PRE-WINDPOWER SHOW ISSUE

WIND SYSTEMS

WIND FARMS AND CRANES: A LONG-TERM RELATIONSHIP

- Build It, Bond It, Fix It
- Minimizing Electrical Hazards
- Making Wind Even More Cost Competitive
- Standard-Essential Patents and the Wind Industry

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Baron USA, Inc.

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Signal Energy Constructors

Maintenance
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Technology
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MARCH 2013

WIND SYSTEMS MAGAZINE
WIND FARMS AND CRANES: A LONG-TERM RELATIONSHIP
MARCH 2013

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EDLETTER

Here at *Wind Systems*, we are constantly looking for ways to better serve our readers. Just recently, we reached out to our readership to provide us with some guidance in our inaugural *Wind Systems* magazine Reader Survey. While final results of the survey were not available at the time of this writing, early submissions have provided us with some interesting (and at times flattering) feedback.

While this data is incomplete, we've got a pretty decent sample. I'd like to share a few highlights. Of those who responded to our survey:

- 64 percent pass along their copy of the magazine to at least one other reader.
- 66 percent rate the quality of our editorial content as higher than other wind energy industry publications.
- 91 percent have recommended our publication to a peer. Nearly 39 percent do so on a regular basis.
- Almost all (98 percent) rated our editorial content as reliable. Nearly a third selected the "very reliable" response.
- Research and Development and Manufacturing led among the most useful editorial topics, followed by Wind Analysis/Forecasting, Construction, and Gearbox/Drivetrain components.
- Most use industry associations as their primary source of wind energy industry information. *Wind Systems* magazine followed — by a margin of more than 2:1 over other wind energy industry publications.
- 85 percent view the wind energy industry in 2013 with some degree of optimism. Less than 2 percent selected "not optimistic."

At the risk of shameless self-promotion, I'd like to address a few of these topics.

First, I would encourage you to continue to recommend our publication to your peers and colleagues. You've indicated that we've earned this honor, and we're grateful. Encourage your coworkers and friends to take a few moments and fill out our subscription card or log on to our website and click "subscribe." The subscription is offered as a no-cost service to our readers, supported by the people with whom you and your employers do business.

Overall, you appeared to be satisfied with the quality and reliability of the editorial content that we make available to you. Without giving up too many trade secrets, I'll let you in on this process a bit. Our staff annually sets an editorial budget, assigning as many as three general topics for publication each month. Our editorial team then reaches out to industry contacts who operate specifically in the monthly topic areas to submit articles that provide you with comprehensive, detailed information that is directly applicable to the industry. We try hard not to duplicate information, and even harder to keep the commercial aspects and bias out of these articles. If articles don't meet those standards, we don't print them. This may not be a great way to make friends, but then again, our obligation isn't to our friends. It's to our readers.

On that note, it has been interesting to learn which topics are of highest importance to you. Research and Development tops the list. And I'd be lying if I said we weren't under-serving our readers on this topic. I feel the same way about Wind Analysis and Forecasting. I'm going to make sure we do a better job of this in the future. We also learned about some topics where our readers think we're falling short. Two that come to mind are Project Development and Distributed Wind. Again, two topics that I personally find very interesting. We're taking steps to investigate these topics further, and already have some article ideas brewing.

In closing, I'd like to personally thank everyone who responded to our survey. It's often difficult to gauge the attitudes and needs of our readers without their input. We're grateful that you're engaged enough by our publication to share your honest opinions and help make it better. I urge you to keep that level of engagement going by liking us on Facebook at /windsystemsmag and following us on Twitter @wind_systems.

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EWEA 2013 HIGHLIGHTS

The EU wind energy sector installed 11.6GW of capacity in 2012, bringing the total wind power capacity to 105.6GW, according to the 2012 annual statistics launched by the European Wind Energy Association (EWEA).

The 11.6 GW installed in 2012 is higher than the 9.4 GW installed in 2011.

Wind energy represented 26 percent of all new EU power capacity installed last year, and investments of between EUR 12.8 billion and EUR 17.2 billion. It is now meeting 7 percent of Europe's electricity demand — up from 6.3 percent at the end of 2011.

Overall, the EU is almost 2GW (1.7 percent) under its National Renewable Energy Action Plan forecasts. 18 Member States are falling behind, including Slovakia, Greece, Czech Republic, Hungary, France, and Portugal.

Renewable energy represented 69 percent of all new power capacity in 2012, while in a continuing trend, fuel oil, coal, and nuclear capacity saw negative growth due to decommissioning.

Last year, wind energy installations were led by Germany (2.4GW, 21 percent of all new wind power capacity), the UK (1.9GW, 16 percent), Italy (1.3GW, 11 percent), Romania (0.9GW, 8 percent), and Poland (0.9GW, 8 percent). In terms of total installed capacity, Germany is also the leader with 31.3GW (30 percent), followed by Spain (22.8GW, 22 percent), the UK (8.4GW, 8 percent), Italy (8.1GW, 8 percent) and France (7.2GW, 7 percent).

In other news from the EWEA Annual Event, held February 4-7 in Vienna, Austria:

EU wind industry faces tough challenge —
The wind industry is being hit by the economic crisis and austerity across Europe, and a difficult situation should not be made worse by politicians undermining investor confidence, warned top industry figures in Vienna.

At the opening of EWEA 2013, politicians and high level industry representatives also spoke of the need to secure the further growth of wind energy in Europe after the current 2020 renewable energy target runs out, and of the disparity between fossil fuel and renewable energy subsidies.

EWEA President Arthouros Zervos criticized "sudden or retroactive changes to support schemes" and warned "the wind industry can be a driver for growth, for jobs and exports but not if government policies drive away investors."

He told the assembled industry leaders and Ministers that "The wind industry is suffering serious job losses, and will suffer more difficulties this year," and called for "binding renewable energy targets for 2030," as a way to create investor confidence.

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.

EU wind industry skills shortage: over 5,000 more workers needed per year —

The European wind industry faces a severe skills shortage of around 5,500 appropriately qualified staff per year. This shortfall could climb to 18,000 by 2030 — nearly 5 percent of the entire wind industry workforce — if numbers of suitable workers don't increase.

The warning comes in a report to be published by the EU's Wind Energy Technology Platform (TPWind), based on research by renewable energy consultancy GL Garrad Hassan.

"There is a real risk of a shortage of suitably skilled workers. Well over half of the shortfall in new workers in 2030 could be in operations and maintenance. Engineers are in desperately short supply and the problem will get far worse unless action is taken," said Andrew Garrad, Chairman of GL Garrad Hassan.

Wind energy's most prestigious prize goes to Professor Arthouros Zervos —

The Poul La Cour prize for outstanding contribution to wind energy has been awarded this year to Professor Arthouros Zervos. The award was presented to Professor Zervos by Klaus Rave, Vice President of EWEA. Speaking at the presentation of the award at the conference dinner of the EWEA 2013 Annual Event in Vienna, CEO of EWEA, Christian Kjaer said "It is hard to know where to begin to describe this year's winner's achievements. They are not limited to one area of work, or one organization. They span education, science, R&D, policy making, representation of the industry, and lobbying."

Professor Zervos has taught wind energy at the National Technical University of Athens since 1982 and was responsible for Wind Energy in EUREC's European Renewable Energy Master's Degree taught at Universities across Europe.

For more information, visit www.ewea.org.

U.S. WIND POWER BREAKS ANNUAL INSTALLATION RECORD

The U.S. wind energy industry had its strongest year ever in 2012, the American Wind Energy Association announced, installing a record 13,124MW of electric generating capacity, leveraging $25 billion in private investment, and achieving over 60,000MW of cumulative wind capacity.

The milestone of 60,000MW was reached just five months after AWEA announced last August that the U.S. industry had 50,000MW installed. Today's 60,007MW is enough clean, affordable, American wind power to power the equivalent of almost 15 million homes, or the number in Colorado, Iowa, Maryland, Michigan, Nevada, and Ohio combined.

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Shaw's Crab House
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Sound-Bar
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Navy Pier
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The Field Museum
1400 S. Lake Shore Dr.
(312) 922-9410

In this historic year of achievement, wind energy for the first time became the number one source of new U.S. electric generating capacity, providing some 42 percent of all new generating capacity; the final tally will be released in April in AWEA's annual report. In fact, 2012 was a strong year for all renewables, as together they accounted for over 55 percent of all new U.S. generating capacity.

Resulting from 190 projects across 32 states plus Puerto Rico, this new record for annual installations of over 13,000MW by the U.S. industry far surpasses the previous record of 10,000MW installed in 2010.

In last year's fourth quarter alone, 8,380MW were installed, making it the strongest quarter in U.S. wind power history. This was due in large part to impending expiration of the successful federal Production Tax Credit (PTC). It was slated to end on December 31, 2012, but was extended by Congress on January 1, 2013, as part of the "fiscal cliff package," the American Taxpayer Relief Act of 2012.

The global wind energy industry will gather in Chicago May 5-8 for the world's largest annual wind power event, WINDPOWER 2013. Thousands of workers and leaders from all sectors will attend to show their wares, attend conference sessions, and seek further solutions for success.

For more information, visit www.awea.org or www.windpowerexpo.org.

GE INTRODUCES 'THE WORLD'S MOST EFFICIENT HIGH-OUTPUT WIND TURBINE'

GE has announced the 2.5-120, the world's most efficient high-output and the first brilliant wind turbine. The 2.5-120 is the first wind turbine to bring together world-class efficiency and power output at low wind speed sites, capturing a 25 percent increase in efficiency and a 15 percent increase in power output compared to GE's current model.

The turbine's high efficiency and high output unlock higher returns for wind farm operators at low wind speed sites. The turbine's advanced controls enable its 120-meter rotor, resulting in increased energy capture and greater power output in low-wind areas. The taller tower, which has a maximum hub height of 139 meters, makes it ideal for heavily forested regions in places like Europe and Canada.

This advanced technology drives higher wind farm output than GE's current offerings, improves services productivity and, creates new revenue streams for customers.

Over the past year, GE has successfully demonstrated the integration of wind power and energy storage at its facility in California, delivering predictable power to the grid. The first prototype of the 2.5-120 will be installed in the Netherlands this month.

For more information, visit www.ge-energy.com

OFFSHORE WIND POWER TO GROW TENFOLD BY 2020

The global offshore wind power market, fuelled by the depletion of fossil fuel reserves, the declining cost of wind power generation and impressive investment from the UK, is expected to explode over the next decade, states research and consulting firm GlobalData.

The company's new report forecasts the global offshore wind power market to rocket from a 2012 cumulative installed capacity of 5.1GW in 2012 to a far greater 54.9GW by the end of the decade, growing at a Compound Annual Growth Rate (CAGR) of 34.5 percent.

The UK is a major player in the offshore wind power market thanks to its substantial financial commitment and ideal location, contributing more than half of the global installed capacity last year, with 2.7GW.

Offshore wind is expected to make a large impact upon the UK's 2020 renewable energy targets and a major expansion is planned. Correspondingly, GlobalData expects the country's offshore wind power installed capacity to hit 21GW by the end of 2020, increasing almost 800 percent from 2012.

NORDEX AWARDED SECOND MAJOR ORDER FROM URUGUAY

Nordex USA, Inc. concluded an agreement with Usinas y Trasmisiones Eléctricas (UTE), Uruguay's state power company, for the sale of 28 of its N117/2400 wind turbines for the Juan Pablo Terra wind farm. Nordex, a leading global manufacturer of utility scale wind turbines, will be responsible for delivery, installation and commissioning and for ongoing maintenance for a minimum of 10 years under a Premium Service Contract.

The site, on the border with Brazil, is located a few miles from the city of Artigas, in the north of Uruguay, about 370 miles (600 kilometers) from Montevideo, the capital city. This will be largest wind farm owned by UTE and represents the country's commitment to the growth of renewable energy. Delivery of turbines is slated to begin in February 2014 with project completion in June 2014.

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

RES AMERICAS COMPLETES PENNSYLVANIA WIND PROJECT

Renewable Energy Systems Americas, Inc. (RES Americas) is pleased to announce the completion of the 139.4MW Twin Ridges Wind Farm located in Somerset County, Pennsylvania. The project was completed in December of 2012 and is now operational.

RES Americas served as the Balance of Plant Contractor for the project, which was developed and is owned by EverPower. The Twin Ridges Wind Farm consists of 68 2.05MW REpower MM 92 turbines that will interconnect to PJM through the Potomac Edison affiliate of FirstEnergy Corporation. The project employed hundreds of workers during the construction phase and up to twelve operations and maintenance staff will be employed during operations.

For more information on RES Americas, please visit www.res-americas.com.

HERGUTH LABORATORIES, INC. JOINS THE SGS FAMILY

SGS is proud to announce the acquisition of Herguth Laboratories, Inc. Herguth Labs is the premier, high end, commercial, oil, grease, fuel and failure analysis laboratory in North America.

The acquisition of Herguth Labs with major testing laboratories located in San Francisco and Chicago introduces the SGS global network of 27 condition monitoring laboratories to the North American market with two more state of the art, 10,000 sq ft facilities, making SGS the world's largest independent testing company in the field of Oil Condition Monitoring.

The alliance between Herguth Labs and SGS will create synergies that will make it the leading Oil Condition Monitoring company in North America, offering both routine, highly automated analysis and equipment condition's diagnostics as well as non-routine consulting services such as lubrication programs audits, root cause and failure analysis. Their high level of service as well as high quality standards make it a good addition for the SGS Group, global leader in the area of quality, health, safety and environmental business practices.

For more information, visit www.herguth.com.

Julian Bell
Signal Energy Constructors

While often summarily discussed initially, planning for safety and quality are key to maximizing budget, schedule, and wind power production.

EVERYONE PAYS A LOT OF ATTENTION to the four major construction issues: safety, quality, schedule, and budget. Of these, safety and quality are typically the least discussed during the project award process. "Good" quality and safety on wind projects is closely related to "good" cost and schedule, and deserve far more attention. A safe job is completed in less overall time since there is less inefficiency caused by injuries. Similarly, a quality job is completed in less time since it requires less rework. It also has less warranty calls and more overall wind power production over time.

In its simplest form, safety is ensuring that no one gets injured on the job. OSHA establishes workplace rules and limits, but they are minimum standards and do not maximize safety in the workplace. Additionally, the construction industry tracks safety statistics (e.g. as the number of recordable injuries, the Experience Modification Ratio (EMR), the Total Recordable Injury Rate (TRIR), and the Days Away, Restricted, or Transferred (DART rate)) that can help assess a contractor's safety record compared to other contractors and the industry as a whole.

Safety statistics are important to track, but they are only a part of the evaluation of the effectiveness of a wind contractor's safety program. To understand a renewable energy contractor's safety program you need to understand the philosophy of the program. On wind projects, where there are numerous dangerous and life-threatening hazards (trenching, electrical work, crane and other heavy equipment work, etc.), it is helpful to look at the following factors of a safety program:

- Upper level management totally supports the safety program: Safety truly comes first, and profits later.
- All employees have "stop work" authority for safety issues.
- Hazards are identified up front through job hazard analyses and adequate training is provided.
- Safety is evaluated through constant "near miss" and incident investigating and analyses, using actual job data as a leading indicator of areas where additional focus may be needed.
- Safety is an integral part of the job plan (through inspections, safety planning, work permitting process, etc.): A work permit system authorizes work on a daily basis after potential hazards are identified and discussed.

A good quality program is also essential to a project's budget and schedule compliance. Most wind project designs require adherence to a wide range of engineering standards: IEEE, ANSI, UL, ASTM, ASCE, to name just a few. All of these standards are incorporated into the wind project design, and a good team will review these at the outset and determine what should be applied to the project in conjunction with the owner and engineer.

A quality wind project begins with the first request for proposals, long before the actual work starts. Quality is then carried to final completion and warranty with checks and audits throughout construction to ensure compliance. A good program treats quality like safety, and empowers all employees with "stop work" authority for quality issues. In addition, a good wind project quality program will have these attributes:

- Procedures for document and record control: Drawings and designs are properly tracked and controlled.
- Procedures for control of material/equipment purchasing, receiving and inspection: Material and equipment is inspected and documented.
- Extensive and specific procedures and guidelines for the performance and inspection of each aspect of the work, with specific substantive quality standards (e.g. checklists, etc.) that ensure that work has been performed in accordance with the design: The heart of the quality program is the specific measuring guidelines used to make sure work is completed according to the plans and within engineering standards.

This last item is particularly important. There is no uniform standard for "quality" in the wind construction industry. Good contractors have developed these standards on their own for each aspect of their work (road standards, concrete placement and rebar standards, trenching standards, electrical cable placement and termination standards, etc.) and can verify and document their quality on all projects.

Signal Energy's quality program contains QA/QC (Quality Assurance/Quality Control) "travelers" for each aspect of the work. These travelers require verification that hundreds of specific work tasks have been properly completed and measurements obtained. They are an integral part of a comprehensive quality management system that insures that the work is completed according to the design.

In addition to the checks, hold points, and audits, a good quality program for a wind construction project should allow the contractor to learn from its experience. Having a good feedback loop ensures that mistakes are not repeated and the overall operations get better as work continues.

Quality and safety are crucial in adhering to a wind project's schedule and budget. Spending time up front planning for these issues pays off in the end.

Julian Bell is the director of preconstruction for Signal Energy Constructors. For more information visit: www.signalenergy.com

Jack Wallace
Frontier Pro Services

Consider the multiple benefits of condition monitoring equipment before basing decisions on the judgement that such systems are just "too costly" — the savings will come.

SOME OF THE BIGGEST PUSH BACK on condition monitoring equipment (CME) comes from the financial groups in wind turbine organizations. Mainly because the equipment and subsequent services related to collecting the data is seen as too costly. They can see the cost of the CME as it is evident with the initial cost of purchase but the money/resources that CME saves is not so easy to see. I have one analogy for the people that spend their efforts with the finances of the company. Those involved with the finances work closely with financial related documents. They wouldn't make plans or run the business without the data that feeds balance sheets, income statements and production forecast. Spending countless hours reviewing this data allows them to make good, informed decisions concerning the finances of the company. The financial decisions are made based off of "Financial Condition Monitoring" data. Making decisions without this data would be extremely uncomfortable for them and "surprises" from doing so could be very expensive and disastrous. The maintenance team is not much different. They also need data to make smart decisions that can save the organization money. The data that would help the maintenance team is generated from vibration CME. This is "game changing" data.

Today's turbines have components that can be extremely expensive to replace or repair. One main concern is the gearbox and the individual components that make it work. If damage starts in one gearbox bearing and continues to run, the damage may progress and cause other components to become damaged. It may make sense to let the bearing damage continue because the repair may cost as much or more than taking the turbine out of service. But how would you know? Where do you get that data? There is a tool that will allow you to gain data to help you make informed decisions. That tool is vibration CME.

Those of you that know me have heard me explain this to you with an analogy I use about playing a game of cards. Running your turbines without CME is like playing a game of poker and not being able to see your cards. All your bets while playing are being made without being able to see your cards. You are playing cards without reviewing the data. The whole game is a gamble and every hand is a surprise. If you use condition monitoring on your wind turbine, it changes the game. It is like playing poker with all the cards facing up. There are no surprises because you see all the cards. You can't change the cards, but at least by seeing the data, there is no surprise. Using condition monitoring gives you a chance to see the cards all the time.

Having this data available can help you with your planning. You can know when a bearing starts to fail, a gear has a problem, and when secondary damage is starting to happen. Having this information allows you to plan your crane, pre-order parts, plan manpower, and time the repair for the lowest wind conditions. Condition monitoring may not stop all surprises but it does make your life easier by allowing you to see the cards you are dealt and plan your budget Having this information should be equally welcomed from the CEO to the wind technician. Surprise events on a wind farm are usually always in the wrong direction, result in less production, and are much more costly. Condition monitoring helps reduce the unplanned events.

There are other components to a condition monitoring system that are not frequently talked about. These other components include vibration data analysis, inspection, and scope of repair planning.

Once the equipment is installed the data generated needed to be reviewed. Ideally this is done by experienced vibration data analyst. Once a signal indicates an area of concern an experienced inspection team should be dispatched to document the actual problem. With this physical inspection a true scope of repair work can be planned out. Sometimes after analyzing the data the correct decision will be to run the item to failure. Inspecting the progression of damage is also important to tie the signal generated to actual machine condition for future failures. You can find the final signal level at which you should stop all machine operation.

If you are still not sure about condition monitoring, let me assure you that you already use it in one respect. If you have been in a car, you have experience with condition monitoring. Every time you ride in your car you feel the ride, hear the machine and see the instruments that feed you data. Even your children know something is not right if your car starts making funny noises. It is up to you as to what you do with that data.

My point is condition monitoring helps reduce cost and eliminate surprises.

Jack Wallace is Director of Wind Turbine Technical Services for Frontier Pro Services. He can be contacted at jwallace@frontierpro.com. For more information on Frontier Pro Services, visit www.frontierpro.com

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By Martin Schmidt-Bremer Jr.
WindGuard North America

Technical inspections of wind turbine generators — a necessity, not an option!

THREE PARAMETERS fundamentally influence the annual energy production of a wind turbine: average annual wind conditions; technical characteristics (power performance); and turbine availability. While influencing wind speed currently lies beyond human abilities, the optimization of the technical performance of a wind farm can be a successful task.

The technical availability of a wind turbine is very much dependent on the quality of its operations management. If the components of a turbine are in good condition, fewer failures and thus fewer standstills are guaranteed. To ensure that components stay in good condition while keeping costs at a reasonable level along with low standstill durations, repairs and maintenance at proper intervals are required. This is most effectively achieved by a condition-based maintenance strategy. This strategy relies on condition monitoring (CM) techniques by utilizing CM-systems for vibration analysis, but also on periodic technical inspections of machine components and rotor blades as well as on gearbox video endoscopy. This optimizes the performance and lifetime of components while curtailing repair costs.

Germany. Early 2000's. A growing number of wind farm operators approach their respective insurance carriers with increasing frequency. The reason: failures. Some common, many catastrophic. As the number of insurance claims and the associated cost rise, the insurance carriers are beginning to seek ways to reduce the staggering payouts. One large carrier then takes the essential step and approaches a consultant to craft what is now known as the "Principles for Condition-Based Maintenance of Wind Turbines". On September 21, 2007, they are adopted by the Expert Consulting Committee of the German Wind Energy Association (BWE e.V.). Today, nearly no insurance company in Germany underwrite a policy for a wind turbine that has not been inspected according to these principles by an independent inspection body and thus comes with the associated documentation.

Today, operators in Germany are looking at technical inspections not a necessary evil, but instead as a means of guarding their assets. The longer that wind turbines operate, the more revenue for the operator, and turbines should be able to run for 20 years and longer. Through the inspection body, the operator gains the ability to gain independent insight into his assets. Hence, German operators see inspections quite positively, simply because they know all the details about their wind farm. Disadvantages of having technical inspections done by an independent inspection body are truly negligible in the grand scheme of things. The two only things to consider are the additional cost to the operator/owner for inspections and down times during the inspection periods.

The advantages, however, clearly outweigh the disadvantages, especially over the long run:

1. Higher revenue due to higher technical availability of the assets
2. Repairs can be planned well in advance during times of low wind speeds and they do not occur randomly and, especially, unexpectedly
3. Improved asset condition awareness, leading to lower spare part inventory and lower costs
4. Assured safe operation of the assets by tracking that all required maintenance is done correctly and on time
5. Major maintenance can be scheduled early and during the low-wind season
6. Knowledge for operator/owner that their assets are technically sound and in compliance with all applicable federal and local safety requirements
7. Maintenance team performance evaluation tool, leading to improved team efficiency

Should operators hence adopt the principles outlined above? One could argue that something working for one does not necessarily work for another, but the general consensus at the AWEA Wind Project Operations, Maintenance & Reliability Seminar in La Jolla, CA, in January 2013 was clear. We cannot continue on the current path. So, as not to reinvent the wheel and to keep costs down, adopting the "Principles for Condition-Based Maintenance of Wind Turbines" seems more than the most effective way to do that. And, looking at the initial draft version of the "AWEA Operation and Maintenance Recommended Practices (O&M RPs)" developed by the AWEA Operation and Maintenance Working Group, this is exactly the path we will be taking in this country. Besides, who can argue that reliably operating wind farms are indispensable for the continued support for wind power? Continuously running WTs keep operating costs down, increase revenue and allow for affordable renewable energy to be provided to consumers.

The most important point to take away from this article is that periodic technical inspections by an independent inspection body represent the best way to guard assets, which directly translates into dollars and cents.

Martin Schmidt-Bremer Jr. is the chief operating officer for WindGuard North America. He can be reached at m.schmidt-bremer@windguard.com. For more information about WindGuard's portfolio of wind energy services, visit www.windguard.com.

Michael Graska
Vectora Transportation LLC

As the industry contracts and companies look to external sources, learning to work efficiently with Contract Logistics Service Providers may become essential.

THE PAST 12 MONTHS has brought great change to America's wind power industry. If I had to summarize it with one word, it would be "contraction." This affects every supplier within the wind supply chain. It may take years to get back to the a period of wind farm construction that matches its peak. So how does this affect developers, construction services, and equipment manufacturers concerning their logistics? They are going to be increasingly more reliant on outside providers of logistics services rather than using internal sources. I call these outside companies "Contract Logistics Service Providers" (CLSP). How you manage a CLSP will go a long way do determining your success going forward.

A CLSP can be described as a bundling of logistics services provided under contract to a manufacturer, retailer or wholesaler by an outside company. A capable CLSP can help companies compete more effectively by improving service, reducing costs and increasing efficiency. A CLSP can plan, implement, and control efficient, cost effective flow and storage of raw material, WIP, FGI and related information from point of origin to the point of consumption.

Successfully controlling a CSLP is dependent on the expectations and boundaries you set up for it.

CUSTOMER POLICIES

The CSLP is operating de facto as the company by providing logistics services to the consumer of the goods. The CSLP needs to know customer service expectations such as availability, demanded lead time, product mix , etc., to profile each line item. Also marketing and forecasting information is required. This profile will help in developing operating and labor hours.

INVENTORY POLICIES

Inventory policies such as amount, stock-out policies, and product mix, can be develop between the client and CLSP once the customer polices are determined. The objective here is to have the product availability expected by the consumer at the lowest possible inventory investment.

PROCUREMENT / OPERATION POLICIES

Supply policies can be developed to cover replenishment issues such issues as packaging, cross-docking, shipment consolidation, order fulfillment, paperless transactions, and stock put away schemes will likely be dealt with at this time. Also, contingency planning is developed during this analysis.

TRANSPORTATION POLICIES

Carriers are selected and contracts are negotiated based on customer, inventory and operation polices. This is the CLSP opportunity to create the customer policies of the carriers. Can carriers support the CLSP's information technology solution is a question that is dealt with in this segment. The cheapest rates may not be the lowest cost solution depending on overhead occurred. Other issues such as contingency planning, export/import issues, hazardous materials, and DOT regulations need to be considered.

DISTRIBUTION CENTER POLICIES

In most cases, a CLSP will need distribution centers. This segment develops policies based on customer, inventory, operation and transportation policies. Issues to be considered during this phase include warehouse location and layout, stocking methods, storage equipment, pick/pack/ship equipment, materials handling, security, return processing, safety, training, staffing and regulatory issues.

Although the sequence is important, proper project management can allow some of these actions to run concurrently. As the policies are being determined and documented, it is a good time to decide on what metrics to use. It is also critical to have marketing, operations, and information technology personnel involved in this process. This is just not a operations management project. Finally, this process allows a CLSP to develop solid contingency plans, before they are needed.

METRICS

Proper metrics are key to a successful operation. Too few measures do not allow the story to be fully told. Too many measures create paralysis through analysis. The proper metrics depend on each CLSP's needs. I would recommend that two metrics always be measured:

- Total Logistics Cost : TLC is a combination of inventory carrying costs, operations costs and transportation costs as compared to revenue. This metric allows for consistency during business cycles as well as comparison across industries.
- Perfect Order Performance: POP is a computation index of all the variables that make a perfect order, an order in which every facet is executed according to plan. What makes up POP is determined by the client and CLSP, but includes such items as inventory availability, order accuracy, shipment accuracy, delivery commitment, document and billing accuracy.

Michael E. Graska is senior manager of operations and engineering for Vectora Transportation LLC.
For more information, go to www.vectoratransportation.com.

BARON USA, INC.

By Stephen Sisk

Tennesse-based company offers transformer dryout equipment that mitigates highly dangerous combustible gas accumulation within wind farm pad transformers.

TAKE I-40 EASTBOUND OUT OF NASHVILLE, and in a shade over an hour, you'll run up on Cookeville, Tennessee — home to Baron USA, Inc.

No, they're not the pizza guys, fighter pilots, or even feudal lords. They're a small, veteran-owned company of about 40 total employees (currently a pretty high roster for them), that specializes in transformer dryout and the purification of oil in electrical equipment.

Following a career at S.F. Bowser & Company (acquired in 1969 by the Keene Corporation), Les Baranowski kept getting inquiries by his former customers about their needs for equipment similar to what they were used to getting from his former company. The volume of requests kept coming until Les finally decided to get a loan and open up his own business.

Nearly four decades later, Les' son Derek now owns Baron USA, where he also serves as the company's president.

"(Baron USA) was founded in 1975 by my father," Derek Baranowski said. "The company started building oil processing systems for Westinghouse Electric, and some of the old names that are no longer around or have merged into some of the bigger companies. We developed over the years from a small mom-and-pop operation to selling around $10 million a year, and we sell worldwide."

Despite that kind of growth, it's the legacy of meeting customers' specific, essential needs that drives the younger Baranowski's company today.

There's no pick-and-choose, catalog-style purchase approach here. Instead, Baranowski and his team of technical consultants work directly with the customer, identifying specific needs, addressing problems, and coming up with smart, custom solutions.

"Our mission is to provide innovative solutions to our customers' problems," Baranowski said. "We really pride ourselves on being able to come up with solutions to solve people's pressing problems."

Those solutions fall primarily into two categories: Oil purification systems and transformer dryout/processing systems.

"We build a lot of systems that process transformer oil — either new or old," Baranowski said. "We also have systems that go into the field and do transformer dryouts and fills for new installations, as well as processing of transformers that are already online and in service. That's 90 percent of our business. The other part is building specialized equipment for OEMs. We're the only manufacturer of vapor phase systems in North America. We compete against companies in Germany and Switzerland." Baron makes their products available for sale to customers, but also has units available for customers to rent.

Although most of the company's customer base is from the electrical equipment manufacturing and electric utility industries, within the last few years, the company recognized a specific need servicing the pad transformers of wind farms. After these transformers had been in operation for some time, a potentially hazardous condition arose — the buildup of combustible gases within the transformers.

"In the wind farm industry, they have a unique problem with their power transmission from the turbine out to the grid," Baranowski said. "Because of the cycling and the surging, those transformers that they're using are subject to a lot of gassing — generation of combustible gases."

If the collection of those gases goes unmonitored, he said, the gas levels rise to a point where it's very risky to keep those transformers running.

"As these levels of gases build up — acetylene and hydrogen — they fill a gas space in the top of the transformer," Baranowski said. "If there would be any short or spark, the gas would ignite and cause a catastrophic explosion."

Baron's Wind Farm Series transformer dryout system can mitigate those gas levels as they are generated within the oil, allowing for safe, continuous operation.

"We have a system that goes on and pulls the oil out of the transformer, removes those combustible gases, and puts the oil back in the transformer," Baranowski said. "So the transformer is always operating with a gas level below a hazardous range."

The Wind Farm Series product is relatively new, and — aligned with the company's mission — came about as a result of a wind farm operator bringing the problem to Baron's attention and working in tandem toward a solution. Currently, wind farms that use Baron's transformer dryout system include the Desert Sky Wind Farm and White Creek Wind Farm. A rental unit is making its way through several of the Shell wind farms in Colorado.

Baranowski expects that the Wind Farm Series segment of his company will grow as wind farms begin to age and operators become more aware of the problem of the combustible gases created by the transformers.

"It's something that doesn't happen right away," he said. "But it's something that is going to happen down the road. It's pretty obvious that, despite all the lack of enthusiasm and loss of government support, the wind farm industry is here to stay and is a vital contribution to our nation's energy program. If it keeps growing, we see big things for us on the horizon as well."

For more information about the products offered by Baron USA, Inc., visit www.baronusa.com or call 931-528-8476.

BUILD IT, BOND IT, FIX IT

The Role of adhesives, sealants, lubricants and coatings in the life of a wind turbine

By Dr. Michael Gansow, Jason Spencer, and Thomas Buckley

Dr. Michael Gansow is manager for PUR adhesive development, Jason Spencer is business manager, and Thomas Buckley is market application engineer — all with Henkel Corporation. For more information, please visit www.henkel.com.

SILENT BEHEMOTHS supporting 60-meter blades that rotate with tip speeds up to 300 km/h and weigh up to 15 metric tons, industrial wind turbines are modern engineering miracles. These sentinels of electric power often stand in excess of 150 meters tall and must withstand decades of harsh environmental conditions found offshore, in coastal regions and on mountaintops.

Industrial wind turbines cost roughly $1.2 million/MW to build based on a 1- to 3MW turbine. Installation costs increase the investment by a factor of 1.2 to 1.35 for onshore projects, with offshore installation costs being significantly higher. Turbine manufacturers and owners are constantly looking for ways to reduce manufacturing and maintenance costs and increase profitability by shortening production cycles, increasing production volume, and simplifying maintenance requirements.

Adhesives, sealants, lubricants and surface treatments play critical roles in the life, health and financial soundness of wind turbines. These materials are used during every phase of manufacturing, installation and day-to-day operation.

TURBINE MANUFACTURING AND ASSEMBLY

For blade and nacelle production, gigantic molds are first treated with semi-permanent mold release agents that allow large-scale composite parts to be easily removed from

the mold. Blade halves and nacelle body components are bonded together and sealed using structural adhesives such as two-part polyurethanes that prevent crack propagation, micro-cracking and fatigue, and ensure the long-term integrity of the structure. Two-part polyurethanes also fill voids found on the molded assemblies (see sidebar on polyurethane technology).

Two component polyurethane adhesives and MS polymer sealants are used to permanently bond components such as access doors, rain deflectors and gurney flaps to the blades. Color-matching, weather-resistant MS polymers and high performance sealants protect and seal the blade and nacelle interior and exterior from moisture and environmental contaminants.

When metal tower components are manufactured, surface treatments such as coatings, conversion coatings and cleaners/degreasers prepare the surface to improve corrosion resistance and paint adhesion. These large parts are then ready for assembly.

On the tower, sealants prevent moisture from penetrating in through tower section breaks and prevent corrosion on load support plates, platforms, bolt heads, ladder frames and other metal surfaces. Anaerobic threadlockers lock and seal large threaded fasteners. Structural adhesives are used to bond and secure ladders and other components.

Anaerobic adhesives play critical roles throughout the turbine assembly, locking and sealing threaded fasteners found on the base, tower, nacelle and blades. Anaerobic materials are widely used in hub, bearing and the gearbox assembly where they retain pitch and yaw bearings, and seal gearboxes, flanges and hydraulic fittings. Anti-seize lubricants protect power train splines, mounting bolts and exposed fasteners.

Throughout the turbine, heavy duty solvent-based and aqueous cleaners remove dirt and residues from composite and metal parts and prepare them for installation and operation in the field.

During installation, epoxy grout materials are used to create a level, secure base for tower assembly. High strength epoxy grouts bond to steel, concrete and other construction materials and withstand high torque loads. Urethane sealants bond, seal and waterproof tower bases. Cables that route out of the turbine to deliver electricity must be sealed to stop moisture/water from entering the turbine, preventing corrosion. Highly flexible silane modified polymers demonstrate good adhesion to many

POLYURETHANE ADHESIVE TECHNOLOGY FOR ROTOR BLADE BONDING

Until recently, most wind blade manufacturers have used GL-certified two-component reactive epoxy resins to bond load-carrying structures like rotor blades. While epoxies offer excellent adhesion, shear strength and chemical/heat resistance, they are expensive to process, take a considerable length of time to cure completely (slowing the production cycle time), and generate extreme exotherm during cure, which may lead to crack formation. These limitations increase the risk for warranty claims and field repair, and can contribute to ultimate blade failure.

A new high performance polyurethane adhesive technology (from Henkel Corporation, Macroplast® UK 1340™) is consistently contributing to the assembly of highly efficient wind turbines. This adhesive satisfies the specific mechanical requirements for use in the wind power industry, improves the long term reliability of rotor blades and makes rotor blade production faster and less expensive.

New PUR technology provides excellent static and fatigue strength, excellent toughness, and resists crack propagation, while significantly improving the efficiency of rotor blade production. The new PUR requires fewer curing steps than epoxies, resulting in reduced assembly costs and 15 to 30 percent shorter production cycles. This improves payback time on critical investments such as molds and factory facilities, and decreases the number of required production lines.

Additionally, the new PUR rapidly develops sufficient green strength for demolding, enabling demolding in a partially cured state followed by a freestanding postcure — a further lever to reduce production cycle time and costs. In addition to blade bonding, two component polyurethane adhesives can be used to attach components to the rotor blade, for nacelle assembly, and for securing the ladder to the tower assembly.

GL requirements for adhesives primarily relate to shear strength, long-term durability, creep behavior and glass transition. The adhesive's physical properties are temperature-dependent. Within a temperature range known as glass transition (Tg), the adhesive's mechanical properties change considerably from brittle or glass-like at low temperatures to flexible or rubbery-elastic at the high end of the range.

For rotor blades, GL requires a Tg of at least 65°C to prevent bond crep or relative movement of the substrates and achieve rigidity at higher ambient temperatures. However, typical polyurethane adhesives offer a range of only -30 to 45°C, depending on the desired elasticity.

Offering breakthrough Tg better than typical polyurethanes, Macroplast® UK 1340™ is the only adhesive in its class to satisfy GL's requirements. Extensive tests have also demonstrated a tensile shear strength exceeding 20 MPa in the -40 to +80° C temperature range and a Tg of 65°C and higher. This improved tensile fatigue strength allows wind blades to better handle deflection across the length of the blade and dynamic load and stress on the adhesive bond line, reducing the risk of damage that may require repair or replacement.

The two-component PUR consists of a resin and a hardener. After mixing, pot life ranges from 30 to 90 minutes at 20°C, but can be adapted as required for a specific manufacturer's production process without the disadvantage of partially overheating the adhesive joint. Manufacturers can maximize throughput without increasing stress in the part or the potential for stress cracking associated with high exotherm.

The new PUR adhesive generates much lower exotherm of up to 75°C maximum when compared to the 120°C - 150°C exotherm of epoxies. Reducing exotherm benefits the process in two ways. First, when composite materials are bonded, stress cracking caused by excessive thermal loading may weaken the rotor blade as a whole. This risk is significantly reduced if the reaction temperature is lower. Second, high temperature polymerization is always accompanied by changes in volume. Low heat emissions and lower thermal loading during chemical crosslinking reduces heat related shrinkage in the bond line. Controlled shrinkage results in a more durable bond over time.

The heat generated from an exothermic reaction will vary depending on the quantity of adhesive undergoing cure. In areas where larger amounts of adhesive are applied, temperatures get much hotter than in those areas with less adhesive volume.

On a single rotor blade there are considerable differences in the quantity of adhesive applied and, therefore, considerable differences in stress. At the interfaces between such stress fields, mechanical flaws will occur, unless the stress is relieved through elaborate tempering. This is where polyurethane systems with low-temperature exothermic reactions have big advantages, particularly when applied in thick films.

substrates and create a soft, elastic seal.

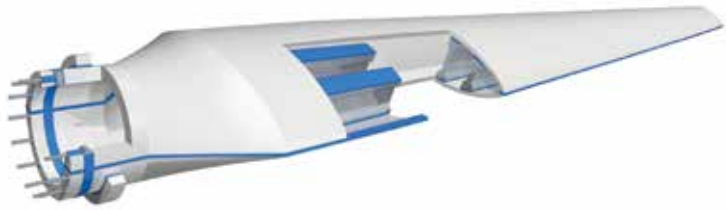
TURBINE MAINTENANCE

From the moment a turbine is assembled and begins to turn, it is exposed to environmental hazards. Lightning, turbulence, sand, rain, hail, snow and bird-strikes all contribute to wear and damage to the blades and nacelle. Corrosion affects the aesthetics and eventually compromises the strength of the tower, while erosion damages the concrete foundation, causing cracks, chips and spalling.

Composite blade tips commonly experience micro-cracking and structural cracking that can be significant and require installation of a new tip or a structural patch. Bird and lightning strikes can penetrate the blade and require repair to the core material, the blade substrate and the blade surface. Pitting and wear caused by weather and environmental elements can decrease the performance and efficiency of the wind turbine.

High viscosity, structural polyurethane putties are hand applied to the eroded edges of the blade to fill pitting and wear damage. Fast-curing, abrasion-resistant putties are used as a repair system along with polyurethane hand lay-up resins and polyurethane structural bonding adhesives, for damage caused by lightning or bird strikes. Cartridge dispensed two-component structural polyurethane adhesives bond patches for damaged tips. To reduce the chance of subsequent lightning strikes, lightning diverter strips designed to transmit and ground lightning away from the blades, can be applied to blade surfaces using a structural adhesive. Working together, these adhesives and sealants return the blades to their original smooth and wind-resistant design and allow the blades to rotate again with little downtime.

On and in the nacelle, sealants are used to protect the generator and motor housing, panels,



hinges, service doors, manholes and exterior appliances such as wind indicators, lights, rails or cable breakthroughs from moisture ingress and corrosion. Anaerobic materials protect yaw bearings and keep gear boxes operating efficiently and reliably. Anti-slip coatings create walking surfaces with good traction so that maintenance workers will not slip in cold, wet and icy conditions outside the nacelle or slippery, lubricant and coolant-coated surfaces inside the nacelle.

The tower assembly must be treated on an ongoing basis with maintenance chemicals to keep it strong and solid throughout the long life of the turbine. High flexibility adhesives and sealants ensure the tower sections stay together and seal out water and chemicals that can cause corrosion and enter the tower assembly. Chemically resistant coatings and galvanizing compounds protect the metal towers from corrosion and damage. Threadlocking and structural adhesives keep accessories such as ladders and platforms in place and prevent threaded fastener failure.

To ensure that blades achieve maximum aerodynamic efficiency, they must be regularly cleaned of contaminations such as algae, dirt and sand. Water-based cleaners quickly cut through grime and reduce the effort and time required for cleaning. By applying specially formulated coatings, maintenance crews can reduce the likelihood of new contaminants sticking to the blades and can increase the turbine's total power production until the next scheduled cleaning.

On the base of the turbine, damage and cracks in concrete pads will deteriorate over time from exposure to outside elements. Repairing damaged areas using crack fillers and fast-fixturing concrete repair products increases the life of the concrete structure and helps it resist future damage.

By incorporating adhesives, sealants and surface coatings from start to finish in wind turbine production, manufacturers can produce more robust turbine components and longer-lasting assemblies. Automated processes shorten production cycles, increase production volume and reduce manufacturing costs. And stronger, more reliable turbine components mean less maintenance when the turbine is assembled and in operation in the field.

During installation and maintenance, wind farms that use adhesives, sealants, lubricants, surface treatments and cleaners top to bottom on their turbines simplify and speed installation, minimize downtime and ensure a safe work environment. The turbines are more efficient, more reliable, and provide more energy over the expected lifespan.

WIND FARMS AND CRANES: A LONG-TERM RELATIONSHIP

Crane operators provide essential services to wind farm constructors and operators from groundbreaking throughout the turbine lifespan.

By Karen Schneider and Ken Dagel

Karen Schneider is business development manager and Ken Dagel is team lead of Health, Safety, and Environment with NCSG Crane & Heavy Haul Services/Mullen Crane & Transport. For more information, call 855-560-5050 or visit www.ncsg.com.

WE ARE ALL FAMILIAR WITH THE important role that heavy haul transport and large cranes have in the erection of turbines. But after all the excitement during construction is over and commissioning is complete, you may not know the extent of their involvement throughout the life of the wind farm including maintenance and end-of-life.

At the beginning of a wind farm project, companies such as NCSG Crane & Heavy Haul Services, one of the largest owners and operators of heavy haul transport and crane equipment, are contracted to transport the turbine components from the port or rail head to the wind farm site and then to the crane pads. For optimal results, it is important that the crane owner/operator's engineers be part of the pre-construction design team, and, well before the crane pads are constructed, to ensure that the specifications for the crane pads are consistent with the turbine type and weight that will be erected. This is especially important when turbine erection is not the responsibility of the EPC Contractor who is responsible for the pads.

Prior to transporting the turbine components, our engineers work closely with civil engineers to help design the site routes to ensure that the large transport equipment can safely negotiate the hills,

corners, and curves as well as the site entrances and exits to least impact the flow of local traffic. Transport problems encountered such as state and local permitting issues that can include: (1) different allowable weights and dimensions for each state; (2) time of travel restrictions; (3) curfews; (4) weather; (5) road conditions; and (6) the problems of managing pilot/escort vehicles. On reclaimed sites, the issue of site access is a constant problem.

During planning stages of the transport of a wind project, experienced heavy haul personnel must survey routes to insure the safe and legal transport of the components.

Many hours of pre-job planning go into designing an erection schedule to meet transport and site deadlines. The components must be strategically off-loaded and placed in strategic positions around the crane pad to ensure that the erection cranes can lift each component while maintaining a safe working load on the crane.

We start with a site evaluation to create the lift plan ensuring proper area for movement and sufficient compaction of soil to ensure a stable hoisting base. Every pick is preceded by a pre-lift meeting. All parties involved assemble to discuss the task, plan and concerns. Signatures are required to be documented for every person attending a pre-lift meeting. NCSG is presently arranging for two Health, Safety, and Environment employees to become Certified Trainers in High Angle Rescue. This provides us with the unique ability to train our own employees the specifics to the tower brand and client configurations. This will provide NCSG, tower authorized employees a professional level of training, expertise and qualifications that few other crane companies are able to provide. By spring 2013 all NCSG tower authorized employees will be competent or authorized to go up any tower with any client, only having to receive site specific training. The training provided includes fall protection, first aid and rescue skills. Our employees will be capable of assisting a client or other contractor in rappelling to the ground in rescue or self-rescue mode.

NCSG preceded federal requirements for crane operators and riggers. We require ALL operators and riggers to be NCCCO qualified. In addition to certifications we provide operator and rigger competency evaluations. All field personnel are visually verified as being competent or qualified prior to be dispatched to a project. Junior level or new hire operators will operate under the guidance of one of our senior "expert" operators prior to being allowed to take control of a lift. Ground crews typically include an A&D Director. This individual is someone who through work experience, education and qualifications has mastered the skills required to assemble and disassemble a crane. Each employee has a specific task and contributes their specific skills to reduce the likelihood of an incident or accident. Every task we face is preceded with safety in mind. Electrocutions are the number one cause of death within the crane industry.

The second leading cause of death is assembly and disassembly of cranes. By understanding this challenge we confront the hazards with education, training and execution of expertise. We have an EMR (Experience Modification Rate) which consistently ranks NCSG as having approximately one-half the industry average of incidents and accidents. This is not an achievement of any one person or department but relies solely on the employees as a whole. Each and every person contributes greatly to the success of our program. From new hire evaluations to computer based and hands on training to mentoring, each step we take is planned

and monitored to ensure success. Employees are encouraged and often times rewarded for refusing to perform a task which they believe may be unsafe. It takes all eyes of every person onsite to achieve and maintain progress in our journey to zero incidents/accidents. The job is never done working towards safety, we just elevate our place on the stairs of life working to be the safest company our employees and clients will ever hope to work with.

All employees are tasked with continuing professional development. Within the HSE department, education and networking are invaluable tools. During the AWEA workshop held in San Diego this past January, NCSG was accepted as a member of the AWEA / OSHA Safety Committee. NCSG will be representing the crane industry within the association. Additional responsibilities will fall within the construction of wind towers and their specific committees. Meetings and calls are held each month to discuss an agenda and to work on solutions to problems. This allows for laws to be written to best protect employees working within the industry and to reduce exposure to clients in the building of the towers. This membership will allow NCSG / Mullen to represent what we see as "best practice" within the industry and will keep us at the forefront of compliance. Following the AWEA workshop, we were asked to nominate a board member for the Montana Safety Council.

At the wind site, the cranes are brought in by multiple types of trailers and are met onsite by the erection crew and site supervisor. Upon arrival of equipment, the crew, under direction of the supervisor, starts the assembly of the large primary lift crane. During erection and assembly a checklist is used to ensure that all components are assembled and secured prior to lift of personnel or equipment. Only after completion of the checklist and authorization of the site supervisor is the assembly task completed. Each lift is specific to the task required by the client. Some or all of the work may be performed by use of a manbasket suspended from the crane. Prior to any lift of personnel, a trial pick is made with the supplied test weights and suspended for a pre-determined amount of time. The basket is then lifted into the same position required for the workers and brought back to the ground. This provides a proven "practice run" for the basket and the crane. Any difficulties which may have provided an obstacle to the actual work is remediated prior to personnel leaving the ground.

All wind sites are different and therefore a different set of risks and challenges need to be considered in the erection and maintenance plans. It takes a multitude of cranes to efficiently erect a wind project as well as an experienced management team to maintain the site schedule. During crane

erection, a primary lift crane such as a Manitowoc 16000, 440-ton capacity conventional crawler and an assist crane such as a Grove RT890E, 90-ton capacity rough terrain crane will perform the lifting work for each turbine component. This process can take several days, depending upon environmental conditions such as wind speeds that exceed the level to perform the work in safe conditions.

Proper maintenance of each crane and heavy haul transport equipment is paramount to ensure adherence to the project schedule, project budget and safety of the operators and other personnel. Training of the operators and support personnel on

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correct use of the equipment and of the task at hand including familiarity with the turbine type all contributes to a successful outcome and removes risk associated with this type of work.

During the 20- to 25-year operational life of the wind farm, certain activities such as gearbox, generator and main shaft components, and blades require removal and replacement. Heavy haul transport companies are responsible for moving the replacement component to the site and returning the component to a repair facility. Depending on the turbine type and availability of tools, the rotor may need to be dropped in order to remove the gearbox and generator. If a rotor must be dropped, a large main crane and a smaller assist crane will be required to be on site. This process generally takes one working week. If a rotor is not required to be dropped, the work can be performed with a less expensive crane, for example a large hydraulic truck crane and the process can be completed in fewer days.

Many wind farm owners remove the crane pads after turbine erection is complete and restore the roads to their original state. However, these actions present a challenge for the transport and cranes to be able to safely access the site and complete the required actions. If permissible, it would be advantageous if the crane pads remained in place and the roads maintained. These would lead to cost reductions due to less time to transport the equipment from the main roads to the turbines and the cost to bring crane pads to the site.

Due to the remote locations of many wind farms and the expense of the crane mobilization and demobilization, it is optimal if the crane equipment can service more than one turbine during its visit to the wind farm. This is often not feasible but with advancements in predictive analysis from SCADA data, it is anticipated that more opportunities to achieve these economies will be realized.

Wind farms that were installed over 20-30 years ago are now starting to experience end-of-life and repurposing efforts. In some cases, the older turbines are removed and the land is restored to its original state. In other cases, the old turbines are removed and new turbines are erected as recently started to occur at the Altamont Pass wind farm in California. Cranes are an integral part of these processes and heavy haul transport is responsible for moving the retired components to the designated location for disposal and recycling.

ZERO DROPS

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By Paul Idziak

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A FEW YEARS AGO, THE WIND MARKET was building farms as fast as turbines were available. During the same time period, there were few concerns about onsite safety and minimal contractor qualifications. Times are changing in the wind market. Employee worksite safety is a major priority from the CEO level down to the technician level. This is evident by the development of sophisticated EHS departments, stringent contractor qualifications standards, and a growing safety culture. Another change has been the involvement of OSHA in the wind industry. OSHA now understands the wind industry considerably better and is making its rounds to the wind sites more frequently.

With the changes noted above, the wind industry has been focusing on creating Electrical Safety Programs tailored to their specific needs. The question is, what happens after the Electrical Safety Program (ESP) has been developed? This article will review what an ESP is, what standards should be incorporated, and then delve into the implementation of the plan.

WHAT IS AN ELECTRICAL SAFETY PROGRAM?

OSHA requires an electrical safety program that focuses on the employee's exposure to electrical

hazards. The ESP needs to establish standards to prevent hazardous electrical exposures and provide compliance with regulatory requirements. This can be reinforced by OSHA's statement "Energized parts — If the exposed live parts are not deenergized (i.e., for reasons of increased or additional hazards or infeasibility), other safety-related work practices shall be used to protect employees who may be exposed to the electrical hazards involved." (Section and regulation this is pulled from ie 29CFR1910.333(a)(2).

The following components, while not required to be in your ESP by OSHA, are required by NFPA 70E, "Standard for Electrical Safety in the Workplace":

- The organization's electrical safety program principles
- Electrical safety program controls
- Electrical safety program procedures
- Procedures for conducting a hazard/risk evaluation
- Procedures for conducting job briefings

Developing an ESP is time-consuming and expensive, but considers the very tangible benefits of creating your program. Having an electrical injury or fatality incident at your site can lower the morale of other workers onsite and can even affect the morale of the entire organization. The cost of down time, equipment replacement, medical expenses, possible fines, and likely lawsuit by those involved or their families are tremendously expensive. Productivity will often diminish as a result of an incident. What is the cost of your downtime?

The Electrical Safety Program needs to be part of the overall Safety Program. The Electrical Safety Program needs to be supported by the corporate offices down to the onsite technicians. Getting buy-in from each will help create a fully-functional safety culture and enhance implementation of your ESP.

POLICIES AND STANDARDS

To help guide the development of your Electrical Safety Program there are already industry recognized consensus standards in place:

- NFPA 70 – National Electric Code (NEC)
  A standard for the safe installation of electric wiring and equipment in the United States. The NEC codifies the requirements for safe electrical installations into a single, standardized source.

- NESC – National Electric Safety Code
  A standard which sets the ground rules for practical safeguarding of persons during the installation, operation, or maintenance of electric supply and communication lines and associated equipment.

- NFPA 70B – Recommended Practice for Electrical Equipment Maintenance
  A recommended practice, which does not contain mandatory language. NFPA 70B covers preventive maintenance for electrical, electronic, and communication systems and equipment and is not intended to duplicate or supersede instructions that manufacturers normally provide.

- NFPA 70E – Standard for Electrical Safety in the Workplace
  NFPA 70E addresses employee workplace electrical safety requirements. The standard focuses on practical safeguards that also allow workers to be productive within their job functions.

- ANSI/NETA MTS – Standard for Maintenance Testing Specifications for Electrical Power Equipment and Systems

NETA Maintenance Testing Specifications were developed for use by those responsible for the continued operation of existing electrical systems and equipment to guide them in specifying and performing the necessary tests to ensure that these systems and apparatus perform satisfactorily, minimizing downtime and maximizing life expectancy.

In addition to using the above-listed consensus standards, specific procedures and policies that pertain specifically to your company/locations will still have to be developed. Here are a few recommendations:

- Insulated Tools
- Personal Protection Equipment
- Personal Safety Ground
- Lock Out/Tag Out
- Job Hazard Analysis
- Hazard Risk Analysis
- Work Zones
- Arc Flash Hazard Analysis
- Safe Approach Distances
- Switching Procedures
- Hot Work Permits
- Confined Space
- NERC PRC-005
- Site Safety Meetings
- Incident Reporting
- Electrical Maintenance Program

A common practice is for the company to create an Electrical Safety Program that is generic enough to cover common practices at each wind farm. Some companies have bought Electrical Safety Programs off the Internet for pennies on the dollar to try to be in compliance. Although the price may be right, packaged programs often require so much work that the end cost is as much or more than one developed specifically for your installation. Each wind farm has different hazards, electrical designs, and electrical equipment. The key is to develop an Electrical Safety Program for each wind farm to reinforce the actual safety practices down to the site level and help create the safety culture to the technician level.

PLANNING

During the Planning stage ideas, thoughts, outcomes, and desired results need to be positioned to help the final product with its intended use. NFPA70E provides six areas that must be included in the Electrical Safety Program: Awareness and Self-Discipline, Electrical Safety Program and Principles, Electrical Safety Program Controls, Electrical Safety Program Procedures, Hazard/Risk Evaluation Procedure, and Job Briefings.

As soon as the Electrical Safety Plan is finalized it will be probably out of date. Some questions then arise: "How will the EHS department will stay abreast of constant changes in codes, standards, tooling, electrical equipment, electrical designs, and legislation to keep the Electrical Safety Program current? What metrics will the Electrical Safety Program use to measure performance?" Upper management will want to see how an Electrical Safety Program is saving money, reducing down time, lawsuits, and reducing workman's compensation/insurance cost.

Failure to plan is planning to fail. You must begin with the end in mind to create a program that will stand the changing markets and quickly changing technology.

IMPLEMENTATION

After spending hours upon hours planning out your Electrical Safety Program and completing the development of the document, what are the next steps? Implementation of the document is the most important and hardest step to accomplish. Implementing will never end because the document will always be changing and new employees will require training on the Electrical Safety Program.

To be successful at implementation involving the stakeholders and day-to-day workers is an important part. Including managers, supervisors, and workers creates the safety culture that is needed in order to adopt the Electrical Safety Program and live the safety lifestyle.

The first step towards implementation is to provide training to make the technicians Qualified Electrical Workers. The technicians have to be trained on the hazards, processes, procedures, and risks in order to become qualified and comfortable around your electrical equipment. Reinforcement training is required to update the individuals on the changes in your Electrical Safety Program and provide a review of past trainings. Having fully-involved qualified workers onsite will breathe life into the Electrical Safety Program and help with the safety lifestyle the EHS department is trying to accomplish.

The next step is to ensure steps have been taken to ensure the workers and contractors are protected. It is very important to verify the arc flash study is correct and update to date. Equally important is to verify the arc flash labels are correct on each piece of gear and easily identifiable. Also make sure the wind farm meets the other electrical codes that are essential to the wind farms operation.

Once you have trained your workers and your wind farm is code compliant, develop and implement safe work practices for the workers. Safe work practices can vary from wind farm to wind farm, so be sure to understand what work practices or procedures are likely to change and maintain the safe work practices for those specific tasks. Up-to-

date safe work practices will help the employees understand the task at hand, the risk at hand, and how to safely and properly perform the task. These safe work practices will also help the employee determine what the proper PPE is required for the job and if they need any permits to perform the work. Developing consistency among your fleet is important and the ESP is one method to do so.

Lastly, whenever the Electrical Safety Program is revised, what is the methodology for getting the changes out to the site and employee level? How are these changes implemented and how are they verified?

Implementation will be the longest step in the process, but it is the most important step. Implementing effectively will be vital to the Electrical Safety Program along with creating the safety lifestyle.

DOCUMENTATION

Providing written documentation for the corporation to reference and for the technicians to use will build consistency of corporate safety policies and procedures across each wind farm. The written documentation is also imperative for third party contractors performing work at the job site to safeguard against any confusion pertaining to onsite safety.

Below are examples of documentation critical to the Electrical Safety Program:

- Policies
- Switching Procedures
- Performance Objectives and Standards
- Procedures
- Permits
- Job Hazard Analysis
- Audits
- Improvement Plans
- Training Records
- Incident Recording

If the documentation is used as a reference, resource, or is seen as a benefit to the employee, it can be a huge asset to your Electrical Safety Program. On the other side, if not used properly or if it is seen as a burden it can have a negative impact on morale and your Electrical Safety Program.

EVALUATION AND IMPROVEMENT

As discussed previously numerous times, the Electrical Safety Program is a living and breathing document. Because of this it will constantly need to be reviewed, edited, and revised.

Evaluating the Electrical Safety Plan can be done several ways. One method is to perform internal audits on the documented processes and procedures to find ways for improvements. Another possible method is to use a third party to perform audits on your Electrical Safety Program. It is good to get a fresh set of eyes on the program, but at the same time it can be expensive. Incidents or near-misses must be investigated to determine if additional policy or procedures need to be implemented. Lastly, unannounced site visits by the EHS department can prove to be beneficial.

Best practices from the evaluations will need to be implemented into the Electrical Safety Program. Once implemented, the proper media will need to be determined in order to get the recommended changes out to the site level.

CLOSING

An Electrical Safety Program is crucial to develop the safety culture within the organization. With the ever changing markets and legislation the Electrical Safety Program will need to be constantly revisited to make certain the newest regulations are followed and the procedures and work practices are up-to-date.

Implementing the program from a corporate level to a site level is challenging but extremely important to promote the safety culture down to the technician level.

MAKING WIND EVEN MORE COST COMPETITIVE

An examination of wind turbine costs through alternatives and a Total Life Cycle approach

By Jussi Vanhanen

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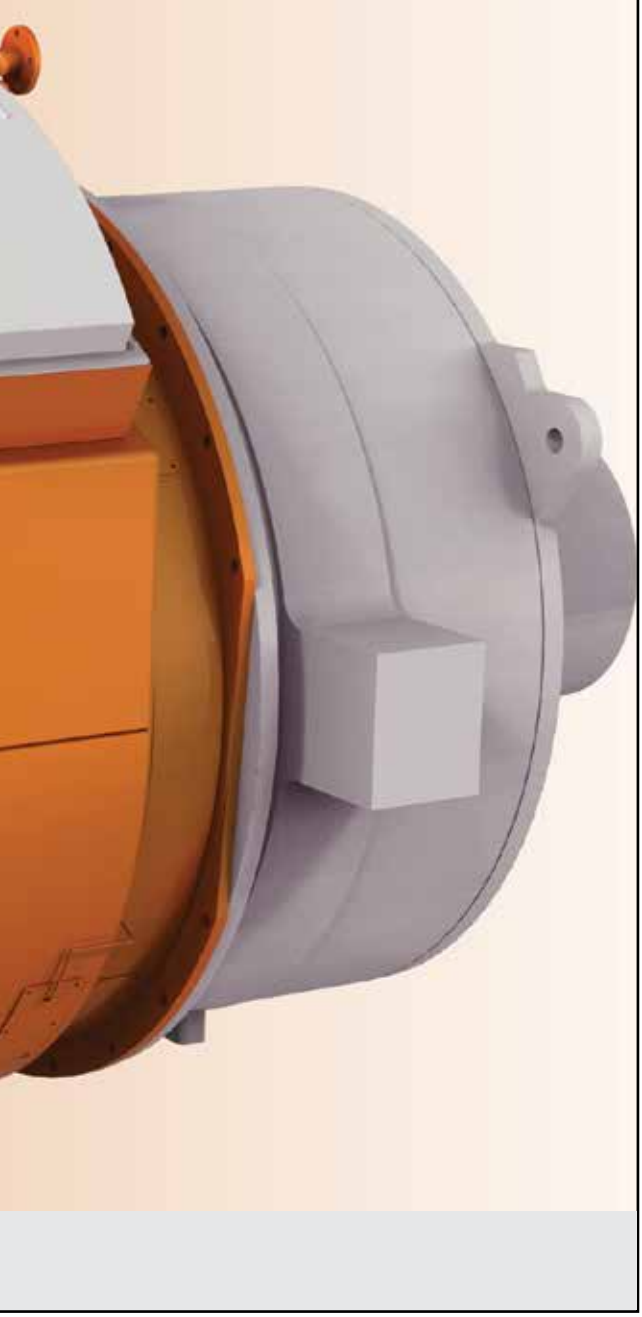
THANKS TO THE FACT THAT WIND ENERGY provides zero fuel and carbon costs as well as low operations and maintenance (O&M) costs, wind power stands a great chance to replace coal, gas, oil and other fossil-based fuels in the next few years.

As debated by some of the leading wind turbine and component manufacturers at the recent EWEA conference in Vienna in early February, wind has come a long way in terms of becoming a viable source of energy. Today, investors know that wind is one of the best energy sources because onshore wind has already reached grid parity. The costs for generating high-quality electricity from wind power have been cut considerably recently due to the concentrated efforts of the companies driving new technology and lower costs.

Although wind has gained a firm position in the energy mix of many countries, such as Denmark and Germany, there is still room for improvement when it comes to lowering the costs of energy generated from wind power before it will become an unquestionable winner.

RAISING THE COST ADVANTAGE OF WIND

For wind to become even more cost competitive, manufacturers need to continue to focus on four



areas: decrease capital investment, reduce equipment operation and maintenance costs, and increase the amount of energy produced.

The good piece of news to start with is that wind energy has built-in competitive advantages with its zero fuel and carbon costs.

So let's examine how the other areas can be addressed to make wind energy an even more viable energy option than it already is currently.

OPTIMIZE TOTAL LIFE CYCLE COSTS

Investing in wind energy demands a long-term perspective. Costs associated with wind energy, the initial capital investment and the equipment lifetime operation and maintenance (O&M) costs all need to be optimized to ensure a sustainable and profitable outcome.

The initial capital investment costs combined with O&M costs result in total life cycle costs (TLC). When considering TLC gives a much clearer long-term picture of the benefits that wind energy can bring to the conversation surrounding energy sources.

Looking at how initial capital investment and O&M costs contribute separately to the TLC of wind energy, we can see the overall financial impact these two areas have on TLC.

CAPITAL INVESTMENT

The initial capital investment required to create a new source of wind energy production is large. This may lead an investor to the conclusion that purchasing lower-cost equipment in the initial stage is the smartest choice. This choice, however, while reducing costs in the short term, may very well lead to greater TLC in the long term. This is due to the equipment lifetime O&M costs associated with cheap equipment. Also, cheaper equipment may be much more costly to install and may be much more difficult to connect to power grids. These hidden costs can add up quickly. Therefore, a somewhat higher initial capital investment in advanced technology is one way of reducing TLC in the long term, making wind energy more cost competitive overall.

OPERATION AND MAINTENANCE

The O&M costs over the lifetime of wind energy equipment can be optimized when the equipment used is designed and built with a goal of minimal maintenance and high serviceability in mind. Achieving these two goals leads to the avoidance of unexpected downtime and costly failures.

There are also other ways to optimize O&M costs of wind energy equipment. For example, if maintenance routines are scheduled to match the season when the wind is at its weakest, the maintenance will be cheaper and more efficient.

To reduce O&M costs, investors in wind energy solutions can choose to purchase equipment that has proven its ability to perform in all types of environments with minimal maintenance required.

WAYS TO MINIMIZE TOTAL LIFE CYCLE COSTS (TLC)

At The Switch, we begin each project with a view to minimize total TLC. We start by optimizing the design for each wind energy customer through our unique design process that involves close collaboration with our customer. The equipment is then built based upon these designs so that the final result is a perfect match for the specific environment in which the equipment will be operating. This extra

emphasis on proper design and development ensures that we can significantly lower O&M costs over the equipment's lifetime.

Some of our other solutions to lower TLC have included carefully calculated magnet placement in the generator to minimize their use, special high-humidity systems to avoid disturbances, and optimized weight-efficiency ratios to best match the desired turbine design. Also, our remote equipment monitoring system and 24/7 technical support allow our customers to easily implement a proactive service plan, avoiding unexpected downtime and costly failures.

The FusionDrive™, our smart gear and generator combo designed with Moventas, improves the entire drive train design by removing all high-speed components that are more prone to failure. Similar to our other products, FusionDrive™ enables our customers to enjoy longer lasting equipment that requires less maintenance, and therefore costs less over the long run.

EXTEND THE LIFETIME OF EQUIPMENT

Also tied into the cost competitiveness of wind energy is the lifetime of the equipment that is utilized. If a piece of equipment can be purchased at a low cost but has a very short lifetime, then in reality that piece of equipment is not as cheap as it initially appeared. This is due to the fact that every time a piece of equipment fails, it must be replaced, which of course increases overall O&M costs. If the lifetime of this same piece of equipment can be extended, then wind energy becomes a more cost-competitive option.

To illustrate, let's examine the case of the typical wind turbine, which currently has an estimated operating lifetime of 20 years. If this same wind turbine could be made to last longer and run more efficiently — even if it costs slightly more — it will cost less in the long run. In other words, it will lead to a decrease in the total cost of implementing a wind energy solution.

Turbine	Double-fed induction generator (DFIG)	Permanent magnet generator (PMG)
Turbine (excluding drive train)	$4,024,530	$4,024,530
Generator / converter	$154,270	$221,350
LVRT filtering and capacitors	$60,370	$0
Yearly maintenance	$120,730	$107,320
Yearly operation costs	$53,660	$53,660
Yearly output	$804,910	$845,150
Fuel	0	0
Lifetime (years)	20	25
Interest rate (%)	10	10
Net present value (NPV)	$1,128,210	$1,963,970

EXTENDING OPERATION WHILE BOOSTING THE QUALITY OF ELECTRICITY

Extending the lifetime of wind energy equipment will increase the cost competitiveness of wind as an energy source. While the typical wind turbine has a lifetime of 20 years, current designs from The Switch have already been calculated to lengthen this time frame by three to five years.

REVVING-UP ANNUAL ENERGY PRODUCTION

There are two factors that lead to increased annual energy production (AEP): greater availability and greater efficiency. For wind energy, the easiest route to increasing AEP through greater availability is to ensure that a wind turbine's blades are constantly rotating. To achieve greater efficiency, the focus should not be on operating at peak power — as all wind turbines experience periods of slow or no winds — but rather the focus should be on the amount of time a wind turbine spends generating electricity over all wind speeds.

First, to address AEP, all of our products are built based on a highly serviceable design, which minimizes the need for maintenance and increases production time. For example, permanent magnet generator (PMG) technology is now rapidly moving mainstream, because it ensures fewer failures. This is due to the fact that there are no wearing parts, and it requires less maintenance. Also, our PMG drivetrains average 97 percent availability or higher in any type of operating condition.

In addition, in order to increase efficiency and therefore AEP, the focus should be on the amount of time a wind turbine spends generating electricity over all wind speeds. This is an area in which our PMGs excel. PMGs demonstrate higher efficiency at partial loads where they spend the greatest number of their operating hours, resulting in a proven higher efficiency curve. PMG efficiency has been calculated to be 5 to 8 percent higher than that of conventional double-fed induction generator (DFIG) technology.

BOOST THE QUALITY OF ELECTRICITY

Besides looking at ways to simply cut costs, the competitiveness of renewable energy solutions such as wind energy can be increased by focusing on the quality of electricity it feeds into the grid. News from recent incidents of wind turbines not connected to the grid has overshadowed some of the earlier favorable progress. Now the industry and governments alike are responding — with stricter and more uniform grid code regulations.

Due to our highly reliable and efficient products, we are also able to help our customers boost the quality of electricity that they produce. The Switch renewable energy solutions have always demonstrated superior grid connection behavior. For example, our full-power converters support fault ride-through and fulfill the world's strictest grid code requirements, including the German BDEW 2008. Our 3 MW units have been tested on site and passed all grid code requirements, even for the latest Chinese regulations. Low flicker, electrical noise emission and THD of <1.5%, the lowest of any in the entire industry, also support the final quality of electricity fed to the grid.

FINANCIAL FIGURES SUPPORT NEW TECHNOLOGY

To get an even clearer picture of how The Switch is making wind energy more cost competitive, we can examine some real numbers. There are essentially two ways to analyze any major capital investment. Both of these financial analysis methods aim to give the investor a complete understanding of the long-term profitability of the investment.

PAYBACK

The payback method of analyzing a financial investment is a simple and easy method to use when analyzing small, repetitive investments. Payback determines the time required for the return on a given investment to repay the total initial investment amount. In the case of wind turbines, an average payback period is commonly calculated to be 8 years. The payback method factors in tax and depreciation rates, but it disregards interest rates, inflation, financial risks and other factors.

Still there are some shortcomings with the payback method. This method does not accurately measure the total income over the actual lifetime of the investment, due to the fact that wind turbines normally have an operational life of 20, and even 25 years as in the case with The Switch, and not just 8. This short-term view means that a huge amount of potential revenue and profit that is being generated beyond 8 years is left out of the equation.

LEVELIZED COST OF ENERGY OR NET PRESENT VALUE

Levelized cost of energy (LCOE) is our formula, and it is simply one way to calculate net present value. LCOE is the sum of all capital expenditures (Capex) and operating expenditures (Opex) divided by the annual energy produced (AEP) over the lifetime of the investment. LCOE is based on calculations that use cash flow and results in investment decisions that truly generate long-term value.

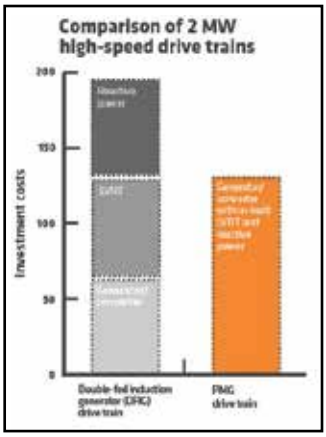
LCOE calculations take into account the initial wind turbine

investment, the operations and maintenance costs as well as the income streams from generating energy and selling it to the grid. LCOE also factors in the value at the end of the turbine's life, which could be positive or negative.

The fact that LCOE takes so many variables into account means that it is the most accurate and efficient way to measure an investment's profitability over its entire lifetime.

FINANCIAL COMPARISON

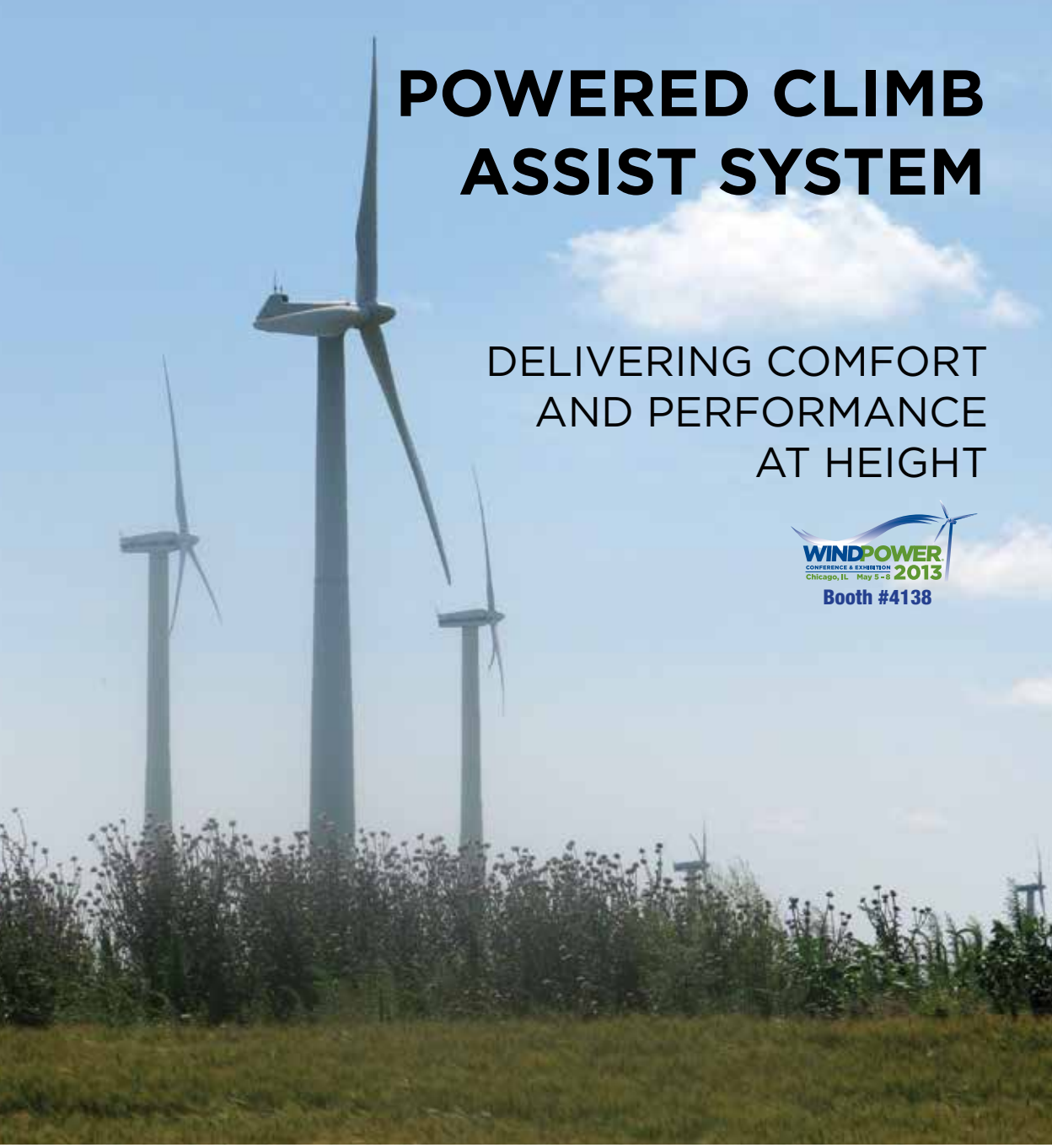
The technology behind The Switch's products reduces costs when compared with wind energy technology, which in turn leads to greater profits now and in the future. This also leads to greater cost competitiveness overall for wind as an energy solution.



To illustrate the financial impact of new technology versus conventional technology, we have provided a simplified cost comparison. This comparison is between a double-fed induction generator (DFIG) and a PMG, using the LCOE financial analysis method.

As can be seen from the table, although the initial investment cost is somewhat higher for a PMG wind turbine, low voltage ride-through (LVRT) capability offers a built-in advantage of PMG, eliminating the need and costs of extra filtering and capacitors. In addition, maintenance costs are significantly lower over the lifetime of the PMG equipment. Plus, PMG efficiency can easily be calculated to be 5 to 8 percent higher than DFIG. When comparing the total of all capital expenditure and maintenance costs with the overall efficiency and energy produced, PMG is the undisputable clear choice. Therefore, technology with a high efficiency ratio considerably reduces risk and increases bankability.

Also, although the upfront costs of key components such as PMGs and full-power converters (FPC) may appear to be higher than the DFIGs, in reality the difference in the initial Capex can be negligible



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for a 2MW wind turbine. The true costs come into play when connecting to the grid. For example, DFIG drivetrains need additional VAR support to make a connection to the network.

Taking a longer-term view on results is the most financially sound approach to analyzing renewable energy investments. To reach the most optimal financial decision with long-term capital investments, The Switch advises using the LCOE approach and pairing it with the payback method to see the complete picture.

Calculating the costs of DFIG and PMG-FPC: Although the initial investment in a DFIG turbine appears lower, the price of LVRT filtering and capacitors must be added. Also, VAR support must be provided to connect DFIG turbines to the grid. In comparison, PMG technology includes inbuilt LVRT and reactive power compensation.

WIND ENERGY IS BECOMING EVER CHEAPER

Wind energy technology is constantly advancing and becoming simultaneously more cost effective. The industry at large can be pleased by the progress made to date, especially now that onshore wind power has reached grid parity. Still there is much more to do to drive costs down — not only with onshore solutions, but also especially as offshore starts to pick up speed.

By simply taking a longer-term perspective concerning results and profitability, investors will find that wind energy is an energy solution with a strong future.

As a provider of key components based on advanced technologies for wind power production, we at The Switch are on a mission to help lower the cost of wind energy and to make it a more viable and competitive power source going forward.

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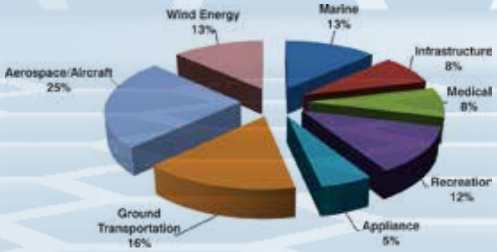

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STANDARD-ESSENTIAL PATENTS AND THE WIND INDUSTRY

Standard-essential patents present opportunities and potential pitfalls for the wind industry.

By Kelsey I. Nix and Thomas J. Bassolino

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LIKE MOST TECHNOLOGY-BASED INDUSTRIES, standards play an important role in the wind industry. Wind industry standards address rotor blades, turbines, gearboxes, power station equipment, noise, offshore structures, construction and demolition operations, interconnection, and interoperability. Wind industry standards are developed by standard-setting organizations and trade organizations such as the American National Standards Institute (ANSI), International Organization for Standardization (ISO), British Standards Institution (BSI), Canadian Standards Association (CSA), Deutsches Institut für Normung (DIN), Danish Standards Association (DS), International Electrotechnical Commission (IEC), American Gear Manufacturers Association (AGMA), American Society of Mechanical Engineers (ASME), American Society of Safety Engineers (ASSE), and Institute of Electrical and Electronics Engineers (IEEE). For example, the following standards are applicable to the wind industry:

- AGMA's "Design and Specification of Gearboxes for Wind Turbines" (AGMA 6006-A03), which provides information for specifying, selecting,

designing, and manufacturing wind turbine gearboxes. This standard has been adopted by ANSI and the American Wind Energy Association (AWEA).

- AMSE's "Wind Turbines" (ASME PTC 42), which provides instructions for conducting performance tests of wind turbines. This standard has been adopted by ANSI.
- IEC's "Wind Turbine Generator Systems" (IEC 61400), which is a set of design requirements to ensure that wind turbines are appropriately engineered.

SEPS AND FRAND LICENSING

It is common for a standard-setting organization to develop a standard that includes a patented invention. When an industry standard includes technology covered by patents, the patents are referred to as "standard-essential patents" (SEPs). Standard-setting organizations commonly have rules that govern licensing of SEPs owned by companies that participate in developing standards. The most common rule is that a SEP must be licensed to an interested party under "fair, reasonable, and non-discriminatory" (FRAND or RAND) terms. In other words, before a patent becomes an accepted part of an industry standard, which as a practical matter industry participants are generally required to adopt, standard-setting organizations will require the patent owner to agree to provide a license that includes FRAND terms (a FRAND license) to any interested party. FRAND licenses are intended to prevent patentees from engaging in licensing abuse based on the negotiating leverage generated as a result of having their patented invention included in an industry standard.

INJUNCTIVE RELIEF FOR SEPS

A recent hot topic in federal courts, government agencies, scholarly publications, mass media, and congressional hearings is the availability of injunctive relief for SEPs. An injunction is an equitable remedy issued by a court that requires a party to perform, or restrains a party from performing, a particular act. In a patent infringement action, a U.S. federal court may grant an injunction that prevents the infringer from making, using, selling, offering for sale, or importing the patented invention. The factors that must be weighed in granting an injunction are whether (1) the patent holder has suffered an irreparable injury, (2) monetary damages are inadequate to compensate the patent owner, (3) the balance of hardships favors the patent owner over the infringer, and (4) the public interest would not be disserved by an injunction. These factors are often referred to as "the *eBay* factors" after a 2006 Supreme Court case[1]. Similarly, in a patent action before the U.S. International Trade Commission (ITC) under 19 U.S.C. § 1337 (*i.e.*, unfair practices in import trade), if the ITC finds that importation constitutes infringement of a valid and enforceable U.S. patent, it may direct that the articles "be excluded from entry into the United States, unless, after considering [1] the effect of such exclusion upon the public health and welfare, [2] competitive conditions in the United States economy, [3] the production of like or directly competitive articles in the United States, and [4] United States consumers, it finds

that such articles should not be excluded from entry."[2]

In patent infringement cases involving a SEP, the issue is whether an injunction can be ordered when a patent holder must offer a license to the SEP on FRAND terms. Specifically, should the inclusion of a patent in an industry standard limit the patent holder's ability to obtain an injunction (or exclusion order from the ITC) against infringers? Patent owners argue that without the threat of an injunction, licensees will not agree to pay a full FRAND royalty without expensive litigation. Accused infringers respond that their right to a FRAND license is not lost simply because the parties are unable to agree on what price constitutes a FRAND royalty.

On January 8, the Department of Justice's (DOJ) Antitrust Division and the U.S. Patent and Trademark Office released a statement entitled "Policy Statement on Remedies for Standards-Essential Patents Subject to Voluntary F/RAND Commitments" (hereinafter the "DOJ Statement").[3] The DOJ Statement argues that an injunction for a FRAND-encumbered SEP may be inconsistent with the public interest, with some notable exceptions. For example, an injunction may be appropriate where the alleged infringer has refused to take a legitimate FRAND license. Specifically, the DOJ Statement argues that "[i]n some circumstances, the remedy of an injunction or exclusion order may be inconsistent with the public interest. This concern is particularly acute in cases where an exclusion order based on a F/RAND-encumbered patent appears to be incompatible with the terms of a patent holder's existing F/RAND licensing commitment to [a standards-setting organization]."[4] On the other hand, the DOJ Statement asserts that an injunction "may still be an appropriate remedy in some circumstances, such as where the putative licensee is unable or refuses to take a F/RAND license and is acting outside the scope of the patent holder's commitment to license on F/RAND terms."[5]

The Federal Trade Commission (FTC), which shares antitrust enforcement authority with the DOJ, did not join in the DOJ Statement. However, the FTC recently expressed its views regarding SEPs and injunctive relief in an *amicus curiae* brief filed with the U.S. Court of Appeals for the Federal Circuit ("Federal Circuit") on December 5, 2012, in *Apple v. Motorola*, App. Ct. Nos. 2012-1548 and 2012-1549 (hereinafter the "FTC Brief").[6] The FTC asserted that "[p]atent hold-up risks harming competition, innovation, and consumers because it allows a patentee to be rewarded *not based on the competitive value of its technology*, but based on the *infringer's costs to switch to a non-infringing alternative* when an injunction is issued."[7] The FTC Brief suggests using the four *eBay* factors discussed above, which take into account important competition and innovation policy issues, and that "[w]hen a patentee makes a FRAND commitment to [a standard-setting organization], the irreparable harm analysis, balance of harms, and the public interest will generally militate against an injunction."[8]

SEPS AND THE WIND INDUSTRY

As the wind industry in the United States continues to grow, technology standards will play an important role for wind power project developers, equipment suppliers, services providers, parts manufacturers, utility service providers, and researchers. For example, standards are critical for harmonizing wind power with existing utilities (*see* IEEE 1547 "Standard for Interconnecting Distributed Resources with Electric Power Systems"). In fact, the AWEA has taken on the task of developing industry, national and international wind energy voluntary consensus standards, where "[t]echnical experts and people materially affected by a particular standard govern the content of a standard being developed."[9] With the influx of increased research and development, and the issuance of an abundance of patents in the wind industry, it is nearly inevitable that industry standards will incorporate patented technologies. Wind industry companies are therefore potential SEP owners, as well as FRAND licensees of SEPs, and should be prepared for the financial and legal obligations that may arise from SEPs. With these developments in mind, some practical considerations for the wind power industry are outlined below.

- **Standards Participants Must Disclose Essential Patents Prior to Approval**

  In addition to requiring a commitment to grant licenses on FRAND terms, standard-setting organizations typically require participants to disclose any patents they own that cover proposed technology before including the technology in a standard. When a patent holder files a patent infringement suit based on a SEP, the accused infringer can assert a number of affirmative defenses if the patent holder failed to disclose its patent rights to the standard-setting organization before adoption of the standard. For example, potential defenses include (1) equitable estoppel (*i.e.*, misleading conduct that suggests that the patent owner will not enforce its patent rights), (2) patent misuse (*e.g.*, failure to license under FRAND terms) and (3) implied license (*e.g.*, through consideration other than through a FRAND license; where patent owner "urges" others to practice the patent in order to obtain

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some benefit). Thus, misconduct or deceptive practices in the standard-setting process can render a SEP unenforceable due to the attempted extension of patent rights beyond their lawful scope.[10] Further, misconduct in the standard-setting process (such as concealment of patents) might lead to claims that the patent holder violated federal antitrust laws or committed fraud through deceptive behavior.

- **The Details of a FRAND License**

A commitment by a patent holder to engage in bilateral licensing negotiations ensures that the patented technologies will be available to parties seeking licenses. First and foremost, a FRAND license must be "fair," which basically means that the terms must not be anticompetitive in nature (thereby creating a monopoly for the patent holder). A FRAND license further requires the terms to be "reasonable," which generally means that the amount of the royalty must be reasonable. This issue is at the heart of most SEP cases, and once a court determines a reasonable royalty, the case (including any issues regarding injunction or exclusion) is typically adjudicated quickly. Various facts can be used to determine whether a particular royalty is reasonable, including, but not limited to: (1) the existence and viability of technical alternatives to determine value, (2) the cost of the next-best alternative, (3) royalties charged by other companies for essential patents of comparable number and value, and (4) royalties charged by the licensor in similar competitive markets.[11] One of the most controversial issues in FRAND licensing is whether the reasonable license price should include the value contributed by the standard-setting organization's decision to adopt the standard.

Lastly, a FRAND license requires that the terms and the rates be "non-discriminatory," which requires that patent holders treat similarly-positioned licensees in a similar manner. That means, for example, that manufacturers should be offered licenses on similar terms to other manufacturers, and end users should each be offered similar terms (but not necessarily the same terms offered to a different class or group of licensees).[12]

- **Other Practical Considerations**

The term "standards essential patent" can be a misnomer or generalization because one must look to the specific claims of the patent in question to determine whether they truly cover the standard in question — and by extension all devices that comply with that standard. Oftentimes, in a SEP infringement action, when the claims are interpreted by the court, all of the patent claims of an asserted patent do not cover both the standard and the accused device.

Another affirmative defense in a patent infringement action may include that the asserted patent is a SEP, and therefore that any damages can be no more than a FRAND royalty and no injunction can be ordered. A FRAND royalty — even if the patent is found to be valid and infringed — would be preferable to lost profit damages and a permanent injunction. However, these considerations do not mean that patent holders should be dissuaded from seeking to have their patents included in industry standards (and thus be SEPs). In fact, patent holders have obvious advantages when their portfolio encompasses SEPs. In addition to the industry-wide royalties collected from FRAND licenses, SEP status can confer an implicit presumption of infringement in licensing negotiations with respect to standard-compliant devices. This can be an important advantage in a patent dispute.

CONCLUSION

The more cost-efficient, reliable, and abundant wind energy becomes, the more important standards will become to make the associated products and services more interchangeable and interoperable. As such, interested parties in the wind industry should be aware of the legal and business implications associated with SEPs.

FOOTNOTES

[1] *eBay, Inc. v. MercExchange, L.L.C.*, 547 U.S. 388, 391 (2006).

[2] 19 U.S.C. § 1337(d)(1).

[3] *Available* at http://www.justice.gov/atr/public/guidelines/290994.pdf.

[4] *Id.* at page 6.

[5] *Id.* at page 7.

[6] Available at http://ftc.gov/os/2012/12/121205apple-motorolaamicusbrief.pdf.

[7] *Id.* at page 16 (emphasis added).

[8] *Id.*

[9] AMERICAN WIND ENERGY ASSOCIATION, *AWEA Standards Program, available at* http://ww.awea.org/learnabout/awea_standards_program/index.cfm.

[10] *See, e.g., Rambus v. FTC, 522 F.3d 456 (D.C. Cir. 2008)* (setting aside the FTC's orders finding that Rambus had violated the Sherman Act §2 and the FTC Act §5 by concealing a patent and pending patent applications from a standard-setting organization, compelling Rambus to license its DRAM technology, and setting the maximum royalty rate that Rambus could charge).

[11] *For more, see Georgia-Pacific Corp. v. U.S. Plywood Corp.*, 318 F. Supp. 1116 (S.D.N.Y. 1970) (the court used 15 factors to determine the type of monetary payments that would compensate for a patent infringement).

[12] *See, e.g., Network-1 Sec. Solutions, Inc. v. Cisco Sys., Inc.*, 6:08-cv-00030-LED (E.D. Tex. Feb. 7, 2008) (license was discriminatory because Network-1 had licensed the SEP to others at a much lower royalty rate).

KEEN Utility Introduces New Work Footwear For Spring

Winter may be in full swing, but KEEN Utility has already set its sights on spring with a collection of innovative industrial footwear for men and women. Leading the charge are two new indoor industrial silhouettes with stellar anti-slip ratings along with expansions of both the Portland "Built in the USA" series and a new insulated KEEN.Welt introduction. These new styles join a roster of progressive work footwear designed with versatility and comfort in mind for hard working feet and the men and women attached to them.

"Each season we meet the challenge of designing better work footwear toe-on. Every year there is a greater demand for versatile footwear that blends comfort, protection and design," said Kevin Kious, KEEN Utility Sales Manager. "KEEN was founded on the idea of creating a hybrid shoe equal parts form and function. KEEN Utility is an extension of this belief and each new introduction allows us to build a better foundation for hard-working feet everywhere."

Among the new Spring 2013 styles are:

Albany

A perfect partner to the Lexington, the Albany is superior slip-resistance with a highly breathable boot built for warm weather comfort. Outfitted with the KEEN's new oil- and slip-resistant outsole, the Albany exceeds Mark II Slip-Resistance safety standards by diverting water and oils away from contact points under the foot through tire-like drainage channels improving traction and stability. A waterproof nubuck leather and mesh upper provide unparalleled breathability while asymmetrical composite toes bring lightweight comfort and protection.

The Lexington outsole exceeds Mark II Slip-Resistance testing standards. The super slip-resistant outsole features drainage channels that direct water and oils away from contact points under the foot, similar to a tire tread, helping to increase stability and sure-footing indoors and out. The low-profile boot features an athletic, hiking-inspired silhouette with waterproof leather and a KEEN.Dry breathable, waterproof membrane that allows moisture out but never in. The Lexington features asymmetrical composite safety toes that deliver lightweight contoured protection. Casual enough to be paired with your favorite pair of jeans during a weekend around the house and durable enough to protect your feet on the job site, the Lexington is a go-to boot for an on-the-go worker.

Lexington

For more information on the KEEN Utility Spring 2013 collection or to find a KEEN Utility retailer near you, visit www.keenfootwear.com.

Keep up with all things KEEN Utility at www.fb.com/keenutility or www.twitter.com/keen_utility.

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.

HRFLEX Series Cable Clamps

HYROFLEX cable clamps are part of a system of various mounting supports for securing power cables in wind turbines. These clamps are supplied in various versions with between three and nine cable mounting segments.

Customized inserts allow for different cable groupings per customer request. The basic frame is formed by a steel support structure, which is fixed to the tower and provides the frame for mounting individual cable segments. This system provides pivoting, spring-action fasteners fixed by snap hooks to prevent the cables from dislodging.

In addition, the clamping band protects against any potential short-circuit forces.

Features of the HRFLEX Series Cable Clamps:

- Two styles available: Half-moon and Star
- For quick installation and excellent support of power cables in wind turbines
- Modular combinations of clamp segments (up to 27 power cables)
- Easy accessibility to all cables
- Cable diameter up to ø35mm
- Sturdy construction
- Fire and short-circuit tested

HYDAC provides fluid power solutions to OEM's, manufacturers and end users of a variety of heavy duty mobile and industrial equipment. These solutions increase the efficiency, longevity and safety of fluid power systems — even under extreme conditions.

HYDAC has division office locations in Bethlehem, PA, Glendale Heights, IL, Birmingham, AL, and regional sales offices across the United States. The company is also supported across the country by a nationwide distributor network.

For more information about HYDAC's line of product solutions, call 610-266-0100 or visit www.hydacusa.com.

Sunday, May 5
SPECIALIZED TECHNICAL TRAINING COURSES (Separate Registration Required)

Monday, May 6						
8:30 am - 10:00 am	**WINDPOWER 2013 — Welcome and Opening Session (Open to all attendees)**					
	MARKET UPDATES	PROJECT DEVELOPMENT	INTERNATIONAL	RESOURCE ASSESSMENT	TURBINE	TRANSMISSION POLICY
10:15 am - 11:45 am	A New Day & New Rules: Assessment of Supply, Demand, and Future Growth	Maximizing Resources: New Methods, Technologies and Strategies for Project Development	International Wind Energy Update	Discussion of The Industry's Most Important Wind Resource Questions — Yours!	Innovative Wind Turbine Components Research and Development (Scientific)	After Project Interconnection Comes Delivery — Addressing Delivery and Integration Challenges
1:30 pm - 2:30 pm	Power Session					
2:45 pm - 4:15 pm	Policy Outlook: Wind Power in the New Congress	Successful Project Siting Through Effective Stakeholder Engagement	Emerging Markets: Finding New Opportunities for Your Business	State of the Science: What is Next in Wind Resource Assessment (Scientific)	Wind Turbine Structures, Dynamics, Loads, and Control (Scientific)	The Economic Decelopment Benefits of Wind Projects in the Midwest

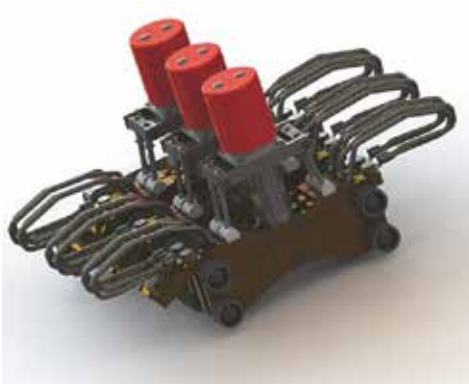
Tuesday, May 7						
8:30 am - 10:00 am	**General Session (Open to all attendees)**					
	FINANCE	SUPPLY CHAIN	SITING	UTILITY	TURBINE PERFORMANCE	STATE POLICY
10:15 am - 11:45 am	Market Landscape for Project Finance	Supply Chain Reboot: Next Gen Opportunities in America	Shifting Sands: Achieving Wildlife Permitting in an Uncertain Regulatory	Utility Ownership, Operations & Maintenance of Wind Projects in the Midwest	Maximizing the Long-Term Value of Wind Projects	Wind Power Growth Opportunities
1:30 pm - 2:30 pm	Power Session					
2:45 pm - 4:15 pm	Today's Wind Finance Structures: A Contract of the Small, the Medium and the Large 2	New Strategies for Project Progression Transportation Issues and Opportunities	Technical Advancements in Modeling and Wildlife Research Present	Critical Topics and Near-Term Issues Facing Utilities on Wind Power Growth	Emerging Solutions for Common Technical Challenges (Scientific)	New Opportunities in the Midwest — Where, Why and How Can I?

”

Wednesday, May 8						
	TURBINE	OFFSHORE	WIND INTEGRATION	FORECASTING/ INTEGRATION	COMMUNITY WIND	SAFETY
9:00 am - 10:30 am	Turbine Manufacturer Forum	Offshore Wind: Making an Off Take Market	Tackling the Challenges of High Wind Penetration and Weak Systems	Improving Short Term Wind Power Predictions (Scientific)	Powering Success with Community Wind Systems	Environmental, Health and Safety Impacts on Wind Energy
11:00 am - 12:00 pm	Leadership Power Hour					
1:00 pm - 2:30 pm	Owner/Operator Panel	The Essential Guide to Successful Risk Management and Mitigation	A Holistic Approach to Wind Integration		Managing the Role of Distributed Wind in Today's Energy Market	

Program subject to change without notice.

Reduce Wind Turbine Maintenance with New Carbon Brush Holder



An innovative carbon brush holder, set to reduce maintenance costs for doubly fed generators in wind turbines, will be introduced by Carbex at the AWEA WINDPOWER 2013 exhibition in Chicago, May 5 - 8 (booth no. 1011).

The Carbex V-type brush holder ensures that all the carbon brushes push against the slip ring with equal force, preventing uneven wear and premature brush replacement. This also reduces electrical and mechanical losses, lowering the temperature of the carbon brushes and improving their lubricating properties. In addition, remote monitoring is simplified, as only one switch per phase is required.

A traditional brush holder set-up includes a number of brushes that are fitted around the slip ring and adjusted individually. Brushes typically wear unevenly as each has different pressure against the slip ring.

The V-type holder eliminates these variations. The brushes are fitted and locked into position in single brush pockets. Through equal load on all carbon brushes, and lower temperature, the V-type holder gives longer life to the brushes, resulting in longer service intervals. This can mean substantial savings on maintenance, as visits to remote locations can be very costly, particularly in offshore applications.

The design of the V-type holder simplifies fitting and facilitates service, saving time while on site. The compact holder is located just inside the inspection hatch of the slip ring compartment for easy access. Only one adjustment is required for the holder. There is no need to adjust the angle and contact surface of the individual brushes.

The Carbex V-type holder is patent-pending in the U.S., EU and China. It is available for all common designs of doubly fed generators in the market. The design is modified for the requirements of each OEM to fit the existing bolt holes in the shield. For more information, visit www.carbex.eu.

ADINDEX

Kristen Graf
Executive Director, Women of Wind Energy

TELL ME A LITTLE ABOUT YOURSELF AND YOUR ROLE WITH WOMEN OF WIND ENERGY…

My love of renewable energy started at a young age when I saw it as an opportunity to turn my enthusiasm for math and technology into exciting solutions for the environment. I went to Cornell University to study engineering with a specific interest in renewable energy. I learned quickly that some of the major obstacles to renewable energy development in the U.S. were in policy, markets, and public perception and I decided to go work for the Union of Concerned Scientists (UCS) Clean Energy Program.

As I watched the conversations around climate policy, I was becoming more and more frustrated with how few women were at the table with expertise in energy. The Executive Director position opened up with Women of Wind Energy and I decided to make the switch. It was an incredible opportunity to combine my passions for renewable energy with an interest in seeing more women advancing in the field. As Executive Director and the only full time staff person of WoWE at the moment, I get to do a little bit of everything from budgets to strategic planning.

CAN YOU GIVE OUR READERS AN IDEA OF WHAT WoWE IS AND ITS MISSION…

WoWE is a national nonprofit, rooted in the idea that in order to have a successful renewable energy industry we must see more women at all levels and in all sectors of the field. We believe that building the renewable energy future we want to see (and believe we desperately need) will require as many diverse talents and voices as possible.

WoWE was started in 2005 by a small group of women that were frustrated with the lack of women at higher decision-making levels in the industry, in the policy conversations, at the podium of wind conferences, and even just a lack of women in the audience. Pooling money from friends and wind companies, they started a fund to cover the costs of travel and registration for young women that wanted to attend the annual conference put on by the American Wind Energy Association (AWEA).

WoWE has been able to build on that success offering broad-based programs focused on community, education, and leadership — including: a vigorous network of U.S. and Canadian chapters; online and in-person mentoring; an annual leadership forum; K-12 initiatives; and annual honors like our Woman of the Year, Rising Star, and WoWE Champion Awards.

HOW CAN SOMEONE BECOME INVOLVED IN WoWE?

Anyone can get immediate access to some of our greatest online resources like our mentoring program, member directory, and resource library including our webinar archive by filling out the form to become a member at www.womenofwindenergy.org/membership.

A great place to start learning more about WoWE is by exploring our website and connecting with us through our various social media communities on Facebook, LinkedIn, and Twitter.

We also have 35 chapters around the U.S. and Canada so there are often opportunities to connect locally with other WoWE participants.

TELL US ABOUT THE WoWE MENTORING PROGRAM…

Presently, women comprise a small but growing demographic of employees in the renewable energy field. Having a mentor is an important success factor for career advancement and growth, particularly for women. Especially in industries evolving as quickly as ours, it can be vital.

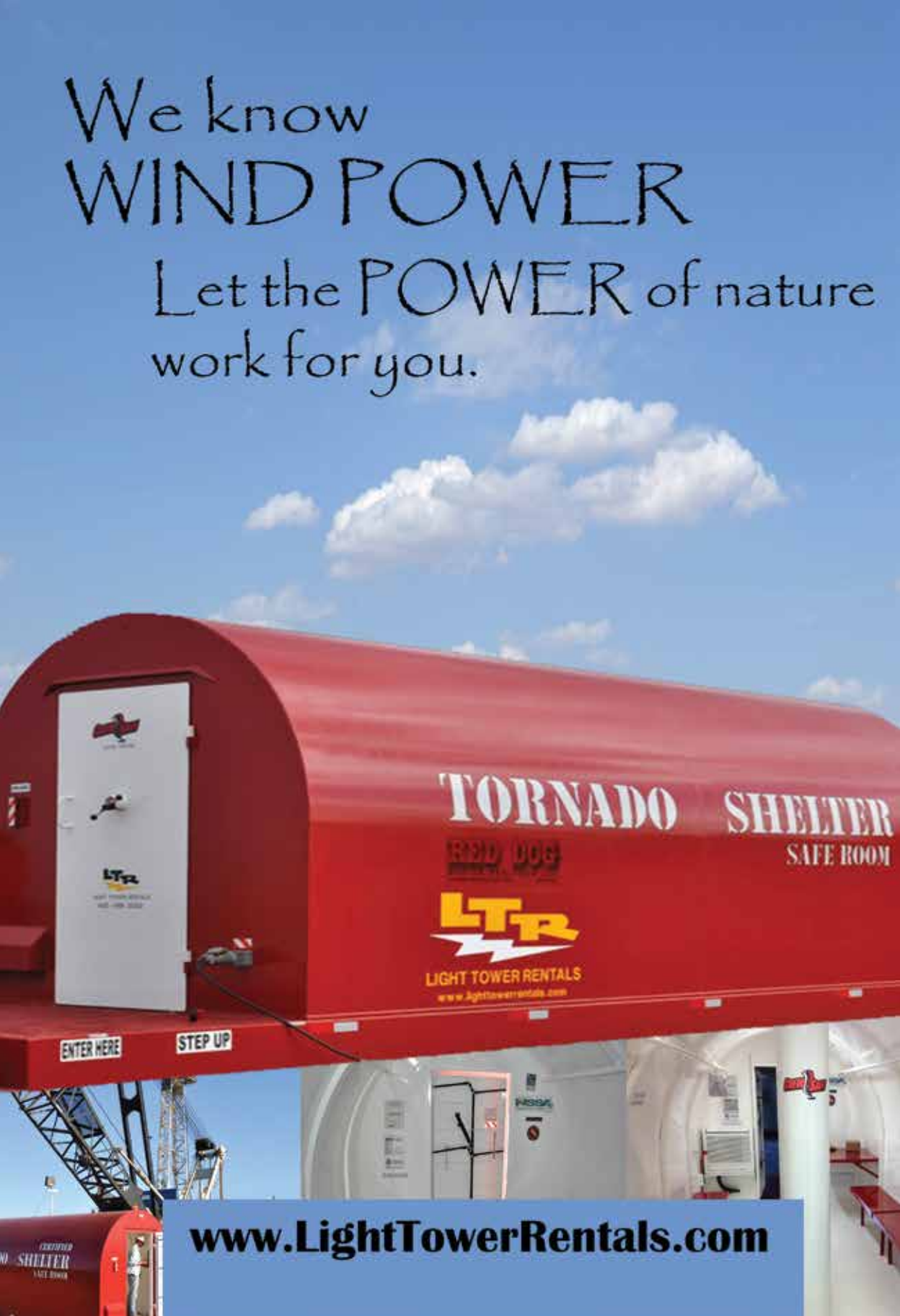
Our mentoring program provides an opportunity for people at different levels of experience or people with expertise in different areas to come together and share insights. Our mentoring partnerships are often two people (but could be a small group) working together on a set of goals for professional development. We offer a variety of levels of participation from one-time informational interviews to year-long partnerships.

TELL US ABOUT THE ANNUAL LUNCHEON AT WINDPOWER 2013…

WoWE's Annual Luncheon is a premier networking event for the wind industry and it is held the last day of WINDPOWER (so this year Wednesday, May 8). It is free for WINDPOWER attendees but it is usually at full capacity, so registering is critical. Registration will open up in this month on our website here: www.womenofwindenergy.org/annual-luncheon.html. The luncheon is a great way to learn more about our organization and our work, network with other women and men, and join us in celebrating our Rudd Mayer Fellows and our annual honorees.

For the complete Q&A with Kristen Graf, visit windsystemsmag.com.

For more information about Women of Wind Energy, visit www.womenofwindenergy.org or call 718-210-3666.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