

*Giving Wind Direction*

# WIND SYSTEMS

**inFOCUS:**

## **OFFSHORE & CANADIAN WIND ENERGY**

» **Conversation:  
BOEM's Jim Bennett  
and Joan Barminski**

SEPTEMBER 2017



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## Wind Powering Canada to a Low-Carbon Future

*Within the past 11 years, Canada has built more wind-energy capacity than any other form of energy generation.*

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# 2017 SUMMER & FALL EVENTS

## **REGIONAL WIND ENERGY CONFERENCE - NORTHWEST**

July 25 - 26 | Renton, Washington, USA

## **WIND RESOURCE & PROJECT ENERGY ASSESSMENT CONFERENCE**

September 27 - 29 | Snowbird, Utah, USA

## **OFFSHORE WINDPOWER CONFERENCE & EXHIBITION**

October 24 - 25 | New York, New York, USA

## **WIND ENERGY FINANCE & INVESTMENT CONFERENCE**

October 25 - 26 | New York, New York, USA

## **WIND ENERGY FALL SYMPOSIUM CONFERENCE**

November 7 - 9 | Albuquerque, New Mexico, USA

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# EDITOR'S DESK

SEPTEMBER 2017

## Offshore and Canadian wind take center stage

There are quite a few wind events happening in the coming weeks, and *Wind Systems* is here to preview some of those exciting industry happenings.

Offshore wind may be a part of European daily life, but in the U.S., it's just starting to take off.

That's sure to be a big part of the discussions during AWEA's Offshore WINDPOWER 2017 Conference in New York City October 24-25.

To help prime that conversation, this issue of *Wind Systems* has a special double-feature Conversation.

In it, we go coast-to-coast as we talk with two officials from the Bureau of Ocean Energy Management.

Jim Bennett, chief of BOEM's Office of Renewable Energy Programs, talks in depth about the state of wind power in the Atlantic, while Joan Barminski, BOEM's regional director of the Pacific Region, discusses how wind energy will be developed off the West Coast.

The September issue also boasts some interesting articles that focus on offshore development both in the U.S. and throughout the world, and what tools and parts will be needed to aid in offshore wind's smooth operation going forward.

Another annual event *Wind Systems* is spotlighting this month is the CanWEA Annual Conference and Exhibition October 3-5 in Montreal.

Canadian wind energy has had some kind of conference before CanWEA even existed. But since the organization's formation in 1981, the annual conference has only continued to evolve and grow.

In Crosswinds, CanWEA President Robert Hornung talks about the show's humble beginnings and what attendees can expect from this year's conference. And as part of our inFocus section, Hornung discusses the flourishing state of wind in our neighbor to the north, as well.

There's a lot happening in the industry in the coming weeks that will only serve to highlight what's in the industry's future in the coming years.

It's an information-packed issue. I hope you enjoy reading it as much as I enjoyed putting it together.

Thanks for reading!



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## U.S. wind power continues to grow

Courtesy of AWEA

- U.S. workers build an average of 10 new wind turbines every day.
- A typical 2-MW turbine in the U.S. powers more than 500 homes, nearly twice as many as turbines in China or Germany.
- U.S. wind jobs have grown by more than 30 percent since 2015.
- There is 41 percent more wind under construction or in advanced development than at this time last year.
- Earlier this year, Kansas became the fifth state to surpass 5,000 MW of installed capacity, joining Texas, Iowa, Oklahoma, and California.

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)



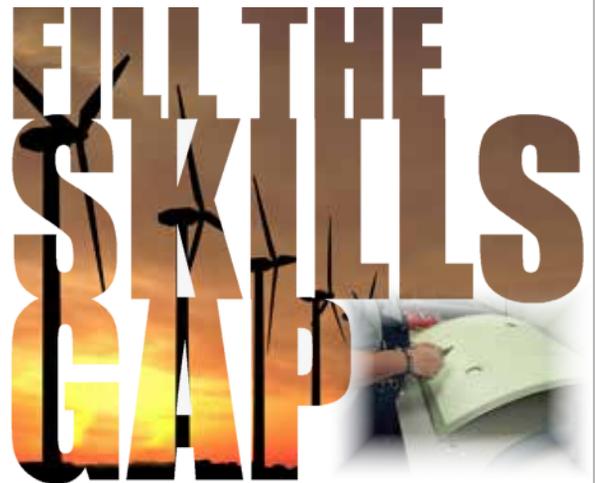
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# DIRECTION

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

## Acciona acquires additional stake in Ontario wind farm



The Ripley Wind farm. (Courtesy: Acciona Energy)

Acciona Energy, a leading global operator of renewable energy projects, announced that Acciona Energy International (AEI), through its Canadian subsidiary, has acquired 50 percent of the 76 MW Ripley Wind Farm from Suncor Energy Inc. Suncor and Acciona built the Ripley Wind Farm as a joint venture in 2007. With the acquisition, AEI becomes the wind farm's sole owner and operator.

The Ripley Wind Farm is near the eastern shore of Lake Huron and generates enough electricity to power 24,000 homes. The facility has a 20-year power purchase agreement in place with the Independent Electricity System Operator.

Acciona operates wind energy projects across Canada, from the Lameque Wind Farm in New Brunswick to the Chin Chute and Magrath wind farms in Alberta. These wind farms represent a total of 181 MW of capacity, 141 MW of which will be owned by Acciona after the Ripley acquisition. The company also supplied construction and operations services for the 102 MW South Canoe wind farm, the largest wind project in Nova Scotia. ↵

Source: Acciona Energy

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

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## Maritime wind energy set to meet Massachusetts' renewable energy needs

The Canadian Wind Energy Association (CanWEA) commended Emera Inc. and several wind and hydro partners for their submission of a proposal in response to a call for tenders issued by Massachusetts utilities in an effort to supply the state with an additional 9.45 TWh of clean energy by 2022. The proposal includes plans to build seven new wind-energy production facilities, five in New Brunswick and two in Nova Scotia, for a total generating capacity of almost 1,200 MW.

The submission of these projects serves to further demonstrate the maturity and affordability of Canadian wind energy — which is well positioned to play a major role in the state's energy transition. Wind energy allows hydroelectricity producers to improve their offering in Massachusetts by granting them access to Class I Renewable Energy Credits. Given the Maritimes' excellent wind resource and the willingness of dozens of its communities to host wind farms, Maritime wind energy can be a cost-effective contributor to any proposal.

"Developing these projects required major investments from participating firms, which goes to show how seriously the process is being taken," said CanWEA Vice President Jean-François Nolet. "If these projects are contracted, New Brunswick, Nova Scotia, and host communities



Wind energy allows hydroelectricity producers to improve their offering in Massachusetts by granting them access to Class I Renewable Energy Credits. (Courtesy: CanWEA)

would see major benefits."

CanWEA extends congratulations to participating wind-energy developers — wishing them all the best in the next phase of the process — and acknowledges the close cooperation of Emera and other partners. Emera's submission is in addition to Hydro-Québec's submission that has multiple scenarios with options for wind energy. Together, these bids demonstrate

that Canadian wind energy can be part of the solution in Massachusetts' effort to reduce greenhouse gas emissions from its electricity consumption.

The proposals will now undergo evaluation, which will continue until January 2018. ↴

Source: CanWEA

For more information, go to [www.canwea.ca](http://www.canwea.ca)

## North Carolina wind moratorium signed into law

North Carolina Gov. Roy Cooper recently signed HB 589, a consensus stakeholder bill for the solar industry that also included an 18-month moratorium on the North Carolina Department of Environmental Quality issuing any permits for a wind-energy facility, a last minute addition from Senate Majority Leader Harry Brown (R-Onslow). In addition to the

moratorium, HB 589 also directs an outside consultant to study any impacts wind energy may have on the military and create maps showing those impacts.

"The passage of HB 589 with an 18-month wind moratorium is incredibly disappointing for the state of North Carolina," said Katharine Kollins, president of the Southeastern Wind Coalition. "This moratorium

jeopardizes hundreds of millions of dollars in private investments in some of the most rural communities in the state, which rarely have access to these kinds of projects. The fact that Sen. Brown needed to hijack an unrelated piece of solar legislation that enjoyed broad support from industry and utilities to continue his misguided attack on wind energy shows just how unpopular this policy is. Without further action from the state of North Carolina to support wind energy, this moratorium sends a strong signal to the wind industry that these projects are not welcome in the state.

“As we move forward, we will continue to educate the citizens and elected officials in North Carolina on the effectiveness of the current Department of Defense permitting process, which ensures no wind project that interferes with military operations will ever be constructed. We will also look for North Carolina to take decisive action to demonstrate to the industry that, despite this moratorium, North Carolina is open for business.”

North Carolina currently has one operating wind farm, the 208 MW Amazon Wind Farm U.S. East project in Perquimans and Pasquotank counties that was developed by Avangrid Renewables. This project would be unaffected by the moratorium. However, proposed projects by Apex Clean Energy, a 300 MW project in Chowan and Perquimans Counties, and RES America, a 130 MW project in Tyrrell County, would be prohibited from obtaining permits under the moratorium. ↴

Source: Southeastern Wind Coalition

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



The DTU Risø Campus is on the Risø peninsula about 40 kilometers west of Copenhagen, Denmark. (Courtesy: Moog)

## Moog picked for testing wind-turbine blades

The Industrial Group of Moog Inc., a motion-control product, solution, and services provider, has signed a contract with the Technical University of Denmark (DTU) to make Moog the prime supplier of

test equipment and services for the university’s large-scale test facility.

The test facility at DTU’s Risø Campus will conduct static and dynamic tests of wind-turbine blades. The facility will have



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three test stands capable of delivering static deflection testing and dynamic (directly coupled and mass resonant excitation) testing of wind-turbine blades measuring 45 meters, 25 meters, and 15 meters long, and the flexibility to test other large structures.

The Moog system is an integral part of DTU's plan to establish a unique research facility that meets the highest international standards and will enable DTU to develop and provide advanced testing methods and research about the

strength and fatigue of large structures when exposed to complex loading.

Moog will supply a test system including hydraulic actuation (i.e., winches, linear actuators, and mass resonant excitation units), closed-loop servo control, hydraulic power and distribution pipe work system, project management, design and modeling, installation, and commissioning services backed with long-term service and support.

"We chose Moog as our equipment provider because its engineer-

ing and sales teams were very diligent throughout the tender process to deliver the best technical solution within budget," said Dr. Kim Branner, senior research scientist and head of the structural design and testing team for DTU Wind Energy.

Moog expects the system to be operating in the fourth quarter of 2017. ↵

*Source: Moog*

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

## Siemens Gamesa speeds up its integration process

At the end of July, Siemens Gamesa Renewable Energy released its third-quarter of fiscal year 2017 results<sup>1</sup> (from April to June 2017).

During this period, the company has accelerated its integration program. The announced synergies of 230 million euros are now the 'minimum,' and the company expects to realize these synergies in year three, one year earlier than previously announced.

"We are highly satisfied with the progress to date in integrating the two companies," said Markus Tacke, CEO of Siemens Gamesa. "Things are progressing at a rapid rate; our company is ready to compete and lead in a growing and challenging market."

Regarding the financial performance, in the third quarter of fiscal year 2017, Siemens Gamesa Renewable Energy's revenues amounted to 2.693 million euros, down 7 percent year-on-year, while underlying EBIT<sup>3</sup> came to 211 million euros (-21 percent) with the margin at 7.8 percent. These results were affected by specific onshore market conditions, including the temporary suspension of the Indian market. Stripping the impact of India, revenues were up 1.6 percent with a strong 8.6 percent growth in underlying EBIT margin.

Siemens Gamesa key figures April-June 2017<sup>2</sup> (vs. Apr.-Jun. 2016):

### FIGURES IN EUROS

- Revenues: 2.693 million (-7%)
- Sales: 1.950 MW (-25%)
- Underlying EBIT<sup>3</sup>: 211 million (-21%)
- Underlying EBIT margin: 7.8% (-1.3%)
- Underlying net profit: 135 million
- Net cash: 236 million

### COMMERCIAL ACTIVITY AND PROFITABILITY

In the third quarter, revenue from the sale of wind turbines decreased by 9 percent to 2.393 million euros, reflecting lower sales volumes of 1.950 MW (-25 percent), as a result of temporary market conditions in the onshore business, as well as normal business volatility in the offshore market. In India, the market shut down pending a revamp of the auction system, which is expecting to normalize by the first quarter of fiscal year 2018.

Overall, the company expects an improvement in the renewable energy sector. Demand prospects remain positive; emerging markets continue to play a particularly important role, and the renewal of auctions is reactivating mature markets — for example, Southern Europe — and activating new markets such as Argentina and Russia. Excluding China, the global market demand for installations is expected to increase by 8 percent from 36 GW in 2017 to 45 GW in 2020.

Siemens Gamesa continues to lead the offshore segment having installed 10 GW, nearly 70 percent of the global offshore fleet and anticipates strong growth of more than 24 percent annually in offshore installations until 2020. The medium term prospects remain positive with an agreement reached this quarter with Dong for the construction of the Borssele 1 and 2 wind farms, involving 94 turbines (756 MW) to be commissioned by the end of 2020.

The O&M service revenue expanded by 8 percent to 300 million euros with an underlying margin of 16.7 percent. The fleet under maintenance continued to grow, reaching 54 GW worldwide (+13 percent).

In this specific market context, Siemens Gamesa obtained 135 million euros of underlying net profit between April and June, equivalent to 0.2 euros per share. Underlying EBIT<sup>3</sup> declined 21 percent to 211 million euros while the underlying EBIT margin was constant at 7.8 percent. These figures were also affected by the disruption in business activity in India, which is expected to normalize by the first quarter of fiscal year 2018.

The company continues to strengthen its balance sheet and ended the quarter with a net cash position of 236 million euros.

### NEW ONSHORE CEO

Ricardo Chocarro was named CEO of the company's onshore business. For the past 18 years, Chocarro has held responsibilities at former Gamesa and since 2013 has served as CEO of the Europe, Middle East, and Africa (EMEA) business.

"I am honored to be appointed for this responsibility," Chocarro said. "We already play an important role in the global onshore renewable energy marketplace. I am convinced that we are prepared to lead the sector and take advantage of future growth."

Chocarro has replaced Xabier Etxeberria, who leaves the company after five years of success and a major contribution to its development. Etxeberria has decided to pursue a new professional challenge.

"It has been a tremendous honor working for this great company during the last five years," Etxeberria said.

### MOVING FORWARD

The integration process is confirming the company's huge potential thanks to its bigger scale and global reach: a presence in more than 90 countries, an installed base of 75 GW, and a strong order

book of 21 billion euros. Siemens Gamesa CEO Markus Tacke said the company has "a very strong global presence, underpinned by solid relationships with customers around the world, a global supply chain, and a broad manufacturing footprint. We have some of the most reliable and efficient products in the industry."

All integration efforts are on track. The company is reorganizing departments; taking first steps about product portfolio, supply chain, and manufacturing footprint. In this sense, Siemens Gamesa agreed to integrate Adwen within the group's broader offshore operations, which will allow it to better serve its customers and maximize business opportunities.

The company will announce its new strategic plan on November 15 at a Capital Markets Day. At that time, Siemens Gamesa will provide the product portfolio, the financial targets for fiscal years 2018-2020, as well as a global sales plan and a model for the future supply chain footprint.

### REFERENCES

1. Siemens Gamesa's financial year runs to the end of September.
2. Financial data are non-audited pro-forma, based on legacy business reported information including standalone, normalization and scope adjustments for Siemens Wind Power operations, amounting to 29 million euros. Adwen is fully consolidated.
3. Data exclude integration costs for 36 million euros and PPA for 124 million euros at EBIT level and 87 million euros at net income level (net of taxes) ↘

Source: Siemens Gamesa

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## CANADA

## Wind Powering Canada to a Low-Carbon Future

*Within the past 11 years, Canada has built more wind-energy capacity than any other form of energy generation.*

By Robert Hornung

Globally, wind energy is one of the fastest growing major sources of new electricity around the world, with installations of more than 55,000 MW of clean, reliable wind power in 2016 alone. More than 80 countries have now installed wind-energy facilities. The U.S. is the second largest market with more than 82,000 MW, capable of supplying up to 25 million homes. Canada is in eighth place with just more than 12,000 MW, meeting about 6 percent of Canada's electricity needs.

Wind energy has made tremendous progress in Canada, and the future promises continued strong growth. In the past decade, wind has become not just a mainstream energy choice; it is now *the* mainstream energy choice. Canadians have built more wind-energy capacity over the past 11 years in the country than any other form of electricity generation.

### COSTS HAVE FALLEN

There are good reasons for this. Costs for wind energy in Canada have fallen dramatically over the past decade, making it one of the country's two most cost-competitive sources of new electricity supply. It is clearly the least costly form of emissions-free electricity generation available today.

Unlike its main competition, natural gas, wind energy is not affected by the carbon pricing that is being put in place

across Canada. Nor is it subject to potential future commodity price fluctuations. It is also widely recognized that the ongoing evolution of technology will lead to further declines in the cost of wind energy. Taken together, this means wind should only become more affordable over time. Plus, system planners know it can be deployed quickly at whatever scale is required to match customer demand growth.

Canadian politicians, electricity sector leaders, and knowledgeable consumers are increasingly aware that no other electricity technology can offer the same combination of affordability, reliability, scalability, and sustainability that wind energy can.

Wind energy's rapid expansion is driven by wind's two most important attributes: It is low-cost and emissions-free.

### GLOBAL COMPETITION

As the Global Wind Energy Council's 2016 Outlook states, wind power is the most competitive option for new power supply in a growing number of global markets with rapidly dropping prices. Some projects are delivering electricity for as low as 4 cents (U.S.)/kWh. The U.S. financial advisory firm, Lazard, has found the levelized cost of wind energy has fallen 66 percent since 2009. Costs are expected to decrease further by up to 26 percent by 2025, according

to the International Renewable Energy Agency.

Wind power is also one of Canada's best hopes for addressing climate change. Study after study has shown the only way Canada will be able to reduce greenhouse gas emissions in a significant way (80 percent or more by 2050) is by moving away from the use of carbon fuels in transportation, heating and cooling buildings, and in industrial processes, and replacing them with clean





Wind energy has made tremendous progress in Canada, and the future promises continued strong growth. (Courtesy: Siemens)

electricity. Wind energy's low costs and lack of emissions have become its competitive advantage.

This means wind energy will play a critical role in helping Canada meet its commitments on climate change. The initial goal is to reduce greenhouse gas emissions by 30 percent as of 2030 compared to 2005 levels.

#### **IN THE U.S.**

While the U.S. has announced its plans to withdraw from the Paris Climate Agreement, many states and cities have made strong commitments to green energy and to reducing greenhouse gas emissions. Some states such as Iowa and South Dakota already get more than 30 percent of their electricity from wind.

#### **ALSO IN THIS SECTION**

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Other states are turning to green-energy sources, including renewable energy from Canada. For example, the state of New York plans to get 50 percent of its power from renewable energy sources by 2030, and Massachusetts plans to acquire almost 10 TW/h of additional renewable energy. A recent request for proposals in Massachusetts saw both Quebec and Atlantic Canada submit bids for consideration that included significant quantities of new Canadian wind energy.

Canada now generates 83 percent of its power using non-emitting sources, and the federal government has set a target to up that contribution to 90 percent by 2030. As part of Canada's emission-reduction commitments, it has targeted the complete phase out of coal-fired generation by 2030. Canada's largest province, Ontario, already has closed several stations and is now coal-free. Other provinces will follow suit and replace much of their coal generation with wind. Two western provinces, Alberta and Saskatchewan — both now reliant on coal — are planning to install close to 7,000 MW of renewable energy capacity, most of it wind energy, as part of its plans to green the grid.

Despite wind energy's rapid growth, Canada has still only scratched the surface of wind energy's potential contribution to electricity production. In July 2016, the Canadian Wind Energy Association released the results of a ground-breaking study that found Canada can reliably and cost-effectively get more than a third of its electricity from wind energy. The Pan-Canadian Wind Integration Study found there are no operational barriers to reaching a 35-percent wind contribution to Canada's electricity supply. New transmission interconnections to facilitate the integration of wind energy and its movement to various markets would essentially be paid for within four years through fuel savings as more expensive coal and gas-fired generation



Canada now generates 83 percent of its power using non-emitting sources, and the federal government has set a target to up that contribution to 90 percent by 2030. (Courtesy: Enbridge)

is displaced in both the U.S. and Canada. Air pollution and climate change emissions would decline by millions of tons, while Canada could increase its clean-energy exports by billions of dollars.

## OPTIMISTIC FUTURE

Achieving such penetration levels requires a smart approach to limiting emissions from natural gas-fired generation, recognizing that natural gas provides a helpful bridge to a greener economy, but it should not act as a barrier to renewable-energy development. Strategic transmission investments need to be made to ensure Canada can move wind energy from wind-rich areas to those in need of clean power. The evolution of electricity market design and the rules that recognize and reward the value wind energy brings to the power grids also needs to continue.

The wind-energy industry faces the future with optimism. It is becoming clearer by the day that the world's energy supply and its economies are evolving, moving toward a greener future. Britain and France recently announced they will ban the sale of new gasoline and diesel cars by 2040. Volvo is moving toward an all-electric or hybrid fleet by 2019. Tesla has received deposits from 500,000 customers for its new electric car, the Model 3. New supplies of emission-free electricity will be needed to power this clean transportation of the future.

Commercial and industrial companies such as Google are contracting for wind energy to power their operations. In the U.S., one third of all new wind-power purchase contracts are being signed by these customers. In Alberta, IKEA owns two wind



Wind power is also one of Canada's best hopes for addressing climate change. (Courtesy: Siemens)



Despite wind energy's rapid growth, Canada has still only scratched the surface of wind energy's potential contribution to electricity production. (Courtesy: Glen Dhu facility, Nova Scotia)

farms, part of its commitment to produce more renewable energy than it uses by 2020.

It's not always apparent that the nations of the world share similar objec-

tives. With the healthy expansion of wind energy around the globe, it's clear Canada, the U.S., and a growing number of countries are moving together in one way, toward a cleaner future. ✎



**Robert Hornung** has been president of the Canadian Wind Energy Association (CanWEA) since August 2003. He represents the interests of CanWEA members who are Canada's wind-energy leaders — wind-farm owners, operators, project developers, consultants, manufacturers and service providers, and organizations and individuals interested in supporting Canada's wind-energy industry. Hornung is also a board member of the Global Wind Energy Council and was named a fellow of the Royal Canadian Geographical Society in 2009.

# OFFSHORE

## From Megawatts to Gigawatts

*Offshore wind market to make prominent ground in the global energy mix; Europe to continue its dominance in the regional landscape.*

By Shikha Sinha

Corresponding to the demands for decarbonization and diversification of energy portfolios, the offshore wind market has witnessed a commendable proliferation on a global scale. Offshore wind has traversed indeed a remarkable jaunt pertaining to its deployment, from a few megawatts of installed capacity since the first commercial scale wind farm commissioned in 2002 to a projected market volume of 60 GW by 2024. Estimates claim the global offshore wind industry size to have been recorded at more than 12 GW at the end of 2015, out of which Europe procured a major chunk of the market share.

2016 also marked another promising year for the global offshore wind market, though the total installations were approximately 31 percent down from the previous year. In 2016, a total of 2,219 MW of new offshore wind power was installed across the seven markets globally. The overall offshore wind market size in 2016 in terms of installation capacity was recorded at 14,384 MW, with an expanse of 14 markets on a global scale.

As of 2016, nearly 88 percent of the global offshore wind-power installations were in 10 European countries, and the remaining 12 percent was shared by China, Japan, South Korea, and the U.S. respectively.

Ireland, Spain, Finland, Japan, South Korea, Norway, and the U.S. are some of the other markets sharing the regional landscape of the offshore wind industry, though the current adoption trends in these economies are quite nascent.

Contemplating the trends of offshore wind market, it is undeniable that Europe will continue its dominance over the foreseeable future as well. However, with the developments in the other corners of the world, it is perceptible that the global growth of the offshore wind market has begun to take off at an appreciable pace.

### EUROPE: THE PIONEER OF OFFSHORE WIND

Europe holds the majority of offshore wind capacity and is poised to lead the regional landscape of this industry over the coming years. A plethora of factors have supported the growth trajectory of this continent. The financial backing by both the government and the private entities is one of the major factors providing a push to Europe offshore wind market. As per the statistics, over the period of 2001 to 2015, the overall RD&D expenditure in offshore wind from the public sector was approximately \$1 billion to \$2 billion. During the same tenure,



the financial backing from the private sector was almost two to three times this valuation.

The large-scale publicly funded initiatives include the European Wind Initiative, the European Commission's Framework Programmes, Horizon 2020, and NER300. Other bodies supporting Europe offshore wind market growth include Spain's National Renewable Energy, Offshore Renewable Energy (ORE) Catapult, and Lindoe Offshore Renewables Center (LORC).



The cost declines commenced in 2015 with a recorded low cost of 103 euros/MWh at Danish wind farm Horns Rev 3. The trend was taken forward by the following year, 2016, when Dong Energy won a Dutch tender in June for the 760 MW Borssele 1 and 2 at 72 euros/MWh. In the same year, during September, a Danish nearshore tender was recorded at a still lower value of 64 euros/MWh. Again, the end of 2016 marked the revolutionary era for offshore wind market when Danish Kreiger's Flak project and Borssele 3 and 4 in the Netherlands were valued at 49.90 euros/MWh and 54.50 euros/MWh during November and December.

For Europe, 2016 represented an era where offshore wind power at some instances gave a cut-throat competition to onshore, in terms of cost parameters.

The cost declines commenced in 2015 with a recorded low cost of 103 euros/MWh at Danish wind farm Horns Rev 3. (Courtesy: Dong Energy)

### **THE COMPETITIVE HIERARCHY**

In 2016, Siemens Wind Power was the chief offshore wind-turbine supplier in Europe accounting for 67.8 percent of the overall installed capacity. The second position was grabbed by MHI Vestas Offshore wind with a share of 16.4 percent. Senvion, Adwen, and BARD mark the balance of the regional landscape with a share of 6.2 percent, 5.2 percent, and 3.2 percent respectively.

In terms of new additional capacity, the top five participants securing the ownership include Northland

Power — 23 percent, Dong Energy — 20.4 percent, Global Infrastructure Partners — 10.5 percent, Siemens — 7.7 percent, and Vattenfall — 7.6 percent.

With a capacity so far of more than 5 GW and 27 wind-farm installations, the U.K. is estimated to be the global leader in the offshore wind market, adding a renowned value to the overall European renewable energy landscape. A strong commitment toward decarbonization and a favorable regulatory landscape will further push the U.K. offshore wind market to evolve with the trends of clean and green energy.

With Europe deriving a major quotient of its power needs from wind energy and the continent treading with a slogan of “go-green,” it is rather undeniable that Europe will continue to maintain its dominance in the global landscape over the years ahead.

### ASIA AND U.S.: THE EMERGING CONTENDERS

Over the period of 2001 to 2015, the Asia public sector made an investment of close to \$1 billion in offshore wind RD&D. The private sector in the same tenure made investments of approximately \$1.5 billion.

China is expected to lead Asia offshore wind market over the coming years.

Despite having a recorded installation capacity of less than 2 GW at the end of 2015, the growth prospects for China look promising over the coming years. With a new target under the 13th Five-Year Plan to achieve an installation capacity of 10 GW by 2020, the country is poised to attain remarkable growth pertaining to offshore wind installations in the years ahead. With ongoing developments toward increasing the reliability of the offshore wind turbines, reduction in energy cost, collaboration between government entities, and favorable norms pertaining to wind-power policy systems, the Chi-



In 2016, Senvion supplied 6.2 percent of Europe’s wind turbines. (Courtesy: Senvion)

### Global offshore wind market statistics — 2015

**Europe:**

11.2-GW capacity accounting for 1.6 percent of power generation. Total number of offshore wind farms: 54, 25 in the U.K., followed by Germany, Denmark, Belgium, Netherlands, and Sweden respectively.

**Asia:**

1.2-GW capacity, accounting for 0.1 percent of power generation. Total number of offshore wind farms: 5, all in China.

**North America:**

2015 marked the first offshore wind project construction on the continent.

na offshore wind market is expected to reach 12 GW by 2024.

Companies such as China Renewable Energy Engineering Institute, China Longyuan, and Goldwind are actively partaking in the regional offshore wind-industry growth.

Taiwan forayed into the offshore wind market with its recent announcement of installing 3 GW of offshore wind power by 2025. At present, the country has only two offshore turbines. However, the growth prospects in Taiwan are strongly driven by the fact that the region is an open market with lesser competition.

Speaking of Japan and South Korea, the regions have not shown much

development with regards to offshore wind power over the past years. In the case of Japan, however, the country targets to build 1.3 GW capacity in the next 10 years with 2.5 GW under the planning category.

South Korea, addressing the country’s focus toward renewables, is estimated to build 1 GW of offshore wind capacity from 2017 to 2026.

### U.S. DEVELOPMENTS, TRENDS, AND PROSPECTS

2016 witnessed much awaited development in the U.S. renewables sector with the launch of the first U.S. offshore wind farm with a capacity of 30 MW. The five-turbine Block

Island project was launched in December 2016 off the coast of Rhode Island. Following this launch, several other projects are in the pipeline in both state and federal waters off the Atlantic and Pacific coasts and Great Lakes. A total of 13 offshore wind projects are under multiple stages of development, as per reliable sources. The U.S. Department of Energy anticipates offshore wind to address 2 percent of the U.S. electricity demand in 2030 and 7 percent in 2050.

In March 2017, the U.S. Bureau of Ocean Energy Management and Staitoil executed the lease of 321 square kilometers offshore New York. This opened up lucrative opportunities for the Norwegian giant to explore and exploit the potential of offshore wind market. Again, in May 2017, the Commonwealth's Department of Energy Resources issued an appeal for proposals to develop 800 MW of offshore wind.

With this active participation of both the federal and state governments and the growing interests of the investors in this region, the U.S. offshore wind market is slated to witness a lucrative roadmap ahead. According to Global Market Insights, Inc., U.S. offshore wind industry held a valuation of \$100 million in 2016.

To completely exploit the enormous range of opportunities ahead, the offshore wind industry must meet the growth parameters encompassing its evolution terrain. For instance, energy costs or LCOE for offshore wind should be regularly cut down to compete against the other forms of energy. Also, unlike every other



The five-turbine Block Island project was launched in December 2016 off the coast of Rhode Island. (Courtesy: Deepwater Wind)

Countries	Installed Capacity (%)
U.K.	36
Germany	29
China	11
Denmark	8.8
Netherlands	7.8
Belgium	5
Sweden	1.4

A synopsis of the regional landscape of the offshore wind market in terms of installed capacity (2016).

industry, offshore wind market development is proportional to its expansion, penetration, and integration with other markets. For instance, the industry was earlier focused only on shallow waters, close to the shore. However, if the present scenario is considered, new innovations and technologies for different water levels and varied wind regimes are becoming

an investment destination at an appreciable pace.

However, the current trends and insights of the offshore wind market assure a long-term growth horizon for its development. What remains to be seen is the turmoil the burgeoning offshore wind industry brings in the regional and competitive landscape over the years ahead. ↵



**Shikha Sinha** is an electrical and electronics engineer, who, with her experience in content and technology writing, develops content for Global Market Insights. Her experience also includes content marketing, market research, and business development domains. Her other interests include sketching, reading, and singing.

# Critical Components Essential as Wind Power Scales Up

*Offshore wind has unique considerations that require technological expertise and a close, collaborative partnership.*



Testing capabilities within Timken's Wind Energy Research and Development Center have the flexibility to focus on wind-turbine applications. (Courtesy: The Timken Company)

*By Doug Lucas*

**T**he wind industry continues to post impressive numbers. The American Wind Energy Association recently reported a strong outlook for 2017, with second quarter figures indicating a 40 percent uptick in wind development activity over the same time last year.

Part of that boost in activity includes momentum in U.S. offshore wind-power development, something that may have seemed unlikely just a few years ago. After the successful completion of America's first offshore wind farm — Rhode Island's Block Island project — the

opportunity for more U.S. offshore projects is at hand. The Maryland Public Service Commission recently approved two major offshore projects that will generate 368 MW cumulatively, and other major projects could soon be on the horizon.

Why offshore, and why now? Europe has more than 12,000-MW capacity in offshore wind infrastructure, but that has largely been driven by necessity, with far less available land for turbines to scale up the continent's wind-power capacity. In the United States, where land is plentiful for the proliferation

of wind farms, a similar case for offshore wind didn't exist.

But that may be changing. Offshore projects bring with them more powerful and consistent wind loads, with far fewer turbine size restrictions, and that means far greater generative capacity. Consider that roughly 50 percent of the U.S. population lives in coastal areas, including both counties directly on the coast and those that drain into coastal watersheds. According to the Bureau of Ocean Energy Management, energy costs are higher in these areas, and land-based renewable resources can

be limited. But offshore wind resources have the potential to deliver enormous quantities of renewable energy to the country's largest and most populous major metropolitan areas.

Consider also that while the typical onshore wind turbine ranges from 2-3 MW, offshore turbines typically generate more than 3 MW. Work is currently being done on large-scale turbines with capacity for 7 MW and up to 10 MW and even larger, driving the potential for offshore power generation even higher.

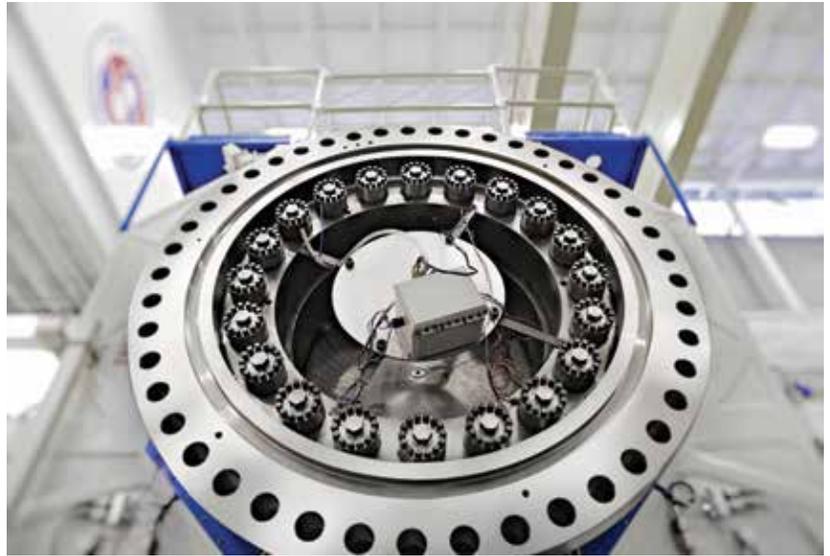
Those on the frontier of offshore wind development are entering uncharted territory. And with that comes the need for highly engineered, highly reliable component parts for power transmission to seize the potential. The choice of a bearing supplier is critical to this process for today's wind-turbine designers and operators to achieve the most effective wind power generation.

### **ONSHORE VS. OFFSHORE: A COMPARISON**

The essential functionality of a wind turbine stays the same no matter if that turbine is operating onshore or off. All turbines have towers, nacelles, three-blade design, and other common essential components.

There are a few critical differences that must be considered, however. The first primarily comes down to the size — that of the completed turbine and the component parts that go into it.

Onshore turbines hit some significant limitations revolving around their physical construction. Road conditions, bridge sizes, and weight capacities must all be considered when transporting oversized turbine components to a build site. Many of these sites are in remote regions where access may not be easy. Offshore wind, by contrast, is not limited by those same restrictions. Parts can be shipped to ports built to handle



Other testing capabilities within the 18,000-square-foot facility include industries such as off-shore oil rigs, mine trucks, electric shovels (in mining), steel rolling mills, cement vertical mills, and hydraulic roll presses. (Courtesy: The Timken Company)



Timken and Stark State College's Wind Energy Research and Development Center tests ultra-large bearing systems up to 13 feet in outside diameter on sophisticated equipment capable of simulating wind-turbine conditions. The new test facility is expected to shorten development cycles and improve reliability and cost-effectiveness. (Courtesy: The Timken Company)

extreme sizes, though the investment in such larger turbines grows when accounting for ship-based transport. With the ability to construct larger turbines, the potential for greater generative capacity is increased.

Another important distinction is wind speeds and loads that occur in onshore versus offshore applications.

In Europe, land limitations led to the early adoption of offshore farms, but there was another benefit: higher velocity and more consistent wind speeds at sea. Those conditions allow continuous and consistent operation, efficiently generating the greatest amount of power possible.

By contrast, onshore wind speeds



The \$14 million Wind Energy Research and Development Center houses a large test rig that can handle 13-foot OD bearings. It's capable of producing load combinations experienced by utility-scale wind turbines, up to 5 MW. (Courtesy: The Timken Company)

and loads are far less consistent. And though the availability of land will likely lead to the continued adoption of onshore wind power in the United States, these installations will be less efficient than an offshore counterpart. Another factor to consider is inconsistent wind loads, causing the turbine to stop and start up again. This may, in fact, cause more stress on gearbox bearings and other components.

No matter the differences, it is clear that bearing design in all wind turbines must be rigorous and suited to the given application.

### HIGHER RISK, HIGHER REWARD IN OFFSHORE

As offshore turbines continue to grow and increase their energy-output potential, components and systems that make it possible are subject to greater loads and expectations. So, as opportunity grows, so does the potential for costly failure if all

systems aren't operating reliably and according to plan.

What are some of the biggest challenges? Like any industry, high-performing components are essential for efficient operation, making overall reliability and reduced maintenance a priority. Geographical location comes into play once again — where an onshore major drivetrain component replacement due to failure may cost several hundred thousand dollars, that same failure in an offshore turbine may easily stretch into the millions when the complexities of sea travel and sea-based cranes are factored into the equation.

The need for thorough engineering expertise is clear. Superior performance from gearbox bearings depends on exacting and typically customized clearances for that specific turbine's design and power output. These bearings aren't sold off the shelf — each is unique. In increasingly powerful applications, the

right geometry, clearances, and load capacity must be custom engineered by expert partners to meet the needs and requirements of the specific project. Slight over- or under-sizing can cause serious performance issues.

Technical expertise to meet the needs of specific applications is highly valued among turbine OEMs when it comes to bearing suppliers. Likewise, product quality and integrity is paramount, because reliable performance depends on it.

### QUALITY AND TRACEABILITY

Given the high cost of bearing failure in any wind application, the integrity of materials selection is something any turbine OEM will be paying close attention to.

For example, material traceability in wind energy is a critical consideration for turbine OEMs. One faulty component can indicate a problem that reaches beyond one individual turbine. The ability to trace one damaged part to its source, and to then determine if like parts are also in use, can help operators identify problems before they happen. With the high cost of failure, complete product traceability in wind energy is not unlike that in the aerospace industry.

This kind of ability to trace products back to their exact source — including the steel heat used in manufacture — in each wind-turbine bearing is essential in wind-energy applications. Likewise, documentation is important to ensure all customer requirements are accounted for when the bearing is manufactured.

### BEARING AND SUPPLIER SELECTION

Bearings providing the highest possible performance potential in the most compact designs help reduce overall system size, weight, and manufacturing costs. In larger and more powerful applications, reducing weight and size where possible

is a significant goal. Maintaining reduced head mass size as turbines grow more powerful is important to lower the cost of energy (COE), which is a focal point for many turbine OEMs today.

For these reasons, tapered roller bearings have demonstrated unique suitability for wind turbine main bearing applications when compared to the traditional choice of spherical roller bearings. Tapered bearings are power dense, satisfying sizing demands in offshore wind applications. Designed to bear both thrust and radial loads, tapered roller bearings are also well suited for the common stresses in wind applications, including sudden changes in both wind speed and direction.

But in the end, bearing choice for any wind application, be it on or offshore, depends on finding the right design for the right application. And as wind turbines on offshore applications continue to grow larger, new design considerations will be discovered. For example, blades on a wind turbine will grow more flexible at larger sizes. This kind of material behavior can cause different forms of stress on the entirety of the turbine, requiring extensive expertise to determine accurate loads and system compliances.

Offshore wind energy is entering uncharted territory. And for wind-turbine designers and operators, close collaboration with a trusted bearing supplier will better enable problem solving, correct system design, and long-lasting reliability and performance. Seizing on the growing potential of wind energy depends on it. ↵



The Wind Energy Research and Development center in North Canton, Ohio. (Courtesy: The Timken Company)

## An Investment in Wind Research

**W**ith the potential in wind energy growing each year, Timken has committed itself to help push this growing market forward.

In 2013, Timken opened its Wind Energy Research and Development Center, the first of its kind in the United States. Focused on advancing the development of bearing systems in wind applications, the \$14-million investment on the campus of Stark State College in North Canton, Ohio, furthers the development of power transmission systems for multi-megawatt turbines. Massive, precision-engineered bearing and sealing systems like those made by Timken are central to that production of power inside these turbines.

As the wind main shaft market trends toward larger applications, Timken identified the need for physical testing capabilities to validate ultra large bearing design practices, component reliability, and additional performance necessities. At the facility, a test cycle equivalent to 20 years can be completed in as little as 4 to 5 months.

Timken collaborates with wind-turbine and gear-drive designers from material selection through engineering and product selection. The company also offers Timken clean steel, antifriction bearings, and a range of power-transmission components for the most demanding megawatt-class turbines. Its services include application development, service engineering, and aftermarket services to help keep equipment running smoothly through its service life. ↵



**Doug Lucas** is a wind-energy engineer with The Timken Company. Over the last 17 years with Timken, Lucas has worked in application engineering and management functions serving the wind-energy industry. He is responsible for application and new product development that leads to delivering innovative, high-value technology solutions to Timken customers in the global wind-energy markets. He has been involved with many development projects and products for the wind market to drive increased reliability and lower cost of energy. Lucas holds bachelor's and master's degrees in mechanical engineering from The University of Akron as well as a professional engineering license in the state of Ohio.

## CONVERSATION

**Jim Bennett**

Bureau of Ocean Energy Management Chief,  
Office of Renewable Energy Programs (national)

**Joan Barminski**

Regional Director  
BOEM Pacific Region

“This is a very exciting time for offshore wind in the U.S.”

**For those who don't know, what is BOEM's mission?**

**Bennett:** As an agency of the Department of the Interior, the Bureau of Ocean Energy Management (BOEM) is responsible for advancing the responsible development of offshore energy resources covering over 1.7 billion acres of the Outer Continental Shelf (OCS). While the OCS remains an important source of conventional energy resources — namely, oil and gas — the OCS also contains abundant renewable energy resources as well — especially offshore wind resources — that are suitable for development.

This is a very exciting time for the offshore wind industry in the U.S. We are getting to the point where the U.S. is about to have steel in federal waters for wind energy.

**Does that not include Block Island?**

**Bennett:** The Block Island Wind farm is a five-turbine, 30-MW wind farm in state waters of Rhode Island about three nautical miles southeast of Block Island. BOEM's jurisdiction over renewable energy activities starts at a state's seaward boundary (generally 3 nautical miles from shore) and extends through the Exclusive Economic Zone (about 200



nautical miles from shore).

BOEM has the authority to issue right-of-way grants that allow developers to build electricity transmission lines that connect renewable energy installations to the onshore electrical grid. While the majority of the activities and permanent structures related to the Block Island Wind Farm are sited in state waters and lands, making the U.S. Army Corps of Engineers the lead federal agency for analyzing the potential environmental effects of the project under the National Environmental Policy Act (NEPA), an 8-mile portion of the Block Island transmission system is located on the federally managed Outer Continental Shelf, which required the project to secure a right-of-way (ROW) grant from BOEM.

BOEM also provided some technical assistance on the development of the turbines themselves.

**What do you do with BOEM?**

**Bennett:** I'm the chief of the Office of Renewable Energy Programs at BOEM. We are responsible for the regulations guiding the development of offshore wind energy leasing. Our office is also responsible for wind-energy leasing activities on the Atlantic.

**Barminski:** To complement that, in the Pacific, I'm the regional director here, and we handle all the energy programs, but for renewables we are implementing the program that's been developed for BOEM specifically in the Pacific, which includes the three West Coast states as well as Hawaii.

## What are the advantages of offshore wind in the U.S. versus onshore?

**Bennett:** Offshore wind has several advantages over onshore wind including much higher wind speeds.

If you look at a map of the country overlaid with wind speeds, you will see that wind is concentrated in the middle of the country and offshore the East and West coasts.

Furthermore, these high wind speeds offshore are located near the major load centers of the nation. Whereas onshore wind has to move power longer distances to the load centers.

Finally, the open ocean allows for larger turbines than could be used onshore due to space restrictions. This results in even greater potential for power production.

The East Coast also has a very shallow shelf, which lends itself to the current available technology for wind energy such as bottom-founded structures, monopiles and jackets.

**Barminski:** Offshore wind has several benefits compared to onshore. In particular, there may be some limitations in terms of onshore locations. That's particularly true in Hawaii where there's interest in offshore wind because of land use already and also accessibility for the resources, as Jim pointed out. There's a very good wind resource in the vicinity of Oahu.

But in California, too, the state's very interested in looking at offshore wind, although there has been quite a bit of development of onshore wind resources in the state. Both California and Hawaii have very aggressive renewable energy goals. And meeting those requires them to look at some of the true potential for additional renewable energy resources offshore.

## Where does wind stand on the Atlantic Coast?

**Bennett:** On the Atlantic, we are very optimistic about both the near-term and long-term potential for offshore wind energy.

BOEM has held seven competitive lease sales, which have generated over \$68 million in high bids for almost 1.4 million acres in federal waters.

After our last competitive lease sale last March for the Wind Energy Area offshore Kitty Hawk, North Carolina, BOEM now has offshore wind energy leases off every state from Massachusetts to North Carolina (Cape Cod to Cape Hatteras). We have awarded 13 leases with over 15 GW of capacity. This indicates to us that the industry is moving forward in a big way.

BOEM has also received unsolicited lease requests from two companies seeking to develop offshore wind energy in areas located offshore New York and Massachusetts. These are both very important areas and are examples of the importance of state leadership. Both states have established strong goals for the contribution of OSW to their respective states, and both are investing in studies to facilitate future projects.

## Where does wind stand on the Pacific Coast?

**Barminski:** In both California and Hawaii, BOEM has determined that there is competitive interest in commercial leasing for offshore wind. In both states, we are working to conduct planning activities for those possible competitive leasing auctions. So, those are in our future. In California, BOEM and the state are working side-by-side to gather stakeholder input. We're trying to identify and collect rele-

vant data and information on existing ocean resources and uses. And that's part of the planning effort.

And all of that information will help identify suitable sites for offshore wind development in the future and help facilitate the decision-making. There is a really good dataset available, which is being put together by the state of California. It's specifically being collected in something called the California Wind Energy Gateway; there's a link on our website. In Hawaii, we're, again, working closely with the state and the Department of Defense, which has a large presence in the state of Hawaii, to identify potential areas for wind leasing offshore Oahu. And, of course, we're looking for compatibility with military uses and the technical potential for the wind development.

## What are the challenges and how do they differ from coast to coast?

**Bennett:** BOEM's mandate to manage 1.7 billion acres on the OCS is no small task. On the Atlantic, we have a lot of diverse ocean users. Despite the vastness of the ocean, once you start identifying different activities, such as commercial fisheries, navigation, vessel traffic, and DOD interest, it becomes very difficult to identify areas that don't have some kind of conflicting use. The OCS is home to multiple users, and BOEM is committed to reducing multiple use conflicts.

Another way BOEM works with its diverse stakeholders is through intergovernmental task forces. These task forces bring together members of state, local, and tribal governments and federal agencies to discuss stakeholder issues, exchange data and information, and

“ Our progress thus far has been the culmination of 10 years of hard work, and I think within five years we’re going to see actual steel in the water for the first time on the federal outer continental shelf. ”

identify potential conflicts early in the planning and leasing process.

**Barminski:** On the Pacific, the main difference is on the technological side in terms of the water depth. In the Pacific, along the West Coast and in Hawaii, there is very little shallow water, and what there is of that is too close to shore and is within the state waters area. And so in looking at the OCS, there’s a rapid drop-off in water depth, which precludes the use of the bottom-founded structures. We’re looking at floating wind as being the prevalent technology to be utilized in these areas on the West Coast and Hawaii. That’s really the main difference. Floating technologies are being deployed in Europe, and those are informing the decision making for the Pacific. But the proposals we’re seeing are all in the floating realm.

I think there are really a lot of similarities to the Atlantic in terms of the ocean users considerations, the DOD constraints, and the equities they have in the operational arenas.

There’s one other thing I can mention that’s different for the Pacific. The renewable energy authority granted to BOEM allows us to lease on the OCS; however, that same authority precludes us from leasing in national marine sanctuaries.

And along the coast of California, there are several large sanctuaries, which comprise areas where we cannot offer leases.

### What is BOEM’s involvement in the development of an offshore wind farm?

**Bennett:** In 2009, Department of the Interior (DOI) announced the final regulations for the Outer Continental Shelf (OCS) Renewable Energy Program, which was authorized by the Energy Policy Act of 2005 (EPAAct).

These regulations provide a framework for issuing leases, easements, and rights-of-way for OCS activities that support production and transmission of energy from sources other than oil and natural gas.

We are responsible for overseeing offshore renewable energy development in federal waters. Since the regulations were enacted, BOEM has worked diligently to oversee responsible renewable energy development.

As part of BOEM’s Renewable Energy Leasing Process, we actively seek stakeholder input throughout the planning and leasing processes, which includes public meetings, listening sessions, and public comment periods

### How does wind off the coasts of the U.S. differ from established offshore wind in Europe?

**Bennett:** We have been working closely with our counterparts in European governments (e.g., Denmark and the U.K.) to benefit from their 20-plus years of experience in offshore wind and seeking to understand how we can best apply that experience to our program.

With Denmark, we signed a Mem-

orandum of Understanding in 2016, which provides a mechanism for bilateral cooperation on areas of mutual interest. We have held information exchanges on a number of topics, with the goal being to share lessons learned and best practices in key program areas.

For instance, BOEM recognizes that the details of a lessee’s project may not be finalized at the time a construction and operation plan is submitted. In Europe, use of a design envelope, commonly referred to as a “Rochdale Envelope,” is an alternative method for considering offshore wind facilities. A project’s design envelope, which is based on conceptual design information and initial survey work, includes engineering options from which the final design will be refined later. Developers have expressed interest in using a similar approach for offshore wind facilities in the U.S.

The use of a design envelope would allow for the evolution of a project and technology in the years between application submission and deployment. Considering a range of build-out options, including different phasing scenarios, could reduce or eliminate additional environmental analysis for revisions to approved COPs, creating efficiencies, and reducing the possibility of delays.

### Could the phase out of the PTC affect offshore wind development?

**Bennett:** There have been some exciting things happening on the state level. For example, in New

York, Gov. Andrew Cuomo committed the state to acquiring power from 2.4 GW of offshore wind by 2030 in his State of the State Address in January. New York is also working closely with BOEM to identify additional areas off of New York that might be appropriate for additional wind farm development.

Another example is up in Massachusetts where Gov. Charlie Baker signed a new energy law that requires utilities to procure a combined 1.6 GW of electricity from offshore wind.

There's a similar situation in Maryland where the state, through its Public Service Commission, has awarded offshore wind renewable energy credits to two companies totaling 368 MW of capacity. The ORECs were awarded to US Wind and Skipjack Offshore Energy, LLC.

## Where do you see offshore wind on either coast in the next 10 years?

**Barminski:** On the Pacific, it's difficult to definitively outline where we'll see offshore wind in the next 10 years, but it's clear that both states and industry are very interested in exploring the opportunities for offshore floating wind. And we have a lot of factors that are guiding our efforts, including demand growth, the state renewable energy goals, which are significant, and then our leasing process and industry readiness.

Cost competitiveness is another driving factor. Based on those factors, we could expect to see initial projects in the 2025 timeframe, at the very least more progress on the planning and then the offshore leasing. But it really does depend on some success with initial deployment and continuation of the cost reductions that have been experienced.

The technologies are definitely being

tested in the European arena offshore Portugal and Scotland, where full-scale floating wind technology is being deployed. It's pretty exciting to see that happening over the last five years.

**Bennett:** On the East Coast, we're very enthusiastic. The last two renewable energy lease sales BOEM conducted exceeded our expectations and demonstrated the level of interest from industry. Our progress thus far has been the culmination of 10 years of hard work, and I think within five years we're going to see actual steel in the water for the first time on the federal outer continental shelf.

I don't want to be overly optimistic, but I am optimistic that we've turned a corner and that the offshore renewable energy industry is going to be coming online in the next few years. ↴

For more information go to [www.boem.gov](http://www.boem.gov)



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# MAINTENANCE

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## Leading liftboat operator enters offshore wind support market



All Coast has undertaken the development of a new liftboat, which will be the first Jones Act Compliant vessel built for the purpose of U.S. wind-farm installation and support activities (WTIV). (Courtesy: A. K. Suda)

All Coast, LLC, the most experienced company in liftboat management and operations in North America, has entered the U.S. Offshore wind-farm market.

All Coast operates the most versatile and largest liftboat fleet in North America. Having won numerous safety awards, its vessels have a reputation of being the most well maintained and safely operated vessels in North America.

Given its success in the offshore oil and gas industry, All Coast has decided to parlay that experience into the support of the offshore wind industry. They have undertaken the development of a new liftboat, which will be the first Jones Act Compliant vessel built for the purpose of U.S. wind-farm installation and support activities (WTIV). The liftboat will be capable of installing the offshore

foundations and wind turbines, as well as providing necessary maintenance in years to come.

All Coast has partnered with Semco, LLC, the Southeast Louisiana-based shipyard. Semco has many years of experience in building liftboats that have been used around the world, including some of the largest liftboats ever built in the U.S. The yard also has the honor of having built the only lift-

boat in the U.S. that has been used for offshore wind farm installation and support. As a yard with the reputation of being on the forefront of large liftboat construction, Semco has been chosen to deliver the vessel to be used in the offshore wind farm jobs, on time, and within budget.

“We have never found a challenging project we didn’t like. Semco has built its reputation on leading the way,” said Semco’s Allen Moore.

The foundation of a good vessel is great design and engineering, which is why All Coast has also partnered with A.K. Suda, Inc., Naval Architects and Marine Engineers, to design this liftboat. Suda is one of the most accomplished designers of liftboats in the world. Suda has designed many first-of-a-kind vessels including the first USCG approved liftboat, the first truss leg liftboat, and the three largest liftboats in the world, to name a few.

“We are honored, though not surprised, to have the best in the business ask us to join the team,” said A.K. Suda’s principal, Ajay Suda. “Our designs are by far the most efficient and cost effective.”

“The vessel has to be special-purpose, and efficiently designed, built, and operated to have any success in this business,” said John Powers of All Coast. “Barges on legs don’t make WTIVs.”

The noted liftboat is based on the Suda model JG6000P. Its design has been optimized by Suda to work within the restrictions presented at different staging ports in the U.S.

“Siemens Gamesa is confident in the development of offshore wind, and the U.S. is a focus market for us as we expand outside of developed markets in Europe. A U.S.-flagged installation and maintenance vessel helps to establish a sustainable offshore industry in our country,” said Jason Folsom, head of sales, Offshore Americas, Siemens Gamesa Renewable Energy. ↘

*Source: A.K. Suda*

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

## **Altitec and Nordex team up for South African end of warranty inspections**

Blade inspection and maintenance specialist Altitec has completed end of warranty (EOW) blade inspections at the Amakhala Wind Farm in South African’s Eastern Cape. The inspections were undertaken in partnership with Nordex Energy South Africa (RF) (PTY) Ltd.

Under the terms of the contract, Altitec carried out EOW inspections on 54 turbines, each with a height of 91 meters. Inspection work began on the first turbine blades in December 2016 and was completed this summer.

“We know turbine blades that are regularly inspected and maintained to a high standard remain cost-efficient,” said Anne Henschel, managing director of Nordex Energy South Africa. “By partnering with Altitec to deliver MWS services, our clients can be assured that their turbines will perform at optimal levels for as long as possible, reducing costs and improving overall wind farm performance in the process.”

EOW inspections and maintenance are essential to the successful long-term operation and financial returns of wind farms such as that at Amakhala. With the end of the warranty period, responsibility for assessing turbines moves from the original manufacturer to the project owner. By carrying out maintenance at this point, Nordex is helping to avoid any project downtime or financial losses later in the wind farm’s life cycle.

As a trusted and experienced international partner, Altitec employed its considerable experience in the field at the Amakhala site, helping the manufacturer to fulfill its warranty obligations.

Altitec also benefits from the range of technological equipment and expertise at its disposal. Use of the Actsafe powered rope ascender, for instance, boosts the efficiency of Altitec’s technicians, allowing them to carry out up to 35 percent more work when compared with traditional rope access techniques.

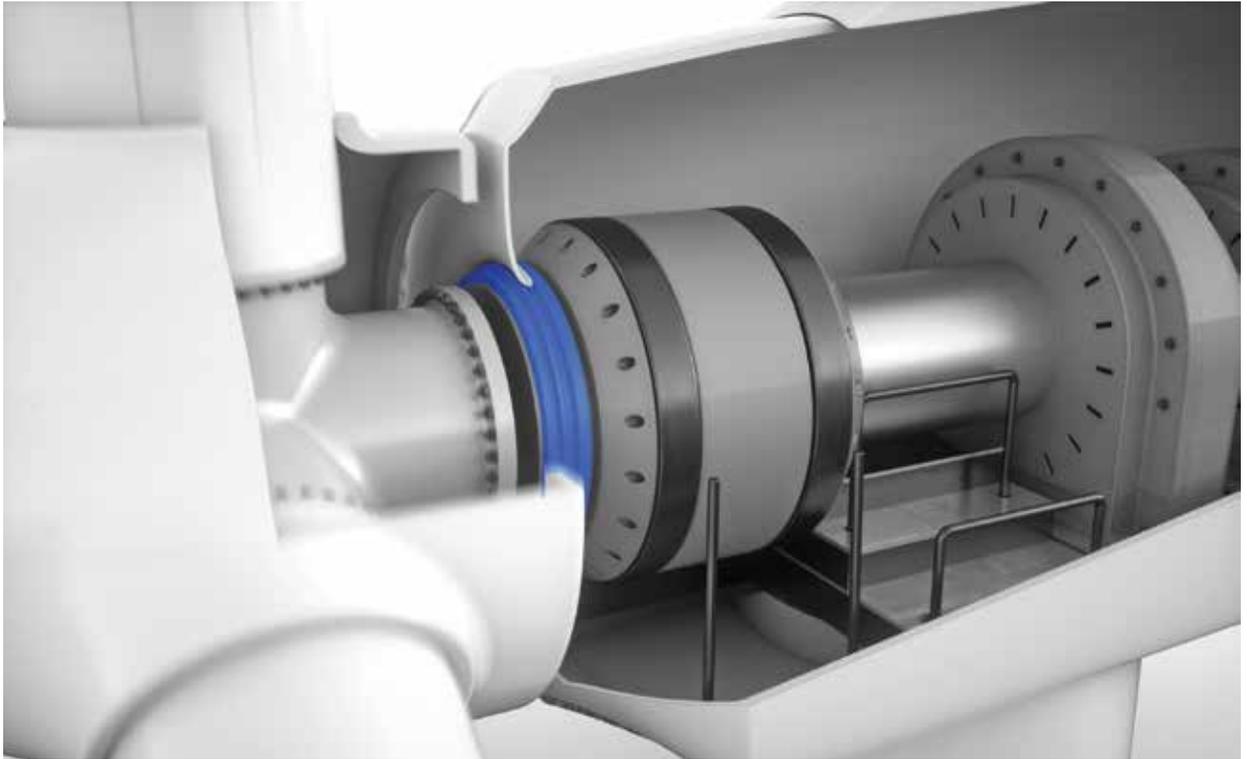
“EOW inspections are not only necessary, but a great opportunity for turbine manufacturers to add value and optimize performance into the future. We were delighted to continue developing our global footprint by carrying out this work at Amakhala on behalf of Nordex,” said Tom Dyffort, managing director, Altitec Group.

“Carrying out blade inspections and maintenance on 54 turbines is a significant undertaking, but the skills and experience of our technicians allowed us to complete this work as quickly as possible, while adhering to the high standards Altitec’s customers have come to expect.” ↘

*Source: Altitec Group*

For more information,  
go to [www.altitec.co.uk](http://www.altitec.co.uk)

## New radial shaft seal ring designed to battle shaft runout



Qualified even for higher loads: The new Merkel Radiamatic sealing rings are always secure against the shaft, even in the event of a strong shaft impact. (Courtesy: Freudenberg Sealing Technologies)

The global expansion of wind-power facilities is proceeding unabated. Based on figures from Global Wind Energy Council, nearly 487 GW of output from wind energy were in place at the end of 2016. At the start of the decade, the installed output wasn't even half that amount. It is not just the number of facilities that has risen sharply — output has climbed as well, especially for wind turbines offshore. But the longer rotor blades they require lead to higher loads on the main bearing and the shaft. The results are more extensive deformation of these machine elements and greater shaft runout, also known as eccentricity.

That's why Freudenberg Sealing Technologies is developing new seals for current and future wind-power facilities. The new generation of radial shaft seal rings has the capacity to follow relatively severe deformations

of main bearings and shafts, basically by providing stronger compensating movements. They have also been especially adapted to grease-lubricated systems and thus clear the way for wind turbine manufacturers to use new designs, such as externally rotating main bearings.

The most important task of the Merkel Radiamatic radial shaft seal ring is to seal the main bearing of wind turbines. This means holding the lubricant within the main bearing and keeping dirt particles and moisture out of the interior of the machine elements needing protection. The tried-and-tested Merkel Radiamatic seals in use today consist of a fabric-reinforced carrier, a diaphragm, and a wedge-shaped seal lip. With the help of a worm spring resembling the tension spring of a desk lamp, the seal lip is maintained under tension. This ensures the continued

contact of the seal lip on the shaft.

For the new generation of radial shaft seal rings, Freudenberg Sealing Technologies' engineers have developed an innovative, robustly configured seal lip design. Together with the carrier, a lean, elongated seal lip creates a V-form. A curved steel band strengthens the seal lip and carrier. In this way, the seal lip acts as a pressure spring. It "presses" onto the shaft on its own, without needing to be fixed by a worm spring. Even at relatively strong shaft runout, the seal lip securely abuts the shaft. In this way, it can fulfill its sealing function even at significantly higher loads on the bearing and the shaft. The steel band is also an integral component of the seal. So in the entire system, the new radial shaft seal ring is just one component that simplifies installation.

Another focus of the developers at Freudenberg Sealing Technologies is

the reduction of friction to achieve greater wind-turbine efficiency. The long and narrow shape of the new seal lip leads it to abut the shaft with just the width of a hair, even at two-to-three times the usual shaft runout today. Very little friction occurs as a result.

It also acts as a wiper for grease, which is the most common lubricant. With every rotation of the main shaft, it conveys the lubricating grease back into the interior, contributing to still more reduction of frictional losses.

“The goal of this development is to bring the tribological system of the shaft, lubricating grease, and seal into harmony,” said Dr. Kristian Müller-Niehuus, development manager at the Lead Center Heavy Industries at Freudenberg Sealing Technologies.

Since the seal lip of the new radial shaft seal ring from Freudenberg Sealing Technologies lies against the shaft on its own, it is also possible to vary the seal’s direction of force at will. Its spring action can act outwardly as well as inwardly. That gives the developers of wind-power facilities and their components new design freedom.

“We had extraordinarily good results in the test bay,” Müller-Niehuus said. “That’s why we are taking the next step and testing the new generation of radial shaft seal rings with our customers, the manufacturers of wind-power facilities, and their components.”

With the innovation, which is suited for all bearing and shaft diameters, Freudenberg Sealing Technologies will make reliable, robust sealing concepts possible to meet future requirements in wind power facilities. ↴

*Source: Freudenberg Sealing Technologies*

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

## VeriSafe™ designed to minimize electrical hazards

Panduit Corp., an industry leader in control panel, wire harness, and heavy-duty cable management solutions for more than 60 years, announced the North American release of its VeriSafe™ — Absence of Voltage Tester. VeriSafe is designed to minimize risk to electrical hazards by verifying the absence of voltage before equipment is accessed, making it easier for qualified electrical workers to determine an electrically safe environment in a fraction of the time compared to hand-held portable test instruments. Before performing de-energized work on electrical equipment, NFPA 70E requires that workers verify equipment is in an electrically safe state. One of the steps in the process of verifying that the equipment is an electrically safe state involves a test for absence of voltage. VeriSafe ensures the entire process of verifying absence of voltage is performed in the proper sequence — every time, every test.

The fail-safe and reliable process performed by VeriSafe tests the tester itself, verifies installation, checks for voltage, verifies installation, and retests the tester; all automatically performed in sequence with no risk of exposure to electrical hazards at the push of a button.

“We understand that our customers are committed to protecting their workers while meeting safety regulations,” said Bob Krisel, vice president of OEM, Panduit. “This new tool allows them to effectively meet their objectives. This highly anticipated new product offering has the capability to transform the way our customers in the manufacturing industries conduct verification testing for industrial enclosures.” ↴

*Source: Panduit*

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



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# INNOVATION

Research & Development • Design & Engineering • Forecasting & Analysis  
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## Antaira expands industrial networking infrastructure

Antaira Technologies, a global leading developer and manufacturer of industrial networking devices and communication solutions for harsh environment applications, recently announced the expansion of its industrial networking infrastructure family with the introduction of the IMP-C1000-SFP series.

The IMP-C1000-SFP series is a compact IP30-rated gigabit Ethernet-to-fiber media converter featuring a 10/100/1000Tx Ethernet port that supports IEEE 802.3 at high power PoE that can supply up to 30 watts and a dual rate 100/1000 SFP slot. It is designed to fulfill industrial applications that require distance extension and high bandwidth capabilities. This small form factor is ideal for saving space in outdoor applications such as factory automation, security, ITS transportation, power/utility, water wastewater treatment plants, and any other extreme ambient weather environments.

Antaira's IMP-C1000-SFP series has a built-in Link Fault Pass Through (LFP) and Far End Fault™(FEF) function with redundant power input 48~55VDC. This product can support DIN-rail as well as wall-mountable orientations and has two operating temperature range models in standard: -10 degrees Celsius to 70 degrees Celsius, and extended operating temperature: -40°C to 80°C. ↵

Source: Antaira Technologies

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



Antaira Technologies' gigabyte media converter. (Courtesy: Antaira Technologies)



Billy Martin, director and research scientist at the NIAR Environmental Test Lab, invented the prototype. (Courtesy: Wichita State University)

## Prototype protects turbines from multiple lightning strikes

Damage to wind turbines can easily cost hundreds of thousands in repairs, but a prototype developed at Wichita State's National Institute for Aviation Research (NIAR) will help protect them from multiple lightning strikes.

Billy Martin, director and research scientist at the NIAR Environmental Test Lab, invented the prototype, which is patent pending.

Previous devices for protecting wind-turbine blades have issues with reliability, are generally single use, and have significant down time when there is a needed repair.

Martin's design involves layers that allow turbine blades to withstand multiple lightning strikes without sustaining damage. A recent test showed no damage after up to eight lightning strikes.

The biggest advantage to this design is the time it allows for repairs, and the ease with which the repairs can be completed. The protective layering can be applied to turbine blades before installation and is repairable after taking multiple lightning strikes.

The damage to the protective layering can be repaired in approximately 20 minutes, not counting the time it takes to reach a blade that is already installed.

Martin continues to improve his prototype with additional tests, making it lighter, more marketable, and convenient for repairs high in the sky. ↘

*Source: Wichita State University*

For more information, go to [www.niar.wichita.edu](http://www.niar.wichita.edu)

## Nacelle-mounted ZephIR Lidar passes verification

An independent performance verification of a nacelle-mounted ZephIR Lidar has been undertaken by DNV GL on the test site in Janneby, Germany, which demonstrates the product is compliant with best-practice guidelines developed in the EUDP UniTTe programs — widely regarded and accepted as industry benchmarks for installations of turbine-mounted Remote Sensing Devices (RSDs).

In the verification, the ZephIR DM nacelle-mounted Lidar was mounted horizontally on a raised platform (FW-MM) — 180 meters away from two reference met masts (T-MM-N and T-MM-S) equipped with calibrated anemometers at DNV GL's test site 20 kilometers southwest of Flensburg, Germany.

DNV GL undertook a series of tests and subsequent analysis on the performance of the ZephIR DM with respect to:

- **Verification of inclinometers.** ZephIR DM uses highly sensitive positional sensors to account for turbine sway and nod to ensure a true hub height measurement is reported at several rotor diameters in front of the turbine within  $\pm 1$  percent of hub height.
- **Availability.** ZephIR DM achieved a 100-percent availability of both system and data during the performance verification. A Continuous Wave Lidar, all power from the system's laser is focused at each measurement range, which helps to ensure the highest levels of sensitivity, and therefore data availability, in all environmental conditions.
- **Wind-speed comparison.** White box test results showed a correlation gradient of 1.00026 was achieved, i.e. a 0.026 percent difference between the Lidar line-of-sight and mast wind speeds were observed.

ZephIR Lidar's nacelle-based wind profiler, ZephIR DM, has been demonstrated to measure wind speed when mounted on a wind turbine at a very accurate

level. Additionally, the ZephIR DM offers the advantage of being mobile and scanning at up to several hundred meters ahead of the rotor in free stream wind flow for a power curve measurement.

Further, the individual unit used in this test will operate as a gold standard Nacelle-Lidar suitable for further tests, validations, and performance verifications at the UK Remote Sensing Test Site where a range of remote sensing devices undergo independent performance verification. For example, a sample of 250 ground-based ZephIR 300 Performance Verifications has been published openly and available at [www.zephirlidar.com](http://www.zephirlidar.com).

Applications for nacelle-mounted Lidar include:

- Power-curve measurements.
- Turbine trouble-shooting, including



A photo illustration indicating verification results at the Janneby Lidar test site in Germany. (Courtesy: ZephIR Lidar)

- yaw alignment studies and nacelle transfer function optimization
- Turbine end-of-warranty inspections

Source: ZephIR Lidar

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

“The individual unit used in this test will operate as a gold standard.”

## Collaborative wind-measurement campaign done

The Wind Forecasting Improvement Project (WFIP2), a \$5 million collaborative study coordinated by Vaisala, a global leader in environmental and industrial measurement, in conjunction with the National Oceanic and Atmospheric Administration (NOAA), and funded by the U.S. Department of Energy (DOE), has completed the largest deployment of measurement technologies to assess the causes of wind-speed variability and their impact on wind energy generation in complex terrain.

The three-year project, based near the Columbia River Gorge, now advances into its 12-month final phase as Vaisala and its project partners use the data collected to enhance the underlying forecasting models used to predict wind variability in areas of challenging topography. Simultaneously, the measurement campaign data have

been made open-source to help improve the global standards of wind-energy modeling and to aid further research.

### GRID INTEGRATION, IN REMOTE REGIONS

As onshore wind development and operations are increasingly undertaken in regions of challenging topography worldwide, demand for a better understanding of atmospheric flow and wind behavior in complex terrain is increasingly urgent. Currently, the uncertainty associated with wind generation results in less favorable financing terms for projects in development and hinders full use of a free and clean energy source for projects already online.

WFIP2 brings together experts from government, industry, and academia to tackle this issue by improving the ability to understand

and forecast wind energy in difficult topography. This will make it possible for the grid to better leverage the U.S.'s significant wind resources and expand the number of places where wind energy is not only feasible, but also profitable.

Wind forecasting has already played a substantial role in making wind power part of the mainstream energy industry. Accurate forecasts allow operators to schedule and trade energy, supporting better overall management of the grid. They also help drive down operational costs by reducing imbalance penalties and facilitating better maintenance scheduling to avoid stranded crews and equipment, while improving personnel safety.

### AN UNPRECEDENTED SCALE

WFIP2 seeks to improve existing models of wind variability, using the dataset collected during an extensive 18-month measurement campaign covering a 50,000-square-kilometer area of the rugged Columbia River Gorge region. Project teams deployed more than 200 measurement devices of more than 24 different types, ranging from SoDAR (Sonic Detection And Ranging) and LiDAR (Light Detection And Ranging) units to wind-profiling radars, radiative flux systems, and microbarographs. Capable of measuring wind conditions throughout the turbine rotor layer and aloft along with other variables, such as cloud position or air temperature, this broad combination of devices has allowed a much deeper insight into wind activity than a conventional anemometer.

“Deploying cutting-edge measurement technology on an unprecedented scale has allowed our project to collect high-value data in an understudied and complex domain,” said Dr. James McCaa, manager of advanced applications at Vaisala and principal investigator for WFIP2. “The resultant data, much of it related to seldom measured atmospheric phenomena, will enable the profound enhancement of current forecasting methodologies, with applications throughout the wind-energy sector, both in the United States as well as overseas.”

### PUTTING PROJECT DATA TO USE

Over the coming 12-month period, project collaborators will use this dataset to upgrade existing forecasting models, with a focus on zero-to-24-hour-ahead wind forecasts. These models consist of the widely deployed Weather Research and Forecasting (WRF) model, which is used in both the National Oceanic and Atmospheric Administration's (NOAA) Rapid Refresh (RAP) and High Resolution Rapid Refresh (HRRR) modeling systems. Improvements to these

models in complex terrain promises to increase the degree of accuracy to which short-term wind variability can be predicted.

Furthermore, the open-source data will afford opportunities that extend beyond the stated aims of WFIP2, with the potential to enrich further studies into wind variability, benefitting industry stakeholders and consumers alike.

“It is exciting to share the project's rich dataset publicly, which will be a valuable resource for the industry and wider research community to further its own understanding of wind behavior and modeling,” McCaa said. We look forward to seeing the directions others take this and encourage them to share their findings with us.”

Vaisala was selected to lead WFIP2 because of its work on numerous U.S. and overseas grid integration studies as well as its substantial renewable energy forecasting experience, which spans nearly two decades and includes forecasting 150 GW of global wind capacity on an ongoing, hourly basis. ↵

Source: Vaisala Corporation

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



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# MANUFACTURING

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## Siemens Gamesa receives 20-turbine order from Indonesia



A SWT-3.6-130 wind turbine like the ones ordered for the ‘Tolo 1’ onshore wind project. (Courtesy: Siemens Gamesa)

With the ‘Tolo 1’ onshore wind project, Siemens Gamesa has secured its first order in Indonesia for the gearless SWT-3.6-130 wind turbines. The wind farm in Indonesia will consist of 20 wind turbines. The wind-power plant developed by Equis Energy, the largest renewable energy IPP (independent power producer) in the Asia-Pacific region, will be installed by late 2017. Commissioning is planned for early 2018.

Equis Energy has signed 5-year contracts with Siemens Gamesa for engineering, procurement, and construction (EPC), as well as operations and maintenance (O&M). The Tolo 1 wind power plant will be installed in Jenepono on the south coast of the central Indonesian island Sulawesi. For the installation work, Siemens Gamesa Renewable Energy is working in consortium with one of the largest Indonesian construction companies, PT PP (Persero) Tbk.

The wind project will be connected to the Indonesian energy grid via a local substation and a purpose-built 150 kilovolt (kV) transmission line. The type SWT-3.6-130 direct-drive turbines — each with a rating of 3.6 MW and a rotor-diameter of 130 meters — will be installed on steel towers with hub heights of 135 meters.

“Indonesia is set for a period of rapid, sustained growth in energy demand,” said Equis Energy CEO David Russell. “Equis is committed to leveraging our experience and expertise in Indonesia to support these government initiatives and local community development.”

“We are proud to be awarded with this order since Equis Energy is an important and very dynamic player in the Indonesian energy market,” said Alvaro Bilbao Moran, head of the Asia Pacific region in Siemens Gamesa’s onshore business unit. “With a number of innovative,

renewable-energy projects in Indonesia, Equis Energy is really a great contributor to the country's climate protection. We are looking forward to further cooperation with Equis Energy in Indonesia and throughout Asia in the near future."

Indonesia has set ambitious energy targets with a renewable share of 23 percent by 2019. For Siemens Gamesa, Tolo 1 is the second order in Indonesia after the 75-MW Sidrap wind farm, announced earlier this year.

Besides these two Indonesian projects, Siemens Gamesa's footprint in the Asia Pacific region extends to Vietnam, the Philippines, Taiwan, South Korea, Japan, Sri Lanka, China, India, Australia, and New Zealand, having installed roughly 9 GW in these markets. ↵

Source: Siemens Gamesa

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

## Renk roller-bearing test systems delivered

Augsburg-based Renk Test System GmbH, a subsidiary of Renk AG, has delivered two unique test rigs to serve as the critical components in the world's most powerful test center for large bearings. Commissioned by SKF in Schweinfurt recently, the test rigs will help to optimize the performance of future generations of large bearings. The objective is the development of even more compact, robust, lower-friction, and longer-lasting large bearings. The bigger of the two test rigs is the world's first for testing not only the main bearing of a wind turbine up to 6 meters in diameter, but also the entire bearing assembly. The control software RENK Dynamic Data Systems (RDDS) enables the rig to test every conceivable load case occurring in wind-energy plants, e.g. in extreme storms or with a tumbling rotor.

The two test systems, the Main Shaft Test Rig (MSTR) and the Dynamic Development Test Rig (DDTR), are a thousand times bigger than a "normal" Renk test rig rated in kilonewtons. In contrast, the systems installed in Schweinfurt operate on a meganewton scale. With combined load input, the MSTR can act on the tested bearing with a bending moment of 40 MNm and a dynamic force of 8 MN both in axial and radial directions. The smaller DDTR, engineered to thoroughly test large bearings in



Assembly of the DDTR load unit. (Courtesy: Renk)

the shipbuilding, mining, paper, cement, and steel industries, can deliver a commendable performance, too. It achieves speeds of up to 250 rpm while applying loads of up to 7 MN to the bearings. Such testing of new components, geometries or materials here, too, accelerates the torture suffered by the bearings.

The sheer dimensions and weight of the two test systems are gigantic. Featuring an energy recovery system, the MSTR is approximately 9 meters wide, 11 meters tall, and 8 meters deep. It weighs about 700 metric tons. The load disk alone has a weight

of 125 metric tons and a diameter of about 7 meters. The deadweight of the DDTR, which also features energy recovery, is in the region of 300 metric tons. Both of the rigs are mounted on reinforced-concrete foundations weighing hundreds of tons, to ensure safe operation. Since the designs will facilitate extremely efficient testing and also contribute toward a resource-friendly production of future generations of large bearings, they have been sponsored to a total value of around 3.5 million euros by the Bavarian State Ministry for Economic Affairs and Media,

## Oklahoma officials visit state's Terex factory

It's not very common for a governor and a congressman to brave a manufacturing factory in the middle of summer — especially when temperatures exceed 100 degrees Fahrenheit — but Oklahoma Gov. Mary Fallin and Rep. Steve Russell did just that on July 21, 2017, when they visited the Terex facility to talk about manufacturing jobs in America.

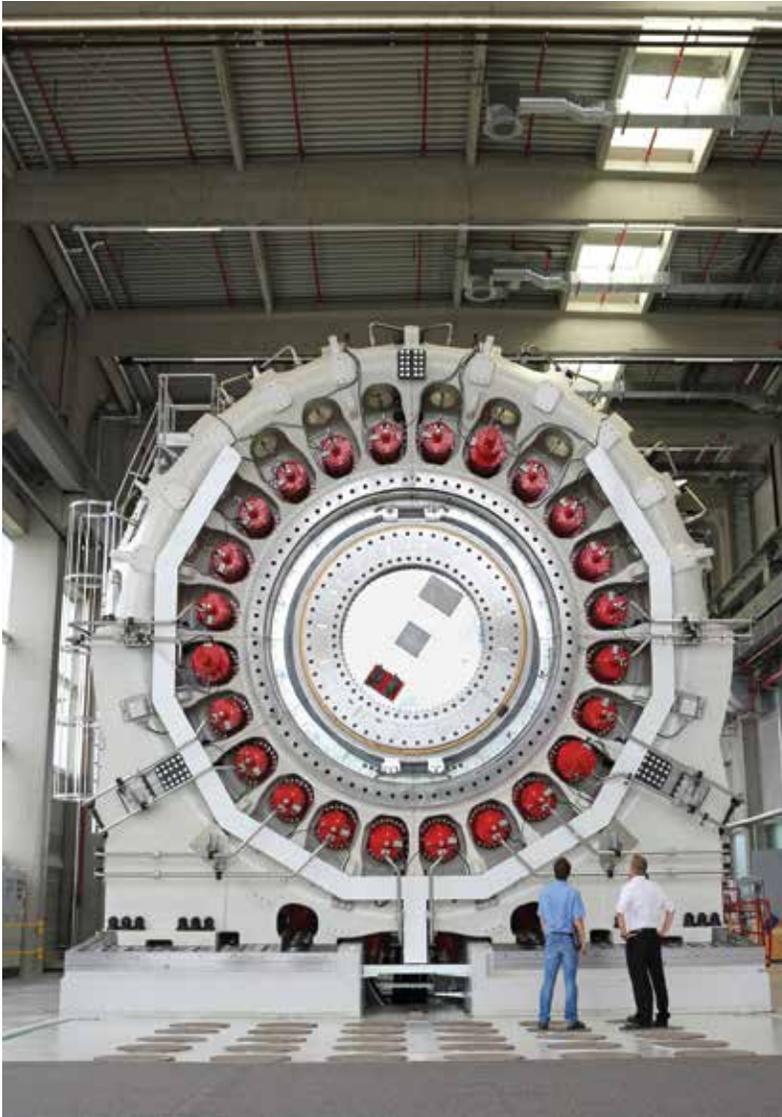
John Garrison, CEO and president of Terex Corporation, and Dennis Slater, president of the Association of Equipment Manufacturers (AEM) joined them. The visit was part of an event called “I Make America,” co-sponsored by AEM and Terex.

Terex was chosen for this visit because it recently moved a significant portion of its manufacturing operations to its plant in Oklahoma. The state-of-the-art facility boasts 700,000 square-foot of operational space. Over the past two years, Terex has invested more than \$40 million into the facility, including the renovation of a large-scale training center, as well as quality-of-life improvements, like the addition of atmospherically tuned fans designed to keep team members cool.

Terex's investment has already seen immediate positive results: It is now the only Terex facility in the world capable of producing heavy equipment for all three segments of the company. The three segments include Terex Cranes, Genie Aerial Work Platforms, and Material Processing.

“You know what I like about this place?” Russell said. “You don't just make stuff. You make stuff that makes stuff.”

After the tour of the facility, Fallin and Russell attended a rally in the new training center, where they were able to speak to all Terex team members. During the question and



Assembly of the MSTR load unit. (Courtesy: Renk)

Energy and Technology, and the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety.

These test rigs also serve as tools in basic development work. Even the most modern simulation programs are unable to faithfully reproduce all the dynamic processes to which large bearings are submitted under actual operating conditions. This is why, until now, such bearings have been engineered with “built-in safety reserves” which cannot completely exclude premature damage. Hence,

experts assume that, under practical conditions, certain phenomena still occur that have not been adequately allowed for in today's simulation models. Test rigs are intended to help analyze such situations. Among the functions is to investigate the reciprocal effects of varying lubrication conditions and bearing designs as well as materials under highly dynamic loads. ↴

Source: Renk Test System GmbH  
For more information, go to [www.renk.biz](http://www.renk.biz)



From left: George Ellis, Kyp Eidburg (AEM), Don Anderson, Rep. Steve Russell, Gov. Mary Fallin, John Garrison, Steve Filipov, Dennis Slater (AEM), and James Hooper. (Courtesy: Terex)

answer period, one of the team members asked Fallin what can be done about workforce readiness in Oklahoma — and beyond.

“Manufacturing is not what grandfather’s manufacturing was,” Fallin said. “If you want to go into a nice company like this, you have to have some education and training, and some work skills to get a job here.”

Fallin said the nation must do a better job in providing the right work skills for today’s jobs. She said the solution is filling the middle skills gap — the gap where a worker needs additional training beyond a high school diploma, but not a full college degree. She said that by 2025, 77 percent of all American jobs would require additional education beyond high school.

Russell said the Terex team

members were proving the fact that there are jobs out there for people who want to learn the skills.

“Oklahoma City has really been the beneficiary of our focusing efforts,” Garrison said. “We’re focusing our portfolio. We’re growing our business here. It’s a very important facility to Terex.”

“Hats off to the OKC team,” Garrison said. “The congressman said that ‘this team has got a lot of spirit. You can tell they’re engaged in the work they’re doing.’ With that kind of attitude and spirit, I’m absolutely confident that our team at OKC will continue to deliver for our customers.”

Source: Terex

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

“ You don’t just make stuff. You make stuff that makes stuff. ”

## UEA celebrates 65 years supplying components

United Equipment Accessories (UEA), a family-owned manufacturer of slip rings, cable reels, hydraulic swivels, and shift controls, turns 65 years this year.

“We’ve weathered a lot of ups and downs to get here,” said Daniel Hanawalt, business development manager at UEA. “Economic downturns, import/export challenges, and more. But we’re proud that we’ve remained a family-owned company based in Iowa since 1952.”

For 65 years, UEA has put a focus on solving problems from the inside out — using engineering to improve performance and efficiency.

“We’ve been very purposeful about the products we do and don’t offer,” Hanawalt said. “We engineer very specific components that make an impact on our customers’ equipment quality, durability, and capabilities.”

UEA started as a supplier to the construction and utility industries, and diversified as they identified additional verticals suffering from the problems they had the expertise to solve.

“We’re still very much in the construction sector, but we’re also heavy in the wind, ag, forestry, oil and gas, and industrial equipment industries,” Hanawalt said. “Our team is great at identifying new applications for our products and finding customers willing to partner with us on engineering and testing.”

UEA’s engineering team is always working on new product ideas. Currently in the works are wind slip ring innovations, set to be finalized in the next 12 months. Additional applications for the aviation and medical industries are being investigated as well.

“We’re excited for what’s to come,” Hanawalt said. “New technology, new industries, new opportunities.”

Source: UEA

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

# CONSTRUCTION

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## Demag® PC 3800-1 Pedestal Crane provides versatility

The new Demag® PC 3800-1 Pedestal Crane offers extended possibilities in lifting performance and lifting abilities. It provides access to jobsites previously not reachable with a standard crawler model. The PC 3800-1 boasts strong load charts, especially with main boom-only configurations, helps reduce ground preparation, and is easy to transport.

Applying the PC 3800-1 can significantly reduce the amount of time needed to prepare a jobsite for crane operation. Typically, crawler cranes require an adequately leveled supporting ground (slope of 0 to 0.3 degrees) over a large area to achieve the nominal lifting capacity — leading to extensive ground preparation before the lift job. In contrast, the PC 3800-1 only needs four spots to be prepared for the outrigger supports, which do not need to be perfectly leveled as the outrigger cylinders can compensate some tolerance on the ground's flatness — up to 2.1 degrees with a 12 x 12 meter outrigger base. On top of this, existing pile foundations can be used as outrigger supports for the PC 3800-1 when providing sufficient stability. This setup makes the equipment especially beneficial on jobsites where ground layout and structure already exist, which is often the case on harbor quays and refineries, as well as when installing bridges from river banks.

The new pedestal crane features hydraulic extendable and foldable outriggers that can be positioned at 12 x 12 meters and 14 x 14 meters with all configurations including Superlift, and 16 x 16 meters without Superlift. It offers additional possibilities for long-reach lifts where the lifting capacity of a crawler crane would nor-



The new Demag® PC 3800-1 Pedestal Crane offers extended possibilities in lifting performance and abilities. (Courtesy: Terex)

mally be limited. The PC 3800-1 also provides increased lifting performance in several configurations or requires less counterweight for the same or slightly higher lifting capacities. Less counterweight means fewer trucks, translating into significantly reduced transportation costs.

For additional versatility, Demag has also developed an adapter to connect the carbody (center pot) of the crane to a self-propelled modular trailer or axle lines. Axle lines are commonly found on jobs involving lifting bridge sections, gantries, or wind-turbine assemblies, which means that the crane can be easily relocated on a jobsite partially rigged, while leveraging the use of axle lines.

Depending on road regulations, the Demag PC 3800-1 equipped with axle lines can be adapted easily to match a 12 metric ton load per axle or to have a cross vehicle weight below 100 metric tons. This can be done with many axle

lines from multiple manufacturers. All a customer would need are axle lines with matching adapters between the carbody (center pot) and axle lines.

Other optional accessories for the Demag PC 3800-1 pedestal crane include a quick connection to un-deck the superstructure from the chassis, and different sizes of outrigger mats.

The PC 3800-1 can be purchased as a complete crane, or the carrier only can be purchased as a retrofit option for the Demag CC 3800-1 crawler crane and its predecessor, Superlift 3800. The quick connection system allows efficient switching between crawlers and pedestal carrier on Demag CC 3800-1 cranes with or without the Superlift, and is compatible with wind-turbine combinations, as well as Boom Booster kits. ↪

Source: Terex

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



The project used the CS Recorder, which has DP2 dynamic positioning; the Q1000, a powerful remotely operated vehicle (ROV) jet trenching system; as well as a skilled onshore and offshore engineering team. (Courtesy: Global Marine Group)

## CS Recorder completes cable reburial project in three weeks

Global Marine Group (GMG), a leading provider of offshore engineering services to the renewables, telecommunications, and oil and gas industries, announced recently that it has successfully completed a remedial cable burial project for Prinses Amaliawindpark (PAWP), a wind farm off the Netherlands' West Coast. PAWP covers an area of about 14 square kilometers and includes 60 wind turbines connected by eight in-field cable strings that converge at the central offshore high voltage station.

The project, operated by Eneco, (an energy company responsible for generating and supplying sustainable energy originating from wind, heat, biomass, and solar farms) was completed on schedule and in conjunction with operational and safety standards. Upon completion, the customer described the outcome as having met 'superb standards.'

GMG's first project with Eneco has been executed by CWind, which is part of GMG and is responsible for delivering the company's power capabilities. The contract was secured, in part, due to GMG's proven track record of completing complex cable burial projects and to having the trenching equipment already mobilized for rapid deployment. The project used CWind's in-house resources including the CS Recorder, which has DP2 dynamic positioning; the Q1000, a powerful remotely operated

vehicle (ROV) jet trenching system; as well as a skilled onshore and offshore engineering team.

The 28-kilometer shore-connection cable responsible for delivering power to the onshore substation was installed in 2007 and was trenched below the seabed to depths of up to three meters. Natural movement of the seabed in the subsequent 10 years reduced its burial depth. As such, the main objective of the project was to rebury the cable to ensure its protection in commercial waters, and to comply with the site's permit requirements.

"We are extremely pleased with the work carried out for us by the CWind team," said Jeroen Achterberg, Eneco project manager. "With a 100-percent clean safety record and high levels of safety awareness during the reburial project, the results led to the project being completed within schedule and to superb standards."

"Key to the success of the PAWP assignment was our ability to respond quickly to the client's requirements by drawing on available in-house resources and, of course, our wide experience in offshore wind farm engineering," said Lee Andrews, managing director of CWind. "We completed the project in just three weeks with utmost safety and efficiency — great work by all concerned." ↵

*Source: Global Marine Group*

For more information, go to [www.globalmarine.co.uk](http://www.globalmarine.co.uk)

## Arkona completes electrical offshore substation assembly

Fewer than three weeks after laying the first block, the STX France team has laid the third and last block of the Arkona project (a joint venture of E.ON and Statoil with transmission system operator 50 Hz) electrical offshore substation topside onto the transportation barge in the dry dock of the yard in St.-Nazaire.

In the meantime, the offshore works at the Arkona wind farm site have started with the installation of the four piles of the substation jacket foundation.

The substation is one of the biggest HVAC (high voltage alternating current) substations ever built — 5,000 tons (4,000 tons topside and 1,000 tons jacket), transmitting a total of 385 MW power — and will be delivered in 2018. The project is running according to schedule.

The three blocks of the topside are now assembled on the barge, which will be used for the transport offshore in spring 2018. Equipment installation and commissioning will continue until 2018 on the barge in the dry dock in St.-Nazaire. The jacket fabrication is in progress in a dedicated workshop in Saint-Nazaire.

Recently, with STX and subcontractor SHL, the first part of the offshore installation was in the Baltic Sea. SHL heavy-lift vessel Oleg Strashnov has installed the pile foundation for the jacket. Due to close collaboration of all involved parties, the project is on schedule.

A full EPCIM contract makes STX France one of the major European industrial stakeholders of the energy transition. From the contract award in July 2015 up to the fabrication start, STX France team has carried out the design of Arkona electrical substation. Building of the topside and the jacket has been realized in the offshore-energy dedicated workshop of STX's St.-Nazaire yard. The contract includes the transport, the installation, and one-year maintenance period.

Finally, the biggest single lift for an HVAC substation so far — 4,000 tons — will be carried out next spring. This will be a key achievement in the offshore wind market. ↵

Source: 4C Offshore

For more information, go to [www.4coffshore.com](http://www.4coffshore.com)



A Connex cast resin joint.  
(Courtesy: Pfisterer)

## Pfisterer to network EA1 wind farm

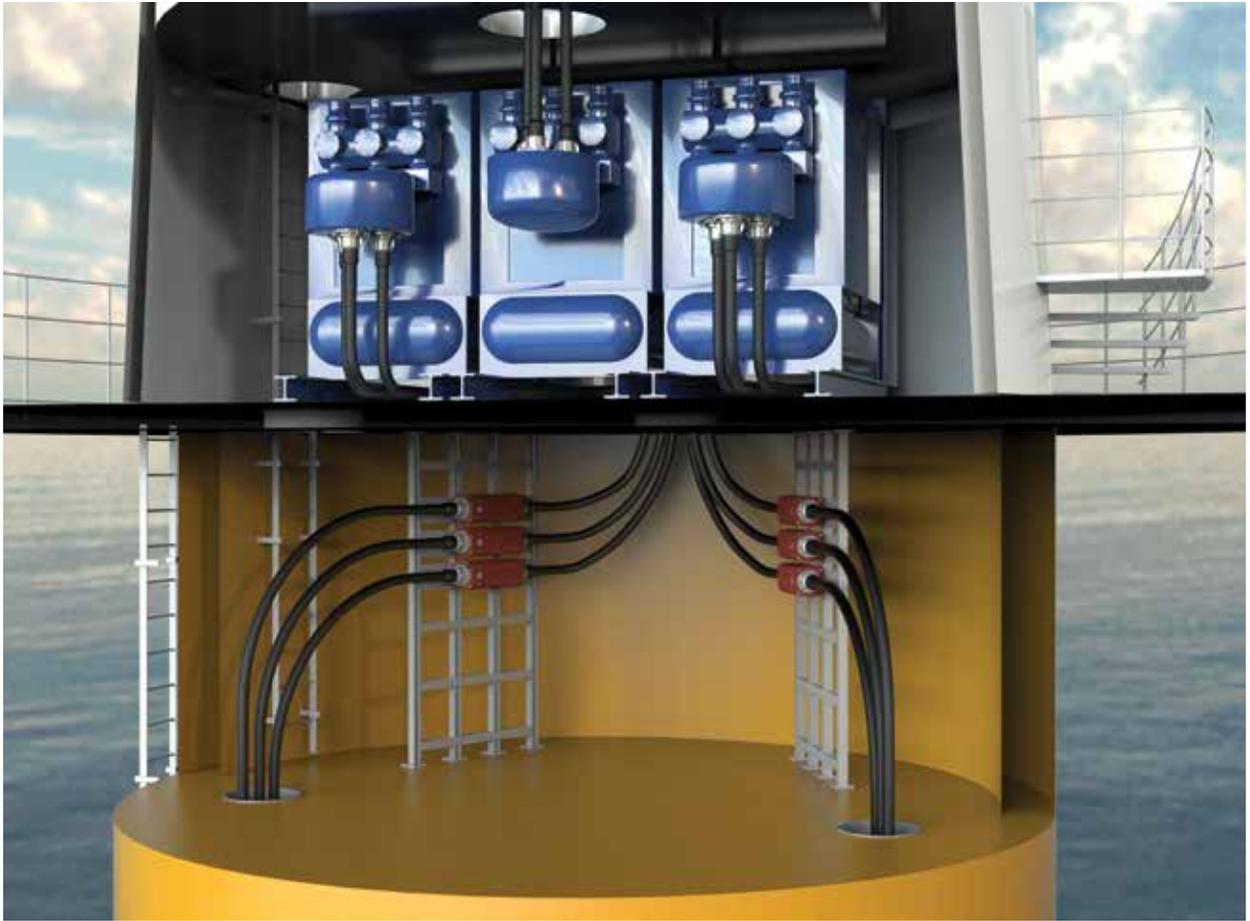
In cooperation with British cable manufacturer JDR, Pfisterer has received the order for the delivery of Connex cast resin joints and Connex plug connectors for up to 72.5 kV for the networking of the new East Anglia ONE (EA1) wind farm. In the initial phase, the new wind farm includes the construction of 102 Siemens turbines with total output of 714 MW. Because of the high output level, the networking will take place with 66 kV. Pfisterer is the only manufacturer with a solution that has proven itself for 20 years in the offshore area.

The new East Anglia ONE wind farm of operator ScottishPower Renewables is being constructed 43 kilometers from the coast of Suffolk in the southern North Sea, and is in the axis between Amsterdam and London. It will be capable of supplying about 500,000 households when it reaches its planned completion in 2020. 102 Siemens turbines, each with 7 MW, will be set up from the middle of next year, and will be connected via two converter stations in a 66 kV network. East Anglia ONE is the first large-scale wind farm to be set up with this voltage level.

“Because the efficiency and output of wind turbines are constantly on the increase, wind farms all over the world are changing from the previous 33 kV networks to 66 kV networks,” said Peter Müller, senior sales manager at Pfisterer. “We have already had a suitable connection for this output range for connecting the inter-array cables to the turbines for 20 years with the size 4 Connex cast resin joint, and the Connex plug connector. The inner cone technology is ideal for this level of capacity, which is why we are receiving many inquiries at present.”

### MORE FLEXIBILITY

ScottishPower Renewables is also convinced by the solution. The inter-array sea and tower cables are connected with the cast resin joints in the lower tower section of the wind turbines. The dry, i.e. gas-free, Connex cast resin joints from Pfisterer are solidly insulated, pluggable, touch-safe, resistant to salt water and UV radiation, and are also submersible. They are offshore-certified by classification company DNV GL and do not require any additional protection. Their integrated longitudinal water barrier prevents water that is entering because of a cable fault from getting into the other connected cable. Also, each phase is connected using a separate joint, therefore making positioning and installation in the tower much more flexible. This also makes it possible for the Connex joint to be re-installed and re-used without having to replace



The solidly insulated, pluggable Connex joints make installation in the tower easier, faster, and more flexible. (Courtesy: Pfisterer)

the entire submarine cable in the event of a fault. Pfisterer has been established in the offshore area for decades and provides a complete range of products for all voltage levels from 12 kV to 550 kV with the Connex family. In this way, the entire cabling within a wind farm can be carried out using the same tried and tested technology — from the submarine cable to the converter platform.

### COOPERATION WITH JDR

Pfisterer received the order for the delivery of the HV fittings in close cooperation with cable manufacturer JDR. The presentation of the Connex solution to ScottishPower Renewables also took place in cooperation between the two companies. This was preceded by type testing of the JDR submarine cables in combination with the Connex fittings, which was immediately successful. In April, JDR was commissioned to supply more than 155 kilometers of inter-array cable by VBMS (UK), including the connecting fittings from Pfisterer. VBMS is a globally experienced

offshore installer, and is responsible for the construction of the wind farm.

“We are delighted that we were able to convince ScottishPower Renewables and VBMS with our experience and the tried-and-tested Connex solution. The implementation of East Anglia ONE with a 66 kV network is a flagship project for the industry, and proof that the entire technology that is required for global conversion to 66 kV is available, from the transformer to the switchgear, and also for transmission,” said Karl McFadden, Pfisterer UK project leader.

Pfisterer is a competent partner for cable manufacturers and offshore companies, and provides a continuous solution from the inter-array connection to the cabling of the platform with Connex. The products in Pfisterer’s IXOSIL series are available for the shore connection. ↵

*Source: Pfisterer*

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

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## Strong Wind from the North

*CanWEA's annual wind show will tackle energy transition as it salutes the present and looks to the future.*

By Kenneth Carter  
Editor | Wind Systems

The Canadian Wind Energy Association's annual wind power show is October 3-5 in Montreal, and it has evolved quite a bit since CanWEA began in 1981.

"It's the largest show in Canada," said CanWEA President Robert Hornung. "It's not just the largest wind-energy show; it's the largest show related to any renewable energy source in Canada. Both from an attendee perspective and an exhibition perspective, it really is the one-stop shop for anyone who wants to get introduced to the Canadian wind-energy industry and what opportunities might exist there."

The theme behind this year's show is "energy transition."

"It's driven by recognition that the electricity grid and the electricity system is undergoing some very fundamental changes at this time, and being driven by a number of different things such as advances in technology and growing environmental concerns," Hornung said.

Wind is riding a tremendous wave in Canada, according to Hornung, with energy produced from wind being the largest source of new generation in Canada for more than a decade.

"We're now the eighth largest wind-energy producer in the world," he said. "And we've really only scratched the surface."

At the conference, officials will discuss what that energy transition means for wind in terms of emerging opportunities that wind energy can

take advantage of, Hornung said.

"I think the answer, which we will be exploring over the course of the conference, is that the future is very bright for wind, and it will play a growing role in helping to ensure that Canada has viable and clean electricity," he said.

Conference sessions will tackle this topic head on.

"We will spend some time envisioning what the electricity grid will look like in 2050," Hornung said. "And we'll hear from companies in terms of what they're doing today to prepare for that future. We're going to look at some of the drivers for future growth in wind energy and renewable energy going forward through electrification, and who are involved in those efforts."

Wind won't be challenged by technology, according to Hornung. If anything, it will be challenged by rules and regulations within the electricity sector, which were built to support an antiquated electricity grid.

"That element of the transition, in many ways, will be one of the most challenging elements of the transition," he said. "And so we want to explore that theme as well."

In more detailed sessions, attendees will explore the Canadian wind-industry fleet, as well as look at wind-resource assessment, a whole range of operations and maintenance issues, and the opportunities to export wind energy to the U.S., according to Hornung.

"We saw a really strong set of submissions from Canada into the recent Massachusetts RFP," he said. "Over 3,100 MW of wind en-

ergy were bid into that process."

The annual show has come a long way from its humble beginnings, according to Hornung.

"There's always been an annual event like this," he said. "In the early days, it started as more of an academic conference, where researchers would share information about technology and wind-resource assessment. As the industry started to get a foothold, then you started to see an exhibition develop, particularly as wind-project developers wanted to make their names known."

As the industry grew, the exhibition side shifted to showcase not only developers, but also manufacturers and components suppliers.

"I started at CanWEA in 2003, and the CanWEA conference in my first year here was in Pincher Creek, Alberta. There were 300 people at the event," Hornung said. "The industry has grown and matured. It is now very much mainstream. It is very much a business. And I think the conference has grown and evolved to reflect that. Now, we expect 1,500 delegates. We expect close to 150 exhibitors."

Wind continues to be a vibrant industry with a strong future, according to Hornung, and the conference reflects that.

"It's gone through a tremendous evolution, but we're very proud of the fact that it remains *the* event in Canada to explore wind energy and the opportunities and challenges that it faces," he said. "And it's an event that's a lot of fun." ↵

For more information, go to [windenergyevent.ca](http://windenergyevent.ca).

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