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» **Profile:
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EDITOR'S DESK

FEBRUARY 2018

February introduces a new feature

One month already down for 2018, and we're knee deep in the month that celebrates dead presidents, candy hearts, and Moon-Pies (trust me, that joke kills in the southern United States).

A lot of *Wind Systems*' nuts-and-bolts revolve around operations, and this month's issue focuses on that as well as turbine maintenance.

To help, we've got quite the array of articles dealing with these topics.

An article from Oerlikon addresses how to extend the life of wind-turbine components. An expert with Campbell Scientific reveals the best practices for cold weather wind energy. Globecore shares its insights on changing oil in turbine gearboxes. And finally, experts with AeroTorque complete their two-part series on torque loading.

Turbine maintenance has been getting a boost in newer turbines as many of the bigger models now come with elevators installed. That extra equipment means that it must be maintained under specific guidelines. In this month's company profile, we talk with an official from the Elevator Industry Work Preservation Fund. This organization exists to ensure that work done on elevators is done as safely as possible.

In our Conversation feature, an official with AMSOIL shares his company's insights on creating some of the best lubricants used by the industry.

In addition to our regular features, I am pleased to introduce a new one: Experts with New Energy Update will be contributing a monthly article about the direction of the industry. The inaugural feature explores how one energy company is optimizing wind resources and site performance by boosting trust between legal, safety, and operations. It's a fascinating piece with a lot of insight into the work being undertaken to reduce internal friction.

I suspect you will see a lot more from *Wind Systems* as the year goes on. We are constantly working with companies and other organizations within the industry to better serve you and bring you valuable information about where wind is headed.

Consider this month just a taste of what's to come, so please enjoy this month's issue. And, as always, thanks for reading!



Kenneth Carter, editor
Wind Systems magazine
editor@windssystemsmag.com
(800) 366-2185, ext. 204



Wind made business inroads in 2017

Courtesy of AWEA

- About half of new U.S. utility-scale electric generating capacity came from renewable sources in 2017, according to the Energy Information Administration.
- Worldwide renewable energy investments exceeded \$333 billion in 2017.
- Notable corporate wind deals from 2017 included purchases by Google, GM, Facebook, Apple, Anheuser-Busch, General Mills, and Target.
- BART, San Francisco's rapid transit system, inked wind and solar PPAs in 2017 that will make it America's first renewable-powered public transit system.
- Google predicted it would run on 100-percent renewables by the end of last year, with 95 percent of its power coming from wind.

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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Improving safety and efficiency

Boosting trust between legal, safety, and operations can unlock optimized wind resources and site performance

By Jason Deign

Pressure from wind owners to shift from availability driven operational models to performance optimized strategies has never been stronger. The trick, however, is being able to carefully balance OPEX reduction with optimization opportunities to protect efficiency and safety portfolio wide. Importantly, efforts to optimize ever more complex sites can lead to internal frictions that have a negative effect on resources, labor performance, and budgets.

To provide some insights into the good work being undertaken across the wind industry, New Energy Update has spoken to Liz Weir, vice president of Law and Deputy General Counsel at Apex Clean Energy, and her colleague, John Boyle, Health & Safety Manager to understand how they've been able to dramatically reduce some of these internal frictions to achieve significant cuts to injuries, site/central distrust, and expensive back office workloads across their business.

The wind industry is being urged to review relationships between legal, safety, and operational teams following pioneering work by Charlottesville, Virginia-based Apex Clean Energy.

CUTTING INJURY RATE

In the last two years, Apex has done away with the traditionally adversarial relations between operations and health and safety executive (HSE) and in-house legal teams, improving safety and efficiency in the process.

The change is credited with helping to cut the rate of recordable injuries by about 80 percent in the last year and reducing legal team workloads by about 50 hours annually.

In most traditional wind businesses, head office



The wind industry is being urged to review relationships between legal, safety, and operational teams following pioneering work by Charlottesville, Virginia-based Apex Clean Energy. (Courtesy: Apex Clean Energy)

teams only visit the field to follow up on an incident, Boyle said. This can lead to feelings of mistrust that hamper cooperation and make it harder to resolve issues.

“Human resources only arrives if someone is going to get fired,” Boyle said. “Safety only arrives if there’s an injury and drug test. Legal arrives when there is a catastrophe.”

Distrust of central office functions can affect the efficiency of investigations, Weir said.

“Legal involvement post-incident imposes an unknown and formal element on a site,” she said. “The attorneys have a chilling effect on site dynamics, which increases suspicion and stifles communication so only the most necessary facts are part of the record, dis-incentivizing accountability as folks try to place blame rather than take responsibility.”

LACK OF PRIOR KNOWLEDGE

Even in the best of situations, a lack of prior knowledge about a site can delay proceedings and contribute to an incomplete picture of events.

“Bringing attorneys in post-incident does not benefit the client as the information gained at this point

may not be as accurate or complete as the attorney would learn in a real-time partnership with site safety and personnel,” Weir said. “Catching up on site facts at a critical time also drains resources, as energy is spent on fact gathering rather than using the time to advocate for a resolution.”

A further problem with the traditional approach to legal and HSE relations with field personnel is that it does little to foster the development of a low-risk safety culture.

On one hand, a reactive approach to health and safety means HSE and legal teams are unable to spot and solve problems before incidents occur.

On the other, the distrust that arises from this reactive approach may make it harder for field teams to appreciate the value of HSE and legal guidance.

“Some legal advice can appear to be a bottleneck,” Weir said. “I try to give advice and not force the resolution.”

“Reactive relationships compromise risk management for all organizations,” Boyle said. “Poor risk management leads to increased incidents and reputational and legal exposure.”

CHANGING THE MODEL

Apex has changed this model by getting its legal and HSE teams to work more closely with field operations. Boyle now typically spends about 60 percent of his time in the field and speaks regularly with Weir, allowing her to provide ongoing counsel on operational matters.

Weir also sits in on a quarterly safety meeting. All this allows the legal team to provide better protection to individuals and to the business, since there is less of a risk

of information being overlooked or withheld in the event of an incident.

The new way of working has unearthed seemingly trivial matters that could nevertheless have created legal risks for Apex.

In one instance, Weir could advise Boyle on the correct level of safety signs Apex should use to

encourage safe working without incurring a legal liability toward contractors.

One measurable result of the more proactive approach has been an improvement in the safety culture at Apex sites.

Even though Apex is not directly responsible for the safety of contractor teams, the number of

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recordable injuries they suffered dropped from five in 2016 down to one in 2017, despite an increase in work hours and in high-risk work.

Apex itself, meanwhile, had a recordable incident rate of just 0.43 percent across 200 employees in 2017. That compares to a rate of 1.3 percent for electric-power generation overall, based on the latest figures published by the U.S. Bureau of Labor Statistics.

OPERATIONS IMPROVEMENT

Another significant improvement has been in the efficiency of operations. The proactive way of working means Weir now deals with fewer incidents and does not have to invest as much time in each one, since she is already usually aware of many of the details.

Previously, for example, if a recordable injury occurred within a contractor organization, then Weir would have to spend about 10 hours on average just getting up to speed with the details of the case. For employee injuries, the workload would be considerably higher.

Much of this time is now being saved because there are fewer incidents, and Weir has greater awareness of operations. The savings in Weir's time alone amounted to an estimated 50 hours in 2017, she said.

WORK GOING FORWARD

Despite these improvements, Boyle and Weir said they are planning to increase the level of proactivity in their work going forward. Weir



"Reactive relationships compromise risk management for all organizations."

John Boyle, Health & Safety Manager at Apex Clean Energy.



"I want legal teams across the industry to step up and be more proactive."

Liz Weir, vice president of Law and Deputy General Counsel at Apex Clean Energy.

will be increasing the visibility of the legal department in the field and auditing Apex's health and safety arrangements.

"In 2018, I have more of a directive to see the sites," Weir said. "It's a matter of making myself available and, in the event an incident occurs, trying to look through lessons learned and how to improve in more of a cooperative manner."

Improving relationships is not just important for HSE and legal teams, but also for people who could be at risk in the field and, ultimately, for the managers and owners of the company.

Weir said other companies could benefit from Apex's approach.

"I want legal teams across the industry to step up and be more proactive," she said.

Weir has 15 years' experience as wind energy counsel at both First Wind and Apex Clean Energy's re-

newable energy businesses.

Boyle brings 15 years of experience in safety, operations, and emergency response. He was previously with Infigen, BP, The MC252 Oil Spill Response, The Pangere Corporation, and U.S. Steel where he held safety leadership positions.

Apex Clean Energy is a major renewable energy company with a 2.2GW operating portfolio, more than 3GW of financed clean energy projects and a further 1.5GW under management

Boyle and Weir will be presenting on Apex's proactive approach to legal and HSE relations at the 10th Annual Wind Operations Dallas 2018 conference April 16-18 at the Westin Galleria in Dallas, Texas. Contact organizer Kerr Jefeferies at kerr@newenergyupdate.com or call +44 (0) 207 375 7565 for more information. ↵



Jason Deign is a contributing writer for New Energy Update, which focuses on global trends in energy storage and wind. He is based in Barcelona, Spain.

Report: Untapped energy in U.S. wind fleet could power 1.1M homes

The U.S. wind fleet could produce an estimated 12 TWh more energy — enough untapped energy to power roughly 1.1 million homes — according to a new report by Uptake, an advanced analytics software company. That's equal to nearly all the homes in the city of Chicago.

“Current wind turbines can produce much more energy than they do today,” said Sonny Garg, global energy solutions lead for Uptake. “With the ability to predict problems before they happen, the potential increase in wind-turbine energy production is massive and important to our transition to a clean energy future.”

Today, the U.S. wind fleet's availability, the measure of a wind turbine's readiness to produce energy, is 94 percent. For each 1-percent gain in availability, an estimated additional 2.4 TWh of wind energy would be produced by the current fleet without new hardware. That would:

- Increase energy production by the equivalent of adding 450 additional wind turbines without building new generation.
- Produce nearly the same amount of electricity as one coal-fired power plant.
- Reduce CO₂ emissions by 1.78 million metric tons, the equivalent of removing more than 382,000 cars from the road every year.
- Power 222,000 additional homes annually.

“The findings from Uptake's report underscore a huge opportunity for the current wind fleet to produce more energy,” said Dr. Sue Tierney, senior adviser at the Analysis Group, Uptake adviser, and former assistant policy secretary at the U.S. Department of Energy. “If the wind-power industry uses data to improve operations and stop problems before they start, it will be better positioned to stay competitive in



Today, the U.S. wind fleet's availability, the measure of a wind turbine's readiness to produce energy, is 94 percent. (Courtesy: energy.gov)

today's evolving energy markets.”

Uptake's report outlines how software technologies that optimize operations, identify component breakdowns before they happen, and provide real-time information on turbine performance can dramatically

increase the amount of energy produced by wind-turbine fleets. ↗

Source: Uptake

For more information, go to www.uptake.com/untapped-energy-report.

inFOCUS

Extending the life of wind-turbine components

Specialized PVD coatings, nitriding increase the durability and lifespan of turbine components.

By Jeff Elliott

With the increasing demand for carbon-free renewable energy, more companies are turning to wind power as a source for their energy needs. Although this presents a good deal of potential for the manufacturers of wind turbines and their components, the technological challenges of providing a reliable product that operates with minimal maintenance or repair is increasingly daunting.

That is because enormous forces are at work on the individual internal components.

Turbine shaft bearings, planetary and sun gears, and rotating shafts, for example, operate under high-load conditions that involve direct metal-on-metal contact, often in poor lubricating conditions. With components increasing in size, these forces only become more extreme.

When this occurs, turbine components made of hardened steel or metal alloys can still break down as a result of extreme wear, scuffing, surface fatigue, pitting, and galling.

Given the sheer size of wind turbines, wind-farm operators must bear significant costs for overhauls that often involve logistics involving cranes for on-site repairs.

“When you have to bring a crane to change the main shaft bearing, for example, it is not only the cost of the new bearing but also the total work to exchange the part,” said Dr. Florian Rovere of Oerlikon Balzers, a company that produces specialized PVD coatings for components in North America.

“It can quickly become \$100,000 or \$200,000 for the overhaul,” Rovere said. “So all of a sudden, your green energy becomes super expensive, which is why wind-farm operators really want to extend the longevity of the components as much as possible.”

To address this issue, coatings and surface treatments can significantly extend the service life of wind-turbine components. Today, this is being accomplished through the application of specialized physical vapor deposition (PVD) coatings and nitriding treatments that increase surface hardness and durability.

By applying coatings optimized for these types of punishing environments, components benefit from increased surface hardness and a much lower coefficient of friction. As a result, these critical parts do not have to be replaced as frequently, if at all, reducing main-

tenance and unplanned downtime while improving wind-turbine performance.

PVD COATINGS

Physical vapor deposition encompasses a wide range of vacuum deposition methods. It essentially covers components with thin coatings to increase their surface hardness and durability, lower the friction coefficient, and resist corrosion.





By applying components with PVD coatings designed for such demanding conditions, not only is the surface hardness and durability increased, but essential parts are far less likely to fail, if at all. As a result, maintenance and unexpected downtime are drastically reduced.

A specialized PVD coating that is particularly effective is Balinit C, which can be applied in thicknesses of 0.5 to 4 micrometers on roller bearings and gear parts.

The WC/C ductile carbide carbon coating has a high load-bearing capacity, even when used with insufficient lubrication or dry contact.

Coatings and surface treatments can significantly extend the service life of wind-turbine components. (Courtesy: Oerlikon Balzers)

Due to its low-friction coefficient, the coating can drastically reduce fretting corrosion and pitting. By forming an effective barrier between metal-on-metal contacts, the coating reduces metal structural damages such as white-etch cracks and fatigue failure.

According to Rovere, there are alternatives to PVD coatings that are at times used on wind-turbine components like black oxide.

Black oxide is a coating produced by a chemical reaction between the iron on the surface of a ferrous

As a result of specialized coatings, these critical parts do not have to be replaced as frequently, reducing maintenance and downtime while improving performance. (Courtesy: Oerlikon Balzers)

metal and oxidizing salts. After a post-treatment with oil, the surface provides protection against corrosion, improved lubricity, and prevents galling during metal-to-metal interactions.

However, black oxide is not durable and can be worn away quickly in repetitive, high-load applications.

NITRIDING

There are limitations to the size of products that can be coated with PVD, such as the ring gears in modern wind turbines that can measure up to two to three meters in diameter.

For these types of large gears,

An advertisement for Wind Systems magazine. The background is a scenic photograph of a wind farm on a rocky coastline at dusk or dawn. The sky is a mix of blue and orange, and the wind turbines are silhouetted against the horizon. In the foreground, there are large, dark rocks and a small pool of water reflecting the sky. The text 'SEEKING OPPORTUNITY?' is written in large, white, bold letters on the left side. In the top right corner, the 'WIND SYSTEMS' logo is displayed with the tagline 'Giving Wind Direction'. A dark, semi-transparent box in the bottom right corner contains a list of features available on the website.

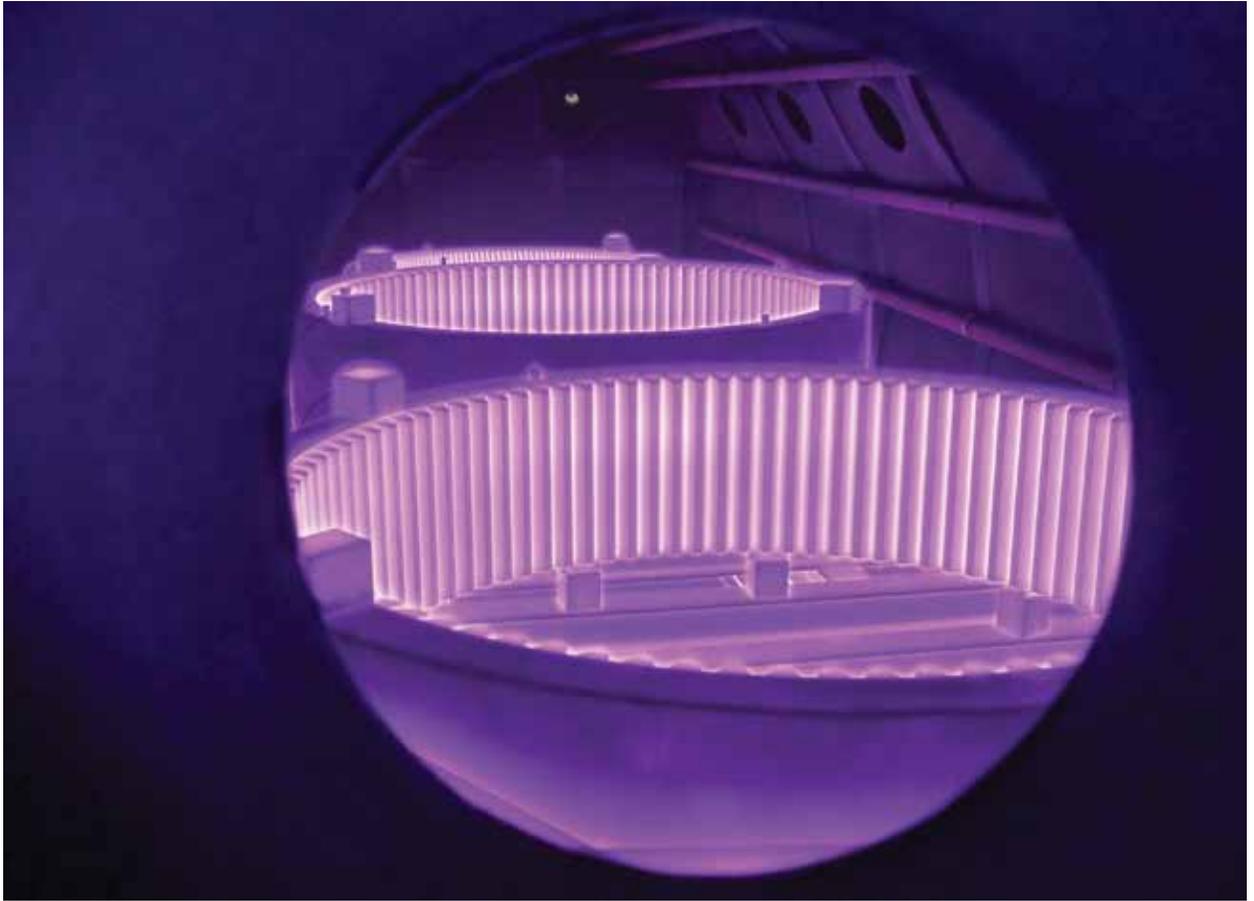
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Nitriding is a heat-treating process that diffuses nitrogen deep into the surface of a metal to create a case-hardened surface. (Courtesy: Oerlikon Balzers)

Rovere said a nitriding process can be used instead to increase the surface hardness of the metal.

“Nitriding is a heat-treating process that diffuses nitrogen deep into the surface of a metal to create a case-hardened surface,” Rovere said. “Because it is not a coating, it does not affect the overall dimensions of the component.”

Although traditional gas nitriding costs less, plasma nitriding has the advantage of making the treatment more precise by minimizing warp-

age and distortion while achieving a higher load-bearing capacity.

In an FZG pitting test, Balitherm Ionit, a plasma-nitriding process from Oerlikon Balzers, exhibited five times less roundness deviation and seven times better planarity than gas nitriding on a two-meter diameter ring gear.

Another potential application for plasma nitriding is for treating the surfaces of large bearing cages used with wind-turbine bearings to increase the sliding wear resis-

tance against the rollers.

The process can be used on components up to three meters in diameter, 10 meters in length, weighing up to 40 tons.

“Compared to gas nitriding, the tolerances for roundness, planarity, and parallelism can be adhered to much better, even with such large parts as the ring gears, and that is of great importance for the service life of a system in which enormous forces are at work simply because of its size,” Rovere said. ↵



Jeff Elliott is a Torrance, California-based technical writer. He has researched and written about industrial technologies and issues for the past 20 years. For more information, go to www.oerlikon.com/balzers.



Monitoring wind in cold climates

The ability to keep track of potential ice build up on turbine blades can significantly reduce maintenance costs.

By Michael Clarke

Wind-farm operators in cold-weather climates such as Canada, Sweden, and parts of the United States are confronted with unique operating challenges. When faced with extreme temperatures of -20 degrees Celsius or lower, atmospheric icing becomes the leading cause of a variety of challenges. And in cold-weather climates, where icing is a frequent occurrence for up to six months of the year, wind-energy projects are often viewed as less feasible or less successful.

The most common challenges created by ice accretion are: reduced production power, reduced lifespan of equipment, and public safety concerns. In its recent study, Development and Validation of an Ice Prediction Model for Wind Farms (2016), the TechnoCentre Eolien summarized: “During an icing event, the presence of ice on turbine blades alters their aerodynamic properties, which reduces their efficiency and generates vibrations. The latter magnify the material fatigue of turbine components, which ultimately compromises their service life. Furthermore, turbines must occasionally be shut down to prevent the risk of ice throw, which can cause injuries to wind-farm employees or citizens residing in proximity.”

Fortunately, a variety of technologies are mitigating these common challenges, and leveling the playing field between cold- and warm-weather climate operators.

CHALLENGE NO. 1: REDUCED PRODUCTION POWER

At any given time, a change in vibrational and/or torsional force on the turbine blade can result in a loss of production power. In cold weather, where ice buildup is frequent, changes in torsional force are commonplace. Many systems exist to detect such changes and would traditionally trigger an automated shut-down cycle. Such a cycle lasts for a period of time, which lengthens each time the turbine attempts to restart, detects a continued change in torsional force, and triggers the next shut-down cycle.

While this shutdown mechanism is beneficial in reducing unnecessary wear on the equipment, it's hugely

In colder climates, turbines must occasionally be shut down to prevent the risk of ice throw, which can cause injuries to wind-farm employees or residents in proximity. (Courtesy: Campbell Scientific Canada)

detrimental to power production. In cold weather climates, ice build up can sometimes last for days, during which time the shutdown cycle has continued to increase to the point where, when the ice finally melts, the turbine may not be triggered to start up again for several hours. This results in significant losses in power production.

According to a six-year CanmetENERGY Ottawa (CEO) study, the average loss factor of wind-energy production in cold weather climates is 3.9 percent. This translates to an estimated total loss of 959 GWh per year across Canada, representing \$113 million in lost revenues country wide (Natural Resources Canada, 2017).

CHALLENGE NO. 2: REDUCED LIFESPAN OF EQUIPMENT

In cold climates, operation and maintenance requirements are far more demanding than in warmer temperatures. IEA Wind's recent publication, Wind Energy Projects in Cold Climates, affirms the economic risk of “increased maintenance costs due to low temperatures and the likely higher-than-average downtime between repairs caused by turbine inaccessibility” (2017).

Ice greatly affects the longevity of turbine blades, nacelles, and motors. As we know, ice build up will create an imbalance in the forces acting on the turbine. Depending on the blade orientation, if one blade has accumulated ice, it can begin pulling outwards, putting additional strain on the gearbox. In addition, icefall has the potential to affect surrounding blades, as well as the roof of the hub, causing significant damage.

Performing maintenance on wind turbines is an additional challenge due to potential inaccessibility. Heavy snowfall can make accessing wind-farm roadways impossible with regular service vehicles. Implementing a regular snow removal schedule during winter months, and/or investing in specialized equipment, will eliminate accessibility issues; however, both options require significant capital expenses.

CHALLENGE NO. 3: SAFETY CONCERNS

Ice throw from turbine blades is a significant concern for public safety. A turbine with an 80-meter blade diameter and 70-meter hub height has the potential to throw a piece of ice a distance of 225 meters. And as

the number and height of installed turbines increases in and around urban areas, public safety becomes increasingly important. In well-established markets like Germany, where the density of wind turbines is much higher than that of North America, it has been mandated that ice detectors be present on all turbines. As the North American market gets denser, it may be subject to similar future mandates.

Operator safety is another serious concern. Ice throw and ice shedding (where fragments of ice and snow fall from the blade) are a risk for anyone working in close proximity to turbines.

BEST PRACTICES

In February 2017, IEA Wind published a study of recommended best practices for wind-energy projects in cold climates. Within the study, it specifically outlined a variety of components and technologies aimed at mitigating the specific challenges outlined above. In particular, the following components and technologies were addressed:

Materials and components: Adapted for low-temperature applications such as low temperature alloys and special elastomers instead of standard rubber.

Welding procedures: Should all be completed with special low-temperature flux.

Lubricants: (Grease and oils) and hydraulic fluids suitable for low temperature.

Heaters: For components and lubricants, e.g. for generator, gearbox, yaw-and-pitch systems, control boxes, converters, and transformers.

- Blade heaters are an option that work to eliminate ice buildup al-

According to a six-year CanmetENERGY Ottawa (CEO) study, the average loss factor of wind-energy production in cold weather climates is 3.9 percent. (Courtesy: Campbell Scientific Canada)



together by forcing hot air directly into the blades. While highly effective in reducing ice formation, they are an expensive option and require a power source to run, which doesn't help to reduce power production.

- Nacelle heating to allow a reasonably safe and comfortable working environment for turbine maintenance.

Cooling system: Suitable for low-temperature operation to avoid icing of condensers or other systems.

Control system: Designed with low-temperature features, such as preheating of components and subsystems during cold start after a grid failure.

Measurement systems: Including heated sensors. It's recommended that the measurement system support structures, such as mounting booms, are also heated.

Ice detection systems: To safeguard nearby personnel and infrastructure from ice throw and to safeguard the wind turbine against rotor unbalances and potential damage to the turbine. Ice detectors are one of the least expensive, low-maintenance, and long-lasting solutions available today. Once attached to the hub or a nearby meteorological tower, they work to detect ice accumulation via an ultrasonic axially vibrating tube that senses changes in mass as a result of ice accretion. They act as an early detection system, allowing

operators to shut down turbines immediately and then restart them once the ice has melted, significantly reducing operational downtime.

Blade ice protection technology: To prevent down time, mitigate ice-throw risks, decreased iced-blade noise emissions, and reduce potential increased turbine loading due to icing. Ice-phobic coatings are another potential solution: A coating or spray is applied directly to the blades, which discourages the accumulation of ice. The lower initial cost of application makes these coatings an effective solution, though ongoing maintenance and continued applications are required.

Cameras: An effective complementary tool for improving safety around wind farms. Outdoor cameras built to withstand harsh climates are installed on the hub of the turbine, where they provide visual confirmation that corroborates data from other prevention methods.

The extreme temperatures of cold-weather climates present many challenges to wind-farm operators. Continued collaboration between manufacturers and energy producers will promote new and innovative solutions. These will work to shape the wind-energy landscape, increase the viability of North American cold-climate wind-energy markets, and create opportunities for operators to become leaders in renewable energy. ↵



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Torque loading: Standards have limits

Part 2: Specific industry standards for wind-turbine drivetrains include gear-failure modes.

By Paul Baker and Doug Herr

(Editor's note: This article on torque loading is presented in two parts. Part 1 on how drivetrain components are important in analyzing component performance appeared in the January issue of Wind Systems.)

The IEC standard 61400-4 (2012) is the latest standard for wind-turbine drivetrains. Although AGMA/AWEA 6006-A03 was reaffirmed in 2016, 61400-4 is one of the most used industry standards.

61400-4 expands on previous standards, and includes new gear-failure modes to be taken into consideration for micro-pitting and subsurface initiated fatigue. One notable change is the requirement to inspect 100 percent of manufactured gears for surface temper, rather than only a sample.

Minor changes also were made to gear rating safety factors. Three goals were established for the inclusion of dynamic drivetrain analysis:

- Verify and confirm the modeling of the gearbox in the WTG aero-elastic model.
- Verify the occurrence of gearbox-specific loads due to dynamic amplification.
- Assess influence of boundary conditions on the internal gearbox loading.

The standard includes minimum requirements for dynamic drivetrain analysis documentation and validation from field or dynamometer testing. Gearbox testing requirements are more stringent. The scope of the test campaign is agreed upon by the gearbox manufacturer, the wind turbine manufacturer, the bearing manufacturer, and the certification body.

The new standard also requires certain parameters to be measured while defining minimum run times for each defined load step. A “robustness test” which mentions “elevated loads” is required, but the details are left to manufacturers. Field-testing also is a new requirement for gearbox testing. It requires certain parameters to be measured during selected events such as high winds, shutdown events, emergency stops, and low voltage ride-through.

For bearing rating calculations, 61400-4 introduces several new and well-defined design requirements. A substantial portion of the gearbox design section of the standard focuses on bearing design and reliability. The standard states the steel quality of bearings shall meet ISO 683 requirements with re-

gards to chemical composition, steel cleanliness, steelmaking process, heat-treatment and micro-structure.

This is an important improvement over previous standards. ISO 281:2007, the calculation standard most used for bearings, requires only steel bearings of good quality. A definition for good quality, however, is missing.

The updated standard requires bearings to be rated using the internal load distribution from detailed models such as ISO/TS 16281. The previous version did not specifically mention how to account for the internal load distribution. This may have an impact on accurately predicting the life of planet bearings, which are subject to constant tilting moments in the 3-point design.

ISO/TS 16281 requires extreme design loads to be specified, and maximum load reversals and accelerations should be included in statistical summaries and identified separately with supporting time series where possible. The standard recommends using:

- Rainflow counting.
- Load revolution distribution.
- Load duration distribution.
- Extreme load matrices to include transient loads into the design load cases.

While these tools provide well-accepted processes for documenting all load cases, they are still fatigue based (duration sensitive), and likely to be under-represented when calculated over the estimated turbine life.

STANDARDS HAVE LIMITS

Ultimately, it is difficult for the standards to adequately quantify all the conditions in a highly variable, dynamic loaded wind turbine. The standards can identify the need to better quantify loading. A methodology used for this is shown in ANSI/ABMA Standards, which allows bearing manufacturers to adjust the theoretical L10 life with life-adjustment factors to try to capture non-rolling contact fatigue failures.

These factors take into account the desired life, the specifics

of the bearing design, and the actual application's conditions. Life adjustment factor A1 is reliability, allowing for a tighter than 10 percent tolerance on failure in the design life. Material factor is the A2 adjustment, allowing for differences in material, melting, and processing for the desired performance. The final adjustment factor is application or A3. This takes into account lubrication, misalignment, temperature, load-zone factors, low loads, and more.

For wind, this A3 factor may be the most difficult factor to consider since the variables are so numerous and are hard to model or test. The A3 factor is what brings the results of the damaging transient loads into the equation. Unfortunately, these are not well defined in the load cases and must be estimated in the A3 factor.

It is impossible to predict the amplitude and frequency of transient loads on individual turbines; farm-to-farm variation can be significant. The standards leave it up to turbine manufacturers to make the decision of how much safety factor are built into their systems. It is not simply a case of making the product cheaper; it is a factor of design compromise. They must balance building the lowest cost turbine (to gain a lower cost of energy) with the most reliable production possible. Standards are not likely to ever "solve" the issues of premature failures. Other solutions must be brought in to help extend the life of turbine drivetrains. They might include:

- Surface finishes above the standards.
- Torque control solutions.
- Better oil and filtration.
- Solutions to better manage the damage of transient loads.

In conclusion, the continuing problem with definition and standardization of severe transient loads is truly a work in progress for the industry. Much more needs to be done in order to quantify and calculate the damage caused by these

short-term but potentially life-limiting conditions. For more details on this topic, look for our white paper to be released in early 2018. ↵

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Paul Baker is vice president of Sales and Engineering for AeroTorque. He joined PT Tech/AeroTorque in February 2016 and has been working in the wind industry since June of 2004 with Moventas and Frontier Pro Services. Baker's diverse background includes the sales, repair, and application engineering of industrial and wind-turbine drives for the past 23 years. He has studied drive-train failures, written papers, and presented at AWEA, CanWEA, AGMA, and the national labs. A graduate of the U.S. Navy Nuclear Power Program, he completed undergraduate work at the University of Wisconsin and Arizona State University. He has served on working groups with AWEA, CanWEA, and AGMA.



Doug Herr is vice president of Sales and Marketing for AeroTorque. He joined PT Tech/AeroTorque in 2007 and has 20 years of industrial drivetrain experience. He began working in the wind industry in 2009, and he was deeply involved in the launch of AeroTorque. His early experience in the wind industry included significant up-tower work and monitoring of wind-turbine drivetrains, working to further develop the unique equipment AeroTorque uses for field data acquisition and field validation of the WindTC torque control. He has had papers published in numerous international industry magazines and has presented at conferences in the U.S. and Canada on the subjects of transient loads, their causes, and how they can reduce drivetrain reliability. He is a graduate of Juniata College.

Changing Turbine Gearbox Oil

Technology automatically changes oil in a fraction of the time it would take with traditional methods.



GlobeCore GmbH has developed the CMM-G unit for double-stage (old oil drain and new oil input) and triple-stage (old oil drain, gearbox flushing, and new oil input) automatic oil change. (Courtesy: GlobeCore GmbH)

By Frank May

Wind turbines remain a significant component of alternative electricity generation. The traditional design of such turbines includes a rotor, a generator, and a gearbox, which converts rotation of the rotor into generator-shaft rotation.

Although a different design of the wind-power units was developed in the 1990s with synchronous generators and frequency converters without the need to use gearboxes, most current wind turbines are equipped with them. Practical experience of operation indicates correct maintenance ensures full compliance with reliability and service life duration requirements.

POINTS OF ATTENTION

The technology of gearbox manufacturing has changed in the last decades due to growing loads and

power. At the same time, the amount of oil used in generators to reduce friction, corrosion, and surface damage has been decreased.

Small wind turbines are equipped with gearboxes with a lifetime load of oil. If such devices break, they are not repaired, but replaced with new ones.

Large gearboxes come under extreme loads, wide temperature variations, variable wind speed, vibration, and moisture. The results are micropitting and breaking of meshed teeth and bearings. To prevent this, gearbox oil must perform its function well. It is the quality of the lubrication material (purity and high temperature stability) that is the decisive factor for long and reliable operation of a gearbox. This means the oil quality monitoring and timely oil change is a must.

WIND TURBINE GEARBOX OIL CHANGERS

As recently as 15 to 20 years ago the oil was changed



The technology of gearbox manufacturing has changed in the last decades due to growing loads and power. (Courtesy: GlobeCore GmbH)

by a human chain with buckets of oil. Some companies still rely on this method even now. However, it is hardly viable. First, manual labor is time consuming. Second, a simple oil change does not solve the problem since most contaminants remain in the gearbox after the change and quickly contaminate new oil.

GlobeCore GmbH has developed the CMM-G unit for double-stage (old oil drain and new oil input) and triple-stage (old oil drain, gearbox flushing, and new oil input) automatic oil change. The unit can heat and filter new oil before filling the gearbox. The CMM-G unit takes the specific conditions of wind-turbine operation into account:

- The unit is fully mobile and can be transported on trailer and in a container.
- The unit can be operated in the field.
- A special electrical drive facilitates quick hose reeling.
- The control system manages flow setting depending on the current condition of the filters, supply height, and other parameters.
- The unit can be used to change both mineral and synthetic gearbox oil.

It takes two technicians more than 12 hours

to change 80 gallons of oil, while the CMM-G unit can perform the same task in one to two hours. For small-scale renewable energy companies or small businesses servicing wind turbines, GlobeCore produces a small oil changer with independent tanks. A small model optimizes costs for servicing wind turbines.

No less important is the issue of frequency of wind-turbine gearbox oil change. There are two approaches: One takes into account the recommendations of the manufacturer regarding lubrication material lifetime, and the change is performed strictly in cycles (usually once every two or three years). The other approach involves assessment of the oil's quality and making a decision regarding oil change only after an analysis of oil

samples.

The development of change schedule and selection of equipment for oil change is a complicated task that requires individual approach, depending on conditions (available equipment, the number of wind turbines to service, availability of specialists with practical experience in oil choice, and oil change). It is worth remembering, however, that only technological innovations can reduce both capital and operating costs. ↵



The CMM-G unit can change the oil in a turbine in one to two hours. (Courtesy: GlobeCore GmbH)



Frank May is a service engineer at GlobeCore GmbH (Oldenburg, Germany). May has 30 years of practical experience in commissioning and servicing various oil-immersed and oil-processing equipment. For more information, go to globecore.com.

PROFILE

Elevator Industry Work Preservation Fund

As the EIWPF increases its footprint in the wind industry, safety is the ultimate goal.

By Kenneth Carter
Editor | Wind Systems

Wind turbines continue to provide alternatives to conventional energy production. These mammoth structures offer challenges to the worker who has to navigate at great height while transporting tools and equipment.

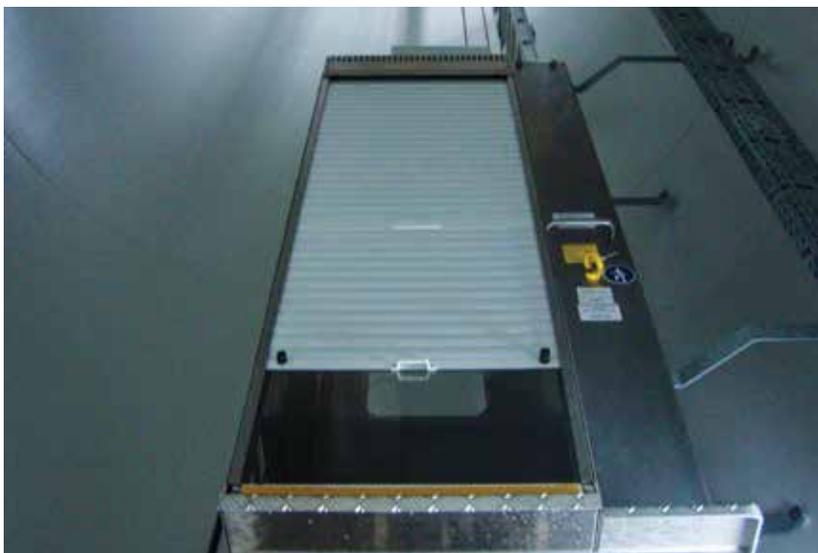
Some, not all, are equipped with a wind-turbine tower elevator affording a safer option than climbing hundreds of feet to get to work.

Like a family car, home, or any machine, these elevators need to be maintained in order to provide reliable safe vertical transportation. Properly working, the benefits include safety, reduction in ergonomic risk, and increased work efficiency reducing cost. A wind farm can have dozens of turbines and those with elevators can improve employee retention by a reduction in the physical challenges.

“By using the licensed National Elevator Industry Education Program (NEIEP) mechanics to service the elevators in wind turbines, they will run more efficiently and reduce risk of injury to those accessing the Nacelle” said Carisa Barrett, national coordinator with the Elevator Industry Work Preservation Fund (EIWPF).

WHO IS THE EIWPF?

EIWPF is a Labor Management



A wind farm can have dozens of turbines and those with elevators can improve employee retention by a reduction in the physical challenges. (Photos courtesy: EIWPF)

Elevator Industry Work Preservation Fund

Founded:
1997

Headquarters:
Columbia, Maryland

Website:
www.eiwpf.org

in the EIWPF, and our main concern is safety of those riding and working on all conveyances,” she said. “We have OSHA master instructors who train the trainer for NEIEP apprenticeship instructors. We sit on many industry-related code committees ensuring safety for the elevator constructors who work on the elevators, the wind techs that use the elevators, as well as any others riding the elevators.”

DIFFERENT ELEVATORS, DIFFERENT STANDARDS

“EIWPF’s reach spans the entire elevator industry; there are hundreds of different standards for different

Cooperation Committee. One of EIWPF’s specific goals within the wind industry focuses on safety.

“We have several programs with-



IUEC mechanics work on an Alimak elevator car top.



Eagle Elevator wind-turbine elevator installed at Block Island Offshore Project.

types of elevators” Barrett said. “For elevators in wind turbines, it would be ASME A17.8 standard for wind-turbine tower elevators that has recently been created. We sit on committees that write these codes. Our committee participation is there to improve safety for all who work on or ride elevators. I sit on the A17.8 committee. I also sit on the wind standards committee within AWEA, as well as the Operations and Maintenance Working group specifically under the sub group ‘towers,’ which encompasses the wind-tower elevators.”

BEST PRACTICES

One of the O&M working groups responsibilities is to publish the Operation and Maintenance Recommended Practices Manual, which is updated every year,” according to Barrett. Members of AWEA can find this manual on the AWEA website.

“You can find the chapter on elevators in wind turbines on page 404 of the manual,” she said. “There you will find the codes associated with wind-turbine elevators and where you can get these code books.”

“The adoption of these national codes and standards can change from

municipality to municipality or, from state to state, according to Barrett

“Thirty-two states have adopted some form of elevator rules,” she said. “So, in 32 states, most likely, you’re going to have to use a licensed elevator mechanic.”

Barrett said that she has seen a big increase in the wind industry using IUEC signatory elevator companies to work on, and do compliance inspections on wind-turbine elevators.

Cynthia Cuenin, who founded Tempest Group, Inc. in 2013 and is signatory to the IUEC, told Barrett that between 2013 and 2017, she had triple-digit increases. 2018 is still trending straight up for Tempest Group.

“The EIWPF participating companies represent over 450 elevator companies throughout North America, Barrett said. “We have companies in every state and major city that can professionally keep your elevators safe and reliable. There are over 27,000 members in the United States and Canada who work for these 450 companies. So there’s no shortage of manpower.”

IMPORTANCE OF TRAINING

There’s a reason why properly trained

elevator mechanics are important, according to Barrett.

“By having NEIEP trained elevator mechanics working on your equipment, you know it’s going to be maintained properly and working safely and efficiently because that’s what our elevator constructors do,” she said.

Those mechanics have completed a four-year apprenticeship-training program requiring eight semesters of classroom instruction along with 8,000 hours of on-the-job training, as well as a cumulative mechanics exam to graduate, according to Barrett.

“Our mechanics aren’t done with their education though,” Barrett said. “NEIEP offers a growing variety of ‘continuing education’ courses that they use to assist in staying up on the ever-changing conveyance world.”

With the expansion of clean wind energy, EIWPF’s signatory companies stand ready and able to fill the need for trained professional workforce, according to Barrett.

“We are here to assist the wind industry with elevator contractors that have a highly educated and motivated work force for all of your vertical transportation needs,” she said. ↵

CONVERSATION

Rigoberto Murillo

Global Business Development Manager
AMSOIL INC.

“We are technically driven and customer-solutions focused”

What do you do with AMSOIL?

I am the global business development manager. Working with our department VP, Dave Myer, my primary focus has been to advance our company's global sales efforts. When entering the renewable wind market nearly 10 years ago, our focus was on the domestic, after-market, but as our product continued to gain popularity with proven results, so did our market share. Fast forward to today, and as a global factory fill to some of the world's largest OEMs, working to stay relative to a global renewable market that's constantly changing, this is what I believe is anyone's biggest challenge when competing in global business. I strongly believe that AMSOIL changed the way things were done in the wind-turbine gearbox business by extending the life of gearbox oil. As the industry grew, so did gearbox technology, which made our oil last even longer. This was how we were able to gain the trust of our customers, and they are the reason we've made headway in the industry. The industry is continuing to grow, so we continue to grow with it.

Business models change, contracts and terms are becoming longer, three-year oil changes became five-year oil changes, and then they went to condition-based. We've grown



our technical teams and increased our sales force all to better educate the customer base and listen to them so we could educate ourselves. We are always looking at the market and the market trends and listening to the customers. We have to because our job is to be a partner for our customers, not just sell them oil. There are plenty of others doing that. We are technical and product-driven first, a solutions company. We're always looking for how to increase the customers' ROI, the return on their investment. As a quality lubricant, this is how we marketed ourselves in the automotive industry. We weren't trying to be in everybody's car, we didn't expect that to happen. We were trying to be in the enthusiast vehicle or for the kind of owner that cared about seeing their vehicle last

as long as possible. That same thinking went into the wind industry. We weren't looking to make another oil being reevaluated every couple of years with one new formula after another. It needed to be right from the start. We went into it with a lot of research, and I believe our market share has proven the results.

So, with all this understanding behind me, I walk into each day thinking — as a company in this market — how are we branding ourselves? How is the customer perceiving us? Do they still see us as a partner? Do they still see us as the company that will do what we say we're going to do? That's my challenge every day. There's always something developing, something new, something to be relevant with, and we're used to being first.

What does AMSOIL do for the wind industry?

We are very technically driven and customer-solutions focused. Whether it be from a sales perspective, any sort of research and development, marketing, and specifically engineering, any one of these people has a mindset of understanding that we are there to bring solutions first. We already know we have the best lubricants in the market, but if you're just going to put all your eggs in the basket of having a top-tier product,

“ We are always looking at the market and the market trends and listening to the customers. We have to because our job is to be a partner for our customers. ”

then you're going to lose your customers because you're there to earn trust and continue working for their business.

We're there to offer solutions and ask the right questions like: What are you challenged with? Let's look at those challenges. Your hydraulic system, your yaw-and-pitch system, your cooling systems, anything that uses lubrication, this is our focus. We've turned our customers away from doing oil changes when it wasn't necessary. We're in this for the long haul. This isn't a short-sale scenario. We want their business for life. And that's the way AMSOIL has built itself up in the industry.

What challenges have you faced while working with wind?

The largest challenge in wind is the industry itself. It's so active, and it's changing so rapidly. One company sells to another company. Or you're working with a customer in the U.S. that has a parent company outside the U.S., or has an engineering and procurement that's being managed in other areas, and you're trying to get everybody to talk together at the same time, and then sometimes the message doesn't always get across. And then you're working with all different kinds of OEMs that have the same issues. Anyone who has a global presence in any industry will always struggle with that. And that's being able to communicate down the road. My largest challenge is making sure we find a way to communicate with everybody in time around the world.

Once we get our message to the right people, and they see the data, and they see the results, they see that we're not selling them anything, we're just showing them the truth, the raw data. And they realize we're real and not just hype. We've earned our credibility in this industry.

Has anything in the wind industry surprised you?

Not anymore. It used to. I've been doing this since 2008, starting off in world of operations, and I have seen my share of changes in the industry. So, for me, I don't think I'm surprised anymore. When I look at how we're going to stay relevant, I never allow myself to stay still. One of my favorite quotes is: "Certainty is the enemy of growth." The minute we become certain that things are going to be a certain way, we stop growing. And when we stop growing, then we are no longer in business.

What pushes AMSOIL to the top of the list in wind?

Our customers. And I say that because it's the trust that we've earned with them, just like in any relationship. We're not offering a product that doesn't do what we say it does. We're not selling anything, to be honest with you. We're solving problems. That's the difference. I'm not out there trying to convince my customer that I'm the best. They already know that because they're using AMSOIL, or someone else they know is using AMSOIL. We didn't call ourselves the best; our customers have. All they did was

validate all the research and all the time and energy we spent to make sure we never have to do this more than once. We hit the market with one product at a time. We took the time and did our due diligence. What brought us to the top was them, the customers. We earned their trust; that you can't sell.

Where do you see AMSOIL's relationship with the wind industry in 10 years?

I think we're always going to have the challenges that the market brings because of the size and magnitude of our competitors. There will always be those folks that are trying to gain the market back. AMSOIL will be looked at as the leader in wind-turbine lubricants, I'm sure of it. We came in as the "little guy" and introduced AMSOIL's PTN 320, and everyone has been chasing us since.

When you look at our competition, they're on their second, third, fourth, even fifth rendition of types of lubricants. And we're still running the same brand. We didn't come out with new names and new formulas. We didn't have to. We got it right the first time. And they have continuously tried to keep up with us. No one expected AMSOIL to be the leader. They take us seriously now. We're always going to be at the top of our game because we're educators; we're problem solvers; we help customers reach their goals, and, by the way, we sell lubricants. ↪

For more information, go to www.AMSOILwind.com

MAINTENANCE

Operations • Service & Repair • Inspection • Safety • Equipment • Condition Monitoring • Lubrication

RIMS receives class approval from Lloyd's Register

Drone and robotics specialist RIMS (Robotics In Maintenance Strategies) has received its fourth Classification Certificate as Recognized External Specialists from Lloyd's Register for the use of remote inspection techniques (drones) during surveys of enclosed spaces. The Lloyd's certification adds to RIMS' CV of class approvals achieved during 2017.

The practical audit was successfully executed on a large deep-water construction vessel. Prior to the demonstration, drawings of the tanks were reviewed to establish a flight plan and to indicate specific points of interest. During the demonstration, the drone was able to be successfully maneuvered around the tank according to the flight plan and was able to react to the instructions of the attending surveyor in real time.

"We are honored to receive the approval, as these audits are not easy," said David Knukkel, CEO of RIMS.

"Class is setting a high standard, not only to ensure safe operations during the flight of the drones but, more importantly, to achieve accurate survey results. Due to the importance of these surveys, we consider each flight as

an examination, and it is up to us to maintain the high standard demonstrated in class audits."

The certification means that ship owners and managers now have the option to avoid the use of costly access equipment such as scaffolding and cherry pickers during surveys, and instead to use RIMS' remote live on-screen object inspection, which offers substantial benefits, reduction in the time to carry out a survey, minimizing of risk, as well as cost savings.

"We were first to gain approval from BV, ABS, RINA, and now also receiving the approval from Lloyds Register, means that the acceptance and use of drone technology finally breaks through in the maritime industry, and drones become a common tool to execute safe and cost-efficient inspections of ships and MOU constructions." Knukkel said. ↴



Lloyd's Register Surveyor (front) and David Knukkel, CEO, RIMS BV (back) during practical audit. (Courtesy: RIMS)

Source: RIMS

For more information, go to www.rims-bv.com

OEM introduces new bolting equipment

Global OEM, HTL Group, known for manufacturing 100 percent British-made controlled bolting equipment have introduced its new DSX Square Drive Torque Wrench Range.

Incorporating industry-first patented safety features, the new square drive tool from the OEM demonstrates its commitment to continually improve safety standards.

Serious consideration to working at height applications was given throughout the design process on the DSX range. The OEM believes this range reduces incidents from dropped objects with unique features, including a fully retained, quick-release reaction arm. This remains connected to the tool while it is adjust-

ed, in addition to a working-at-height connection point and safety handle as standard.

Reflecting HTL's dedication to innovation and proactively responding to industry demands, the DSX illustrates continuous product development incorporating a high strength, low weight, slim-line uni-body design with only a few moving parts to reduce operating costs. A multi-direction stainless steel hose swivel completes the package.

Headquartered in Northumberland with strategically placed facilities across the globe, the complete OEM range of solutions are all designed and manufactured in the U.K. and suited to all controlled bolting applications.



The DSX incorporates a high strength, low weight, slim-line uni-body design with only a few moving parts to reduce operating costs. (Courtesy: HTL Group)

HTL Group's culture is one of driving innovation to meet the highest quality and performance standards, understanding and endeavoring to exceed customer requirements at all times. Its in-house, highly skilled design team is confident and competent in delivering concept, design, rapid prototype, and 3D models.

"Working in partnership with our customers, we continue to develop and solve their problems using the latest 3D technology," said Mike Johnson, group director of engineering. "Our policy is to innovate and provide cost effective solutions while maintaining operator safety and the highest product quality to ensure our products meet and exceed our customer's needs." ↴

Source: HTL Group

For more information, go to htlgroup.com

Enerpac introduces new bolt tensioners

Enerpac, an international market leader in high-pressure hydraulics, recently introduced its new portfolio of Power Generation bolt tensioners for critical fastening applications. Three new bolt tensioner series are designed for maximum durability in harsh environments, ease-of-use, and improved speed of operation.

The PGT-Series Double Deck and Single-Stage Bolt Tensioners have a broad range and provide high performance in tight spaces typically found in wind and gas turbines. Key features, including auto-retract pistons, over-stroke protection, and auto-engage nut rundown, help make the PGT-Series bolt tensioners fast, durable, and easy to use.

The FTR-Series Foundation Bolt Tensioners are designed specifically for tensioning wind-tower foundations bolts. These bolt tensioners provide the speed and precision required by this critical application. Long stroke models provide greater speed and ease-of-use by enabling applications to be completed in a single pull.

The FTE-Series Elliptical Foundation Bolt Tensioners provide an ideal fastening solution on wind-tower foundation applications where limited space between the stud and wall prevent the use of standard tools. They feature an elliptical geometry, which enables fit in narrow access foundation applications without reducing load capabilities. In addition to close-clearance applications, FTE-Series Bolt Tensioners make the perfect "universal solution" that will work in nearly any foundation application, whether standard or narrow access.

In addition to the standard Portfolio of Bolt Tensioners, as part of an ongoing effort to support the industry, Enerpac is also releasing a series of customized kits designed for critical installation and maintenance applications in gas plants. Enerpac's experienced team of tensioning professionals in its Bolting Center of Excellence provides expert technical support and specializes in creating custom solutions for these applications. ↴

Source: Enerpac

For more information, go to www.enerpac.com

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INNOVATION

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Nabrawind makes turbine blade transport easier

Nabrawind Modular Blade System (Nabrajoint) is a technology applicable to any wind-turbine blade (existing or new) that allows manufacturing blades in two or more parts that are transported separately and assembled on site.

Nabrajoint technology is based on a bolted connection between blade modules with conventional, controlled, and robust assembly methods.

Nabrajoint is conceived to have a simple integration in the blade, without relevant modifications in the global design. The manufacturing process of the blade is not affected either: With no significant investments in the original production line, the process may be adapted to produce modular or standard blades as demanded.

Nabrajoint breaks all the blade logistic barriers even for rotor diameters over 70 meters. It is a game-changer technology configuration for onshore wind farms located within islands or on mountainous onshore sites. Difficult access sites may become feasible with the Modular Blade.

Nabrajoint technology is conceived to be the most reliable, light, and cost-effective segmented blade solution in the market.



Nabrajoint technology is based on a bolted connection between blade modules with conventional, controlled, and robust assembly methods. (Courtesy: Nabrawind)

Nabrajoint has been highlighted by MAKE Consulting as one of “the technologies capable of revolutionizing the wind-power industry.” ↗

Source: Nabrawind

For more information, go to www.nabrawind.com

Self-erecting towers reduce assembly time and cost

Nabrawind Self Erecting Tower (Nabralift) is a new tower technology developed to break the barriers that conventional towers are facing for hub heights greater than 120 meters:

- Tower manufacturing and transportation costs increase significantly, making additional hub height increase unprofitable.
- Resonances between the tower and the turning rotor are usual on conventional steel towers, increasing the tower loads and cost.
- Massive and expensive cranes are needed, with long assembly and disassembly times that delay the wind-farm installation rate.

Nabralift reduces the cost of extra

large towers by 30 percent and integrates a self-erection system to erect the full wind turbine (including nacelle and rotor), avoiding large and expensive cranes. Nabralift is maintenance-free, and it is conceived to be easily integrated with any wind turbine (existing or new). Wind turbine aerodynamics and mechanical/electrical design are not affected, and the stiffness of the tower avoids any resonance with rotor turning.

Additionally, Nabralift breaks all the tower logistic barriers for any hub height. It is a game-changer technology for onshore wind farms located within islands or on mountainous

Artist conception of a self-erecting tower in place. (Courtesy: Nabrawind)



onshore sites. Difficult access sites may become feasible with the self-erected tower.

The first Nabralift prototype (160-meter hub height) is already in construction and will be installed during 2018 in Eslava (Spain). It will be the third highest wind-turbine tower in the world.

The tower will be tested after erection to demonstrate operative life. For this purpose, several millions of load

cycles will be applied in an innovative fatigue tower test method developed together with CENER.

Nabralift serial production and installation will start in 2018. ↵

Source: Nabrawind

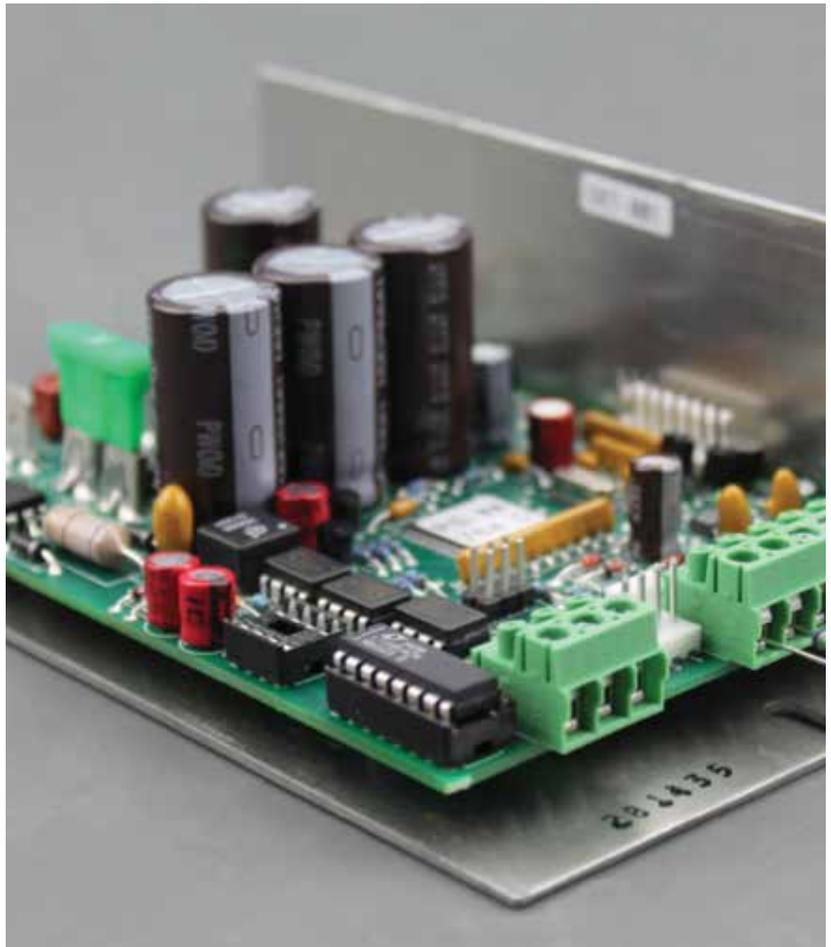
For more information, go to www.nabrawind.com

Oven Industries introduces communication port temperature controller

Oven Industries recently introduced its standard 5R7-001(RS232) and 5R7-002 (RS485) temperature controllers.

The bi-directional or unidirectional H-bridge configuration of this temperature controller creates a seamless transition between heating and cooling as it commands the thermoelectric modules. The included user-friendly PC software makes it easy for the user to change control configurations through the RS232 or RS485 interface, which has 1500VAC isolation from the electronic circuitry, virtually eliminating interference from noise or errant signals. Once the temperature controller is set up, the computer may be disconnected, and the temperature controller becomes a standalone unit, or the computer can remain connected for data acquisition. The load circuit is pulse width modulated at 2.7 KHz and delivers a load current of 0.1 to 25 amps.

Oven Industries, Inc. (OI) was founded in 1964 and specializes in the development of custom electronic temperature controllers and sensors along with extensive turn-key contract manufacturing capabilities and international sourcing. OI also carries a full line of standard products, purchasable online, including temperature controllers and sensors, power supplies, heat sinks, thermistors, and thermocouples. OI supplies precision electronic devices that serve an ar-



The bi-directional or unidirectional H-bridge configuration of this temperature controller creates a seamless transition between heating and cooling as it commands the thermoelectric modules. (Courtesy: Oven Industries)

ray of clients not limited to these industries; aerospace, automotive, biomedical, defense markets, medical and semiconductor. With a superior design engineering staff and complete production facilities, the

company is a leading technology and development company. ↵

Source: Oven Industries

For more information, go to www.ovenind.com

MANUFACTURING

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Siemens Gamesa to supply turbines for Cepsa's first wind farm



Siemens Gamesa will install 11 of its G114-2.625 MW turbines at the wind facility being developed in Jerez de la Frontera. (Courtesy: Siemens Gamesa)

Siemens Gamesa, Spain's leading wind turbine OEM, recently secured a new order for the supply of the turbines for Cepsa's first wind farm, a project with which the Spanish energy player is diversifying its business into the renewables arena.

The wind farm, which is being developed in Jerez de la Frontera (Cadiz), will be equipped with 11 of the firm's G114-2.625 MW turbines for a total capacity of close to 29 MW. Siemens Gamesa has also been engaged to operate and maintain the facility for five years. The wind farm is due to come on-stream toward the end of this year.

Having installed 13,000 MW nationwide to date,

Siemens Gamesa is Spain's No. 1 OEM, with a market share of more than 55 percent. In addition, the company services more than 7,500 MW of turbines in Spain. Specifically, the company has installed close to 2 GW in Andalusia, which is almost 60 percent of the region's installed base.

Spain is also home to the company's main R&D center as well as one of its global production and supply hubs. ↪

Source: Siemens Gamesa

For more information, go to www.siemensgamesa.com

Senvion to supply Argentina wind farm

Senvion, a leading global manufacturer of wind turbines, recently announced its contract for the supply and delivery of 27 Senvion 3.6M114 NES turbines with EREN Renewables (“EREN RE”) in Argentina has become a firm contract.

All conditions precedent have been fulfilled. The project, developed and owned by EREN RE, was awarded a PPA in the RENOVAR Round 1 tender in October 2016. A total of 1,142 MW of different technologies were awarded of which 707 MW were wind projects.

“Strong partnerships make a real difference when entering new markets together,” said David Hardy, chief sales officer at Senvion. “The very good relationship with EREN RE and the trust they have put in Senvion have facilitated an environment of quick and efficient cooperation. We are looking forward to the further positive development of the project with EREN RE that has until now lead to a financial close in record time, despite challenging market conditions. I am also proud of Senvion’s entry into the Argentina market, a market we see strong potential for growth in the future.”



The Senvion 3.6M114 NES turbine. (Courtesy: Senvion)

After the planned completion of the project, Los Hercules wind farm will see a total rated output of 97.2 MW. The wind farm will be built by Senvion on a full EPC basis. The turbines will be installed at a hub height of 93 meters.

The completion of the project is planned for December 2018. Los Hercules wind farm will be in the Deseado department in the southern province of Santa Cruz and after its completion will be able to supply about 64,000 house-

holds with green electricity per year.

The Senvion 3.6M114 was presented at Windenergy Hamburg 2016. It has an upgraded power yield of roughly 2.5 percent compared to the 3.4M114 NES and is particularly fitting for projects with restricted maximum tip heights at strong wind locations. ↴

Source: Senvion

For more information, go to www.senvion.com

Janicki Industries passes Nadcap audit for composite manufacturing

Janicki Industries has been approved for Nadcap accreditation until 2020.

Nadcap accreditation indicates that Janicki’s Hamilton Facility is a qualified manufacturer of composite parts and tools. Janicki has made several capital investments that helped ensure this accreditation.

It has implemented non-destructive inspection equipment and processes, added advance testing equipment to its research and development lab, and expanded its Class 8 Clean Room by 50 percent to accommodate larger parts and greater production speed.

Janicki Industries is one of 11 composite suppliers in Washington State that are Nadcap approved to make composite parts. And it is one of four suppliers who has achieved 24 months merit.

This means its manufacturing process controls are so excellent the auditors have certified Janicki for two years, rather than the one year normally applied.

“This Nadcap qualification shows our aerospace customers that JI is a premium supplier of composite parts and tools and that we meet the most stringent process requirements for manufacturing with advanced composite materials,” said Bill Vaith, director of quality assurance of Janicki Industries.

“We are pleased to achieve 24-month merit on our Nadcap certification, and our customers can trust Janicki for their most challenging carbon-fiber composite fly-away parts,” said John Janicki, president of Janicki Industries. ↴

Source: Janicki Industries

For more information, go to www.janicki.com

CONSTRUCTION

BOP/EPC • Project Status • Siting • Equipment • Project Due Diligence • Services

Arkona offshore wind farm concludes second construction phase

Construction of the Arkona offshore wind farm in the German Baltic Sea is progressing at a fast pace. After the foundations, the 60 connecting pieces are now also prematurely installed. The so-called “Transition Pieces,” each weighing 400 metric tons, were taken from the port of Mukran on Rügen into the construction site and placed on the foundations and bolted together. The project has thus also successfully completed the second major construction phase on the high seas.

Preparations for the next steps are also in full swing. At the French shipyard STX France, the transformer station, which will be operated jointly by the project partners, E.ON and Statoil and the transmission grid operator 50Hertz, will be transported by sea from the French Atlantic Ocean to the Baltic Sea in spring. Once this platform has been installed, the turbines are connected to the substation. The 75 kilometers of submarine cables required for this have already been delivered from the Nexans plant in Hanover to the base port of Mukran Port in Sassnitz. At the same time, production of the 6-MW turbines has begun at the Siemens plants.

The Arkona project is 35 kilome-



The Arkona project will have a capacity of 385 MW. (Courtesy: E.ON)

ters northeast of the island of Rügen. The wind farm will have a capacity of 385 MW and will be able to supply up to 400,000 households with renewable energy from 2019 onwards.

Compared to conventionally generated electricity, Arkona saves up to 1.2 million metric tons of CO2 per year. It will install 60 6-MW class turbines from Siemens. The plants

are based on Monopfahl foundations at water depths of 23 to 37 meters. The investment amounts to 1.2 billion euros. Arkona is a joint venture between E.ON and the Norwegian energy company Statoil. ↴

Source: E.ON

For more information, go to www.eon.com

Mammoet updates crane fleet with 10 Demag® all terrain cranes

Mammoet's purpose is to help its clients improve construction efficiency and optimize the uptime of its plants and installations, which is why the company has placed an order for 10 Demag® all terrain cranes including an AC 500-8 crane, three Terex® MAC 25-4 pick & carry cranes, and a Demag CC 3800-1 crawler crane.

The cranes will be added to Mammoet's crane fleet, unparalleled in size, variety and capacities, and help the

company continue to provide industry leading productivity and performance for its broad range of customers.

Committed to having the latest equipment advances, Mammoet's new fleet of Demag all terrain cranes feature innovations such as the Demag IC-1 Plus control system and a single engine concept with an intelligent motor management system. The IC-1 Plus control system provides real time calculation of the lifting capacities.



The Demag CC 3800-1 crawler crane. (Courtesy: Terex Corporation)

This allows the crane to perform jobs usually reserved for larger machines. The single engine with start-and-stop function reduces idle times and total engine hours, which contributes to the reduction of fuel costs and helps preserve the crane’s residual value.

The popular Terex Mac 25-4 pick & carry crane has a 25-metric-ton lift capacity and a maximum boom length of 18.4 meters. Mammoet’s three units include intuitive controls with a large LCD and cruise control, making them simple to operate, easy to rig, and fast to transport

from one job to the next.

Mammoet’s powerful Demag CC 3800-1 lattice boom crawler crane is the industry’s preferred choice for constructing wind turbines. The 650-metric-ton capacity crane features an ergonomic cab and includes fall protection as standard equipment. ↵

Source: Terex Corporation

For more information, go to www.terex.com

BOEM increases flexibility for future wind projects

In support of the Administration’s America First Energy Plan, the Bureau of Ocean Energy Management (BOEM) recently announced the availability of draft guidelines for the use of a “Design Envelope” approach in construction and operations plans (COPs) for offshore wind energy facilities in the United States.

“The Outer Continental Shelf’s offshore wind poten-

tial is a tremendous asset and part of the Administration’s America First Energy Plan to make it easier for industry to do business here.” said Secretary Ryan Zinke. “And now, more than ever, we must use every tool at our disposal to ensure an energy-secure future — one that promotes jobs and is affordable, competitive, and safe. Offshore wind will play a big role in this future.”

In order to take advantage of the rapid pace of technological development within the offshore wind industry, offshore wind developers have asked BOEM to adopt this practice, which is standard in some European countries for permitting offshore wind energy projects. This would afford developers a degree of flexibility and allow them to make certain project-design decisions — such as which turbines to use — at the more commercially advantageous time later in the project-development process.

Last August, the Administration announced Executive Order 13807 to streamline the review and permitting of infrastructure projects. The design envelope approach would allow BOEM to analyze the environmental impacts of the proposed project in a manner that could reduce or eliminate the need for subsequent environmental and technical reviews without sacrificing appropriate environmental safeguards.

“The offshore wind industry is moving at a phenomenal pace, and I’m proud to announce that this Administration is working with industry and stakeholders to make the renewable energy development process quicker, cheaper, and more competitive with the rest of the world,” said Counselor for Energy Policy Vincent DeVito.

It is important to note that when describing a proposed wind facility, the use of a design envelope is not mandatory. Design envelopes are intended to be an optional tool for prospective developers.

BOEM welcomes input from industry and other interested stakeholders before finalizing this guidance. ↵

Source: BOEM

For more information, go to www.boem.gov

Allete purchases turbines from GE

Allete Clean Energy recently announced a 40-MW purchase of wind turbines from GE Renewable Energy. The turbines qualify for 80 percent of the Production Tax Credit (PTC) and would create more than 400 MW of additional qualified wind projects through 2021. This latest purchase will bring Allete Clean Energy’s total wind project opportunity to approximately 1,500 MW.

The safe harbor turbines are part of Allete Clean Energy’s multifaceted growth strategy that includes building and operating new wind projects based on long-term power purchase agreements, and build, own, and transfer projects.

Additionally and separate of these safe harbor turbines, the company is in the midst of refurbishing some of its existing wind sites. With refurbishment efforts already underway in Minnesota and Iowa, and an expansion wind project with Montana-Dakota Utilities (MDU) in North Dakota, 2018 will be an active construction year for Allete Clean Energy.

“Adding to our PTC qualified inventory will ensure Allete Clean Energy’s continued growth and demonstrates the robust pipeline of project opportunities we are pursuing that will utilize this qualified capacity,” said Al Rudeck, president of Allete Clean Energy. “In working with our customers in the industry to accelerate the development of clean energy, we are finding the GE brand, reputation, and breadth of offerings will bring significant value as we advance several new and exciting projects.”

GE is one of the world’s leading wind-turbine suppliers, with more than 35,000 turbines across the globe. The turbines will be manufactured in the U.S.

“We are delighted to work with Allete Clean Energy on this project,” said Pete McCabe, president and CEO of GE’s Onshore Wind business. “Allete shares our unwavering commitment to renewable energy, and together we will help to deliver affordable, sustainable power to communities across the U.S.”

“The purchase of these PTC turbines will enhance our positioning to capitalize on the rapid growth of renewable energy evident throughout our country,” said Allete Chairman, President and CEO Al Hodnik. “We are confident in Allete Clean Energy’s performance as an earnings engine as we answer the nation’s call to transform its energy and water landscape.” ↵

Source: Allete Clean Energy

For more information, go to www.allete.com

“ Adding to our PTC qualified inventory will ensure Allete Clean Energy’s continued growth. ”

Making turbines last longer

Through lifetime extension projects, wind farms can go beyond their initial 20-year lifespan.



Certain components have a shorter lifetime, so part of a lifetime extension plan can focus on replacing them. (Courtesy: UL)

By Kenneth Carter
Editor | Wind Systems

Wind turbines are built to last 20 years. But as assets approach that 20-year lifespan, companies involved in wind-farm assessments such as UL are working to increase that lifespan through a process called lifetime extension.

“Turbines are designed to operate over a 20-year lifetime,” said Bruce Bailey, renewable energy busi-

ness manager at UL. “But design margins within projects typically allow them to operate longer than that. The lifetime extension service is a way to assess the remaining useful life of wind projects, and this helps wind-plant owners and operators understand what their options are for their projects.”

Many project owners want to reassess the long-term

value of their investments in the middle of their investment life — not necessarily at the end — in order to optimize the returns on their portfolio, according to Bailey, who has more than 40 years of experience in wind energy.

“It’s a little like managing a portfolio of stocks and mutual funds,” he said. “A portfolio is initially set up to achieve a targeted return at an acceptable risk level, and periodically that portfolio is reassessed because some of the numbers in the portfolio have deviated from expectations or overall market conditions have changed. So reassessing is just good business practice. Of course, wind-farm assets are much less liquid than stocks, and their year-to-year performance is usually less volatile, but nonetheless, the same basic principles apply.”

OVERALL SAFETY

A lifetime extension plan also can benefit the overall safety of a wind farm and its assets, according to Jose Javier Ripa, business development manager for UL.

“We help ensure the lowest cost of energy by keeping the highest levels of safety for the users and also the producers,” he said. “From that point, we started creating services to ensure that our producers have all the necessary information on hand to make optimal decisions for when they are thinking of extending the life of their assets. Our main goal is to help — with our expertise and tools — our clients make a proper decision.”

That safety factor is important when it comes to turbine load levels, according to Ripa, who is responsible for UL’s wind life extension business in Spain and Latin America. Turbines are designed to tolerate certain load levels, and they can affect a turbine in two ways: extreme loads and fatigue, where loads are accumulated through millions of cycles.

The load levels can cause internal damage to a structure.

“Wind conditions, poor maintenance, or turbines operating over the load limits can cause dramatic failure rate increases,” Ripa said. “The producer is facing high safety risks. And those safety risks can be risks for the workers working on the turbine, doing operations, doing maintenance, or risks for people or animals living near the turbine. So there are safety risks, which, in the end, can have economic consequences and also can have a consequence on people’s safety.”

THE “REAL SITUATION”

Implementing a lifetime extension often can boil down to what Ripa calls the “real situation.”

“The real situation means: What are the real conditions at the site?” he said. “How is the wind? How is the operation? How is the maintenance? Once you know the real conditions, you can put those conditions into certain models, which determine how those conditions are affecting the life of the different turbines. Once you know the projection of the life of the turbine, you have much more accuracy to determine the best alternatives for the extension of the life of those assets.”

The degree to which the operating environment of wind projects is accurate is the key to evaluating how much of a lifetime extension is necessary, according to Bailey.

“Some projects do a good job of monitoring site wind conditions and others such as operational conditions, exposure to lightning strikes, and number of starts and stops under normal and emergency operation,” he said. “It requires good record keeping and good data history of the operating environment. The better data you have, the better the project’s track record is documented, and the more accurate the simulations will be. That can also be augmented with inspections. And at some point you can get into measurements, which is more of a data-driven approach. Projects vary in terms of the quality of monitoring and the ability of acquiring high quality of data over a period of time. That is something we have to address.”

Basically, poorly monitored projects can lead to higher uncertainties, Bailey said.

REGULATIONS

Regulations can often play a part in a lifetime extension project, according to Bailey. There are about a quarter million turbines operating around the world, and several thousand in Europe are already 20 years old or older.

“In Germany, for example, once a turbine exceeds its design lifetime, new rules kick in requiring inspections of turbines,” he said.

In the U.S., the situation often reverts to local jurisdictions, and it can vary from area to area, Bailey said.

So there are a number of dynamics at play for an asset owner.

“Lifetime extension services allow for the verification of how well the project actually is performing and what the actual health of the components are,” Bailey said. “And because the design conditions for

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Giving Wind Direction

David C. Cooper
Publisher
david@msimktg.com
ext. 200

Chad Morrison
Associate Publisher
chad@msimktg.com
ext. 202

EDITORIAL DEPARTMENT

Kenneth Carter
Editor
editor@windssystemsmag.com
ext. 204

Jennifer Jacobson
Associate Editor
editor@windssystemsmag.com
ext. 205

SALES DEPARTMENT

David Gomez
Regional Sales Manager
dave@windssystemsmag.com
ext. 207

Tom McNulty
Regional Sales Manager
tom@windssystemsmag.com

CIRCULATION DEPARTMENT

Teresa Cooper
Manager
info@windssystemsmag.com
ext. 201

Cole Morrison
Assistant
ext. 209

Jamie Willett
Assistant

DESIGN DEPARTMENT

Rick Frennea
Creative Director
design@windssystemsmag.com
ext. 206

Michele Hall
Graphic Designer
michele@windssystemsmag.com
ext. 210

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P. O. Box 1987 • Pelham, AL 35124
(800) 366-2185 • (205) 380-1580 fax

David C. Cooper
President
david@msimktg.com
ext. 200

Chad Morrison
Vice President
chad@msimktg.com
ext. 202

Teresa Cooper
Operations Director
info@msimktg.com
ext. 201

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the project may vary from the actual operating conditions of the project, it's that difference between the two that helps define the remaining useful life of the project. So from a business point of view, understanding the health of the asset, the need for continued investment, and the need to enhance the return on the investment are just options from a business point of view."

There are other implications as well, including the future cost of energy for the project's expected lifetime and what new environmental permits are required if any significant project changes are being made through repowering, according to Bailey.

NEW TECHNOLOGY

Technological advancements have also helped owner-operators consider a lifetime extension, Ripa said.

Bailey agreed, citing the ability to monitor an operating environment using Lidar, for example, and smarter systems and advanced monitoring software.

"There are different ways of extending the life of a turbine," Ripa said. "You can keep everything as it is, but you can also change some things. You can change certain operating parameters; you can change components. But the more things you change, the more you get closer to repowering."

Repowering is different from life time extension in that full repowering involves removing and reducing the number of turbines at a site, but still retaining the same rated power, he said.

Bailey said there is a spectrum of options.

"You can leave a project operating physically the same but change some controls to help reduce loads," he said. "You can replace some components, which starts to get into partial repowering."

Certain components have a shorter lifetime, so part of a lifetime extension plan can focus on replacing them, Bailey said.

When it comes to deciding on a lifetime extension plan or various levels of repowering, it all boils down to being financially driven, according to Bailey. But depending on the circumstances, those decisions are made on a case-by-case basis.

"Through fact-finding and analysis, you make the appropriate decision on what to change," he said. "It could be software or hardware or a combination of the two. It can also be O&M practices that could extend the life of the investment. It's just another element to be aware of." ↴

For more information, go to industries.ul.com/energy/wind.

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