

*Giving Wind Direction*

# WIND SYSTEMS

AWEA  
WIND  
POWER  
2018

PROFILE:  
Bachmann  
electronic  
GmbH

APRIL 2018





info@torkworx.com

888.502.WORX

torkworx.com

OH BABY! We have cut the  
cord on RAD Extreme

Torque Machines.

Come check it out at

AWEA Windpower Expo

Booth 3730.



- Range from 250 to 3000 ft/lbs
- Torque and angle feature
- Automatic 2-speed gearbox
- Programmable preset torque settings
- Latest Li-ion 18V battery
- High accuracy +/- 5%

## WIND ENERGY SOLUTIONS

- ACCELERATED TORQUE AND TENSION SERVICES
- TURNKEY BOLTING SERVICES
- COMPLETE OEM TORQUE AND TENSION SYSTEMS
- BOLTING CONSULTATION SERVICES
- ISO 17025 ACCREDITED CALIBRATION SERVICES
- REPAIR SERVICES FOR MOST TOOL MODELS
- DBRAD DIGITAL TORQUE CONTROL SYSTEMS
- ELECTRIC GEAR TURNING SYSTEMS
- WTG SPECIFIC BOLT TENSIONING SYSTEMS
- HYDRAULIC WRENCH SYSTEMS

*extreme bolt working solutions*

sales  
rental  
service  
consulting  
engineering



AMERICAN  
CHEMICAL  
TECHNOLOGIES, INC.

Contemporary Lubricants for Machine Reliability

## EcoGear® 270 XP

*Full-Synthetic PAG Wind Turbine Gear Oil*

Chemically Engineered Load-Carrying Capacity

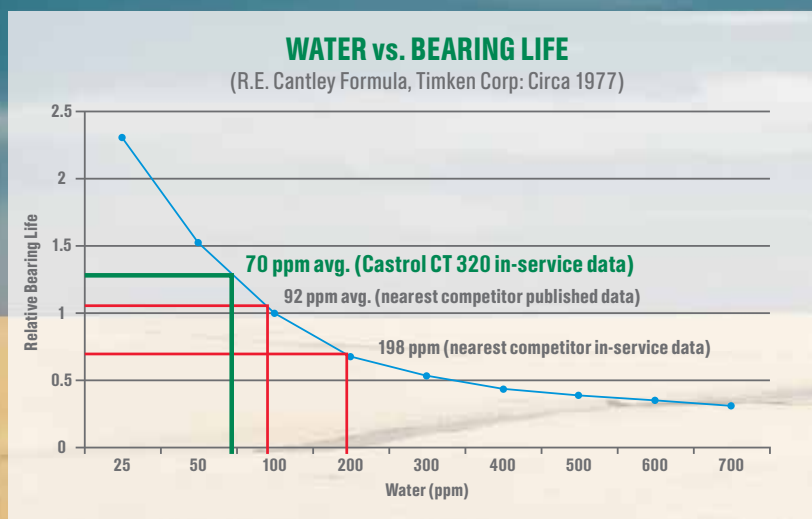
Better Cold Temperature Start-Ups

Condensation/Water Forgiveness

Superior Wear Characteristics

[www.AmericanChemTech.com](http://www.AmericanChemTech.com)

Tel: 800.938.0101



\*WEU Operations and Maintenance Report 2016. \*\*Based on sample data available to Castrol.

**VISIT CASTROL BOOTH 2612 AT AWEA MAY 7-10**



# WINNING THE BATTLE AGAINST BEARING WEAR

Bearing failures are the most important issue in wind turbine gearbox maintenance, accounting for 70% of gearbox failures\*. Castrol® Optigear® Synthetic CT 320 retains half the water PPM on average than our nearest competitor using similar types of chemistry. By choosing Castrol Optigear you can increase your bearing life by 50% and win the bearing life battle\*\*.

If you want to get the lowest water content in the field opt for Castrol Optigear Synthetic CT 320.

For more information go to [castrol.com/optigearWPE](http://castrol.com/optigearWPE)  
or call 1-630-961-6562



IT'S MORE THAN JUST OIL. IT'S LIQUID ENGINEERING.®



**OPTIGEAR®**



12

## Cheaper Wind Equals More Wind

*As wind power becomes more affordable and cost effective, its reach across the U.S. widens — 41 states are now home to utility-scale wind farms.*

**18** The World of Turbine Bearings

## ALSO IN inFOCUS

- 22** The Business Value of Digitalization
- 26** Profile: Bachmann electronic GmbH
- 30** Conversation with AWEA's Jana Adams

# SECTIONS

Volume 10 Issue 04



## DIRECTION

GE to develop world's most powerful offshore wind turbine

8



## MAINTENANCE

Danish company launches intelligent wind-power technology

32



## INNOVATION

Systematic now entering the global offshore wind market

38



## MANUFACTURING

TÜV Rheinland to surveil Senvion rotor blade production

44



## CONSTRUCTION

Pattern Development completes financing of Montana wind project

48



## CROSSWINDS

Extracting wind power from high altitudes

53



Cover Photo: Courtesy of Shutterstock



*Wind Systems* (ISSN 2327-2422) is published monthly by Media Solutions, Inc., 266D Yeager Parkway Pelham, AL 35124. Phone (205) 380-1573 Fax (205) 380-1580 International subscription rates: \$72.00 per year. Periodicals Postage Paid at Pelham AL and at additional mailing offices. Printed in the USA. POSTMASTER: Send address changes to *Wind Systems* magazine, P.O. Box 1210 Pelham AL 35124. Publications mail agreement No. 41395015 return undeliverable Canadian addresses to P.O. Box 503 RPO West Beaver Creek Richmond Hill, ON L4B4R6. Copyright 2006 by Media Solutions, Inc. All rights reserved.

# EDITOR'S DESK

APRIL 2018

## Gearing up for WINDPOWER 2018

**T**he AWEA WINDPOWER 2018 show is headed for the Windy City, and so is *Wind Systems*.

*Wind Systems* usually highlights AWEA's biggest trade show of the year in our May issue. But since this year's event in Chicago is May 7-10, we wanted to make sure you had access to some show information in plenty of time, which is why we pushed our show coverage up a month.

And it's a good thing we did, because it looks like this year's show is going to be even bigger and better than last year.

Don't believe me?

Well, don't take my word for it. Check out this issue's Conversation with AWEA's Jana Adams. I was thrilled to have the opportunity to chat with her about this year's show and what attendees can expect.

Show planners are taking advantage of the venue and crafting an amazing show around some of Chicago's unique offerings, including Navy Pier and some phenomenal tour opportunities at the close of the show. For more on what attendees can get out of this year's event, make sure you read through Jana's Q&A.

Since our inFocus in this issue revolves around WINDPOWER 2018, our cover article is from John Hensley, AWEA's senior director of research. In it, he discusses how wind power is becoming even more affordable and cost effective across the U.S.

And because turbine components make up a big portion of the show, Dayananda Raju with SKF USA Inc. shares his insights on the world of turbine bearings.

But the physical pieces of a wind turbine aren't the only factors that go into building and maintaining these massive energy-creating machines. Dr. Karen J. Cassidy with Sentient Science talks about how digitalization of wind-turbine data can go beyond operations and maintenance.

I hope that whets your appetite, because I am excited about renewing industry relationships in Chicago, as well as meeting some new industry insiders and experts as I walk a few miles each day on the show floor.

Be sure and stop by our booth (#5027) for a chance to win a Snap-On toolbox. They are super nice, and we're giving away three of them during the show. But you have to be present to win. We do love a captive audience.

I hope to meet all of you at the show and discuss opportunities for editorial content you want to share with our readers. With your help, we can make 2018 the best year yet for the wind industry.

See you in Chicago, and as always, thanks for reading!



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





## Wind keeps growing in U.S. states

Courtesy of AWEA

- The Southwest Power Pool set a wind penetration record of 60 percent in March, 2018.
- Iowa, Kansas, South Dakota, and Oklahoma now all generate more than 30 percent of their electricity using wind power.
- Overall, 14 states now generate at least 10 percent of their electricity using wind.
- The U.S. now has enough installed wind capacity to power the equivalent of 28 million American homes.
- The U.S. is on track to generate 10 percent of its electricity using wind power by 2020.

The American Wind Energy Association (AWEA) is the premier national trade association that represents the

interests of America's wind energy industry. For more information, go to [www.awea.org](http://www.awea.org)



## WIND HAPPENS

WINDBLADE REPAIR TRAINING

CLASSES FILL UP FAST - ENROLL TODAY!

**ABARIS**  
TRAINING

Leading the World in Advanced Composite Training Since 1983!  
+1.800.638.8441 • [www.abaris.com](http://www.abaris.com)

## ROTOR BLADE LOCKS

The Roemheld Rotor Lock, a robust cylinder for use in large or small wind turbines, provides maximum safety for employees. Rotor Lock features include a protection coating that prevents corrosion, reducing service cost and the need for frequent lubrication.

[www.hilma-usa.com/rotor-locks](http://www.hilma-usa.com/rotor-locks)



**ROEMHELD**  
HILMA ■ STARK

Carr Lane Roemheld Mfg. Co. · Fenton, MO 63026  
Phone 800-827-2526 · Fax 636-386-8034

## GE to develop world's most powerful offshore wind turbine



GE will invest more than \$400 million over the next three to five years in development and deployment of the Haliade-X. (Courtesy: GE Renewable Energy)

BGE Renewable Energy recently unveiled its plan to develop the largest, most powerful offshore wind turbine: the Haliade-X. Featuring a 12 MW direct drive generator and an industry leading gross capacity factor of 63 percent, the Haliade-X will produce 45 percent more energy than any other offshore turbine available today. GE will invest more than \$400 million over the next three to five years in development and deployment of the Haliade-X.

“We want to lead in the technologies that are driving the global energy transition,” said John Flannery, chairman and CEO of GE. “Offshore wind is one of those technologies, and we will bring the full resources of GE to make the Haliade-X program successful for our customers.”

Towering 260 meters over the sea, more than five

times the size of the iconic Arc de Triomphe in Paris, France, the Haliade-X 12 MW carries a 220-meter rotor. Designed and manufactured by LM Wind Power, the 107-meter-long blades will be the longest offshore blades to date and will be longer than the size of a soccer field. One Haliade-X 12 MW turbine will generate up to 67 GWh annually, enough clean power for up to 16,000 households per turbine, and up to 1 million European households in a 750 MW windfarm configuration.

“The renewables industry took more than 20 years to install the first 17 GW of offshore wind,” said Jérôme Pécresse, president and CEO of GE Renewable Energy. “Today, the industry forecasts that it will install more than 90 GW over the next 12 years. This is being driven

by lower cost of electricity from scale and technology. The Haliade-X shows GE's commitment to the offshore wind segment and will set a new benchmark for cost of electricity, thus driving more offshore growth."

The ability to produce more power from a single turbine means a smaller number of turbines in the total farm, which translates to less capital expenditure for the balance of plant and reduced risk in project execution as the installation cycle time is reduced. It also simplifies operation and maintenance of the wind farm. All of this reduces the investment and operation cost for developers, makes offshore wind projects more profitable, and ultimately lowers cost of electricity for consumers.

"The Haliade-X 12 MW will help our customers in an increasingly competitive offshore environment, and through its size and digital functionality provide important value across manufacturing, installation and operation," said John Lavelle, CEO of Offshore Wind at GE Renewable Energy.

GE's Haliade-X platform is designed to offer greater efficiency in generating power from the wind that is available. With a 63 percent gross capacity factor, the Haliade-X 12 MW is five to seven points above the current industry benchmark. Therefore, it will produce more energy per megawatt installed, which will significantly increase returns for customers.

To design and build the Haliade-X platform, GE

Renewable Energy is relying on an unprecedented collaboration across the GE portfolio, leveraging the knowledge of GE's Onshore wind team, with 50,000 turbines in the field; the blade expertise of LM Wind Power; the GE Power and GE Aviation engineers for peer reviews of component and systems design; the Global Research Center for control systems and component validation; and GE Digital for supporting

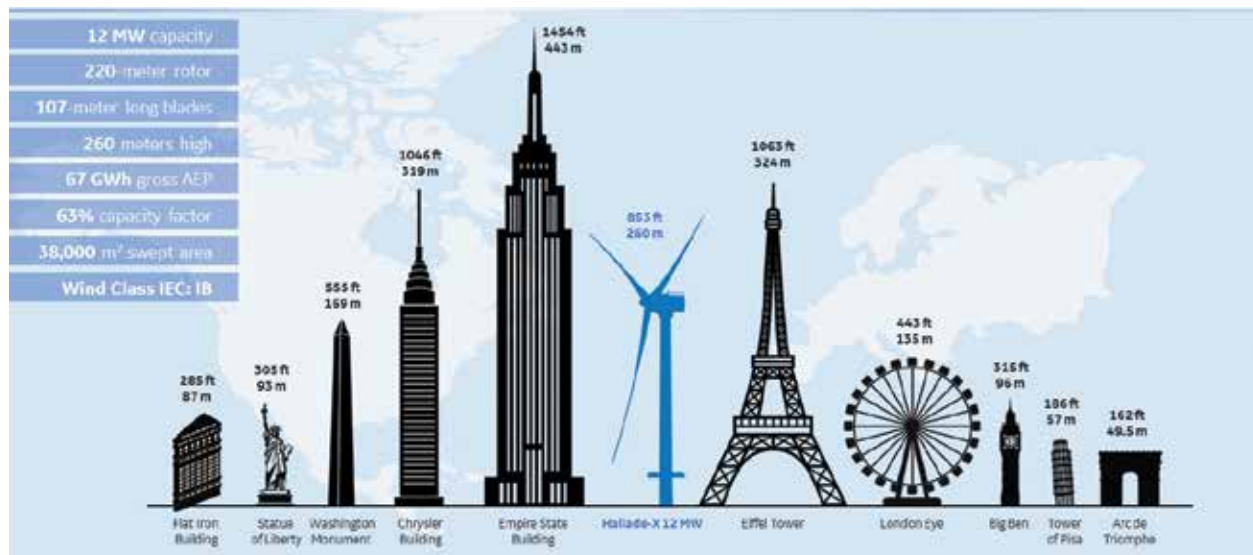
**The Haliade-X 12 MW will help our customers in an increasingly competitive offshore environment, and through its size and digital functionality provide important value across manufacturing, installation and operation.**

digital modelling, analytics and app development. The program is a GE-wide effort.

GE Renewable Energy aims to supply its first nacelle for demonstration in 2019 and ship the first units in 2021. ↘

*Source: GE Renewable Energy*

For more information, go to [www.gerenewableenergy.com](http://www.gerenewableenergy.com)





## GEV Wind Power continued growth in 2018

U.K. wind turbine blade maintenance specialists, GEV Wind Power, based in the North of England, is set for another year of continued growth and is now in a position to support its expanding order books for both North America and EMEA. This follows the successful fundraise of 1.2 million pounds from large grant applications from both the U.K. and Europe plus further input from their investment partners.

The total grant fundraising for more than 500,000 pounds will see the development for offshore application of the innovative and patented GEV Ventura Habitat — a field deployable temporary environment to facilitate blade maintenance in inclement conditions.

“Demand for the Habitat solution is increasing through interest from industry leading manufacturers, together with deployment on our own USA based projects,” said Alastair Gadney, director of Research and Development Projects at GEV Group. “We are delighted that the innovation is now helping to drive down the cost of blade maintenance. More than 65 per cent of our projects are currently deployed offshore and developing the Habitat for this environment will be a natural progression.”

“Innovate U.K. and Horizon 2020 grants help to match our existing significant R&D budget and are crucial to support SME’s like ourselves in helping to drive down the cost of energy,” he said.

The need for infrastructure expansion in the U.S. is brought about by a significant increase in demand for utility scale turnkey blade maintenance solutions. GEV is one of the few ISPs capable of supporting such technically demanding scopes of work and who is prepared to make the necessary investment to support the activity.



GEV Wind Power’s Ventura Habitat. (Courtesy: GEV Wind Power)

“The geographic split of all our projects in the U.S. requires that we invest in our infrastructure appropriately to ensure that our client projects are executed well,” said David Fletcher, managing director of GEV Group. “To scale up and meet the growth potential of our U.S. business requires a significant financial commitment, and it has been encouraging that we have been able to access our existing investor group to support this further expansion in a key geographical market

for our wind division.”

GEV has completed more than 28 individual projects in North America over the past six months, deploying up to 60 blade-repair specialists at the peak. The projects extend over eight states and have been managed from the Group’s office in Austin, Texas. ↘

*Source: GEV Wind Power*

For more information, go to  
[www.gevgroup.com](http://www.gevgroup.com) or  
[www.gevwindpower.com](http://www.gevwindpower.com)

## Ingeteam wins control center contract with Mexican energy company

Ingeteam, an independent global supplier of electrical conversion and turbine control equipment, recently announced it has been awarded a substantial contract by Mexican renewable energy developer Zuma Energía to provide a state-of-the-art control center for its operational wind farm in Oaxaca, PE Ingenio. The platform will collect all the relevant information on the infrastructure of the wind farms in real time, enabling the operator to effectively manage and optimize the operation and maintenance of its wind turbines.

The control center will be the cornerstone of Zuma's asset performance management. It will allow them to gather and analyze a vast array of essential operating data, not only on the wind turbines and substations, but also on the electricity market and the variations of meteorological conditions. The control systems collect the continuous stream of information that each wind turbine generates every second. All key condition parameters, such as temperatures, vibrations, operating conditions, and alarms are monitored and stored in "Big Data" databases optimized to work with large volumes of data in real time in a scalable way. The Control Center will be in the offices of Zuma Energía in Mexico City.

"Currently, Zuma Energía has 725 MW in its portfolio, which were awarded to the company in Mexico's second clean-energy tender held in September 2016," said Zuma Energía's




Ingeteam Zuma Energía Mexico Control Center. (Courtesy: Ingeteam)

CEO Adrian Katzew. "This accounts for a quarter of the tender's total and is a major achievement for our company. It is a privilege to contribute to the sustainable transformation of Mexico's electricity system, benefiting the generations to come."

More than 1 GW of installed wind power in Mexico is being managed through the Ingeteam control center platform. With its maintenance equipment covering almost half of the country's total installed wind-power capacity, Ingeteam has positioned itself as a leader in O&M services in this market. The Spanish company has more than 400 technicians servicing customers throughout the country. Together with Zuma, they aim to continue advancing the industry's optimization of wind farms through

innovative techniques, with the clear ambition of becoming benchmark companies not only in Mexico, but also in the rest of the world.

"We are very pleased to support Zuma Energía in their goal to contribute to the sustainable transformation of Mexico's electricity system," said Jorge Acedo, R&D director of Control Systems, Ingeteam Wind Energy. "The project consolidates Ingeteam's position as a leader in the monitoring and analysis of wind farms in Mexico. Currently, the Ingeteam platform is monitoring and analyzing in real time more than 1 GW of installed wind power in Mexico." 

Source: Ingeteam

For more information, go to [www.ingeteam.com](http://www.ingeteam.com)


## EDPR secures a 200 MW PPA for a new U.S. wind farm

EDP Renewables, a global leader in the renewable energy sector, has secured a 20-year power purchase agreement (PPA) with Great Plains Energy to sell the energy produced by the 200 MW Prairie Queen wind farm.

Prairie Queen wind farm is in Allen County, Kansas, where operations are

scheduled to commence in 2019.

Through this new arrangement, EDPR will expand its footprint in Kansas to a total of 600 MW. The company already has locked down 1.5 GW in long-term agreements in the U.S. for projects to be installed through 2016-2020, which represents 82 percent of

the 1.8 GW target capacity additions in the U.S. for that period, as announced at the EDP Group Capital Markets Day in May 2016. 

Source: EDP Renewables

For more information, go to [www.edpr.com/en](http://www.edpr.com/en)

## inFOCUS

## Cheaper Wind Equals More Wind

*As wind power becomes more affordable and cost effective, its reach across the U.S. widens — 41 states are now home to utility-scale wind farms.*

By John Hensley

American wind energy continues to power forward to reach new heights. Today, it powers more U.S. families and businesses than ever before — the country now has enough installed wind capacity to power more than 28 million American homes. That means wind has become a key contributor to our electricity mix, and the days of wind occupying a niche space are long gone.

Wind continues to expand to new areas, as 41 states now have utility-scale wind farms. Last year, wind surpassed conventional hydropower, and it is now the country's largest source of renewable energy capacity. It likely will not be long before wind surpasses hydropower in terms of generation as well. Utilities and Fortune 500 companies continue to buy ever increasing amounts of wind to meet their electricity needs, and that means more jobs and more opportunities for Americans in all 50 states.

What further developments can we expect to see in the years to come?

### CHEAPER WIND MEANS MORE WIND

In each of the last three years, wind power has been one of the top three sources of new U.S. electric generating capacity. For this to happen, wind needs to win on cost, and in fact, wind is now the cheapest source of new electric generating capaci-

ty in many parts of the country. It's also cost-competitive in many more. Overall, wind's costs are down by two-thirds since 2009.

Several factors have made such dramatic declines possible. Technological advances help modern turbines access stronger, steadier winds. That means new projects can generate more electricity more of the time. It also expands the map of existing wind projects. In 2017, North Carolina's first utility-scale wind farm came online. This project would not have been possible without the advances of the past several years. Ground has also broken at Arkansas's first wind farm, and projects are under development in Virginia as well, meaning wind will continue its expansion into new frontiers.

Improved domestic manufacturing has also played a key role in driving wind's cost down. Today, more than 500 U.S. factories build many of the 8,000 parts in a typical wind turbine. Given the scale of certain wind components, transportation costs are lowered as more companies choose to locate new factories in the U.S. rather than importing from overseas. That has the added bonus of creating new opportunities for factory towns badly in need of them.

Recent wind deals demonstrate just how low these developments have driven wind's cost. Investment firm

Lazard Inc. reported late last year that, "in some scenarios, the full-life-cycle costs of building and operating renewable-based projects have dropped below the operating costs alone of conventional generation technologies such as coal and nuclear. This is expected to lead to ongoing and significant deployment of alternative energy capacity."

Recent results from Xcel Energy's request for proposals (RFP) for







In each of the last three years, wind power has been one of the top three sources of new U.S. electric generating capacity. (Courtesy: AWEA)

new power in Colorado show how cost-competitive wind has become. Companies submitted more than 400 bids for new power projects, and wind energy led all technologies with the lowest median bid price: \$18.10 per megawatt hour, a truly remarkable milestone. Nor was this result a one-off outlier — more than 100 wind projects were proposed, signifying

these rock bottom prices are indicative of broad industry trends.

In reviewing these results, Vox energy and climate reporter Dave Roberts concluded, “Let’s face it: In most areas of life, when you look past the hype at the real numbers, it’s depressing. Renewable energy is one area where that typical dynamic is diverted. The closer you look, the better the

news gets ... It is the cheapest power available in more and more places, and by the time children born today enter college, it is likely to be the cheapest everywhere. That’s a different world.”

“These prices should have every policymaker, utility, and energy investor in the region reconsidering their thinking about how much renewable energy to purchase, and when,” wrote

Kevin Steinberger and Noah Long of the Natural Resources Defense Council. “The short answer: as much as you can get, and now.”

## THE WIND-BELT LEADS THE WAY

Texas continued to be America’s wind-power leader in 2017 with more new wind projects becoming operational than any other state. In fact, Texas has more than three times the installed wind capacity as second place Oklahoma. The Sooner State is no slouch, however, as it passed Iowa to claim second place in installed capacity last year. California and Kansas round out the top five, proving wind is popular in both red and blue states.

The wind development pipeline continues to be robust, too. More than 28,600 MW of new wind projects are under construction or in the advanced stages of development, a 34 percent year-over-year increase. That is enough new wind to power millions of additional American homes. Thirty percent of this activity is in the Midwest, 21 percent in Plains states, 20 percent in the Mountain West, and another 20 percent in Texas. This anticipated market growth, combined with existing capacity, positions wind to supply 10 percent of America’s electricity by 2020, a visionary goal laid out in the Department of Energy’s Wind Vision report.

## CUSTOMERS REMAIN HUNGRY FOR MORE WIND POWER

Utilities, Fortune 500 companies, and other buyers all inked substantial wind deals in 2017 — overall power purchase agreements (PPAs) were up 29 percent from 2016. And the deal flow has not slowed. In just the first two months of 2018, more than 2,300 MW of new deals have been struck.

Fortune 500 companies continued the trend of powering more of their operations using wind. From Nike to Anheuser-Busch to Amazon and



Technological advances help modern turbines access stronger, steadier winds. (Courtesy: AWEA)

General Mills, businesses across the economic spectrum turned to wind in 2017. Significantly, Google achieved its 100 percent renewable energy goal in 2017, and wind supplied 95 percent of that electricity. On the municipal side, San Francisco’s Bay Area Rapid Transit System inked a wind PPA that will supply a substantial portion of its energy.

These buyers turn to wind for two reasons: because its costs are both low and they are fixed. Because the fuel cost of wind never changes, buyers know exactly what they will pay for electricity five, 10, or 15 years down the road — an attractive property that facilitates long-term planning.

“Our approach takes different business, social, and environmental ben-

efits into account,” Anheuser-Busch InBev said when announcing its 100 percent renewable target. “We do not expect our cost base to increase. Renewable electricity is competitive with or cheaper than traditional forms of electricity in many markets.”

“Establishing a 100 percent renewable energy goal helps us better serve society by reducing environmental impact,” said GM Chairman and CEO Mary Barra. “This pursuit of renewable energy benefits our customers and communities through cleaner air while strengthening our business through lower and more stable energy costs.”

### DEMAND FOR WIND MEANS AMERICAN JOBS

All of this new wind means jobs for American workers. They build turbines, construct wind farms, and keep projects running through skilled operations and maintenance. In fact, there are now more than 100,000 wind jobs across all 50 states. And wind-turbine technician, along with solar installer, is one of America’s two fastest growing jobs, according to the U.S. Bureau of Labor Statistics.

“It just seems like this is the future. This is where we are headed, and where we should be headed,” said Meredith Halfpenny, who has helped build about 400 wind turbines and climbed up tower an estimated 1,200 times. “Working in renewables, you feel good about it. A lot of people are drawn to it, and it resonates with people. Everyone comes together very quickly. You have a collective purpose for your jobs.”

Once again, Texas is the country’s job leader, followed by Iowa, Oklahoma, and Colorado. A recent report on Texas wind workers found:

“(They) include veterans and women, those leaning politically right and left, environmentalists and climate-change skeptics, the civically engaged and those who never vote. The clean energy component

seems to be a bonus for some, but it was not the primary reason they chose this field. There is the laid-off gas worker who noticed all the wind turbines on the horizon and thought there must be an opportunity there. The English major who couldn’t find a job and remembered how much she liked the outdoor work on her family’s farm in the Texas panhandle. The two veterans who liked the

element of risk and heights and the sweet spot of job independence and camaraderie.”

### BRINGING OPPORTUNITIES TO FARMING TOWNS

More than 99 percent of wind farms are built in rural areas — places that often need new investment. Wind farms frequently become the largest taxpayers in a county, so

## WANZEK RENEWABLE SERVICES

**WANZEK**

a MasTec company

Renewable Services

wanzek.com

AWEA  
**WINDPOWER**  
CONFERENCE & EXHIBITION  
Chicago, IL May 7-9, 2018  
**BOOTH 2043**



We are an ISP specializing in comprehensive renewable power maintenance services utilizing our extensive crane fleet and a regional deployment strategy. Our services include self-performed maintenance and repair services for wind turbines, electrical collection systems, substations and civil components.



these communities get substantial new revenues to fill out town budgets. That can help pay teacher salaries, fund fire departments, and fix roads while keeping local taxes low.

Sheldon, New York, for example, eliminated local taxes completely for eight years because wind revenue met its budgetary needs. In Van Wert County, Ohio, wind made it possible for the Lincolnview school district to provide every student in grades K through 12 with their own computer and fund the repair and replacement program.

“In pre-wind, our county taxable value was \$500 million,” said Ken Becker, executive director of the Sweetwater Economic Development Corp. in Texas. “In 2008 (after wind came to the area), it was \$2.8 billion.”

More than 98 percent of wind farms are also built on private land, and in exchange, landowners receive lease payments hosting turbines. This is guaranteed income that helps during the hard times, especially important in a thin margin business like agriculture. For many families, it makes the difference between continuing a multi-generation tradition and ending a way of life.

“Financially, it’s a huge boost to us,” says third generation Colorado farmer Richard Wilson. “And I know if we didn’t have this wind farm, my sons wouldn’t be able to keep this. I might have been able to, but they could not — there’s no question.”

## TAPPING INTO A NEW OCEAN ENERGY RESOURCE

U.S. land-based wind has been growing since the 1980s, and to date, there are nearly 54,000 wind turbines spread across 41 states. But it wasn’t until last



More than 28,600 MW of new wind projects are under construction or in the advanced stages of development, a 34 percent year-over-year increase. (Courtesy: AWEA)

year that five offshore turbines made their way to U.S. shores with the completion of the Block Island Wind Farm.

Now, 14 offshore projects are under development in U.S. waters, with particularly active areas along the coasts of Long Island, Maryland, and Massachusetts. And companies are investing R&D money to cut offshore costs further, including \$35 million in a South

Carolina facility to test a 9.5-MW offshore wind turbine.

That continued development will create new supply chains and jobs in coastal cities up and down our seaboards.

The outlook for American wind power remains bright — we’re adding new chapters to this American success story, and the good news should continue for years to come. ↘



**John Hensley** is the senior director of research with the American Wind Energy Association. Hensley holds a Masters of International Economics and International Affairs from the Johns Hopkins School of Advanced International Relations.



# FROM PROTECTING YOUR ASSETS TO POWERING OUR CITIES

TOGETHER IT'S POSSIBLE

**Innovative lubrication that enhances performance.**

Wind turbines are a vital part of the electricity network, the world's largest and most complex machine. Often operating in extreme environments, the effective lubrication of gearboxes and bearings are vital for wind turbines to deliver optimum performance. As well as offering a range of lubricants and greases, our experts are ready to share the knowledge and practices that will help ensure maximum performance, no matter what the conditions. To find out how we can help you power tomorrow, go to [shell.us/power](https://shell.us/power)

**SHELL LUBRICANTS**  
TOGETHER ANYTHING IS POSSIBLE

# The World of Turbine Bearings

*Recent technological innovations show how far bearings have evolved in meeting operational demands and improving productivity and profitability.*

By Dayananda Raju

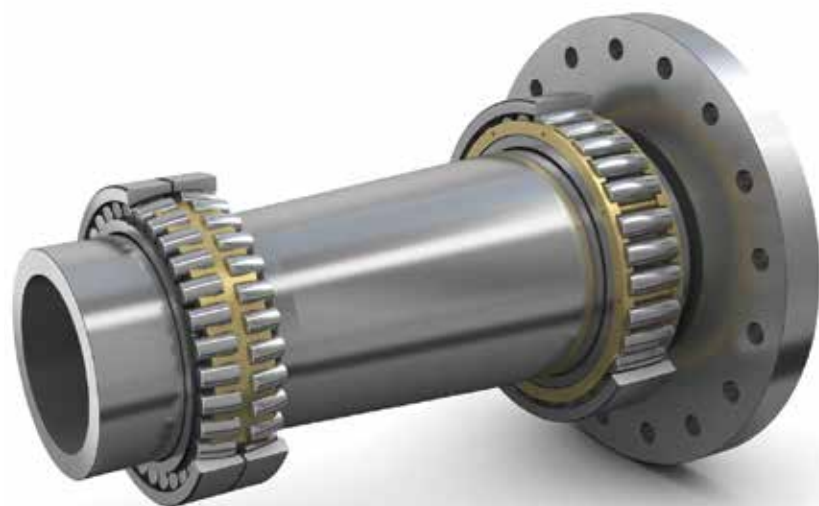
The operational challenges for wind turbines can be daunting, whether related to increased turbine power and size, extreme weather conditions, heavy loads, and/or remote locations, among many others. In turn, significant advances in rolling bearing designs, materials, and engineering have helped to realize enhanced performance, reliability, and service life at all points in wind turbines.

Some of the recent innovations in bearing technologies serve to illustrate how far bearing technologies have evolved in meeting operational demands and improving the productivity and profitability of wind turbines, whether on land or offshore.

## HIGH ENDURANCE SLEWING BEARINGS

Slewing bearings historically have equipped a wide range of applications across industries, including wind turbines. These bearings consist of an inner ring and an outer ring, one of which usually incorporates a gear. Together with attachment holes in both rings, they enable optimized power transmission with a simple and quick connection between adjacent machine components. The bearing raceways, in conjunction with the rolling elements and cages or spacers, accommodate loads acting singly or in combination and in any direction.

Among typical turbine applications, slewing bearings will be used as pitch bearings to optimize blade



The combination of a spherical roller bearing (left) and CARB toroidal roller bearing (right) results in a self-aligning bearing system offering greater load capacity in a smaller and lighter housing for wind-turbine applications. (Courtesy: SKF)

position for different wind conditions or as yaw bearings to correctly position the nacelle during operation. A new generation of high endurance slewing bearings raises the bar for performance and reliability in service.

This class of bearings benefits from enhanced internal bearing geometry in the cages and raceways to reduce friction and increase turbine and pitch control performance. Reduced friction contributes to pitch system effectiveness and efficiency to maximize energy production.

As an added plus, a unique seal material, manufactured from polyurethane, provides better resistance to ozone, UV light, and salt water compared with conventional nitrile-based seals, thereby reducing wear and providing relatively longer service life. The seal design itself has been engineered to be less sensitive to ring deformation during operation for ideal seal function under high loads and reduced grease leakage and water ingress, which results in improved robustness and lower maintenance costs down the road.



## SELF-ALIGNING BEARING SYSTEM

In typical industrial applications, a bearing system must accommodate misalignment, shaft deflections, and thermal expansion of shafts. To cope with misalignment and shaft deflections, design engineers conventionally use a bearing arrangement consisting of two self-aligning ball bearings or two spherical roller bearings. However, thermal expansion of a shaft is a more complex issue requiring one of the bearings to be a “locating” bearing and the other to be a “non-locating” bearing.

In most cases, the locating bearing must be secured in the housing and on the shaft. The non-locating bearing, in contrast, has to be able to move axially on its seat in the housing. To achieve this movement, the bearing’s outer ring must be mounted with a loose fit and have enough room to move in the axial direction. The loose fit, however, under certain load conditions, can allow the bearing ring to creep and damage the housing seat. This accelerates wear, increases vibration, and provides less rigid shaft support in the radial direction.

In addition, when the non-locating bearing moves in the housing, the movement generates a considerable amount of friction, which then further induces vibration, axial forces in the bearing system, and heat — all threatening to reduce bearing service life.

An effective alternative to this conventional and problematic “locating/non-locating” bearing arrangement ideally suited for wind turbines is a system combining a self-aligning spherical roller bearing in the locating position and a CARB (compact aligning roller bearing) toroidal roller bearing in the non-locating position.

The CARB toroidal roller bearing is a self-aligning radial bearing able to accommodate both misalignment and axial displacement of the shaft inside the bearing at the same time. This helps to eliminate the risk of induced axial loads, improve reliability, and enable the cross-section of the bearing to be

smaller than possible with standard types.

CARB bearings exhibit very high load-carrying capacity, high running accuracy, low friction, and resistance to wear resulting in reduced noise and vibration and promoting improved reliability and longer service life. They integrate design



## Check-in for savings on gear oils.

NUFLUX™

Expectations on performance and durability of wind turbine gear oils are rapidly increasing. Without compromising on performance, NUFLUX™ technology from Evonik provides lubricant manufacturers with cost-efficient and flexible alternatives, endorsed by leading OEM approvals. There has never been a better time for savings on gear oils. Checked.

**The Oil Additives specialists at Evonik — Let it flow.**  
[www.evonik.com/oil-additives](http://www.evonik.com/oil-additives)

 **EVONIK**  
POWER TO CREATE



A black oxide surface treatment for all types of critical bearings in wind-turbine systems can promote higher reliability as a defense against a range of conditions that can threaten bearing service life. (Courtesy: SKF)

gearless turbines (direct drive). Whereas turbines with gearboxes were once standard, the trend is toward direct drive turbines with permanent magnet technology, which are relatively lighter and more compact.

The portfolio of main shaft bearing solutions has been significantly expanded with the recent introduction of spherical roller bearings designed explicitly for wind-turbine main shafts. The heavy-duty bearings can significantly improve reliability and bearing life, in turn reducing the levelized cost of energy (LCOE).

Noteworthy features compared with standard spherical roller bearings

include modified inner geometry with super-finished functional surfaces, optimized contact pressures, robust cast-iron cages, and significant total weight reduction. The resulting benefits: improved performance and enhanced reliability under typical wind-operating conditions and overall best-in-class ranking. Bearing boundary dimensions, in compliance with ISO standards, are compatible with existing arrangements, allowing for swap-out and upgrades.

These new bearings join a family of advanced stiff bearings (the Nautilus series in the case of SKF) providing high carrying capacity with minimum friction on turbine drive trains. Designed to handle heavy and complex loads, this is a single bearing solution based on double row tapered roller bearings, arranged back-to-back. These two rows lock the unit axially and deliver extremely high stiffness. The

Stahlwille Tools is the ONLY tool company with dimensionally accurate hand tools!

**TORQUE WRENCHES**

- Super accurate scale designed for industrial applications
- Can be used as a breaker bar with no damage
- Designed to ISO 12 month calibration cycle
- Does not need to be "zero'd" after use
- Interchangeable insert heads

**MOBILE TORQUE TESTERS**

STANLWILLE TOOLS NA, SARASOTA FL 800-695-2714  
WWW.STANLWILLETOOLS.COM

Dealer Inquiries Invited

**STANLWILLE**

Professional Tools made in Germany  
800-695-2714

## MAIN SHAFT BEARINGS IN DRIVE TRAINS

Wind-turbine drive trains use one of three concepts: turbines with gearboxes, hybrid turbines, and

compact bearing design helps reduce nacelle dimensions and weight and helps reduce production costs, in part, because tower and fundamental weight can be decreased.

The bearings, which can integrate a variety of options or otherwise be customized, have been designed overall to improve ease of installation, increase reliability and operational safety, enhance maintainability and reduce operating and maintenance cost, and increase turbine productivity, availability, and profitability.

Recent improvements include an enhanced segmented cage, a bolted inner ring, sealed and pregreased units, and corrosion protection:

- The segmented cage technology consists of a single-pocket cage, which can operate in a flexible environment with the bearing being preloaded — a prerequisite for a stiff surrounding structure resulting in a stiff drive train. This new design makes it possible to increase the static and dynamic load-carrying capacity of the bearing, and the segmentation improves the roller guiding to deliver optimized load distribution among the rollers. The window-type cage further provides extremely low friction and makes the bearing less sensitive to inadequate lubrication conditions, resulting in less wear.
- A bolted inner ring allows the bearing to be attached directly to the rotor hub and mainframe, thus reducing bearing preload variations and resulting in higher operational reliability and safety, easier mounting, replacement and maintainability.
- Units can be supplied already sealed and pregreased with optimized grease fill, virtually eliminating any chance of contamination during manufacture and installation.
- Corrosion protection can be achieved with the application of a specialized corrosion-inhibiting coating, especially appealing for turbines in harsh offshore environments.

## BLACK OXIDE BEARINGS

Wind-turbine bearings must endure widely varying temperatures, speeds, and loads, plus exposure to contaminants, including moisture and chemicals.

These conditions can limit bearing service life and increase already high operation and maintenance expenses. An innovative black oxide surface treatment offers a viable line of defense for a variety of wind-turbine bearings.

The black oxide coating can be specified for all types of critical bearings in wind-turbine systems to help promote higher reliability against widely varying temperatures, speeds, and loads and to resist moisture and chemicals that otherwise could limit bearing lifecycles and increase costs of turbine operation and maintenance.

This surface treatment is applied to a bearing's rings and/or rollers. The process — involving a chemical reaction at the surface layer of the bearing steel — is performed in an alkaline aqueous salt solution at defined temperatures. Up to 15 different immersion steps create a thin, dark black surface layer delivering a significant performance upgrade for the broad range of bearing types and sizes in wind turbines (up to 2.2 meters in diameter and up to 1,000 kilograms per individual bearing component).

Black oxide bearings can increase turbine uptime by enhancing resistance to corrosion and smearing; improving performance in low-lubrication conditions; limiting risk of fretting, micropitting, and cracking; reducing potential damage from aggressive oil additives; and reducing the effects of friction and wear.

Suitable bearing types for the coating include tapered roller bearings, cylindrical roller bearings, spherical roller bearings, and CARB toroidal roller bearings, among others playing vital roles in wind-turbine systems.

Black oxide coated bearings can be specified for new installations or as replacements for conventional bearings of many types without encroaching on existing design envelopes.

All these examples of bearing innovations for wind-turbine applications individually and collectively can help support sustainable and ongoing success for wind-farm operations.

More innovations can be expected on the horizon as technology responds to the ever-present and emerging demands on the wind farm. ↴



**Dayananda Raju** is manager applications engineering — wind energy at SKF USA Inc., based in Lansdale, Pennsylvania. He can be reached at 267-436-6495 or [Dayananda.Raju@skf.com](mailto:Dayananda.Raju@skf.com). For more information, go to [www.skfusa.com](http://www.skfusa.com).



# The Business Value of Digitalization

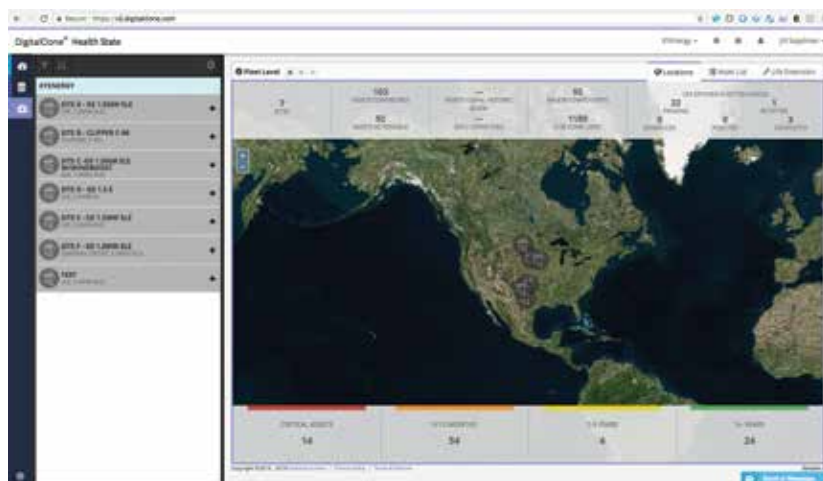
*It goes beyond creating a digital model of a turbine for operations and maintenance.*

By Karen J. Cassidy, Ph.D.

Digitalization may mean something different depending on who you are talking to in the wind industry. For some, digitalization is about getting ahead of unplanned failures and focusing on the operations and maintenance (O&M) problems that occur annually in a fleet. For others, it may be converting analog turbine data, like maintenance records, to digital data so they can be further analyzed. For others, it's making a digital model of an asset to reduce capital expenses through economies of scale. At Sentient Science, digitalization is converting the design, material, operational, and maintenance data into digital format, applying advanced analytics and providing the best prediction capabilities for life and health of assets and fleets. That information is then used by customers to make business decisions for cost reduction and better forecast planning.

## IRENA REPORT

According to the International Renewable Energy Agency (IRENA), wind-turbine cost reductions in the last two decades, for both onshore and offshore wind turbines, have been achieved already by economies of scale and learning effects as installed capacity has grown. LCOE of wind has been reduced further through increasing turbine height and rotor diameters.



DigitalClone provides a fleetwide view of the failure rate of each wind turbine in the field. (Courtesy: Sentient Science)

The larger blades and hubs may mean higher torque and loading conditions on the critical components within the drivetrain. This shifts the digitalization strategy from increasing the installed capacity to improving the operational availability of the fielded turbines.

Gearboxes typically represent 13 percent to 15 percent of wind-turbine costs, according to the IRENA report. Some gearbox failure rates range between 4.5 percent to 8 percent in a fleet ahead of the gearbox's 20-year design life. That's because there is a major difference between physical testing of critical drivetrain components and the actual loading conditions seen

in operation.

Sentient Science calculated a difference of as much as 68 percent between a physical test and live operational data.

The discovery was made by validating Sentient's materials science models against actual fielded maintenance reports.

The reason for the difference in life is because physical testing is limited in the number of data points that can be tested because of cost and time.

In addition, what happens in a laboratory under controlled parameters can be different from the unpredictable and harsh environments experienced in the field.

“Gearboxes typically represent 13 percent to 15 percent of wind-turbine costs.”

## BEYOND THE DIGITAL MODEL

Therefore, digitalization goes beyond making a digital model of an asset for economies of scale, and it goes beyond using big data applications to catch impending failures in the field.

It involves simulating how the materials used in design respond to the actual operating conditions experienced in the field. This is done by converting the data into a digital format called a DigitalClone, applying materials science-based analytics to critical components of the drivetrain, and then measuring the true-life expectancy of the asset. By combining the materials model with the empirical data from the field, the behavior of the asset tells the operator a different story from the design and physical testing that was done before going to market.



When a damage class of 3 or 4 is flagged, a user can look at the Bill of Materials within the software to see where the failure is occurring, on which component, and look at the asset actions recommended to make a business decision on the best action to take for that asset.

It tells the operator how that asset will really perform in the field under a broad range of operating conditions. The same type of wind turbine, with the same type of gearbox, may perform vastly different depending on location

and wind regimes. The combinations of major component OEMs within the turbines can vary, especially as assets are exchanged over time and different models used as replacement, furthering the variation.



- Grout Sleeves are More Effective in Protecting Bolts from Grout

- Saves Labor – Enhances Safety – No More Cutting Foam

- Displace Almost No Grout, Resulting in a Considerably Stronger Foundation



800.359.0372  
JWBURCE@NTCWIND.COM  
NTCWIND.COM

**Call to inquire about our special limited time pricing!**

## We cut and haul your bad blades!

## got^blades? bad

### Fiberglass Recycling Alternative, LLC

**Do you have a bad blade? We can cut it up on site, below the tower, saving you time and money.**

Fiberglass Recycling Alternatives specializes in the recycling and repurposing of wind turbine blades, tower sections, nacelles, frames and hubs. We pride ourselves in our reputation for cleaning up the worksite after the job is complete.

MOBILE: 507-829-5500 • OFFICE: 507-872-5940  
WEB: [www.ruggedrockinc.com](http://www.ruggedrockinc.com) • EMAIL: [JN@ruggedrockinc.com](mailto:JN@ruggedrockinc.com)



For example, one wind farm with moderate wind conditions may experience far less failures in their fleet from another wind farm that lives in dynamic conditions with high turbulence and sheer rates. The same wind-turbine model by design and manufacturing process may have different failure rates. The bearings and gears selected for use in the gearbox contributes to the variation of failure rate.

When the operator understands the failure rates of their assets at the major system and component level, life extension actions can be taken to achieve savings of up to 13 percent of revenues. The data from merging materials science and data science enables informed decisions beyond O&M.

When looking at just short-term failure rates, a planning horizon is on average between one week and one month.

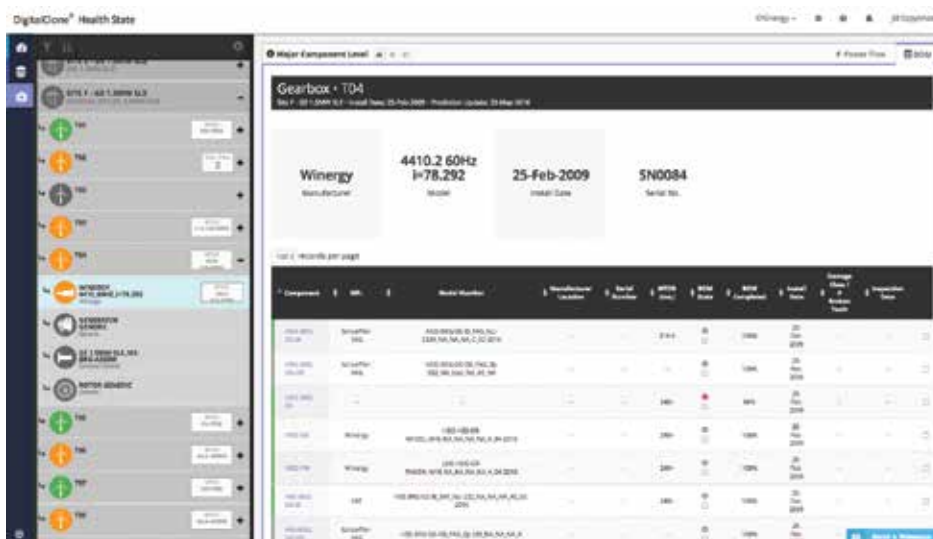
There is little life extension that can be gained in this timeframe; however, optimization of site resources can be achieved, including better visibility into the equipment and manpower needed for the job.

Medium- and long-term prognostics, ranging from one year to five years and five-plus years, respectively, can be used for asset management, risk reduction, and increased availability of field assets.

Consider looking at industries who have successfully integrated digitalization, such as Uber and Airbnb. They use digitized information to create new sources of revenue and cost reduction; sometimes a completely new way to look at how business gets transacted.

Uber and Airbnb transformed the taxi and hotel industries through economies of scale and enabling transactions in a platform, which may have implications in renewable energy.

Imagine connecting operators, OEMs, and suppliers in a platform with the needs and availability communicated almost seamlessly.



A risk ranking of the components enables supplier purchasing decisions based on the life impact vs. just price and delivery. Sentient Science calls this Buy on Life.

## MULTIYEAR BUDGETING AND FORECASTING

Visibility to one- to five-year failure rates enables multi-year budgeting and forecasting for aftermarket parts to keep in stock. Inventory reduction has substantial value with the ability to shift to Just in Time planning.

This planning method is facilitated with knowledge of the failure rates of the major systems and critical components 12 months to five years in advance. Additionally, strategic partnerships with suppliers and other operators can be developed for maximum buying power that reduce capital expenses through economies of scale and accurate forecasting. It is also possible to correctly size insurance coverage and defend warranty and serial defect claims.

To gain significantly more savings from O&M optimization, operators have to look at applying digitalization to several areas of the business as a way to offer more substantial return on investment. For example, inventory carrying charge reductions and better terms and conditions with suppliers.

Sentient has calculated that a savings of up to 13 percent of revenue can be achieved when looking at the various business units that can benefit from using long term forecasting and budgeting to lower the cost of operations. ↵



**Karen J. Cassidy** has a Ph.D. in Mechanical Engineering from Northwestern University. She has worked 12 years in the field of rotating machinery prognostics including president of GasTOPS Inc. and senior engineer for SmartSignal (now part of GE Intelligent Platforms). She is currently vice president of Customer Success for Sentient Science.





## VOLT LT + SEAT

---

Sleek design, spacious interior,  
freedom to move with total ease.

**ANSI and CSA rated fall arrest and work positioning harness**

The VOLT harness's adjusted fit and semi-rigid waistbelt combine work-positioning with a lightweight design. Quick and easy to put on, this form-fitting harness offers incredible freedom of movement. The VOLT allows sternum connection to ladder fall protection systems and ensures optimal comfort when fitted with a VOLT SEAT for hands-free work-positioning.

[www.petzl.com](http://www.petzl.com)



## PROFILE

### Bachmann electronic GmbH

*Bachmann electronic supplies wind-turbine controllers, SCADA systems, condition monitoring, and more to a wind market that is constantly changing.*

By Kenneth Carter  
Editor | Wind Systems

Quality. Flexibility. Adaptability.

Those three words sum up what Bachmann electronic GmbH brings to the table in the competitive wind-energy game, according to Brian Hill, general manager — North America for Bachmann.

“Across the board for Bachmann, what really differentiates us from our competitors is our quality,” he said. “That really is a huge focus for Bachmann.”

The wind-turbine controller is, for all intents and purposes, the brain of a turbine. Without a properly functioning controller, the turbine will never be able to deliver power correctly.

Those controllers are a large part of Bachmann’s slice of the wind sector.

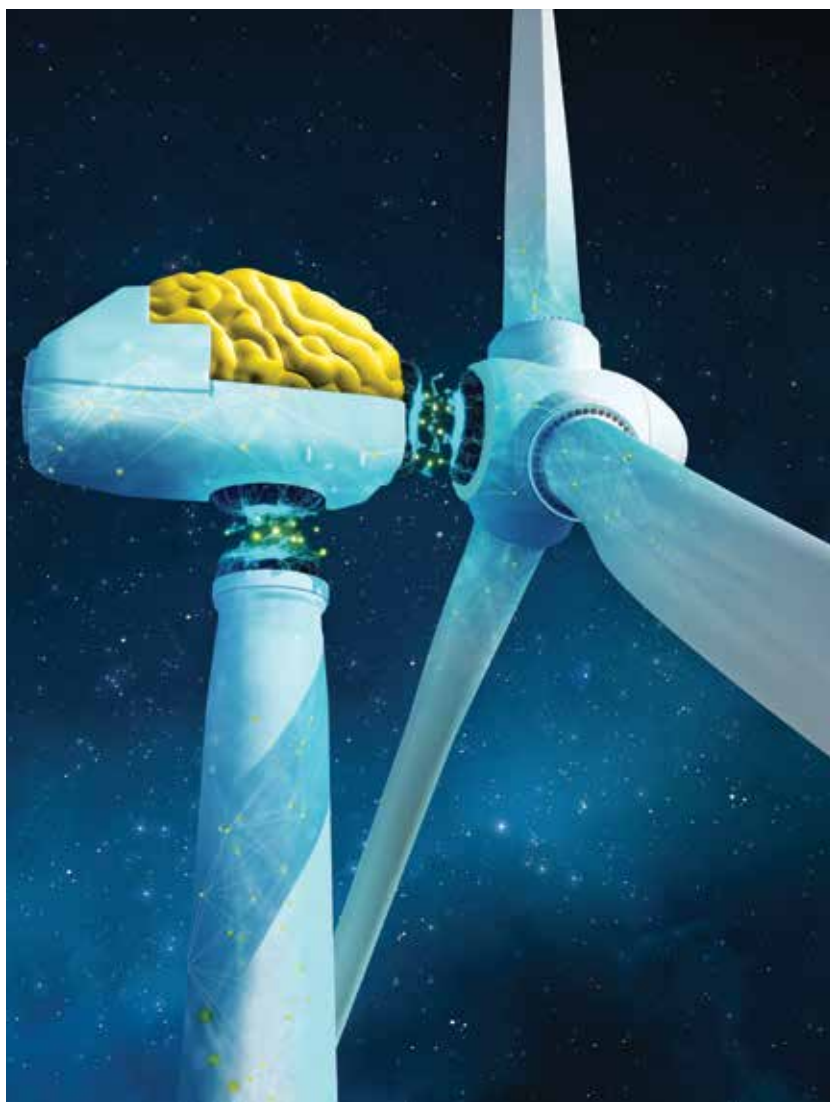
When it first entered the wind sector more than 20 years ago, Bachmann supplied controllers to GE.

#### Bachmann electronic

**Founded:**  
1970

**Headquarters:**  
Feldkirch, Austria

**Website:**  
[www.bachmann.info](http://www.bachmann.info)



Smart automation not only increases turbine efficiency but also helps to structure and connect the ever-increasing masses of data involved. (Photos courtesy: Bachmann electronic)



With a detection rate of more than 99 percent across the drivetrain and an install base of more than 6,500 systems globally, Bachmann's comprehensive Condition Monitoring solutions continue to set the industry standard for the wind sector.

"About 19,000 GE turbines have Bachmann controllers, and we have since become the No. 1 independent controls manufacturer in the wind space," Hill said. "About 65 percent of Bachmann's business is now in the wind sector."

And even though GE recently began manufacturing its own controllers, Bachmann is still a major supplier of controllers to wind companies such as Suzlon, Acciona, Inox Wind in India, as well as several turbine manufacturers in China, according to Hill.

## CONTROLLERS AND MORE

In addition to controllers, Bachmann also offers condition monitoring, retrofit condition monitoring, SCADA for new turbines and retrofit SCADA solutions, park controllers, and grid monitoring.

"The number of hardware and software platforms that can be utilized are pretty extensive," Hill said. "We also have a proprietary communication protocol that allows for very quick communication of large amounts of data, which is becoming more and more in need as these wind parks try to communicate with the grid and respond to the demands of the grid operator. That's obviously a unique feature as well. That's our bluecom communication protocol."

And every module that leaves the Bachmann factory has gone through extensive testing. Whereas other companies may only test a random fraction of products, Bachmann tests every one, according to Hill.

"Our controllers are basically in operation as they go through vibration and environmental testing," Hill said. "Ev-

ery one before it leaves has gone through this extensive 48-hour testing. We have a very low rate of failure, so we can really stand behind the product. That quality piece is the hallmark for Bachmann."

## FLEXIBLE PRODUCTS

That sums up the quality, but flexibility also is a big part of the Bachmann brand.

"Every module we put out is backward compatible with any of the previous operating parameters that we've done," Hill said. "We service and repair any modules that have problems. We're now in the wind business 20 years, and a Bachmann module that went into a GE turbine in the early '90s can be plugged into a brand-new controller string. Each specific function, if there's a problem with it, can be taken out and replaced



instead of having to replace the whole controller string. It allows for expansion of I/O and a lot of flexibility.”

And as Bachmann’s customers face a rapidly changing market that can include grid changes and other new requirements that aren’t grandfathered in, flexibility and adaptability are key, according to Hill.

It’s important to be able to listen carefully to customers in order to assess what their needs may be, because not every need is the same, he said.

“Listening is a very important part in getting to the bottom of those issues,” Hill said. “We’ve come up with custom solutions for some of the big players in the industry to adapt that communication with the grid operator.”

## FINDING SOLUTIONS

Recently, that Bachmann expertise was able to solve a problem for a wind farm in Texas, in ERCOT territory, according to Hill.

The older turbines and park controller at the site could only provide low resolution frequency on 1-minute averages, but the new grid requirements demanded that information be recorded in Milo hertz resolution in 1-second averages and one year of data be stored.

“The wind-farm owners presented this grid requirement to one of the big OEMs,” Hill said. “It was their turbines and controls, and they went to them first. And they said, ‘sorry, you’re on your own.’”

And there was no way these turbines would be able to comply with those new requirements as originally designed, he said.

“We were able to put in this small PLC — our grid monitoring data unit — and be able to provide that information to ERCOT and basically keep it on the grid,” Hill said. “The important thing for us is listening to what it is the customer is trying to get to. And that may be adapting a solution we already have or creating a new one that meets their needs.”

## RE-POWERING TURBINES

With more older turbines needing to be re-powered and retrofitted over the coming years, Bachmann is set to play a huge part in that thanks to the modularity in its product line, according to Hill.

“I think Bachmann also will have a good percentage of the new turbines coming out because of that flexibility that we have across that whole automation part of wind,” he said. “Being able to provide a high-quality, long-life product is the key to this business. Some of these older turbines aren’t able to meet the changing rules of the business. But if you have an adaptable product like ours — and we don’t really know what the future will hold on some of these things — we’re confident that we can help our customers meet those unforeseen changes that are coming.”



There is a 30 percent cost difference between being able to use all the available data and not having it at your disposal.

And some of that flexibility is seeing Bachmann come full circle with one of the companies that it started with: GE.

“With GE now offering retrofit repowering of those older 1.5 MW turbines that have our controls in them, even though we’re no longer their OEM controls provider, they’re buying upgraded Bachmann PLCs with more memory to adapt to their solutions,” Hill said.

Bachmann’s adaptability applies because it prevents GE from having to put in a whole new controller system, according to Hill.

“Here, they’re adding more sophistication, but they can leave all the older modules that handle the data and the communications and all the other parts of the automation system in place, and just change out the PLC,” he said. “So, last year GE became our largest customer again even though we’re not their OEM controls supplier anymore.”

## APPROACHING 50 YEARS

Bachmann has been a major player in the wind industry for close to 20 years, but the company started life almost 50 years ago with automation in the industrial sector dealing with plastics manufacturing, according to Hill.

Now that a majority of what Bachmann does is in wind, the sheer numbers speak for themselves.

“We have over 100,000 wind turbines in the world with Bachmann controllers and an additional 9,000 condition monitoring systems in place,” Hill said.

It’s that kind of visibility in the industry that Bachmann will demonstrate at the AWEA WINDPOWER show in Chicago in May.

“We’ll have all our major product lines shown,” Hill said. “We’ll be able to demonstrate our SCADA solutions and our retrofit of older turbines all across our product line. And we’ll be happy to speak to them about their customer needs.”



**SCADA  
webMI**

# **WIND POWER SCADA**

## **MORE TRANSPARENCY – MORE POWER**

### **CUSTOMER REQUIREMENTS INCLUDED.**

Flexible, configurable, adaptable,  
Expandable to customer requirements,  
Access security through user management

### **READY-TO-USE.**

Wind branch requirements integrated,  
Online configurable and adaptable,  
Fast efficient overview (dash-board)

### **INVESTMENT SECURITY.**

Based on pure web technology,  
Responsive design, Standard  
protocols (OPC UA, IEC 61400-25, ...)

# CONVERSATION

## Jana Adams

Senior Vice President for Member Value and Experience  
AWEA

“I am really excited about the general sessions.”

With AWEA's WINDPOWER 2018 scheduled to hit Chicago May 7-10, AWEA's senior vice president for member value and experience talked with *Wind Systems* on what to expect from the year's biggest wind energy trade show.

### Remind our readers what you do with AWEA.

Our team creates products and services for the industry through our events and different publications. And ideally, we make sure that they are what the industry needs, and make sure people get access to them efficiently through our membership programs and delivery systems and onsite event management.

### What went into planning this year's WINDPOWER?

We have a great group of industry leaders that form our WINDPOWER marketing taskforce. It is the marketing and communication folks from some of the biggest players in the industry. And we get together a couple of times each year, so right after each event, to reflect on what worked and where we can keep improving. Then we meet again over the summer to refine our plans based on that input and feedback from the previous year, and we put together our theme, on what kind of constructs we can have in terms of delivery of edu-



cational content, and what we want the fun parties to look like. We really try to get as much member feedback as possible and incorporate that anywhere we can. We want it to reflect what our members need and what they want to do when they're onsite making the business of wind happen.

### What did you learn from last year's show that helped you plan this one?

We ended up having an opportunity with our show decorator to do a thorough and intense study of the traffic of the trade show. Because we do everything on the show floor now — all of the education is on the show floor and the general sessions were on the show floor for the first time this past year — we wanted to see how people were using it: Where are the hotspots

on the show floor that really attract people. We had a theory going into the decision to move the education that it would help anchor people there and that it would help to expand the footprint so there aren't any cold corners where the poor, lonely exhibitor never gets any traffic. The study really reinforced that we were successful on that.

The study helped us understand how people are making use of the entire show floor and seeing all the exhibitors. We were able to use that in our marketing this year to say that there's not any bad spots on the floor. But what it also showed us was that we need to make sure that people are consistently coming to the show each day. We have an opportunity to really retain our audience on Thursday, which is our half day. We added a lot of components to the Thursday program to make sure people are having just as many business meetings. We wanted to anchor some events that will both add value to folks' participation in the Thursday programs as well as make it a little more fun.

### Last year, you did live online streaming. Are you planning on doing that again? Is any of how that's done changing?

We try to always build on what worked the previous year and try something new every year, so we have



two new cool things. We are streaming our general sessions again, so we're excited to bring that back. We had a really good showing for the first year with hundreds of people logging in to watch it remotely, and we hope we can make it thousands this time. So, we're definitely going to focus on ramping that up. And one of the new initiatives this year is really revitalizing the content of our general sessions.

We've had a really great formula over the past several years that I think has worked, and we just want to take the good and refine it and make it even better. During each of the main general session days, we're going to have five to seven individual speakers who are going to give their vision on the future of wind, such as the perspective of the offshore side of the industry, talking about floating turbines being the next big thing or energy storage and the implications it has on the electricity grid, our CEO Tom Kiernan talking about AWEA and how we're continuously trying to improve ourselves to help drive good outcomes in the future. So, attendees will hear all of those different perspectives, including the OEMs, will be talking about the technology and digitalization that's going on and revolutionizing the industry.

We're going to have these individual presentations, and all of the audience is going to have an opportunity to vote on who they want to hear more from. And that person will be added to our Thursday program, which is an industry town hall. It's going to be a much differently styled session. Everybody will have an opportunity to ask Tom Kiernan and Tristan Grimbert of EDF, our current board chairman, and Steve Lockhart of TPI Composites, our incoming board chairman, and our poll winner what's going on, what are they seeing, and what individuals can do to help drive the future of wind. It's going to be a very interactive town-hall style session to close it out.

### **Another aspect of the show you did last year was integrate ways to do business right on the show floor. How did that turn out, and can attendees expect that same convenience in Chicago?**

It was a huge hit last year, and we're continuing it. We're expanding it. We have even more meeting rooms on the show floor. It's just an evolution of the trade show model. The one-size-fits-all model of "here's your 10x10 booth, put up a pop-up frame, and get to work." That doesn't meet the needs of every attendee or every company that really wants to leverage WINDPOWER to advance their business. And so, we've got the meeting spaces on the show floor. One thing we're adding this year is

the opportunity for people to access hourly or two-hour meeting room rentals. Some of them don't need a space for two and a half days, so we've got this flexible functional space right in the AWEA booth that we're going to allow members to access to carry out those very targeted, on-the-spot needs to talk to clients.

### **Are you doing any unique tie-ins with Chicago? It is the Windy City, after all.**

What we decided was that — and this was really good feedback from our members and other folks that we talked to — when you think of Chicago, a lot of people think of Navy Pier, and they think of the Ferris wheel. We're delighted to host our opening reception at the Crystal Gardens, which is a beautiful room that overlooks the Ferris wheel. And everyone that is registered is invited. It's a great fun way to start your week in Chicago. And we're also excited that our AWEA WindPAC members, which is our political action committee, will have special access to the Ferris wheel after the opening reception. It will be when the sun is setting over Lake Michigan, so it will be a really fun experience for people who are interested in supporting the PAC.

We're closing things down with some really cool Chicago things. We are ending the show with a plan-your-own ending. Attendees are able to reserve space on one of three tours: We've got a tour of White Sox Stadium. We've got a gangster tour of Chicago covering some of the interesting history of the city. And the final option is an architectural boat tour, where you go down the river and get a cool lesson on the different architectural styles that Chicago is known for. So that's a great way to start it and end it with the unique Chicago experiences.

### **What are you personally looking forward to at this year's show?**

I am really excited about the general sessions. I think that there is just so much amazing innovation happening in the industry right now. To be able to hear from these different leaders of the industry from their fields and their perspective of what they see we need to focus on and what they see that's really driving the future of our industry. It's going to be such a unifying way to start off each day, that we're all hearing from the same folks; we're all hearing the same message, and then we go out and do our business and carry on the business of wind. I think that's going to be a very positive way to start each day. So, I'm excited to see that. ✌

For more information, go to [www.awea.org](http://www.awea.org)

# MAINTENANCE

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

## Danish company launches intelligent wind-power technology



Mita-Teknik's intelligent control systems have a flexibility that is a great advantage since different regions of the world require wind turbines to operate in diverse ways. (Courtesy: Mita-Teknik)

Intelligent control systems have taken over the wind industry. The Danish company Mita-Teknik leads the drive for innovative solutions with its new generation of control systems that ensures higher profits, performance, and leveled cost of energy (LCOE) for larger wind farms.

Mita-Teknik, which provides state-of-the-art technology for the renewable energy market, especially for wind turbines, has launched a new and advanced control system that secures the future of the world's wind farms. The control system is the backbone of the turbine as it controls the whole operation.

“With the next generation of the WP4200 Control System, our company goes from producing systems with single-core to multi-core processors,” said Thomas Andersen, CTO at Mita-Teknik. “Compared to other solutions on the market, we deliver a very competitive control system. Our solution provides customers with a user-friendly system with the power to process large amounts of data.”

“This means that the turbine can produce and process data itself,” he said. “The turbine can learn from the results and optimize or respond to immediate changes in its operation. Until now, you had to transfer data from

the turbine to an external system to process large datasets — with the risk of slow processing or even losing data. Our system solves these problems by processing the data inside the turbine. The control system also provides a high level of data security that safeguards the turbine against external threats.”

## INTELLIGENT ALGORITHMS

Mita-Teknik has great expectations for its next generation of control systems equipped with intelligent algorithms and software geared to adapt future application software. The control system is open, and the customer can easily navigate in the system and add new applications to suit their needs.

“Each individual module is intelligent and can tell us about its condition,” Andersen said. “It also has a processor that allows the customer to change the behavior of the different applications. You can, for example, add machine-learning algorithms to optimize the performance and maintenance of your turbine. You can easily install extra applications because of the powerful system that runs up to ten different applications at the time.”

## GRAND EXPECTATIONS

The control systems’ flexibility is a great advantage because different regions of the world require wind turbines to operate in diverse ways. Instead of changing the turbine’s software, an extra application can be added to meet immediate demands. The next generation of control systems are on the market from mid-March 2018, and Mita-Teknik expects to increase its markets shares in Asia, America, and Europe.

“We aim to provide state-of-the-art technology for the lowest costs throughout the wind turbine’s life cycle,” Andersen said. “The market demand is to reduce costs on all parts of the turbine while enhancing quality and performance. Our customers achieve both with the new generation of the WP4200 Control System.”

*Source: Mita-Teknik*

For more information,  
go to [www.mita-teknik.com](http://www.mita-teknik.com)



The Triton Wind Profiler. (Courtesy: Vaisala)

## Vaisala bolsters its global network

Vaisala has signed a succession of new regional partnerships in response to rising global demand for its advanced wind measurement system, the Triton Wind Profiler. Additionally, as wind-farm owners and operators worldwide continue to expand their use of remote sensing in wind-industry applications, Vaisala has launched an improved observations platform that enables users to access their wind data from the same dashboard as Vaisala’s time series and energy forecasting tools.

Combined, these efforts provide Vaisala’s customers with the benefits of an unparalleled support network and improved management of their data, while laying the groundwork for further adoption of advanced remote sensing technology worldwide.

As Vaisala’s recent Remote Sensing Revolution highlights, the global wind industry increasingly uses remote sensing technology to guide decisions from site prospecting and resource assessment through to project optimization — providing more accurate data without long permitting delays and complex installations.

Maximizing the logistical and cost benefits afforded by remote sensing devices, however, requires access to fast and efficient local field support. In order to meet this requirement, over the past 12 months Vaisala has established or expanded regional partnerships with NERI in Japan; Jim Latimer GmbH & Co. KG, MM Pro Management Oy, and Windhunter in Europe; Marti Ltd. in Turkey; LOHO M&E Equipment Co. in China; and WISE in Australia. Each of these agreements will provide greater access to specialist servicing and technical advice for Triton users in these promising wind markets.

Getting maximum value out of a remote sensing measurement campaign also depends on the ability of the owner to effectively manage data collected by units on site and use this data to inform development and operational decisions. Users of Vaisala’s Triton may now monitor their units via a new online Observations platform.

*Source: Vaisala*

For more information,  
go to [www.vaisala.com/energy](http://www.vaisala.com/energy)



## Siemens Gamesa to provide service at four Polish wind farms

Siemens Gamesa will provide service to Polish onshore wind farms of innogy SE, one of the major operators of onshore wind farms in Europe. Via its subsidiary innogy Renewables Polska, the company has signed four agreements with Siemens Gamesa Renewable Energy to cover service and maintenance for 55 of its wind turbines. The turbines, with a combined rating of 120 MW, are installed at four different onshore wind farms in Poland. The four projects include two parks with Siemens G2 platform technology and two parks with Gamesa G90-2.0 MW turbines. The contracts cover customized service agreements including Siemens Gamesa's cutting edge remote diagnostic services.

The Suwalki project, commissioned in 2009, consists of 18 Siemens turbines of the type SWT-2.3-93 installed at a hub height of 103 meters. The 41-MW project is in the northeast of Poland in the Podlaskie region. The 30-MW Taciewo project in the same region consists of 15 Gamesa G90-2.0 MW units.

The 14-MW Krzecin wind farm erected in 2012 adds seven G90-2.0 MW turbines. The project is in the northwest of the country, together with the remaining Tychowo project commissioned in 2010. The Tychowo



Innogy SE has signed four agreements with Siemens Gamesa Renewable Energy to cover service and maintenance for 55 of its wind turbines. (Courtesy: Siemens Gamesa)

wind farm features 15 SWT-2.3-93 wind turbines with a total rating of 34.5 MW.

"We are proud that innogy has selected us as the service provider for these four projects," said Mark Albenze, CEO Service at Siemens Gamesa Renewable Energy. "We especially look forward to providing service and best-in-class remote diagnostics for the recaptured Suwalki project again. With our flexible and customized service contracts, we were able to offer the best solution for this important customer."

Siemens Gamesa has more than 500 wind turbines in operation in Poland with a combined capacity of more than 1 GW. ↴

Source: Siemens Gamesa

For more information, go to [www.siemensgamesa.com](http://www.siemensgamesa.com)



### Technology Partners in Blades

Blade inspection and repair services including:

- Major repairs and retrofits (on ground, in-house and up-tower)
- End of warranty & post warranty inspections
- 3rd party blade consulting expertise
- Ultrasonic & thermographic inspections
- Touch-up repairs before wind-farm construction
- Training
- Manufacturing of other wind turbine composite components





ENERGY SERVICES

wind

**GD Energy Services - Wind, Inc.**  
 8150 S Akron Street, Suite 404  
 Centennial, CO-80112

Contact: Lucas Llado – President, - email: [l.llado@gdes.com](mailto:l.llado@gdes.com)  
[www.gdes.com](http://www.gdes.com) - Cell: +1 312 576 0661

CUSTOMIZED  
SOLUTIONS  
FOR HARMONIOUS  
PERFORMANCE

...MAXIMIZING  
COMPONENT LIFE



A FULL RANGE  
OF SOLUTIONS  
DEDICATED TO  
YOUR WIND  
TURBINES



CARBON  
BRUSHES



BRUSH-HOLDERS



SLIP RING  
ASSEMBLIES



SIGNAL & POWER  
TRANSFER SYSTEMS



CL-PROFILER:  
SLIP RING  
DIAGNOSTICS



ASK US ABOUT OUR  
WINDTRACKER™ SERVICES

[info.ptt@mersen.com](mailto:info.ptt@mersen.com)

VISIT OUR BOOTH:

AWEA  
7 - 10 MAY 2018  
CHICAGO, IL, USA  
BOOTH 3212

[WWW.MERSEN.COM](http://WWW.MERSEN.COM)

**merSen**  
Expertise, our source of energy

## Vestas partners with InspecTools to expand blade-service offerings



take your **CAREER**

to the **NEXT LEVEL**

WIND ENERGY & TURBINE TECHNOLOGY

ELECTRICAL TECHNOLOGY

HVAC TECHNOLOGY

ENGINEERING TECHNOLOGY

ENVIRONMENTAL STUDIES

WATER QUALITY & SUSTAINABLE AQUATIC RESOURCES

Jobs in these fields are in high demand and are only growing bigger. Take advantage of these opportunities and position yourself on a path to a greater, more rewarding career and future.

We also offer custom training & certification courses

**866-IALAKES**  
[iowalakes.edu](http://iowalakes.edu)

**POWERING the FUTURE through EDUCATION and SUSTAINABILITY**

IOWA LAKES COMMUNITY COLLEGE

Vestas turbines in Macarthur, Australia. By partnering globally with InspecTools, Vestas continues to expand its multi-brand business to meet customers' fleet-wide service needs. (Courtesy: Vestas)

Vestas customers will now get online access to blade inspection analysis and data from any of their turbines in any market, thanks to the expansion of Vestas' partnership with InspecTools, a leading energy asset inspection company. With the ability to efficiently analyze inspections, Vestas strengthens predictive wind-turbine maintenance, enabling customers to lower costs and better manage risks and safety — around the world.

The partnership includes global access to the industry-leading asset data management system WindAMS that will enable customers to reduce performance loss or unforeseen costs by using Vestas' superior technical knowledge and unparalleled inventory of wind-turbine performance data



“

We welcome this opportunity to take our existing relationship with Vestas to the next level with the signing of this global partnership.

”

to obtain best-in-class inspection insights. Together with customer access to an online portal to view blade conditions across entire fleets, WindAMS can further improve predictive maintenance and help mitigate issues such as severe leading-edge erosion, which can reduce annual energy production by up to 5 percent.

“By extending our partnership with InspecTools, Vestas will provide customers with even better and faster blade condition insights, which enable customers globally to better manage their fleets by investing more effectively in maintenance to lower costs and increase production and revenues,” said Christian Venderby, group senior vice president and head of service at Vestas.

“We welcome this opportunity to take our existing relationship with Vestas to the next level with the signing of this global partnership,” said InspecTools’ CEO Paul Bingaman. “Deploying WindAMS will enable Vestas to standardize the collection, review, analysis, and reporting of turbine blade condition data collected anywhere, by any method. Working with Vestas’ service business units around the world is a great opportunity for us to have the kind of impact on the wind-energy industry that we have always intended to have. And we’re excit-

ed to be working with a company whose commitment to the wind energy industry matches ours.”

By partnering globally with InspecTools, Vestas continues to expand its multi-brand business to meet customers’ fleet-wide service needs. Since 2016, Vestas and InspecTools have partnered in North America on drone inspections to reduce both inspection costs and

safety risks. The partnership also includes an agreement to further develop WindAMS artificial intelligence (AI) to automate inspection data analysis. ✎

Source: Vestas

For more information, go to [www.vestas.com](http://www.vestas.com)

## PROTECT YOUR INVESTMENT



**PADDING/SHADING EQUIPMENT  
AVAILABLE FOR SALE, RENT OR LEASING.**

**WRS**  
WORLDWIDE  
RENTAL SERVICES

**WORLDWIDE  
MACHINERY  
PIPELINE DIVISION**

**SUPERIOR**  
MANUFACTURING

AUTHORIZED DEALERS OF

**TEC**  
EARTHMOVERS INC.

**TATU**  
TATU

☎ 1.888.997.3687 ✉ [RENTALS@WRSRENTS.COM](mailto:RENTALS@WRSRENTS.COM) 🌐 [WRSRENTS.COM](http://WRSRENTS.COM) 🐦 @WRSRENTS

# INNOVATION

Research & Development • Design & Engineering • Forecasting & Analysis  
Consultancy • Certification & Standards • Efficiency • Emerging Technologies

## Systematic now entering the global offshore wind market



The SITE software suite. (Courtesy: Systematic)

At offshore wind farms many kilometers from land, where wind and weather conditions are often extreme, employee safety is of paramount importance.

To help deal with this, Systematic now provides the new software solution SITE, which aims to enhance personal safety in exceptionally demanding offshore environments, as well as optimizing the complex logistics involved when establishing and subsequently maintaining offshore wind farms.

“With SITE, we provide a digital platform that creates an effective overview of everything that’s going on, and establishes reliable communication between marine coordinators on land and the vessels and personnel operating offshore on and around the wind turbines,” said Systematic Group Senior Vice President Flemming Bent Thomsen. “Establishing a wind farm usually involves a construction phase extending over about two years, during which time there are several hundred people, vast amounts of equipment, installation vessels, transport ships, and all kinds of tenders and auxiliary vessels in operation out there, as well as helicopters flying to, from, and above the site. It’s vital with reliable tracking of all people, vessels, and assets at all times and to be able to coordinate both planned and unforeseen tasks effectively. These capabilities are absolutely crucial

for commercial success. At the same time, there are extremely strict safety requirements that must be complied with, and it’s crucial to know where every person is at any given time. SITE provides exactly the right tools needed for doing this.”

### CAN REVOLUTIONIZE THE BUSINESS

SITE is an IT solution that provides shared situational awareness, simplifies critical decision making, and establishes digital communication between onshore coordinators at HQ and the vessels and personnel at sea.

“Operational users and vessels particularly appreciate mobile apps that can send data over the available radio channels, and thereby pass plans and mapping information back and forth with each other, even though there is no access to the capabilities normally required for this, such as a 3G network and Wi-Fi, or if the radio connection to land is lost — which is a known problem, the farther away from land you get,” Thomsen said.

### GLOBAL POTENTIAL

Earlier in 2017, Systematic was able to announce that the company had been selected to deliver a fully-integrated resource tracking and communication system supporting the coordination of all Vattenfall’s onshore and offshore

wind operations.

The SITE solution provides overview and safety for employees when Vattenfall constructs and maintains the company's many wind farms in the U.K., Germany, the Netherlands, Sweden, and Denmark.

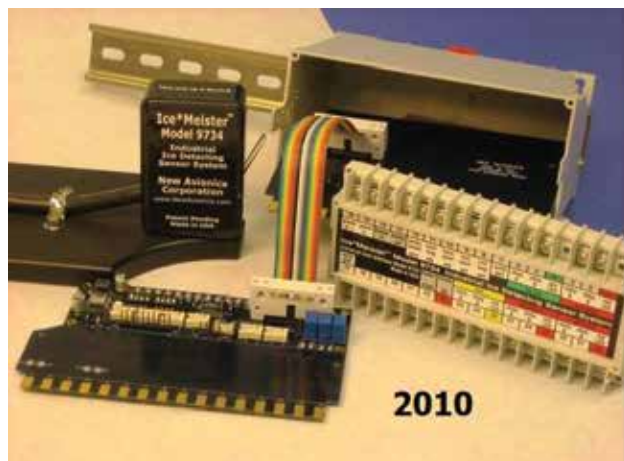
"We have taken this big step into a very exciting market, and we see a great potential for SITE in the offshore industry," Thomsen said. "Greater safety, streamlined logistics, better situational awareness, and data-driven decision making support for both administrative and

operational users feature prominently in a wide range of Systematic IT solutions. As a result, we have customers worldwide in energy, defense, law enforcement, logistics, and health care, and it is a great pleasure to now also be able to offer our considerable experience in this field to customers in the wind-turbine industry." *Λ*

Source: Systematic

For more information, go to [www.systematic.com/site](http://www.systematic.com/site)

## New ice sensor technology entirely optical



Ice\*Meister Model 9734-SYSTEM was introduced in 2010 as a system of two elements: a sensor probe on top of the nacelle, wired to a rail-mounted electronics box inside the nacelle. Now, eight years later, the 9734 is completely contained in a single nacelle-mounted, epoxy-filled unit the size of a thumb, at half the price. (Courtesy: New Avionics Corp.)

New Avionics Corp manufactures modern ice sensors for wind farms, manned and unmanned aircraft, commercial refrigerators, sensing the formation of hazardous ice for corrective action. NAC's Ice\*Meister™ Model 9734-SYSTEM was introduced to the wind-power community in March of 2010 and has since proven itself at wind-power farms and other industrial sites across the northern hemisphere.

The technology is entirely optical. With no moving parts, Model 9734 has been constantly improved with new optical configurations and lower-cost manufacturing techniques.

This evolves continuously into smaller, lighter, more sensitive ice detectors at lower prices.

Since 2010, the 9734 ice sensor has shrunk from a nacelle-top sensor head the size of a human fist with a large rail-mounted DIN box inside the nacelle, to a single epoxy-filled unit the size of a thumb. Price and discount schedules for 2018 have likewise shrunk to less than half the original prices of 2010.

In operation, the 9734 monitors the wind turbine's immediate meteorological environment for real-time formation of an icing domain. It works on the principle of refraction.

When air is in contact with the probe surfaces, it senses the optical characteristics of that air and reports no ice. When ice is in contact with the probe surfaces, it senses the optical characteristics of that ice and reports *ice alert*.

### TURBINE BEARINGS HEAT SIGNATURE

NAC's ice-sensing technology is also found on fixed-wing aircraft, with well over 5,000 hours flight time and more than 18 continuous hours per mission in electrically-propelled UAVs.

Ice\*Meister™ works in ice-protected

autonomous drone aircraft for fixed-schedule operations in wind-turbine farms, regardless of rain, cold, ice, or snow, much as commercial and military aircraft do everyday.

New Avionics ice-sensing technology is size-appropriate, weight-appropriate, and cost-appropriate to modern drone aircraft. It opens the door to inspection drones for wind-power farms, suitably equipped with digital maps and flight algorithms; infrared, visual and Lidar cameras; multiple swappable batteries, housed in local “garages” similar to drone prototypes for rural Federal Express delivery vans.

On fixed schedule under SCADA control, each autonomous drone would take off and fly a specific circuit of turbines, record high resolution images of turbine blades and other key features, then fly to the next turbine much like a honey bee collecting nectar in a field of flowers, returning to its garage for battery charge or swap as required.

In the unlikely event of fire or other anomaly, SCADA would immediately dispatch its drone for video monitoring and situational awareness before technicians and fire apparatus could arrive.

Wind-farm drones would also be night watchmen, with heat-sensitive infrared cameras that would alert operators of intruders, the movement of wildlife at night, or flocks of birds, sounding a horn to shoo them away. It would also monitor the heat signature of turbine bearings and other equipment for signs of impending failure.

In addition to end-of-warranty inspections and preventive maintenance, inherent advantages of ice-protected autonomous drones include safety, objectivity, uniformity, accuracy, low cost, and real-time dissemination of critical data.

None of the above would be possible without Ice\*Meister™ modern ice sensing and protection for drone aircraft operating fixed-schedule missions in ice and snow.

Such are the recent advancements in ice sensors for wind turbines, made possible by New Avionics Corporation. ✎

*Source: New Avionics Corp.*

For more information, go to [www.newavionics.com](http://www.newavionics.com)

## WindShark turbines to be introduced in California

Mitu Resources Inc. is introducing commercially the company’s licensed WindShark self-starting vertical axis wind turbines within the regulated cannabis sector in California.

One of the major factors affecting gross margins in the cannabis sector is the cost of the enormous quantity of electricity required to run a greenhouse or indoor grow facility. Experts estimate that currently more than 3 percent of all California energy is used in cannabis cultivation. Mitu sees tremendous potential in California’s emerging cannabis market for the deployment of rooftop arrays of WindSharks to supply a significant portion of the required power of the average indoor cannabis growing operation.

The company estimates that each of California’s largest licensed indoor cannabis producers requires approximately 4,500-5,000 kWh/day for lighting alone. WindShark’s compact and light-



WindShark vertical axis wind turbines. (Courtesy: Mitu Resources Inc.)

weight design make them ideal to be supported on existing rooftops of buildings in arrays of up to 200 individual turbines with the potential to produce more than 480 kWh/day per license, or approximately 10 percent of the average lighting requirement.

There are 2,500 licensed cannabis producers in California, of which more than 1,500 are indoor facilities of up to 20,000 square feet. Assuming a 2 percent adoption by current indoor producers, Mitu believes that potential demand in California for WindShark

could reach 6,000 total turbines installed for gross revenues of approximately \$6 million.

“One of the most exciting and immediate opportunities for applying the WindShark technology is in California’s emerging regulated cannabis market where indoor growers face stiff competition from outdoor growers and higher than the national average energy prices,” said Simeon Leonardo Reyes Francisco, CEO of Mitu Resources. “We think that a WindShark turbine array on an existing rooftop is a cost-effective way to



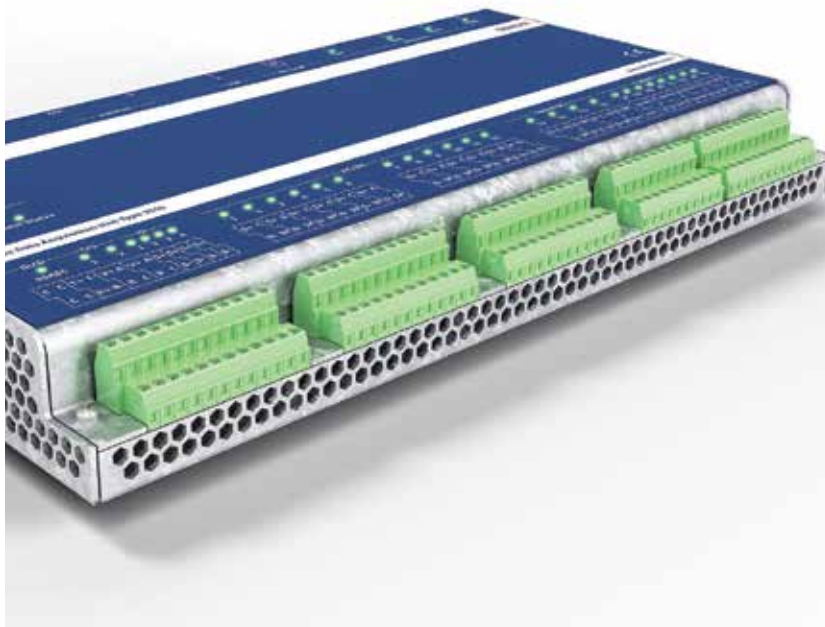
produce a significant amount of the daily energy requirement and positively impact the bottom line of any indoor cannabis grower. We look forward to partnering with several California-based cannabis growers for the first WindShark

installations in the very near future.”

Source: Mitu Resources Inc.

For more information, go to [www.mituresources.com](http://www.mituresources.com)

## New generation condition monitoring unit launched for turbines



The DDAU3 condition monitoring unit. (Courtesy: B&K Vibro)

After a period of customer surveys and research, followed by an intense development phase, B&K Vibro recently introduced the new condition monitoring unit: the DDAU3 (diagnostic data acquisition unit).

As one of the world's largest suppliers of condition monitoring systems and condition monitoring services for the wind-turbine market, B&K Vibro has developed the new DDAU3 based on extensive experience. Since the beginning of this century, the company has

monitored almost 12,000 wind turbines all over the world from their condition monitoring and diagnostic centers. In addition to this, it also delivered almost 20,000 wind-turbine condition monitoring systems to customers, based on the successful DDAU2. All this experience, plus the many years of close collaboration with owners, operators, service providers, and manufacturers, has resulted into DDAU3 as the next generation wind-turbine condition monitoring unit.



**MANKIEWICZ**   
Coating Concepts of the Future

Whether you need a system for wind blade production or repairs, come by and learn how Mankiewicz can provide your complete coatings solutions.

**AWEA WINDPOWER**  
CONFERENCE & EXHIBITION  
Chicago, IL May 7-10, 2018

**Booth # 3827**




North America: +1 (843) 654 7755  
Europe: +49 (0) 40 / 75 10 30

**[www.mankiewicz.com](http://www.mankiewicz.com)**

DDAU3 is a condition monitoring platform designed with the newest technology to meet the condition monitoring challenges of today and many years to come. It will help customers with their increasing need to optimally reduce downtime and overall life-cycle costs of wind turbines by implementing enhanced condition monitoring methods, easy system integration, built-in cyber security, and simple IT solutions.

DDAU3 is backward compatible to existing DDAU2 devices and has a seamless interface to the VibroSuite Condition Monitoring Software or popular data historians. DDAU3 is flexible and scalable and offers application/machine specific monitoring strategies as well as customized solutions.

The DDAU3 functionality and design concept make it the ideal


device for nearly any remote condition monitoring task:

- True IoT edge computing with direct compatibility to Microsoft® Azure IoT Hub.
- Standardized interface protocols such as OPC UA, MODBUS TCP/IP, MODBUS RTU.
- A holistic condition monitoring approach. DDAU3 is not limited to vibration data but accepts direct input from a large variety of sensors, devices, and data interfaces.
- Onboard storage of large amounts of data in case of a network outage.
- Stand-alone operation for off-line data recording.
- Remote update of application specific monitoring strategies and software updates, with complete cyber-security.
- High computational power and

onboard intelligence reduces load on the central monitoring servers.

- 60 years of condition monitoring experience translates into a wide range of scalar descriptors, advanced statistical analysis techniques, and array measurements, which include FFT spectra, envelope spectra, cepstra, and time waveform recordings for detailed analysis.
- Proprietary measurement techniques for early fault detection of rolling element bearing faults and complex gearboxes.
- Advanced process dependent onboard alarming.

“DDAU is a key element in B&K Vibro’s comprehensive condition monitoring solution for wind turbines” said Dr. Christian Klostermeier, business line manager at B&K Vibro. “Within a service agreement, we can work directly with the customer maintenance team to help them to make the correct asset decisions reliably and quickly, based on the right information. This is made possible by the remote monitoring and analysis capabilities of DDAU. The same DDAU system, together with the VibroSuite monitoring software or data historian, offers a versatile database server, customized user dashboard, and advanced diagnostic tools that can be used by customers with all levels of in-house monitoring expertise.”

DDAU3 is supported by a worldwide network of sales and service offices and partners. B&K Vibro’s renowned monitoring and diagnostic centers are in Denmark, Houston, Texas; and China. Other services also are offered for installation, commissioning, and training. 

Source: B&K Vibro

For more information, go to [www.bkvibro.com](http://www.bkvibro.com)

When precision, reliability and quality are your expectations...  
**TURN TO SOTEK/BELRIX**




established in 1989

A leader in the manufacturing of precision metal stampings. We supply custom stamped laminations and assemblies to a variety of customers – large and small.

Whether your need is for immediate turn around or delivery of production quantities on a regular basis, we are equipped to meet your needs.

- Stator, Rotor, and Pole Laminations
- Stator, Rotor, and Pole Assemblies
- Vent and Finger Plates
- Stamping and Laser Capabilities
- Complete In-House Tooling Capabilities



Sotek, Inc. and Belrix Industries, Inc. • 3590 Jeffrey Boulevard • Buffalo, NY 14219  
716-821-5961 • fax: 716-821-5965 • [www.sotek.com](http://www.sotek.com) • [info@sotek.com](mailto:info@sotek.com) • ISO REGISTERED

SERVING MEDIUM TO HEAVY INDUSTRIAL MOTOR AND POWER GENERATION INDUSTRIES

# ENGINEERED DROP PREVENTION SOLUTIONS



Since inventing the socket and driver back in 1920, Snap-on has been driven by innovation. This GE 1.5 Hub Hatch Tool is an engineered solution that replaces the homemade version in many technician bags. It includes a floating, certified attachment point, ensuring functionality and drop prevention.

GE Hub Hatch Tool



Stainless Steel Safety Coil is designed to slide freely along the handle, so you can hold the wrench where you need to.

CUSTOM DESIGNED AND TESTED DROP PREVENTION TOOLKITS WITH INVENTORY MANAGEMENT SYSTEMS ARE ORDERED AS A SINGLE LINE ITEM.



Contact Power Generation Manager John Tremblay  
413-519-3380 or [john.r.tremblay@snapon.com](mailto:john.r.tremblay@snapon.com)

[www.snapon.com/industrial](http://www.snapon.com/industrial)

**Snap-on**  
INDUSTRIAL



# MANUFACTURING

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

## TÜV Rheinland to surveil Senvion rotor-blade production



The Trianel Windpark Borkum II wind farm is being developed 45 kilometers to the north of Borkum in the German North Sea as the second stage of the Trianel Windpark Borkum. (Courtesy: Trianel Windkraftwerk Borkum GmbH & Co. KG)

TÜV Rheinland has been commissioned to perform comprehensive testing on behalf of Senvion, a manufacturer of wind turbines. The experts will surveil the production of rotor blades for the Trianel Windpark Borkum II offshore wind farm. In the process, they will check that the blades conform to the production documents, that the rules of technology are observed, that specific quality requirements set down in the specifications are met, and that deadlines are observed.

The experts from TÜV Rheinland also will examine the documentation. This is not the first commission of its kind for the internationally active certification service provider. After successfully completing a production monitoring order for rotor blades in Castellón/Spain for the Nordgründe and Nordsee One wind farms, TÜV

Rheinland has now been commissioned to surveil the blade production in Portugal as well.

The Trianel Windpark Borkum II wind farm is being developed 45 kilometers to the north of Borkum in the German North Sea as the second stage of the Trianel Windpark Borkum, a wind farm that has been operating since 2015. After completion, which is planned for autumn 2019, it will have an output of around 203 megawatts. It will contain 32 turbines from the Senvion 6.XM series.

Senvion is a leading global manufacturer of both onshore and offshore wind farms. The international engineering company develops, produces, and operates wind farms for almost any location — with a rated output between 2.0 and 6.33 MW and rotors ranging



from 82 to 152 meters in diameter. Senvion also offers its customers project-specific solutions in the fields of turnkey solutions, service and maintenance, transport and installation, and foundation planning and construction.

TÜV Rheinland is accredited by DAkkS, the German accreditation body, as a certification organization for type and component certification for onshore and offshore wind turbines according to national and international standards and is listed as an RE Certification Body by the IECRE. The company offers ambitious services such as location analysis, geotechnical exploration, and verification of structural analysis but also manufacturer mon-

itoring, quality inspection, and construction monitoring. As an inspection body accredited by DAkkS according to DIN EN 17020, TÜV Rheinland offers wind-turbine operators recurring and state-oriented testing, digitally assisted assessment of system conditions, and special examinations by means of the latest destruction-free test methods. Special location reports, due diligence investigations, and yield forecasting in turn serve to secure investments. ↘

*Source: TÜV Rheinland*

For more information, go to [www.tuv.com](http://www.tuv.com)

## Vestas installs V120-2.0 MW prototype

Vestas is improving energy production for its 2 MW platform in low- and ultra-low wind conditions by installing a prototype V120-2.0 MW turbine with the ability to run in 2.2 MW Power Optimized Mode. At the same time, Vestas is introducing an upgraded 2.2 MW nominal rating turbine that expands the 2 MW platform into medium- to low-wind conditions with high turbulence.

Having announced the V120-2.0 MW turbine in the spring of 2017, the upgraded V120-2.2 MW includes a stronger gearbox and reinforced blades that strengthen performance in higher wind conditions. The V120-2.2 MW is globally applicable and designed for medium- to low-wind with higher turbulence conditions, which make the turbine a great fit for North America.

The V120-2.0 MW prototype is operating at the Lem Kjør wind park in Western Jutland, Denmark, and has produced its first kilowatt hour of electricity. The prototype will undergo an extensive test and verification program to ensure reliability before full-scale production commences prior to the first deliveries. The turbine at Lem Kjør will be converted into a V120-2.2 MW prototype in the fourth quarter of



Vestas also is introducing an upgraded 2.2 MW turbine. (Courtesy: Vestas)

2018 where blades and gearbox will be changed.

“With the successful V120-2.0 MW prototype installation and introduction of the upgraded V120-2.2 MW turbine, Vestas once again demonstrates its ability to meet customer requirements by lowering cost of energy and reducing time to market for new products,” said Anders Vedel, executive vice president & CTO.

The 2 MW platform was launched

in 2000 and leverages years of experience in supply chain, transport, and installation optimization. With more than 20,000 turbines installed in 45 countries since its debut, Vestas’ 2 MW platform the most widely installed platform in the industry with 40 GW of accumulated installed capacity. ↘

*Source: Vestas*

For more information, go to [www.vestas.com](http://www.vestas.com)

## Vestas strengthens presence in Argentina with new assembly facility


Building on its successful track record in Latin America, Vestas strengthens its position as the leading wind-turbine manufacturer in Argentina by building a hub and nacelle assembly facility in the Buenos Aires province. The new facility, which will generate hundreds of new jobs once complete, is being established to meet the country's huge growth potential within wind energy, expected to reach 10 GW of new installations by 2025.

"Our leadership position with more than 900 MW of either installed capacity or capacity under construction underlines the need to take a big step forward to better support the government's ambitions for renewable energy," said Andrés Gismondi, sales director for Latin American South Cone. "By building this assembly facility, we will serve our customers' needs in the country even better and generate hundreds of local jobs."

With nine production facilities around the globe and carefully selected partners, Vestas' global manufacturing footprint guarantees delivery of high quality products to its customers by manufacturing core components close to key markets. With the new production facility in Argentina, Vestas aims to optimize production while creating about 300 direct and indirect jobs.

"The fact that a global leader in renewable energy is interested in expanding its presence in Argentina clearly proves that we are on the right path, providing investors with the confidence and trust needed to invest in our green transition," said Minister of Energy Juan José Aranguren.

"Vestas' positioning in Argentina is good news, not only for the number of jobs that will be created thanks to its localization plan, but also for the technology transfer to small- and medium-sized enterprises in the country," said Minister of Production Francisco Cabrera.

Vestas pioneered Argentina's wind-energy market with the installation of the country's first commercial wind turbine in Neuquén back in 1991. Since then, Vestas has closely monitored the evolution of the market, which now stands out as a key market in Latin America. The government launched the RenovAr programme in 2015, which aims to reach a 20 percent renewable energy target by 2020. 

Source: Vestas

For more information, go to [www.vestas.com](http://www.vestas.com)



**WIND TURBINE MAIN SHAFTS**

Fusion Inc. can assist you with repairing of bearing journals, seal areas and coupling fits on wind turbine main shafts with our large capacity lathe, grinders and HVOF coating systems. We can perform incoming inspection, level II NDT-Inspection, lathe machining, HVOF coating and finish grinding in-house. To be repaired ODs can be HVOF coated with up to .020" per side of coating thickness and ground back to standard OEM size/finish.

**FUSION INC.** THE COATING & GRINDING EXPERTS

6911 FULTON ST HOUSTON, TX 77022 PHONE 713-691-6547 FUSIONHOUSTON.COM



**BOOTH 1139**

# MAKE PLANS TO ATTEND TOP-RATED CONFERENCES IN 2018

## **Operations & Maintenance and Safety Conference**

February 27 – 28 | San Diego, CA

[www.awea.org/oms](http://www.awea.org/oms)

## **Siting & Environmental Compliance Conference**

March 20 – 21 | Memphis, TN

[www.awea.org/siting](http://www.awea.org/siting)

## **WINDPOWER Conference & Exhibition**

May 7 – 10 | Chicago, IL

[www.windpowerexpo.org](http://www.windpowerexpo.org)

## **Regional Wind Energy Conference - Northeast**

June 26 – 27 | Portland, ME

[www.windpower.org/northeast](http://www.windpower.org/northeast)

## **Wind Resource & Project Assessment Conference**

September 11 – 12 | Austin, TX

[www.windpower.org/wra](http://www.windpower.org/wra)

## **Wind Energy Finance & Investment Conference - East**

October 1 – 2 | New York, NY

[www.awea.org/financeeast](http://www.awea.org/financeeast)

## **Wind Energy Finance & Investment Conference - West**

October 5 | San Francisco, CA

[www.awea.org/financewest](http://www.awea.org/financewest)

## **Offshore WINDPOWER Conference & Exhibition**

October 16 – 17 | Washington, DC

[www.offshorewindexpo.org](http://www.offshorewindexpo.org)

## **Wind Energy Fall Symposium**

November 13 – 15 | Colorado Springs, CO

[www.awea.org/symposium](http://www.awea.org/symposium)



[www.awea.org](http://www.awea.org)



# CONSTRUCTION

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

## Pattern Development completes financing of Montana wind project



Stillwater Wind will use a total of 31 Siemens Gamesa wind turbines comprised of five 2.3 MW turbines with 108-meter rotors and 26 2.625 MW turbines with 120-meter rotors. (Courtesy: Siemens Gamesa)

Pattern Energy Group 2 LP recently announced completion of a construction financing, letter of credit facility, and term tax equity financing commitment for the approximately 79.75 MW Stillwater Wind project in Stillwater County, Montana.

“This successful closing of construction financing for our first wind project in Montana demonstrates our ac-

cess to low-cost debt and continued attractive tax equity for our projects,” said Mike Garland, CEO of Pattern Development. “We are continuing to advance our extensive development portfolio, which totals more than 10 GW of wind, solar, and transmission projects. Our pipeline includes a second project in Montana, which we look forward to telling you more about in the near future.”




Stillwater Wind has entered into a 25-year power purchase agreement for 100 percent of the energy produced. The project will interconnect to the local transmission provider's 230-kV transmission line via a newly constructed 230-kV switching station. Stillwater Wind will use a total of 31 Siemens Gamesa wind turbines comprised of five 2.3 MW turbines with 108-meter rotors and 26 2.625 MW turbines with 120-meter rotors.

Construction of the project has begun, and it is expected to reach commercial operation in September. During each year of operations, the 79.75-MW facility will generate energy equal to the needs of more than 23,000 Montana homes.

During construction, the project will create about 80 jobs within the local and regional communities and will employ about six full-time personnel during operations. In addition, the two construction contractors responsible for construction of the Stillwater Wind project are both headquartered in Montana.

Over the first 25 years of the facility's operational life, it is expected to produce more than \$18 million in local county tax revenue. The local county also will receive fee payments from the project.

Affiliate company Pattern Energy Group Inc. has previously added Stillwater Wind to its list of identified Right of First Offer (iROFO) projects. 

*Source: Pattern Development*  
For more information,  
go to [www.patterndev.com](http://www.patterndev.com)



ALLETE Clean Energy has selected GE's advanced technology 2.X MW platform for the project. (Courtesy: GE Renewable Energy)

## ALLETE Clean Energy to build Montana wind facility

ALLETE Clean Energy recently announced it will construct, own, and operate an 80-MW wind-energy facility near Great Falls, Montana, that will supply electricity to NorthWestern Energy under a signed power sale agreement.

ALLETE Clean Energy acquired the South Peak project from Peak Clean Energy and will manage construction of the wind facility, scheduled to be online by late 2019. Energy from South Peak will be delivered to NorthWestern Energy customers through a 15-year power sale agreement.

"We're excited to be working with our newest customer in NorthWestern Energy and hope this project leads to more opportunities together in the future," said ALLETE Clean Energy President Al Rudeck. "This expansion of our portfolio across the high-quality northern wind corridor demonstrates the power of our growth strategy which leverages our capabilities to build lasting partnerships that advance, construct, and operate renewable facilities across North America. We are excited to establish a positive and lasting relationship with the state of Montana, the local community and landowners as part of the South Peak project."

The South Peak project will use GE wind turbines and will be built adjacent to NorthWestern Energy's existing Spion Kop wind facility. It will deliver energy via a direct connection to NorthWestern's transmission grid and has landowner agreements and design elements in place.

"We are delighted that ALLETE Clean Energy has selected GE's advanced technology 2.X MW platform for this project, along with a 15-year servicing agreement," said Pete McCabe, president and CEO of GE's Onshore Wind Business. "ALLETE shares our unwavering commitment to renewable energy, and this is another great example of how we can work together to deliver affordable, sustainable power to communities across the U.S."

To qualify for federal renewable energy production tax credits, the project will use a share of wind turbines ALLETE Clean Energy purchased in 2016 that meet the standards for the production tax credit “safe harbor” provision. The safe harbor turbine investment allows ALLETE Clean Energy to pursue its three-pronged production tax credit strategy that includes building and operating new wind farms based on long-term power sale agreements, building wind farms for other companies through a build-transfer structure, and refurbishing existing wind farms while extending power sale agreements.

“ALLETE recently raised its average annual earnings per share growth outlook, and a big reason for that is the solid performance of ALLETE Clean Energy,” said ALLETE Chairman, President, and CEO Alan Hodnik. “The investment in safe harbor turbines, along with ALLETE Clean Energy’s rising status and reputation as a solid wind-project developer and operator, have led to a steady stream of new partnerships and projects. With more untapped safe harbor capacity and the continued interest in renewable wind energy within the industry, ALLETE Clean Energy’s deal pipeline remains robust as it answers the call to transform the nation’s energy landscape.”

In addition to developing this new project with NorthWestern Energy, ALLETE Clean Energy in 2017 announced it will build, own, and operate a 106-MW wind-energy facility in Morton and Mercer counties in North Dakota that will supply electricity to Northern States Power and will develop the Thunder Spirit II wind-farm expansion near Hettinger, North Dakota, for Montana-Dakota Utilities, which recently exercised its option to purchase the expansion project. Construction on both projects are scheduled to begin in 2018.

ALLETE Clean Energy also operates a total of six wind-generation facilities in Minnesota, Iowa, Oregon, and Pennsylvania with existing power sale agreements. *▲*

*Source: ALLETE Clean Energy*

For more information,  
go to [www.allete.com](http://www.allete.com)

## Senvion Australia to start construction on 226-MW first-stage project



The first stage of the wind farm will have 61 of Senvion's 3.7M144 turbines. (Source: Senvion)

Senvion, a leading global manufacturer of wind turbines, has received Notice to Proceed for the first stage of the 429 MW Murra Warra wind farm near Horsham in Western Victoria. All conditions precedent have been fulfilled, and the contract is now firm and in force. This announcement follows the signing of a delivery partnership agreement for the project in June last year.

The first stage of the wind farm will have 61 of Senvion's 3.7M144 turbines with a total generating capacity of 226 MW. A consortium of large energy users led by Telstra has entered into long-term power purchase agreements, which will cover the energy generated from the first stage of the wind farm. Senvion will deliver the wind farm with Downer, one of Australia's leading civil and electrical contractors. Early works for the Murra Warra Wind Farm have already begun, and the project is expected to be fully operational

by mid-2019. The construction of Murra Warra Stage 1 will create about 150 jobs as well as significant opportunities for businesses in the local area.

“We are excited to be delivering our first project for RES and Macquarie Capital in Australia,” said Raymond Giffeder, CEO and managing director of Senvion Australia. “The Murra Warra wind farm will be our 11th wind farm in Victoria, cementing Senvion's position as a trusted turbine supplier and wind farm operator in the State.”

“The Murra Warra wind farm is a fantastic project with a high level of community support,” said Matt Rebbeck, chief executive officer of RES Australia. “Senvion is a great delivery partner for us, because they are very committed to working with local businesses and people and have an excellent history of effective community engagement in Victoria.”

Stage 2 of the project will comprise an additional 55 turbines. When fully con-

structed, the Murra Warra Wind Farm will be one of the highest performing wind farms in the southern hemisphere. Including the first stage of the Murra Warra wind farm, Senvion now has more than 900 MW of wind capacity installed or under construction across 14 wind farms in Australia. ↴

Source: Senvion

For more information, go to [www.senvion.com](http://www.senvion.com)

## Global Wind Service delivering crane, installation for Serbian wind farm

GE Renewable Energy contracted wind-turbine installation and service company Global Wind Service (GWS) to deliver crane and installation for the commissioning of the Čibuk 1 wind farm in Serbia. It will be the largest wind project in the Western Balkans.

Pre-assembly started at the site in November 2017, and installation is planned to finish in the third quarter of 2018.

The Čibuk 1 wind farm is the first project in Serbia where GWS has been awarded both installation and craning. Vetroelektrane Balkana (WEBG), the project company behind Čibuk 1, is wholly owned by Tesla Wind, a 60/40 joint venture between Masdar, Abu Dhabi Future Energy Company, and Čibuk Wind Holding.

“We are very pleased that GE Renewable Energy has given us this opportunity to take on more responsibility by awarding us with both installation and craning,” said Michael Høj Olsen, chief commercial officer at GWS. “Having the full scope within one contract will enable us to work more efficiently by means of improved planning and coordination between the two parties.”

Due to expected potential in the Serbian market, and more work secured, GWS has established a local business unit in Serbia — supporting GWS business in the country for not only this, but also other projects.

“GWS has a strong emphasis on continued growth, and as such, Serbia, which is a relatively new wind-energy market, is very interesting and promising for us” said Lars Petersen, CEO and co-founder of GWS.

Serbia is a member of the European Energy Community and in the process of joining the EU. The country has committed to increase its share of renewable energy in an action plan. In terms of the electricity sector, Serbia is aiming for 500MW of wind capacity by 2020 — wind thereby comprising 27.4 percent of the country’s total planned capacity of renewable energy for the electricity sector. ↴

Source: Global Wind Service

For more information, go to [globalwindservice.com](http://globalwindservice.com)

Giving Wind Direction

# WIND SYSTEMS

## SEEKING OPPORTUNITY?



Scan **Wind Systems** website to enjoy a host of features, including:

- Our new jobs listing, for employers and jobs seekers alike
- Events calendar to keep you informed
- A searchable articles archive, downloadable individually
- View the digital magazine, or download entire issues
- Vendor listings, along with our annual Buyer’s Guide
- Company profiles and Q&As
- Connect to the wind industry through social media
- Wind industry news from around the world

Visit [windsystemsmag.com](http://windsystemsmag.com) today and get connected!

# A Radical Change in Bolting is Coming Your Way

**Norbar Torque Tools Introduces  
a New Generation in AC Powered  
Torque Multipliers**



## **EvoTorque<sup>®</sup> 2**

**It's Time to Change the Way You  
Think About AC Powered Torque Multipliers**

- Operating ranges from 100 lb-ft to 4500 lb-ft
- Measures in Torque, Torque and Angle, and Torque Audit mode for pre-tightened bolts
- Versions for 110 VAC or 230 VAC
- Lightweight at only 23lbs.
- Factory calibrated and certified to  $\pm 3\%$  accuracy regardless of fluctuating voltages
- USB and Bluetooth<sup>®</sup> 4.0 data transfer (also called Bluetooth<sup>®</sup> Smart)
- 3,000 readings in internal memory, time and date stamped
- Includes PC software 'EvoLog' for data management and tool configuration
- From factory to field; for fabrication, installation, verification and maintenance



*Let's Talk Torque*

**Norbar Torque Tools, Inc.**

440.953.1175 PH

440.953.9336 FX

[inquiry@norbar.us](mailto:inquiry@norbar.us)

[norbar.com](http://norbar.com)





## Extracting wind power from high altitudes

*Airborne wind-energy turbines could be renewable energy's next quantum leap forward — transforming a hardware challenge into a software challenge.*

KITEnergy's kite-based AWE has the potential to reach the megawatt scale, according to company officials. (Courtesy: KITEnergy)

By Dr. Graham Dudgeon

As you drive down the highway these days, wind turbines off in the distance are a familiar sight, sprouting up from the landscape like so many oversized metal dandelions. Yet, how often do you see wind farms today with turbines that aren't turning?

The downtime every wind farm experiences represents time not spent generating electricity. (According to the U.S. Energy Information Administration, over the course of 2016, wind farms in the U.S. operated at just 34.7 percent of their capacity — a number that includes both downtime for maintenance and days with insufficient wind.) In fact, the wind's intermittency is probably the greatest downside to this otherwise free, clean, and abundant source of energy.

But it doesn't have to be this way, say a cadre of technologists, engineers, and startup companies. Geothermal energy is an "always-on" source of power. In 2016, geothermal energy sites in the U.S. operated at 74.2 percent of their capacity. What if wind could somehow be made to approach geothermal-scale capacity?

Next-generation wind-energy advocates point out that you only need to go one kilometer up into the sky to find winds that almost never stop blowing. According to a recent study, for instance, the entire world's energy budget is a drop in the bucket compared to the wind energy found at high altitudes. The world consumes some 18 TW of power at any moment (source: IEA), and according to this study, extracting 18 TW of power from high-altitude winds would not make a

noticeable difference to the world's winds or climate.

Moreover, unlike conventional wind farms, where a few windy regions on Earth are the prime locations, potential airborne wind energy (AWE) sites are prevalent across the world. High-altitude winds blow more steadily, more powerfully, and more reliably nearly anywhere on Earth one might care to look.

AWE turbines could, in fact, represent the quantum leap forward that wind energy needs. They could join the mainstream of future zero-carbon energy sources that are electric grid-scale levels of robust, reliable, and always (or nearly always) on.

## THE NEXT STEP

So how does the world get there from here? For starters, as most AWE companies and researchers have discovered, the most promising AWE systems are not actually turbines — they're kites, modified parachutes, drones, dirigibles, tethered aircraft, or some clever combination of these aerial systems.

Yet ditching the turbine complicates the problem considerably. In a single step, the engineering problem goes from the comparatively simple one of making a propeller fixed to a pole in the ground to creating an airborne system of custom-fit aerial technologies that now have the dual problem of hovering or circling with a strictly confined tether — buffeted by those never-ceasing winds — while somehow generating more electricity than it consumes in propelling and guiding itself and maintaining its own operations.

AWE, in other words, is a challenging engineering problem. But its appeal is apparent, too.

"It has the potential to be huge," said Antonello Cherubini, research fellow at the Scuola Superiore Sant'Anna in Pisa, Italy. Cherubini has conducted perhaps the most comprehensive overview of the entire AWE industry, publishing his group's findings in a 2015 issue of the journal *Renewable and Sustainable Energy Systems*. "High-altitude winds are extremely favorable. We are talking about orders of magnitude more than at ground level. Imagine what humanity could do with a wind turbine that could access winds



Ampyx Power has developed a drone-based AWE system. (Courtesy: Ampyx Power)

that are 50 times more powerful with respect to what they can reach today."

## APPROACHING THE PHYSICS

Megawatt-scale AWE plants are not difficult to envision, Cherubini said, considering there's nothing fundamental in the physics that couldn't be scaled up to a farm consisting of larger airborne wind "turbines."

For the Torino, Italy-based startup company KITEnergy, the AWE "turbine" is that wind-lofted flyer in their company's name. Kite-based AWE, said KITEnergy project manager Gian Mauro Maneia, has the potential to reach the megawatt scale.

The company's 60-KW prototype generates power on a give-and-take scheme in which the parasail-sized kite flies at an altitude of between 300 meters and 1 kilometer. Then, a winch connected to a generator at the ground station lets the tether out. The rotation in the winch as the kite pulls the tether out generates electricity. The kite "autopilot" software maneuvers and reels the kite back in to its original position, from where it will pull on the tether again to start the cycle anew.

The company is now working on a 250-KW model,

Continued on Page 56

# WIND SYSTEMS

*Giving Wind  
Direction*

**David C. Cooper**

**Publisher**

david@msimktg.com  
ext. 200

**Chad Morrison**

**Associate Publisher**

chad@msimktg.com  
ext. 202

## EDITORIAL DEPARTMENT

**Kenneth Carter**

**Editor**

editor@windsystemsmag.com  
ext. 204

**Jennifer Jacobson**

**Associate Editor**

editor@windsystemsmag.com  
ext. 205

## SALES DEPARTMENT

**David Gomez**

**Regional Sales Manager**

dave@windsystemsmag.com  
ext. 207

**Tom McNulty**

**Regional Sales Manager**

tom@windsystemsmag.com

## CIRCULATION DEPARTMENT

**Teresa Cooper**

**Manager**

info@windsystemsmag.com  
ext. 201

**Cole Morrison**

**Assistant**

ext. 209

**Jamie Willett**

**Assistant**

## DESIGN DEPARTMENT

**Rick Frennea**

**Creative Director**

design@windsystemsmag.com  
ext. 206

**Michele Hall**

**Graphic Designer**

michele@windsystemsmag.com  
ext. 210

Nopartofthispublicationmaybereproducedortransmittedinanyformorbyanymeans,electronicor mechanical,includingphotocopying,recording,oranyinformationstorage-and-retrievalsystemwithout permissioninwritingfromthepublisher.TheviewsexpressedbythosenotonthestaffofWindSystemsmagazine,orwhoarenotspecificallyemployedbyMediaSolutions,Inc.,arepurelytheirown.All"News"materialhas eitherbeensubmittedbythesubjectcompanyorpulleddirectlyfromtheircorporatewebsite,which isassumedtobedeclaredforrelease.Commentsandsubmissionsarewelcome,andcanbesubmittedto editor@windsystemsmag.com.



**Media solutions**

**Published by Media Solutions, Inc.**

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

**David C. Cooper**

**President**

david@msimktg.com  
ext. 200

**Chad Morrison**

**Vice President**

chad@msimktg.com  
ext. 202

**Teresa Cooper**

**Operations Director**

info@msimktg.com  
ext. 201

# AD INDEX

Abaris Training Resources.....	7
American Chemical Technologies .....	1
Amsoil.....	BC
AWEA (American Wind Energy Association).....	47
Bachmann Electronic Corporation.....	29
Carr Lane Roemhold.....	7
Castrol Industries.....	2
Elevator Industry Work Preservation Fund .....	IBC
Evonik Oil Additives USA Inc. ....	19
Fiberglass Recycling Alternative LLC.....	23
Fusion Inc .....	46
GD Energy Services .....	34
Iowa Lakes Community College .....	36
Mankiewicz Coatings c/o Stealth Mktg. ....	41
Mersen France Amiens S.A.S.....	35
Norbar Torque Tools Inc.....	52
NTC Wind Energy.....	23
Shell Oil Company .....	17
Snap-On tools .....	43
Sotek/Belrix Industries .....	42
Stahlwille Tools NA.....	20
TorkWorx .....	IFC
Verde Brand Communications.....	25
Wanzek Construction.....	15
Wind Systems .....	51
Worldwide Machinery Pipeline Division .....	37

Maneia said, which could represent one-quarter of a 1-megawatt, kite-based AWE wind farm.

He said a typical ground-based wind turbine sited at a windy location might operate 2,000 to 2,500 hours out of the 8,760 hours in a year. KITEnergy's prototype can be sited in many more locations than the selective windy-site-only geography that ground-based wind turbines require. And even still, he said they find they can generate electricity at least 3,000 to 3,500 hours per year operating at the KITEnergy system's nominal capacity.

Maneia said scaling up to the 250-KW prototype involves two big challenges that require substantial computer simulation: The kite's automatic flight control system and the generator's power system. KITEnergy power systems use two energy storage technologies. One stores energy in the electric field of parallel electric plates (a so-called "supercapacitor"), while the other stores energy via chemical reactions (a.k.a. a battery). The supercapacitor can charge and discharge rapidly, but it doesn't retain its power over the longer term as well as a battery does. So, striking the right balance between gulp-sized and sip-sized energy requires careful modeling.

### DRONE-BASED AWE SYSTEM

Of course, kites aren't the only way to generate AWE. A second popular modality is via drone. The Dutch company Ampyx Power has developed a drone-based AWE system that is similar in approach to KITEnergy — the reel-out and reel-in tethered and ground-based electricity generation approach.

But Ampyx's strategy is to target primarily sea-based wind farms. Traditional offshore wind farms put a lot of torque on the turbines' foundations. Ultimately, over the span of years, the torques so loosen the foundations that the sites must be abandoned.

Yet, Michiel Kruijff, head of product development at

Ampyx, said their AWE system applies just 20 percent to 30 percent of the torque on the foundation compared to a standard wind turbine today. So, an Ampyx drone AWE platform could be swapped in when an offshore turbine is swapped out.

"There are 600 poles waiting to be refurbished in the North Sea alone," Kruijff said. "Our projected launching customer has 100 such poles."

### SIMPLER INSTALLATION

In addition to siting on pre-built structures, Ampyx's AWE strategy offers other cost-cutting measures for

what they project will be power ratings comparable to those of a present-day offshore wind turbine. For starters, transporting and installing the system is simpler, because there are no oversized components like giant wind-turbine blades that require special transport and clearance.

Ampyx AWE platforms also require fewer expensive aviation-grade parts — again, including traditional turbine blades. Rather, as with many AWE technologies, ground-based wind

energy's hardware problem becomes, under the AWE paradigm, more of a software problem.

"The complexity of this is in systems and software," Kruijff said. "In the end, when everything's said and done, the system should be simple. But the software will be complex. That's the challenge we're working on now."

So perhaps in a decade or so, as you're driving down the highway, instead of huge metal dandelions, you might just see a cluster of kites or tethered drones performing loops and figure eights high in the sky — all the while generating energy. And if innovators such as Cherubini and Kruijff are right, you might also wonder why people once spent so much time and effort trying to wring wind energy from intermittent gusts and gales down here, near the ground. *✍*



The drone-based and kite-based AWE systems work on a reel-out and reel-in tethered and ground-based electricity generation approach. (Courtesy: Ampyx Power)



**Dr. Graham Dudgeon** is principal industry manager for energy at MathWorks, starting his career at the company in 2004 as a senior technical consultant. Prior to this, he held senior research fellow positions at the University of Strathclyde in the Centre for Economic Renewable Power Delivery (CERPD) and the Rolls-Royce University Technology Centre in Electrical Power Systems. Graham has a masters MEng degree in Avionics and a PhD in Multivariable Control Systems, both from the University of Glasgow. Graham can be reached at [Graham.Dudgeon@mathworks.com](mailto:Graham.Dudgeon@mathworks.com).



# Don't Be Let Down By An Elevator

*Installation and  
preventative maintenance  
by IUEC elevator mechanics  
will keep your elevators  
moving SAFELY  
and more efficiently!*

27,000 Trained Craftspersons  
using more than 119  
Training Centers!

Contact Carisa Barrett at [cbarrett@eiwpcf.org](mailto:cbarrett@eiwpcf.org) or (253) 561-4902

We represent more than 450 elevator companies  
ready to serve your Elevator Lift needs





# PTN 320

# #1

**IN WIND GEARBOX OIL  
RELIABILITY & PERFORMANCE**



***Devoted to Protection®***

FOLLOW THE LEADER AT  
[AMSOILWIND.COM](http://AMSOILWIND.COM)

OR BY CONTACTING US AT  
[WINDSALESGROUP@AMSOIL.COM](mailto:WINDSALESGROUP@AMSOIL.COM)

**Stick with a proven product and  
take out the guessing game.**

Used by more OEM's and Owner/Operators  
in North America, and around the world.

With over 9 years of proven results and an  
industry-leading warranty, make AMSOIL  
the first and last choice when it comes to  
your lubrication solutions.

## NO ADDITIONAL TOP TREATS NEEDED