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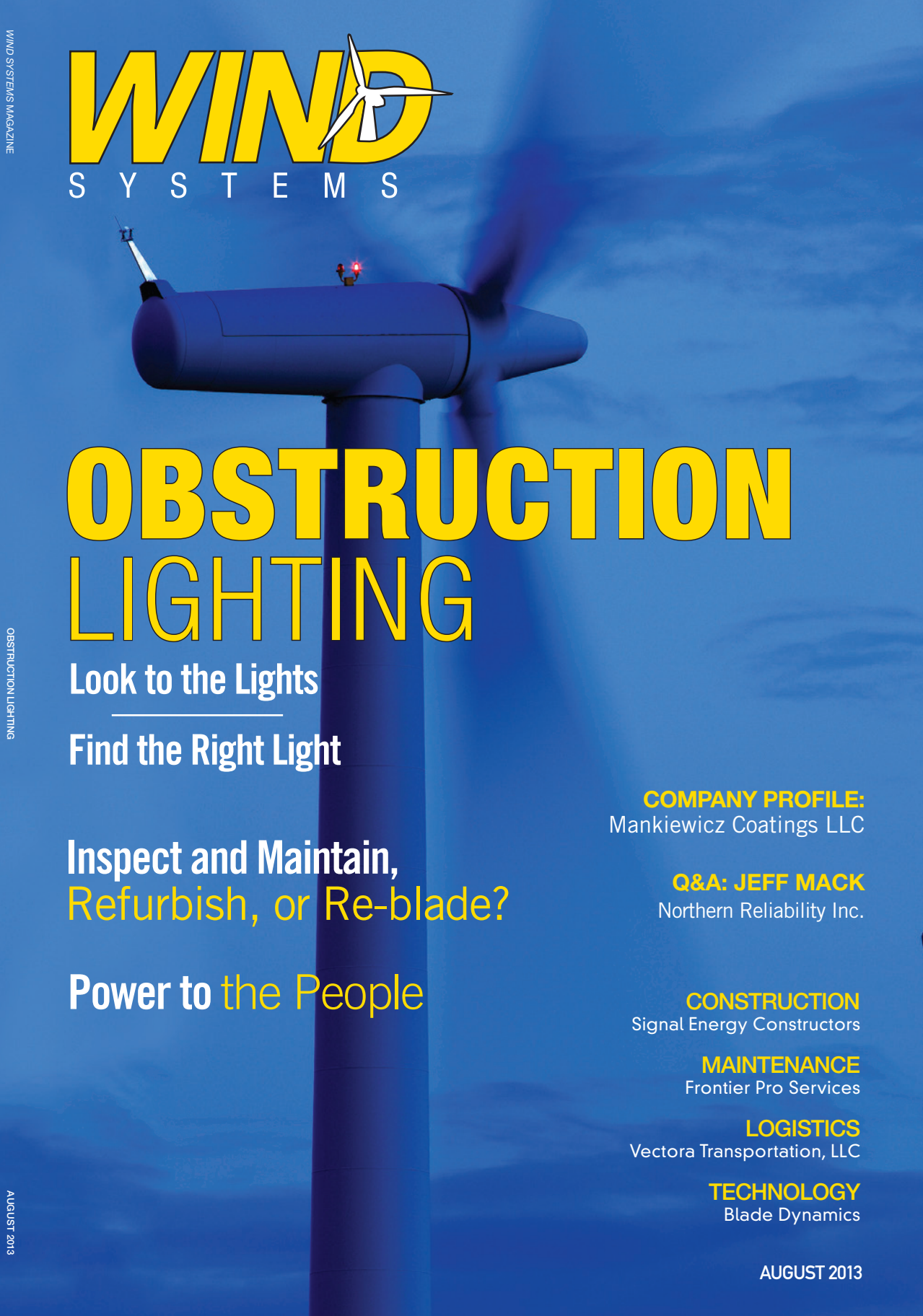

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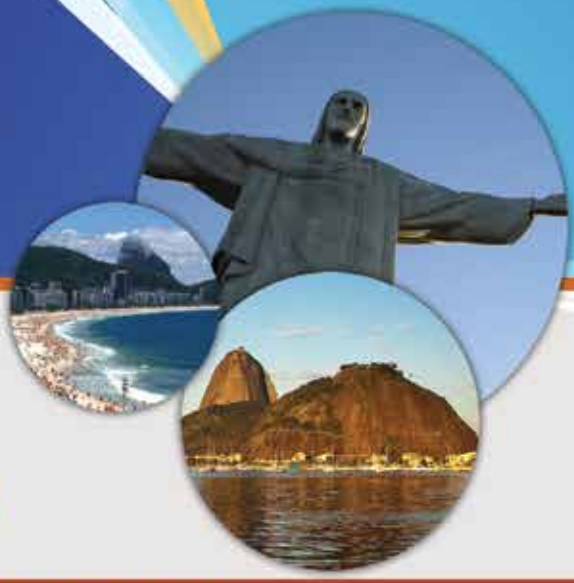

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EDLETTER

Given that this is our blades issue, I'd be remiss not to mention a recent high-profile blade issue.

In a span of less than six weeks, two Siemens turbines threw two blades at two different wind farms in two different states.

The first incident happened in April at MidAmerican Energy's Eclipse Wind Farm, when a Siemens SWT-2.3-108 casted a B53 model blade to the ground. No injuries were reported in what the manufacturer called a first of its kind incident for the B53 blade.

On May 16, a second B53 was grounded—this time 1,700 miles away at Pattern Energy's Ocotillo Wind Farm.

Investigations followed. However, in the wake of the second occurrence, Siemens also (prudently) ordered the curtailment of all of its turbines worldwide equipped with the B53 blade.

Resulting from the investigations, Siemens found that an undisclosed number of B53 turbine blades had suffered fracturing, resulting from adhesive bonding failure at the root segment of the blade.

Specifically, the company identified the cause of the failure as "insufficient surface preparation" issues with the blade's root segment. The company sources these components to a number of different suppliers. The blade design, Siemens reported, is sound.

Siemens vowed to repair to all of the blades in question. The company has also been performing precautionary modifications of all B53 blades worldwide to protect against future failures.

At the time of this writing, it's still too early to tell the exact circumstances surrounding these failures. Such incidents can often leave companies, contractors, manufacturers, and suppliers pointing fingers and assessing blame. There will be a time for that. And considering the costs associated with these failures, the topic won't go away quickly.

What costs are those? The most obvious costs are the monetary costs incurred by Siemens in making the repairs. But we should also consider the loss of energy production suffered at the curtailment of all B53-equipped turbines worldwide.

Probably the most damaging cost, however, will be the scars these incidents will leave on the industry's reputation as a reliable, stable, clean source of energy. Opponents feast on such blows to the industry's integrity. We've been gaining ground in terms of support; it's important that we make sure these kinds of events don't happen on a regular basis to avoid taking steps backward in advocacy for our goals.

Ultimately, the responsibility for quality control lies wholly with Siemens—no matter what they receive from their suppliers. But the blame doesn't rest on Siemens. Blame doesn't rest on its suppliers, or MidAmerican, or Pattern, or any contractor, executive, engineer, or technician.

Consider this: Both the Ocotillo and Eclipse projects were completed and began operation in December of last year—mere days before the expiry of the PTC.

With the threat of the credit's expiry last year, manufacturers were closing plants at an alarming rate. Companies were laying off employees nearly weekly. Component demand was through the roof as developers tried to finish under the wire, but manufacturing supply had been shifted to fewer, understaffed production facilities. There's no question that quality suffered as a result.

I don't want to sound like a broken record, but this credit—in its historical and current form—is NOT good for this industry. We're making a move toward garnering greater support, as evidenced by the administration's proposed energy policy. Long-term policy IS the answer. It IS a little further down the road, but it's within walking distance.

If you shoot yourself in the foot, it's difficult to walk. You end up relying on crutches to get to the finish line. But if you train and condition yourself properly and safely—mindful of your goal and never wreckless—you can go the distance.

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SIEMENS SUPPLIED TURBINES, CONNECTION FOR LARGEST OFFSHORE WIND FARM

The world's largest offshore wind power plant, London Array, has been inaugurated. Siemens supplied the 175 wind turbines and the grid connection for London Array. Together with Dong Energy, Siemens will also be responsible for the service of the wind turbines through a long-term agreement. The wind power plant owned, developed and built by a consortium consisting of Dong Energy, E.ON and Masdar has a total capacity of 630MW and will generate enough power to supply 500,000 British households with clean electricity. London Array will reduce annual CO2 emissions by approximately 900,000 tons, which equals the emissions of 300,000 passenger cars.

"London Array is the world's largest offshore wind power plant and marks a milestone in the development of offshore wind power. This project underscores the leading position of Siemens in this attractive growth market," said Peter Löscher, president and CEO of Siemens AG on the occasion of the opening ceremony in Margate, Great Britain.

The London Array offshore wind farm is located in the Thames estuary, approximately 20km off the Kent and Essex coast. Siemens supplied and installed the 175 wind turbines, each with a rotor

Companies wishing to submit materials for inclusion in this section should contact Stephen Sisk at editor@windsystemsmag.com. Releases accompanied by color images will be given first consideration.

diameter of 120 meters and a rating of 3.6MW. In addition, the company supplied the grid connection with one onshore and two offshore substations in the North Sea. The electricity generated by the wind turbines is bundled at sea and transported via high-voltage submarine cables to the coast. The wind farm will be operated and maintained from a purpose-built base at Ramsgate Port.

"Projects of this magnitude contribute to further industrialization of complex production and logistics processes for offshore wind power plants," Löscher said. During the execution of the project, Siemens was able to further standardize offshore installation processes covering manufacturing, transport and logistics as well as installation of wind turbines offshore.

Offshore wind power is already playing an important role in the energy systems of Northern Europe. Its largest offshore markets, Great Britain and Germany, have ambitious development plans. Both countries are planning rapid and broad expansion of offshore energy generation. In Germany, a successful energy transition to meet future needs is only possible with the further increase of offshore wind power. The German government plans to have 10GW of offshore capacity installed by 2020. Great Britain is targeting up to 18GW of wind energy by 2020, enough to meet nearly one-fifth of Britain's electricity demand.

Siemens is at the front of the market for offshore wind power plants, grid connections and offshore wind service. The company has already installed more than 1,100 wind turbines at sea with a total capacity of 3.4GW, more than two thirds of which are located in Great Britain. In total, it has 4.6GW of offshore capacity in its order books. Including London Array, Siemens has also implemented five grid connections in Great Britain.

For more information, visit www.siemens.com/wind.

NORDEX TO CLOSE ARKANSAS ASSEMBLY PLANT

Nordex SE has announced that the company will cease nacelle production at its Jonesboro, Arkansas, facility after it completes the orders in its current pipeline. The decision was driven by the wind

industry's global overcapacity and the continued uncertainty and instability of the U.S. market. The decision will not impact the current year's business performance, as exceptional expenses were already accounted for in 2012 as previously reported.

"This was an extremely difficult decision for Nordex. We are reacting to the weakened demand from the U.S. market, brought on by the unpredictable extensions of the Production Tax Credit (PTC), and the resulting low utilization rate of our U.S. assembly plant," Nordex SE CEO Dr. Jürgen Zeschky said. "We see great potential in the U.S. and Latin American markets and are committed to serving those markets and increasing our installed base. With this decision we also increase our flexibility to react to US demand for our turbines out of one single plant in Rostock, Germany. We will be maintaining the extensive expertise in sales, engineering, service, project management, training and support which we have built at our Chicago and Jonesboro locations to continue the growth we have achieved through these challenging times."

"This is a sad day for all of us at Nordex USA," Ralf Sigrist, president & CEO of Nordex USA, Inc. said. "We will lose valued colleagues, who have done their very best for us, but the decision was inevitable considering the underutilization of our plant."

In the future, nacelles for the North and Latin American markets will be supplied from Nordex' factory in Rostock, Germany, using the global supply chain and logistics support based there. Service activities for all existing U.S. wind farms are not affected by the closure of the U.S. production. The training academy, the central parts storage and the repair facility in Jonesboro will remain in operation to support service and operations in the Americas. Around 40 employees will be affected with layoffs beginning in October.

The restructuring of the company in the United States is in line with Nordex' strategy to position its operations to maximize capacity utilization.

For more information, visit www.nordex-online.com.

XCEL ENERGY PLANS SIGNIFICANT INCREASE IN WIND PURCHASES

Xcel Energy's Southwestern Public Service Company is seeking approval in New Mexico to purchase almost 700MW of additional wind energy through three purchase agreements, deals that will save Texas-New Mexico customers more than $590 million in fuel costs over 20 years.

The wind purchases will come from three facilities to be located in Oklahoma, Texas and New Mexico:

- 199MW from NextEra Energy Resources/Mammoth Plains Wind Energy Center, located in Dewey and Blaine counties, Okla.
- 249MW from NextEra Energy Resources/Palo Duro Wind Energy Center, located in Hansford and Ochiltree counties, Texas.
- 250MW from Infinity Wind Resources/Roosevelt Wind Ranch in Roosevelt County, N.M., between the towns of Dora and Elida.

The price per MWh of energy generated at these wind facilities will be less than the per-MWh price of most of the company's natural gas-fueled generation, according to Riley Hill, president and CEO of Southwestern Public Service Company, an Xcel Energy company. Over the 20-year terms of these agreements, Xcel Energy expects to save $590.4 million in fuel costs, Hill said.

"We started shopping for more wind energy in March after seeing some very good prices on the market," Hill said. "We are making these acquisitions purely on economics and the savings we can deliver to our customers."

Hill pointed out that the favorable pricing is partly the result of a federal production tax credit that Congress extended for one year, applicable to facilities that begin construction before the end of 2013.

Xcel Energy currently has close to 1,500MW of wind energy capacity connected to its Texas-New Mexico transmission and distribution network, which spans the Panhandle and South Plains regions of Texas, six eastern and southeastern counties in New Mexico and portions of Oklahoma and Kansas. Xcel Energy purchases more than 600MW through long-term contracts

The three additional contracts will more than double the company's contract wind resources, and will push the total Texas-New Mexico wind capacity beyond 2,200MW.

The company solicited additional wind resources through a request for proposals process that opened in March. This process generated more than 75 proposals that included the winning bidders. The deals are for energy only, and do not include the purchase of renewable energy certificates (RECs).

For more information, visit www.xcelenergy.com.

DNV KEMA: ACCURACY OF WIND FARM ENERGY ASSESSMENTS IMPROVING

DNV KEMA Energy & Sustainability, a global energy consulting firm and authority in testing, inspection and certification, said a study it conducted found that performance predictions for large-scale North American wind energy projects placed in service between 2010 and 2012 were substantially more accurate than for wind farms placed in service between 2001 and 2009.

The firm recently published the 2013 update

to its study "Actual versus Predicted Wind Power Project Performance." The study indicates that wind energy projects entering service since 2010 have produced an average of 97 percent of the energy predicted, an improvement of six percentage points over wind farms that went on line between 2001 and 2009. According to DNV KEMA, "Additional improvement is anticipated when data is available from projects for which energy estimates include recent changes in energy assessment techniques."

"To minimize the cost of energy from wind energy projects, investors need to have confidence in the energy production estimates made before the projects are built," said Robert Poore, a senior advisor at DNV KEMA. "While DNV KEMA energy assessments have historically been more accurate than the industry average, we found that in the last three years improved methodologies for assessing project energy production have lowered the average variance between pre-construction energy estimates and actual plant performance for the entire industry. As confidence is gained in the improved methods, we expect to see less discounting of pre-construction estimates when investors evaluate wind projects. In the long run, this should help reduce the cost of energy from wind."

According to the study, robust wind assessment campaigns, more comprehensive curtailment risk analysis and further research into wake and flow modeling are key elements in further reducing uncertainty in wind project energy assessments. "Our work with clients has demonstrated that an enhanced energy assessment program is one of the best investments a developer can make. When we plan and execute a better than average site measurement program, including the use of remote sensing, the reduced uncertainty in the energy assessment frequently results in more favorable financing terms, higher project value and higher confidence when bidding for power purchase agreements," Poore said.

For more information, visit www.dnvkema.com.

SIEMENS WIND POWER DIVISION SELECTS CEO

Markus Tacke has been appointed CEO of Siemens Energy Sector's Wind Power division. The forty-eight year old Tacke was scheduled to take the helm August 1. He succeeds Felix Ferlemann who, at 53, left the company by mutual agreement to pursue new career challenges.

Tacke studied mechanical engineering at the Technische Universität Darmstadt, where he completed his doctoral degree. He also earned a Master of Engineering degree from Cornell University in Ithaca, New York. Before joining Siemens AG in 1998, Tacke had been active for the construction firm Wayss & Freytag AG at their unit for commissioning of large-scale machinery. At Siemens, he has been serving as CEO of the Industrial Power Business Unit at the Energy Sector's Oil & Gas Division since October 2009. Before that, he had been responsible for the worldwide business of Siemens in industrial steam turbines. Tacke is married and has four children.

"Felix Ferlemann provided essential stimuli, and we thank him for his commitment," notes Michael Süß, member of the managing board of Siemens AG and CEO of Siemens' Energy Sector. Ferlemann had been active at Siemens Wind Power since October 2011. Holder of a doctorate in mechanical engineering, he had previously been in charge of automotive chassis systems at Benteler-Automobiltechnik GmbH.

For more information, visit www.siemens.com/wind.

AVANTI ACHIEVES GWO CERTIFICATE

With a new certification from Lloyd's, Avanti Wind Systems now meets the demands from the Global Wind Organisation to train and educate operators to work in wind turbines and other workplaces in similar heights.

Both the training personnel and the facilities at Avanti Wind Systems, headquartered in Hillerød, Denmark, are now certified after GWO standards to basic safety training for onshore and offshore activities covering "Working at Heights." This is the first step for Avanti to follow the GWO standards

for safe work in wind turbines. Other GWO-certifications are expected to follow later this year.

The object of Global Wind Organisation is to support an injury-free work environment for construction and operating of wind farms on- and offshore. To support this, GWO has developed a standard for basic safety training to provide personal working at wind farms with sufficient knowledge to obtain this target.

GWO is working together with most of the wind turbine manufacturers and larger wind farm owners in Europe and the U.S.

Safe work in wind turbines has always had first and top priority at Avanti Wind System. Therefore, Avanti follows the highest standards in the field irrespective of the country where Avanti Wind Systems is working. With this GWO certification, Avanti Wind Systems states that the company also will train and educate anyone working in wind turbines in the same high standards.

For more information, visit www.avanti-online.com.

NORDEX PERFORMS EXTENDED QUALITY TESTING

Turbine system performance, safety and service life are frequently determined solely by means of calculations, computer simulations or years of field testing. At its Rostock, Germany production site, Nordex is now employing additional test rigs to check numerous core components of the Generation Gamma and Generation Delta wind turbines under laboratory conditions as well. The Company scrutinizes the entire turbine systems right from the development phase at the Nordex technical center "Technikum," the floor area of which has now been extended to 3,900 m^2, plus the rotor blade testing facility with a floor area of an additional 2,400 m^2.

Last year, Nordex invested 4,600,750 million in extensions to the modern "Technikum," developing new testing facilities and now putting them into operation step-by-step. With these new test rigs, Nordex is testing the system functions under extreme climatic and mechanical conditions including in the form of long-term endurance tests. This way, the company is able to ensure that its developments satisfy strict quality criteria and that it is able to release a high-quality product for series production. A further goal is to increase the pace of development.

"In addition to larger rotors, a greater installed capacity and growing tower heights, real-life conditions at wind turbine sites, which can be quite harsh in some places, are increasingly playing a role in the development of our systems," Nordex SE CEO Dr. Jürgen Zeschky said. "Our turbines must operate perfectly in extreme cold or heat, in icy or very humid conditions and under different grid conditions."

Nordex uses a project validation plan to make sure that no critical components are neglected during testing and that everything proceeds in-sync with current development projects. This plan defines the components which must be tested, the target result, the type of test required and the testing interval.

15 different testing facilities, including an azimuth and motor/vibration test rig, have been installed for complete and thorough testing of the core components fitted to Nordex. In addition, various tests are performed on the blade adjustment system using three different pitch testing systems. The advantage of this is that Nordex is now able to perform advance tests of the turbine software, the pitch converter under load and the entire system comprising switching cabinets, drives and cable loops under normal and also extreme temperatures.

The most important new addition is the climate chamber, which has been expanded and is now more efficient. With a capacity of almost 150 m^3 and a range from -40°F to +140°F, it submits the turbine systems to extreme climatic endurance testing. In addition, a relative ambient humidity of 95 percent can be simulated. A further five test benches are devoted solely to tests on slip rings. One of these is also fitted with a climate chamber with a capacity of 2m^3.

A grid simulator with variable voltages and frequencies at the configuration limits is also available for testing the system capabilities even under difficult grid conditions. In addition, it is possible to generate dynamic grid errors and harmonics. To guarantee the best possible quality of electricity, Nordex also simulates the grid errors of a wind farm in a medium-voltage grid in the field. The fault ride-through capabilities for bridging any drops in voltage are checked on a continuous basis. This also aids the development of grid codes and helps to ensure that the necessary certificates are gained.

The testing system for the Company's internally produced rotor blades with a length of up to 65 meters has been in operation since 2010 and allows static and dynamic stress tests to be performed. In addition, Nordex started up a cable loop test bench last year.

All tests form part of the standard inspection of the core components of the Generation Gamma and Generation Delta wind turbines. In addition to performing its own tests, Nordex imposes on its suppliers a duty to perform vibration, EMC and lightning protection testing on the components which they deliver. In this connection, Nordex has stipulated in its internal quality requirements that internally developed or externally sourced components must function perfectly in the entire range of different ambient conditions. The findings gained are continuously incorporated in the innovation process, with the results directly plugged into the turbine development process in order to additionally enhance their quality.

For more information, visit www.nordex-online.com.

SKY HARVEST TO ACQUIRE VERTICAL AXIS WIND TURBINE TECHNOLOGY AND MANUFACTURING FACILITIES

Sky Harvest Windpower Corp. announced that it has entered into an agreement to acquire a vertical axis wind turbine manufacturing and sales business from a private Canadian company in consideration of the issuance of 650,000 shares of its common stock, cash payments totaling $65,000, and the grant of an option to the vendor to acquire up to 550,000 shares of its common stock at a price of $0.10 for a period of five years. This grant is pursuant to the company's previously announced 2011 stock option plan. In addition, Sky Harvest has agreed to pay the vendor a royalty of $200 for every vertical axis wind turbine that it sells for a period of ten years. The vendor will also receive 500,000 voting shares of the subsidiary company that holds the turbine assets if that company's shares trade publicly on a recognized stock exchange or quotation system. As part of the agreement, Sky Harvest has acquired the intellectual property rights relating to the turbine design, and leasehold interests in both manufacturing facilities and equipment.

Sky Harvest has received written expressions of interest for the purchase of over 13,000 vertical axis turbines from parties in four different countries. The sale of such number of turbines would generate revenue of approximately $250 million. Sky Harvest has also entered into discussions with additional parties with compatible technology regarding the potential joint venture development of additional wind turbine products.

Unlike most wind turbines which have blades that rotate around a horizontal axis, a vertical axis wind turbine has blades that spin vertically around a horizontal mast. They are primarily used in remote areas to provide electricity to communication towers, mines, and communities that typically rely on diesel or propane for power generation, which results in reduced costs to the user, as well as a smaller environmental impact through the reduced use of fossil fuels and no risk of on-site diesel spills. These turbines are also suitable for rural areas of developing countries where grid infrastructure is minimal or non-existent. They can also be mounted near the upper portion of commercial smoke stacks and are powered by the updraft. The principal advantages of a vertical axis wind turbine include low noise levels, minimal vibrations due to low RPM, the ability to utilize wind from any direction, ease of installation and maintenance, durability, and very low

impact to wildlife. In addition, the Sky Harvest turbine is self-starting and begins to move at wind speeds as low as two meters per second and commence generating power at wind speeds of three meters per second. The additional advantages of the Sky Harvest turbine when compared to its competitors are its ability to withstand temperatures well below freezing and to operate without a driveshaft or gearbox.

"We are excited about the potential market for our vertical axis wind turbine given that there are many areas of the world where horizontal turbines are not feasible due to a lack of infrastructure or public resistance to large-scale projects," Sky Harvest's President, William Iny, said. "The initial interest that we have received from prospective customers is overwhelming and not only reflects the features of our turbine, but also the potential market for this type of product. Our board believes that this manufacture-ready segment of our growing business will bring additional value to our shareholders. Through the development of highly engineered vertical turbines, our goal is to become the pre-eminent, reliable supplier to the telecommunications and remote community power generation sectors."

For more information, visit www.skyharvestwind.com or call 877-700-7021.

EU OFFSHORE WIND GROWS, BUT WARNING SIGNS EVIDENT

277 new offshore wind turbines, totaling 1,045MW, were fully grid-connected in Europe during the first six months of 2013. This is double compared to the same period in 2012 when 523.2MW were installed. In addition, 268 foundations were installed and 254 turbines erected, all during the first 181 days of the year. "Offshore wind power installations were significantly higher than in the first six months of last year," said Justin Wilkes, director of policy at the European Wind Energy Association. "But financing of new projects has slowed down with only one project reaching financial close so far this year. This, together with a lack of orders being placed for offshore wind turbines, substructures and components, reflects the regulatory uncertainty in key offshore markets including Germany and the UK. It highlights the significant challenges faced by the offshore wind sector.

"Offshore wind is a new industry that creates jobs, reduces fossil fuel imports and in which Europe is a world leader with huge export opportunities. The installation rate shows what the European offshore wind industry is now capable of. But to attract investment to the sector governments need to provide a stable regulatory framework and the EU should set a binding renewable target for 2030," Wilkes said.

Total offshore capacity in Europe is now at 6,040MW in 58 wind farms across ten countries—up from 4,336MW in June 2012.

21 offshore wind farms are under construction or in preparation, with a total capacity of 5,694MW.

Location	No. of turbines connected	MW fully connected to grid
Belgium	12	73.8
Denmark	98	352.8
Germany	21	105
UK	146	513.5
TOTAL	277	1,045.1

The 277 wind turbines fully grid-connected in the first half of 2013 were in seven wind farms: Thornton Bank (BE), Gunfleet Sands 3 (UK), Lincs (UK), London Array (UK), Teesside (UK), Anholt (DK), BARD offshore 1 (DE).

For more information, visit www.ewea.org.

VESTAS SECURES SERVICE CONTRACT RENEWALS FOR 130MW GDF SUEZ FLEET

Vestas has secured 10-year advanced service contract renewals with GDF SUEZ Energia Italia, which heads the Italian-based energy business of the GDF SUEZ Group, for six wind power plants in Italy with a total capacity of 130 MW—comprising 31 units of V90-2.0 MW and 80 units of V52-850 kW wind turbines.

The service contract extensions include a 10-year service agreement with Vestas' Active Output Management (AOM) 5000 service scope, a complete service package to ensure minimised lost production, including everything necessary to maximise output but with further aligned incentives. AOM 5000 offers an energy based availability guarantee that aligns service and maintenance execution with low wind periods.

Under the agreement, GDF SUEZ Energia Italia will also benefit, for the entire fleet, from the Vestas Weather & Power Forecast—a high-quality, site specific, continuous weather and production forecasting system. It enables the optimization of maintenance schedules by identifying low wind periods during which service is to be performed. It also improves customers' business by delivering precise power forecasting, and it fulfils the grid requirements established.

"We decided to renew our 111 Vestas wind turbines' service and maintenance agreement for another ten years on the basis of our long-lasting business relationship with Vestas and its ability to meet a number of specific requests—not least, maximizing our wind power plants' value by increasing the turbines' reliability and availability, reducing down time and improving lifetime performance of our wind turbines in the country," said Pascal Renaud, generation director for GDF SUEZ Energia Italia.

"We are very proud that GDF SUEZ Energia Italia has chosen to sign 10-year advanced service renewal contracts for their entire Vestas installed fleet in Italy. The GDF SUEZ Group is one of the largest and most experienced utilities in the world that demands excellence within its organisation and from Vestas. Vestas is therefore very pleased to have been chosen by the customer on the basis of the confidence built over years and our ability to listen

and act on their requests," said Nicolas Wolff, general manager of Vestas France. "We are pleased with the trust GDF SUEZ shows in our organization as this is a huge recognition of our service performances."

The six wind power plants produce approximately 250,000 MWh per year, which is enough to meet the residential electricity consumption of about 220,000 people in Italy and save the environment from almost 100,000 tons of CO2 emissions on an annual basis. Installed between 2006 and 2010, the power plants are located in the regions of Campania, Molise and Sicily.

For more information, visit www.vestas.com.

REPOWER COMPLETES 325MW OFFSHORE INSTALLATION

Suzlon Group subsidiary REpower Systems SE have installed the last of the 48 total REpower 6M turbines in the Belgian offshore wind farm Thornton Bank. The customer for this project is the Belgian offshore project development company C-Power, which was set up by four Belgian investors and counts REpower customers RWE Innogy and EDF EN amongst its shareholders.

"We are very proud to have installed the largest fleet of 6 megawatt turbines worldwide," Andreas Nauen, CEO of REpower Systems SE, said. "Thornton Bank confirms the long-term potential of the market. We offer our customers the best technology combined with industry leading experience in building projects in complex and challenging environments."

The 2013 construction phase covers all 18 REpower 6M turbines. Each of the turbines has a rated power of 6.15 megawatts. REpower completed Phase III successfully and on time: that proofs the company's well-developed logistics concept and the good cooperation between the teams during the installation of the turbines. After the completion of all three construction phases, the wind farm has a total output of 325 megawatts —enough to supply 600,000 people or a city the size of Glasgow with electricity. In terms of investment volume, the contract marks the largest financing for a completed project to date in the offshore wind industry overall. Companies from Belgium, Germany, France, the Netherlands, Denmark and Sweden are involved in Thornton Bank, making the wind farm a showcase project for the European offshore wind industry.

For more information, visit www.repower.de.

Julian Bell
Signal Energy Constructors

Rules of the game: Assessing and assigning project risks through important elements of wind energy engineering, procurement, and construction contracts.

WIND CONSTRUCTION PROJECTS typically begin with a contract between the owner and the general contractor. This engineering, procurement and construction (EPC) contract establishes the "rules of the game" for the project, and the nature of the obligations each party will have to the other. Properly allocating major project risks through the EPC contract is an important part of being a successful contractor. This article examines a few of the more important sections of the EPC contract.

SCOPE OF WORK AND TECHNICAL EXHIBITS

EPC contracts consist of the main body of the contract and several technical exhibits, often a dozen or more. These technical exhibits play a critical role in establishing the construction parameters. While parties commonly spend most of their negotiating time on the main contract, the most useful contracts result when the parties also spend significant time on the technical exhibits. A major exhibit, or group of exhibits, will be the "scope of work." In all EPC contracts, both parties are well served by making sure that all technical exhibits, and in particular the scope of work, are accurate and complete.

MILESTONE DATES

The EPC contract should specifically define the milestone dates for the major construction activities, including the following: A.) The issuance date for a limited notice to proceed for engineering and procurement of long lead time items; B.) The issuance date for a full notice to proceed for all construction activities; C.) The turbine delivery schedule (start and end of deliveries, and number of complete turbines delivered per week); and D.) The date for provision of backfeed power by the utility; E) and all liquidated damage dates (typically substantial completion).

SCHEDULE CHANGES

In addition, the EPC contract should define the circumstances under which the contract dates and time periods can change. The typical contract clauses allowing schedule changes include the following: A.) An owner-caused delay clause; B.) A force majeure clause; and C.) A material changes clause. Each of these important clauses should contain a list of items that, once they occur, will permit a change to the contract schedule. For example, it is common for the owner-caused delay clause to permit the schedule to be extended when items that are the owner's responsibility (turbine deliveries, deliveries of other owner-provided material or equipment, backfeed power, etc.) do not occur on the scheduled date. In such cases, the contractor may be entitled to an extension of the construction schedule. In addition to these clauses, the contract should contain a change order clause that allows for both the owner and contractor to submit a change order request to the other. Change orders enlarging, or contracting, the contractor's scope of work often require changes to the contract schedule.

PAYMENT AND SECURITY ISSUES

The contract must establish payment procedures and requirements, as well as the security that each party will provide to make sure that their contract obligations are fulfilled. Payments clause should set out the payment timing, documentation and review requirements, and payment amounts. It is common to have a "schedule of values" exhibit that lists the payment value for all major construction activities and forms the basis of payment amounts. In addition, where the project owner is a single purposes entity, the contract should establish any payment security to be provided by the owner, such as a parent guarantee or a letter of credit. Likewise, the contract should establish any security required of the contractor, such as a parent guarantee or a payment and performance bond.

COMPLETION DEFINITIONS AND LIQUIDATED DAMAGES

Wind projects typically have critically important deadlines. The project power purchase agreement may have a deadline for providing power to the purchaser. The project interconnection agreement may contain a deadline for providing power to the grid. In addition, tax deadlines always play an important role in shaping a wind project construction schedule. Failure to meet any of these deadlines may subject the owner to liquidated damages, or the loss of tax advantages. It is common for EPC contracts to shift a portion of this risk to the contractor by way of liquidated damage provisions. Most contracts impose liquidated damages for the late completion of project substantial completion. Liquidated damage provisions should be clear on how the damages are calculated, and the conditions under which they will be imposed. For example, if liquidated damages are imposed for late substantial completion, the contract must specifically define what constitutes substantial completion. The most common contract clauses contain a list of tasks that must be completed by the contractor before substantial completion is achieved, as well as the specific approval.

Wind EPC contracts are complicated. Parties should use the contract to define construction parameters and to place risks on the party most able to control that risk.

Julian Bell is the director of preconstruction for Signal Energy Constructors, an EPC/BOP renewable energy contractor with more than 7,000 MW of utility scale project experience. For more information visit: www.signalenergy.com.

Jack Wallace
Frontier Pro Services

More than just for crew photos, a digital camera can be a powerful tool in giving a total "snapshot" of your maintenance practices.

TECHNOLOGY HAS BECOME a part of our everyday lives. Use of technology in maintaining wind turbines is a prime example. One technological tool we use regularly now is a digital camera. You can find a digital camera in nearly everyone's pocket today. They have been integrated into most cell phones and are permeating all aspects of our lives. I consider a digital camera one of the most versatile tools that I now use. This is one tool that was not available when I first started in wind energy. Advances in digital camera technologies have significantly altered and improved the way we work in the service and operation of wind energy plants.

Sharing information has become so much easier with the widespread use of digital cameras. Taking project photos before, during, and after a job has become commonplace in reporting services performed. We can track broken items when and how they arrive for repair. We can show the progress of the repair, including photos of the new components that are used in the repair. The final finished product is usually photographed as it leaves the repair facility. All this information is shared with a few simple snapshots.

Advantages of the digital camera are such that you don't have to be a photography expert to get good photos, and you don't have to worry about running out of film. You can take a photo; instantly review the photo; zoom in for more detail; crop the image; and delete or retake the photo until it is to your liking.

Once, while I was teaching an electrical troubleshooting class to wind turbine technician students, one of the students came up with a unique and innovative use for a digital camera. Part of the curriculum included practical troubleshooting of an electrical turbine control system. In preparing the lesson, I rewired the trainer board so that it would not function properly. The student then had to use a digital multimeter and schematic to troubleshoot the installed problem. Unknown to me, he had taken a photo of the board's wiring prior to me installing the error and was able to identify the problem by comparing the rewired board to the original photo he had taken. This process of troubleshooting was effective, although he did not use the skills we were hoping he would develop. In the field, using this technique may be a great idea. What if your wind turbine's control wiring has been disassembled and your technician is unable to reassemble it? A quick, simple solution is to have them go to a similar turbine, take photos of the affected area, and then use those photos to help with reassembly. This method also works with mechanical systems. Digital photos help guide repair procedures and can help ensure that proper safeguards are in place and are being followed. Quick updates to training and operation manuals are facilitated by including updated photos of recent failures or new repair procedures. All of these are sped up by the ease of use of the digital camera.

Another area in which digital cameras have become standard equipment is inspection related work. Digital photos are a big part of inspection reports—particularly those for end-of-warranty inspections. Thousands of photos of all parts of the turbine—from top to bottom, and all in between—are taken during these inspections. Hundreds of photos are taken of the blades, gears, bearings, welds, slip rings, and other components that can exhibit signs of early wear in a wind turbine. Proper high-quality digital photos can make the difference in whether or not an item suspect of abnormal wear will be considered as a warrantable claim.

This tool is simple but powerful, as digital photos can be quickly shared from a technician up tower to those down tower, or even to another part of the world by text message or e-mail. These photos can be shared where others on the team who can help make quick decisions—saving money in the process. More than once, I have been asked to take another or a few more to share with other concerned parties who are hundreds of kilometers away in their air-conditioned offices with big-screen monitors. Sometimes I wonder if their view is better than mine. They are able to view the photo on large screens, and can view the item closer with powerful zoom control—showing more detail than my naked eye can see at the scene.

Digital photos properly taken can help settle warranty disputes concerning process and methods of repair. This is especially true with blade repair. Scarf, laminate, fairing and coatings can all be properly documented step by step with these cameras.

Recent blade failures by a major manufacturer were reported to be due to improper preparation of bonded surfaces. Digital photographs of the actual parts after this step in the process would have quickly brought this problem to the surface. As for the investigation, you can bet that digital cameras were used to help share detailed data used to help come to a resolution with team members worldwide.

The use of digital cameras will continue to be used in documenting, troubleshooting, training, and in general sharing of machine and system information. Proper usage of this tool can help: control work quality; ensure that repairs are made properly; and enforce safety and warranty practices. Ultimately, digital cameras can save you money and eliminate surprises.

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Harde Eddison
Vectora Transportation

In drawing up your component transportation playbook, consider choosing an experienced third-party logistics provider to call the plays in the huddle.

AT ONE POINT, all companies have internally analyzed the option to have their suppliers own the transportation of components or to manage it themselves. Decisions were made based on resident knowledge of the transportation industry and the final cost of the good sold. These factors are critical when negotiating the transportation scope, but are not the only factors that should be considered when making this analysis.

3PLs (third-party logistics providers) are more often used when the supplier or customer of the purchased goods does not have the internal staff available to manage the abundance of asset-based trucking, rail, barge, ocean, and warehouse companies generally used during a project or delivery to a port or staging location. 3PLs are best utilized for entire turnkey solutions as well as the management of only a portion of the project delivery. Working directly with an asset-based establishment is the streamlined approach to the pieces of equipment needed, and eliminates the need for an additional vendor. This is no secret. The hidden risks can be in the supplier's or customer's internal operational abilities and resources to manage every single asset-based carrier, scheduling, invoices, scorecards, inspection sheets, claims, and—above all—their ability to perform in accordance with DOT regulations, on time and within budget. This is feasible with a limited staff if everything works perfectly. For those who have had firsthand experience with transporting wind turbine equipment, we all humbly know even the most successful projects face challenges in their execution.

At times when project contingencies are in full swing, the ability to rely on a 3PL to realign the project may be the best option. Not only do 3PLs have an abundant network of carriers and other critical supply chain partners, it is in their best interest to build and foster those relationships. It has been my experience that the network of "players" are always eager to help and contribute to the success of any endeavor. Think of a 3PL as the quarterback on a football team. Your project is the ball and the network comprises the remainder of your offensive. Though not all players touch the ball, they are all in formation to deliver your project to the goal line. As in football, a play is created and the quarterback gives the ball to another player with the sole purpose of advancing the ball toward the goal line. If the quarterback doesn't take full advantage of the entire offense that is at his disposal, he can't move the ball effectively. If the network isn't there to protect him, the quarterback may be subject to a blindside sack. These unforeseen challenges can slow progress—or even force steps backward. Similarly, the offensive players would not function properly without a quarterback, requiring the sideline coaches to manage the players individually. Because it is not football season now, I will digress from this illustration and refocus on the benefits of a 3PL.

With the abundance of 3PL options in the marketplace, choosing which company to send an RFP can sometimes be a daunting task. Identifying which 3PLs have a well-rounded staff of project managers, engineers, technical support, and experience is the first way to separate the professionals from the companies who don't measure up. Secondly, it is important to identify if the 3PL is licensed and certified in areas such as NVOCC and C-TPAT. These qualifications demonstrate that the companyand its supplier network operate at a high security level, and are validated by the Federal Maritime Commission and Customs Border Patrol. Lastly, it is important to know what the 3PL can provide from a technological standpoint. Only a handful of 3PLs are proving customized cloud-based services that enable their customers to have real-time visibility of inventory levels and cargo in transit, as well as provide a platform for capturing valuable data for KPIs reporting and document library platforms to centrally house, BOLs, inspection reports, inventory tracking sheets, and delivery schedules. This is very appealing for suppliers and customers who do not want to invest in a full transportation or warehouse management system.

Whether hiring a 3PL, an asset-based carrier, or simply having the supplier manage the transportation, it is important that the risk of transporting the components be understood and packing and transportation and handing specifications be current. Although a large number of deliveries have been made successfully, there has been and always will be the need for process improvement and innovation.

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Theo Botha
Co-Founder, Blade Dynamics Ltd.

Lowering the cost of wind energy through composite technology and quality-by-design.

ENERGY HAS ALWAYS BEEN PIVOTAL to the progress and sustainability of civilization. This has never been more true than today and we are facing a unique set of circumstances. The importance of energy security, its cost, and the global requirement for reducing carbon emissions are more pressing than ever. While solar and wind are really gaining traction, "fracking" of natural gas is also changing the energy environment. We all understand these issues very well, but the point is that renewables are required to stand alongside conventional power generation right now. This requires a different degree of industrialization and process control in order to deliver the reduced cost and improve reliability that is so obviously required.

Blade Dynamics exists solely to develop composite technology to reduce the cost of energy through increased performance, simpler transport, and improved reliability. At its core, the belief of the company is that quality is everything. This is easy to say, but when we discuss some the technical challenges required to scale up wind turbines it can be seen that there has been a conflict between innovation and financing which has ultimately led to some suboptimal engineering. This is a common problem, but recognizing the fundamental issues is important for the growth of the industry.

As we know, today's wind turbines have scaled up from far smaller machines and to a large extent share similar technology. Fantastic advances have been made within the constraints of risk reduction pressure from organizations financing and insuring wind farms. This is quite understandable, as innovations in the industry have not always been successful or reduced the cost of energy. However, we have seen incredible scaling up and reductions in energy cost. In many locations, wind is now the cheapest source of energy—regardless of source.

For wind to be forever free of financial subsidization from government, further innovations are required. Blade Dynamics has pursued the importance of improving quality by developing an entirely new manufacturing methodology for wind turbine blades. Although novel, this more modular approach has been pursued to reduce the risks and the difficulties that continually scaling up existing manufacturing technology brings. Conventional blades are already an assembly of modular sections and this new technology introduces some more sections in order to improve quality, increase the maximum potential length and also to bring some very interesting possibilities to onshore blade transportation.

Fundamentally, when a composite structure is made, the material is made at the same time. To a far greater extent then with metallic components, the physical characteristics of a composite structure are determined during its processing. This processing gets more difficult to control as the scale of the component and of the chemical reaction increases. With this reduction in control comes an increase of the likelihood of an individual quality defect. With a blade, the common failure mechanisms result from out-of-control processing or the inclusion of physical defects in the finished blade. In either case, better control of processing ultimately results in: improved reliability; the elimination of material designed into the structure as contingency; and the reduction of the delivered cost of wind.

The critical understanding with modular blade technology is that the total variation in the structure can be reduced by increasing the number of individual components. Mechanical reliability can also be improved using the same method. This is demonstrated by the astonishingly low mass variation between each modular blade manufactured. It should be remembered that all blades are modular, being an assembly of components—however large! The unique modular technology in the GL-tested and approved D49 blade is currently being used to design and build next generation ultra-large offshore blades. It is also being used in the development of very large onshore blades—which will be transportable in two shorter subsections and assembled more locally to the wind farm. Both of these innovations will allow larger capacity wind turbines to operate efficiently and make a significant contribution toward low-cost wind energy.

Generally speaking, the wind energy industry is at a pivotal time, and must—more than ever—learn to innovate. The opportunity to generate low cost energy from wind resources in the oceans, and to greatly improve the penetration and scale of onshore wind energy requires innovation. Rather than bringing risk into the equation and making banks nervous, the innovation must increase the scale of wind turbines while improving their reliability.

To do things better, you very often you have to do things a little differently. The wind energy industry needs to embrace innovation at every level; and we should all look forward to some astonishing technical leaps forward in the coming decade.

Theo Botha is co-founder of UK-based Blade Dynamics Ltd., which designs, develops, and builds technologically advanced blades for the future of the wind energy industry. For more information, please visit www.bladedynamics.com.

MANKIEWICZ COATINGS, LLC

By Stephen Sisk

Mankiewicz Coatings offers its versatile ALEXIT BladeRep repair and maintenance system to wind farm owners and service personnel seeking efficiency, durability, and cost savings.

Wind turbine blades don't carry umbrellas. They can't dodge hailstones, wildlife, airborne debris. They can't exactly slather on SPF 30 either. They battle the elements day-in, day-out in doing their jobs. They take a lot of abuse.

Considering ever-increasing demands for larger-diameter rotors and the ultimate in efficiency, OEMs and wind farm owners are taking increased measures in protecting their assets.

In order to perform at maximum efficiency, rotor blades must have a smooth surface, be extremely durable, and be able to withstand all of the challenges the environment throws at them. Enter Mankiewicz Coatings and its ALEXIT BladeRep rotor blade maintenance and repair system.

Headquartered in Charleston, S.C., Mankiewicz Coatings, LLC has been meeting the maintenance and repair needs of the wind energy industry for more than a decade with its versatile BladeRep solution.

The system, built on the industrial coatings expertise of Hamburg, Germany-based Mankiewicz Gebr. & Co. provides a strong, resilient, streamlined blade profile, resulting in increased efficiency and cost savings due to reduced downtime.

Founded nearly 120 years ago as a specialty paint company for horse-drawn carriages, Mankiewicz Gebr. & Co. is currently the largest privately owned paint and specialty coatings company in Germany, serving niche segments of industries such as transportation (automotive and rail), aviation, medical technology, and manufacturing.

Given that history and expertise, the company was able to make a fairly seamless transition into the wind energy market. Mankiewicz's research and development staff took its successes and experiences in industrial coating applications and partnered with coatings experts across the globe in the initial development of BladeRep.

"Around 2000, Mankiewicz really got into the wind blade coatings industry heavily—both at the OEM level and at the aftermarket repair level," said Tripp Nelson, sales and marketing director for Mankiewicz Coatings. "It's something that we sought out primarily in Europe. We quickly became a leading supplier to the OEM market with a variety of different product offerings. "

Shortly thereafter, the company recognized the need for blade repair coating solutions for the maintenance side of the independent service provider market.

"The BladeRep product line was a natural offshoot of supplying the OEMs," Nelson said. "As more blades were being built, they would eventually need to be repaired and maintained."

In developing the actual products, Mankiewicz' team of 150 chemists and engineers had the benefit of a vast portfolio of industrial coating formulations. The group weighed and altered those formulas to meet the specific engineering and environmental needs presented by wind turbines. Experience in advanced resin technologies used in coatings for the aviation industry—which has similar needs as wind turbine applications—also drove much of the initial development of the coatings.

The BladeRep system consists of four separate components—profile filler, pore filler, leading edge protector, and topcoat—that, depending on individual circumstances, can be used individually or together for long-term protection of blades against the inherent environmental damage and corrosion they face. The system has been GL certified for performance and reliability.

Mankiewicz lists the four components of the ALEXIT BladeRep system as follows:

- Profile Filler 3—Used for filling major imperfections caused by weather or object penetration, this is a solvent-free, two-component polyurethane filler designed to be used for filling and fairing on glass reinforced substrates. This non-porous filler cures into an easily sanded surface and is ideal for repairing non-structure threatening cracks, pock marks, hail inclusions, or other deformations caused by flying objects or debris.
- Pore Filler 6—Used for filling smaller pinhole-sized surface imperfections, Pore Filler 6 is a solvent-free, two-component polyurethane filler designed to seal any surface to achieve a defect-free, smooth surface prior to applying LEP 9 or Topcoat 12 on glass reinforced substrates. Pore Filler 6 cures to a surface that is easy to sand and is ready for finish coating.
- LEP 9—Used as a finishing product specifically designed to protect leading edge areas where a coating with excellent abrasion and erosion resistance is required, this two-component, solvent-free polyurethane product has superior elasticity and flexibility for long-term leading edge protection. These "stretch" properties help distribute the kinetic energy of a variety of environmental conditions such as rain, sleet, snow, and pelting sand, thereby reducing blade erosion and extending the life of the blade.

In response to feedback from wind farm owners and applicators, a built-in BladeRep Maintenance Service Indicator (MSI) was developed within the LEP 9 system. With the MSI, a variety of application colors—red, white, and gray—helps to indicate wear visible from down tower, allowing wind farm personnel to assess current blade life expectancy. By visually identifying erosion, personnel are able to be proactive with blade maintenance—avoiding costly repairs after the fact.

- Topcoat 12—Used for additional protection as a final

For more information on Mankiewicz Coating's BladeRep products, visit www.bladerep.com or www.mankiewicz.com, or call 843-654-7755

topcoat to permanently seal and finish blade surfaces and provide exceptional durability, Topcoat 12 is formulated specifically for coating blades where a superior product with chemical, UV, abrasion, and mechanical resistance is required. This two-component polyurethane topcoat provides applicators with the ideal product for extending blade life and may be applied over all BladeRep products or any properly prepared surface. Available in many color shades according to global standards, Topcoat 12 can be easily matched to OEM colors as well.

Industry demand for BladeRep has surged over the last five or six years, Nelson said, due to what the company identifies as shifts in the wind turbine maintenance landscape.

"We've seen the market move from a responsive attitude to much more of preventative maintenance mind-set," Nelson said. "Now, a wind farm will often identify a set of turbines to coat with leading edge protection each season." Doing so, he said, makes sense because of the long-term cost savings.

"The BladeRep line itself was in its infancy before five years ago, because maintenance and repair really was not a high priority, from what we saw," Nelson said. "Now, the market is looking at more preventative maintenance."

Appropriately, BladeRep is primarily sold and used in the aftermarket repair and maintenance segment of the wind power industry. However, as more OEMs are signing on to perform service and maintenance agreements beyond the obligatory warranty period, they are also becoming potential customers for the BladeRep system.

In response to the increased demand, Mankiewicz has expanded its distribution and support staff for the BladeRep system in order to best assist and educate their customers on the products. "We've actually brought on more staff—both here and in Europe—to help support the applicators with these products," Nelson said. "We've expanded our distribution so that the products are available throughout the globe."

That commitment to not only provide the end user with long-lasting, reliable blade protection, but also provide service beyond the sale has also led the company to create other technical and instructional resources. These include online application guides and technical datasheets, and even a series of instructional videos hosted on YouTube.

Mankiewicz Gebr. & Co. has nearly 1,000 employees worldwide staffing more than 20 manufacturing, support, or sales facilities on five continents. The South Carolina facility serves as the sales, support, and distribution hub for the United States.

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LOOK TO THE LIGHTS

Understanding wind turbine obstruction lighting procedures and responsibilities outlined by the FAA.

By Andy Rudolph

Andy Rudolph is vice president of engineering with International Tower Lighting, LLC. Fore more information about International Tower Lighting, visit www.itl-llc.com.

THE U.S. DEPARTMENT OF ENERGY established its Wind Powering America (WPA) initiative in 1999 with the goal of increasing the installed wind capacity, then around 2.5GW, to 5GW by 2005 and 10GW by 2010. It also set goals for wind generation capacity at the state level and renewable energy consumption at the federal level of 5 percent by 2010.

In fact, by 2005 the national installed wind capacity had reached over 9GW—far surpassing the original WPA goal. During this same time, the average generating capacity of mass produced wind turbines increased by more than 40 percent. Wind turbines were getting taller and wind farms were growing larger. Until this time FAA Advisory Circulars had treated wind turbines much like communication towers, requiring prescribed lighting on each structure. Wind turbine farms represented a new type of obstruction, not a lone structure like a communication tower, and not multiple structures closely spaced together like "antenna farms," but many tall structures spread over large distances. The FAA's William J. Hughes Technical Center took on the task of studying how best to mark wind turbine farms. The study took over four years to complete and included eleven wind turbine sites in five separate states. The result of the study, a report authored by James W. Patterson, Jr., titled

Broken Bow Wind Farm, Nebraska; Courtesy of Edison Mission Energy.

"DEVELOPMENT OF OBSTRUCTION LIGHTING STANDARDS FOR WIND TURBINE FARMS" was published in November, 2005. FAA Advisory Circular 70/7460-1K Obstruction Marking and Lighting was updated in February of 2007 and incorporates many of the recommendations of the Patterson report with the addition of Chapter 13. Marking and Lighting Wind Turbine Farms.

MARKING AND LIGHTING OF WIND TURBINE FARMS

The following is brief summary of FAA Advisory Circular 70/7460-1K, Chapter 13, Marking and Lighting of Wind Turbine Farms. The complete Advisory Circular is available at www.faa.gov. Red flashing obstruction lights (FAA Type L-864) are the preferred lighting system for wind farms. Light fixtures should be placed as high as possible on the nacelle for increased visibility. Wind turbines around the periphery of an array of turbines should be lit. Unlighted gaps of less than one half statue mile are allowed in many instances, however, a wind turbine located apart from the grouping of turbines should be lit. The array of flashing obstruction lights should be synchronized to flash simultaneously. For daytime conspicuity turbine structures painted in a bright white or light off-white color are effective. Other colors, such as light gray or blue are less effective.

MONITORING OBSTRUCTION LIGHTS

Section 47 of FAA Advisory Circular 70/7460-1K addresses monitoring of obstruction lights. This brief section covers both visual and automatic monitoring.

Visual Monitoring

The AC states "It is extremely important to visually inspect obstruction lighting in all operating intensities at least once every 24 hours on systems without automatic monitoring." Since the release of 70/7460-1K in February of 2007 most wind turbine farms have used the "preferred L-864 red flashing lights." L-864 lights have only one operating intensity so a single visual inspection every 24 hours performed when the light is operating is all that is required. Prior to the 2007 revision of the AC, wind turbine farms may have used white lighting systems (L-865) or dual red/white lighting systems (L-864/L-865), both of which have two operating intensities. Both of these types of lighting systems have different operating intensities for day time and night time operation. Dual lighting systems are also commonly used on meteorological towers (MET towers). Lighting systems with two operating intensities require visual inspection of day intensity operation and night intensity operation, requiring two inspections daily. It can be argued that a single visual inspection where the photocell is stimulated (covered to block light or illuminated with artificial light) to force the system to change operational intensity would be an acceptable alternative, however, visual verification of night time intensities during day can prove to be difficult. The AC also requires that a log be maintained for each lit structure in which the daily operational status of the lighting system be maintained.

- Visually inspect all L-864 red flashing obstruction lighting systems at least once every 24 hours.
- Visually inspect all L-864/L-865 obstruction

lighting systems during day intensity operation and during night intensity operation.
- Maintain a log of each lit structure noting the operational status of the lighting system for each 24 hour period. Note all operational intensities inspected.

Automatic Monitoring

While the FAA Advisory Circular does allow for visual inspection of obstruction lighting systems, the size and location of wind farms is rapidly making visual inspection impractical. The Advisory Circular addresses this in stating "In the event that a structure is not readily accessible for visual observation, a properly maintained automatic monitor should be used." Wind turbines are typically equipped with remote monitoring capability such as SCADA (Supervisory Control And Data Acquisition). Wind turbine obstruction lighting systems provide dry-contact alarm points that can be easily interfaced to monitoring equipment such as SCADA for alarm notification. All available dry contact alarms on the obstruction lighting system should be monitored. During installation, the latency of the alarm reporting should be measured to verify that it happens quickly enough to allow reporting within the 30-minute time window. Similar to visual monitoring, the AC similarly states that "When using remote monitoring devices, the communication status and operational status of the system should be confirmed at least once every 24 hours."

- Verify the communication status of the system at least once every 24 hours.
- Verify the operational status of each obstruction light at least once every 24 hours.
- Maintain a log of each lit structure noting the operational status of the lighting system for each 24 hour period.

REPORTING

Section 23 of FAA AC 70/7460-1K addresses light failure notification or reporting. The AC states "Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or a flashing obstruction light, regardless of position, should be reported immediately." The AC includes the basic information required for reporting an obstruction light outage, however, it refers the reader to the "telephone book" or to www.afss.com (Automated Flight Service Station) web site for information on who to contact to report outages. Unfortunately, neither of these resources provides quick access to the contact information for reporting an outage. A valuable resource that clearly presents this information is the FAA's Obstruction Evaluation / Airport Airspace Analysis (OE/AAA) web site (https://oeaaa.faa.gov). In the left side bar of this the page there is a link for "Light Outage Reporting." The Light Outage Reporting page lists the toll free numbers for reporting, 877-487-6867, for Alaska 800-478-3576, as well as detailed information that will be required to complete the report. This site has many other useful resources in the sidebar so it is worth spending some time exploring. When you call the toll free number, you will be connected with Lockheed Martin Flight Services. An automated system will ask you "What state are you departing

from?" You should answer will the name of the state in which you wish to report the outage. You will then be directed to Flight Service Specialist who will ask you for information regarding the outage. The list below is an example of the minimum that should be recorded for an obstruction light outage report. This list also contains much of the information the Flight Service Specialist may request.

- Your name and the name of your company or organization
- Your phone number

- Name or identification number of the structure.
- The type of Structure
- Location of structure (latitude/longitude)
- Height of structure above ground level (AGL)/ above mean sea level (AMSL)
- Nearest Airport to the structure with the outage.
- A return to service date (usually assumed to be 15 days)
- Your initials (usually given using the NATO phonetic alphabet, ie. "Alpha-Zulu")
- Flight Service Specialist initials for the outage report
- Date and time of the outage report

The Flight Service Specialist will issue a Notice to Airmen (NOTAM) describing the outage. NOTAMs are associated with airports so you may be asked for the airport nearest the structure with the outage. You may also be asked for the "ASN" or "ASR." For telecommunication structures this is the Antenna Structure Registration Number, but for wind turbines and MET towers you will not have such a number. The Flight Service Station processes an average of 13,200 obstruction light outage NOTAMs each month. Since most of these NOTAMs are issued for communication and broadcast towers it is often assumed you are reporting on a structure that is regulated by the FCC.

A NOTAM will be issued that will last 15 days after which time it will automatically be canceled. If additional time past the 15 days is required to repair the outage, call before the NOTAM expires and request to extend the NOTAM. Rather than let the NOTAM expire, call and cancel the NOTAM when a repair has been completed and the lighting system is functioning correctly. Allowing NOTAMs to expire is at least considered bad housekeeping. In the world of telecommunications, FCC licensees risk fines when a NOTAM is allowed to expire. In addition to the information listed above the date and time that the NOTAM was canceled should be recorded as well as the initials of the Flight Service Specialist who canceled the NOTAM.

- Flight Service Specialist for NOTAM cancellation
- Date and time of NOTAM cancellation

Keeping an up-to-date database of information on each structure equipped with obstruction lighting is essential to facilitating the timely and accurate reporting of light outages.

REPORTING VIA THE INTERNET WITH E-NOTAM II

At a time when everything is changing through internet connectivity one might wonder why you

have to pick up a telephone and call a toll free number to report a tower light outage. The FAA has undertaken the Federal NOTAM System (FNS) modernization initiative and it is approaching completion. Companies providing tower light monitoring services, like my employer International Tower Lighting, LLC (www.i-nocc.com), already use FNS NOTAM Origination Service (FNS NOS) to electronically file NOTAMs, and "Sponsors" such as wind farms, broadcasters, and wireless infrastructure providers are being provided with access to e-NOTAM-II (EN-II) Web Application to request NOTAMs using a web portal. The EN-II web site contains a new user registration link that can be used to request access. EN-II accounts must be individual so each person who will need to file NOTAMs must register at https://notams.aim.faa.gov/en2/.

GOING FURTHER

While the FCC does not have regulatory authority over wind farms, it may be of benefit to review some of their requirements. FCC rules in 47 CFR §17.47 require quarterly light Inspections.

47 CFR §17.47 "The owner of any antenna structure which is registered with the Commission …. Shall inspect at intervals not to exceed 3 months all automatic or mechanical control devices, indicators, and alarm systems associated with the antenna structure lighting to insure that such apparatus is functioning properly."

Performing and documenting quarterly light inspections would be an appropriate practice for wind farm operators to consider adopting.

CONCLUSION

While the majority of this article has dealt with FAA Advisory Circular 70/7560-1K requirements for reporting light outages and filing NOTAMs, a NOTAM is not a substitute for a properly functioning obstruction lighting system. The Advisory Circular makes this point well:

"Sponsors should keep in mind that conspicuity is achieved only when all recommended lights are working. Partial equipment outages decrease the margin of safety. Any outage should be corrected as soon as possible."

INSPECT AND MAINTAIN, REFURBISH, OR RE-BLADE?

A method for addressing blade damage that has been discovered too late.

By Chris Wraith

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AS TODAY'S OPERATING WIND TURBINE ASSETS age, owners and operators are being straddled with higher operation and maintenance costs than those experienced during the early years of operations; in many cases, more than those assumed within the pro forma. These cost increases are particularly common for wind turbine rotor blades. Even many of those operators who have signed long-term maintenance and service contracts will discover they aren't immune to these rising costs.

Most owners and operators do not perform full-scale rotor blade inspections on the operating fleet after end-of-warranty, and are typically only carried out after the field technicians start to report increased signs of damage or when higher associated rotor blade maintenance costs dictate that the inspections be performed to get a better understanding of the conditions of the rotor blades on-site. Once the rotor blades reach this condition, on-site/on-tower repair becomes much more costly and impractical, and other options must be considered. These are commonly:

A. Allow the turbines to operate with minimal maintenance and plan for near-term re-powering of the site

B. Re-blading the wind turbines with newer blades of the same or greater length
C. Refurbishment of rotor blades
D. Some hybrid solution of b and c

Most owner/operators do not have the in-house rotor blade knowledge required to perform the comprehensive assessment of their rotor blades in order to understand their current operating condition. For this reason, many third party independent service providers (ISP's) are brought in to perform these inspections and aid in the decision-making process for addressing issues with the rotor blades. Provided that the condition of the rotor blades is not so deteriorated that options "A" or "B" are the only feasible solutions and on-site repair is no longer an economical option, most companies prefer option "D".

Option "D" is generally used due to the ramp-up time associated with the refurbishment process, as most spare rotor blade sets are not normally readily available on-site. At minimum, a lag-time of 4–6 weeks can be expected from the time the rotor blades are removed from the turbine until the refurbishment is completed and the blades are ready to be re-installed. Subsequent rotor blade sets can be expected to be available at much lower lag-times. In order to minimize this downtime cost, new rotor blade sets are purchased, when possible; when not possible, older rotor blades that can be matched into a set are sought and purchased. As is most often the case, these older rotor blades require some degree of refurbishment before being installed, so in many instances these rotor blades are the first to go through the refurbishment process.

What is involved in the refurbishment process?

From the inspection findings, a detailed understanding of the wind farm rotor blades condition is known. When the discovered damage includes defects such as extensive surface coat cracking; flaking; erosion; chord-wise and span-wise cracking in the max chord and transition area; leading edge (LE) erosion; and interior defects affecting a high percentage of the rotor blade population; an off-site refurbishment plan is usually found to be the most cost effective solution—if repair is even economically feasible. In order for an owner and/or operator to proceed with this process, a number of steps need to be taken and items considered:

STEP 1: PROJECT TENDER

If the work is to be performed by third party contractors, the work should be tendered to multiple potential contractors. Within the tender, a detailed scope of the work to be performed provided with the request that a fixed price for refurbishment be provided. For this reason, most owners and operators work diligently—with outside consultants when required—to establish which of the common defects require repair; and ensure that these defects are repaired under the standard scope of repair. Time and materials rates are also requested for defects requiring repair that are out of the original scope of refurbishment definition.

Establishing, before submitting the request for tender, which rotor blade repairs need to be included as part of the fixed set refurbishment cost is critical to obtaining a higher level of

cost certainty for the project. However, careful consideration must be given to which repairs are and are not critical, as this can greatly influence the overall set refurbishment cost. When replacement rotor blades are available, refurbishment costs above 40–60 percent of new rotor blades costs are generally considered as the upper limit. At a minimum, the following classes of defects require repair:

1. Interior and exterior structural defects that will have an effect on the safe operation of the rotor blade during the expected operating life
2. Lack of continuity in lightning protection system down conductor
3. Blocked drain holes
4. Missing and damaged aerodynamic elements

Additional repairs will influence the overall set refurbishment cost. However, careful consideration must also be given to the following:

1. The condition of the LE of the rotor blade commonly deteriorates. Based on an assessment of the current condition at the time of refurbishment and the local site conditions, the application of a supplementary LE protective coating is typically performed.

2. A number of interior and exterior structural defects will be discovered during inspection following operation of the rotor blades. Not all of these defects will have an effect on the safe and continued operation of the rotor blades within the rotor blade design life. Taking a conservative approach when selecting which defects require repair will increase the refurbishment cost, but will likely decrease the long-term operating costs.
3. Re-application of the final surface coat following completion of repairs is recommended for three main reasons:

a. A very patchwork surface results from the refurbishment process. This will leave the final surface condition of the rotor blade very unaesthetic.
b. Wear of the surface coating will occur as the rotor blades continue to operate. Re-coating will ensure areas of thin coating are repaired.
c. A refurbished surface coating will facilitate defect discovery during subsequent rotor blade inspections.

If, as is commonly requested, the contractors request access to a sample of the rotor blade population prior to responding to the request for tender, this access should be granted. It can be expected that through this inspection, the individual

contractors will gain a better understanding of the rotor blade condition, and be able to provide more accurate pricing.

It is also important that, as a requirement of responding to the tender, the contractor is able to provide demonstrated knowledge of the specific rotor blade materials and design as well as the general practices within the rotor blade repair industry. If this information cannot be provided, the contractor must be able to describe the processes that will be employed to determine this information and ensure the integrity and continued safe operating ability of the refurbished rotor blades.

STEP 2: SELECTION OF CONTRACTOR

Selection of the contractor to perform the work cannot be awarded solely on a lowest-tendered-quote basis. Careful consideration must be given during this process and individual site visits to assess the individual contractor's capacity to perform the required work should be performed.

Depending on the scale of the wind farm, the number of years planned for refurbishment and the capacity of the individual contractors responding the request for tender, multiple contractors may be required to complete the refurbishment project.

STEP 3: DEVELOPMENT OF STANDARD REPAIR PROCEDURES

If possible, the development of standard repair procedures should be performed prior to commencing with the rotor blade refurbishment process. Individual procedures for all of the common defects specified within the request for tender are required. This is an arduous task, and the required development of 10–20 procedures or more, is not uncommon for the full scale refurbishment process. However, as this generally set-up as a milestone event in the process, the contractor has the required encouragement to perform and complete this task.

Accordingly, standard repair procedures contain at least the following information:

1. Specific defect condition for which the standard repair procedure applies
2. Acceptance limits for the individual defects before repair is required
3. Materials to be utilized
4. Allowable ambient environmental conditions
5. Specific and detailed instructions for performing the repair
6. Reference to quality control check and hold points

STEP 4: QUALITY ASSURANCE

A quality system designed to ensure that all inspections, repairs, and documentation are being performed as per project expectations; and where available, defined policy, is required before beginning with the refurbishment project. Once the quality system is implemented, it must be clear that at every stage of the refurbishment process a quality control plan is present and being followed. Insufficient quality control will lead to variability in the refurbished rotor blades end quality, potentially leading to increased operating costs.

Periodic audits of this system should be considered as an integral part of the project due diligence.

STEP 5: PERFORMANCE OF STANDARD AND OUT OF SCOPE REPAIRS

All defects that have a standard repair procedure must be repaired following the prescribed procedure. This ensures repair and refurbished rotor blade final condition consistency. Any and all defects that are to be repaired according to a specific standard repair procedure that are not repaired as per the standard repair procedure should be recorded as a non-conformance.

Out-of-scope repairs are for defects that require repair without a standard repair procedure. The sub-process for developing, approving, and performance of out of scope repairs must be decided prior to commencing with repair portion of the refurbishment process. As these repairs represent a cost increase to the fixed rotor blade set refurbishment cost, the scope of the repair must be clearly defined so that cost and quality assurance can be tracked and maintained.

STEP 6: DOCUMENTATION

As part of the delivery package for each rotor blade set, the following documentation, at minimum, should be requested and provided:

1. Interior and exterior inspection findings and defect disposition
2. Repairs performed and procedures used
3. Rotor Blade Set Balancing
   a. Individual Rotor Blade Mass
      1. Inclusive of mass added and location added at to balance
   b. Centre of Gravity
   c. Individual Rotor Blade Static Moment

STEP 7: ROTOR BLADE SET MATCHING

Following the refurbishment of the rotor blades, the deviation between the individual rotor blade static moments is almost always above the allowable limit, necessitating the need for mass addition to balance the rotor blade set. Establishment of what this acceptance limit is should be performed prior to commencing with the refurbishment process. In all instances, if an OEM specified imbalance limit is available, it should be utilized. In the event no OEM specified limit is available, technical rationale for the acceptance limit to be utilized is required.

As part of the original rotor blade design, sealed compartment(s), which are accessible from the exterior of the blade, are bonded in the rotor blade to allow for the addition of mass in order to match the individual static moments within the rotor blade set. Unfortunately, the records for the mass added to

these compartments during original manufacture are not commonly available. Additionally, in many cases these compartment(s) have already been filled to max capacity. For this reason, as part of the refurbishment process, if not already defined, limits must be established for the allowable mass quantity addition and location(s) for balancing rotor blade sets. Uncontrolled mass addition to the rotor blade may lead to the development of non-design operating characteristics, affecting the safe operating condition of the turbine.

Although the rotor blades to be refurbished began as matched rotor blade sets, following refurbishment, all of these blades will not be able to be placed in their original matched sets, due to the mass addition limits defined above. For this reason, a minimum work in progress (WIP) of approximately 3 sets is recommended. With the increased number of blades in WIP, and the common practice of some wind turbine OEM's to have rotor blades manufactured from different rotor blade OEM's at the same wind farm, owners and operators must be diligent in ensuring that only like operating characteristic and aerodynamic profile rotor blades are matched and whenever possible, that rotor blades are matched in sets by manufacturer and mold.

STEP 8: RE-INSTALLATION ON TURBINE

Incoming inspection of the rotor blades prior to re-installation on the rotor hub is a due diligence check that is required. Transportation damage is commonly found, and should be repaired at this time, as the ease of access to the rotor blades and repair will provide long-term cost savings.

Additional due diligence checks such as testing of rotor mass imbalance and aerodynamic imbalance should be considered. Failing to perform these due diligence checks may lead to greater than design loading in the rotor blades and through the wind turbine drive train and structure.

STEP 9: DEVELOPMENT OF COMPREHENSIVE AND THOROUGH LONG TERM MAINTENANCE PLAN

Through the refurbishment process substantial costs will be incurred. In most cases, these costs could have been minimized through the development of a thorough and comprehensive long term maintenance and inspection program implemented during the original project commissioning. To avoid Einstein's definition of insanity and repeating the original process and expecting a different end result, it is imperative that a program be developed. If an in-house model is not already available, owners and operators are encouraged to work with the contractor(s) performing the refurbishment and other industry experts to develop a cost effective program that remains sufficiently comprehensive.

FIND THE RIGHT LIGHT

Combining the latest LED advances with other factors can provide optimal efficiency in cost, maintenance, and performance.

By Dr. John Peck

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WITH WIND POWER PRODUCTION SURGING to a new record last year and steady growth expected to continue, the need for reliable, effective, and community-friendly obstruction lighting has become a paramount concern for both the FAA and wind farm operators. LED technology has been used extensively in the wind power market for nearly a decade as a greener, more efficient, and reliable solution to FAA AC 70/7460-1K specified wind turbine obstruction lighting. New advances in longer-life, energy-efficient LED technology have made it the de facto standard for optimum performance, cost savings, and the lowest total cost of ownership.

But with new capacity on tap for construction over the next five years, and many existing wind farms due for an upgrade, operators need to know that all LED obstruction lights are not created equal. Variations in engineering design, reliability testing, product materials and even certification can mean the difference between a high-quality, long-lasting product and one that will require costly maintenance down the road.

Wind turbine beacons are unique compared to standard beacons in that each beacon light has its own internal Global Positioning System (GPS) unit and photocell. The individual wind turbines of the

farm are located at substantial distances from each other, so running control wires between beacons is not practical. The GPS units in each of the beacons receive a clock signal from the orbiting satellites. The beacons use this clock signal to set the timing of their flash sequences. All beacons flash synchronously throughout the wind farm because they all use the same satellite clock signal.

The photocells in each of the beacons measure the ambient light level in order to transition the lights on and off for the day. It is important that the beacons transition on and off at about the same time each day, so a high-accuracy photocell that is stable throughout its life is important. Avoid the standard, and problematic, photoresist-type photocells and opt for a photocell that utilizes a communication-grade silicon photodiode for maximum accuracy and long life.

If you're thinking of an upgrade or need lighting for a new installation, here are the top ten questions you should ask any prospective LED lighting supplier to ensure you get the best product at the best value to deliver the longest life and highest return on your investment.

1. **Does the product carry the required federal and local certifications?**
   This seems like an obvious first step, but surprisingly, there are suppliers that actually sell non-certified obstruction lighting into the wind market. In short: buyer beware. In North America, the FAA, Transport Canada, and DGAC in Mexico all have established standards that obstruction lighting must meet. In many ways, this certification provides both quality and compliance assurance—a sort of "Good Housekeeping Seal of Approval." To reduce your risk in quality, reliability and compliance, purchase only LED systems that carry the required certifications. In fact, for operators with presence in multiple countries, it's wise to choose a supplier with products that meet ALL certification requirements, to streamline supply chain and provide installation flexibility.

2. **How well does the product perform in extreme environments?**
   Turbines are installed in some of the toughest conditions on earth—blistering heat, deep-freezing temperatures, and brutal winds can take a major toll on an obstruction lighting system. To ensure maximum reliability, be sure the product you choose is rated for performance in extreme temperature ranges. The FAA standard requires third-party performance testing at a range of -40°C/F to +55°C (131°F), and reputable suppliers will provide their temperature performance testing results.

3. **Does the product have battery backup capability?**
   Global certifications normally require 12-16 hours of battery backup capability on obstruction lighting to ensure failsafe operation in the event of a primary power outage. Look for a turnkey solution that either integrates, or is compatible with, standard battery backup systems to reduce your risk of unexpected failure, aviation safety concerns and noncompliance fines.

4. **How does the product design maximize the life of the LEDs?**
   LEDs offer superior long life performance compared to conventional incandescent and

Xenon lighting, but not all LEDs offer the same lifetime. To operate at their best, LEDs require two key design considerations: thermal management and optimal drive current. LEDs produce a fair amount of heat, and dissipating this heat efficiently is a must in order to protect the fixture components and circuitry from damage. Poor thermal management within the fixture will negatively impact the performance of the system, no matter how robust the LEDs may be.

Similarly, drive current is a major concern. In order to achieve the specified light output, some manufacturers over drive the LEDs (often using off-the-shelf power supplies not intended for demanding obstruction lighting applications), which takes a toll on the components, produces excessive heat and contributes to premature failure. To maximize your LED obstruction system investment, look for a manufacturer that incorporates state-of-the-art thermal management technology and custom-designed power supplies specifically tailored for the challenging demands of obstruction lighting.

5. Do the LEDs come from a reputable supplier?
While there are many components in each LED flash head design, the actual LEDs are the system linchpin when it comes to maximum performance. It's wise to purchase a system from a company that specializes in LED design and manufacturing with a long history in the LED industry. Working with a supplier that has been at the forefront of innovation, industry firsts and achieving FAA certifications for their products will ensure the investment you make will result in a quality product that delivers on the long-life performance and durability benefits of LED technology.

LED obstruction technology has seen rapid evolution over the last decade. The first FAA certified L-864 (red strobe) system became available in 2001, with the L-865 white strobe following 10 years later. Last year, the first dual high-intensity white/red L-856/L-864 strobe achieved FAA certification per AC 70/7460-1K specifications. Like most technological evolutions, each new generation of LED fixture has emerged smaller, lighter, more efficient, and longer lasting—with most products now carrying a five-year industry-standard warranty. However, it's important to note that manufacturing processes often differ. Some suppliers are merely assemblers, putting off-the-shelf components together to build a fixture. More advanced suppliers custom-build the fixtures, including other critical components

such as those used in the power supply, giving these manufacturers much greater control over the system to optimize the design for maximum performance under the harsh conditions seen on wind turbines.

6. Is the product energy efficient?

As sustainable energy advocates, wind energy producers strive to "practice what they preach," implementing green operating practices wherever possible. It's no doubt that LEDs provide the greenest lighting solution for this green energy industry. Consuming as little as 4W on average, the most advanced LED beacons only sip electricity to minimize energy cost and the associated CO2 emissions. This not only reduces operating cost for overall bottom-line savings, but also amply satisfies sustainable practice initiatives for any wind operator. However, energy consumption among LED suppliers can vary. Look for the lowest-wattage lighting systems to minimize energy usage and maximize your savings.

7. Does the product offer adequate surge and lightning protection?

By their nature, wind turbines are highly susceptible to lightning strikes and other electrical discharges — and while the intense voltage levels that occur during strikes far surpasses the FAA's requirements for surge protection, the lighting system should be able to handle all types of electrical surges. Reputable suppliers will not only satisfy the FAA standards with a certified product, but can also produce test reports to show their products' resilience to lighting, including indirect and direct hits. Again, ask for the reports—a supplier with the credentials will be happy to provide them to you.

8. Is the flash head dome made from high-impact, UV-resistant material?

Many suppliers use acrylic material to enclose the flash head. Acrylic is susceptible to cracking from impact during installation or maintenance and hail or "shedding" of snow/ice off the rotor blades. Choose a supplier that uses high-impact UV-resistant polycarbonate material on the dome. This offers a higher IK (impact strength) rating and is more resistant to the adverse effects of UV rays. Use a lighting supplier that can apply an additional specialized "hard coat" to the dome to maximize UV protection, scratch resistance, and protection from chemical attack. This will provide about 10 years of protection out in the elements. Without this hard coating, the lens will show degradation after just a few years. It's also wise to make sure the product carries a minimum IP66 rating for water ingress protection, which is part of the FAA standard.

9. How well does the lighting system control light pollution?

The FAA specifies the minimum and maximum light intensity at zero degrees, i.e., along the horizon, for red beacons. These standards ensure

beacon lights provide the proper lighting needed to alert aircraft pilots of obstructions in their flight path. However, the FAA does not specify any limits on the maximum light intensity requirements below the horizon for red beacons since this does not affect aviation safety. But, at the end of the day, complaints about disturbing flashing lights at night will go to the tower owner, not the FAA. As a result, it behooves the tower owner to evaluate the proximity of local residents to determine if light pollution may be an issue. Therefore, preventing neighbors from filing these complaints is the responsibility of the individual purchasing the obstruction lighting system. As such, it is a good idea to request light intensity distribution charts from the obstruction lighting supplier. Many suppliers will claim "community friendly" optics but some products emit more than 10 times more light pollution compared to the best products in the market.

10. Does the product have a smooth outer lens?

This might seem superficial at first (who cares what the lens looks like, right?). But, it's actually a critical factor in the durability of the flash head. Products that incorporate optic features on the outside of the dome to direct the light, such as sharp edges and contoured shapes of Fresnel lens features, are susceptible to snow/ice buildup and accumulation of dirt and debris. On the other hand, suppliers that use internal optics design can enclose their flash head with a smooth dome that is not prone to these harsh conditions.

FUTURE LED ROAD MAP TO MEET WIND POWER NEEDS

Down the road, a number of new challenges are on the horizon for the wind energy market. As turbines grow taller, the combined tower and blade circumference are beginning to exceed FAA medium-intensity marking requirements, obligating operators to install high-intensity lighting systems. To reduce neighborhood intrusion and energy consumption, there is also a movement toward incorporating radar technology into turbine lighting systems that would trigger the signals to come on only when aircraft are in the immediate area. In addition, the FAA is now recommending visible marking for Meteorological Tower (MET) installations used ahead of wind turbine construction to determine ideal turbine placement. While the current parameters call for orange/white paint schemes, guy wire sleeves and marker balls, these all must be maintained and replaced, causing many operators to consider whether signal lighting might be a better option.

From a forward-looking perspective, the very nature of the LED systems design provides much more flexibility for innovation to meet these evolving needs and specifications. The combination of maintenance savings, energy efficiency and more precise optics and controller technology of LED obstruction lighting is already providing bottom-line savings and payback/ROI in as little as two years. Coupled with a customizable design that supports a road map for continued innovation, LED lighting is certain to remain the technology of choice for the wind energy market.

POWER TO THE PEOPLE

Securing grassroots support for wind requires a nimble approach to overcome the NIMBY mind-set.

By Matthew Segal

Matthew Segal is campaign manager at Calvert Street Group, a public affairs consulting firm specializing in state and local affairs, land use and development, and grassroots lobbying. He can be reached at msegal@calvertstreet.com.

IN EARLY 50 YEARS AGO, Bob Dylan sang that "you don't need a weatherman to know which way the wind blows." Dylan certainly wasn't referring to the wind energy industry in 2013, but his commentary is surprisingly applicable: Surrounding every wind turbine are political factors that cannot be measured by instrumentation alone.

The things that affect whether a wind project is sited—or not—require more than sound science and excellent engineering. Reaching a favorable outcome means understanding and thriving in the local political climate by mitigating threats and influencing key decision-makers.

Power projects are inherently political, and without identifying the pitfalls on the path to permitting, consolidating support, and neutralizing opposition, even the best-planned efforts may be left twisting in the wind. What follows is an in-depth look at how to properly navigate the obstacles on your landscape so that the permitting process may go according to plan.

GAUGE THE ATMOSPHERE

When it comes to a wind project, the landscape is more than just the local geography. It encompasses all of the facts on the ground, including the people

and their politics. No two sites are the same, so understanding the configuration of the surrounding community—and the why and where of potentially vociferous opposition—can prevent a project from slipping off the path to approval. Indeed, when projects fall through, it is often because preliminary steps were skipped or avoidable mistakes were made.

When it comes to wind developments, scientific assessments determine the project's internal viability. But the permitting process is not governed by science; rather, obtaining approval is more of an art. The path to success requires appropriate attention paid to external factors.

Investors in any business, whether a restaurant or shoe store, should expect a detailed market research study. That's because good market research is predictive: It provides backers with a reliable forecast by giving due consideration to the external factors that influence the project. While wind power doesn't operate like a retail outlet, understanding these external factors is just as valuable. This is why every wind project needs a political due diligence assessment.

GET A GOOD BAROMETER

A proper due diligence report answers critical questions that can determine a project's likelihood of a favorable outcome. First, it examines the procedural landscape. This includes a holistic evaluation of where the battles may be fought, be they at the regional level—planning commissions, economic development committees, and zoning boards, for example—or inside local bodies like county commissions and city councils. The assessment envisions scenarios at each level of approval, paying particular heed to procedural matters. What are the guidelines for public hearings and citizen input? How does a resolution make it to the agenda? How many readings does the motion require? How many votes are needed for it to pass?

While these boards and committees hold power as a collective, they are comprised of individuals. Determining who is for or against the turbine project is only the starting point. Who are the personalities that will decide on the legislation? What motivates them and where do their allegiances lie? When are the next elections? Is the swing vote a businessman or a bureaucrat, a political neophyte or veteran decision-maker? How does this official respond to public pressure and his constituents? To learn this make-or-break information, profiles of the lawmakers in question must be created, looking to previous votes and statements on similar issues to fully elucidate their tendencies on wind energy or renewable power.

Identifying stakeholders does not stop at the policy level. The other influencers in a community—the heads of social organizations, civic groups, and local businesses—should be mapped out and their motivations and goals clearly understood. This cadre of community-minded individuals will be essential for building support for wind—or, at the very least, knowing who to keep on the sidelines. Seeking these opinion leaders prior to the permitting process can allow a wind farm developer to have key allies in hand.

Doing the appropriate due diligence is about the proverbial "ounce of prevention"—it facilitates smarter investments. As plans go off-course, they rack up high incidental costs. Imagine the damage to a developer's bottom line stemming from unanticipated legal fees (for fending off community-based challenges), hiring experts, and even the need to make additional land acquisitions. Then multiply those expenses by the

months and years of delays as the unsettled issues stumble toward resolution. These difficult scenarios can often be avoided by simply structuring the project with the most favorable political circumstances in mind. A good political due diligence assessment can save a company untold time and money by identifying the most advantageous path to permitting.

THERE'S NO FLYING UNDER THE RADAR

Determining who is negatively affected by the project—and who is most likely to transform their disapproval into vocal opposition—is often a simple matter of geography. The wind farm's neighbors, whether they live in the shadow of the turbines or travel daily on impacted roads, are the most obvious source of hostility. They often form the core of the "Not In My Backyard" (or NIMBY) crowd that has rankled developers of projects big and small for years.

These citizens abutting the project need to be engaged from the beginning—even before feasibility is being studied—if possible. Knocking on doors in the neighborhood, listening to concerns, and identifying opponents and supporters is an important step as the permitting process begins to take shape. It may seem naive that by simply engaging residents early on, many of the potential land-mines can be defused safely—but in fact, experience shows this is the case. In-depth conversations with abutters also serve as an informal focus group, helping proponents can understand community dynamics and honing the pro-wind message accordingly. Determining which arguments—and which words—are most effective for communicating wind power's benefits is instrumental in educating the public.

Of course, not everything will be copacetic even after the most dedicated neighbor-to-neighbor outreach. Opposing groups may be campaigning to draw attention to their cause, utilizing a combination of fliers, blog posts, letters to the editor, public meetings, rallies, and demonstrations. To address these community concerns, wind developers are known for holding town hall-style meetings in a single, centralized forum. While this approach can be well received, it opens up the possibility of a wind project's worst nightmare—the angry mob.

A more effective approach may be a "community walk-through," an open house-style event with small stations for engineers, developers, local officials and company employees. At a walk-through, each group of stakeholders can discuss the wind project with ordinary residents and local press. Community members will feel listened to—and the threat of a public spectacle is significantly reduced.

Meanwhile, skeptical or antagonistic public officials will have their own pulpit. It is easy for local politicians to throw in their lot with the opposition crowd; when they see an angry group of constituents, they understand the threat to re-election. More than that, however, ambitious political leaders see an emotional base of voters and seek to capitalize on their energy for the next election (and beyond). The question is, then: Who is willing to speak in favor of the wind project? Who is willing to lead the pro side and explain the benefits? Who is willing to create political cover so elected officials can support economic development and feel secure in their jobs?

This is where the dividends paid from the political due diligence assessment will be most visible. While opponents and decision-makers will be in plain view, finding a local leader to carry the torch for the project is a painstaking but important portion of the process. Often, it starts with looking at a map of the affected area and knocking on doors in the neighborhood. The invaluable nature of face-to-face interaction creates an immediate bond, and provides a launching point for developing supporters into flag-carrying leaders. This is an underrated aspect of siting a project from the grassroots: cultivating proponents early and empowering them to organize and lead.

CAUSE FORCES TO SHIFT

With a group of local proponents leading the way, the critical weeks and months leading up to 'the big vote' should be fought like a political campaign. Those managing the campaign must help their citizen leaders educate on the issue and make a lot of noise in the process. Just like a race between two candidates, local issues—like job creation, future tax revenue, funding for schools, or infrastructure improvements—must play prominent roles.

Informing and persuading should follow the tactics of a targeted media offensive. Focusing on the key players, this stage entails spreading hyper-local pro-wind messages through meetings with editorial boards, columnists, community activists, and representatives from business and trade organizations. Mobilizing pro-wind citizens and redoubling their grassroots efforts—canvassing neighborhoods on foot and by telephone—is essential.

Advertising via mail, print and broadcast media can be enormously effective at drawing attention to the campaign's messages and should be utilized as appropriate. A site-fight also relies heavily on person-to-person communication; use of social media platforms like Facebook and Twitter, as well as blogs and YouTube videos are all vital for demonstrating broad citizen support. Similarly, a good website acts as a clearinghouse for proponents, media and information-seekers alike.

INCREASE THE PRESSURE

Where the political campaign analogy diverges from an election for mayor, for example, is that ordinary citizens do not decide—and the ballot is not secret. Instead, the people that stand between a wind investor and project approval are a small group of local officials.

Their vote will forever be part of the public record. Many local decision-makers understand the benefits of inviting wind energy into their community, but are faced with the pressures of elected office.

Imagine a throng of irate NIMBYs showing up to a county commission meeting, with no one there to voice support for the project. The commissioners might reasonably fear what a 'yes' vote could mean for their political careers. This is why a strong pro-wind citizen group is so critical—they provide decision-makers with the reassurance and political cover to permit the project.

Every community has its pressure points. If its schools are dealing with budget cuts, tax revenues from wind power generation can plug that hole. If area infrastructure is deteriorating, permitting wind turbines can provide the catalyst to fund improved roads and bridges. If crop yields are low, or families' farms are in trouble, leases can help farmers stay afloat. If police officers and firefighters are facing layoffs, a municipal host agreement could keep those essential services properly funded. Understanding these sensitive issues—and communicating to citizens and public officials how wind energy can solve them—is essential in shaping the outcome. No political leader would like to be known as the person who voted against restoring school budgets or keeping local farms in business.

Even at the smallest scale, the benefits of wind farms must be visible. If a little league team needs uniforms or a river needs a clean-up, donations and a civic-minded approach will help local officials and residents understand the value of siting wind in their community. The challenge is in identifying these community priorities and educating residents on their importance to the area's ongoing debate about wind farms.

CONCLUSION—ALWAYS HAVE THE WIND AT YOUR BACK

For many wind developers, it's a terrifying thought: The difference between a project that receives approval and one that withers away can have nothing to do with investors, engineering, or environmental impact. Instead, the gatekeepers are a small group of people—sometimes well-versed in wind power, sometimes not—who need a reason to issue a permit. It starts with planning and assessment, then the painstaking work of coalition building, followed by strategic communication and public education. Properly executed, the project can sail through, applying pressure to ambivalent decision-makers and giving political cover to those officials who need it.

In other words—and with sincerest apologies to Bob Dylan—wind developers in 2013 must understand that you can't solely use a met tower to know which way the wind blows.

Slatercom Offers FAA-certified D1RW Obstruction Lighting System

Slatercom-WCD, located in Salem, Oregon, has announced the availability of the industry-standard Dialight D1RW Series- LED Medium Intensity FAA certified obstruction lighting system, designed to utilize existing xenon flash head cables. Existing xenon medium intensity lighting systems typically use either a five- or six-conductor flash head cable and are noted for being quite troublesome and expensive to repair. The new Dialight LED lighting system comes ready to install without changing the existing flash head cable thus saving considerable time replacing flash head cable. Systems are in stock for immediate delivery. The complete system is covered by a five-year warranty.

FAA rules require all obstruction lighting systems to be monitored and logged daily—either visually or electronically. Slatercom lighting systems are typically provided with alarm monitoring capability that can be connected into remote monitoring equipment. In remote locations such as wind farms, visually monitoring and logging of obstructions (as required by the FAA) is not convenient or even practical. Slatercom-WCD offers several options for monitoring including the Slatercom Cellular Alert System, RMS Live Monitoring, WEB600 IP based monitoring system and the SAT4 satellite based system. These systems can provide cell phone, text or e-mail notification of lighting system problems and prevent heavy FAA fines for non-compliance. In addition, an automatic log of lighting system status done a daily basis can be downloaded to comply with FAA rules. These logs are typically kept on the server for at least one year.

Most wind farm met towers are installed prior to construction of the wind farm to facilitate data collection for wind farm design. These sites typically are located in areas that lack commercial power. Slatercom offers extremely efficient (less than 100 watts/ day) FAA "A" series lighting systems for these applications. The Slatercom Solar Harvester solar system utilized in these systems provide the seven-day autonomy as required by the FAA for solar powered systems. The solar systems are engineered site specific, guaranteeing a properly-sized system for the installation location.

Interior wind turbine lighting is often provided by the manufacturer using florescent or incandescent lighting fixtures. Slatercom is one of the largest Dialight LED "White Lighting" distributor. Slatercom stocks a large selection of linear (florescent replacement) fixtures, down lights, wall packs and many versions of high bay lighting fixtures. These long life, energy efficient fixtures can provide decades of trouble free performance.

For more information, visit www.slatercom.com, call 503-581-5550 or e-mail info@slatercom.com.

Companies wishing to submit materials for inclusion in this section should contact Stephen Sisk at editor@windsystemsmag.com. Releases accompanied by color images will be given first consideration.

Keen Tucson Brings Protection, Functionality to Jobsites This Fall

Founded on the idea of creating multi-purpose hybrid footwear that combines form and function, KEEN understands that life extends from work to play and everywhere in between. The KEEN Utility line was a natural extension of that idea, bringing versatile and progressive work footwear that stands on its own to men and women everywhere.

This fall, KEEN Utility takes this idea of hybrid footwear to the next level with the introduction of the Tucson. The outdoor-inspired silhouette is reminiscent of a much-loved hiking boot while blending all the innovative work boot performance features KEEN Utility has developed and incorporated into the entire collection.

"Each season we strive to innovate both within our product line as well as the industrial footwear industry," said Mark Reilly, Division Director for KEEN Utility. "The love for outdoor adventure and active lifestyles runs deep in the KEEN DNA. The Tucson allows us to blend that outdoor look and comfort with the functionality of top-notch protective footwear."

Hitting select retailers this month, the KEEN Utility Tucson work boot features an outdoor-inspired silhouette with all the technical features required for a hard day on the job site. Crafted with a waterproof, nubuck leather upper the boot features a sleek, low profile midsole and open mesh inserts to increase air circulation. A KEEN.Dry waterproof, breathable membrane lets moisture out but never in and a hydrophobic/hydropholic two-zone comfort technology lining helps to keep feet cool and dry.

The Tucson features KEEN Utility's signature asymmetrical steel toes that are contoured to the natural shape of the left and right foot, providing ASTM-rated protection with a roomy toe box for maximum comfort without sacrificing safety. The oil- and slip-resistant non-marking rubber outsole exceeds ASTM Mark II non-slip testing standards, proving the Tucson is one boot ready for whatever the workday puts in its path. Available in mid and low heights with steel and soft toes.

For more information, or to find a KEEN Utility retailer near you, visit www.keenfootwear.com.

Sandvik Introduces CoroMill Plura End Mill Tool for Composites Manufacturing

The CoroMill® Plura compression end mill for composites from Sandvik Coromant targets manufacturers machining carbon-fiber reinforced polymers (CFRP). Unlike conventional end milling cutters, the CoroMill Plura tool combines positive and negative helix design to "compress" the top and bottom of the component edge. This minimizes any potential for delamination, a common defect when machining CFRP and several other types of engineering composites using higher helix cutters.

The new Plura end mill has been designed for edge milling applications on workpieces with a minimum thickness of 6mm. It features optimized micro geometry that offers six effective cutting edges for achieving a surface finish (Ra) of well below 0.0001 in. (4 µm), in combination with high material removal rates. Users should keep the split-line in the middle of the material for best results. It is also important to remember that when the tool cuts fibers going against the grain on the top or bottom surface there is potential for more splintering than when the tool cuts along the fiber direction.

Conventional up-milling strategies are recommended as these typically deliver less vibration. Among the cutting data users can expect to see is cutting speeds of 656-1,312 ft./min. (200-400 m/min), and feed rates of 0.001-0.002 in./tooth (0.03-0.06 mm/tooth) for roughing or 0.008-0.0015 in./tooth (0.02–0.04 mm/tooth) for finishing.

The CoroMill® Plura compression end mill for composites makes use of GC1630 grade for extended life, and comes in diameters ranging from 0.24-0.63 in. (6.0-16.0 mm), and lengths (total) from 2.99-3.94 in. (76 to 100 mm).

For more information, visit www.sandvik.coromant.com.

STAUFF Introduces PPC-04-plus Compact Mobile Hydraulic Tester

STAUFF introduces the PPC-04-plus, the latest generation of hand-held hydraulic testers. The STAUFF PPC-04-plus features robust construction and an oil-resistant rubber coating to withstand impacts, vibration, dust and moisture (protection class up to IP67) and is designed for use in particularly harsh conditions. This compact mobile tester measures pressure, temperature, flow rate, frequency and speed in mobile and industrial hydraulic systems.

The STAUFF PPC-04-plus is available with either two analog sensor inputs or a CAN interface (PPC-04-plus-CAN) for connecting up to three digital sensors.

Even in low-light situations, measured values can still be read quickly and reliably from the multi-line, backlit LCD graphic display.

Using the USB port and the included software, measurement values can be easily read and transferred to the PC, where they can be displayed, analyzed and further processed.

The STAUFF PPC-04-plus joins the family of portable hydraulic testers, which includes the larger STAUFF PPC-Pad, which features a large-format (3.5" x 4.5") LCD screen and up to six analog inputs, and the smaller PPC-06/08-plus series, which features a digital readout LCD screen.

For complete product information, e-mail diagtronics@stauffusa.com, or call 201-444-7800.

TWR Lighting Offers "All-In-One" Obstruction Lighting Solution

TWR Lighting, Inc./Orga Aviation offers the L450 LED "All-In-One Solution" The new L450 product range of red and red/white, medium intensity LED obstacle lights incorporate the most advanced optical engineering design and LED technology enabling the development of the most cost effective solutions for the medium intensity obstruction light market. The new L450 products are focused on minimizing the visual impact that obstacle lights can have on the surrounding environment, while at the same time further reducing power consumption. The L450's "All-In-One Solution" concept, follows the designs successfully adopted over the past 10 years in the L350 product with the light having a built in power module, controller and GPS synchronizer.

Also available is the L450 RED LED/Infrared LED "All-In-One Solution". This new L450-864-IR-G product incorporates both red led and infrared led technology into a single medium intensity obstacle light. Using the most advanced optical engineering design for both an FAA L864 LED and Infrared LED technology enables this fixture to provide the most reliable nighttime marking of structures where military and civilian aviation night vision goggle (NVG) technology is required.

In addition to LED lighting for Wind Turbines TWR Lighting, Inc. offers a complete line of LED lighting systems including the LEDBEACON3 24VDC Beacon and PV solar power systems for use on meteorological towers 60-100 meters in height. These systems were designed specifically for remote solar applications and offer the lowest power consumption thus minimizing both the capital costs and cost of ownership.

In 2001 TWR Lighting Inc. partnered with Orga Aviation and introduced the first lighting systems to the U.S. designed specifically for the wind turbine market. The company has manufactured and distributed FAA/ICAO-approved obstruction lighting since 1981, and operates out of a recently expanded 50,000-plus sq.-ft. headquarters in Houston, Texas.

For more information, visit www.twrlighting.com.

Capital Safety Adds PROTECTA PRO Welder's Harness and Extends Sealed-Blok SRL Offering

Capital Safety, home of the DBI-SALA® and PROTECTA® brands of fall protection equipment, recently expanded its already successful product lines—the PROTECTA® PRO™ Welder's Harness, and the DBI-SALA® Sealed-Bok™ SRL.

The PROTECTA® PRO™ Welders Harness is uniquely engineered to endure harsh welding environments. Featuring Modacrylic over Kevlar and Polyester webbing that is both heat resistant and flame retardant, the Welders Harness resists heat bursts and weld splatter. Specifically, the webbing can withstand char temperatures up to 700 degrees Fahrenheit, absorbing heat and lasting longer than the standard harness. With a lightweight design that dramatically improves comfort and a 420-pound user capacity, the Welders Harness is an affordable, economical option for workers who weld at height.

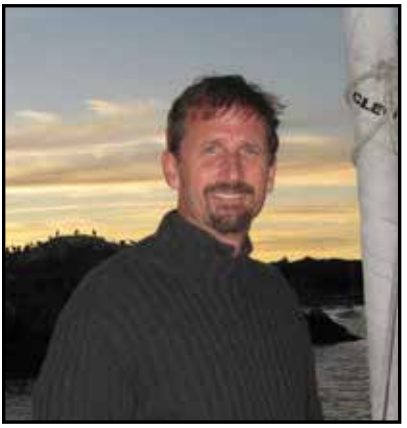
The DBI-SALA® Sealed-Blok™ family recently expended its product offering with the addition of a 175-foot SRL. The Sealed-Blok™ series now includes SRLs ranging from 15 feet to 175 feet. Featuring heavy-duty, durable aluminum housing and stainless steel end-plates, the 175-foot Sealed-Blok™ SRL delivers superior sealed performance, resisting water, contaminants and even corrosion. Dynamic components are safely sealed inside the IP68-rated housing, making this SRL ideal for the toughest working environments, including offshore platform access in the oil and gas and wind energy industries. With a built-in carrying handle, certified as a secondary anchor point, the Sealed-Blok™ SRL is certified for "dropped objects" protection.

Both products comply with current OSHA and ANSI industry standards.

For more information, visit www.capitalsafety.com, or call 800-328-6146.

ADINDEX

Jeff Mack
Vice President of Post-Sale Customer Support, Northern Reliability Inc.



TELL US A LITTLE ABOUT YOURSELF AND YOUR RESPONSIBILITIES AT NORTHERN RELIABILITY.

I am an entrepreneur who loves ideas and possibilities. I founded Northern Reliability in 2007, and just recently stepped down as the company's president and CEO. After leading the company for more than five years, I realized that it was time to bring someone in with more experience building a company in the growth stage we're currently in. I have remained in my role as chairman of the Board of Directors, so I am still involved in setting the strategic direction of the company. In my day-to-day role, I am VP of post-sale customer support—which really means I'm an expediter who helps customers, vendors, and our team with whatever needs arise once our systems are in place. This includes field service, training, warranty issues, and fulfilling new needs, among other things.

COULD YOU GIVE US SOME INFORMATION ABOUT THE GENESIS OF THE COMPANY AND ITS HISTORY?

Northern Reliability is an off-shoot of Northern Power Systems—a pioneer in the wind and remote power industry. In 2007, Northern Power Systems made the business decision to move out of the remote power system business, and focus exclusively on wind turbine manufacturing. I worked for Northern Power at the time in the warranty and post-sale support department and saw a great opportunity to start a new company focused on servicing the Northern Power legacy customers needing support for their remote power systems. I founded Northern Reliability in 2007, focusing mainly on spare parts procurement for large legacy contracts. In time, it became evident that customers were looking for engineering support and a new source for high-quality, low-maintenance remote power systems, which lead us to make the natural transition into the design and manufacture of power systems.

CAN YOU GIVE OUR READERS A GENERAL DESCRIPTION OF YOUR PRODUCTS AND SERVICES PORTFOLIO?

Northern Reliability designs and builds electric power systems for use in off-grid locations around the world. Our systems incorporate solar, generators, and other energy production technologies (wind, fuel cell, thermal) with batteries and state of the art controls, enabling our customers to produce their own highly reliable, continuous, low-maintenance source of power, wherever they need it. Our Solar Obstruction Lighting Systems (SOLS Series) are used in the wind industry on MET towers, and our Solar Power Systems (SPS Series) are used to power LIDAR and SODAR systems in remote areas. We also offer Battery Energy Storage Systems (BESS) to provide energy storage for net metered renewable power systems and back-up power for businesses to keep the power on for critical loads during times of disaster or when the utility grid is down.

Northern Reliability also provides a full slate of engineering and field services, both for new systems and system already deployed in the field (including feasibility studies; system engineering; equipment and parts procurement; installation, commissioning, and testing; owner and end-user training; remote monitoring and control; and maintenance, auditing, and upgrades).

HOW LONG HAS NORTHERN RELIABILITY BEEN ACTIVE IN THE WIND ENERGY INDUSTRY?

As an off-shoot of Northern Power Systems, Northern Reliability's roots fall squarely in the wind industry. Our professionals have worked on wind turbine design, production, and installation for decades. We continue to incorporate wind into our remote power systems, where the situation warrants it, and partnering with wind companies to provide the balance of system for their turbines.

WHAT IS IT THAT MAKES NORTHERN RELIABILITY AND ITS PRODUCTS AND SERVICES UNIQUE?

Time-tested reliability is the cornerstone of our business. Our engineers are experts at designing rugged, low-maintenance systems that perform in harsh environments, often unmanned for months at a time. The key to this reliability is our expertise in battery energy storage, and in our system controls which optimize energy production and storage, and protecting the system components through environmental controls.

For the complete Q&A with Jeff Mack, visit windsystemsmag.com.

For more information about Northern Reliability Inc., call 802-496-2955, or visit their newly re-designed website at northernreliability.com

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– Company profiles and Q&As
– Connect to the wind industry through social media
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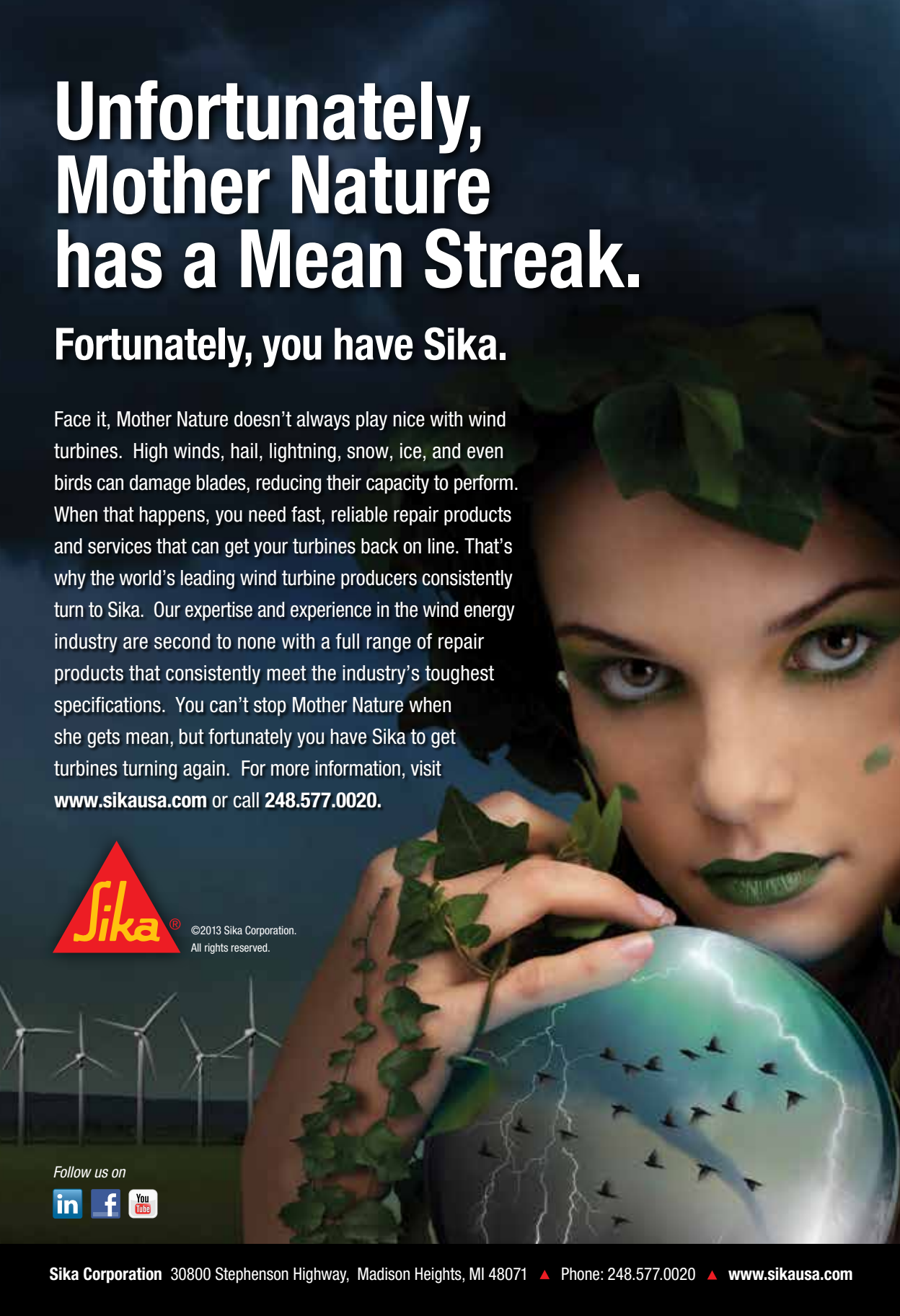
Unfortunately,
Mother Nature
has a Mean Streak.
Fortunately, you have Sika.
Face it, Mother Nature doesn't always play nice with wind turbines. High winds, hail, lightning, snow, ice, and even birds can damage blades, reducing their capacity to perform. When that happens, you need fast, reliable repair products and services that can get your turbines back on line. That's why the world's leading wind turbine producers consistently turn to Sika. Our expertise and experience in the wind energy industry are second to none with a full range of repair products that consistently meet the industry's toughest specifications. You can't stop Mother Nature when she gets mean, but fortunately you have Sika to get turbines turning again. For more information, visit www.sikausa.com or call 248.577.0020.
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