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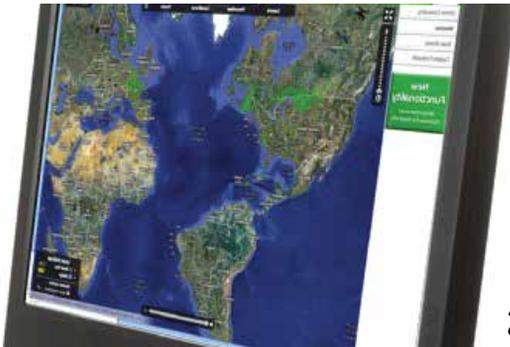
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EDITOR'S DESK

JANUARY 2016

While harnessing wind as a source of renewable energy was just a distant dream 15 years ago, today it has blossomed into a large and growing source of clean power across North America.

According to the American Wind Energy Association (AWEA), the total wind capacity in the United States reached 69,343 MW as of September 2015, and U.S. wind farms currently provide enough clean energy to power 18 million American homes and have attracted more than \$100 billion in private investments since 2008. The wind energy industry also employs more than 73,000 people in the U.S. with a manufacturing supply chain of 500-plus factories across 43 states.

In addition to wind energy generation being an economically sound option, it's also beneficial for the environment. According to a recent report by the Environment America Research & Policy Center and the Frontier Group, fossil fuel-fired power plants emit 31 percent of U.S. greenhouse gas emissions, making them the largest source of carbon dioxide pollution nationwide. Wind turbines, on the other hand, do not release any carbon dioxide into our atmosphere. In fact, 98-percent fewer greenhouse gases are emitted per unit of the electricity produced throughout the life cycle of a wind turbine over what would be released over the life cycle of a natural gas power plant.

All good things, and they're expected to continue in 2016. With the massive opportunity for wind energy development on- and offshore, wind power can be a key player in meeting the emissions reduction targets of the Clean Power Plan and moving us toward a future of 100-percent renewable energy. Congress recently passed an omnibus spending bill that included a provision to extend the expired production tax credit (PTC) for another five years. While the value of the tax credits will decline by 20 percent each year beginning in 2017, the new predictability of the federal policy should catalyze innovation, cost reductions, and growth, providing the wind energy industry with a break from the boom-bust cycles it has endured in recent years.

This month, we explored the bolting and torquing side of the wind industry, as well as advancements being made in wind assessments and measurements. Our inFocus section features a company profile on Hytorc Industrial Bolting Systems and a conversation piece with Nick Rasper from ITH Bolting Technology. You'll also find a column written by Hank Surface from Tork Worx on electronic torquing and how it can provide the speed, accuracy, and repeatability necessary to get the job done, as well as two columns in the maintenance section from some familiar faces — Jack Wallace of Frontier Pro Services, who discusses how bug build-up on blades affects wind energy generation, and Jeff Walkup of Gram & Juhl North America, who addresses condition monitoring and the challenges its various applications can present to those involved in this industry.

As always, thanks for reading!

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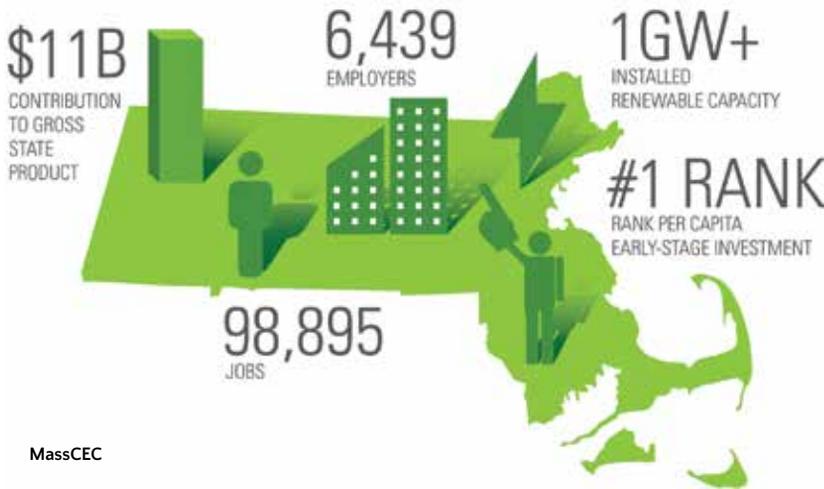
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The advertisement features a blue background with a large image of a red and silver bolt tensioning tool. Below this, there are two smaller images: one showing a worker in a yellow safety vest using a torque wrench on a bolt, and another showing a worker in a white hard hat and safety vest using a torque wrench. The ITH logo is prominently displayed at the top.

DIRECTION

Policy • Advocacy • Business • Finance • Legal • Environment • International

MASSACHUSETTS CLEAN ENERGY INDUSTRY GROWS BY DOUBLE DIGITS FOR FOURTH YEAR



clean energy is an \$11 billion industry in Massachusetts and represents 2.5 percent of the Commonwealth's gross state product. The report also found that clean energy jobs represent 3.3 percent of the overall workforce in the state with three quarters of workers earning more than \$50,000 per year.

The clean energy industry is employing residents of every county in Massachusetts and has grown over the past year in each of the state's regions, with the largest growth coming in northeastern Massachusetts (16.8 percent) and central Massachusetts (13.6 percent).

"With five years of consistent job growth, the clean energy sector is an economic engine that is putting Massachusetts on the map for global leadership in clean energy," said Northeast Clean Energy Council (NECEC) President Peter Rothstein. "Private sector innovation and investment combined with public sector leadership on forward-thinking clean energy policies are continuing to prove to be a strong formula to drive the flourishing of this industry."

Massachusetts Clean Energy Center (MassCEC) Interim CEO Stephen Pike recently announced the results of the 2015 Massachusetts Clean Energy Industry Report, which found that the Massachusetts clean energy sector has grown by double digits for the fourth consecutive year and now employs 98,895 workers at 6,439 employers across the Commonwealth.

The report finds that clean energy employment grew by 11.9 percent between 2014 and 2015 — the largest

increase of any year since MassCEC began collecting data in 2010. In total, the number of clean energy jobs in Massachusetts has increased by 64 percent since 2010.

"With steady job growth over the past five years, the Massachusetts clean energy industry is robust," Pike said. "The clean energy sector is fueling small businesses and paying workers high wages across the state from Beverly to Pittsfield."

The report, prepared for MassCEC by BW Research Partnership, found that

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- 13** Bloomberg and EDP Renewables Announce New York's Largest Corporate Renewable Energy Purchase

As clean energy jobs have grown, so has the installation of clean energy technologies across the Commonwealth. In July, Massachusetts passed 1 GW of installed renewable energy capacity, which is enough to power more than 152,000 average Massachusetts homes annually.

“The Clean Energy Industry Report demonstrates the Commonwealth’s commitment to foster and encourage innovative ideas and technologies while creating a strong job market within the state,” said Energy and Environmental Affairs (EEA) Secretary Matthew Beaton. “The Commonwealth will continue to leverage the state’s robust, cutting-edge clean energy sector with Massachusetts’ world-class universities and research institutions to work to balance and diversify the state’s energy portfolio while positioning Massachusetts to achieve our greenhouse gas reduction goals.”

According to Tom Pincince, president and CEO of Digital Lumens, “clean technology has

moved from being adjacent to the traditional hardware, software, and networking communities to being an integral and high-growth part of the technology landscape in Massachusetts in the last decade.”

The report also found Massachusetts to be the national leader in early-stage clean energy investment. Massachusetts companies attracted more than twice the amount of early-stage investment per capita than second-place California. Overall, public and private investment in the industry exceeded \$549 million.

“Massachusetts’ forward-thinking policies have helped develop the market for highly efficient, clean energy combined heat and power within the state,” said Lee Vardakas, president of Aegis Energy Services, Inc. “We in western Massachusetts have benefited from the state’s innovative approach to clean energy and have been able to continue expanding our business with double-digit growth year-over-year. This has led to an increase in employment and has benefited the

local businesses that support our manufacturing in the area.”

The Massachusetts Clean Energy Industry Report, primarily based on survey data gathered directly from clean energy employers in Massachusetts, is an in-depth breakdown of clean energy deployment, gross state product, employment, investment data and innovation, classified by technology sector, and geographic region. The report’s methodology has been replicated in the following 10 states: California, Florida, Illinois, Iowa, Missouri, Ohio, Pennsylvania, Rhode Island, Tennessee, and Vermont.

State energy officials announced the results of the 2015 Massachusetts Clean Energy Industry Report at events at Groom Energy in Beverly and the South Middlesex Opportunity Council’s Green Jobs Academy in Worcester. ↵

— Source: MassCEC

For more information, go to www.masscec.com.

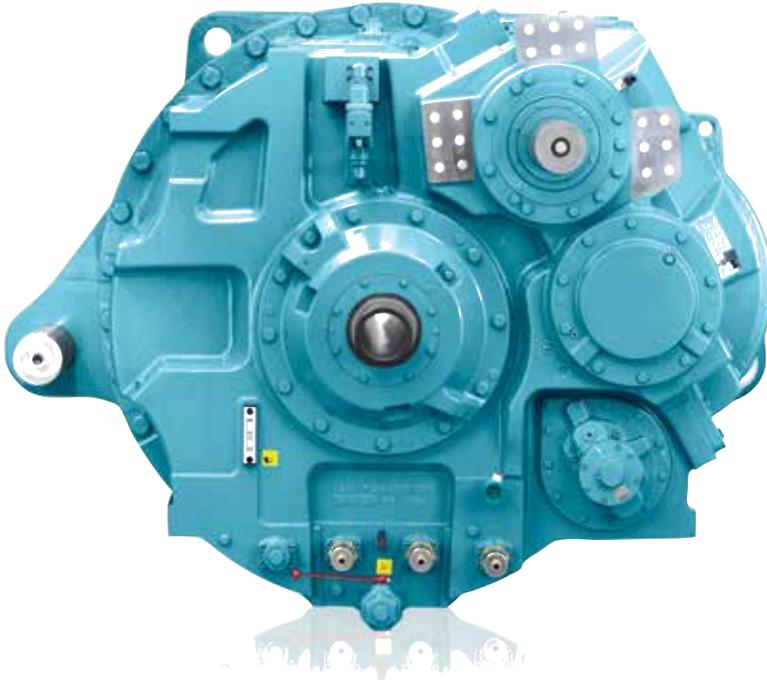
ZF ACQUIRES INDUSTRIAL GEARS AND WIND TURBINE GEARBOX SEGMENT FROM BOSCH REXROTH

ZF has officially taken over the industrial gears and wind turbine gearbox business from Bosch Rexroth AG. Approximately 1,200 employees at the Witten, Beijing, and Lake Zurich, Illinois, locations will join the technology company. The various product lines will be brought together in the new ZF Industrial Gears business unit based in Witten, Germany. The company is also strengthening its wind turbine gearbox business.

“With the newly created Industrial Gears business unit, we intend to get things moving on a large scale,” said ZF Chief Executive Officer Dr. Stefan Sommer. “We are extending our portfolio with large transmissions for industrial applications and mobile machinery to tunnel drilling machines and 600-ton mining excavators. The product range will also be extended in the Wind Power Technology business unit with gearboxes for turbines generating up to 8 MW.”

With the transaction, ZF is taking over the two production locations of Bosch Rexroth AG in Witten (North Rhine Westphalia, Germany) with almost 900 employees and in Beijing with approximately 300 employees, as well as the service location in Lake Zurich with 15 employees.

Two newly founded companies will be added to the Industrial Gears business unit as ZF Industrieantriebe Witten GmbH and ZF Powertrain Systems (Beijing) Co., Ltd. Witten is the headquarters for the business unit, which is not only home to administration and production, but also to the development and sales departments for large gearbox technologies, including industrial gears and wind turbine gearboxes. Witten is also the production location of ZF’s existing wind power technology business unit that is headquartered in Lommel, Belgium. At the Beijing location, gearboxes for ZF’s wind power segment are being produced, and as a result, the company is further



ZF

extending its presence in the important wind gearbox market in China.

ZF appointed Christoph Kainzbauer, an experienced manager in the field of large gearbox technology, to head up the Industrial Gears business unit. He was previously responsible for

global sales of Bosch Rexroth's large gearbox segment. The new business unit includes product lines for transmissions for mining applications and large construction machinery, transmissions for offshore and marine applications, transmissions for

industrial plants and equipment, and for cableways.

"We see ideal future opportunities for the industrial technology division, especially in wind power technology," said Wilhelm Rehm, who is responsible for corporate materials management and industrial technology on the ZF management board. "Strengthening ZF's non-automotive segment is an important objective of our long-term corporate strategy. We are supplementing our industrial technology portfolio optimally while also opening up access to new markets and customer groups."

The two companies have agreed not to disclose the purchase price. In 2014, Bosch Rexroth generated sales of approximately £300 million with the large gearbox business. In the same year, ZF generated roughly 12 percent of its group sales with the industrial technology division in which the company bundles its off-road activities. This figure should rise over the long term. ↵

— Source: ZF

For more information, go to www.zf.com.

GAMESA AND CFE SIGN AGREEMENT FOR WIND ENERGY PROJECTS IN MEXICO

Gamesa and the Mexican Electricity Board (the CFE for its acronym in Spanish) have signed a memorandum of understanding (MoU) for the fostering of wind power generation in Mexico by means of the co-development of wind energy projects.

The MoU was signed by Hipólito Suárez, Gamesa's managing director for Mexico and Latin America, and Benjamín Granados, director of project finance at the CFE. The signing ceremony was attended by Gamesa's Business CEO, Xabier Etxebarria, and the managing director of the CFE, Dr. Enrique Ochoa.

The two companies have pledged to search for ways to encourage technological, industrial, and supply chain development in the sector in Mexico and to champion research, development, and innovation in the renewable energy field. The MoU also contemplates the possibility of the CFE studying opportunities for participating in wind projects in which Gamesa has a stake in other Latin American markets and the U.S. In addition, the MoU will promote the extension of best practices in wind farm operations, maintenance, and control.

Construction of a Tower Factory in Mexico

Against the backdrop of this agreement and with the aim of contributing to the sector's technological and industrial development in Mexico, Gamesa, the leading OEM in this market, is planning to build a wind tower factory through Windar Renovables, the joint venture with the Daniel Alonso Group.

The factory will be located in Puerto Altamira, in the state of Tamaulipas, a high-potential wind region. Stretching 75,000 m², the center will have enough capacity to manufacture 500 MW per year for the Mexican,

U.S., and Central American markets. The construction work was scheduled to begin in December 2015, and the factory should be up and running by the end of 2016.

Gamesa is also planning to step up the renewable energy training and research activities it already carries out in Mexico through the existing Gamesa University located in Juchitán where local people specialize in operations and maintenance tasks.

“This MoU with the CFE highlights Gamesa’s commitment to the Mexican market where, in addition to developing and on-selling wind farms, it supplies, installs, and services wind turbines,” Suárez said. “Execution of this agreement will lead to the creation of hundreds of jobs in the tower manufacturing area and by nurturing a local supply chain capable of manufacturing major parts not only for the Mexican market, but also for the U.S.”



Wind farm in Mexico with Gamesa’s WTC installed

Since it began doing business in Mexico in 1999, Gamesa has been active in its capacity as an OEM, having installed over 1,700 MW and, as a wind farm developer, with more than 700

MW complete and a sizeable pipeline at various stages of development. ↘

— Source: Gamesa

For more information, go to www.gamesacor.com.

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PILOT HILL WIND PROJECT CLOSES FINANCING FROM GE AND METLIFE



EDF Renewable Energy's 175-MW Pilot Hill wind project located in Kankakee and Iroquois counties in Illinois has closed structured equity financing from GE Energy Financial Services and MetLife, Inc.

Pilot Hill Wind Project, which has achieved commercial operations and is located approximately 60 miles southwest of Chicago, will power 100 percent of the energy needs of Microsoft Corporation's Chicago data center. Microsoft has committed to purchase the output under a 20-year power purchase agreement (PPA). This is Microsoft's second and largest wind energy deal, demonstrating its commitment to a neutral carbon footprint.

"Pilot Hill serves as another example of EDF Renewable Energy's strategy to develop renewable energy projects with first-tier equipment suppliers and contractors, and then invite the investment from longstanding financial partners," said Jim Peters, vice president of project finance for EDF Renewable Energy. "EDF Renewables will manage the wind project and bring our expertise in operations and maintenance through EDF Renewables' services to optimize long-term investment profitability."

"Investing in Pilot Hill contributes to the growth of EDF Renewable Energy, an important worldwide GE customer, builds on strong commercial interest in the renewable energy sector, and helps Microsoft meet its environmental goals,"

said Kevin Walsh, managing director and head of renewable energy at GE Energy Financial Services.

Pilot Hill comprises 91 GE 1.7-100 and 12 GE 1.85-87 wind turbines. GE Energy Financial Services holds a portfolio of approximately 14 GW of wind power projects in operation or under construction and plans to continue to invest over \$1 billion annually in renewable energy projects worldwide, including projects that utilize GE's wind turbine technology.

"MetLife is proud to support efforts that drive sustainability, and we're pleased to be working with EDF and GE on the Pilot Hill Wind Project," said Steven J. Goulart, executive vice president and chief investment officer for MetLife, Inc. "The Pilot Hill Project aligns with MetLife's approach to investing for the long term and builds upon the \$3.5 billion we've invested in renewable energy projects."

According to U.S. Energy Environmental Protection Agency (EPA) methodology, Pilot Hill will avoid approximately 365,000 metric tons of greenhouse gas emissions per year, the equivalent of the annual emissions from approximately 77,000 passenger vehicles. ↴

— Source: MetLife

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

BLOOMBERG AND EDP RENEWABLES ANNOUNCE NEW YORK'S LARGEST CORPORATE RENEWABLE ENERGY PURCHASE

EDP Renewables, a global leader in the renewable energy sector and the world's fourth-largest wind energy producer, recently announced that it has signed a 20-year power purchase agreement with Bloomberg, the global business and financial information and news leader, for 20 MW of clean energy that will be used to offset the energy use of their New York offices.

Bloomberg has agreed to buy more than 25 percent of the energy generated by the Arkwright Summit Wind Project in Chautauqua County, New York, totaling 79 MW. The project is expected to avoid the emissions of more than 340,500 metric tons over 20 years, which is the equivalent of taking more than 71,000 cars off the road.

"We are extremely satisfied with this agreement," said João Manso Neto, CEO of EDP Renewables. "The fact that companies like Bloomberg are playing such an active part in renewable energy projects is a very clear indicator that the future lies in the generation of this type of energy. To be chosen as their partners confirms the confidence of the market and companies in our delivery capacity, experience, and know-how."

The project is located less than 30 miles from the retired BPU Jamestown Coal Plant, one of more than 205 U.S. coal-fired power plants that have been retired in the last five years as part of the Sierra Club's Beyond Coal campaign, in partnership with Bloomberg Philanthropies. Thanks to local, grassroots efforts, coal-fired power plants in the U.S. have been replaced with cleaner energy, driving down power sector emissions to its lowest level since 1994.

"This agreement will benefit our company financially, but it also reflects our commitment to sustainable business practices," said Michael R. Bloomberg, founder of Bloomberg LP. "This new wind farm that is just a short drive from a coal plant that Bloomberg Philanthropies helped phase out will bring more clean energy onto the grid and power about half of our New York operations, helping to make our company one of the greenest in the state."

The project is the largest corporate renewable energy purchase on record in New York state, and, coupled with previously announced renewable energy projects, Bloomberg will power 51 percent of its New York state energy needs from clean energy sources once the project is complete.

"Bloomberg is aggressively looking for clean energy projects that make good business sense and reduce costs, diversify energy supply, and have a positive environmental impact," said Curtis Ravenel, Bloomberg's global head of sustainable business and finance. "With this project, we're projecting to save more than \$10 million over the life of the 20-year agreement versus traditional utility prices and demonstrating how businesses can contribute to the climate challenge while improving the bottom line."

"Governor Andrew M. Cuomo has championed efforts to reduce greenhouse gas emissions and combat climate change by increasing the use of renewable energy in New York," said John B. Rhodes, president and CEO of New York State's Energy Research and Development Authority. "With our support, the development of the Arkwright Summit Wind Farm will

help ensure New York achieves its 50 percent by 2030 renewable energy goals. We commend Bloomberg LP and EDP Renewables North America for their commitment to securing a stable energy supply with long-term economic and environmental benefits to benefit all New Yorkers."

Bloomberg aims to source 35 percent of its energy from clean power sources and reduce absolute emissions 20 percent from its 2007 baseline by 2020.

"Bloomberg has become a leading corporate buyer of renewable energy," said Charles Esdaile, managing partner of Altenex, the firm that served as Bloomberg's exclusive adviser on this transaction. "This is the largest corporate purchase of wind energy on record in New York. By completing this transaction, Bloomberg and EDP have helped to pioneer the New York market for large-scale renewable energy purchases by corporate buyers."

Bloomberg is a founding member of the Business Renewables Center, a collaborative platform launched by the Rocky Mountain Institute. It aims to accelerate corporate renewable energy procurement and double U.S. capacity of wind and solar energy by 2025. Bloomberg is also a signatory of the Renewable Energy Buyers Principles, a set of six principles that articulate the needs of corporate renewable energy buyers.

Construction of the wind farm is targeted for completion in 2017. ↴

— Source: EDP Renewables

For more information, go to www.edpr.com.

inFOCUS

Bolting Technology for the New Year

By Hank Surface

The tides are turning from the misinformed belief that hydraulic power pack systems are still the most relevant and accurate ways to torque. As we enter the new year, we need to focus on the ever-expanding bolting solutions that are available. While it may seem like a hindrance to incorporate new technology, electronic torquing is easier to use and boasts undeniably better results. If you do not torque correctly, accurately, or with repeatability, you cannot do anything else. From the basement to the blade bolts and everything in between, you have to be certain that you are achieving the correct torque that has been designated.

Efficiency is king when it comes to scheduled maintenance, and hydraulics no longer wear the crown. For example, in the same amount of time it takes to set up, torque a tower section, and prepare for the next section with hydraulics, all tower sections could be torqued. Each bolt would be recorded automatically with the exact torque applied, and the technician would not need to make a costly trip to the chiropractor before hitting the yaw deck.

New tooling varieties such as the E-RAD BLU and Smart Socket technology make it more appealing to all site personnel, from the project manager having exact readings and torque transmitted via Bluetooth when he wants, to the wind technician that has effectively lost more than 50 pounds of bulky bolting hydraulic equipment. Smaller footprints mean more production and faster deadlines. You

have to be certain that you are achieving the correct torque that the OEM has designated. Too much, and you would have fatigued the jointed material and bolt; too little, and it rattles, becoming loose. Accidentally turning the knob on a hydraulic pump can exponentially increase the hydraulic tools torque and leave you with a sheered bolt wreaking havoc in the hub or worse.

There are some key differences between hydraulic and electronic wrenches. Electronic precision torque wrench tools, for example, are designed to provide a high degree of accuracy, plus or minus 2.8 percent, and repeatability of plus or minus 2 percent using a more efficient planetary gearbox design and the precision of an electric AC servo motor. Having control with the touch of a finger further demonstrates the increasing differences from the hydraulic predecessors.

Risk mitigation is also deeply engrained within hydraulic torque wrench alternatives that could not be implemented into hydraulic power pack systems. Introducing an engineering control for safety trumps individual personal protective equipment and costly equipment training. For example, with electronic torque wrench systems, the tool operates at extremely low noise levels at only 75 decibels, meaning you can be safer knowing you will hear your radio when the booming and unforgiving weather conditions such as thunder and lightning comes unexpectedly.

Data collection software allows for the most absolute traceability and

transcription of data in a simple plug-and-play or wireless connection. With safety and risk management being the biggest concern, electronic torque wrenches have LED indicator lights such as pass or fail located on both sides. These visual signals indicate the status of torque procedure for maximum accuracy as well as fast and convenient error-free digital single increment torque settings.

The wind industry is consistently





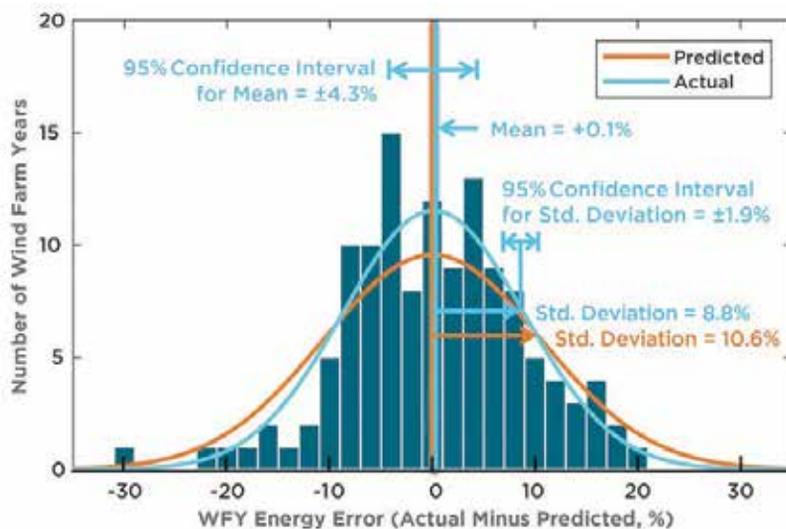
improving for the better. Electronics are now becoming the go-to choice due to their accuracy and repeatability. From years of calibrating hydraulic tooling in an ISO/IEC 17025:2005-accredited hydraulic calibration laboratory, most hydraulic wrenches have an OEM-specified accuracy of 5 percent. While this is a good standard, it is only 50 percent as accurate of what electronic torque wrenches are capable of. Hydraulic tooling kits has to either be

flown up in a box (if the specific model supports an outward hoist) or carried. The setup alone for torquing with hydraulic wrenches can be more than the time it takes to accomplish the task at hand. Electronic torque wrenches clearly surpass the equivalent tooling that would be needed by hydraulics for speed. Instead of using a pen and some paper, you can simply press a button on a calculator, eliminating that possibility for error. ↵

ALSO IN THIS SECTION

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VAISALA VALIDATES ACCURACY OF WIND ASSESSMENT METHODOLOGY



Vaisala Wind Assessment Validation Histogram

Vaisala

Vaisala, a global leader in environmental and industrial measurement, recently performed an extensive validation confirming the accuracy of its state-of-the-art energy assessment methodology. The results of this assessment validation process have revealed that the wind projects in the validation study performed within 0.1 percent of Vaisala's pre-construction estimates during the years analyzed on average.

This statistic is based on a comprehensive analysis of 30 operational wind farms, totaling 127 wind farm years. Of the years encompassed by the study, 90 percent were between 2010 and 2015, providing a significant sample size while still ensuring that projects' measurement techniques were up to modern standards. The results confirm that Vaisala's calculations are calibrated and in line with P50 wind energy estimates.

For the last decade, underperformance has been a key concern of the wind industry, and investigations have revealed that more sophisticated assessment methods are required to improve pre-construction energy estimates during the due-diligence phase.

While Vaisala's approach to energy assessment follows many of the standard practices that are familiar to the industry, it has also introduced several new innovations.

For example, Vaisala pioneered the broad integration of numerical weather prediction (NWP) models into the wind resource assessment process and works with ensembles of all the leading global reanalysis datasets to more accurately characterize the impacts of climate and weather at a project.

The company also relies on full time series data rather than averaged quantities to show the influence of unusual weather patterns more realistically. In addition, it has developed a next-generation uncertainty model known as the Energy Risk Framework that captures risk at every

step in the assessment process, incorporating complex dependencies ignored in classical approaches.

"Our techniques move the industry forward by addressing shortfalls in the standard approach," said Matthew Hendrickson, global manager of energy assessment at Vaisala. "The advantage of using next generation methods like NWP modeling has already been demonstrated in recent industry validation studies. The transparency of our method and how we communicate risk makes our science accessible to clients, building confidence and trust. As a responsible player in the industry, we felt it critical to validate our methods and answer the simple question of how well we predicted actual plant production."

With advantages in both modeling technique and risk characterization, Vaisala has gained respect with a number of global banks and investors, increasingly becoming their preferred choice. Today, the company is in regular outreach with key investors and is working toward universal acceptance of its approach.

"While these results are encouraging, this study is only the first cycle of a perpetual feedback loop," Hendrickson said. "As technology evolves and greater sophistication is required, this ongoing validation process ensures that Vaisala continues to lead the industry with cutting edge-science while maintaining an accurate and calibrated wind assessment process." ↵

— Source: Vaisala

For more information, go to www.vaisala.com/energy.

PRODUCT

IRONCLAD™ GROUT SLEEVES



NTC Wind Energy is pleased to offer its patent-pending IronClad Grout Sleeves. This product will save time and produce a better foundation for wind turbine generators.

The IronClad Grout Sleeve is a tapered polypropylene sleeve that is 3 1/2 inches tall with a slightly funneled flange at the base. The sleeves are tapped down over the bolts in the grout trough in place of foam rings. Once installed, they will protect the bolt from contact with grout and prevent grout from going down into the bolt sleeve. They grip tightly to the bolt and will not float in the grout.

For example, a foam ring that is 1 5/8 inches in diameter and 1/2 inch thick will displace 2.55 square inches of grout. At 144 bolts, the foam is displacing 367 square inches of grout in the foundation. If the grout has a compressive strength of 12,500 pounds per square inch, 4,594,590 pounds of compressive strength would be lost in that foundation. That amounts to nearly 2,300 tons of lost strength due to the voids created using foam rings. Grout sleeves displace almost no grout, resulting in a considerably stronger foundation.

IronClad Grout Sleeves project approximately 1 inch into the

base flange when the base is set. The top leading edge provides the added benefit of sealing the area immediately below the flange. This prevents any potential for the grout to interfere with proper tensioning.

There's no need to cut foam rings and tape them around each bolt any longer. IronClad Grout Sleeves are quick and easy to install and are priced at approximately the same cost as foam. They are also approved for use by all major engineering firms in the industry. ↙

— Source: NTC Wind Energy

For more information, go to www.NTCWind.com.

PROFILE

Hytorc Industrial Bolting Systems

For more than 45 years, Hytorc has provided bolting tools and training services for heavy industries, including wind power, and developed new torque and tension systems for industrial bolting to make jobs safer and simpler.

By Anna Claire Howard

Founded in New Jersey by John K. Junkers in 1968, Hytorc got its start by addressing the difficulties in industrial maintenance related to bolting. At that time, the majority of heavy industry bolting was done with a large wrench and hammer, and the definition of tight was when the nut stopped turning. While this was an inexpensive method that seemed to get the job done, in reality it was dangerous and time-consuming. In fact, in many cases, this method would lead to loosened nuts and joint failures, thus resulting in leaks and costly, unscheduled shutdowns. Yet, it became considered to be a part of normal plant operations since there weren't many other options available.

Hytorc recognized this need for a more efficient and safe way of doing things, so with its first system, it created a simple hydraulic ratchet that would turn the nut as it was powered from a hydraulic pump. This led to the development of air-powered industrial torque wrenches and electric models, including a handheld battery-powered tool. Today, those principles remain the same, but the systems have evolved to become much more intuitive and safer. And in these endeavors, the company has made its mark on the wind energy industry.

"Nearly every major innovation in industrial bolting over the last 45



years has come from Hytorc," said Jason Junkers, Hytorc's chief operating officer and one of the founder's three sons who has been working full time at his family's company for more than 12 years. "We are driven by feedback from our customers as well as continuous research and development. Intuitive design is a priority during new product development to ensure that the tools can be used safely, even when complete training has not been provided. There are many times where a tool may be purchased by one department that receives the complete training, and then it's borrowed and used by another group that only gets a brief overview

on how to properly use it. In these instances, it is critical that the tool is as safe and simple to operate as possible."

Hytorc also has many resources dedicated to improving the quality and availability of training to ensure that all tool operators understand the safest way to do the job. These principles are especially important in the wind industry where tools are shipped all over the world as wind farms are constructed.

"It is our mission to eliminate safety incidents related to bolting, and we are continually developing training courses and product advancements to help us achieve that goal," Junkers said.

Aside from the incredible accuracy and performance guarantee, Hytorc's tensioning systems have also been proven to reduce job time by at least half over any other bolting system.

Additionally, according to Junkers, as the wind energy industry developed, Hytorc quickly realized that the large scale of modern wind turbines would require strict assembly and maintenance processes to assure safe, continuous operation.

"The manufacturing and assembly of today's wind turbines includes up to 1,500 bolts and nuts per turbine, and many of these need to be checked on a regular basis to ensure that the vibration and movement of the turbine has not resulted in any loosening," Junkers said. "Over the years, we have developed custom fixtures and job kits for nearly every application on wind turbines from all major manufacturers. We are continually developing systems that make the jobs safer, faster, and more accurate while staying intuitive and operator-friendly."

In that effort, Hytorc began recruiting wind turbine technicians who could work hand-in-hand with its representatives and customers to find the best solution for each bolting job. The company has representatives across the globe with service centers spread throughout to provide a quick turnaround for its customers on all repairs, tool calibrations, and training courses. Additionally, Hytorc's employees and representatives have a tremendous collective knowledge of industrial bolting information.

"We aim to be the greatest resource in the industry so that all of our customers know that with just one phone call, they can get an answer to any bolting-related question," Junkers said. "From the beginning, our customers have been our priority, and we always strive to exceed their expectations."

This level of customer service and dependability has helped Hytorc



Hytorc's booth at the AWEA WINDPOWER trade show in Orlando in May 2015

earn the unofficial title as "the most trusted name in the industry."

"We've gained a reputation of being a partner for our customers' success rather than just a tool sales company," Junkers said. "Our dedication to our product quality, no-questions warranty, and worldwide coverage are some of the things that help us maintain our high standard of excellence."

From the manufacturing floor of the largest wind turbine manufacturer to the most remote wind farm, Hytorc has provided bolting solutions that increase productivity through improvements in safety, quality, and schedule. On the manufacturing side of wind farm operations, Hytorc's engineers bring an unmatched collective experience to problem solving and custom solutions for their customers, according to Junkers. One recent example of this is when the company's team of engineers was approached with a bolting job that previously took up to eight hours to complete, creating a bottleneck in the production line. Junkers' team at Hytorc was able to complete that same job in less than one hour using a custom-designed Hytorc system.

Junkers initially got involved in the wind energy industry when he took on the task of developing a fleet of 24/7

mobile service vehicles to address the need for such repair services in the wind energy industry.

"Our tools are heavily used in the wind industry, and there was a need for on-site calibration and repair so that down-time could be reduced," Junkers said. "This project showed me the opportunity for new innovations that could improve our service to the wind industry, and we have been dedicated ever since."

Over time, this proved to be a valuable resource for all of Hytorc's customers across several industries, but the wind industry remains the one where the service is most valued. Tools are heavily used during turbine maintenance, resulting in more stringent calibration requirements, according to Junkers. The service vehicles can arrive on site and do the calibration to get the tool back in service within an hour. This also proves to be beneficial in reducing the loss that can occur when tools are shipped to a service center for service and then returned to a site after a crew has left.

In addition to its mobile repair services, nearly all of Hytorc's wide range of products have been used to address bolting challenges in the wind industry. Its hydraulic, air, and electric tools can be coupled with custom-



designed fixtures to simplify otherwise challenging bolting jobs.

“Over the years, we have developed custom fixtures for nearly every bolting job imaginable, including the yaw drive, yaw brake, yaw bearing, blade bolts, pitch drive, foundation bolts, tower bolts, and more,” Junkers said. “One of our latest tools, the Lithium Series battery gun, is an excellent choice for wind turbine maintenance.”

Unlike the company’s hydraulic-powered tools, the battery gun does not require a heavy pump to be pulled up the tower. In fact, the tool is not much bigger than a standard power drill, albeit with a much larger battery and a bit more weight. This makes it easy for a wind turbine technician to clip it onto his belt as he makes the climb to the nacelle. Additionally, Hytorc offers technician training sessions and OSHA-approved safety courses. All of its tools are manufactured domestically in the U.S., and the company offers a one-year, no-questions-asked warranty to cover repair or replacement, regardless of cause.

According to Junkers, his family’s company has worked on nearly every turbine and wind farm in the world in one way or another. From central Iowa to remote regions in Asia, Hytorc has worked on both the manufacturing and maintenance sides. Its projects have involved turbines manufactured by GE, Siemens, and Vestas, among many others, and its client base in the wind energy industry is evenly spread between owners, operators, manufacturers, and service contractors.

Going into 2016 and future years, Hytorc has several new bolting systems currently in development that Junkers said he can’t wait to share with his company’s customers. Many of these developments have been a direct result of customer feedback, something Hytorc takes seriously.

Additionally, Hytorc’s training programs have improved in recent years and have become more widely available.

“Welders require certification to weld a connection right next to a bolted joint, but there is no standard for certification required for the bolting

tool operator,” Junkers said. “We have worked together with OSHA and the American Society of Mechanical Engineers to develop programs that will help standardize bolting training to ensure that safety and efficiency are improved across the board.”

As for Junkers’ outlook on the wind energy industry, he said he believes good things will come out of 2016, and Hytorc is looking to further develop and improve on the training courses it offers.

“We are aware of many new projects and new manufacturing opportunities around the world, and we are excited to share our expertise in the industry and our custom solutions to help owners, operators, and manufacturers improve their productivity,” Junkers said. “There is always room for improvement when it comes to training, and we are continually developing our training programs to ensure that all tool operators receive the best training possible.”

For more information on Hytorc go to www.hytorc.com.

PRODUCT

REVOLUTIONIZING BOLTED JOINTS WITH NEW WIRELESS LOAD-MONITORING SPC4



Valley Forge & Bolt Mfg. Co. uses innovative bolting technology to revolutionize bolted joints with its new wireless load-monitoring capabilities. Starting from its patented load-indicating technology, Valley Forge is now taking it a step further in allowing the user to monitor the load on a critically bolted joint from a remote location.

The company's well-known load-indicating technology started with the Maxbolt™ load-indicating fastener that continuously measures and displays the amount of tension in a bolt or stud. The fastener offers a simple method for accurate joint assembly and is the only product available for most applications that will continually monitor clamping force while the fastener is in service. Then the company introduced the SPC4™ load-indicating system, which allows the user to constantly monitor the clamp load of any SPC4 bolted joint by easily attaching a probe to the datum disc located on the end of the fastener. The user is able to read the value on a handheld battery-powered digital monitor with optional data gathering and storage of the bolted joint available.

Valley Forge's newest technology has taken the patented SPC4 technology and made remote reading a reality. With the new wireless load-monitoring device, SPC4 fasteners are assembled with a small probe attached to the datum disc. This probe then remains with the fastener assembly while in service. The probe allows the load of the fastener to be relayed to a receiving station that can be

located anywhere the user chooses. The receiving station displays the load as a percentage of the fastener's total capacity, as designed for the specific application.

The Wireless SPC4 load monitor is now in the beta testing stages and is being applied on a large rotating piece of machinery. One system consists of four probes or channels with a wireless remote reader for fixed applications. No positional information is included in this system, but it has a long range of up to 2,000 feet in ideal conditions. It can be designed to use another wireless technology, but generally, the longer the range is, the shorter the battery life will be. Another system monitors and logs 20 probes or channels for rotating applications that can be attached to an optional wireless transmitter. The system can be equipped with an optional programmable 5-megapixel video camera to send alerts in unattended installations or automate some tasks. The range would be shorter than the previous system.

The configuration of this technology can be tailored to specific customer needs, including the number of channels, frequency of reading, battery life, auxiliary outputs, and data logging. Other capabilities include sensors relaying positional information of each fastener and real-time clock circuit, if time records are desired. ↘

For more information, go to www.vfbolts.com, email sales@vfbolts.com, or call (800) 832-6587.

CONVERSATION

Nick Rasper

Sales

ITH Bolting Technology

 (815) 363-4900

 www.ith.com

 ITH Bolting Technology



Tell us about ITH Bolting Technology's history and how it made a name for itself in the wind energy industry.

ITH Bolting Technology was founded in 1979 by engineer Hans Hohmann in Meschede, Germany. The first product designed and manufactured by ITH was the hydraulic bolt tensioning cylinder. From there, ITH went on to develop a complete range of tension and torque tooling intended for larger industrial bolting applications. Today, ITH also offers fasteners and services that range from technical design of bolted joints to on-site bolting.

Involvement with the wind turbine industry began in the early 1980s. Bolts of large-sized slewing bearings, which are an integral part of wind turbines, require precise and even tightening to avoid galling between the single ring units. For this type of application,

tensioning is the best bolting method because, overall, it is significantly more accurate, precise, and faster than alternative methods. ITH promoted this and became directly involved with wind turbine OEMs as they began realizing the benefits of tensioning. The wind industry has become huge over the years, and ITH has continued working with the growing number of turbine OEMs, contractors, and service companies.

ITH is family-owned and operated, and it has maintained consistent core values. We have a worldwide reach, yet we emphasize customer focus with the flexibility and speed to meet their needs. ITH has more than 50 representations and 10 subsidiaries. We work together as a global network to provide international support.

What makes ITH one of the world's leading system suppliers in bolting technology?

Being a system supplier goes far beyond delivering a set of tools. We can offer support from the design phase through the life of a bolted connection. Engineering, tools, fasteners, and service — this is our complete system that comes from extensive experience and knowledge in bolting. The extra step that sets us further ahead as a leader is our drive for innovation through continuously applying the knowledge and experience gained over the years.

What types of products and services does ITH provide to the wind energy industry, and how do these help it stand apart from its competitors?

We provide products and services from every level of our complete system of engineering, tools, fasteners, and service. ITH designs and manufactures all of its own tooling and pumps, including hydraulic bolt tensioning systems, hydraulic torque wrench systems, and nut runners, which are more commonly known as torque multipliers. Some of the services we provide include technical design of bolted joints, training, and on-site bolting. Fasteners provided include a wide range from standard to specialized.

ITH stands apart from competitors by using its full range of products and services combined with experience and knowledge to push the advancement of bolting in the wind industry. One example is the introduction of maintenance-free bolting on wind turbine tower segments with the ITH Stretch System. This is a bolting package brought together by ITH to offer the best possible technical solution.

ITH tools are used on applications throughout different wind turbines, from foundation and tower section bolts to the hub and blade slewing bearings, as well as various other applications. We supply to OEMs, construction contractors, and service

“ ITH stands apart from competitors by using its full range of products and services combined with experience and knowledge to push the advancement of bolting in the wind industry. ”

companies for maintenance so our tooling has been widely used across the U.S. from the largest site, Alta Wind, down to single turbine projects.

How has ITH set new quality standards in the market, and what effect has that had on its role in the industry?

Better bolting solutions for slewing bearings, foundation and tower connections, and other bolted joints throughout wind turbines have positive impacts on their design, construction, and maintenance. While we continue to push adoption of these improved solutions across the wind industry,

we also use feedback from customers at each level to improve our products down to minor convenience features.

In 1995, ITH was the first market actor to be certified according to the strict requirements of DIN ISO 9001. Our strong commitment to quality persists. We were recently certified according to the updated quality management guideline DIN ISO 9001:2015.

How can wind farm owners and operators benefit from working with ITH?

From the start, we can help customers identify their tooling needs, and,

from there, we follow up with fast and reliable support. We have a large inventory of new tools and spare parts, and our service department has quick turn-around times.

What is your outlook on the wind energy industry in the U.S. going into 2016?

It's hard to predict how 2016 will go, especially with the uncertainty of the PTC extension. My general outlook is that the industry advances every year, aside from market fluctuations. The reports I've seen show that 2015 had some growth over 2014, and I think this will continue with 2016. ↘

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MAINTENANCE

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SCHNEIDER SELECTS VAISALA AS GLOBAL WIND FORECASTING PARTNER

Schneider Electric, a global specialist in energy management and automation, has signed a long-term international wind energy forecasting agreement with Vaisala, a global leader in environmental and industrial measurement and an expert in wind measurement, project assessment, and energy forecasting.

The agreement was signed following a competitive two-month live trial where Vaisala demonstrated superior performance in several key accuracy metrics across multiple forecast horizon times at several independent wind farm sites located throughout North America and Europe. This means that developers and operators can now benefit from best-of-breed wind power and weather forecasting information and an industry-leading software platform along with all of the other management tools Schneider Electric offers within its online decision-support application.

Schneider Electric's application, known as WeatherSentry Wind Energy Edition, uses next-generation mapping to provide detailed weather forecasting for wind farms around the world. This includes patented alerting technology to signal wind farm personnel about approaching lightning or other severe weather. It also includes dynamic location support through mobile device apps. The application helps wind operators enhance situational awareness and efficiently schedule operations by assessing their risk with respect to multiple weather parameters so that proactive and reactive wind project site activity can be better managed, monitored, and planned.

The wind power forecasts will also be available as part of the Schneider Electric Renewable Control Center solution, an automation tool for renewable power plant performance monitoring, management, and optimization.

This combination of services delivers an improved user experience, particularly for individuals working on



Vaisala

Schneider Electric interface

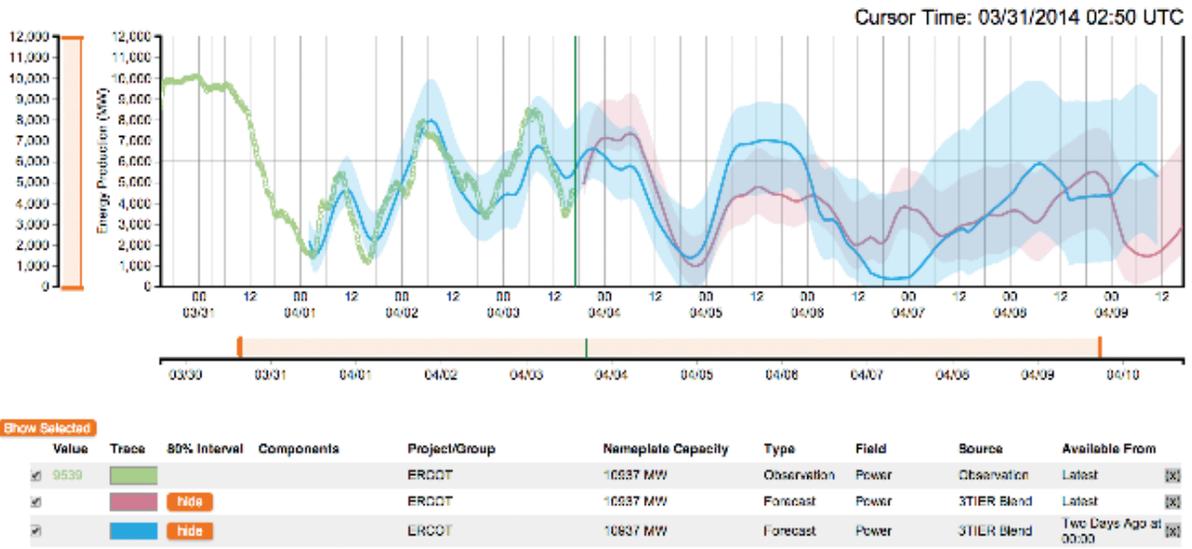
operational projects who may not be directly experienced with meteorology and weather markets.

“Irrespective of where in the world wind farm owners and investors are operating projects, it’s imperative to have access to high-quality weather forecasting information to plan for operations and maintenance, maximize production, and safeguard the facility,” said Jon Reifschneider, vice president and general manager of weather at Schneider Electric. “In light of this, and having spent considerable time developing a product that’s tailored to the specific needs of our global wind customer base, it was crucial that we develop a strong commercial partnership with a trusted renewable energy

ALSO IN THIS SECTION

28 Recover Lost Energy Output with Blade Cleaning

29 Condition Monitoring Failure Is Not an Option



Vaisala's forecast dashboard (The information looks slightly different when presented through the Schneider Electric's application.)

Vaisala

forecast provider. Vaisala consistently demonstrated forecast accuracy and an unrivalled understanding of the market. Through its first-class forecasting technology, Vaisala provides us a strong source of data that can be delivered globally to enable further development and growth.”

According to Pascal Storck, global manager of energy services at Vaisala, “Vaisala and Schneider have enjoyed a longstanding global working relationship, and this latest agreement underlines the strength of this commercial partnership.”

“Working closely with the team and having added considerable forecasting integrity to the platform, the focus over the course of the next 12 to 18 months now lies in continuing to attract new end users to the platform, while at the same time expanding and developing the existing service and reach,” Storck said. “This is likely to include regional wind forecasts in key energy markets.”

— Source: Vaisala

For more information, go to www.vaisala.com/energy.

ROMAX WINS IWEF TECHNICAL CONSULTANT OF THE YEAR

Romax Technology was recently acknowledged as Technical Consultant of the Year through an award at the Indian Wind Energy Forum held in New Delhi in November 2015.

The event focused on the future of operations and maintenance (O&M) and asset management of wind farms, where Romax’s InSight division gave a presentation on using technology for performance and reliability improvement. Romax has a proven track record working on the predictive maintenance and condition monitoring of wind farms across Asia, particularly in India, Korea, and China. In India, this has involved establishing key partnerships that successfully include

providing turbine health assessments and condition monitoring services for India’s largest independent power producer, Mytrah Energy, and working with India-based wind turbine manufacturer Inox Wind, which not long ago placed its 500th order for the Romax-designed 2-MW wind turbine gearbox.

Romax is widely regarded as a market leader in wind turbine drivetrain design and wind turbine generator (WTG) technical operation and maintenance services. Its condition monitoring software tools and predictive maintenance services provide wind farm owners and operators with diagnostic and prognostic

intelligence to facilitate cost- and time-saving predictive maintenance regimes.

This latest award is a great accreditation for the company, whose focus has been to invest in some of the industry’s brightest minds, including strategic thinkers, technology innovators, experienced engineers, and world-leading software specialists to be in a position to develop and supply innovative simulation tools and services for drivetrains and gearboxes across the globe.

— Source: Romax Technology

For more information, go to www.romaxtech.com.

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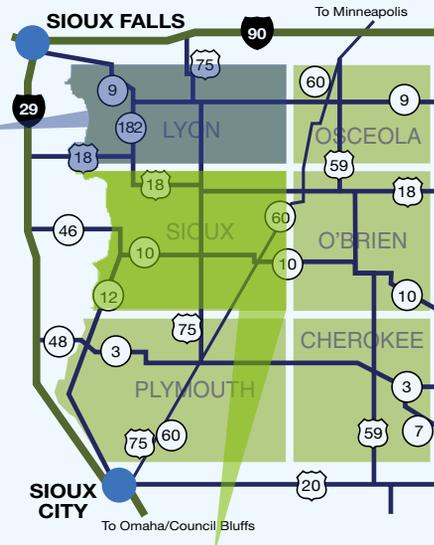
Northwest Iowa Development is a six-county regional economic development marketing partnership dedicated to efforts to grow the regional economy. See highlights below on two county regional partners.

LYON COUNTY

Lyon County is located in the northwest quadrant of Iowa and borders both South Dakota and Minnesota. Lyon County is strategically located within minutes of access to the 4-lane Highway 60 Expressway, Interstate 90 (east-west) and Interstate 29 (north-south).

The Lyon County Economic Development (LCED) office serves all Lyon County communities with financial assistance, site location and research tools. Lyon County is home to a wide range of growing businesses, such as Diversified Technologies, Elanco Animal Health, Glynlyon Inc., and the Grand Falls Casino & Golf Resort.

Contact Steve Simons, LCED Director of Economic Development at 712-470-6508 or visit the website at: www.lyonedia.com



SIoux COUNTY

Sioux County is the largest and fastest growing County in the Northwest Iowa region. The Sioux County economy is diverse with growing business and skilled workers in all of the vibrant communities.

The largest communities in the county are Sioux Center, Orange City, Rock Valley, Hawarden and Hull. Sioux County communities are home to leaders in advanced manufacturing, biotechnology and animal health. Each of the communities will provide assistance to businesses with their financial and site selection needs.

Sioux County is an active member of the Northwest Iowa Development (NWID) regional economic development partnership.

Contact David Miller, NWID Board Member and Development Director for the City of Rock Valley at 712-476-9300 or visit the website at: http://www.siouxcounty.org/community_links/community_links.php



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RECOVER LOST ENERGY OUTPUT WITH BLADE CLEANING

By Jack Wallace

Wind farm owners spend a great deal of time figuring out how to produce more power, make more money, lower their expenses, and achieve the most part gain out of their spinning assets. For a wind turbine to generate power, and thus more money, either the wind has to blow more or you have to get paid more for your power. We don't have control of how much wind is blowing within the swept area of the turbines, and we usually don't have control over the rate of pay that we are compensated for when we supply power. The best option is to make the turbines as available as possible (as safely as possible). In doing so, there may be a way to improve your revenue.

There is a maintenance task that is for the most part ignored, but it can affect the turbines' energy production — blade washing. Those who know me understand that I don't waste my time or limited budgets on performing unnecessary services to keep our turbines running. Some may believe that

turbines with dirty blades that have variable pitch and variable speed don't need washing. However, I have not found this to be true. I have found that blade washing can improve your turbines' production output during certain times of the year. In fact, you may find that your power output will benefit from a blade-washing program.

Blade washing has been one of the wind turbine services that Frontier Pro Services has provided over the last 30 years. Thousands of wind turbine blades have been getting washed in California since the 1980s. Each spring, during the hatching season for winged insects, we begin our blade-washing program, and we continue it throughout the summer as the blades get dirty from bug build-up and the turbines' energy production declines. We have found that the build-up of smashed insects creates enough of a change to the blade airfoil and a drag on the blade that the turbines' production outputs drop. My yearly indicator to know

when it's time to start our blade-washing program is when bugs start to build up on my truck windshield. If I need to clean the windshield of my truck, then it is time to start washing blades.

The way the blades are washed in California has been an evolving process. Sometime in the early 1980s, tower operators installed permanent blade washing pipes up the sides of the wind turbines near the top of the tower. The blade pipes have open ports along the pipe behind the rotor. While the turbine is running and the blades are passing by the pipes, water is pumped up-tower by a water truck that is connected to the bottom of the pipe. The water jets out of the ports along the pipe and sprays out into the path of the rotating blades. After a few minutes of the blades passing through the spray water, the blades are mostly clean of bugs, and the airfoil performs more efficiently.

Another method of blade cleaning is using a water truck or insulator



Image 1: Bug build-up on blade



Image 2: Blade surface after cleaning

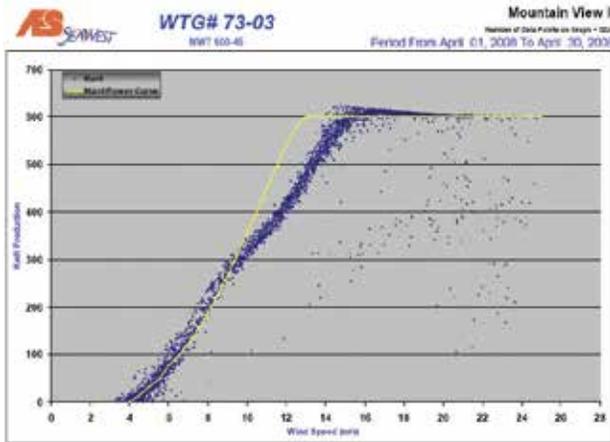


Figure 1: The dirty blades' power curve

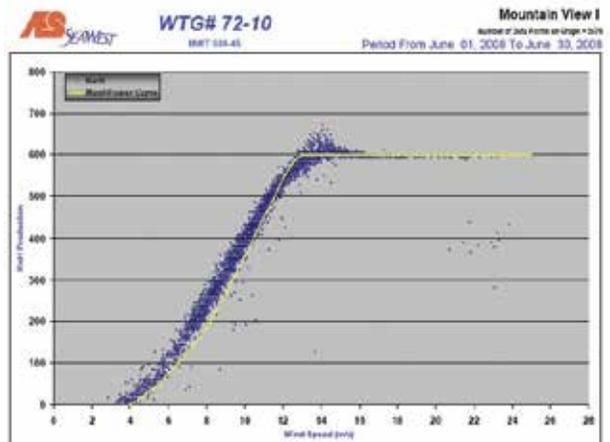


Figure 2: Normal power curve

cleaner truck with a similar spray bar attached to it. The boom with the spray bar is placed in front of the rotating rotor, and the water is sprayed out into the rotating rotor. Once again, the turbine production is back on track after a few minutes. This method is still used today, and it is completed as often as every two weeks during production months. There is even an automated smart spray bar system that uses the timing of the blades to spray the water as each blade passes the tower, thus conserving the amount of water used. There are a few other methods used for cleaning wind turbine blades, including a sponge-type apparatus attached to a boom truck. When the turbine is turned off, the sponge rubs the bugs off. This method cleans better, and

the time between cleanings can be doubled to once a month. This has been done on turbines as large as 1 MW on 60-meter towers. Once again, with the blades cleaned, the turbines' production returns to its design's output. Sometimes, waxes or other coatings can be applied to make the bugs unable to land on or adhere to the blade's surface. Blades can be cleaned by rope-access teams, men in crane baskets, and virtually any way you can imagine.

Dirty-bladed variable pitch and/or variable speed turbines cannot produce energy as well as clean-bladed variable pitch and/or variable speed turbines. You just cannot make enough adjustments in less-than rated winds to bring the power curve back to the optimal design power curve.

Figures 1 and 2 show data from older turbines with variable pitch that are greater than 500 kW, but less than 1,000 kW. Images 1 and 2 are of two blades, and Figures 1 and 2 are of the two power curves that they each produced — the clean blade with the normal power curve, and the dirty blade with the poor-performance power curve. Owners and managers of a wind power plant know that most of the energy production is produced during winds with less-than rated power. Turbines produce power for thousands of hours at less-than maximum output. If your blades are not clean, then you are losing production.

As always, work safe and prevent surprises. ♪

CONDITION MONITORING FAILURE IS NOT AN OPTION

By Jeff Walkup

One question that stands out in the wind industry is if we can revisit time-tested fundamentals and practices already proven successful in other industries and apply them to wind. The wind industry has a target service life for the typical wind turbine gearbox of approximately 20 years. The U.S. wind industry not only represents a large market for wind power capacity installations, but also serves as a growing market overall for American manufacturing business and, subsequently, the jobs created as a result. Hundreds of manufacturing facilities

all across the country make components for wind turbines, ranging from the towers and blades to the assembled nacelles. These jobs range from professional and engineering services to the skilled crafts and tradesmen that make, repair, and service the towers in all facets of their development, operation, and electrical production life cycle. As we strive to meet the evolving clean energy demands of the 21st century, the challenge will be to provide an environmentally clean and profitable solution for generations to come.

Taking into consideration wind farm history and case study documentation, it would suggest failures of wind turbine components are far too commonplace, with each failure requiring possible major component replacement or repair before designed end-of-life. Industry data indicates that in many cases, this occurs within the five- to seven-year range and possibly outside of a warranty period. This anomaly attributes to substantial loss in electrical production and associated cost that must be captured or passed on to the electrical consumer. Those who consider employing various forms or methodology of condition monitoring must validate from a business perspective the initial cost of condition monitoring versus run to failure (RTF) and energy cost. You must also factor in that the wind power industry is relatively young in comparison to other energy production sources and, thus, determining initial

capital cost, maintenance, and operation scenarios is not an exact science. Wind turbines and wind farms in general can present various and complex challenges due to their remote locations, height above ground, adverse weather conditions, and the fact that as far as the power production demand goes, if a wind turbine should fail, its loss could be absorbed to some extent by other components within the infrastructure. Modern industry demands maintaining and monitoring bearings, gear systems, pumps, and hydraulic applications to any component that may require a vigilant proactive system and methodology to manage cost, reduce consumption, and reduce friction and wear. We must utilize the resulting data to monitor system health while reducing its impact to the environment. Machinery problems and failures are often not attributed to an engineering flaw and design, but rather to the lack

of human intervention when indications warn us of an impending failure.

Developing plans and considering factors, such as the following, may prove to be beneficial regarding your condition monitoring program and goals going forward:

- Accept the risk as well as the reward by evaluating your current maintenance and monitoring program. Be willing to change things that are not working.
- Concentrate on factors that you can change and control. Enact good planning.
- Consider continual evaluation of lubrication usage and selection. Are you doing the correct things and getting the best result and return on your investment?
- Are you driven by circumstances, or are you in control?
- Consider benchmarking performance before and after the process. Are your efforts producing results?
- Establish organizational goals and objectives. Are all members of your team moving in the same direction?
- Ensure a program of sustainability in order to leave a legacy. Are you providing training for your team and preparing them to be in a better position than you were in?
- Prevent falling back into previous methods of business and maintain consistency.
- Grasp the power of momentum and seize opportunities. Early wins will motivate and propel you to new heights.
- Understand how to communicate change and its potential results. Be willing to take the time to establish accountability and credibility.

By building on these steps and adding to your existing program, you can be well on your way to achieving your goals. Failure does not have to be an option when you are in control. Use tools, systems, and experiences from lessons learned to work smarter, not harder. ↴

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EDF RENEWABLE ENERGY AGREED TO SUPPLY GOOGLE WITH 201 MW OF WIND POWER



Google, Inc. recently announced that it has signed a deal with EDF Renewable Energy (EDF RE), as well as with five other renewable energy companies including Invenery LLC and RES Americas, to purchase renewable energy for its data center. The power purchase agreement (PPA) will provide Google with the full output of the 201-MW Great Western Wind Project

located in Woodward and Ellis counties near the base of the Oklahoma panhandle. The project will commence construction in the first quarter of 2016 and be fully operational by the end of the year.

The deal was announced in Paris as part of Google's presence at the 21st Conference of the Parties to the United Nations Framework Convention on Climate

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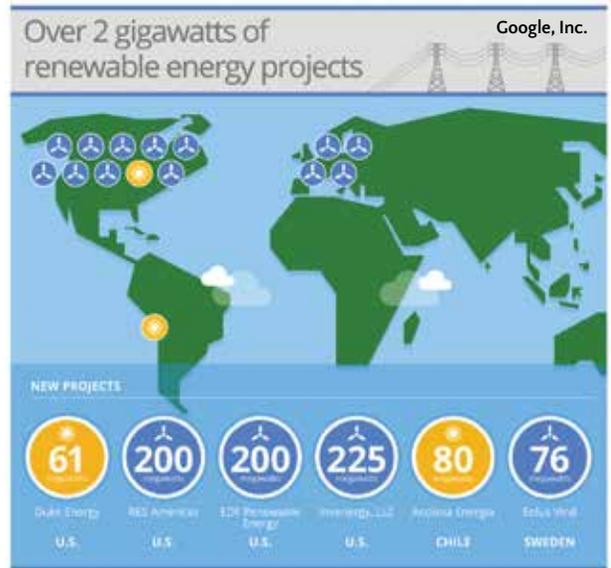
Change (COP21). The announcement brings Google one step closer to its commitment to triple the purchases of renewable energy by 2025 and eventually powering 100 percent of its operations with clean energy. One of the key actions on the ambitious journey to rely more on renewable energy is to partner with EDF RE to build the Great Western Wind Project and place more clean energy on the grid.

The Great Western Wind Project will be comprised of 30 V117 (unit capacity of 3.3 MW) and 51 V100 (unit capacity of 2.2 MW) wind turbines supplied by Vestas. The amount of power generated will be equivalent to avoiding more than 600,000 metric tons of CO2 emissions annually. This is equivalent to the emissions of 125,000 passenger vehicles driven over the course of one year.

“The participation of Google to directly procure wind power demonstrates their understanding of both the environmental benefits of renewable energy as well as the business opportunity,” said Tristan Grimbert, CEO and president of EDF Renewable Energy. “Wind not only emits zero greenhouse gas emissions, but it also delivers long-term energy price stability. We applaud their leadership in action around the climate change conversation and providing the financial certainty through the power purchase agreement to remove a key barrier to building a wind project.”

According to Gary Demasi, Google’s director of operations for Data Center Energy and Location Strategy, Google has already committed to purchase more renewable energy than any other company.

Google joins EDF’s growing North America portfolio of corporate purchasers including Procter & Gamble, Microsoft, Yahoo, Grupo Modelo, and Walmart.



This new PPA builds on the relationship forged between the two companies in December 2012 when Google made an approximately \$200 million equity investment in EDF RE’s Spinning Spur Wind Project, a 161-MW facility located in Oldham County, Texas, demonstrating that corporations can serve as a new source of capital for the renewable energy sector.

Google is already the largest corporate purchaser of renewable energy in the world, and the Great Western Wind Project adds to the company’s long-term contracts to buy green electricity from wind generation, bringing the total portfolio of renewables to nearly 2 GW. ↴

— Source: EDF Renewable Energy

For more information, go to www.edf-re.com and www.google.com/green/energy.

TURBINE OWNERS ESTABLISH GLOBAL PEER-TO-PEER PLATFORM TO SOLVE O&M ISSUES

Wind farm owners representing 12 percent of global turbine assets have founded a new peer-to-peer online platform called o2owind International, meaning owner-to-owner, dedicated to the exchange of knowledge and experience on operation and maintenance issues. The o2owind forum is the first initiative of its kind aimed at fostering wind farm O&M best practice through a collaborative approach.

Wind energy giants such as EDPR, Vattenfall, RWE, DONG Energy, and Acciona Energia have already joined this exclusive network, along with numerous other wind turbine owners.

“When it comes to troubleshooting the O&M issues they encounter, wind farm owners are not competitors,” said Märten Nilsson, who is heading o2owind. “On the contrary, they are in the same boat, and that’s why

adopting a collaborative approach to problem solving makes a lot of sense. Our members recognize that the most valuable information for turbine owners is the hands-on experience held by their peers.”

Members share the common objective of optimizing turbine yields, and many specialized discussions revolve around issues with main components such as rotor blades, gearboxes, or substations.

With o2owind members owning more than 60 percent of all offshore turbines in the world, the platform is also strong on offshore O&M. Although the topics treated on the forum are mainly technical, they can also be connected to major investment decisions.

O2owind takes down the usual barriers to information exchange that get in the way of the performance optimization of wind assets.

“Compared to other industries, wind still has some teething issues that are difficult to change when we operate in isolation,” said Sverre Trollnes, manager of operation and maintenance at Statoil.

According to Alan Henderson, head of technical asset management at RWE Innogy,

“Low yields and costly stand-stills have plagued the industry for too long, with no long-term gains for anyone. We need to collaborate to reach the goal. It’s that simple.”

The strict member selection criteria are designed to weed out noise and maintain a high level of expertise throughout the network.



“I consider the o2owind group as the best forum to share experiences with other wind farm owners regarding technical problems and their solution from the point of view of the owners,” said Cristobal Courret, director of production at Acciona Energia. ↴

— Source: o2owind

For more information, go to o2owind.com.

SIEMENS TO SUPPLY 126 MW TO ONSHORE WIND POWER PLANTS IN SCOTLAND



The Siemens SWT-3.2-101 and other models of the Siemens D3 product platform provide high energy yields and efficient operation for three Scottish onshore wind projects.

Siemens has been awarded orders for three onshore wind projects in Scotland, supplying up to 50,000 households in

South and North Ayrshire and Lockerbie. The contracts also include long-term service and maintenance.

For the Dersalloch wind farm in the South Ayrshire region, Siemens will construct, install, and commission 23 units of its D3 direct drive wind turbines, providing a combined output of 69 MW. The installation of the turbines is scheduled to begin in the spring of 2016 with the official handover of the site to developers ScottishPower Renewables in the fall of 2016. Siemens will also be responsible for servicing the wind turbines.

In addition, Siemens will supply six SWT-2.3-93 wind turbines to the Ewe Hill Phase 1 located 15 kilometers from Lockerbie in Dumfries and Galloway. Furthermore, 16 wind turbines of the same type will be installed for Phase 2, bringing both sites up to 22 wind turbines with a potential generating capacity of up to 51 MW. The installation of the turbines for Phase 1 is scheduled for the spring of 2016, followed by Phase 2 installation in the fall of 2016.

For Millour Hill Community Wind Co Ltd, Siemens will deliver two SWT-3.2-101 turbines to North

Ayrshire where six 3.0 MW-rated wind turbines were already installed. Three years ago, the installed turbines marked a product premiere for the Siemens' D3-product platform in the British market. Within the scope of a 20-year services agreement, Siemens is taking charge of maintaining the two SWT-3.2-101 turbines.

"We are delighted to continue our partnership with ScottishPower Renewables and Community Windpower Limited," said Thomas Richterich, CEO of onshore at Siemens' wind power and renewables division. "With their combined rating of 126 MW, these three projects will provide reliable, clean energy for the region, equivalent to the demand of both Scotland's Orkney and Shetland Islands." ↵

— Source: Siemens

For more information, go to www.siemens.com/wind.

XCEL ENERGY PROPOSES OPTION FOR 100-PERCENT RENEWABLE ENERGY

Xcel Energy recently proposed a new program that would allow its Minnesota customers to choose energy generated exclusively from wind and solar resources.

The company submitted its proposal for Renewable*Connect in a filing with the Minnesota Public Utilities Commission (PUC).

If approved by the commission, Xcel Energy customers who subscribe to Renewable*Connect will be able to secure up to 100 percent of their electricity from a blend of wind and solar resources dedicated to the program.

In addition to allowing customers the option of choosing all renewable energy, this new program would provide price predictability as the fuel charge is tied to the wind and solar energy used in this project.

"Our customers want more options when it comes to energy use, and this new program will help them meet their sustainability goals," said Chris Clark, president of Xcel Energy. "Renewable*Connect will give

customers a new choice for wind and solar energy, flexible terms, and no up-front costs. This proposal builds on the success of Windsource, a renewable energy program that generated 173,000 MWh of sales in 2014."

Program Details

If approved by the commission, Xcel Energy customers will be able to sign up for Renewable*Connect on month-to-month, five-year or ten-year contracts. In addition to reviewing the overall program, Xcel Energy is asking the PUC to approve a portion of wind and solar projects coming online in 2016 for the program with the resources dedicated to the equivalent amount of electric demand of program participants. Initially, the program will be offered on a first-come, first-served basis, with plans to expand as the utility adds new wind and solar projects.

Meeting Customer Sustainability Goals

The program provides benefits to business customers with

sustainability programs as it will deliver a verifiable method to track renewable energy use. Xcel Energy will seek Green-e certification from the Center for Resource Solutions and retire Renewable Energy Credits associated with the wind and solar projects on behalf of participating customers. The Renewable Energy Credits will be registered with the Midwest Renewable Energy Tracking System.

The program will also meet the unique needs of new or expanding businesses in the region, according to Michael Langley, CEO of Greater MSP (Minneapolis Saint Paul Regional Economic Development Partnership).

"Sustainable energy options are an advantage for businesses expanding in our region," Langley said. "Our region is a leader in many aspects of sustainable energy and this program will meet business' needs. It will be another tool for regional economic development."

Industry Organizations Are Similarly Encouraged

“This sort of innovation is exactly what the large buyers were hoping to spur when they drafted the Corporate Renewable Energy Buyers’ Principles,” said Letha Tawney, director of Utility Innovation and Polsky Chair for Renewable Energy at the World Resources Institute. “Xcel Energy has thought in a creative way about features like simplicity, predictable pricing, program flexibility, and shielding other rate payers. We’re looking forward to sharing the details with our corporate partners and hearing what the Minnesota

Public Utilities Commission and other stakeholders think of the program.”

Long-Term Price Predictability

Current customer bills include a fuel surcharge that can change on a monthly basis depending on the price of fuel used in generating electricity. The Renewable*Connect program will reflect only the cost of the utility-scale wind and solar resources dedicated to the project, providing more price stability, particularly for long-term contracts.

The filing also includes incentives for customers who have signed up

for a separate electric vehicle meter who will receive exemptions from some program charges. Businesses that locate or expand under the existing Business Incentive and Sustainability (BIS) Rider are also exemptions from some program charges.

Minnesota PUC’s review of the program is expected to last approximately one year. Customers can start signing up for the program when approved, which is expected to occur in early 2017. ↵

— Source: Xcel Energy

For more information, go to www.xcelenergy.com.

GE RENEWABLE ENERGY SIGNS 60 MW WIND DEAL IN THAILAND

GE Renewable Energy recently announced it has signed a contract with Khao Kor Wind Power Co., Ltd., to supply wind turbines for the Khao Kor wind farm in Petchaboon, Thailand. The 60-MW project is expected to supply power to the northern part of the country, generating enough equivalent energy to power approximately 36,000 Thai households for a year.

“This region has huge potential for wind power, and our technology is competitive, reliable, and innovative,” said Peter Cowling, general manager of GE’s wind business in the Asia Pacific region. “GE is committed to supporting local developers in Thailand, and we hope to continue collaborating with regional customers to build additional wind power capacity in the future.”

Wind energy has been making progress in Thailand. The Department of Alternative Energy Development and Efficiency’s (DEDE) Alternative Energy Development Plan (AEDP) aims to increase the share of renewable electricity in Thailand’s total electricity mix from approximately 12 percent in 2014 to 25 percent by 2021.

“The Khao Kor wind farm will be GE’s first wind facility in the country,”

said GE Thailand President and CEO Kovit Kantapasara. “GE is proud to

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help Thailand change its energy mix and reach its renewable energy goals.”

The 24 wind turbines that will deliver the power each utilize a 120-meter rotor diameter to provide 2.5 MW of power per unit. With its hub sitting atop a tubular steel tower 110 meters off the ground, the 2.5-120 specializes in increasing power yields for low-to-medium wind speed regions, like the conditions anticipated at the Khao Kor wind farm.

“We are delighted to collaborate with GE in this endeavor, as we aim to contribute to the country’s cleaner sources of energy,” said Dr. Surachet Tamronglak, managing director for Charoen Energy and Water Asia Co., Ltd. “We are anxious to begin construction on the project and expect to have the wind farm up and running by mid-2016.” ↵

— Source: GE

For more information, go to renewables.gepower.com.



GE

UPWIND AND SUSPENDEM BRING VORTEX GENERATORS TO CANADIAN MARKET

UpWind Solutions, Inc., North America’s leading independent full-service provider for the wind industry, and Suspendem Inc., a leader in Canadian wind turbine O&M services, have recently entered into a strategic relationship in which Suspendem will be able to provide UpWind’s Vortex Generator (VG) Solution to the Canadian wind market for the first time.

UpWind partnered with Smart Blade®, the wind industry aerodynamics experts and 3M™ to deliver the best-in-class VG solution for wind turbine rotor blades. The vortex generators have successfully increased Annual Energy Production (AEP) by 1 to 3 percent for 10 or more turbine technologies. UpWind developed a proprietary installation process with Smart Blade that is customized to each turbine blade type, utilizes precise installation lines and repeatable installation procedures, and uses a strong adhesive from 3M that can last the life of the turbine.

With guidance and training from UpWind, the strategic alliance will allow Suspendem to use this custom installation process and provide the VG Solution to both parties’ customers in Canada.

“This is an important expansion of our VG solution into the Canadian market,” said Jason Shelby, vice president of services at UpWind Solutions. “We’re excited to have Suspendem join our team, where they are positioned for exceptional service and support in the Canadian market”

Suspendem performs specialized inspection, repair and maintenance services for the wind energy industry. They are the leading provider of at-height services in the Canadian wind energy market.

“Suspendem is pleased to add UpWind’s VG Solution to our gamut of O&M service offerings for the Canadian market,” said Bill Talbot, managing director at Suspendem. “We will utilize our experienced, pan-Canadian service teams to install this VG solution and help Canadian wind farm owners increase AEP with a short return on investment.”

The strategic alliance brings North America’s top rope-access providers together to give Canadian wind farm owners access to UpWind’s VG Solution. ↵

— Source: UpWind Solutions

For more information, go to www.upwindsolutions.com.

MANUFACTURING

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

SENVION CELEBRATES THE COMMERCIAL OPERATION OF ITS LARGEST ONSHORE PROJECT



Rivière-du-Moulin Wind Project in Quebec

Senvion, one of the world's largest manufacturers of wind turbines, recently marked the commercial operation of the Rivière-du-Moulin wind project in Quebec, Canada. With 175 2-MW turbines totaling 350 MW, the wind project consists of Senvion MM92 and MM82 cold climate version (CCV) turbines. Several of the turbines are equipped with Senvion de-icing technology, adapted

for cold Canadian climate conditions. The Rivière-du-Moulin wind farm is the largest onshore contract in the history of Senvion and comes as part of the 1-GW framework agreement Senvion signed with EDF EN Canada Inc. in 2009.

"Rivière-du-Moulin is yet another achievement for us in 2015," said Andreas Nauen, CEO at Senvion. "As

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40 Wind Energy To Power GM's Texas Assembly Plant

the largest onshore wind project in our history, Rivière-du-Moulin represents more than a third of our installed capacity in Quebec. This very large wind farm represents a major milestone for Senvion across the globe.”

The project is located in the unorganized territory (UT) Lac Pikauba in the MRC de Charlevoix and the UT of Lac Ministuk in the MRC du Fjord du Saguenay. Rivière-du-Moulin is expected to produce enough electricity to power approximately 77,000 households with clean, renewable energy and will generate a significant amount of economic benefits for the surrounding communities.

“Rivière-du-Moulin is a great example of our regional expertise in action as Senvion managed to complete and deliver the project to commercial operation two weeks ahead of schedule,” said Helmut Herold, CEO of Senvion in North America. “That is no small feat, considering the

territory’s complex terrain and often adverse weather conditions. Its completion is a result of the outstanding efforts by our exceptional workforce on-site as well as in our office, not to mention our local partners. Rivière-du-Moulin illustrates how cooperation between industry partners, governments, and communities drives change for cheaper and cleaner energy in Quebec.”

As part of its growing achievements in 2015, Senvion has become the second largest onshore wind turbine manufacturer in Germany with an installed capacity of 285 MW in the first half of 2015. Globally, Senvion has installed over 6,100 turbines, providing an output of over 12 GW. ↘

— Source: Senvion

For more information, go to www.senvion.com.

ENBRIDGE ACQUIRES 103-MW WEST VIRGINIA WIND PROJECT

Enbridge Inc. recently announced the acquisition of a 100-percent interest in the 103-MW New Creek Wind Project from EverPower Wind Holdings, LLC, an independent U.S. renewable energy developer. Enbridge’s total investment is approximately \$0.2 billion.

Located in Grant County, West Virginia, New Creek Wind will

comprise 49 Gamesa G97/G90 turbines and is targeted to be in service in December 2016. The project was developed by EverPower Wind Holdings.

“With strong fundamentals and commercial underpinnings, the New Creek Wind Project is a strong fit within our low-risk value proposition

and advances a key corporate priority of growing our renewable generation platform,” said Vern Yu, senior vice president, corporate planning and chief development officer at Enbridge Inc. “We welcome the relationship with EverPower, a safe and community-focused developer, owner, and operator of U.S. wind projects.”



The project is backed by renewable energy credit (REC) sales and off-take agreements with fixed pricing through mid- and long-term contracts.

New Creek will be constructed under a fixed-price engineering, procurement, and construction (EPC) agreement with White Construction Inc. Gamesa will provide turbine O&M services under a five-year fixed price contract, following which Enbridge will operate.

Including this acquisition, Enbridge has invested approximately \$5 billion in renewable power generation and transmission since 2002. Enterprise-wide, the company now has interests in nearly 2,000 MW of net renewable generating capacity operating, secured, or under construction. ↴

— Source: Enbridge

For more information, go to www.enbridge.com.



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GE Energy



WIND ENERGY TO POWER GM'S TEXAS ASSEMBLY PLANT

General Motors' Arlington Assembly plant will soon be able to build up to 125,000 trucks a year using wind power from turbines whose blades span the length of a football field in diameter.

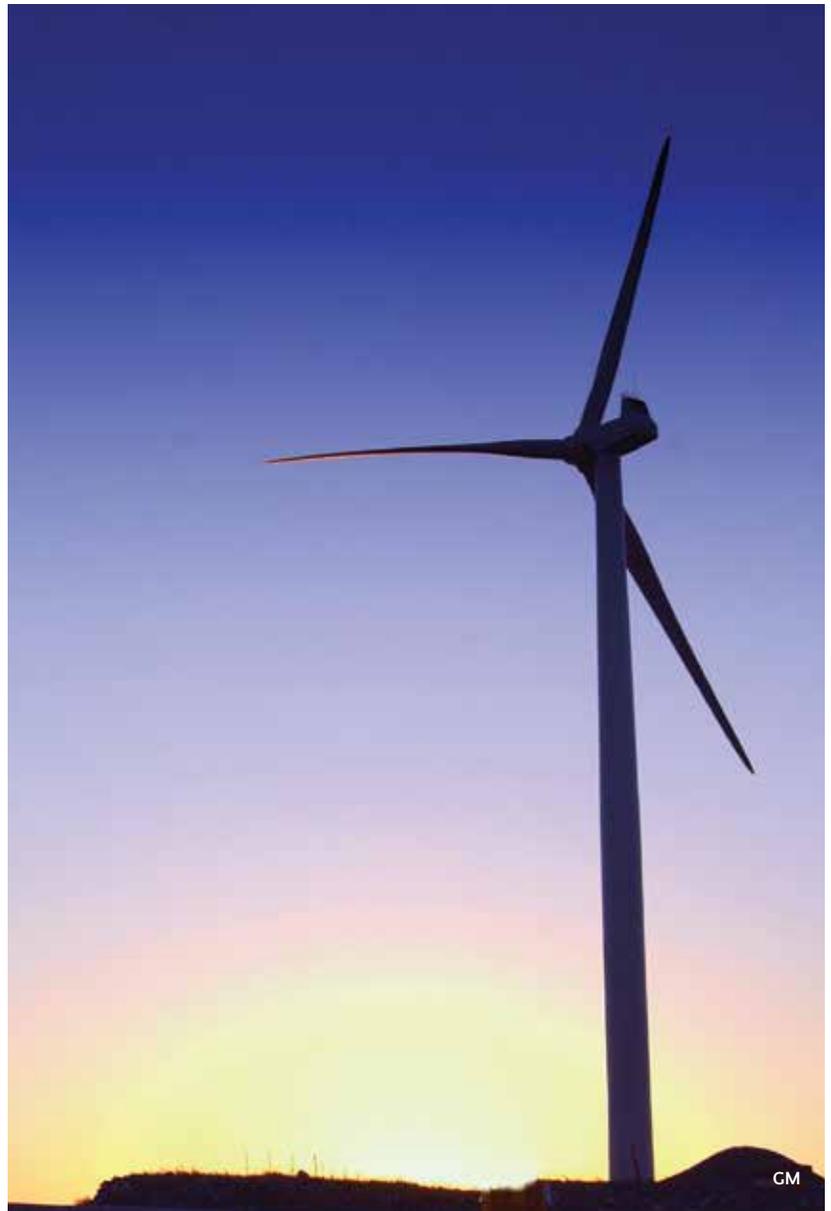
Arlington Assembly produces more than 1,200 vehicles daily, including the Chevrolet Suburban and Tahoe; GMC Yukon and Yukon XL; and Cadillac Escalade and Escalade ESV. The 115-million kwh of renewable energy will be enough to manufacture more than half of the plant's annual vehicle output.

GM recently signed a power purchase agreement with EDP Renewables North America, a fully owned subsidiary of EDP Renováveis, for 30 MW of renewable energy from the planned 250 MW Hidalgo Wind Farm in Edinburg, Texas. Fifteen of the wind farm's 261-foot-tall turbines will generate the energy GM will use.

Arlington Assembly expects to start using the clean power during the fourth quarter of 2016, avoiding approximately \$2.8 million in energy costs annually. Over the course of the 14-year deal, GM will avoid more than 1 million metric tons of carbon dioxide emissions, which is equivalent to the emissions of 112-million gallons of gasoline consumed.

"Our investment is helping accelerate the proliferation of clean energy in Texas and the use of wind as a reliable, renewable source of energy," said Jim DeLuca, GM executive vice president of global manufacturing. "Our sustainable manufacturing mindset benefits the communities in which we operate across the globe."

"We are pleased to enter into this agreement with General Motors and



look forward to providing clean and more economical energy for GM's Arlington Assembly plant in the coming years," said EDP Renewables North America CEO Gabriel Alonso.

Renewable energy complements a robust energy efficiency program at the plant. Arlington Assembly recently met the U.S. Environmental Protection Agency's Energy Star® Challenge for Industry by reducing the energy intensity of its operations by 10 percent in five years, marking the second time it has met the challenge. Arlington

Assembly is also investing in a new paint shop that will use half the energy of the system it will replace.

Beginning in the first quarter of 2016, wind energy will help power three GM Mexico facilities. Once online, the company will exceed its commitment to use 125 MW of renewable energy by 2020. GM's investments in renewable energy to date have yielded nearly \$80 million in savings. ↴

— Source: GM

For more information, go to www.gm.com.

CONSTRUCTION

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BLOCK ISLAND WIND FARM CAPS OFF SUCCESSFUL FIRST OFFSHORE CONSTRUCTION SEASON



The first offshore construction season is now complete in the U.S. for the nation's first offshore wind farm with all five steel jacket foundations fully installed at the Block Island Wind Farm site.

Construction crews installed the last deck platform on November 21, 2015. All of the construction and crew vessels associated with the operation have now demobilized from the site.

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“From the first ‘steel in the water’ in July to the last deck lift in November, we’ve completed a season of firsts — not only for the Block Island Wind Farm but also for the launch of a new American offshore wind industry,” said Deepwater Wind CEO Jeffrey Grybowski. “We are proud of the work we’ve accomplished so far, but we’ve only just begun, and 2016 will be a year to remember.”

“Rhode Island is proud to be home to the nation’s first offshore wind farm, and we’re quickly becoming a center of innovation in this growing industry,” said Rhode Island Governor Gina M. Raimondo. “With this project, we’re putting hundreds of our local workers to work at-sea and at our world-class ports to build a project that will help diversify Rhode Island’s energy mix and protect our environment. I applaud Deepwater Wind for their successful first offshore construction season, and I look forward to seeing the project fully operational and generating renewable energy in 2016.”

Over the course of the busy 18-week construction period, approximately 200 workers (100 of them local) and a dozen construction and transport barges, tugboats, crew ships, and monitoring vessels were active at the project’s port facilities and the wind farm site roughly 3 miles off the coast of Block Island.

More than 300 local workers will be involved with building the Block Island Wind Farm. Deepwater Wind is utilizing four Rhode Island ports — Block Island, Galilee, Quonset Point, and the Port of Providence — to complete construction and staging.

All construction activities were completed in accordance with strict environmental rules set by state and federal government agencies. In 2013, Deepwater Wind voluntarily agreed to a series of protective measures to minimize potential underwater noise impacts on North Atlantic right whales during wind farm construction.

“We are especially proud that our work was done while upholding very high environmental standards,” Grybowski said.

The focus this winter and spring now turns to turbine assembly and submarine cable installation work.

Deepwater Wind and GE are establishing a new temporary manufacturing facility at the Port of Providence for the assembly of turbine components. GE, which recently completed its acquisition of Alstom’s offshore wind unit, is supplying the 6-MW Haliade 150 offshore wind turbines for the Block Island Wind Farm. Approximately 60 local workers will be involved in this aspect of the project.

Over the next six months, GE will install the critical electrical, mechanical, and safety equipment within the bottom tower sections now at the Port of Providence with the remaining tower sections arriving in Rhode Island next year. (Each turbine tower consists of three sections with a total height of approximately 270 feet and a total weight of approximately 440 tons once assembled.)

The assembly activities at the Port of Providence will complement construction and staging work completed at Quonset Point in North Kingstown, Rhode Island. Fabrication of some of the foundation components was completed by local welders at Quonset’s Specialty Diving Services in early 2015, and the port continues to host construction work and vessel staging for the wind farm. Quonset will also host the project’s long-term operations and maintenance facility.

Submarine cable installation is scheduled to begin in the spring of 2016 with the erection of the five offshore wind turbines set for the summer of 2016. The project is scheduled to be in service and generating power in the fourth quarter of 2016. ↙

— Source: Deepwater Wind

For more information, go to www.dwwind.com.

DUKE ENERGY RENEWABLES BLOWS INTO OKLAHOMA WITH 200-MW WIND PROJECT

Duke Energy Renewables recently announced that it is planning to build a large-scale wind power project in Oklahoma, the company’s first renewables project in the state.

When built, it will increase Duke Energy Renewables’ U.S. wind capacity to more than 2,000 MW.

Duke Energy Renewables will

build, own, and operate the Frontier Windpower Project sited in Kay County, which is east of Blackwell, Oklahoma. The 200-MW wind farm will produce enough emissions-free electricity to power approximately 60,000 homes.

“We’re investing heavily in renewable energy, and surpassing 2,000

MW of wind power is a significant accomplishment for our company,” said Greg Wolf, president of Duke Energy’s Commercial Portfolio. “We are excited to be working with the community and local landowners as we get our first project in this wind-rich state underway. The facility will help City Utilities meet its renewable

ACCIONA WINDPOWER TO SUPPLY TURBINES FOR BUILDING ENERGY'S FIRST U.S. WIND PROJECT



Acciona Windpower, an Acciona group subsidiary dedicated to the design, manufacture, and sale of wind turbines, has completed a turbine supply agreement with Building Energy, a multinational company operating as global integrated IPP in the renewable energy industry, for a 30-MW wind power project located in central Iowa. Under the agreement, Acciona Windpower will deliver 10 AW125-3000 turbines and provide operations and maintenance services to the project for 10 years.

Each of the turbines will have a rotor diameter of 125 meters and a 3-MW generator mounted on an 87.5-meter steel tower, a configuration designed

for maximum production at the lowest cost of energy. This project will expand Acciona Windpower's footprint in the U.S. to over 1,400 MW. Acciona Windpower will support the project from its North American headquarters in West Branch, Iowa.

"Acciona Windpower is proud to partner with Building Energy to further the growth of clean energy here in Iowa and around the globe," said Enrique Teruel, CEO of Acciona Windpower North America. "We are confident that Acciona Windpower's turbine technology will help make this project a success."

Building Energy is a global renewable energy company with experience in 24

countries worldwide. The Iowa project will be Building Energy's first wind farm in the U.S. It is expected to be online by November 2016 and will supply electricity to Alliant Energy.

"Building Energy is delighted to collaborate with Acciona Windpower, a major player in the wind power sector," said Andrea Braccialarghe, Building Energy managing director, USA. "We have chosen this company for their expertise and the performance of their turbines, which is a crucial factor for the project outcome." ↴

— Source: Acciona Windpower

For more information, go to www.acciona.us.

WIND ENERGY IN AUSTRALIA

Australia's Renewable Energy Target (RET) is a federal government policy designed to ensure that at least 33,000 GWh of Australia's electricity comes from renewable sources by 2020.

By Vidur Raj

Low operating costs and extensive availability make wind one of the most advantageous and effective renewable energy sources. To harness wind energy, large wind turbines rotate available wind energy within the area swept by the blade and produce a power output that is proportional to the air density and the wind speed cubed. These spinning blades are connected to electric generators that produce electricity for export to the grid. In 2014, 30 percent of total renewable energy produced in Australia was from wind. Wind power also supplied 4.2 percent of Australia's overall electricity during that year. By the end of 2014, Australia had 1,886 wind turbines spread across 71 wind farms. Australia began installing eight wind farms between 2014 and 2015 with a total power generation capacity of 566.7 MW. Three of the eight wind farms were completed by the end of 2014, and five more were completed in 2015.

Why Australia Should Move Toward Renewable Energy Production

Australia has one of the highest per-capita greenhouse gas emission levels in the developed world. This is due in part to its large domestic reserves of coal that has kept electricity prices low and attracted energy-intensive industry. Currently, more than 75 percent of total domestic electricity generation relies on coal-fired power. However, in recent years, concerns over climate change have prompted Australian policymakers to revive their energy policy and create a mandatory target for energy production using renewable energy including wind. Australia needs to meet future energy requirements in an increasingly carbon-constrained, multilateral policy environment that is challenging and in need of active mobilization of all available assets.

What Australia Is Doing To Promote Renewable Energy

Federal policy has changed since the publication of the Garnaut Climate Change Review study and several policies, targets, and initiatives have been announced to improve the renewable energy sector in Australia. Some of these initiatives include a Carbon Pollution Reduction



Scheme white paper, an announcement in 2010 of an Emissions Trading Scheme, and an announcement of a national mandatory renewable energy target of a 20-percent share of electricity supply in Australia by 2020.

The national Mandatory Renewable Energy Target was announced to achieve the following:

- Encourage the additional generation of electricity from renewable sources
- Reduction of greenhouse emission
- Ensure that renewable energy sources are ecologically sustainable

Is Wind Energy an Option for Australia?

Wind energy is a proven and mature technology with low operating costs. Wind turbines require low maintenance costs, which reduce the economic barriers related to work force and management. For wind-rich sites, wind energy holds great possibilities and can compete with other renewable sources of energy such as solar and biomass. Currently, wind cannot compete with the cost of electricity produced using a traditional or existing coal-based power plant that has already been depreciated and paid for by taxpayers and electricity consumers. However, wind energy is one of the cheapest of all the available renewable energy



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Australia vs. the United States in Wind Energy Policy

By 2013, at least 144 countries have announced different renewable energy targets and policies to support renewable energy development at the national level compared with only 55 countries in 2005. There are also a large number of state/provincial level and local level policies in different countries such as Australia and the U.S. Similar to the national mandatory target in Australia, the Renewable Portfolio Standard (RPS) uses market mechanisms to ensure that a growing percentage of electricity is produced from renewable sources such as wind power. The Renewable Electricity Standards

(RES), also called RPS, provides a competitive and predictable market in which renewable energy generators compete with each other to lower the prices. Currently, RES policies exist in 29 U.S. states as well as the District of Columbia and Puerto Rico, but not at the national level. Additionally, the U.S. Department of Energy has also targeted to increase the contribution of wind energy to 20 percent of total electrical energy by the end of 2030. In collaboration with the American Wind Energy Association (AWEA), the DOE’s “Wind Vision Report” provides valuable insight into the cost, major impacts, and associated challenges in achieving the 20-percent wind by 2030, as well as wind energy supplying the U.2. with 10 percent of the country’s electricity by 2020, 35 percent by 2050, and road maps on how to get there. Wind Vision updates and expands on the DOE’s 2008 report, “20% Wind Energy by 2030: Increasing wind energy’s contribution to the U.S. electricity supply,” which galvanized the rapid growth of wind so that it now generates 4.5 percent of America’s electricity.

Conclusion and Advice for Further Improvement in Successful Utilization of Wind Energy

Utilization of software and sensors to constantly monitor forces exerted on the blades would help to significantly increase the amount of electricity generated and lower the cost of wind power. Grid constraints such as a lack of capacity or availability may limit the growth of wind energy in some areas that have good wind resources. In such areas, the upgrade and extension of the wind grid to the current grid may be needed to accommodate further wind energy development.

State	Number of Projects
Western Australia	21
South Australia	17
Victoria	14
New South Wales	10
Tasmania	7
Queensland	2
Northern Territory	0
Australian Capital Territory	0
	71

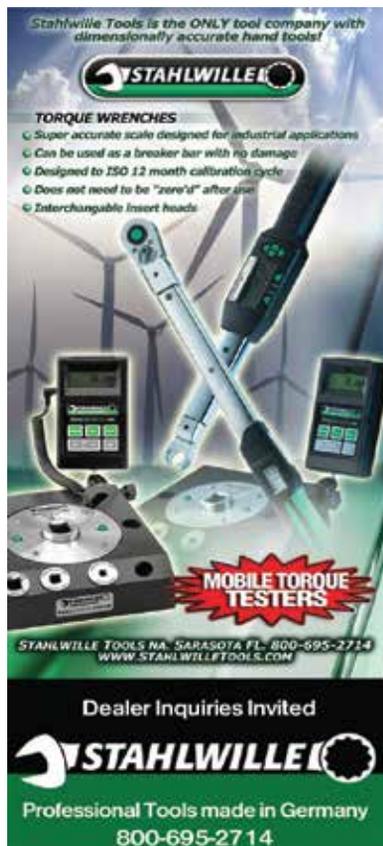
Table 1: Installed wind energy in Australia by the end of 2014

With new developments in wind energy technology, Australia is expected to reach a high level of wind energy generation over the next few decades. Deployment of wind energy in Australia may be further accelerated by improvements in wind forecasting technology and more accurate estimates of the likely output from wind farms.

Both Australia and the U.S. have set renewable energy targets to increase the scale of renewable energy applications, introduced legislation and regulations at national and state/provincial level, implemented different governmental programs, and provided incentives and funding to ensure that the targets can be met in required time. ↵

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