

WIND

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Innovation

Real-time monitoring of bearing conditions emerges

- Norvento's nED100 reaches milestone for medium-scale wind
- Turbine blade sanding application borrows from aerospace industry

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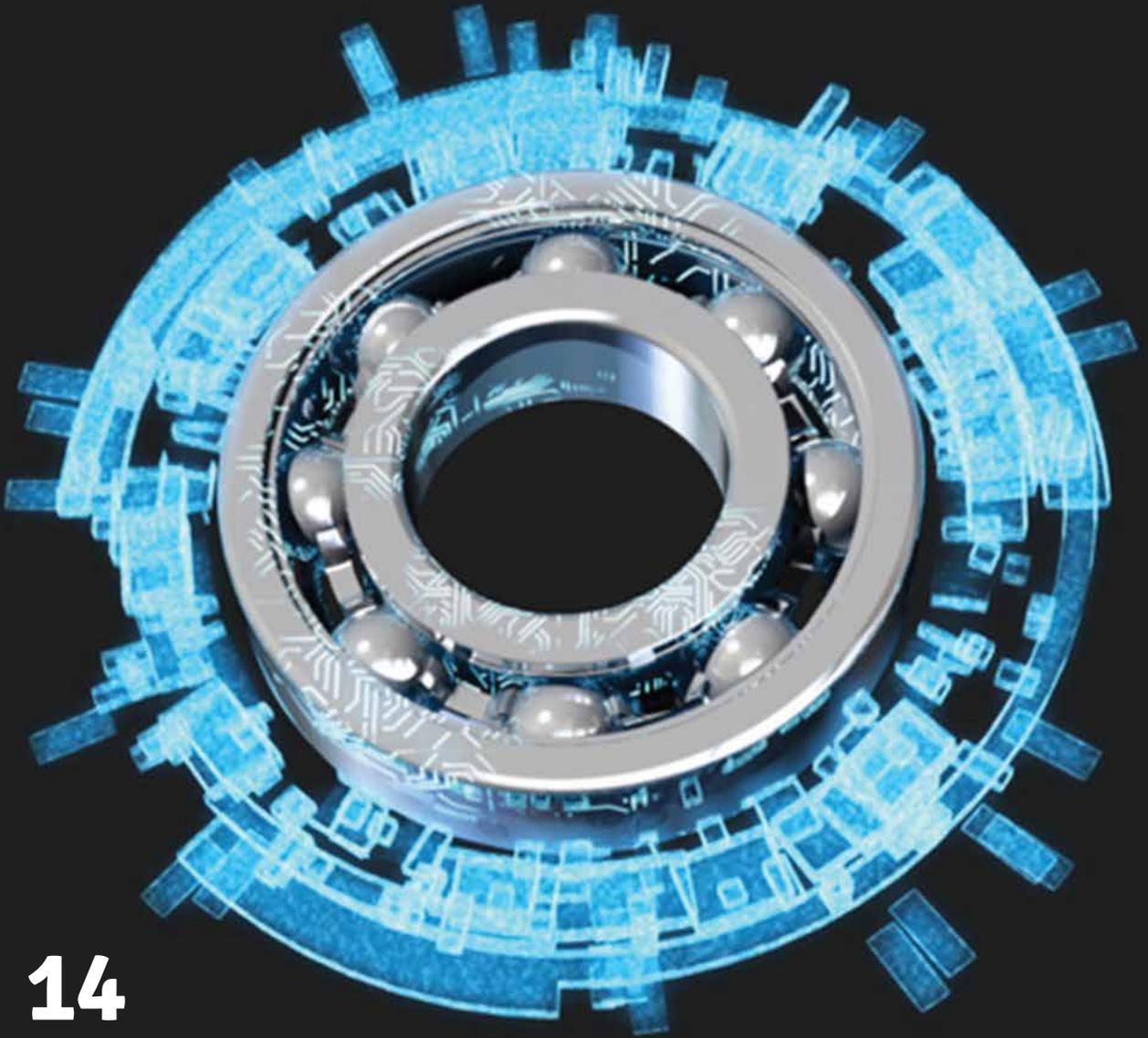


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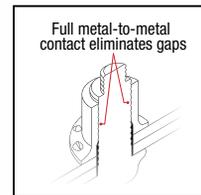
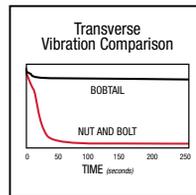


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When I was a kid, the holiday's were always my favorite time of the year.

What's not to love? I got to spend time with family. I was surrounded by wonderful food and treats. And the gifts... who could forget the presents?!

But there was always one aspect of the holidays that I dreaded — when they were over and you had to go back to school.

I wanted to stay at home, stuff my face with cookies, and play with other kids and all the cool new stuff we got.

But alas, January always follows December, no matter how sad of a proposition that is.

We try to pass the coming of a new year off as a time of renewal and growth. We half-heartedly commit to goals when we have no intention of following through. Truth be told, we'd all just rather be on holiday vacation playing with our presents — until they broke or we got tired of them.

Presents are a big deal when you're a kid. Well, the ones you like anyway.

There are always exceptions. As a child who is overflowing with anticipation, there's nothing more disappointing than tearing through a neatly wrapped present only to find something lame like winter socks or a label maker.

Still, your folks always taught you to smile and express gratitude, because...

"It's the thought that counts."

If that sounds trite, it's because

it is. It's one of those things we're taught as kids that just doesn't stick.

I can think of no better example than what happened to the wind energy industry last month in the halls of the U.S. Congress.

Despite the aggressive, empasioned advocacy campaign by the wind energy industry and the fact that Americans (contituents, voters, etc.) overwhelmingly side in favor of alternative and renewable energy policies, Congress voted passed a one-year extension of the production tax credit.

In reality, that amounted to roughly two weeks ... after taxes.

The wind industry's official stance was one of gratitude, while remaining firm to it's position that long-term support is crucial for the advancement of the industry.

It's a good thing I don't speak for the industry as a whole, because I'm pretty sure my toothy, fake smile couldn't cover the utter dejection that accompanied unwrapping an electric blanket.

I'm probably being too harsh. After all, Congress *did* allow us to re-create the holidays swof our youth — sort of.

They provided us two weeks at the end of the year to play with the lousiest gift we got.



Thanks for reading,

A stylized, handwritten signature in black ink, appearing to read 'Stephen Sisk'.

Stephen Sisk, editor
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EDITORIAL 2015

*inFOCUS topics in BOLD;
Bonus sections in italics*

FEBRUARY

O&M: OPERATIONS

Transmission

MARCH

**MANUFACTURING: SYSTEMS &
COMPONENTS**

Standards/Certification

APRIL

DIRECTION

Safety

MAY

WINDPOWER 2015

JUNE

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JULY

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PORTLAND GENERAL COMPLETES 267MW TUCANNON RIVER PROJECT



Portland General Electric Company recently announced its Tucannon River Wind Farm is in service and available to generate power for PGE customers. Tucannon River is PGE's second fully owned and operated large-scale wind project, with 116 turbines and a total installed capacity of 267 megawatts. Given the variability of wind power, the plant is expected to produce an average of 101 megawatts — enough to power the homes of about 84,000 average PGE residential customers.

“Tucannon River Wind Farm is a key infrastructure investment that will serve our customers with clean, renewable energy for de-

acades to come,” said Jim Piro, PGE president and CEO. “Tucannon River supports a balanced, diverse energy portfolio for reliable, reasonably priced power. The new wind farm will also help PGE meet Oregon's Renewable Portfolio Standard, which requires us to supply 15 percent of the electricity our customers use from qualified renewable resources by 2015 and 25 percent by 2025.”

Tucannon River Wind Farm is located on 20,000 acres near Dayton, Wash. The new wind farm complements PGE's existing portfolio of wind resources located in Eastern and North-central Oregon: Biglow Canyon Wind Farm, which

is fully owned and operated by PGE, and power purchase agreements for the output of the Klondike II and Vansycle Ridge wind farms. By securing wind power from different geographic locations, PGE is able to better integrate wind into the system because the facilities are less likely to cycle up and down simultaneously.

In addition to providing carbon-free and emissions-free generation of electric power, Tucannon River is providing economic support to the region.

“The Tucannon River Wind Farm has been a great addition to Columbia County and the Dayton community,” said Mike Talbott,

Columbia County Chair. “The project brought hundreds of construction jobs to the region, and now 18 permanent, family-wage positions to the Dayton community. It’s also bringing income to local businesses and increasing county tax revenue. We’re happy to have PGE in our community.”

Tucannon River was built for PGE by general contractor and independent renewable power developer Renewable Energy Systems Americas Construction Inc. using wind turbines manufactured by Siemens, each with a nameplate generating capacity of 2.3 megawatts. Power generated at Tucannon River will be brought to PGE customers via a new interconnection at Central Ferry Substation constructed by the Bonneville Power Administration. The plant was completed

on time and on budget under fixed-price contracts, with final construction costs expected to be approximately \$500 million, excluding AFDC.

Completion of Tucannon River Wind Farm is a significant milestone in the implementation of the action plan that came out of PGE’s 2009 Integrated Resource Plan. The plan was acknowledged by the Oregon Public Utility Commission in November 2010. The requests for proposals used to select the project were conducted pursuant to competitive bidding guidelines established by the OPUC, using objective scoring criteria intended to identify projects that provide the best balance of cost and risk while meeting PGE customers’ needs for reliable, affordable electric power. ↘



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MARYLAND ENERGY CHIEF CHOSEN TO DIRECT BOEM

Secretary of the Interior Sally Jewell recently named Abigail Ross Hopper as the Director of the Bureau of Ocean Energy Management (BOEM), which manages the development of our nation's conventional and renewable energy and marine mineral resources on the Outer Continental Shelf.

Hopper, who most recently served as the Director of the Maryland Energy Administration, will be the second director in BOEM's history. Acting Director Dr. Walter Cruickshank, served in the post temporarily since former Director Tommy Beaudreau became Chief of Staff to Secretary Jewell in May 2014.

"Abigail Hopper's knowledge of the energy sector, experience working with a wide variety of stakeholders and her legal expertise will be valuable assets to the Bureau and the Department as we continue to ensure the safe and responsible development of our domestic energy and mineral resources and stand up an offshore wind program," said Secretary Jewell. "She is an accomplished professional who brings strategic leadership and long-term vision to the job, and I look forward to having her as a member of our senior leadership team."

Hopper has led the Maryland Energy Administration since 2012, first as Acting Director and then as Director in June 2013.

She also served concurrently as Energy Advisor to Maryland Gov. Martin O'Malley since 2010. The Maryland Energy Administration coordinates and directs energy planning for Maryland State agencies, and helps local governments implement programs to reduce energy consumption. It also helps businesses become more competitive by introducing new technologies and developing strategies for emerging competitive energy markets.

As Director, Hopper was pivotal in ensuring the passage of the Maryland Offshore Wind Energy Act of 2013. She oversaw programs designed to achieve Maryland's strategic energy goals, including increasing renewable energy production, reducing energy consumption and reducing greenhouse gas emissions. She presided over the launch of new programs, including Smart Energy Communities, which provides funding to local governments that adopt cutting-edge clean energy policies. Hopper has also focused significant resources on improving the resiliency of the State's electric utilities in the face of major storms.

— Source: U. S. Department of the Interior

ENBRIDGE ACQUIRES 80 PERCENT INTEREST TWO E.ON WIND FARMS

Enbridge Inc. recently announced a deal whereby the Company will purchase an 80 percent interest in a portfolio of two wind farms in the U.S. from E.ON, one of the world's largest investor-owned power and gas companies. The agreed enterprise value for the portfolio is approximately \$650 million.

The 203 MW Magic Valley 1 wind farm located near Harligen, Texas and the 202 MW Wildcat 1 wind farm near Elwood, Indiana are operational and came into service in 2012. The two wind farms are located in areas with favourable wind regimes and combined, provide enough clean power for more than 120,000 households.

"This strategic investment provides a significant contribution to our growth targets in power generation," said Vern Yu, Senior Vice-President of Corporate Development for Enbridge. "The transaction extends our renewable platform in the U.S., complementing our existing wind farm presence in Texas and establishing Enbridge in the Indiana renewable market. E.ON is a global leader in renewables and we welcome the partnership with a company that is a safe, reliable and proven asset operator."

Enbridge has invested approximately \$3 billion in renewable energy assets over the past five years. Upon closing, the acquisition of these two wind farms will bring Enbridge's total net generating capacity of green power projects to more than 1,600 MW and helps position the Company to double existing capacity by 2018. The projects also further help Enbridge meet its Neutral Footprint commitment to generating a kilowatt hour of renewable energy for every additional kilowatt of energy consumed by its Liquids Pipelines business, a goal the Company is on track to meet by 2015.

Commenting on the deal, Eckhard Rummeler, CEO of E.ON Climate & Renewables, said: "Thanks to our excellent project portfolio and our capabilities there is a vital demand in the market for assets built and operated by E.ON. We are happy to have found a reliable partner in Enbridge, who shares our approach of combining high class assets and safe operations."

Under the terms of the agreement, E.ON will retain a 20 percent interest and remain the operator of the wind farms, demonstrating its ongoing commitment to the projects and the North American market. E.ON currently operates more than 2,700 MW of renewable capacity in the U.S. and is a leader in the American wind industry.

Completion of the transaction is subject to regulatory approvals.

REPORT STATES WORLD'S DOCUMENTED WIND POTENTIAL AT 95 TW

The Technical Committee of the World Wind Energy Association has published the first World Wind Resource Assessment Report. The report gives a comprehensive overview of currently available wind resources assessment from most world regions, as far as available. The total wind potential of the world, as identified by these existing studies, is 95 million MW, or 95 TW. The relation to the current global energy demand of around 100,000 TWh suggests that wind energy alone would be more than sufficient to cover the world's energy supply several times.

Dr. Jami Hossain, Chair of the WWEA Technical Committee: "In assessing the worldwide potential for wind energy, data and information has been accessed from varied but authentic sources such as national laboratories, research reports, peer reviewed scientific publications and industry associations. Interestingly, different methods and information sources have come up with numbers that are similar in order and magnitude for different parts of the world. Be it the wind energy potential for Germany,

US, Russia China or India or the entire world, the order of magnitude appears to be similar and one study corroborates the other. The report also presents a bird's eye view of the wind resource assessment practice."

"The new WWEA report underlines once more that there is no scarcity of energy on our planet. We can state that we have an abundance of wind alone, although some of the documented figures are still rather conservative," said Stefan Gsänger, WWEA Secretary General. "In addition to wind, also solar, hydro, geothermal and bioenergy can contribute a lot to mankind's energy supply hence a combination of renewable energies makes it even easier to satisfy the demand. Also in terms of cost, wind power can now beat today fossil and nuclear power. The main challenges are still in the need to change the energy market regulations all over the world so that this abundance can be used, for the benefit of human development, of the climate and the environment in general."

— Source: World Wind Energy Association

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DOE TAKES ON ENVIRONMENTAL REVIEW OF PLAINS & EASTERN TRANSMISSION PROJECT

Proposed 700-mile HVDC transmission line could carry up to 3,500 MW of renewable energy to the Mid South and Southeast

The U.S. Department of Energy has released for public review and comment the Draft Environmental Impact Statement (EIS) for the proposed Plains & Eastern Clean Line transmission line project. The Draft EIS describes the project, its purpose, and assesses its potential environmental impacts. Clean Line Energy (Clean Line) is developing the Plains & Eastern Clean Line, an approximately 700-mile overhead high voltage direct current (HVDC) transmission line and associated facilities capable of delivering more than 3,500 megawatts (MW) from renewable energy generation facilities in the Oklahoma Panhandle region to customers in Arkansas, Tennessee, and other areas in the Mid-South and Southeast. The proposed project includes converter stations at the endpoints of the HVDC line near Guymon, Oklahoma and Memphis, Tennessee. In addition, an intermediate delivery converter station that would have the capacity to deliver up to 500 MW of power has been proposed in central Arkansas. The Draft EIS identifies the proposed location of the direct current transmission line and other project facilities, and provides analysis of the potential environmental effects at these locations as well as alternatives. DOE is accepting public comments on the Draft EIS and will hold public meetings in January and February of 2015.

“The release of the Draft EIS marks an enormous step for the Plains & Eastern Clean Line project. After a multi-year process that involved input from thousands of stakeholders and a tremendous amount of analysis and thought, we are very pleased with the quality and depth of the information presented in the Draft EIS,” said Michael Skelly, President of Clean Line Energy. “We appreciate DOE’s consideration and independent review of the Plains & Eastern Clean Line and encourage stakeholders to continue to participate in the environmental review process.”

Prior to making a determination whether to participate in the proposed project, DOE, in consultation with the Southwestern Power Administration, must complete its evaluation of the proposed project, including reviewing the potential environmental impacts pursuant to the National Environmental Policy Act (NEPA). Other federal agencies, including the U.S. Fish and Wildlife

Service, the U.S. Army Corps of Engineers, and the Tennessee Valley Authority, are cooperating with DOE in the NEPA review. The project is not seeking federal funding.

Clean Line developed the proposed route for the direct current transmission line using a multi-step process that minimizes adverse impacts. Routing for the Plains & Eastern Clean Line involved an extensive review of existing conditions including the locations of homes and businesses, as well as cultural, historical and environmental resources. Clean Line adopted guidelines and criteria consistent with best practices for transmission line siting. Over the past several years, Clean Line received input regarding routes and other project locations from thousands of stakeholders, including landowners, local leaders, agencies, and conservation organizations in Arkansas, Oklahoma and Tennessee.

“We are pleased that the review process for the Plains & Eastern Clean Line project has passed this crucial stage so that Arkansas and other southeastern states are one step closer to having greater access to low-cost wind energy,” said Steve Patterson, Executive Director of Arkansas Advanced Energy Association. “We look forward to the continued progress of the environmental review process and appreciate the diligence involved with siting this project carefully and thoroughly.”

DOE will not make a decision regarding the project until it has completed the environmental review process. The release of the Draft EIS initiates a 90-day public comment period that is scheduled to conclude in March 2015. DOE will host 15 public meetings in Oklahoma, Arkansas, Tennessee, and Texas during January and February of 2015. Based on the current schedule, Clean Line anticipates that DOE would issue a Final EIS later in 2015, which will consider and respond to comments received regarding the Draft EIS. Clean Line expects DOE to identify a preferred route in the Final EIS.

Public input is a key component of the NEPA review process. Interested parties can learn more about the NEPA review process, view a copy of the Draft EIS, and learn how to participate in DOE’s comment process by visiting DOE’s Plains & Eastern EIS website at www.PlainsAndEasternEIS.com.



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REAL-TIME MONITORING OF BEARING CONDITIONS EMERGES

SKF introduces 'smart' bearing technology with integrated wireless sensors

At Hannover 2013, SKF unveiled a new and innovative technology that promised to revolutionise the way in which engineers use and interface with bearings. Called SKF Insight, this new technology integrated a miniature, self-powered and intelligent wireless sensor at the heart of the bearing. For the first time, this allowed engineers to monitor the operating conditions of a bearing from within a machine, in real time. As a result, bearing wear and potential failure could be planned and prevented, rather than simply being predicted, as was previously the case.

Now, 18 months later, the technology is under validation and is finding practical applications in a number of different market sectors. Before considering these in greater detail, let's first look back at what makes SKF Insight so revolutionary.

The Insight project was born from the fact that few bearings fail in service as a result of normal operating conditions. Indeed, most in-service failures result from misuse, neglect, lubrication problems or operating conditions that were unforeseen when the machine was first designed or the bearing originally specified.

Traditionally, condition monitoring looks for early signs of failure by measuring levels of vibration. Vibration signals are normally produced

when the first small fragments of steel begin to spall from the raceway surface of the rings or the rolling elements. By the time this damage reaches the stage where it can be detected using conventional sensors it is already too late, as the bearing has already suffered damage that affects its operating performance and life.

SKF engineers wondered what would happen if instead of using external monitoring devices, a bearing could detect the critical parameters affecting its immediate operating environment; and then to make this information instantly available via a wireless connection to the plant operator or machine manufacturer.

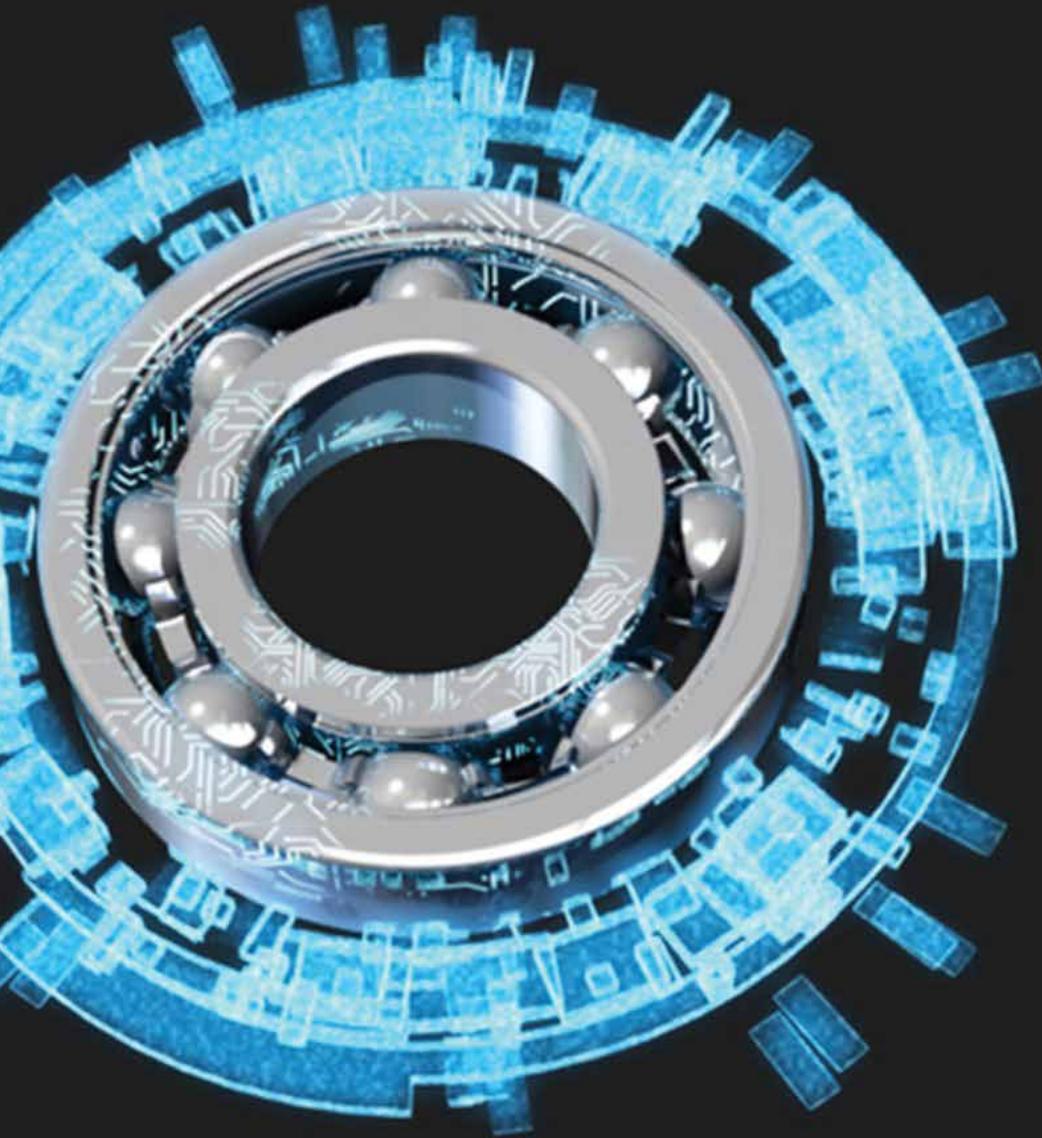
If operating conditions can be monitored in this way then potential damage can be prevented, or at least identified before it has an impact, with corrective actions being taken while machinery is working. This would ensure that expensive and disruptive failures are avoided, thereby reducing total cost of asset ownership and giving a much longer machine operating life.

The solution that has been developed uses miniature sensors and intelligent wireless components that are embedded in the bearing and draw their power from the application environment as the bearing rotates. The package is therefore completely self-contained; there

are no cables required for power or sensor output, and once installed the device operates autonomously.

The intelligent wireless communication technology inside the bearing enables it to be used in environments where traditional Wi-Fi cannot function properly. It also allows bearings to be configured in smart networks, which communicate via wireless gateways.





An SKF Insight bearing can monitor the applied load, the quality of lubrication, operating speed, temperature and vibration, and detect changes in the microstructure of the bearing steel, giving early warning signs before damage occurs at a macro-structural level. This data can then be broadcast via cloud servers either to a local operator, who can use a specialised app on a smart phone

or tablet, or to a remote monitoring centre. In each case, diagnostic tools interpret the data to establish fluctuations from optimum operating conditions, including excessive loads, duty excursions and lubricant contamination, so that modifications can immediately be made to the operating conditions by adding lubricant, mitigating transient overloads and so on.

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As the bearings are self-contained they can be used in applications where it has previously been impossible to embed sensors within the heart of a machine. Not only does this represent an important step forward in real time condition based maintenance, it also provides a far better understanding of the operating environment so that it may be possible, for example, for a machine to be uprated to extend its life or power rating beyond the initial specification.

One of the purposes of SKF Insight technology is to make condition monitoring more widely applicable and accessible, particularly in applications where it has been previously been considered impossible or impractical. This is one reason why the technology is in testing in challenging industries such as wind power, rail and steel manufacturing.

Wind farms can be remote and difficult to access. In some offshore applications, the cost of changing

a wind turbine main bearing can be so high that it undermines the business case for building the turbine in the first place. It therefore makes business sense to record loads and lubrication conditions in service and to take action to eliminate damaging conditions.

SKF is now working with customers to integrate SKF Insight technology and develop smart bearings for wind turbine monitoring. This allows dynamic bearing information to be measured in the true operating state and to be wirelessly communicated to remote monitoring centres, or to local maintenance crews. The solution currently under consideration can monitor bearing speed, vibration, temperature and lubrication and can be retro-fitted, thereby instantly enhancing the operational potential of tens of thousands of turbines around the world.

A similar solution is being developed for wheel end bearings used in

the rail sector. These are safety-critical components and are normally changed at set intervals regardless of condition. By fitting SKF Insight it becomes possible to create an extremely cost effective method of collecting condition monitoring data, so that bearing life, and thus change-out intervals, can be accurately determined based on actual rather than predicted operating conditions.

Intelligent bearing technology is opening up new dimensions, both in the field of condition based monitoring and in machine design, operation and life. Innovations such as SKF Insight are now providing for the first time the critical tools and data that engineers and business managers need to maximise the efficiency, productivity and profitability of their machine assets. ↗

— Source: SKF

NORVENTO'S nED100 REACHES MILESTONE FOR MEDIUM-SCALE WIND

100kW turbine makes history as the first of its size to certify under large wind standard



Medium-scale wind turbine manufacturer Norvento has completed the TÜV SÜD design evaluation process for its nED100 100kW turbine. In doing so it has set an industry benchmark for technical excellence by becoming the first company to achieve IEC 61400-1 certification for a turbine of this size.

The small and medium wind turbine industry has grown to play an integral role in many rural and industrial applications and is now of significant value to the UK economy. In this context, Norvento believes the industry has a duty to respond by setting quality standards on a par with those seen in other matured sectors. .

Furthermore, in light of the additional hurdles posed by planning, grid connection and tariff depression, it is becoming increasingly critical to learn lessons from the utility-scale wind sector by demonstrating a commitment to maintaining the highest possible technical and operational standards.

Nevertheless, while carrying out design assessment is standard practice for multi-megawatt turbines, medium turbine manufacturers have not typically dedicated the required time and resources to the procedure. Ultimately, this may leave turbine owners and

landowners vulnerable to unanticipated performance issues in the long-term.

The TÜV SÜD Design Evaluation of nED100 is, therefore, a key quality-assurance milestone for the turbine, which is the product of a five-year research and development program that commenced in 2008, and has been in operation since 2011.

During the extensive two-year certification process, TÜV SÜD validated every single system and component of nED100. The turbine underwent the simulation of 1000 unique loads, covering every eventuality likely to occur during day-to-day operation. The data accumulated during this process was then used to verify the structural strength and lifetime of each component.

This technical testing was accompanied by a stringent safety validation, which analysed the potential effects of a wide range of internal and external conditions and resulted in a detailed calculation of the safety levels of the system as a whole, based on the performance of each individual component. The lightning protection system was validated to the same standard required for utility-scale wind turbines.

Finally, all installation, commissioning and maintenance manuals were revised according to international standards.

In carrying out this process, TÜV SÜD verified that the turbine was in compliance with the latest safety and engineering standards. In December, Norvento was issued with a Provisional Statement of Compliance, confirming this achievement.

The design evaluation complements recent testing by other accredited entities validating the electrical safety, the electromagnetic compatibility and the power quality of nED100, and will be followed by further field and bench tests to certify the power curve, load measurement and structural properties of the blade.

“While power curve certification is undertaken for some of the most recognized medium wind turbines, the IEC 61400-1 design evaluation sets a standard far beyond the usual level,” said Miguel Hoyos, technical director for Norvento.

“nED100 boasts design quality, safety and reliability equivalent to modern large-scale wind turbines, underlining our unrivalled commitment to engineering excellence and setting a benchmark for the improvement of standards throughout the UK and European distributed wind sectors.”

“The design evaluation is essential to ensure the safety and durability of wind turbines during their whole life cycle,” added Alexander Trunz, Head of Department, Wind Turbines at TÜV SÜD.

“With our provisional statement of compliance we confirm that the design of the wind turbine nED100 meets the requirements of IEC 61400-1. The same standard is applied to the assessment of large, multi-megawatt turbines.

For more information, please visit www.norvento.com

BLADE DYNAMICS AWARDED FUNDING FOR OFFSHORE BLADE DEVELOPMENT

‘Advanced Blade Tip’ design project aims to improve leading edge durability and increase energy yield



Blade Dynamics announces today the award of Process Technology Innovation Funding under the GROW:OffshoreWind program for a £1m Advanced Blade Tip development project, due for completion in Q2 2015.

The performance of offshore wind turbine blades in their challenging operating environment is one of the critical issues in energy cost, reliability and safety. Costs associated with repairing blades are extremely high and time consuming, causing significant operating losses due to downtime and having a significant detrimental effect on the cost of energy generated.

Blade Dynamics have created a new and highly innovative ‘Advanced Blade Tip’, which improves the critical outer third of a wind turbine blade. This high performance tip is designed to integrate into standard wind turbine blades, creating a ‘hybrid blade’ that upgrades performance whilst using existing manufacturing infrastructure. It features built-in leading edge erosion protection, has a highly accurate aerodynamic profile to enhance energy generation,

is lightweight to reduce turbine loads and to allow blades to be extended in length and has an innovative lightning protection system. The Advanced Blade Tip both enhances the performance of offshore wind turbines, increasing Annual Energy Production (AEP), and reduces costs incurred through expensive downtime due to blade deterioration and the current need for frequent maintenance.

The project will refine, demonstrate and test the manufacturing technologies used in the tip solution as well as optimise the design of the interface between the tip and the rest of the blade.

“This is an exciting new technology development that can substantially reduce the long term cost of energy from offshore wind turbines and the company is proud and thankful to be supported by GROW:OffshoreWind in this work,” said Theo Botha, co-founder of Blade Dynamics.

“The project is a great example of funding being provided for technologies that can have a substantial positive impact on the British economy and environment by nur-



turing sustainable, knowledge based, domestic manufacturing in the vitally important offshore wind energy sector.”

Botha went on to explain that

“The outer portion of a blade produces most of the energy and the technology allows these high value blade tips to be exported from the UK and deployed on offshore wind

turbines globally as well as in the domestic market.”

Regarding the funding, Dominic Brown, CEO of GROW:Offshore-Wind said:

“We are delighted to support Blade Dynamics in making these important technology innovations for offshore wind turbine blades. The successful delivery of this project will provide a route for substantial financial benefits to both the purchasers of wind turbines and manufacturers, through increased blade life and significantly reduced maintenance costs, as well as a reduction in the cost of energy from offshore wind farms.”

— Source: *Blade Dynamics*

TURBINE BLADE SANDING APPLICATION BORROWS FROM AEROSPACE INDUSTRY



Growing demand for wind power creates production demand that wind blade manufacturers can address by increasing capacity in one of three ways: 1) Hire more people; 2) Build another factory and hire more people; or 3) boost productivity with current people and facilities. The last of these is worth our focus because it holds the most promise of boosting productivity with the least disruption and at the lowest cost. When discussing productivity challenges associated with large composite surfaces like wind turbine blades, sanding is one of the major issues crying out for improvement because each blade is so large, and the whole surface typically has to be sanded twice before final paint.

Some of the smartest investments in technology start by asking what other markets — in this case other composite-intensive markets like aerospace and marine — have prov-

en works well to address the same problem. One aerospace technology now available to improve wind blade finishing operations was born at Boeing more than ten years ago, and is currently deployed by almost every major aerospace manufacturer — EMMA™ Sanding Systems from Temple Allen Industries.

EMMA was created in 2003 focused on the needs of the upcoming 787 program to prepare composite surfaces prior to the application of final paint. A major driving force behind the development of EMMA was the poor ergonomics of manual sanding. Humans are simply not built to wield a heavy vibrating tool for an eight-hour shift, particularly out in front of the worker or over their head. With EMMA, workers stand comfortably and wield a joystick, and the EMMA Arm applies a consistent force against the surface to be sanded while the End Effec-

tor — deploying virtually any desired sanding or grinding tool — keeps the abrasive disc flat on the surface minimizing dust exposure and maximizing finish quality. Particulates are routed into a disposable 3M Clean Sanding Filter Bag, keeping the workplace clean.

For Wind Turbine Blade surface finishing operations, the EMMA configuration getting the most traction is their Telescoping Stand System (EMMA TSS). For times when the blade is held vertically or diagonally, the TSS configuration allows operators to conduct edge grinding or full surface abrasion, from near ground level to about 10' high.

The first EMMA installation was in the 737 Rudder Shop in Renton, Washington where they conducted sanding operations that were known to put workers at risk of injury. Since EMMA was installed, there have been no process-related injuries, and

workers injured while working elsewhere in the facility have sometimes been reassigned to the Rudder Shop in order to heal. Process time for each sanding step has also been reduced. In addition to the health and safety gains, the EMMA-equipped shop was able to seamlessly accommodate Boeing's regular rate increases for the 737 program — which is now building more than 40 aircraft a month, up from approximately 18 a month the year EMMA was installed.

Management considerations of new technology always include questions about implementation. Unlike full-automation initiatives (e.g. installing robots) which often require shutting down a process line for days or weeks and require significant facility modifications, EMMA rolls out onto the factory floor, plugs into an air line, and is ready to go to work, and an operator can be fully trained in a matter of hours.

As capital equipment, EMMA TSS units are particularly flexible — nothing is bolted to the floor and EMMA can simply roll from one process line to another as required. They are also dramatically less expensive than robots configured for surface treatment operations.

For more information, visit Temple Allen Industries online at www.templeallen.com, or call (301) 541-3662. ↵

— Source: Temple Allen

AWS TRUEPOWER ADDS TO WIND ENERGY TECHNOLOGY PORTFOLIO WITH ACQUISITION OF WINDOGRAPHER SOFTWARE

Agreement reinforces AWS Truepower's strategic focus on providing integrated analysis and development tools to serve the global wind industry

Continuing its strategy of creating and delivering exceptional wind analysis and development tools, AWS Truepower, LLC, an international leader in renewable energy consulting and information services, has purchased the Windographer software from Mistaya Engineering, Inc.

Windographer is the market-leading software for analyzing, visualizing, and validating wind resource data from meteorological towers and remote sensing systems. These data are fundamental to accurately estimating the amount of energy that will be produced by wind projects.

Windographer complements AWS Truepower's suite of wind analysis and development tools, which include the wind project design and optimization software Openwind® Enterprise, and the web-based Wind Site Assessment and Wind Data Management dashboards. Tom Lambert, previously CEO of Mistaya and chief architect of Windographer, will lead the Windographer team from AWS Truepower Canada, a new subsidiary based in Calgary, Alberta.

"Windographer's success in the market reflects the innovation and passion of Tom and his team," said Bruce Bailey, CEO of AWS Truepower. "They have created an elegant and useful product for the wind industry, and we are happy that they are joining us to continue to expand its development as part of AWS Truepower."

Michael Brower, President and Chief Technical Officer at AWS Truepower added, "With Windographer joining AWS Truepower, we will be able to provide the

full range of wind software, online services, and data to our customers, who will benefit from more powerful tools and greater cross-platform integration and compatibility. At the same time, existing Windographer users will see continuity and growth in the product they already value."

"The Windographer team is thrilled to be joining AWS Truepower," said Tom Lambert. "The vision AWST has for their software suite aligns very well with ours, and their expertise will allow us to advance Windographer farther and faster than we could on our own."

"It makes sense to all of us as a natural progression in building a world-class suite of wind development tools," he added.

With the closing of AWS Truepower's acquisition of Windographer software on November 28, 2014, AWS Truepower will provide the wind industry's most comprehensive portfolio of advanced wind monitoring and modeling software tools.

AWS Truepower provides renewable energy project development, engineering and operations solutions.

Energy developers, investors, utilities, system operators, and governments rely on the company's 30 years of experience, expertise and technology to reduce uncertainty, mitigate risk, and maximize return on their investments. AWS Truepower's suite of consulting and engineering services, software, maps, and data products support the complete wind and solar project development lifecycle.

— Source: AWS Truepower

WINDLAB UTILIZING VAISALA'S TRITON REMOTE SENSING EQUIPMENT IN SOUTH AFRICAN SITE SELECTION



Vaisala, global leader in environmental and industrial measurement, has announced that wind energy developer, Windlab, is using the Vaisala Triton Sonic Wind Profiler, a ground based remote sensing system, to assist with ongoing and critical site selection work in Africa.

With the continent registering a boom in renewable energy deployment in a number of countries, and South Africa in particular working to reduce its dependence on coal fired power plants, developers must quickly and efficiently make key site selection decisions for development.

The Vaisala Triton can be used either in locations where meteorological masts might be inappropriate or difficult to install, or used in conjunction with these

masts to identify site suitability issues and gain a more detailed assessment of a project's resource potential. Tritons are also able to operate autonomously, powered in most cases by on-board solar panels, enabling them to be used in remote areas with no access to the power grid.

These capabilities allow Vaisala to better assist developers and investors in unlocking growth in emerging markets, and gain improved perspectives on project risk.

Having previous experience using the Vaisala Triton in its global operations, Windlab clearly understood the strategic advantage of deploying them in a market like South Africa. Several potential sites were initially identified in the region through early stage wind modeling. However,

in order to finalize development and investment decisions, it was necessary to characterize the wind profile of these sites in more detail, gather wind measurement data over large distances, and monitor multiple locations simultaneously. For this the Tritons were invaluable.

“Our Triton equipment has proven time and again to have the versatility needed for emerging markets,” said Lee Alnes, Key Account Manager at Vaisala. “Working with Windlab in South Africa to assist the firm in reaching its development targets, we’ve demonstrated that Tritons offer an efficient way to open up new clean energy markets.”

Shane Quinnell, Project Engineer, Windlab, added, “The Vaisala Triton was instrumental in streamlining our site selection process, quickly enabling us to select the best and highest performing project sites in South Africa.”

“By placing the Tritons we own in strategic locations at each prospective site, we gained a strong understanding of potential site performance, while eliminating the cost and consenting challenges typically associated with meteorological masts,” he said.

“As a direct result, and coupled with the fact that we can deploy the equipment in rugged and remote locations, we intend to continue using Vaisala Tritons and technical support in the future.”

— Source: Vaisala 

LEEDCo LAUNCHES ENGINEERING AND DESIGN EFFORT FOR OFFSHORE TURBINE FOUNDATIONS

Project aims to solve facilitate fabrication of monopiles in the U.S.

The Lake Erie Energy Development Corporation (LEEDCo) recently announced that it is leading an international engineering team to design an offshore wind turbine foundation optimized for fabrication in the United States. The design will catalyze domestic manufacturing growth by removing barriers to entry faced by U.S.-based steel fabricators that want to supply foundations for the offshore wind industry.

LEEDCo developed the conceptual design of the foundation system last year through a U.S. Department of Energy (DOE) competition. A new DOE award of \$2.8 million was finalized today to complete the detailed engineering.

“This will be the first monopile foundation designed from the ground up to be built by American companies and installed in American waters,” said Dr. Lorry Wagner, President of LEEDCo. “Monopiles have proven to be the most cost-effective solution for the vast majority of offshore wind projects in the world. This design will enable American fabricators to compete against their European counterparts that already have decades of experience in this industry.”

LEEDCo has partnered with GLWN, a leading wind industry supply chain adviser, to engage local and regional fabricators. GLWN is an initiative of WIRE-Net, a Cleveland-based manufacturing support organization. With their help, LEEDCo selected American Tank & Fabricating (AT&F), a Cleveland-based steel fabricator, as a partner to represent U.S. fabricators during the design process. AT&F is the leader among several U.S. companies with the sophistication necessary to fabricate monopiles of the scale and complexity needed for use in the offshore wind industry.

“AT&F has over 70 years of experience providing quality steel products, and we are excited about the opportunity to extend our expertise for use in the offshore wind industry,” said AT&F CEO Michael Ripich. “Offshore wind in Lake Erie has huge potential, and we look forward to collaborating with LEEDCo on this project. Bringing manufacturers on board at this early stage is the best way to develop the most cost-effective design.”

LEEDCo will work with several other key project partners. A team at Case Western Reserve University led by Professor David Zeng, Chair of the Department of Civil Engineering, will conduct laboratory testing to validate the design; Offshore Design Engineering, a U.K.-based company that has designed and installed several European offshore wind projects, will lead the detailed engineering of the foundation; the Cold Regions Research and Engineering Laboratory, located in Hanover New Hampshire and part of the U.S. Army Corps of Engineers’ Engineer Research and Development Center, will characterize ice formations in Lake Erie to inform the loads analysis; Sound and Sea Technology, an ocean engineering firm based in Lynnwood, Washington, will perform geophysical and geotechnical analysis.

The foundation design will be used first for LEEDCo’s Project Icebreaker, a six-turbine offshore wind demonstration project planned for the Ohio waters of Lake Erie seven miles north of downtown Cleveland. The design team will collaborate closely with Fred. Olsen Windcarrier, LEEDCo’s key partner for developing an installation strategy for offshore wind the Great Lakes.

Cleveland Mayor Frank G. Jackson and Cleveland Foundation President and CEO Ronn Richard, longtime supporters of the Icebreaker project, voiced their enthusiasm for this latest development.

Mayor Jackson said, “The Department of Energy’s further support of Project Icebreaker will provide the initiative with continued momentum to create a freshwater wind industry built upon our current economic assets. The transition to a clean, renewable energy economy is a key part of my Sustainable Cleveland initiative.”

Mr. Richard, who also chairs LEEDCo’s board, said, “This engineering initiative is hugely exciting because it is one more step on the path to creating a new advanced energy economy in Greater Cleveland. Building offshore wind projects in Lake Erie sets our region on a path to creating jobs and protecting one of our country’s most important freshwater resources.”



2015 TURBINE DIRECTORY

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GE CHOSEN TO SUPPLY TURBINES FOR WIND PROJECT IN POLAND

GE announced that it will supply Lewandpol Company with 27 GE 2.5-103 wind turbines for the Galicja Wind Farm in Poland. Ten of the wind turbines are currently under construction, with another 17 planned to begin construction in 2015. Once operational, the 120 MW Galicja Wind Farm will generate the equivalent energy needed to power approximately 52,000 Polish homes for a year.

Galicja is GE's first wind farm in the southern Polish region of Podkarpackie and will be one of the country's largest wind farms.

"GE's wind turbines are well suited to our sites," said Andrzej Lewandowski of Lewandpol Company. "Foundation works started beginning of December and we are pleased to be working closely with GE as construction at the site progresses."

Crido Legal operated with the Lewandpol Company as

the legal and financial advisor for the transaction. "We are very excited that we provided our extensive knowledge and experience in the purchasing phases and make such a relevant investment possible," said Filip Grzesiak, senior associate, Crido Legal, the legal firm advising Lewandpol Company.

"We are delighted that Lewandpol Company has chosen GE wind turbine technology," said Cliff Harris, general manager for Africa, Europe, and the Middle East for GE's renewable energy business. "This agreement highlights our commitment to Poland's wind energy development."

In 2013, Poland installed 894 MW of new wind capacity, ranking the country eighth highest in the world in terms of annual wind capacity growth, according to the GWEC's Global wind report. At the end of 2013, Poland's total installed capacity was 3.4 gigawatts

(GW), nearly half of the of the 6.5 GW wind target by 2020, as defined in its National Renewable Energy Action Plan. Under its current energy policy, the Polish government forecasts additional wind growth reaching up to 13 GW by 2030 and 21 GW by 2050.

"GE is excited to help our customers in Poland work toward its goals for renewable energy growth in the country," said Beata Stelmach, GE chief executive for Poland and the Baltics. "With an increasing electricity demand at 0.9 percent per year and aging power infrastructure, Poland needs to invest in modern, low-emission energy sources, and it has huge potential for wind energy."

GE will ship the turbines from its manufacturing facility in Salzbergen, Germany, and the wind farm is expected to begin commercial operation by the end of 2015.



Photo: GE Energy

GE					
	1.7-100 / 103	1.85-82.5 / 87	2.3-107	2.75-120	3.2-103
Rated Power (kW)	1,700	1,850	2,300	2750	3200
Wind Class (IEC)	IIIs	IIs	IIs	IIIs	IIb
Rotor Diameter (m)	100 / 103	82.5 / 87	107	120	103
Hub Height (m)	80, 96 / 80	80, 65, 100 (1.6MW)/ 80	80	85, 110; 139 (hybrid)	70 - 98
Swept Area (m ²)	7,854 / 8,332	5,346 / 5,945	8,902	11,310	8,332
Generator Type	DFIG				
Rated Voltage (V)	50/60				50
Drivetrain	Gearbox				

VESTAS

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VESTAS 2MW PLATFORM						
	V100-2.0 MW	V90-1.8/2.0 MW		V100-1.8/2.0 MW		V110-2.0MW
Variant/application		1.8 MW	2.0 MW	1.8 MW	2.0 MW	
Rated Power (kW)	2,000	1,800 (50 Hz); 1,815 (60 Hz)	2,000 (50 Hz)	1,800 (50 Hz)	2,000 (60 Hz)	2,000
Wind Class (IEC)	Ia	IIa	IIIa	S (IIIa average wind/ IIa extreme wind); IIb		IIIa
Cut-in Wind Speed (m/s)	3	4		3		
Cut-out Wind Speed (m/s)	22	25		20		
Rotor Diameter (m)	80	90		100		110
Hub Height (m)	80, 95, 120 (IIb)	80, 95, 105 (50 Hz)	80, 95, 105, 125	80, 95, 120 (IIIa)		95, 125 (50Hz); 80, 95 (60 Hz)
Swept Area (m ²)	7,854	6,362		7,854		9,503
Generator Type	4-pole (50Hz)/6-pole (60Hz) doubly fed generator, slip rings					
Rated Voltage (V)						
Drivetrain	gearbox; 2 helical stages and one planetary stage					

VESTAS 3MW PLATFORM					
	V105-3.3 MW	V112-3.3 MW		V117-3.3 MW	V126-3.3MW
Variant/application		IIa	IIb		
Rated Power (kW)	3,300				
Wind Class (IEC)	Ia	IIa	IIb	IIa	IIIa
Cut-in Wind Speed (m/s)	3, 23 (re-cut in)				3, 20 (re-cut in)
Cut-out Wind Speed (m/s)	25				22.5
Rotor Diameter (m)	105	112		117	126
Hub Height (m)	site specific	84, 94 (IEC IIa); 119, 140 (IIIa)	site specific	91.5, 116.5	117 (IIIb); 137 (IIIa)
Swept Area (m ²)	8,659	9,852		10,751	12,469
Generator Type					
Rated Voltage (V)					
Drivetrain	gearbox, two planetary stages and one helical stage				

MITSUBISHI

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mitsubishi-power-systems-americas

MITSUBISHI WIND TURBINE MODELS					
	MWT62/1.0	MWT92/2.4	MWT95/2.4	MWT100/2.4	MWT102/2.4
Rated Power (kW)	1,000	2,400			
Wind Class (IEC)	IIa				
Rotor Diameter (m)	61.4	92	95	100	102
Hub Height (m)	50, 60, 69	80			
Swept Area (m ²)	2,960	6,648	7,088	7,854	8,171
Generator Type	Induction generator (4-pole)	Doubly fed asynchronous generator + IGBT converter			
Rated Voltage (V)	690 (50Hz), 600 (60Hz)	690			
Drivetrain					

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Photo: MHI Vestas Offshore

MHI VESTAS		
	V112-3.3 MW	V164-8.0 MW
Rated Power (kW)	3,300	8,000
Wind Class (IEC)	Ib / IIa	S
Rotor Diameter (m)	112	164
Hub Height (m)	84 -140; Site specific	Site specific
Swept Area (m ²)	9,852	21,124
Generator Type		permanent magnet
Rated Voltage (kV)		33-35 or 66
Drivetrain	Gearbox	

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D3 (DIRECT DRIVE)							
	SWT-3.0-101	SWT-3.2-101	SWT-3.0-108	SWT-3.2-108	SWT-3.0-113	SWT-3.2-113	SWT-3.3-130
Rated Power (kW)	3,000	3,200	3,000	3,200	3,000	3,200	3,300
Wind Class (IEC)	Ia				IIa		
Rotor Diameter (m)	101		108		113		130
Hub Height (m)	74.5 - 99.5		79.5		79.5 - 142		
Swept Area (m ²)	8,000		9,144		10,000		13,300
Generator Type	Synchronous, permanent magnet						
Rated Voltage (V)	690						
Drivetrain	Direct drive						

D6 (DIRECT DRIVE OFFSHORE)	
	SWT-6.0-154
Rated Power (kW)	6,000
Wind Class (IEC)	Ia
Rotor Diameter (m)	154
Hub Height (m)	Site-specific
Swept Area (m ²)	18,600
Generator Type	Synchronous permanent magnet
Rated Voltage (V)	690
Drivetrain	Direct drive

G2 (GEARED)		
	SWT-2.3-101	SWT-2.3-108
Rated Power (kW)	2,300	
Wind Class (IEC)	IIb	
Rotor Diameter (m)	101	108
Hub Height (m)	Site specific	
Swept Area (m ²)	8,000	9,150
Generator Type	Asynchronous	
Rated Voltage (V)	690	
Drivetrain	3-stage planetary/helical gearbox	

G4 (GEARED OFFSHORE)			
	SWT-3.6-120	SWT-4.0-120	SWT-4.0-130
Rated Power (kW)	3,600	4,000	
Wind Class (IEC)	Ia		Ib
Rotor Diameter (m)	120		130
Hub Height (m)	Site-specific		
Swept Area (m ²)	11,300		13,300
Generator Type	Asynchronous		
Rated Voltage (V)	690		
Drivetrain	3-stage planetary/helical gearbox		

GOLDWIND

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GW 2.5MW			
	GW 100	GW 109	GW121
Rated Power (kW)	2,500		
Wind Class (IEC)	IIIa	IIa / IIIa	IIIb
Rotor Diameter (m)	100	109	121
Hub Height (m)	Site specific		
Swept Area (m ²)	7,823	9,516	11,595
Generator Type	Permanent Magnet Direct Drive Synchronous Generator		
Generator Output (V)	690		
Drivetrain	Direct Drive		

GW 1.5MW				
	GW 70	GW 77	GW 82	GW 87
Rated Power (kW)	1,500			
Wind Class (IEC)	Ia	IIa	IIIa	IIb
Rotor Diameter (m)	70	77	82	87
Hub Height (m)	Site specific			
Swept Area (m ²)	3,886	4,649	5,325	5,890
Generator Type	Permanent Magnet Direct Drive Synchronous Generator			
Generator Output (V)	620 (air-cooled) or 690 (water-cooled)			
Drivetrain	Direct drive			

SIEMENS RELEASES ENVIRONMENTAL PRODUCT DECLARATIONS ON TURBINE PORTFOLIOS

Siemens Wind Power and Renewables has published four new Environmental Product Declaration (EPD) brochures, each representing one of the company's four product platforms, covering both geared and direct drive wind turbines for offshore and onshore projects. The figures are based on Life Cycle Assessments (LCA) of four defined wind power projects—two offshore wind plants with 80 wind turbines and two onshore wind projects with 20 wind turbines. The new brochures offer valuable figures of the environmental performance of Siemens' products. Central to LCA is the energy payback time calculation. This is the length of time the wind power plant has to operate in order to produce as much energy as it will consume during its entire lifecycle. In an onshore wind power plant with an average wind speed of 8.5 meters per second, the energy payback time of a Siemens SWT-3.2-113 wind turbine is 4.5 months.

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 SuzlonGroup

SUZLON							
	S52	S66 MARK II	S82	S88	S95	S97	
Rated Power (kW)	600	1,250	1,500	2,100			
Wind Class (IEC)	IIa	IIIa	IIIa	IIa	IIa	IIIa	IIb
Rotor Diameter (m)	52	66	82	88	95	97	
Hub Height (m)	75	74.5	76.8	80,100	80, 90, 100	80, 90, 100, 120	90
Swept Area (m ²)	2,124	3,421	5,281	6,082	7,085	7,386	
Generator Type	Single speed induction generator	Dual speed induction generator	Induction generator with slip rings, variable rotor resistances		Asynchronous 3-phase induction generator (DFIG)		
Rated Voltage (V)	690						
Drivetrain	Gearbox, one planetary stage and two helical stages						

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AW1500			
	AW 70	AW 77	AW 82
Rated Power (kW)	1,500		
Wind Class (IEC)	Ia	IIa+	IIa
Cut-in Wind Speed (m/s)	4	3.5	3
Cut-out Wind Speed (m/s)	25		
Rotor Diameter (m)	70	77	82
Hub Height (m)	60, 80 (steel)	60, 71.5, 80 (steel); 100 (concrete)	80 (steel)
Swept Area (m ²)	3,848	4,657	5,289
Generator Type	6 poles, double feeding		
Generator Output (V)	12,000		
Drivetrain	3-stage gearbox: 1 planetary, 2 parallel (helical)		

AW3000				
	AW 100	AW 109	AW 116	AW 125
Rated Power (kW)	3,000			
Wind Class (IEC)	Ia	IIa+	IIa	IIIa
Cut-in Wind Speed (m/s)	4	3.5	3	3.5
Cut-out Wind Speed (m/s)	25			
Rotor Diameter (m)	100	109	116	125
Hub Height (m)	100 (concrete)	95.5 (steel); 100 (concrete)	92, 120 (steel); 100, 120 (concrete)	87.5, 120 (steel); 120 (concrete)
Swept Area (m ²)	7,864	9,360	10,568	12,305
Generator Type	6 poles, double feeding			
Generator Output (V)	12,000			
Drivetrain	3-stage gearbox: 2 planetary, 1 parallel (helical)			

NORDEX

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NORDEX GENERATION GAMMA			
	N90/2500	N100/2500	N117/2400
Rated Power (kW)	2,500		2,400
Wind Class (IEC)	Ia	IIa	IIIa
Cut-in Wind Speed (m/s)	3		
Cut-out Wind Speed (m/s)	25		20
Rotor Diameter (m)	90	99.8	116.8
Hub Height (m)	65, 70, 80	75, 80, 100	91, 120, 141
Swept Area (m ²)	6,362	7,823	10,715
Generator Type	Double-fed asynchronous		
Generator Output (V)	660		
Drivetrain	Combined spur/planetary gear or differential gearbox		

NORDEX GENERATION DELTA			
	N100/3300	N117/3000	N131/3000
Rated Power (kW)	3,300	3,000	
Wind Class (IEC)	Ia	IIa / IIIa (141m)	IIIa
Cut-in Wind Speed (m/s)	3.5	3	
Cut-out Wind Speed (m/s)	25		20
Rotor Diameter (m)	99.8	116.8	131
Hub Height (m)	75, 85, 100	91, 120, 141	99, 114
Swept Area (m ²)	7,823	10,715	13,478
Generator Type	Doubly-fed asynchronous		
Generator Output (V)	660		
Drivetrain	Combined spur/planetary gear		



GAMESA

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GAMESA 5.0 MW CLASS					
	G128			G132	
	ONSHORE		OFFSHORE	ONSHORE	OFFSHORE
Rated Power (kW)	4,500	5,000			
Wind Class (IEC)	IIa	Ia / IIa	B	IIa	
Rotor Diameter (m)	62.5			64.5	
Hub Height (m)	81, 95, 120, 140		80-94; also project-specific	95, 120, 140	Project specific
Swept Area (m ²)	12,868			13,685	
Generator Type	Permanent magnet synchronous generator with independent modules in parallel				
Generator Output (V)	690				
Drivetrain	Gearbox; 2 planetary stages				

GAMESA 850 kW CLASS		
	G52	G58
Rated Power (kW)	850	
Wind Class (IEC)	Ia	IIa / IIIb
Rotor Diameter (m)	52	58
Hub Height (m)	44, 55, 65	44, 49, 55, 65, 74
Swept Area (m ²)	2,214	2,642
Generator Type	Dual power fed	
Generator Output (V)	690	
Drivetrain	3 stage gearbox: 1 planetary, 2 parallel	

GAMESA 2.0-2.5 MW CLASS							
	G80	G87	G90	G97	G106	G114	
Rated Power (kW)	2,000				2,500	2,000	2,500
Wind Class (IEC)	Ia	Ia, IIa	Ia, IIa	IIa, IIIa	Ia	IIa, IIIa	IIa
Rotor Diameter (m)	80	87	90	97	106	114	
Hub Height (m)	60, 67, 78, 100	67, 78, 90, 100	67, 78, 90, 100	78, 90, 100, 120	72, 80, 93, site specific	80, 93, 125, site-specific	93, 120, 140, site-specific
Swept Area (m ²)	5,027	5,945	6,362	7,390	8,825	10,207	
Generator Type	Doubly-fed machine						
Generator Output (V)	690						
Drivetrain	1 planetary, 2 parallel stages					2 planetary, 1 parallel stages	

MM PLATFORM			
	MM82	MM92	MM100
Rated Power (kW)	2,050		1,800 / 2,000 (50Hz)
Wind Class (IEC)	up to Ia	up to Ib	S (IIIa annual; IIa extreme)
Cut-in Wind Speed (m/s)	3.5	3	
Cut-out Wind Speed (m/s)	25	24	22
Rotor Diameter (m)	82	92.5	100
Hub Height (m)	59, 69, 80, 100	68.5, 80, 100	80, 100
Swept Area (m ²)	5,281	6,720	7,854
Generator Type	Double-fed asynchronous; 4-pole (50 Hz, 6-pole (60 Hz)		
Rated Voltage (V)	690 (50 Hz); 575 (60 Hz)		
Drivetrain	Combined planetary/spur wheel gearbox		

3.XM PLATFORM				
	3.0M122	3.2M114	3.4M104	3.4M114
Rated Power (kW)	2,970 (MV-side), 3,000 (LV-side)	3,170 (MV-side), 3,200 (LV-side)	3,370 (MV-side), 3,400 (LV-side)	
Wind Class (IEC)	IIIa	up to IIIa	up to Ib / IIa	IIa / III a
Cut-in Wind Speed (m/s)	3		3.5	3
Cut-out Wind Speed (m/s)	22		25	22
Rotor Diameter (m)	122	114	104	114
Hub Height (m)	139	90-93; 120-123; 140-143	78-80; 93; 96.5-100; 125-128	90-93; 119-123; 140-143
Swept Area (m ²)	11,690	10,207	8,495	10,207
Generator Type	Asynchronous doubly-fed generator			
Rated Voltage	10/20/30 kV			
Drivetrain	Three stage planetary/spur-gear system			

6.XM PLATFORM		
	6.2M126	6.2M152
Rated Power (kW)	6,150	
Wind Class (IEC)	Ib (offshore); Ib, IIa (onshore)	S (offshore); Ib (onshore)
Cut-in Wind Speed (m/s)	3.5	
Cut-out Wind Speed (m/s)	25 (onshore); 30 (offshore)	
Rotor Diameter (m)	126	152
Hub Height (m)	100-117 onshore; appr. 85-95 offshore (location-dependent)	121, 124 onshore; appr. 95-110 offshore (location dependent)
Swept Area (m ²)	12,469	18,146
Generator Type	Double-fed induction	
Rated Voltage (kV)	20, 30, 33	20, 30, 33, 66 (upon request)
Drivetrain	Three-stage planetary/spur gearbox	

CONSTRUCTION

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

CREW OVERCOMES TERRAIN CHALLENGES AT TURBINE INSTALL



“From the factory to the work site – putting a crane to work can’t get any faster than that,” said Frank Stempel, who is responsible for the large cranes operated by Berlin-based crane service provider Mobi-Hub. His comment refers to the company’s new Terex® CC

2800-1crawler crane, which was taken directly from the manufacturer’s facilities in Zweibrücken to a work site near Koblenz, Germany in order to erect an ENERCON wind turbine.

While the crane was on its way from Zweibrücken to the

Rhineland, 31 heavy haulage vehicles were also traveling from Berlin to the work site, carrying all the components that would be required for the project. A series of challenges awaited the team at the site: The space available there was extremely limited because the

wind turbine was being erected right in the middle of a forest and the path that had been cleared for the vehicles was relatively narrow. In addition the crane's boom, which had a total length of 492 feet, had to be assembled on sloping terrain. This also proved to be challenging for the assist crane required for the assembly operation, as it could not be placed just anywhere on the steep terrain. "On top of that, we had to use the suspended superlift tray with a weight of 358 tons when erecting the boom," says Frank Stempel when describing an additional challenge that the team faced at the tight work site. Despite all this, the team was able to set up the crane with six assembly technicians and have it ready to go in only two days. The crane's ease of assembly made it possible to quickly set up the machine despite the series of adverse circumstances. Moreover, the Mobi-Hub team was assisted by Terex service technicians while setting up the crane, as it was the first time the company was using the crane model.

SUCCESSFUL DEBUT

"It was a sheer stroke of luck that we were able to pick up the CC 2800-1 crane in Zweibrücken right when we needed it, as it definitely proved to be the perfect machine for the job," says Frank Stempel. This was not only because the Terex crane had the required lifting capacity, but also because it is able to move while under load. In addition, its extraordinary maneuverability and precise controls also proved to be tremendously useful.

The CC 2800-1 crawler crane was set up with a 452.7-foot S7 boom, a 39.3-foot fixed jib offset by 10 degrees, and 198 US tons of counterweight, ensuring that it would be optimally configured



for the task at hand. This configuration enabled it to safely handle the three main lifts required to erect the wind turbine, which had a hub height of 130 meters, while working with working radii of 20 to 22 meters. The team estimated a total of three days for the work: On the first day, The CC 2800-1 crawler crane lifted the 52.9-ton

nacelle and the generator, which was the heaviest wind turbine component at a weight of 78.3 tons. On the second day, the rotor, weighing about 75 tons), was assembled on the ground so that it could be lifted on time on the third. This required the crane to move towards the wind turbine, with the load already rigged, on



an extra gravel path that had already been laid earlier. “The CC 2800-1 did an extraordinary job all throughout and proved that we could not have made a better decision. Not only because of the crane itself, but also because our experience with Terex has shown that we can always count on them for fast and reliable service,” Frank Stempel happily summarizes.

The Terex® CC 2800-1 lattice boom crawler crane offers a maximum 660-ton lift capacity at a 32.8-foot radius and excellent lifting capacities throughout its entire working range. Its variable superlift radius increases lifting capacities at further distances away from the crane’s base. A variety of boom configurations, including extensions, luffing jib, windmill kit, and vessel lift as well as many other modules are available to increase crane versatility.

Transportability is excellent due to the crane’s unique open-boom design. These rectangular sections do not sit as high on the trailer as competitive boom designs, and no internal cross bracing allows smaller boom sections to be nested inside of larger sections to reduce the number of trailers required for transport. The CC 2800-1 crawler crane can be equipped with the exclusive Terex Fall Protection System, winner of the 2012 ESTA Safety award, which helps keep operators safe when rigging boom sections.

Its innovative IC-1 crane control system features a touch-screen with intuitive pictorial displays for operating ease. The crane’s exclusive Quadro-Drive on-demand system improves operating versatility and allows the base to move and spin under load even on extreme sticky ground soil. ↴

— Source: Terex Cranes

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PRODUCT

TORKWORX DELIVERS THE LATEST IN ERAD TECHNOLOGY



Torkworx and RAD Torque Systems recently announced the next generation of the E-RAD series of torque and tension equipment, exhibiting the companies' shared ongoing commitment to being on the forefront of Electronic Digital Control Systems.

The ERAD-BLU provides the ability to control multiple tools through one single control case. The calibration is stored inside the E-RAD Handle which allows for multiple handles to be used with any E-RAD BLU controller. The 2" x 3" touch screen provides ultimate ease of use. Torque and angle operation is standard in all systems and WTG specific installed presets make the torque process error free. With newly advanced data collection and the ability to password protect the system settings, the ERAD-BLU is the most advanced electronic digitally controlled torque system available. We included a robust single cable design that can be removed from both ends for easy storage and replacement. The accuracy of our latest version has an accuracy of +/-2.8%. Currently the ERAD-BLU is available in 700, 2500, 3000 and 6000 ft/lbs

models with the E-RAD 7500 to be released in the near future.

Joint Calibration can be completed via Bluetooth technology. This new technology delivers the ability to calibrate the ERAD-BLU with a Smart Socket via Bluetooth right on the joint with only two pulls. RAD Smart Sockets uses RAD's Transducer Technology combined with a custom socket to measure the actual torque applied to the bolt during a torque cycle. Comparable in size to a standard socket, the RAD Smart Sockets are the perfect audit tool for inspecting bolted joints and can function as a master calibration for any torque tool. This patented technology provides accuracy within +/- 1% and measures then displays the peak torque reading. Smart Socket Technology logs the data on every torque reading for instant torque read-out on your application in real time. The operator can view and download logs right onto a Bluetooth enabled smartphone or tablet.

If you have critical torque and tension requirements, contact Torkworx by email at support@torkworx.com or by phone at (888) 502-WORX (9679).

PRODUCT

ITH BOLTING TECHNOLOGY INTRODUCES NEW COMPACT PUMP ITH MICROMAX SERIES



ITH Bolting Technology has introduced the ITH stretch method on wind turbine bolt connections bigger than 3/8".

Next to its high system precision the ITH stretch method has even more benefits. As the required preload is applied by axial stretching of the bolt, the system works without friction effects and torsion effects. Friction occurs during torquing. When torquing bolts the effects of friction can influence the applied preload force up to 100 % from bolt to bolt. This high variation can lead to a collapse of the bolt connection. Therefore it is strongly recommended to use ITH Bolt Tensioning Cylinders on foundation bolt connections like shown in the picture above.

As ITH is worldwide leading tensioning system supplier, there are a lot specific innovations made for the demands of wind industry. In the application picture you can see a compact foundation bolt tensioning cylinder (multi-stage) including NIOX coating to prevent from corrosion, which is especially useful

in offshore environments. The tensioner also features the ITH safety concept including patented safety handle, safety fracture device and patented cycle counter.

The new compact pumps series ITH Micro-MAX features an optional protective cage, a fast pressure build-up up to 1,500 bar as well as a remote control for easy one-man operation. Its both weight-optimized (50 lbs) and compact design (15" x 11" x 18") makes the Mico-MAX series perfectly match to work in the tight areas of a wind turbine like on tower bolt connections or inside of the nacelle.

All leading wind turbine manufacturers trust in ITH bolting solutions for all bolting applications like on the main bearing, main bearing hub, blade bolts, yaw bearing bolts, frame bolts or hub bolts.

Find all ITH bolting tool solutions for wind turbines at www.ith.com/industries/tension-and-torque-tools-for-wind-turbines.php

MAINTENANCE

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



REMOTE SITE MONITORING EXPANDS REACH TO GLOBAL PROPORTIONS

Industry veterans Gamesa and Iberdrola align to facilitate distance-based wind farm management tool

Gamesa and the Iberdrola Group, through its engineering and construction subsidiary, have launched a wind sector-pioneering system which enables the remote management, using a single interface, of any make of wind turbine, anywhere in the world.

Leveraging both firms' know-how and experience in the wind sector, this new system, called WindCORE® + WindOne®, enables operators to control and monitor this class of renewable facilities from a distance, analyze their operating data and generate reports with a view to optimising their electricity output.

This tool developed jointly by Gamesa and Iberdrola has become an indispensable tool for supervising, in real time and from a single control center, the multiple variables which can affect a wind farm's operations, from wind speed at each turbine to their temperature, intensity, and production. Analysis of these variables feeds the development of predictive models which in turn facilitate operations and maintenance work.

In addition, the WindCORE® + WindOne® system is

capable of operating, using a single interface, turbines made by any manufacturer, doing away with the need for a different software programme for each technology brand, as is the case with most of the systems being used at present.

"Gamesa operates over 400 wind farms worldwide from its control center in Sarriguren (Navarra). With over 10,000 MW in operation, and reinforced by Iberdrola's know-how, we want to offer this value-added tool to our customers so that they can get the most out of their wind farms by operating them to the highest performance specifications", said Fernando Valleperes, director of services sales & marketing at Gamesa.

"The versatility of WindCORE® + WindOne®, the result of a collaborative development between two of the sector's leaders, will pave the way for its implementation in any environment while respecting each customer's proprietary communications network infrastructure and management tools," said Iberdrola's Javier Ontañón Ruiz.

SCOTTISH DEVELOPER TAPS POWER CLIMBER WIND FOR TOWER CLIMB ASSISTS

Power Climber Wind, a division of SafeWorks, LLC, recently installed 75 IBEX® Climb Assist Systems at three wind farms in Scotland.

The system allows the wind turbine technician to have complete control of the climbing experience, delivering personalized performance, increased safety, and better productivity. The IBEX 1000P utilizes a patented closed feedback loop and EasyClimb Controller, and features a lightweight, compact, portable control box.

Fred Olsen Renewables purchased a combination of IBEX 1000s and IBEX 1000Ps to install on turbines at three of its Scotland wind plants — Rothes I, Cristal Rig I, and Paul's Hill.

"IBEX is the market-leading climb assist globally, and we're excited to see one of the leading wind project owners in the UK adopt it for their retrofit program," said Edwin Holtkamp, director of sales for Power Climber International. "Repeat sales for new project construction as well as turbine retrofit efforts by leading global power producers testify to the level of customer satisfaction in this product and in Power Climber Wind. We anticipate IBEX to earn the same reputation in this region."

For more information visit powerclimberwind.com.



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HEADLINES

Gamesa awarded 8-year service contract in Spain

Gamesa has secured a new contract with Parques Eólicos Gestiver (a company 50%-owned by each of Gestamp Eólica and Genera Avante) to provide operation and maintenance services for 132 MW located in five wind farms in Spain.

Under the terms of the agreement, Gamesa will perform maintenance

services on 66 of its 2.0-2.5 MW platform wind turbines located in Lugo, Coruña, and Tarragona, Spain.

The contract contains an option for a five year extension, and renews the operation and maintenance agreement Gamesa has had for the five wind farms since their commissioning.

EDF Renewable Services sees 52 percent growth in Canada

EDF Renewable Services, a leading provider of O&M services in North America, signed contracts for 454 MW of wind and 134 MWp of solar in 2014, adding to the company's Canadian portfolio. These additions represent a 52 percent increase in contracted projects in the Canadian market through 27 individual projects in Quebec and Ontario, signifying the company's commitment to the Canadian renewable energy economy.

"We are pleased to continue expanding our depth of experience and presence in Canada, to assist

our customers in achieving operational excellence., said Dalen Copeland, director of business development for EDF Renewable Services, "From full O&M agreements, to customized monitoring, engineering support, SCADA solutions, balance-of-plant, and more, we leverage our more than 25 years of O&M expertise to optimize project availability and maximize profitability."

EDF Renewable Services operates over 8.5 gigawatts of wind, solar and biomass projects throughout the US, Canada, and Mexico.

GAMESA SEEKS CERTIFICATION OF TURBINE LIFETIME EXTENSION PROGRAM

DNV GL to examine “life-prolonging” measures of OEM’s G47 wind turbine

DNV GL, the world’s largest resource of independent energy experts, has been chosen by Gamesa, to certify its wind turbine lifetime extension program for the design of its G47 wind turbine, extending the lifetime to up to 30 years. The turbine lifetime extension programme aims to maximise the profitability of ageing wind farms by reducing the lifecycle-based costs of energy of existing turbines and keeping them operational for a longer period of time.

Although a lot of wind farms are still less than 20 years old, many owners anticipate that their assets will be affected by rising operation and maintenance costs. While existing turbines were certified by the standards in force at the time they were designed, greater technical knowledge and practical experience have led to more accurate models and new design standards. Upgrading the turbines to extend their design lifetime requires an in-depth understanding of all disciplines involved, in order to ensure a safe operation of the turbines after they have exceeded their original design lifetime.

Sergio Vélez, Director of Gamesa’s Life Extension program, said: “Extending wind turbine operation beyond

the original design life without additional risks for health, safety, environment and grid integration, is of huge benefit to the renewable energy industry. DNV GL’s certification supports our efforts in maximising the lifetime of our turbines and optimise its continuous operation.”

“Wind turbine lifetime extension is a vital step for the global renewable energy market to maximise efficiency and reducing costs,” said Andreas Schroeter, executive vice president-Renewables Certification of DNV GL. “One of the largest benefits of lifetime extensions for owners and operators is driving down the lifecycle-based costs of energy.”

Many wind farm owners in Europe and the U.S. are starting to consider operational strategies for turbines approaching the later stages of their design life. This provides them with the option to either replace their turbines or seek to extend their operational lives. In order to find suitable solutions from a technical point of view, DNV GL has published a guideline on the continued operation of wind turbines. This guideline has been the technical basis for the lifetime extension program of Gamesa’s G47 wind turbine.



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GEARBOX EXPRESS BUILDS 75,000 SQUARE-FOOT FACILITY IN WISCONSIN

Rapid growth, dwindling capacity prompts remanufacturer to double plant size

Gearbox Express, an independent company focused on providing down-tower, wind gearbox remanufacturing services, is building a 75,000-square-foot manufacturing facility south of Mukwonago, Wisconsin.

Founding partner and CEO Bruce Neumiller, CEO, cites lack of capacity to support the company's growth as the major reason. "When we started operations in 2012, we had a vision on how to help wind farm owners protect and manage their assets," said Neumiller. "Our growth has exceeded expectations to the point of needing to double our facility space. Owners are embracing the value we bring in keeping their investments running and we need a facility that helps us fulfill our promise to deliver efficient and high-quality customer service from a company bringing

dedicated gearing, bearing and gearbox expertise."

Gearbox Express is the first facility to be built in a newly established industrial park in Mukwonago, located about 30 miles west of Milwaukee. The new facility will incorporate the same climate-controlled and specialized mechanical offerings as the current location, including its highly flexible, technologically advanced 3.1MW test stand. The current test stand will relocate to the new site, but an additional plate will be added to maximize set-up.

Construction began in December and Gearbox Express is expected to be fully up-and-running by the end of third quarter, 2015.

— Source: Gearbox Express

PSI REPAIR SERVICES AMONG BUSINESS GROUP'S "BEST AND BRIGHTEST" EMPLOYERS

Recognition highlights company's commitment to promoting an employee-centric workplace

PSI Repair Services, Inc., a subsidiary of Phillips Service Industries and leading industrial component repair service, recently announced that it has been selected to the 2014 Best and Brightest Companies to Work For list by the National Association for Business Resources.

The winning companies were assessed by an independent research firm, which reviewed a number of key measures relative to other nationally recognized winners. They include compensation, benefits and employee solutions; employee enrichment, engagement, and retention; employee education and development; recruitment, selection, and orientation; employee achievement and

recognition; communication and shared vision; diversity and Inclusion; work-life balance; community initiatives; strategic company performance and the best of the best small business.

"Nationally recognized award recipients keep innovative human resource initiatives at the forefront of their company culture and make it a priority to consider their workforce as an essential aspect in their company success. Our Association is proud to recognize and honor these winning companies for this impressive achievement," said Jennifer Kluge, NABR president.

Established in 1967, PSI Repair Services offers the world's most com-

plete range of repair and engineering services to resolve poorly performing electronics, hydraulics, robotics and precision mechanical assemblies. PSI serves a wide range of industries and markets like automotive, aerospace, defense/military, food and beverage, healthcare, public transportation, and wind energy.

"PSI is a valued supplier and trusted partner to many customers all over the world because of our dedicated workforce," said Mike Fitzpatrick, general manager of PSI Repair Services, Inc. "We strive to provide a fun, team-oriented working environment that allows our talented employees to shine."

MANUFACTURING

Production • Fabrication • Components • Supply Chain • Materials • Tooling • Machinery

UK ALLIANCE ISSUES \$10.9 MILLION IN BUSINESS SUPPORT

Manufacturing grants boost interest and support for offshore project



Manufacturers looking to take advantage of the growth in the offshore wind market have received a \$10.9 million windfall of business support and capital funding.

Bosses at the GROW:Offshore-Wind service made the announcement at a recent supplier event to promote the \$2.3 billion Dudgeon Wind Farm project in Norfolk and immediately pointed to further investment in Hornsea as a sign that the sector is finally maturing.

More than 900 companies have benefited from the assistance to date, which has helped firms bring new innovations to market, purchase state-of-the-art machinery and explore crucial R&D.

The grants have also been used to facilitate relocation to new purpose built premise, an important feature for suppliers looking to increase capacity and manufacture larger components than they're normally used to.

"When we launched at the end of 2013 we had the single aim of getting more manufacturers and technology providers in a position where they could effectively supply into offshore wind," explained Dominic Brown, Head of GROW:OffshoreWind.

"We feel we have achieved this, providing strategic advice and access to funding for over 900 companies, ranging from steel fabricators

and composite specialists, to blade tip innovators and toughened glass specialists."

He continued: "Early estimates suggest that the (\$10.9 million) we have allocated will safeguard in excess of 1,150 jobs and, importantly, could create nearly 2,500 new ones."

GROW:OffshoreWind is delivered by Grant Thornton and program partners the Manufacturing Advisory Service (MAS), Renewable UK, and the University of Sheffield.

Working closely with government and industry leaders, the service has been instrumental in raising the profile of offshore wind and how suppliers can tap into opportunities



slowly coming to fruition in and around the UK's coasts.

Eight dedicated GROW specialists have been working with companies on the ground, whilst

senior officials have been cultivating relationships with tier-1s and the big contractors responsible for delivering the wind farms.

Dominic continued: "Another

focus has been around building links with the organisations responsible for developing the supply chains.

"We are starting to see a noticeable change in Developers and tier-1s engaging with SMEs. There seems to be a genuine commitment for local supply and, as a result, we are now putting on events that are bringing suppliers in direct contact with tier-1s (A2Sea, Carillion and Sif Group for example) and operators, such as Statoil and Siemens.

"It has taken a while for the potential to turn into reality and suppliers need to work hard to prove themselves. However, with investment being seen in East Yorkshire and off the Norfolk Coast, the appetite to be involved has definitely grown."

For more information, visit www.growoffshorewind.com. ↗

REPORT: WIND TURBINES ARE IN OVERSUPPLY GLOBALLY

Innovation and lean manufacturing practices cited as causes for surplus

A new report from Navigant Research examines the significant forces shaping the global wind power industry's supply chain, including analyses of more than 500 component and materials suppliers.

During the past two years, more flexible sourcing strategies across the wind power supply chain have resulted in cost reductions, enabling greater geographic market access while reducing risk and ensuring profitability for wind turbine vendors and their partners in the component value chain. Overcapacity, however, persists in most, though not all areas of the supply chain, providing purchasers with more choice, flexibility, and cost control. According to a new report from Navigant Research, while demand in 2014 is projected to be less than 47,000 MW, annual turbine manufacturing capacity, according to vendor estimates, is likely to exceed 71,000 MW.

"Oversupply is allowing wind turbine manufacturers to more easily adjust what components they produce in-house, what is outsourced, and when a blend of both is advantageous for cost, technological, or geographic reasons," says Jesse Broehl, senior research analyst with

Navigant Research. "Although many manufacturing facilities are running at less than full capacity, product innovation, lean manufacturing, and outsourcing are resulting in a highly competitive wind industry ready for the challenges of today's and tomorrow's wind markets."

Blades are a particularly strong area of strategic product evolution and sourcing shifts, according to the report. Turbine manufacturers are making major, capital-intensive investment changes in how blades are designed, what materials are used, the manufacturing processes behind them, and what companies they source from.

The report, "Supply Chain Assessment 2014 – Wind Energy," examines the significant forces shaping the global wind power industry's supply chain. The nearly 300-page report examines 11 component categories and profiles more than 300 component suppliers; it also identifies more than 200 suppliers across four groups of materials. Analysis is provided of the top wind turbine vendors and their manufacturing capabilities, supply chain relationships, and technology strategies. Key offerings and the capacity for leading suppliers, located

primarily in North America, Europe, Asia Pacific, and Latin America, are quantified. The report also analyzes the major technology trends within each of the component and materials categories, as well as the related manufacturing capacity and supply versus demand dynamics

expected through 2018. An Executive Summary of the report is available for free download on the Navigant Research website. ✎

— Source: Navigant Research

MANUFACTURER REPORTS \$7.3 MILLION IN ORDERS FROM WIND

Cleantech Solutions International, Inc., a manufacturer of metal components and assemblies used in various manufacturing industries, including clean technology, textile dyeing and finishing machines, and oil and gas refineries, recently announced that it received two purchase orders in early December for a total purchase price of approximately \$7.3 million from customers in the wind power industry.

Pursuant to one of the purchase orders, Cleantech Solutions will supply shafts to a major wind turbine and electric machinery manufacturer in China, for a purchase price of approximately

\$4.4 million. Cleantech Solutions has received an advance payment of 20 percent of the purchase price, will receive an additional 70 percent upon delivery, and the remaining 10 percent within three months after delivery — provided that there are no technical problems with the equipment. The company expects to deliver the equipment in May 2015.

Pursuant to the second purchase order, Cleantech Solutions will supply gearbox casings for wind power equipment to one of the largest industrial blower manufacturers in China, for approximately \$2.9 million. The same

payment schedule applies to the second order, which Cleantech expects to deliver in March.

“We believe that the recent push by China’s leadership to support wind power spurred these orders. Although China’s wind power industry still has significant issues to address in terms of system integration, we are cautiously encouraged by the government’s support and hope that it will drive additional demand for our products,” said Mr. Jianhua Wu, Chairman and CEO of Cleantech Solutions.

— Source: Cleantech Solutions

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Spring 2014 WoWE Board Meeting

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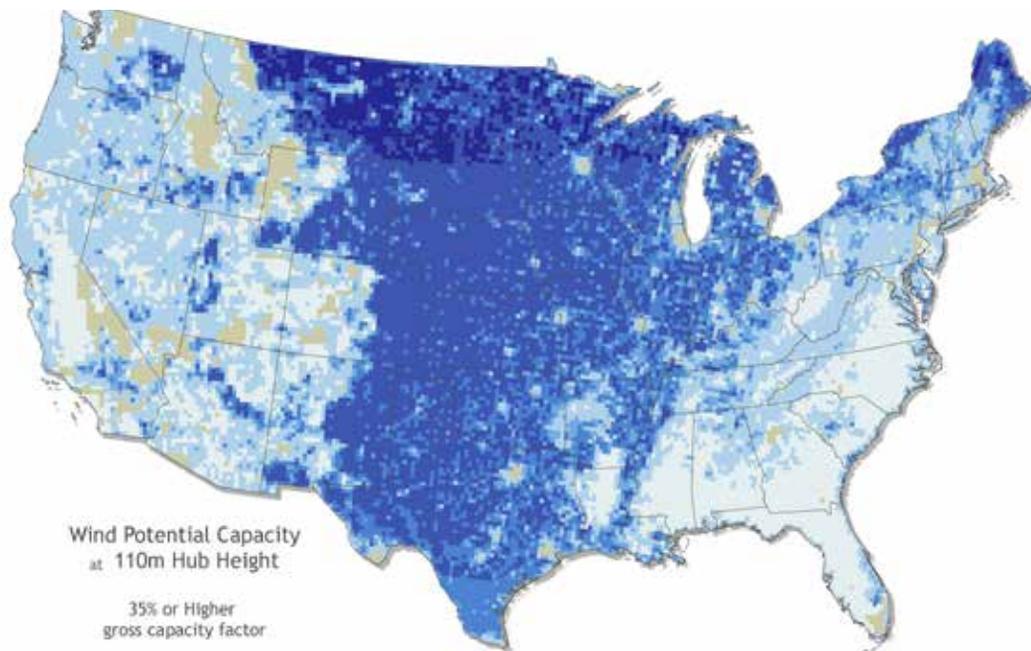


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DOE OPTIMIZES RESOURCE MAPS BASED ON WIND SUITABILITY AND LATEST TECHNOLOGY



Maps can help you plan a road trip, explore new places, or even find buried treasure. But there's another kind of map that can help chart the path to a more sustainable future and unlock the potential for wind energy development. The National Renewable Energy Laboratory (NREL), together with the Energy Department's Wind Program and AWS Truepower, has released maps that illustrate the potential for wind energy development using new wind turbine technologies.

Wind industry professionals use wind resource maps in the early stages of wind farm project planning to understand the potential for wind development in a particular region and to see where more in-depth site evaluation might be justified for various types of turbines.

The Energy Department previously released maps that gauge average wind speeds at 80 and 100 meters (262 and 328 feet) above the ground. The new maps released by NREL build on these wind speed data to identify areas throughout the country that have an average wind energy capacity factor greater than 35 percent. (Wind energy capacity factor is a measure of power plant productivity that indicates how much electricity a wind farm actually produces relative to the maximum it could potentially produce at continuous full-power operation over a specific time period.)

These new maps also show the concentration of land areas with capacity factors over 35 percent at higher turbine hub heights of 110 and 140 meters (361 and 459 feet), representing recent and planned turbine advancements, respectively.

Since stronger and more consistent winds are typically found at higher heights, the Energy Department has been working with the wind industry to produce the next genera-

tion of taller wind turbines that reach higher hub heights (the height of the nacelle mounted atop a turbine tower). The Energy Department estimates that enabling cost-effective deployment of wind turbines with hub heights up to 140 meters will unlock an additional 1,800 gigawatts in wind power resource potential across 237,000 square miles of the United States.

Technological advancements are also leading to more efficient wind turbines with longer blades, allowing them to generate more electricity out of the same amount of wind. With these advancements, areas with limited wind resources at lower heights—such as the southeastern United States—now have the opportunity to add new wind power capacity using utility-scale wind energy technologies. All of these advancements also help reduce the cost of clean, renewable energy for consumers across the country.

The Energy Department's Wind Program and industry partners have made great strides in increasing the performance and reliability of next-generation wind power technologies. The program's research efforts in testing, manufacturing, and component development have helped increase the efficiency of turbines, generating even more clean energy from wind. As the Energy Department and industry continue to invest in improved wind turbine manufacturing and resource assessments, these new wind resource maps will serve as an important tool for future wind energy planning. ↗

— U.S. Department of Energy; Office of Energy Efficiency and Renewable Energy – Wind and Water Power Technologies Office.

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