — both year-on-year and over the past two decades — and is consistent with results recording weaker surface wind speeds,” Umakanthan said. “Our Energy Risk Framework seeks to address this by comparing recent wind speeds with long-term performance data, defining the likelihood that recent data is consistent with past performance. A shortening of the long-term climate reference is then calculated and applied when appropriate to refine the energy due diligence process and provide asset owners with the best reference possible.”

Vaisala continues to refine the Energy Risk Framework by incorporating additional wind-speed analysis and testing conducted as part of its continuous validation process. ↵

Source: Vaisala

For more information, go to www.vaisala.com



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Boosting operating efficiency

Predictive maintenance based on vibration monitoring can raise the efficiency of wind turbines by preventing catastrophic failure and unscheduled downtime.

By Martin Armson

The cost of maintenance in the wind-turbine industry is escalating: A report from Global-Data estimates that the cost of turbine maintenance will rise to about \$17 billion in 2020 — nearly twice that of 2014. It's because the number of turbines is increasing — including many old ones that require more frequent maintenance. For an offshore wind farm, about one-quarter of total cost is accounted for by operation and maintenance.

Introducing sophisticated condition monitoring technology can help keep these costs under control. Employing vibration monitoring to keep tabs on a turbine's rotating parts helps maintenance teams to spot potential problems and carry out necessary repairs at the earliest opportunity in order to avoid breakdowns. In this technique, the vibration “signature” of bearings and other moving parts is monitored using vibration sensors (otherwise known as “accelerometers”). Any variation from the norm can indicate early signs of failure, allowing small problems to be corrected before they spiral out of control.

Wind power is a booming area of engineering. In 2017, global capacity for wind turbines hit 539,581, according to the Global Wind Energy Council. Not surprisingly, this figure is expected to grow significantly over the next decade — some outlets suggest global capacity may be four times higher by 2030.



AC accelerometers are typically used with data collectors for the vibration monitoring of more critical or complex machines, such as gearboxes and turbines, so they are the sensor of choice for wind turbines. (Courtesy: Hansford Sensors)

Let's not forget, however, that wind power is also highly demanding. To achieve profit, operators must run as efficiently as possible by raising output and controlling costs. Preventing unscheduled downtime — such as through catastrophic part failure — is key to this. However, wind turbines must perform under punishing conditions: There have been instances in recent years of high winds causing turbines to explode through gear failure. As well as footing the repair bill, operators may also be faced with fines and compensation costs.

While the sensors used in high-spec applications like wind turbines are top of the range, their price has come down far enough to justify the use of multiple sensors, which



enhances data gathering. Using multiple sensors also helps to boost techniques such as acceleration enveloping (more on this later), which “extracts” the vibration signal of a failing bearing by filtering out the “noise” of other components.

DOWNTIME COSTS

Unscheduled downtime does not just affect the wind-turbine industry: According to a recent joint survey from plantservices.com and ARC advisory group, the problem costs global process industries about \$20 billion every year. The goal for nearly 90 percent of all companies using predictive maintenance was to increase uptime, said the survey. In addition, more than half wanted to use

predictive maintenance techniques and processes to cut maintenance and overall operational costs.

Among its conclusions, the survey recommended that predictive maintenance should ideally be integrated with plant-wide control systems, and that the operation and outcomes of such systems should be linked to financial incentives for plant operators. It makes a strong case for fitting such systems, especially in an industry such as wind energy where maintenance is difficult and costly, and operators are under pressure to maximize efficiency and productivity.

While this type of maintenance regime has its obvious advantages, there are historical factors to overcome: Many engineers have genuinely considered it cheaper to

continue running with worn equipment rather than invest in “costly” replacements. However, when the costs of unscheduled downtime are considered, this “efficiency” theory is proved to be nothing more than myth.

Machines that have begun to exhibit defects are at greater risk of failure than those without defects, so they are more likely to generate unwelcome downtime costs. In contrast, a condition-monitoring system helps engineers plan maintenance and replace defective components before problems occur.

SENSOR INSTALLATION

When mounted in key positions on mechanical equipment, vibration sensors offer continuous monitoring and analysis. While this requires investment, it is minimal when compared with the potential cost of downtime on a wind turbine.

There are two main types of industrial accelerometers: AC accelerometers and 4-20mA accelerometers. AC accelerometers are typically used with data collectors for the vibration monitoring of more critical or complex machines, such as gearboxes and turbines, so are the sensor of choice for wind turbines. In general, 4-20mA sensors are used with PLCs to measure lower value assets such as pumps and motors.

The latest vibration monitoring sensors operate over a wide temperature range, measuring both high and low frequencies with low hysteresis characteristics and high levels of accuracy. Because of the punishing conditions they must withstand, they offer robust and reliable service thanks to stainless steel sensor housings to prevent the ingress of moisture, dust, oils, and other contaminants.

Accelerometers can be mounted on casings to measure the vibrations of the casing and/or the radial and axial vibration of rotating shafts. A typical approach is to examine the individual frequencies in a signal that correspond to certain mechanical components or types of malfunction – such as shaft imbalance or misalignment, so analysis of this data can identify the location and nature of a given problem. A typical example would be a rolling-element bearing that exhibits increasing vibration signals at specific frequencies as wear increases.

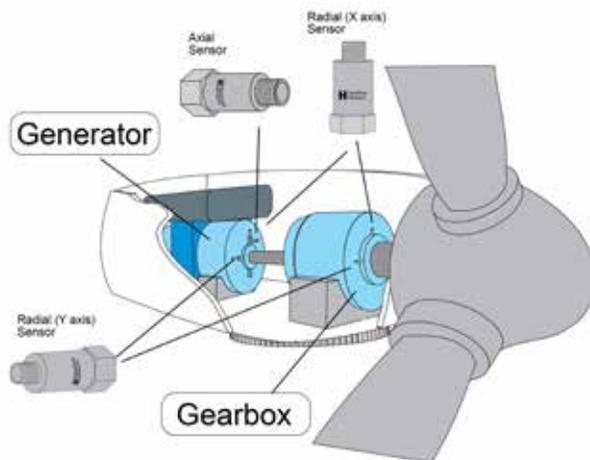
VIBRATION SPECIFICATION

To specify a vibration accelerometer correctly, engineers must consider the vibration level and frequency range to be measured, weight or fitting restrictions, and environmental conditions. It’s best to work closely with a supplier that has appropriate industry experience and knowledge.

For wind-turbine applications, low-frequency accelerometers are the ideal choice for detecting anomalies. In general, the models used on wind turbines are 100mV/g, or the higher sensitivity 250 or even 500mV/g. These might



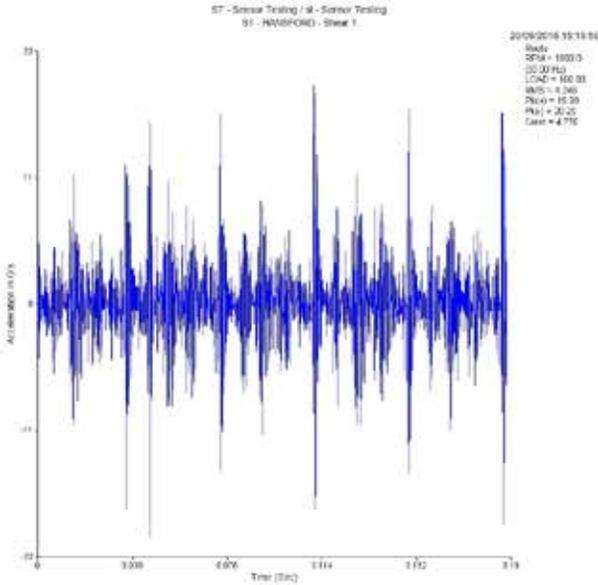
When mounted in key positions on mechanical equipment, vibration sensors offer continuous monitoring and analysis. While this requires investment, it is minimal when compared with the potential cost of downtime on a wind turbine. (Courtesy: Hansford Sensors)



The typical locations of sensors in wind turbines. (Courtesy: Hansford Sensors)

be used to monitor the low-speed aspects of the generator such as output shafts.

In most of the wind-turbine projects Hansford Sensors has been involved in, a local junction box was used to house the accelerometer cabling at the top of the turbine. This is usually fed back down to the ground using multi-core screened twisted pair cable to connect it to an online monitoring system, allowing operators to monitor turbine conditions in real time using a handheld device with internet access. Such a system will identify faults and enable maintenance engineers to take corrective action prior to failure.



This typical vibration monitoring signature shows acceleration over time from an AC output accelerometer. (Courtesy: Hansford Sensors)

ACCELERATED RESULTS

While the latest accelerometers are highly sophisticated, in some instances it can be a challenge to find a signal — such as that of a malfunctioning bearing — among all the other vibrations generated by a turbine.

An effective way to do it is to use acceleration enveloping: a signal processing technique that filters out low-level, repetitive vibrations to leave a “clean” signal that indicates the sound of a bearing alone. It is used in many applications to separate the signal of a malfunctioning bearing from the noise from the rest of a machine. It enables engineers to overcome the limitations of conventional velocity spectrum measurements and detect component failures at the earliest possible stage. The rate of wear then can be monitored and maintenance work planned accordingly.

A defect in a rolling element will cause repeated impacts that generate resonant frequencies in the surrounding machine surfaces, causing a “ringing” signal. Although the amplitude of the signal decays between impacts and becomes part of the overall vibration signal of the machine, it will affect the natural resonance response of the machine at the impact frequencies.

The signal from an accelerometer can be enhanced with acceleration enveloping. It progressively filters out un-

wanted parts of the vibration spectrum until the signal of the bearing defect can be isolated from the noise around it and clearly be identified.

LOW AND HIGH

The unfiltered waveform from a failing bearing is a mixture of low and high frequencies with no obvious pattern. Acceleration enveloping uses a two-step process to overcome this. The first step is to apply a band pass filter, which isolates only those frequencies in which the signal of interest is hiding. The filtered output pinpoints repeating, high frequency signals, caused by impacts of the rolling elements hitting the defect of the rotating bearing. These signals are represented graphically by a series of energy “spikes.”

In the second step, the filtered output is passed through an envelope. Here, the waveform is rectified — that is, the negative part is inverted to positive. This is then demodulated by tracing a line over the general shape of the rectified signal. This “envelope” is now used as a true vibration signal, helping it stand out from the noise.

The envelope helps to contain regularly spaced signals, such as a single defect on a raceway. Other causes of noise, such as shaft rub, are random, so they will not produce evenly spaced peaks. Once the signal has been filtered, the information is taken from the accelerometer using a data collector. A specialist can then review and interpret the data and decide whether maintenance is required immediately or can be done as part of routine schedules.

CONCLUSION

Wind-turbine operators are under constant pressure to run operations as efficiently as possible by raising output and controlling costs.

A predictive maintenance regime based on vibration monitoring can reduce catastrophic breakdowns, boost turbine availability, and increase the economic viability of wind energy. Coupling this with acceleration enveloping can further enhance efficiency.

This kind of maintenance regime is especially effective for offshore wind turbines, which are more expensive to repair due to their remoteness. Together, these techniques can help to cut the cost of maintenance and begin chipping away at the wind-power sector’s potential \$17 billion maintenance bill by 2020. ✎



Martin Armson heads up the U.S. operations for Hansford Sensors based in one of the fastest-growing states, South Carolina. Armson has a Mechanical Engineering degree. He first became involved in the vibration monitoring industry in the 1980s. Since then, Armson has worked with several leading companies before joining Hansford Sensors in 2017.



When machines wear out, they perform worse, are less productive, and finally, begin to fail as a result of mechanical damage.
(Courtesy: Photostock)

Protecting critical equipment

How tribology can help extend machinery service life.

By Edgar Martínez

Tribology is the science of interacting surfaces in relative motion. Basically, it studies friction, wear, and lubrication — three phenomena linked to surface degradation and, thus, to machine reliability and performance. When machines wear out, they perform worse, are less productive, and finally, begin to fail as a result of mechanical damage.

A major reference covering all major aspects of tribology is the book published by Emeritus Professor Ernest Rabinowicz, Ph.D. in Physical Chemistry, who worked for several decades at the Massachusetts Institute of Technology doing research in this field. He studied the things that cause machines used in a variety of industries to lose usefulness. According to Rabinowicz, surface degradation was the cause of more than 50 percent of loss of usefulness, as shown in the graph in Figure 1.

Therefore, controlling the conditions that affect tribological behavior is of the utmost importance to protect critical equipment. Drawing on knowledge from the fields of materials technology, physics, and chemistry, tribology is a truly multidisciplinary area. Its applications aim at reducing machine downtime while increasing productivity. Tribology can help extend the service life of critical machinery, as it pro-

vides the tools required to optimize friction and wear values.

Researchers around the world have shown the huge potential savings that can be achieved with improved tribological knowledge in a variety of industries. According to Theo Mang, Kirsten Bobzin, and Thorsten Bartels, authors of *Industrial Tribology: Tribosystems, Friction, Wear and Surface Engineering, Lubrication* (2011), gross domestic savings resulting from proper use of tribological knowledge could amount to 1.5 percent of the GDP. In the European Union, up to \$303 billion could be saved with better tribological practice.

HOW CAN TRIBOLOGY HELP PREVENT MACHINE FAILURE?

Each tribological system (that is, machine and lubricant taken as a whole) has its own features. Therefore, there is no single answer to this question.

To minimize machine failure, the first step is to choose the right lubricant. Depending on the industry, there are original equipment manufacturer (OEM) classifications and specific recommendations that should be followed at all times. When this information is not available, experts in lubricants can give advice on technical specifications such as viscosity,

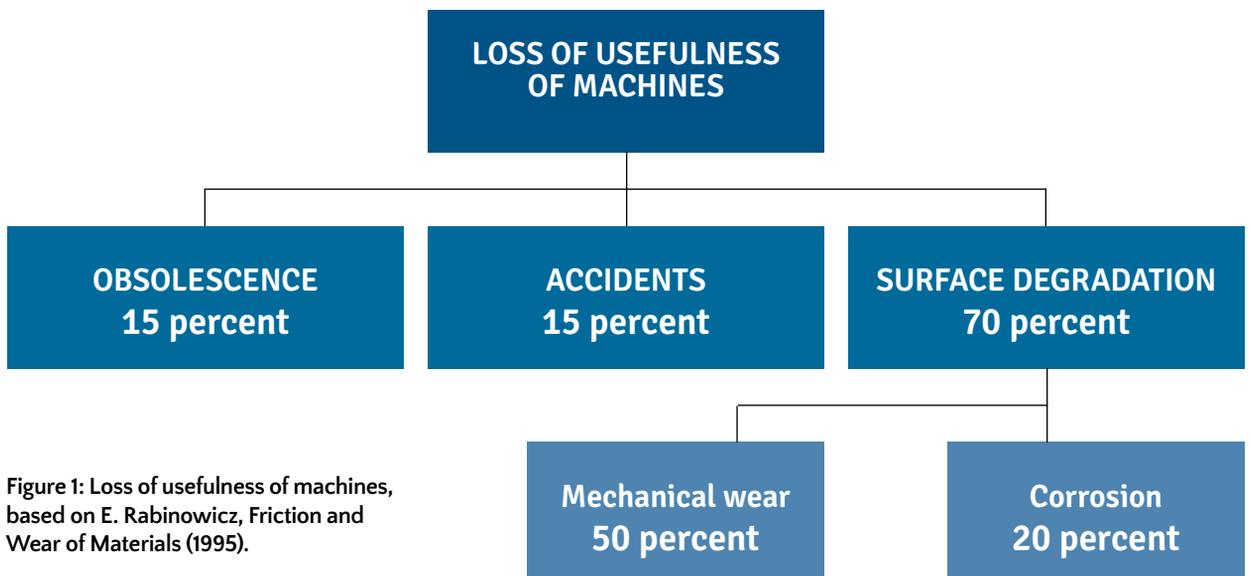


Figure 1: Loss of usefulness of machines, based on E. Rabinowicz, *Friction and Wear of Materials* (1995).

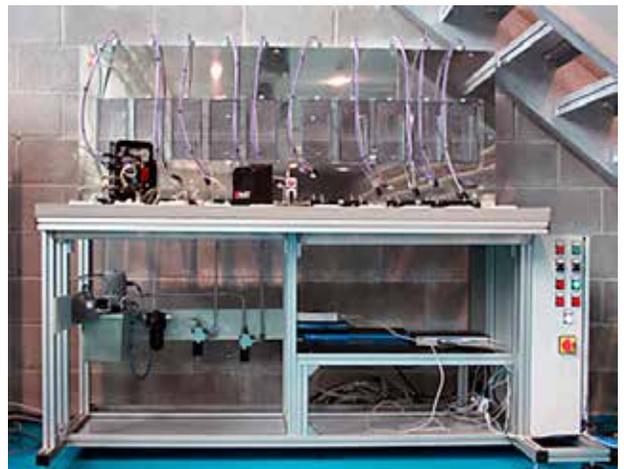


An optical sensor that monitors the state of lubricant oil. (Courtesy: Atten2)

base oils, additives, and so on.

Another key to keeping machinery at optimal performance involves monitoring fluid condition and checking start-up operation. Users must be fully aware of OEM fluid cleanliness recommendations before starting a machine. Since new oils can come with high contamination levels, filtering them before starting up the machine can be an effective measure.

When partial oil changes are performed, it is important to prevent undesirable oil blends that can facilitate reactions that change the properties of the lubricating fluid or the condition of machine surfaces. A lubricating oil with inadequate viscosity values, for example, will not function as expected throughout its lifespan. The fluid film that separates the metal surfaces of tools and machines will be too thin, allowing for contact between them, and thus leading to wear and, eventually, failure. In addition, potentially incompatible chemicals in the different lubricants may come into contact, in which case a complete system flush is required to drain the full volume of used oil before refilling the system with new oil.



A work table at Atten2. (Courtesy: Atten2)

Three basic parameters should be assessed in order to ensure good tribological behavior: lubricant degradation, tribological system contamination, and machine wear.

“ Tribology can help extend the service life of critical machinery, as it provides the tools required to optimize friction and wear values. ”

Inadequate tribology-based analysis of critical equipment can lead to catastrophic machine failure (adapted from Machinery Lubrication).

Monitoring all the aforementioned elements of oil-lubricated equipment is one of the best tribological practices. The criticality and type of the machines being assessed will determine whether regular offline analysis can be carried out or innovative online monitoring technologies should be applied.

Online sensors can also be used for measuring critical characteristics of lubricating oils and to provide indicators of the condition of the machines the oils are used in.

HOW CAN LUBRICATING OIL SERVICE LIFE BE MAXIMIZED IN CRITICAL EQUIPMENT?

Lubricating oil service life is affected by a number of factors. You can extend it, or at least prevent rapid degradation, by using it properly. The following best practices are recommended:

Choosing the right lubricant: ISO grades and viscosity are the most important parameters, since they are the primary indicators for the ability of fluids to keep contact areas separated. It is necessary to choose the right additive package as well, since additives cover or enhance a range of properties of the base stock, such as inhibiting the production of air bubbles or foam, preventing the metal from causing oil oxidation, or keeping metal surfaces from touching even at high pressure inside gears.

Maintaining the machine and the lubricating system in optimal working conditions: The machine-lubricant system needs to work within a specific range of parameters; otherwise, the stress on the system increases, leading to higher temperatures and rapid deg-

radation of the lubricating oil. Particle production and air entering the lubricating fluid might increase, too, affecting the degradation process. Using the proper filters and anti-foam agents can help reduce the impact of external factors such as metal particles or water, thus maximizing the useful life of the lubricating oil.

Monitoring the lubricating oil can help detect critical degradation values, so the user can take measures to extend the fluid's lifetime and enhance the reliability of the critical machinery and the processes involved.

WHAT MEASURES ARE TO BE TAKEN AFTER MONITORING AND ANALYZING THE TRIBOLOGICAL CONDITION OF CRITICAL MACHINERY?

Optimizing tribological conditions prevents premature machinery wear and reduces friction, thus increasing energy efficiency and ensuring a longer service life for your machinery.

Controlling the tribological conditions in critical equipment provides useful information on probable causes for failure. Assessing the tribosystem allows for the identification of factors (surfaces, working conditions, lubricating fluids) that can be controlled by taking corrective and preventive maintenance measures. For instance, identifying the types of wear can help determine whether machine failure is the result of lubricant condition or surface damage. With this information in hand, maintenance engineers and technicians can make better-informed decisions for greater machine efficiency and optimized costs.

Likewise, corrosion as the cause of wear is associated with inadequate oil condition, while wear resulting from mechanical abrasion will lead to control of the tribological condition of the contacting surfaces. ↵



Edgar Martínez De Aguas has been the CEO at Atten2 since 2016. He has an extensive career with more than 15 years of experience in O&M management projects in different sectors (paper, steel, petrochemical, food), failure and root cause analysis. Martínez is a mechanical engineer by the Universidad Simón Bolívar in Venezuela, and he also completed an MBA by the Instituto de Empresa in Madrid. He also holds a project management and direction certificate, Vibration Analysis Level I and Certified Maintenance and Reliability Professional (CMRP).



Hardware and software are critical for the secure and economical operation of wind turbines. (Courtesy: NREL)

Tackling turbine security

Turbine hardware and software aren't made in a bubble, which sparks the need to tackle security vulnerabilities.

By Robert Weber for Bachmann electronic

One wind turbine can create 18 full-time jobs in the U.S., and so even detractors are having a hard time ignoring wind power's momentum. The challenge for the coming years, however, is plant security. The industry is looking at a challenge from grid operators and regulators: How can the wind industry support efforts leading to more security?

For the past year, independent security researcher Maxim Rupp has been in great demand, particularly in the wind-power sector. It was about a year ago when this Germany-based security specialist published a document on the security vulnerabilities of wind turbines in the United States.

Rupp discovered many risks including: He could change the administrator password using a so-called cross site request forgery, so that he could then make changes to the turbine blade or the network settings. He also found a security breach on the web connections of the plants. The results of Rupp's work were disturbing for operators and the entire industry. Forbes magazine published a major report on the discoveries.

WHERE PROBLEMS START

The problem begins when an application is developed. Suppliers still start from the premise that devices will be implemented in a secure network, Rupp told Forbes. The German security expert said this was an assumption that arose in the '90s. For Rupp, there is no difference between a web page or a wind turbine. Both systems are susceptible to attack and must be protected.

According to Forbes, Rupp said wind turbines were operating in Europe without protection. Case in point: Not only in Europe, but also in the U.S., many turbines are still using Windows 95 computers. A simple search using the shodan.io search machine revealed security risks such as modifying the turbine operation and accessing the grid. However, PLC suppliers have responded to this with a solution that involves updated controls and software. Rupp has also noticed this. Companies are beginning to understand the situation and are making more effort to protect their products, Rupp reports.

However, the issue seems initially limited to the U.S. In Germany, there are only a few publications over the last several years that have addressed attacks

or security breaches on wind turbines.

In the U.S., Brian Hill from Bachmann electronic talks frequently to his customers about security. The importance of wind-farm security has increased and is at the top of the agenda for many customers. U.S. authorities set high standards with regard to security, since failures in infrastructure must be prevented. The government is working on more stringent regulations and requirements for the operators.

REGULATIONS IN PLAY

There are many new regulations coming from the NERC. The Energy Policy Act of 2005 (Energy Policy Act) gave the Federal Energy Regulatory Commission (FERC) authority to oversee the reliability of the bulk power system, commonly referred to as the bulk electric system or the power grid. This includes authority to approve mandatory cybersecurity reliability standards.

The North American Electric Reliability Corporation (NERC), which FERC has certified as the nation's Electric Reliability Organization, developed Critical Infrastructure Protection (CIP) cyber security reliability standards. On January 18, 2008, the Commission issued Order No. 706, the final rule approving the CIP reliability standards, while concurrently directing NERC to develop significant modifications addressing specific concerns.

Additionally, the electric industry is incorporating information technology (IT) systems into its operations — commonly referred to as smart grid — as part of nationwide efforts to improve reliability and efficiency. There is concern that if these efforts are not implemented securely, the electric grid could become more vulnerable to attacks and loss of service. To address this concern, the Energy Independence and Security Act of 2007 (EISA) gave FERC and the National Institute of Standards and Technology (NIST) responsibilities related to coordinating the development and adoption of smart grid guidelines and standards.

SECURE INFRASTRUCTURES

Bachmann is ready to create secure infrastructures for its customers, according to Hill. Bachmann electronic provides its customers worldwide with new hardware and regularly supplies new software updates to address

ongoing security concerns. Customers only have to install the software patches on their own or have their service provider do it for them.

Hardware and software are critical for the secure and economical operation of wind turbines. For this reason, Bachmann electronic is involved in the retrofitting of existing systems. Hill and his colleagues are working together with a variety of owner/operators. Their goal is to retrofit wind turbines with state-of-the-art Bachmann electronic technology in order to modify the various wind-turbine fleets, bring them into compliance with current regulations, and have the flexibility to meet the unforeseen regulations of the future.

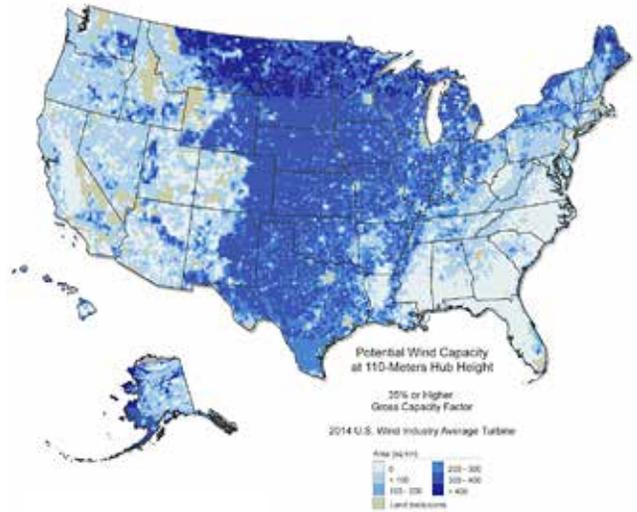
RETROFIT GOALS

Bachmann electronic is working with one of the U.S. national labs on one such retrofit where researchers will be able to carry out tests on wind turbines, change parameters, and adapt them to actual conditions. They can use the results for more efficient systems laboratory tests that will ultimately help improve turbine operation. The plan is to help them through the application of a new controller system, replacing the original wind-turbine controls' hardware and software, according to Hill, who is expecting new orders in the U.S. resulting from the collaboration with the lab and the test results.

In North America, Bachmann is concentrating on existing systems, Hill said. In the world's largest wind-power market, condition monitoring systems from Bachmann electronic are also in demand and are likely to be coupled with a controls retrofit solution.

A lot of new wind-energy capacity is moving forward this year and next through the benefit of continued momentum of clean-energy initiatives. Federal, state, and local governments, along with large corporations such as Google and Amazon, will continue to invest in renewable energy, Hill said.

These investments in wind power in the U.S. are creating new jobs. The U.S. Department of Energy estimates there will be about 250,000 Americans working in the wind-power sector by 2020, and even up to 600,000 by 2050. The sector continues to be optimistic about the future in spite of some opposition and in spite of the U.S. withdrawal from the Paris Climate Accord.



This map shows wind potential in the U.S. (Courtesy: Department of Energy)

The U.S. Department of Energy estimates there will be about 250,000 Americans working in the wind-power sector by 2020.

Hill said he still has some concerns.

“We have a lot of space in North America for land-based wind projects, but one of the biggest challenges is moving the energy from wind turbines to the population/load centers,” Hill said. “Our U.S. colleagues also understand the issues around the power grid. It’s been my experience that it is easier to build power stations than power lines.”

The grid is overloaded in some regions; however, new lines are planned, and this will help wind power in the United States.

In the meantime, Rupp continues to highlight the security features of the controller suppliers and is eagerly publishing security breaches in wind turbines in the U.S., Europe, and elsewhere in the world. There was one disturbing fact that arose from his discovery of security risks in June 2015: When it comes to hacking the computers of a wind farm, it’s not that difficult. ↴



Robert Weber is a technology journalist and founder. Until May 2015, he was responsible for the German-language trade journal *Elektrotechnik*. Instead of concentrating on his journalistic career, Weber now focuses on his start-up *Industrial Newsgames*, which develops communication solutions for the challenges of IIoT.

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PROFILE

Shermco Industries

Shermco Industries provides comprehensive wind generator maintenance and repair.

By Kenneth Carter
Editor | Wind Systems

At Shermco Industries, they have a simple goal: Help wind-energy project owners and operators reduce their overall cost of energy.

But achieving that goal takes a lot of effort and a lot of planning.

Part of that planning involves expanding the equipment reliability culture that exists in other industries into wind generation, said Kevin Alewine, director of marketing with Shermco Industries.

“We help this endeavor by developing as many solutions for uptower preventative projects as possible, supplying the most reliable and cost-effective remanufactured generators and by providing the highest level of testing, repairs, and service recommendations for the balance-of-plant equipment,” Alewine said.

FOUR DECADES OF EXPERIENCE

Shermco Industries was founded in 1974 to service, repair, and remanufacture electric motors and generators for general industry in the Dallas-Fort Worth area. The Engineering Services Division was added in 1981 to provide electrical engineering services and to test and repair the power systems, transformers, switchgear, and related components that deliver power to



Field service generator replacement. (Photos courtesy: Shermco Industries)

Shermco Industries

Founded:
1974

Headquarters:
Irving, Texas

Website:
www.shermco.com

factory machinery and power generation facilities.

And Shermco has only continued to grow, adding services and products to improve reliability and safe operations for a gamut of industrial and utility customers.



Generator being installed in turbine.

“We now have over 900 employees and 23 locations in the U.S. and Canada focused on engineering and field services, concentrating our motor and generator remanufacturing in Irving, Texas, and St. Paul, Minnesota,” Alewine said.

ENTERING WIND

Shermco’s first foray into the wind industry involved troubleshooting and failure analysis on a wind turbine’s electrical components for European-based OEMs, according to Alewine. Those OEMs had little-to-no specialized service capabilities in North America.

“As more turbines were installed, we developed great working relationships with both the OEMs and the generator manufacturers and have repaired or remanufactured hundreds of these units in our Irving facility,” Alewine said.

With many wind turbines starting to come out of warranty, Alewine said most of Shermco’s customers are the project owners — utilities in particular — who are interested in long-term reliability solutions.

“Since we have seen so many of these machines and understand their varied failure modes, we have developed upgraded engineered solutions for many of the designs, both mechanically and for the electrical insulation systems,” he said. “These solutions provide reliability and worry-free performance well beyond the original designs.”

Over the years, Shermco has worked with OEMs and owners on multiple upgrade projects, and the company has developed many of the processes used for uptower generator repairs, according to Alewine.

Those projects include rotor and stator lead replacement, mechanical upgrades, fleet change-out of failed bearings, and slip rings replacements ... to name a few.

“Recently, we have been able to



Remanufactured wind generator being set up for testing.



Stator during winding process.

identify rotor winding damage on some popular wind generators that can be repaired before a catastrophic failure, and we are performing quite a few surveys and life extension projects all over the U.S.," Alewine said. "In total, we have repaired or remanufactured more than 5 GW of generators. That's well over 3,000 units representing virtually every manufacturer, so we know what to expect and what is needed to make them more reliable."

CONTINUING EDUCATION

Adding to that, Shermco has a stand-alone training department that provides classroom and field-learning opportunities for hundreds of wind-energy technicians and managers.

"Our electrical safety classes are among the most sought-after in the country, and our technical classes on BOP (balance of plant) and substation maintenance have been adopted by many major OEMs and operating companies," Alewine said.

Shermco had been in the generator remanufacturing business for 25 years before wind became a factor. Because of those decades of expertise, the company has developed many solutions dealing with harsh-environment applications, and it understands what's involved to make those machines last until the end of their 15- to 20-year lifespan, according to Alewine.

"Working with key material suppliers and processing experts, we have been able to provide leading-edge solutions for generator remanufacturing," he said. "Our electrical insulation system has proven extremely reliable, and our redesigns for rotor leads, magnetic wedge retention, and both rotor- and stator-coil designs provide the long term life expectancy required by owners."

Shermco is also an early adopter of ISO 9001 quality standards.

“We have always been ahead of the curve for product quality,” Alewine said. “The Irving, Texas, repair facility was among the first to be accredited by EASA, the industry association for electrical machinery repair, and we have hundreds of technicians certified by the InterNational Electrical Testing Association (NETA), and all of our field-service projects comply with the NETA standards.”

SAFETY FIRST

But all that training and expertise are hard to justify without, according to Alewine, the most important statistic: safety.

Shermco regularly provides speakers and subject-matter experts for presentations, training events, and standards development committees for wind operations as well as the electrical industry in general.

“We have employees on multiple electrical safety and industry committees including NFPA 70E, NFPA 70 (the National Electrical Code), and NFPA 70B as well as the IEEE, ASTM, NETA, and AWEA,” Alewine said. “Additionally, we are avid supporters of the wind industry and have provided strong leadership in the Operations and Maintenance Committee, the Safety Steering Committee, and during multiple visits to Congress in Washington, D.C., on behalf of the industry.”

With all that in its arsenal, Shermco’s employees have worked diligently for more than three years to make the company the first and — so far — only motor and generator remanufacturer to achieve the OSHA VPP Star status in its Irving facility.

“These high standards of safety are adopted throughout our other offices and the field service team, which has led to awards and recognition for our efforts and achievement,” Alewine said.

So, Shermco’s goal of helping project owners lower their costs



Shermco Industries’ corporate office and flagship remanufacturing center in Irving, Texas.

may sound simple; however, the execution of that focused goal is anything but.

“Shermco employees and managers, through human performance education and practice, are embracing a culture of principled owner-

ship, responsibility, and mentoring to achieve the highest level of safety, quality, and job satisfaction,” Alewine said. ↴

Editor’s note: This article was originally published in the February 2017 issue.

CONVERSATION

Larry Barr

Senior Vice President of Operations & Maintenance
EDF Renewables

Dan Summa

Vice President of Generation
EDF Renewables

“It is imperative that we take a more holistic approach to extracting value from our assets”

In April 2018, EDF Renewables (EDFR) announced that its five North American entities, EDF Renewable Energy, EDF Renewable Services, EDF EN Canada, EDF EN Mexico, and groSolar would operate under one common brand. Additionally, EDFR announced that it would be organizing its business around three primary lines: Grid-Scale Power, Distributed Solutions, and Asset Optimization. Asset Optimization aligns Operations & Maintenance (O&M) with Asset Management under one executive vice president to leverage technical skills and operational expertise, with commercial and financial experience, to deliver the best value to asset owners. The leaders of the Asset Optimization group, Larry Barr, SVP of Operations & Maintenance, and Dan Summa, VP of Generation (i.e. head of EDFR’s Asset Management group), discuss their vision for the future and how the industry benefits from combining these two functions under one group.

What is the new scope that your combined Asset Optimization Group covers?

Barr: Asset Optimization combines two distinct groups within our organization of O&M and Asset



Larry Barr



Dan Summa

Management. Our O&M group is focused on providing the best value to the project owner. Our Asset Management group is focused on “making the assets sweat.” There is a lot of commonality between the two groups. Combining them helps to continue and accelerate each of their

separate primary objectives but also leverages the synergies between the two groups.

Summa: The combined group will focus on maximizing the value of our generating assets and bringing new and innovative service offerings to an ever-increasing competitive market. The renewable space is becoming more and more complex and competitive, and it is imperative that we take a more holistic approach to extracting value from our assets — everything from market optimization to increased plant performance and efficiency.

Barr: Another important benefit will be improved communication between Operations and our other business units including Development and the Corporate Support groups. Our synergies will improve also as we are speaking with one voice instead of two. We’ve already seen better information sharing amongst all EDFR groups, which not only helps our operating assets but our development asset as well.

Could you give an example of how this will improve communication?

Barr: Under the previous structure we had a lot more of an “us and them” mentality where every decision

was viewed from two different perspectives with, potentially, different desired outcomes. Under the current approach, we are aligned with the same goals and direction, which eliminates time-consuming review and challenge processes, which, in the end, did not add value.

What does EDF Renewables expect to gain from organizing the two groups under one leader?

Barr: The most obvious and short-term benefit would be a better understanding of the project needs and financials, elimination of some redundancy, better alignment of engineering support work for both groups, and faster decision making. We expect to extract additional value from the assets by leveraging the technical skills and operational expertise of O&M and the commercial and financial experience of the Asset Management group.

Summa: The Asset Management group can provide the O&M group with insight into services offerings that are attractive to asset owners, which in turn, they can then leverage in the competitive third-party space. The O&M group can assist the Asset Management group in maximizing the performance of its assets through its years of operational experience. Each group is very good at what they do, and combining the groups under one organization will only make them better.

How will this improve communication between Operations and other business units?

Summa: The increased communication and alignment between the groups is already producing results from eliminating unnecessary and



EDF Renewables' 175 MW Pilot Hill project in Illinois has both GE & Vestas turbines and benefits from a 20-year PPA with Microsoft Corporation. (Courtesy: EDF Renewables)

cumbersome processes to enabling both groups to react quicker to operational challenges.

Barr: Combining the two groups has eliminated significant gaps and overlaps. In the past, sometimes we would be working on an engineering solution (for example) only to discover later that we were working on the same problem in parallel. The improved communication now allows us to be more aware of what the other group is working on and discover and capitalize on synergies before we act.

What effect will it have on your O&M and Asset Management third-party business?

Barr: Our goal remains to be the O&M provider that delivers the best value to asset owners. To do this, we need to make sure we excel on our own projects. As noted, the world is changing fast. We must continue to innovate in order to remain the best in class provider: new services, new technology, new know-how. We intend to remain a big player on the third-party O&M business. Providing services to others makes us better on our own projects (new know-how, more pur-

chasing power, etc.). Conversely, being the best service provider to our internal customers means we can deliver more value to third parties. I see the two as synergetic.

Summa: Agreed, closer alignment between Asset Management & O&M will enhance O&M's ability to bring the "owner" perspective to third parties.

How will this increase your ability to remain a big player in the third-party O&M business?

Barr: As previously discussed, this new alignment will significantly improve our ability to implement improvements in services, engineered solutions and even organizational structure resulting in getting these solutions to our third-party customers quicker than in the past. Additionally, having already implemented these things on our projects gives us the added advantage of using our own experience as a primary sales tool: "Yes, we know it will work because we've already tested it on our own projects." ✨

For more information, go to www.edf-re.com

INNOVATION

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NREL releases major update to wind-energy dataset

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

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

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

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

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



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

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

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

An interactive online visualization lets users interact with the data.

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

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

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

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

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

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

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

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

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

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

Source: NREL

For more information, go to nrel.gov

New research addresses ice accumulation

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

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

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

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

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

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

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

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

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

Source: Dr. Wei Zhang

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

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

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

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

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

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

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

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

Source: Dulas

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



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

Acciona receives grid-scale energy storage certificate by DNV GL

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

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

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

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

Energy storage is a key element



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

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

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

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

Mørk said.

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

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

Source: Acciona Energia

For more information, go to www.acciona.com

MANUFACTURING

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Siemens Gamesa secures new order in Japan for 74.8 MW



An SGRE wind farm in Japan. (Courtesy: Siemens Gamesa)

Siemens Gamesa continues to reinforce its presence in Japan by reaching its first agreement with Tokyu Land Corporation for two projects in Hokkaido and will supply 22 of its SWT-3.4-108. Both nacelles and hubs will be manufactured in Denmark, while the blades will be produced in China.

The turbines will be delivered in 2018-2019, and the first batch arrived at the port in Hokkaido in April. Siemens Gamesa will also handle the operations and maintenance services at these facilities for the next 20 years.

“Siemens Gamesa is strongly committed to the Japanese market,” said Álvaro Bilbao, CEO of Siemens Gamesa’s APAC Onshore business. “We were pioneers in this market, and we have established ourselves as the leading supplier thanks to our ability to adapt to our customers’ needs.”

The contracts were signed in August 2017 and March 2018 and are part of the Order Book announced in the results of Q2 FY2018.

SIEMENS GAMESA IN JAPAN

Since entering this market in 1999, Siemens Gamesa has installed 188 wind turbines in the country (more than 323 MW). The company is also an active player in the operation and maintenance segment.

In addition to Japan, Siemens Gamesa’s footprint in Asia Pacific extends to China, South Korea, Indonesia, the Philippines, Thailand, Vietnam, Australia and New Zealand, where it has already installed more than 6.6 GW. ↘

Source: Siemens Gamesa

For more information, go to www.siemensgamesa.com

Senvion unveils new 4.2 MW turbines for North American market



Senvion, a leading global manufacturer of wind turbines, recently unveiled its 4.2 MW platform, the 4.2M140 and 4.2M148, based on the company's 3.XM series.

The Senvion 4.2-MW turbines are best suited for low and medium wind sites and are an excellent choice for the U.S.

"The 4.2M140 and 148 are the logical next step in our product line for the U.S., and initial market indications are extremely positive," said Lance Marram, CEO Senvion of North America. "The 4.2 MW platform is driving down LCOE, maximizing yields and — considering our strong track record — creating long-term business case certainty for our customers' investments."

"Over the last year we have made significant strides in technology and supply chain to strengthen our competitive edge; the 4.2 MW platform is a clear result of that," he said.

The 4.2M140- and 4.2M148-type turbines provide a modular approach and technical advancements such as lighter, longer, and more efficient rotor blades. The company's dynamic control technologies en-

The 4.2 MW is a direct evolution of Senvion's 3.XM series.
(Courtesy: Senvion)

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able the 4.2M140 and 148 to safely maximize energy production and adapt to specific regional requirements, such as noise, site conditions, and grid.

The 4.2 MW is a direct evolution of Senvion's 3.XM series. These turbines are set to generate a significant increase in AEP, while driving down LCOE. Senvion's highly modular platform enables delivery of competitive products across wind regimes. The 4.2M140 and 148 are designed for more efficiency, higher availability and lower transport, installation, and service costs.

The 4.2M140 and the 4.2M148 are another milestone in Senvion's modularization and standardization strategy.

Coupled with the company's focus on its partnership approach and project specific solutions, Senvion is well positioned to generate high-yields and high returns for its customers. ↴

Source: Senvion

For more information,
go to www.senvion.com

Siemens Gamesa to supply 199.5 MW at Live Oak wind project

Siemens Gamesa Renewable Energy has been selected by ENGIE North America Inc. to supply turbines for the Live Oak Wind Power Project. The company will supply 76 of its SWT-2.625-120 wind turbines, totaling nearly 200 MW. The project will be in Schleicher County, near San Angelo, Texas. The deal also includes a 10-year long-term service and maintenance agreement. This contract was signed in March 2018.

The turbines for this project are expected for delivery in July 2018. The Live Oak Wind Project is targeted for commercial operation by year's end. The blades will be manufactured at the company's Fort Madison, Iowa, facility, and the nacelles and hubs will be assembled at the Hutchinson, Kansas, facility.

"The Live Oak Wind Project

demonstrates the continued competitiveness of wind power in the energy mix and its contribution to the local economy," said José Antonio Miranda, Siemens Gamesa Renewable Energy, CEO Onshore Americas. "The Siemens Gamesa team takes an immense amount of pride seeing our commitment to continuous innovation and cost optimization come to life."

In Texas, Siemens Gamesa has more than 2,000 wind turbines installed, totaling more than 4 GW of installed capacity. In total, the company has provided turbines for more than 150 project sites with an output capacity of more than 18 GW in the U.S. ↴

Source: Siemens Gamesa

For more information, go to
www.siemensgamesa.com

Senvion posts one of the best first quarters in terms of order intake with more expected

Senvion has recorded one of the strongest first quarter order intake

in the first three months of 2018 driven by solid business in new mar-

kets such as Australia and India in particular. Order intake growth is expected to continue in 2018 due to a large pipeline secured in key markets, and it is likely to pave the way for further growth in 2019 and 2020.

Senvion posted 256 million euros in revenues the first quarter of 2018. The main reasons for this development were the typical seasonality witnessed in this industry coupled with the back-end loaded nature of the installation schedule this year. In line with revenues, EBITDA was also weaker resulting in an adjusted EBITDA margin of 0.3 percent.

Working capital was slightly higher, up 3.1 percent, influenced by the build-up of inventory for the business installation phase in the second half of the year. Given the soft start to the year and the higher working capital, the free cash flow amounted to 59 million euros. Nevertheless, Senvion remains fully optimistic that it will meet its 2018 revenue and EBITDA targets against the background that 99 percent of the revenues are already covered at the lower end of our guidance range.

The order intake in the first quarter grew by 37 percent year-on-year. The company's total order book amounted to 5.2 billion euros, of which 1.9 billion euros were in firm orders, 600 million euros in conditional orders and 2.7 billion euros in service orders. In particular, the onshore firm order

book showed solid growth in the first quarter, growing by 35 percent and is expected to grow even further during the course of the year. Senvion has secured multiple exclusivities and preferred supplier status in many markets totaling to more than 2.5 GW, which is expected to keep order intake at a healthy level by the end of 2018.

"The first quarter is typically a soft quarter in our sector," said Senvion's CEO Jürgen Geissinger. "We recorded thin operating margins due to lower revenues and installation levels in this quarter. However, we were able to show a very solid strong growth in

order intake in the first three months of this year. It was our best first quarter in terms of order intake since IPO. It is a very encouraging sign, and it underscores our outlook for 2018 and 2019. Our focus is now on making sure that we deliver our cost savings program in time."

Senvion is continuing to make good progress in implementing the announced strategy. While it is still focusing on the transition of its supply chain to reduce variable costs without compromising on high quality standards, the efficiency measures in the "Move Forward Program" are contributing to de-



Senvion is a leading global manufacturer of onshore and offshore wind turbines. The company develops, produces and markets wind turbines for almost any location. (Courtesy: Senvion)

creasing fixed costs.

“Our financial performance was weaker during the quarter mainly due to the cyclical nature of the business,” said Manav Sharma, CFO of Senvion. “But, we are happy to report further improvements in our opex rate and interest costs. We were able to achieve a quarterly opex reduction of 8 percent on a year-on-year basis in the first quarter, and we

expect to maintain a stable cost base going forward. Compared with the first quarter of 2017, net interest costs were down by 34 percent in the first quarter.” ↵

Source: Senvion

For more information, go to www.senvion.com

Siemens Gamesa to supply 70 wind turbines to three Norway projects

Siemens Gamesa Renewable Energy will supply three onshore wind farms in Norway including 70 units of its Onshore OptimaFlex wind turbines. The SWT-DD-130 turbines will each feature a rated capacity of 4.2 MW and a 130-meter diameter rotor. All turbines will be installed on steel towers with 125-meter hub heights. The project sites with 15, 18, and 37 units are in the Bjerkreim and Ha municipalities — about 50 kilometers southeast of Stavanger. A 25-year full service agreement with a yield-based availability warranty secures the long-term performance of the wind farms.

Owner and long-term operator of the wind farm trio is Hamburg-based Luxcara, a leading asset manager for

renewable energy investments for institutional investors. The installation of the 76-MW Skinansfjellet project, the 63-MW Gravdal wind farm, and the Eikeland-Steinsland project with more than 155 MW — a combined rating of 294 MW and collectively known as the Bjerkreim cluster — will start in spring 2019 with completion planned for autumn 2019.

“We are very happy to be able to rely on Siemens Gamesa as such an experienced partner in the Nordics for our largest wind project so far,” said Dr. Alexandra von Bernstorff, managing partner of Luxcara.

Siemens Gamesa is executing the projects in close collaboration with Luxcara and the Norwegian devel-

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oper Norsk Vind Energi. A strong focus in this collaboration was on regional content and a minimized environmental impact during installation and operation. Construction services including groundwork and foundations are going to be commissioned by local companies. A technician team will be recruited locally to service and maintain the projects over their 25-year lifetime. All three project sites are characterized by a complex terrain. Nevertheless, earth movements to create storage and installation areas will be kept to a minimum.

“We are proud to perfectly meet the site and project specific demands of these wind farms with our highly flexible SWT-DD-130 turbines,” said Ricardo Chocarro, CEO Onshore at Siemens Gamesa Renewable Energy. “Our technology is well suited for complex wind regimes like

Norway while the experience of our regional team helps to meet all demands including challenging logistics and installation environment.”

Present in Norway since 2002, the accumulated base installed by Siemens Gamesa accounts for more

than 500 MW and more than 200 turbines. A further 390 MW is under installation. ↙

Source: Siemens Gamesa

For more information, go to www.siemensgamesa.com



The SWT-DD-130 turbine features a rated capacity of 4.2 MW and a 130-meter diameter rotor. (Courtesy: Siemens Gamesa)



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Mortenson to build \$140M wind projects in Illinois in 2018



Work also is underway in Lee County at the 15-year-old Mendota Hills Wind Farm for Leeward Renewable Energy, LLC. (Courtesy: Mortenson)

Already the largest alternative energy builder in Illinois, Mortenson recently added three new Illinois wind farm projects that will contribute an additional 289 MW of electricity to the state by the end of 2018 and an additional 194 MW in 2019.

“Illinois is an ideal state for wind energy, both because of its geography and its need for power due to major manufacturing centers and large population,” said Tim Maag, vice president and general manager of Mortenson’s Wind Energy Group. “Despite ranking sixth in the nation for

wind energy, though, Illinois has to really ramp up energy from renewables very quickly to meet its goals.”

“According to the American Wind Energy Association, as of 2016, wind power contributed less than 6 percent of all electricity in Illinois,” he said. “Yet renewable portfolio standards require Illinois electric companies to generate 25 percent of electricity from renewable sources by 2025.”

The new wind projects will help toward that goal. Mortenson is building the Walnut Ridge Wind Project

in Bureau and Whiteside counties for BHE Renewables, a unit of Berkshire Hathaway Energy. The project includes engineering and construction of roads to the site and the foundations and installation of 106 Vestas V110 turbines. Mortenson also is building transmission lines, met towers, interconnect facility, and collection substation that links into the Commonwealth Edison electrical grid. Started in August 2017, the wind farm will be completed in late 2018 and begin generating 212 MW, enough to power the equivalent of 63,600 homes.

Work also is underway in Lee County at the 15-year-old Mendota Hills Wind Farm for Leeward Renewable Energy, LLC. Mortenson is replacing 63 wind turbines with 29 more powerful SG 2.6-126 wind turbines. The repowering project, which will be completed in December 2018, will increase total capacity to 76 MW from roughly 50 MW.

“We are pleased to have an experienced construction firm like Mortenson as our partner on the Mendota Hills repowering,” said Greg Wolf, CEO of Leeward Renewable Energy. “Together, we will focus on safely bringing today’s modern technology to this proven wind project.”

With 23 years of alternative energy construction, Mortenson has built more than 220 U.S. wind farms in North America contributing more than 24,000 MW of energy. The two Illinois projects are Mortenson’s ninth and 10th wind projects in the state. Illinois wind power produces 4,332 MW each year, according to the U.S. Wind Energy 4th Quarter 2017 Market Report from the American Wind Energy Association. ↘

Source: Mortenson

For more information,
go to www.mortenson.com

Flurry of U.S. offshore vessel deals prepares market for huge turbines

Vessel suppliers and wind installation experts are collaborating to build new vessels and convert existing assets to bring rising turbine capacities to the booming U.S. offshore wind market, offshore experts told New Energy Update.

Surging growth in U.S. offshore wind activity has spurred a range of new vessel supply offerings and collaborations within the marine sector. Larger, higher-efficiency turbines and growing installation experience have dramatically reduced offshore wind costs, producing record-low tender prices in Europe and raising U.S. growth outlooks.

About 28 U.S. offshore wind projects totaling 23.7 GW were planned or under development by mid-2017, with most near-term projects planned in the North Atlantic region, figures from the U.S. Department of Energy (DOE) show.

The U.S. federal Bureau of Ocean Energy Management (BOEM) has awarded 13 commercial wind-energy leases off the Atlantic coast, and



Two Falcon Global feeders leave port with offshore wind components. (Courtesy: Falcon Global)

in April, it launched a lease sale proposal for two offshore wind sites offshore Massachusetts. BOEM also recently called for information on nominations to develop wind farms in New York State waters and launched an assessment of Atlantic coast waters for potential future offshore wind lease areas.

Also in April, Florida-based Aeolus Energy Group announced it

plans to build a U.S.-flagged vessel fleet to serve the offshore wind sector, expecting to generate 4,000 jobs in the next couple of years.

“We are confident that offshore wind at scale has finally arrived in the U.S.,” said Elia Golfin, CEO of Aeolus Energy.

Aeolus will make “a considerable billion dollar” investment, Golfin said. The company plans to build

jack-up vessels capable of installing 10- to 12-MW turbines, as well as cable ships to install medium- and high-voltage marine cables, service operations vessels to provide large-scale accommodation at sea, a fleet of crew transfer assets of vessels and helicopters, and port facilities in Massachusetts and Maryland.

The company will also invest in training facilities.

“During the construction season for offshore wind, we have a 24-hour work cycle,” Golfin said. “Staffing all of those jobs around the clock for months on end with qualified Americans is a significant challenge.”

Aeolus plans to have its first vessels ready for operation between the end of 2021 and early 2022.

INSTALLATION SPEED

In March, Seacor subsidiary Falcon Global and Norway’s Fred Olsen Wind Carrier agreed to jointly supply vessels and marine installation crews to the U.S. offshore wind market. Fred Olsen Windcarrier is one of Europe’s most experienced offshore wind installation groups and has installed more than 300 turbines to date.

The two companies have already combined to install the Block Island windfarm, the U.S.’s first utility-scale offshore wind farm, in 2016.

The new partnership will combine Fred Olsen Windcarrier’s fleet of wind-turbine installation vessels with Falcon Global feeder vessels. The Falcon Global fleet consists of one of the largest existing U.S.-flag and Jones-Act compliant lift boats.

The Jones Act requires that vessels transporting cargo between offshore wind farms and U.S. ports must be built in the U.S.

By using a Fred Olsen installation vessel at the Block Island site and smaller U.S. flagged feeder vessels to move wind-farm components such as towers and blades, the proj-

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ect partners were able to complete the installation 25 percent faster than expected.

This accelerated installation process offset extra costs of using feeder vessels and reduced the risk of weather affecting project schedules and staff safety, according to Joseph Orgeron, special projects manager at Falcon Global.

“It is more expensive to do the feedering, but this (extra cost) is very negligible in the overall expenses of the installation process,” Orgeron said.

LARGER TURBINES

By the end of 2019, offshore engineering group Zentech and Renewable Resources International plan to launch the first Jonas Act-compliant offshore wind jack-up installation vessel, said Andy Geissbuehler, managing director at Renewables Resources International.

The partners will convert an existing Jonas Act-compliant vessel into a jack-up offshore wind installation

vessel at about half the cost of a new vessel, Geissbuehler said. The converted vessel will be able to navigate the New Bedford Hurricane Barrier in Massachusetts, an area that most of the larger existing vessels cannot access.

The launch date for the vessel was delayed after GE announced in March it planned to launch a 12-MW offshore turbine, the world’s largest, by 2021.

GE’s Haliade X turbine will be 250 meters tall and represents a significant advancement in offshore turbine capacity. Last year, Denmark’s Orsted installed the world’s first 8-MW turbines in the U.K., and the average capacity of newly installed turbines was 5.9 GW.

“We are in the process to upgrade several aspects of the vessel including an even bigger crane,” Geissbuehler said. “We are making some critical design changes, and this vessel is going to be much more powerful than initially planned.”

The vessel will be able to trans-

port equipment from onshore to the offshore wind-farm site and perform installation, a process used in Europe.

“As wind farms get bigger, the feeder barge solution is becoming less and less attractive, except if you build very fast and very large feeder barges, which would be really expensive,” Geissbuehler said.

According to Orgeron, Falcon Global and Norway’s Fred Olsen Wind Carrier’s fleet can handle the vast majority of turbines available for installation, and no extra investment is planned in the short term.

“For the GE 12-MW turbine that was recently announced ... we are currently still working through the optimizations for those types of next-generation turbines, and whether they can be done with our existing assets,” Orgeron said. ↴

Source: New Energy Update

For more information, go to www.newenergyupdate.com

Siemens Gamesa to refurbish turbine gearboxes for Eneco

Eneco, owner of the Princess Amalia Wind Farm, has selected Siemens Gamesa as the supplier for gearbox refurbishment. For the next five years, the company will maintain and refurbish the gearboxes of 60 Vestas V80-2.0MW wind turbines. The Princess Amalia Wind Farm was commissioned in 2008 and offers a total capacity of 120 MW. This contract is part of a number of new management and maintenance contracts for the Dutch offshore wind power plant.

The scope of the work includes the initial supply of up to four gearboxes of the type ZF- EH804, fully equipped with all auxiliaries. After the first exchange campaign, which is expected during Q2 2018, the removed gearboxes will be handed over to Siemens Gamesa facilities to be



The gearbox facility of Siemens Gamesa includes five manufacturing sites in Spain. (Courtesy: Siemens Gamesa)

“ We are very pleased to expand our multi-brand wind service solutions also to offshore wind projects. ”

fully refurbished. The overhauled set of gearboxes will be supplied for exchange in the next step of the campaign. A dedicated repair team for the project contributes a repair capacity of up to four gearboxes within 10 weeks. All of the work will be done in Spain.

The gearbox facility of Siemens Gamesa includes five manufacturing sites in Spain. The company has a long-term track record in design, manufacturing, and service of gearboxes for heavy-duty industries such as wind turbines. With more than 400 repair units per year, the facility is the

largest of its kind globally. For Siemens Gamesa’s service business unit, it offers an efficient competence center for the repair of main shafts and transmissions of various types.

“We are very pleased to expand our multi-brand wind service solutions also to offshore wind projects,” said Mark Albenze, CEO, Service at Siemens Gamesa Renewable Energy. “For the repair work at Princess Amalia Wind Farm, we rely on the expertise of our colleagues in our Spanish facilities, who add their extensive experience in the professional refurbishment of wind gearboxes to this project.”

ishment of wind gearboxes to this project.”

The 120-MW Princess Amalia Wind Farm, operational since 2008, is 23 kilometers off the coast of Ijmuiden, the Netherlands. This wind farm supplies electricity to 125,000 households, and it is the first Dutch wind farm built at this water depth and at such a large distance from the coast, outside the 12-mile zone. ✎

Source: Siemens Gamesa

For more information, go to www.siemensgamesa.com

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Higher hub heights eyed for North American wind

Many wind turbines in the United States consist of a steel tower with an average hub height of less than 100 meters. Yet higher wind turbines are proven to produce higher yields. Max Bögl Wind AG is the market leader for hub heights above 130 meters and recently built the world’s tallest wind turbine with a hub height of 178 meters. At AWEA WIND-POWER, the company presented its Hybrid Tower system and showcased its activities in the North American market.

The Hybrid Towers of Max Bögl Wind AG offer an advantage — an efficient combination of concrete and steel that allows for the cost-effective implementation of hub heights of up to 180 meters. Less wind turbulence and thus significantly better wind yield means that each additional meter of hub height increases the annual energy yield of the turbine by 0.5 percent to 1 percent. This ensures a

faster ROI for the entire project.

KNOWLEDGE TRANSFER

Max Bögl Wind AG has been deploying its modular hybrid tower system in Germany with great success over the years and is now the market leader for hub heights above 130 meters. The world’s tallest wind turbine — with a hub height of 178 meters — began operating near Stuttgart at the end of last year. The family company from Bavaria said it believes hybrid towers can be a huge success in the North American market as well. Ever rising steel prices make it difficult to accurately calculate the costs for steel-tower turbines.

Concrete prices, on the other hand, are stable and make cost calculations for hybrid towers much more reliable. The hybrid towers of Max Bögl Wind AG are constructed in mobile factories using local workers and local resources.



Hybrid towers achieve great heights and more yield. (Courtesy: Max Bögl Wind AG, Reinhard Mederer)

This ensures added value on the local level.

COMBINING STEEL AND CONCRETE

The secret to achieving such great heights lies in the unique combination of precast concrete parts and steel elements. The concrete component is completely maintenance-free and especially durable. Consisting of a rigid concrete tower section and a more flexible steel tip, hybrid tower systems also offer better static and dynamic

response behavior and higher fatigue strength and longevity than pure concrete or steel towers. The modular design and simple “stacking” of rings allow fast construction of the concrete tower within a week, and this under any weather conditions.

With the water battery, Max Bögl Wind AG has also developed a completely new large-scale storage facility, which sets new standards in a technologically innovative way. For the first time, power generation from renewable energies such as

wind, solar, or biomass is combined with a modern pumped-storage power plant. The water battery can store surplus power from the grid and then release it when needed. The tower foundations of wind turbines also can serve as storage reservoirs that are higher than the pumped storage power plant and the lower reservoir. ↴

Source: Max Bögl Wind AG

For more information, go to www.mbrenewables.com/en

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CROSSWINDS



Visitors to GE Renewables could have a virtual reality experience. (Photos courtesy: Wind Systems)

The McCormick Convention Center played host to 426 exhibitors.



Another successful WINDPOWER

At this year's WINDPOWER show in Chicago, booths of more than 400 companies filled the McCormick Convention Center; 100 of them exhibited their expertise

for the first time. That alone is proof at how far wind has come and how far the industry expects it to go. "The stability created by an orderly five-year phase out of the Production Tax Credit was a home run for our industry, American manufacturing, and job growth," AWEA CEO Tom Kiernan said during the general session. "Wind is now an essential part of the modern American electricity supply." Here are some photo highlights from Chicago.

Models of turbine blades made up the "ceiling" of Vestas' booth.

Wind Systems will see you in Houston in 2019. ↘



Uptake's booth boasted an interesting display using iPads.



Products from Avanti made a striking impact for passing attendees.

ENGINEERED DROP PREVENTION SOLUTIONS



Since inventing the socket and driver back in 1920, Snap-on has been driven by innovation. This GE 1.5 Hub Hatch Tool is an engineered solution that replaces the homemade version in many technician bags. It includes a floating, certified attachment point, ensuring functionality and drop prevention.

GE Hub Hatch Tool



Stainless Steel Safety Coil is designed to slide freely along the handle, so you can hold the wrench where you need to.

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