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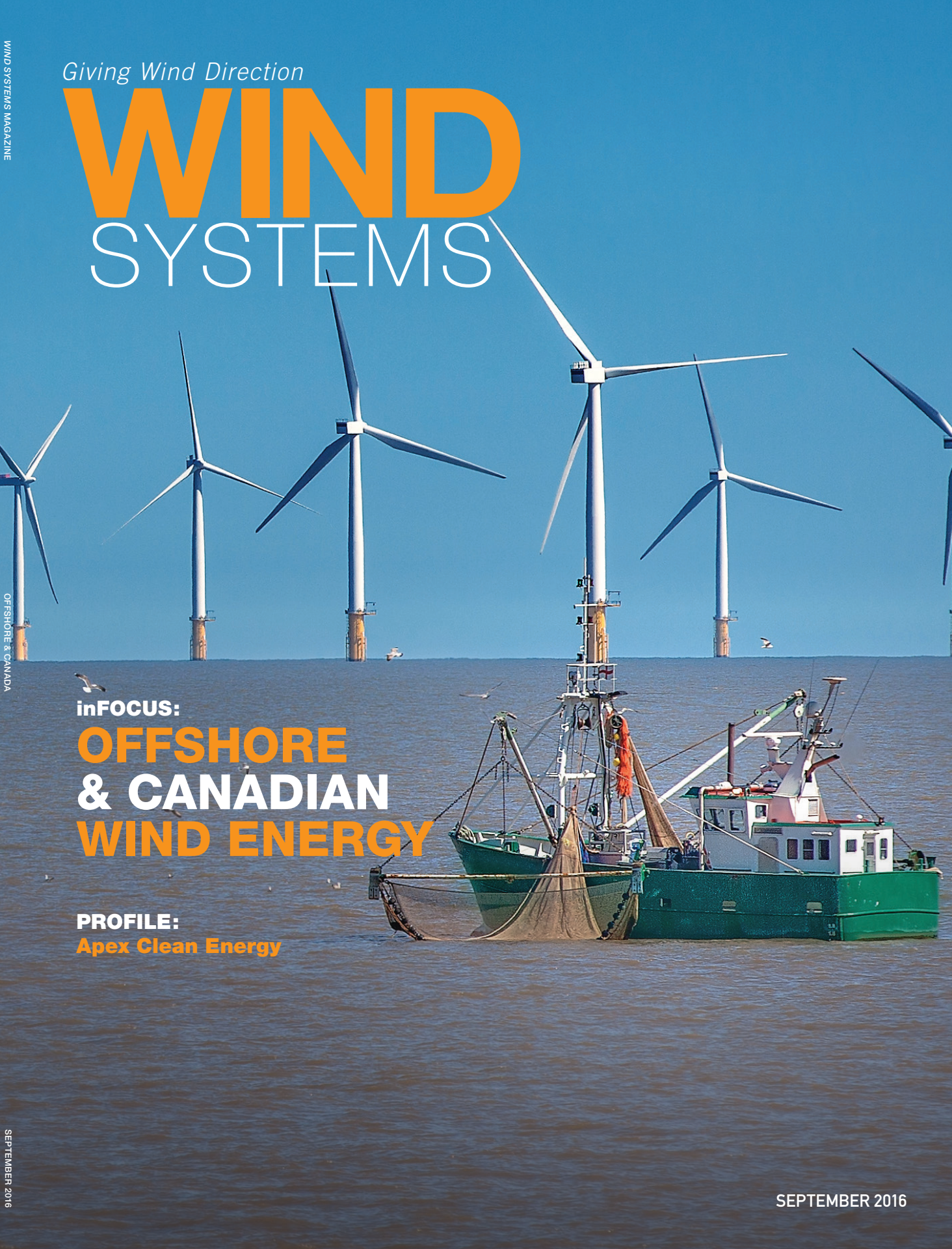

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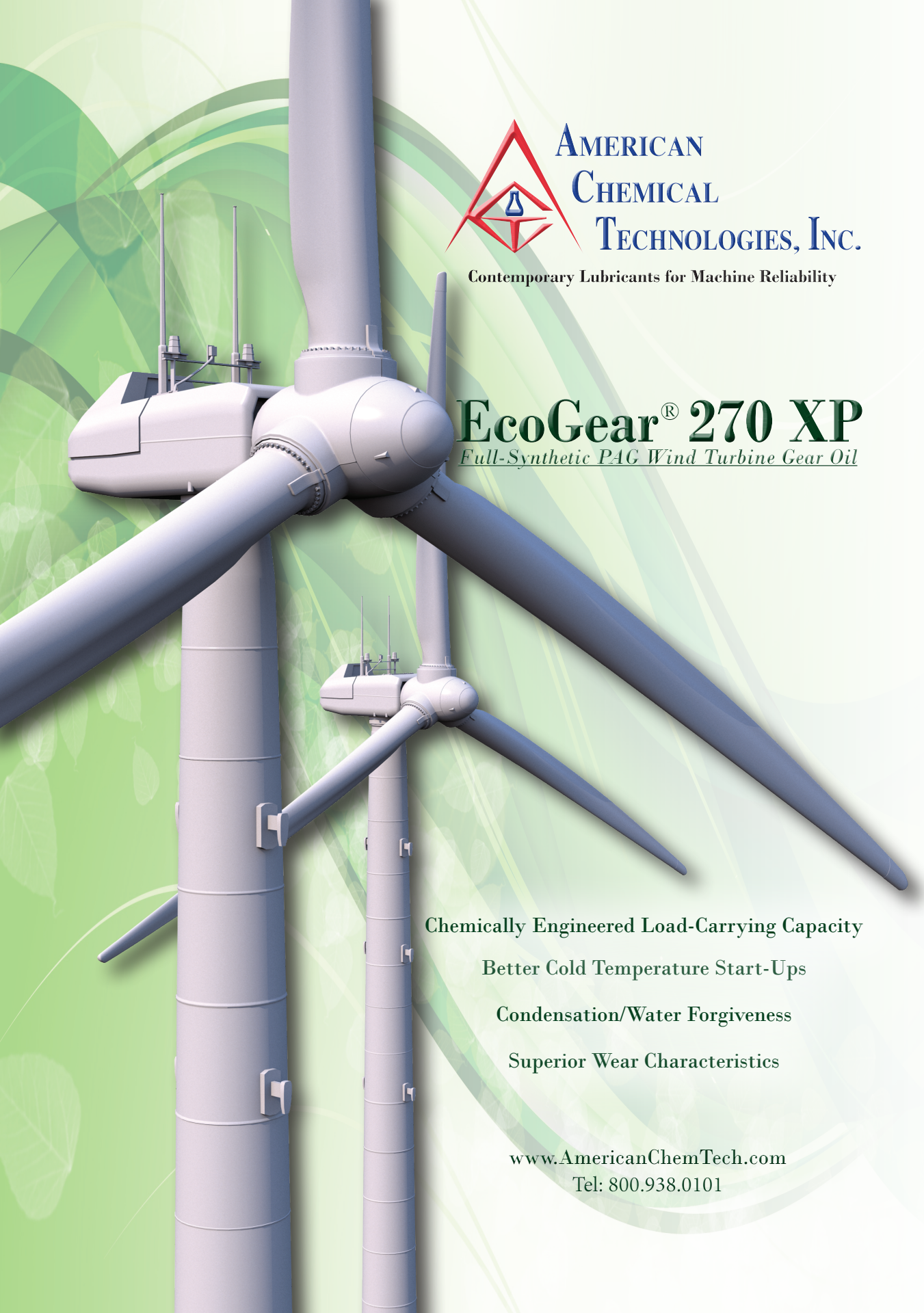

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Looking North for Solutions

Canadian wind energy is integral to a North American transition to a clean-energy economy.

By Jean-François Nolet

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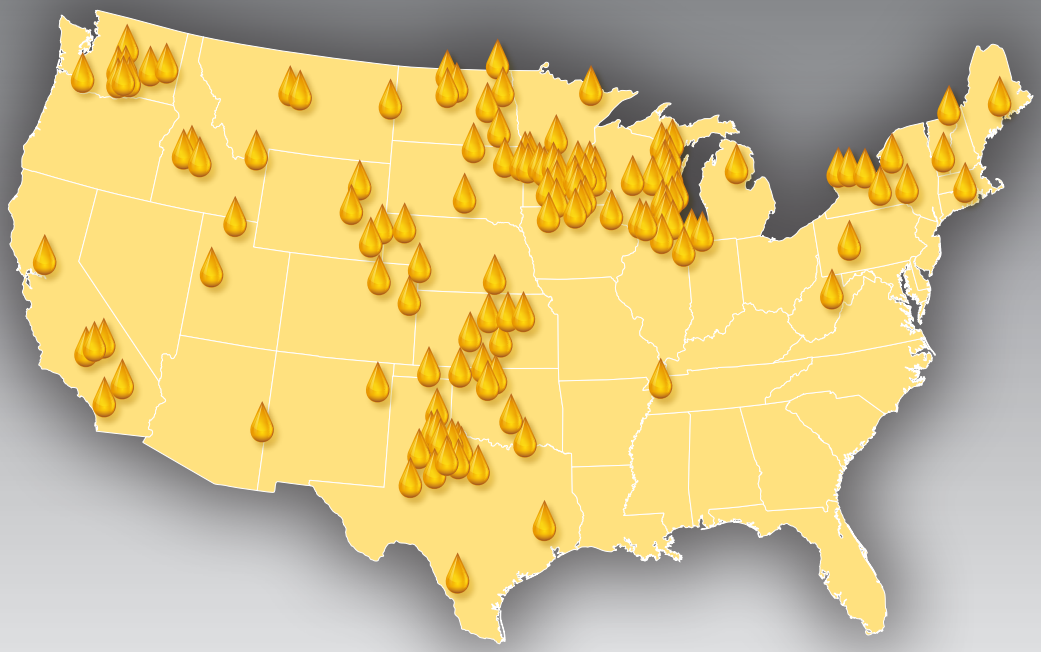
Wind Systems (ISSN 2327-2422) is published monthly by Media Solutions, Inc., 266D Yeager Parkway Pelham, AL 35124. Phone (205) 380-1573 Fax (205) 380-1580 International subscription rates: $72.00 per year. Periodicals Postage Paid at Pelham AL and at additional mailing offices. Printed in the USA. POSTMASTER: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

Cover Photo: Courtesy of iStock



EDITOR'S DESK

SEPTEMBER 2016

Offshore Windpower and CanWEA Take the Stage

Kenneth Carter, managing editor
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Offshore wind power — a reality in Europe and other overseas markets for years now — is close to being a reality in the U.S. as well.

Block Island Wind Farm off the coast of Rhode Island is on schedule to become the first offshore wind farm in the U.S. when it goes online later this year.

And since AWEA Offshore Windpower 2016 is happening in Warwick, Rhode Island, there will no doubt be much discussion about the first U.S. wind farm to connect to the grid. The show is October 25-26, and a lot of topics on the schedule should provide a fascinating look at offshore wind — both in the present and the future. In this issue of *Wind Systems*, we have a few articles about offshore wind to get readers in the mood for the show. We talk with Walt Musial, manager of Offshore Wind and Ocean Power Systems at the National Renewable Energy Laboratory. He is scheduled to chair a panel at Offshore Windpower on floating-wind technologies. In this month's Conversation, Musial shares his expertise on offshore wind power and what people might expect from his panel. We also have an article from Jim Bennett, chief of the Office of Renewable Energy Programs at the Bureau of Ocean Energy Management. He talks about major milestones and the future outlook of offshore wind in the U.S.

But Offshore Windpower isn't the only major tradeshow on deck in the coming months. On November 1-3, the 32nd annual CanWEA Annual Conference and Exhibition is happening in Calgary, Alberta, Canada.

This year's conference will host about 1,500 attendees representing topics that include: project developers, manufacturers, federal, provincial and municipal governments, utilities, consultants, communities, and students.

To get Canadians — and Americans as well — in the mood, Jean-François Nolet with the Canadian Wind Energy Association (CanWEA) shares his insights on how Canadian wind energy is integral to a North American transition to cleaner power. And representatives from the Wind Energy Institute of Canada (WEICan) take a look at a project that will help create a common database for Canadian wind farms.

In addition to our focus on wind power both offshore and in Canada, our Company Profile is with Apex Clean Energy. A relatively new company in name, Apex has been a market leader in the world of renewable energy across the country with assets under management hitting the $2 billion mark.

And last, but not least, in our Maintenance section, Siemens reveals how it has teamed up with Herchenbach to build temporary warehouses at turbine sites where repairs will be made onsite.

Those are a few highlights of this month's *Wind Systems*, offering some timely information on the state of wind energy from the New England coasts to Canada, our neighbor to the north. So if you're headed to a show, may the wind be at your back.

Thanks for reading.

CONTRIBUTORS

Jim Bennett is the chief of the Office of Renewable Energy Programs in the Bureau of Ocean Energy Management (BOEM), U.S. Department of the Interior. Bennett has more than 35 years of experience with environmental and energy issues focusing on federal outer continental shelf (OCS) programs, including oil and gas, sand and gravel, and renewable energy. Prior to becoming the program manager for renewables, Bennett led BOEM's Division of Environmental Assessment, overseeing BOEM's compliance with NEPA and other environmental laws.

Jean-François Nolet is vice president of policy and communications at the Canadian Wind Energy Association (CanWEA). Nolet joined CanWEA in 2008 as policy manager for Québec and the Atlantic Region and was appointed to the position of vice president of policy and government affairs in 2012. His work has been instrumental in providing support to the various stakeholders in Canada's wind-energy industry, from project developers to manufacturers and service providers.

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Report: Canada Can Reliably Integrate Large Amounts of Wind Energy

Canada can get more than one-third of its electricity from wind energy without compromising grid reliability — and at the same time realize economic and environmental benefits, according to a wind-integration study issued by the Canadian Wind Energy Association (CanWEA).

The *Pan-Canadian Wind Integration Study* (PCWIS) is the first to take a detailed national, system-level look at the production costs and benefits of high wind-energy penetration in Canada and helps identify potential operational challenges and the most efficient solutions.

The study presents utilities, system operators, and policymakers with data they've never had access to before. It provides a technical platform that can be used to inform the development of provincial, regional, and North American energy policies that are realistically achievable and technically sound. The study serves as a solid foundation for further research and analysis in this area.

"Understanding the implications of integrating a greater amount of wind energy into Canada's electrical system contributes to our goal of developing clean-energy resources and moving our country towards a low-carbon economy," said Jim Carr, Canada's minister of Natural Resources. "The Government of Canada supports clean energy technologies that encourage energy efficiency, bring cleaner renewable energy onto a smarter electricity grid, and promote sustainable economic growth and competitiveness."

The study is timely, given Canada's commitment to shift to a low-carbon economy. It considers four pan-Canadian scenarios with wind energy supplying between 5 percent and 35 percent of the country's forecast system load in 2025, including power flows across the border. The analysis concludes that 20-percent and 35-percent wind penetrations can be achieved in a reliable and efficient manner.

"Affordable, reliable, zero-emission electricity generation, like wind energy, will reduce greenhouse gas emissions by helping to clean the electricity grid so that clean electricity can be used to power vehicles, buildings, and industry, and generate export opportunities," said CanWEA President Robert Hornung. "This technical study contributes to our understanding of how we can make the most effective use of a valuable, but underutilized, clean-energy resource to make the kinds of deep emissions cuts ultimately needed to address climate change."

RECOVERING THE COSTS

The findings speak to the costs of integrating higher penetrations of wind energy. With respect to the estimated cost of new transmission tie-lines between provinces and between Canada and the U.S. needed to accommodate high penetrations of wind, it shows costs would be recovered within a few years. As well, the additional backup generation required to balance wind energy's variability is shown to be modest, amounting to a small fraction of total wind-generating capacity.

At the installation levels studied, wind production displaces output from the most expensive and least efficient power plants, which the scenarios show to be mostly natural gas- and coal-fired generation. As fossil fuels are displaced with zero-carbon wind energy, greenhouse gas emissions are reduced.

The economic benefits of the wind resources in the study scenarios have two components: Firstly, there is a reduction in production costs in Canada as a result of displacing thermal generation, which has fuel costs to consider, with wind energy that has no fuel costs. Secondly, there are revenues from increased exports to the U.S. The study did not quantify investment costs of new generation or its interconnection.

"While the benefits of wind energy are widely known, this nearly three-year-long project helps provide decision makers with insights into how those benefits can be most efficiently realized as Canada takes steps to make use of this vast renewable resource," said Bahman Daryanian of GE Energy Consulting Group, who was the study's technical director and project manager.

"The project confirms Canada has high-quality wind resources in all provinces, and makes laudable contributions to the study and understanding of wind-integration issues," said Charlie Smith, executive director for the Utility Variable-Generation Integration Group (UVIG) and an active member of the study's Technical Advisory Committee. "A notable example is its examination of what changes can be made in the operations and forecasting of existing thermal and hydroelectric generation to take advantage of available wind energy in a cost-effective way."

PARTNERSHIP PROJECT

"The project team included among their efforts a number of sensitivity analyses to confirm the PCWIS results are robust and dependable; the Canadian wind resource is outstanding and matches the load over the course of a year remarkably well," said DNV GL's Dariush Faghani, the project adviser to CanWEA.

GE executed the project in partnership with Vaisala, Electranix, EnerNex, and Knight Piésold. Guidance was provided by CanWEA, DNV GL, and a Technical Advisory Committee that included representatives from: Alberta Electric System Operator (AESO), BC Hydro, Hydro-Québec, Independent Electricity System Operator (IESO), ISO-New England (ISO-NE), Manitoba Hydro, Midcontinent Independent System Operator (MISO), National Renewable Energy Laboratory (NREL), New York Independent System Operator (NYISO), SaskPower, Utility Variable-Generation Integration Group (UVIG), and Western Electricity Coordinating Council (WECC).

The PCWIS was co-funded by CanWEA and Natural Resources Canada (NRCan), through the ecoEnergy Innovation Initiative. Environment and Climate Change Canada provided data and modeling input. The contents of the study do not necessarily reflect the opinions of the Government of Canada nor those of the Technical Advisory Committee members or the organizations they represent.

Source CanWEA

For more information, go to www.canwea.ca

Wind Investment Grows During the Second Quarter

U.S. wind-industry activity approached record levels in the second quarter as utilities and other purchasers locked in record-low wind costs.

More than 18,200 MW of wind-power capacity are now under construction or in advanced stages of development, according to the American Wind Energy Association's (AWEA) *U.S. Wind Industry Second Quarter 2016 Market Report*.

Recognizing the value of low-cost, reliable, stably-priced, and zero-emission wind energy, major utilities announced plans during the second quarter of 2016 to develop and own up to 2,600 MW of new wind-energy generating capacity.

"There's never been a better time to buy American wind energy," said Tom Kiernan, CEO of AWEA. "Smart utilities and other customers are locking in prices at record lows by starting construction this year to qualify for the full-value PTC. The industry is thriving thanks to policy stability, and we appreciate support

> Wind power has bipartisan support from governors, members of Congress, and elected officials at all levels.

from champions in Congress for a multi-year extension of the PTC. Wind power supports 88,000 well-paying jobs, and the wind-turbine technician is the fastest growing profession in the U.S. This is what an efficient, performance-driven policy delivers — more low-cost clean energy and the American jobs that make it happen."

EARLY WIND INVESTMENT

Congress passed a multi-year extension of the performance-based wind-energy Production Tax Credit (PTC) with a bipartisan vote late last year. The multi-year PTC extension encourages utilities to invest in wind early, so they can scale-up clean energy while making the most of the full-value PTC. The 2.3 cents per kilowatt hour PTC is scheduled to decrease to 80 percent of that value for projects that start construction in 2017, 60 percent in 2018, and 40 percent in 2019.

After emerging from several years of policy uncertainty that placed American jobs at risk, wind energy is on track to grow from supplying about 5 percent of U.S. electricity today to 10 percent by 2020, and 20 percent by 2030.

The 18,200 MW of current activity includes more than 12,450 MW of wind projects now under construction, with 3,000 MW in new construction announcements during the second quarter, an increase of 23 percent over the first quarter of 2016. Kansas led the nation this quarter in new construction announcements at 778 MW, followed by Iowa at 551 MW and North Dakota at 400 MW.

Enel Green Power North America Inc.'s (EGP-NA) 400 MW Cimarron Bend wind farm in Kansas is among the projects that started construction this quarter to meet demand for wind energy from utilities and emerging corporate buyers.

Cimarron Bend will supply half of its power to the Kansas City Board of Public Utilities, and half will go to Google, once completed.

"For EGP-NA, the first half of 2016 has been marked with rapid growth, including the announcement of more than 720 MW of new wind capacity under construction," said Jack Thirolf, senior director of regulatory affairs for Enel Green Power North America. "Not only are we seeing capacity growth, but also diversification of power purchasers as more commercial and industrial customers are attracted to the competitive pricing and long-term stability that clean wind energy can deliver."

Even larger projects are on the way. Utilities announced large scale wind-power investments during the second quarter, including the up to 2,000 MW Wind XI project by MidAmerican Energy in Iowa, as well as the 600 MW Rush Creek project by Xcel Energy in Colorado.

UTILITIES AND PPAS

Utilities also disclosed more than 1,800 MW of wind Power Purchase Agreements (PPAs), the second highest volume of announcements in a single quarter since the beginning of 2014. Other utilities released requests for proposals and requests for information for thousands of megawatts of new renewable capacity, which are likely to lead to new wind purchases in the near future. These an-

nouncements illustrate growing utility appetite for wind energy to help keep costs low for ratepayers while also meeting clean energy targets.

Utilities are vocal in their support of wind power for its consumer benefits:

- Iowa Economic Development Authority on MidAmerican Energy announcement to invest $3.6 billion in Wind XI Project, April 14: "Investments of this scale are viable because federal production tax credits are at their highest level. It makes sense to leverage that benefit to solidify Iowa's leadership in wind energy. (The) announcement continues to build Iowa's legacy in the renewable energy space — and in a very real way, provides economic benefits to all Iowans."
- Xcel Energy, May 31: "The addition of cost-effective renewables that take advantage of the recently extended PTC and ITC can still provide significant savings in power-supply costs for customers."
- Kansas City Power & Light on 500 MW PPA announcement with Osborn and Rock Creek wind projects in Missouri, April 7: "Both of these projects qualify for the federal PTC. This tax credit allows KCP&L to pass savings along to customers, keeping rates lower than would otherwise be possible."

BIPARTISAN SUPPORT

The industry installed 169 wind turbines across four states during the second quarter, representing 310 MW of capacity. Texas led the country with 200 MW of wind capacity installed, followed by Kansas (72 MW), Nebraska (36 MW), and a single turbine installation in Iowa. Across the U.S., cumulative year-to-date installations total 830 MW. The U.S. now has an installed wind-power capacity of 74,821 MW.

American wind power is growing, as is its popularity. Wind power has bipartisan support from governors, members of Congress, and elected officials at all levels. In a divisive election year, several new polls signal wind power's broad support among the American public:

- A March Gallup poll found 73 percent of adults say the U.S. government should "emphasize the development of alternative energy such as wind and solar power" (up from 66 percent in 2011).
- Lazard's Alternative Energy Poll 2016, release in March, shows 90 percent of likely voters favor "expanding wind power" (up 12 points from 78 percent in 2012)
- The same 2016 Lazard poll found 81 percent of self-described conservatives favor "expanding wind power" (up 34 points from 57 percent in 2012).

Federal support in the form of the PTC is important to level the playing field and to keep growing wind power, but state and local policies and adequate access to transmission remain critical to scaling up and delivering low-cost wind energy to more Americans.

A number of states have shown leadership by expanding their Renewable Portfolio Standards (RPS). At present, California, Oregon, Hawaii, Vermont, and the District of Columbia have all increased their target standards to 50 percent renewable energy and beyond. Other states, such as Maryland, Massachusetts, New York, and Rhode Island have passed or are actively considering other big increases to their standards.

Strengthening the electric grid provides a number of benefits by providing consumers with lower-cost and more reliable power and greater access to renewable energy. Investing in more transmission capacity makes the grid more resilient and increases access to wind resources in low-cost areas.

Source AWEA

For more information,
go to www.awea.org

New York Gets Historic Clean-Energy Standard

The New York Public Service Commission recently issued an order requiring 50 percent of New York's electricity come from renewable, clean energy resources such as wind and solar power by 2030.

A separate section of the Clean Energy Standard order establishes an incentive program to keep upstate nuclear power plants operating through 2030. The nuclear incentive level was established only for the next two years and can be adjusted up or down after 2018 based on market conditions. Output from the nuclear plants will not count toward the 50 percent renewables mandate.

New York, with the country's third-largest population, joins California, America's most populous state, in having set a "50 by '30" renewable electricity benchmark. This also means that a total of five states (New York, California, Vermont, Hawaii, and Oregon) and the District of Columbia have established a requirement to reach 50 percent renewable energy levels or higher.

Source Natural Resources Defense Council

For more information,
go to www.nrdc.org

PROFILE

Apex Clean Energy

Renewable energy company delivers large-scale, clean-energy solutions across the U.S.

By Kenneth Carter

Race-car drivers say the point of acceleration begins at the apex of a curve. This is how Apex Clean Energy chose its name — a name consistent with its mission to accelerate the shift to clean energy.

Although Apex was officially founded in 2009, its roots go much deeper.

"I like to say it's the next generation of a company called Greenlight Energy," said Steve Vavrik, chief commercial officer for Apex. "Greenlight was founded in 2000 by our CEO, Sandy Reisky, as an independent wind-energy company that would go on to develop $750 million of facilities with a combined generating capacity of 450 MW."

Greenlight was acquired by BP Alternative Energy in 2006. That set the stage for Reisky and the leadership team to launch several new clean-energy companies including solar, waste-to-energy, and direct-drive wave energy, followed by Apex in 2009. Further fueling Apex was capital from the sale of solar-focused Axio Power to SunEdison in 2011.

"They are all related through the consistent vision and the continued commitment of the core group of investors who helped launch Greenlight more than 15 years ago," Vavrik said.


Source: Apex

Turbine blades are transported to the Canadian Hills Wind construction site in Oklahoma on July 23, 2012.

Apex Clean Energy

Founded:
2009

Headquarters:
Charlottesville, Virginia

Website:
apexcleanenergy.com

THE POWER OF THE PIPELINE

Many of the executives responsible for guiding Greenlight remained on the team when Apex was founded.

The key to its evolution as a market leader — Apex brought more wind power online than any other company in 2015 — is a guiding principle to invest in a diverse portfolio of high-quality energy resources. As such, Apex has built the largest pipeline of active wind-energy projects of any company in the U.S., spanning 25 states and representing more than 12 GW of potential.

"We're not focused on any one region, we have established a position in each of the major markets," Vavrik said.

As Apex has grown, it has successfully attracted a team of more than 250 professionals with expertise in wind power going back 10 to 15 years — including Vavrik, who said he's been in the power industry since 1996.

So even though Apex is not as established as the larger utility players, the leaders have been at it for a long time, helping explain its fast-evolving track record in developing, financing, and delivering large-scale, clean-energy solutions.

Along the way, Apex has installed wind turbines from top suppliers including Acciona, GE, Mitsubishi, REPower, Siemens, and Vestas to translate the potential of the wind to power on the grid.

SINKING COSTS, RISING DEMAND

There have been many changes in the world of power in the past decade or so.

First and foremost, the cost of generating wind energy has fallen 66 percent since 2010 according to the American Wind Energy Association (AWEA). The second major shift is the emergence of a whole new group of customers. In addition to utilities looking to diversify their generation mix and replace retiring coal and nuclear plants, corporations are purchasing clean power directly from developers.

"What is new is the interest from a broad range of Fortune 500 companies looking to enter power purchase agreements, especially technology and retail companies," Vavrik said. "Like any commodity input, electricity prices are a risk that needs to be managed. Failure to do so can directly affect financial performance, especially for those companies operating data centers such as Amazon, Facebook, and Microsoft, where power supply is a significant operating cost."

The stable price of wind energy over a long-term contract is an effective hedge against long-term exposure to energy inflation that also can mitigate the risk of future carbon pricing. Of course, clean energy also addresses the environmental, social, and governance considerations in the boardroom.

The 165-megawatt Cameron Hills Wind facility, about 11 miles north of Brownsville, Texas.

"So the success of clean energy begins with a cost-competitive product with significant hedging advantages, that also addresses mission-driven motivations, where clean energy procurement becomes part of their corporate identity and responsibility to their shareholders and customers," Vavrik said.

CUSTOMIZED SOLUTIONS

The flexibility provided by the Apex pipeline of projects allows companies to optimize their purchase of renewable energy. One such factor is location, as a company may want the power generated near its headquarters or key facilities. At the same time, when a company begins exploring renewable energy procurement, an education process takes place illuminating opportunities to achieve goals that might not be obvious at first.

As an example, Vavrik brings up Steelcase — a forward-thinking furniture manufacturer based in Michigan.

While Michigan has the potential for wind, at the time an appropriate project did not exist in the state to meet the company's need.

So Apex introduced Steelcase to a project in Oklahoma.

Power doesn't actually flow from Oklahoma to Michigan, but Vavrik called investing in such a project having a "bucket effect."

"Imagine the electricity we all use fills a bucket the size of the U.S. A new wind facility fills the bucket in Oklahoma, and Steelcase is utilizing power in Michigan. Overall, the water in the bucket is getting cleaner. Steelcase was able to introduce new renewable power onto the grid, while managing their energy risk, comprehensively meeting their objectives," he said.

Similarly, a company such as IKEA has operations spanning the globe and an objective to make the grid greener through the addition of renewable energy.

"The starting principle for IKEA was focusing on their overall global carbon footprint," Vavrik said. "They had established a clean-energy track record with on-site solar and other investments in eight wind facilities

At the time of its completion in December 2012, Canadian Hills Wind was the largest single-phase wind farm in Oklahoma.

Operations staff at the Hoopeston Wind farm in Illinois. Apex maintains a 24-hours-a-day, 365-days-a-year Remote Operations Control Center in Virginia in addition to staffing its facilities with on-site workers.

outside of the U.S. They sought out Apex to add large-scale U.S. facilities to their portfolio. Working together with Apex, IKEA is on-track to achieving its goals."

In addition to IKEA and Steelcase, Apex has worked with utilities and infrastructure investors including AEP, Southern Power, Google, and First Reserve.

At the end of the day, Vavrik said Apex is delivering value to both utility and corporate purchasers by leveraging a comprehensive suite of services from development to finance to operating and managing the generation facilities over the long-term.

"We want to come up with the power sales agreement that fits precise needs," he said. "So we take a partnership approach."

THE ROLE OF ASSET MANAGEMENT

In most cases, Apex operates and maintains the wind facilities it builds for its owners, delivering comprehensive asset management services over the life of the project.

Apex recently opened a Remote Operations Control Center, which is manned 24 hours a day, 365 days a year.

"The real-time application of complex technology to assess and control the turbines and the flow of power is impressive," Vavrik said. "But it's the quality of our people that make the difference, both in Charlottesville and the teams out on our sites."

As communities take a greater interest in the operation and long-term stewardship of wind farms, the facility managers become critical ambassadors for the project owners. Not only do they perform inspections, maintenance, and data collection, but they also are the primary contact for EMS crews, elected leaders, and environmental stakeholders.

"We aim to be good neighbors; our staff lives down the road from the sites where they work, in the communities hosting our facilities," Vavrik said. "We originated the sites, develop and build them, and the relationship continues through operations."

BATTER UP

Getting a wind farm built and operating doesn't really take that long — six to nine months on average, but the steps to get to that point can take years of planning and development.

Vavrik compares it to a baseball game.

Members of the community gather for a turbine-blade signing at the Hoopeston Wind construction site Oct. 27, 2014.

The first and second innings are all about securing the land. Apex approaches landowners, conducts deep habitat and environmental studies, and builds a land position that captures the wind and extends to the point of transmission interconnection with the grid.

"We're talking about everything from generating income to preserving multigenerational land to tracking multi-season migration patterns of any number of species," Vavrik said.

The third and fourth innings are all about wind data. Beginning with construction of meteorological towers and data comparison with existing weather stations, specific turbine placement is planned.

"The trick is having a long-term data set, and extrapolating the data to the hub height of 80 meters, or 110 meters," Vavrik said. "So that's the art-and-science part where multiple years of data establish the confidence to make a multi-year forecast of the wind resource across seasons."

The middle innings are consumed with projecting the performance of the future facility, gaining interconnection rights, permitting at the local and state level, and identification of customers for the power. The closers are the finance team, who stitch together the capital partners to get the deal done.

"It's a process that can take two to five years, and the community is going to evolve as well," Vavrik said. "That's a critical element here, working to provide information and opportunities for engagement with the local community."

The 98-megawatt Hoopeston Wind facility in Vermilion County, Illinois.

ACCELERATING THE SHIFT TO CLEAN ENERGY

Apex has the capability of offering utilities and companies many options on their path to procuring clean energy. It's a model built on the resource, and bringing the resource to market in ways that dramatically expand the clean-energy footprint across the country.

Wind was America's largest source of new electricity last year, representing more than 40 percent of capacity additions, and it is expected to quadruple by 2030 to supply 20 percent of the nation's electricity.

With wind farms completed in Illinois, Texas, and Oklahoma, and more than 70 wind and solar projects in various phases of development, Apex is poised to accelerate the shift to clean energy.

"I would say everyone here believes renewable energy should become more and more part of our mix if not the entire mix," Vavrik said. "It's inevitable just given the fundamentals of the technology, but we want it to happen faster. So that's what keeps us going."

CANADA

Looking North for Solutions

Canadian wind energy is integral to North American transition to a clean-energy economy.

By Jean-François Nolet

For years, Canada's wind-energy industry has had the potential to expand its market through exports to the United States, but it is only now — bolstered by a perfect storm of supply-and-demand drivers — that the opportunity is finally becoming concrete.

On the U.S. side of the border, state governments and electricity distributors are grappling with the multifaceted challenge of meeting ever-more stringent renewable-energy targets, responding to federal efforts to cut power-plant emissions, and navigating the looming retirement of tens of thousands of megawatts of aging coal and nuclear facilities. Increasingly, they are seeing clean-power exports from Canada as a reliable and cost-effective solution.

The Massachusetts Omnibus Energy Bill is a case in point. The state is looking to Canadian hydroelectricity imports, or hydro, in tandem with onshore wind or other renewable technologies, for as much as 12 TWh of new electricity supply. Its neighboring state, New York, plans to reach 50 percent renewable energy by 2030 and also will need large amounts of clean electricity from Canada.

MEETING THE TARGET

The Obama Administration's Clean Power Plan (CPP), which aims to slash carbon emissions from the U.S. power sector by 32 percent from 1990 levels over the next 15 years, identifies clean-energy exports from Canada as a viable way for states to meet that target. And many will make that choice.

The North American Electric Reliability Corporation (NERC) predicts that, as the plan comes into effect, Canada-U.S. exports will triple. Whether the CPP survives court challenges and November's presidential election remains to be seen, but whatever happens, it is clear U.S. commitments under the Paris Agreement will eventually require it to act to clean up its coal-heavy grid.

It's not surprising that U.S. states are looking north for solutions.

Meeting aggressive targets from in-state wind and solar will be a challenge, especially in the densely populated U.S. Northeast. Siting projects can be difficult; permitting costs are high, and the grid needs additional tools and options to absorb new influxes of variable generation. Coastal states are eyeing offshore wind as a way to meet their clean-energy needs, but that brings a whole other set of issues, ranging from cost to social acceptance.

Canada, meanwhile, produces more than 80 percent of its electricity from emissions-free generating sources, and it already exports about 10 percent of its output to U.S. customers. While the overwhelming majority of that power comes from Canada's vast complex of hydro reservoirs, there is growing recognition on the Canadian side of the border of the advantages of bringing wind energy into the mix.

A BUNDLED PRODUCT

Major players like Emera and Hydro-Québec are talking about using hydro to back variable sources of generation like wind and delivering a bundled product to their U.S. customers.

In Hydro-Québec's case, the utility is testing the waters by teaming with

The 62 MW Glen Dhu Wind Farm in Nova Scotia, Canada.

Chicago-based Invenergy LLC and developers of the proposed Vermont Green Line transmission project in a bid to supply 400 MW of clean energy to Rhode Island, Connecticut, and Massachusetts. Under the proposal, Québec hydro would supplement the output of Invenergy's planned Bull Run wind project in northern New York to ensure a firm block of power is delivered 24 hours a day, seven days a week.

The results of the New England Clean Energy request for proposals (RFP) have yet to be announced, but the Québec government already is running with the concept. Its new long-term energy strategy not only looks to boost exports overall, but it also specifically targets the construction of wind farms in Québec as part of the plan.

ALSO IN THIS SECTION

The 198 MW Wolfe Island Wind Facility in Ontario, Canada.

There are a number of reasons why a wind-hydro bundled product makes sense.

WIND COSTS DROPPING

First, the cost of wind energy has dropped dramatically, falling 61 percent in the past six years alone. Hydro-Québec's most recent wind-energy request for proposals ended in the utility paying just 6.3 cents/kWh for the output of three projects totaling 446 MW. When you take 6.3 cents/kWh wind and combine it with low-cost heritage hydro, it becomes interesting for potential buyers, especially when you consider those prices are in Canadian cents.

A wind-hydro hybrid is also better positioned to meet the requirements of prospective customers who want a green product.

Wind is considered a renewable energy source in most of the U.S., and large hydro is often not. Being sensitive to this difference not only expands the market opportunity for Canadian suppliers, but also pays additional dividends. New York and the New England states may allow large hydro to meet a portion of their clean-energy targets, but unlike wind, hydro does not qualify for potentially lucrative renewable energy credits in those markets.

The bottom line is if Canadian utilities don't incorporate wind into their export product, it represents a lost economic opportunity.

BUILT FOR NEED

Finally, taking advantage of new markets for clean electricity will require building new generation to meet the demand. On that front, wind energy's advantages are clear. Wind-generating capacity can be built incrementally in line with need, and it can be deployed quickly. If permits were started on a new large hydro project today, it would not be built for 15-20 years. Most importantly, however, wind energy is less expensive than any new large hydroelectric project now on the drawing board in Canada.

A new study, sponsored by the Canadian Wind Energy Association (CanWEA) and conducted by an expert team led by GE Energy Consulting, underscores the critical role Canadian wind can play in North America's transition to a clean-energy economy.

The Pan-Canadian Wind Integration Study (PCWIS) examined four cross-Canada development scenarios and found no operational barriers to achieving a 35 percent wind penetration by 2025.

Managing that level of wind on the grid depends heavily on the free flow of electricity across jurisdictions, not just between provinces in Canada, but also across the border with the U.S. It would require 10 GW of new transmission connections between markets, but given that wind would displace more expensive coal- and gas-fired generation in both Canada and the U.S., the operating cost savings would pay for the $3.7 billion capital cost of those lines in just three years.

INCREASED EXPORTS

The opportunity for Canada to economically benefit from increased exports is significant.

For every 1 MWh of additional wind generation produced in Canada, the analysis found that electricity exports from Canada would increase by 0.5 MWh.

From an environmental aspect, benefits would accrue on both sides of the border. At a 35 percent wind-penetration level, Canada would see 32.3 million metric tons of greenhouse gas reductions, while emissions on the more fossil-dependent U.S. grid

The 198 MW Wolfe Island Wind Facility in Ontario, Canada.

would fall by 46.5 million metric tons.

The Pan-Canadian analysis is timely, coming just weeks after leaders of Canada, Mexico, and the U.S. agreed to collectively source 50 percent of North American electricity from clean sources by 2025. Given the U.S. generates 33 percent of its electricity from non-emitting sources of generation and Mexico gets only 18 percent, the target is yet another clear incentive to leverage Canada's tremendous renewable energy capabilities.

And like the PCWIS, the Three Amigos agreement recognizes the importance of inter-jurisdictional cooperation. The pact includes supporting the development of cross-border transmission projects, and conducting a joint study to better understand the planning and operational impacts of integrating ever-increasing penetrations of variable energy sources.

FOUR PROJECTS IN WORKS

Working with the U.S. to build new transmission infrastructure is key.

There are already at least four major projects on the drawing board, including two planned links between Québec and New England, one transmission line increasing transfer capacity between Manitoba and Minnesota, and an underwater cable between Ontario and Pennsylvania.

Removing market barriers with coordinated grid planning and operations is also key.

There is an even more fundamental step required, however, if we are going to close the gap between the potential for Canadian wind-energy exports and getting new wind-energy projects in the ground. We need to get the customer on board.

There are some early-mover states, but for many U.S. decision makers, looking outside their home turf for solutions to their challenges is not always a natural step. Educating American legislators and consumers about what Canada has to offer, and how it benefits the U.S., is essential.

TECHNICAL GUIDE

That is one of the reasons CanWEA teamed with a consortium of industry and government partners to produce a technical guide showing U.S. state-level policymakers how to use clean-energy resources from Canada to comply with the CPP targets, as well as other U.S. environmental policy goals. The report, written by the global economic consulting firm The Brattle Group, helps state policymakers and environmental regulators, public utility commissions, and elected state officials understand their options, but it also provides recommendations for ensuring they meet their objectives in the most cost-effective way.

A policy discussion also needs to take place north of the 49th parallel. Shifting the conversation from pipelines to power lines is a good start, but Canada still has work to do to really seize the clean-energy opportunity.

The Brattle Report shows what U.S. states can do to access carbon-free electricity from Canada, but we need to develop and implement a renewable-energy export strategy to make sure we have the products they want and the ability to deliver them.

Canada may have the cleanest power system in the G7, but the PCWIS demonstrates that it is possible to go much further. That is important because the only way to get the large-scale emissions reductions required to address climate change is to aim for a 100 percent zero-emissions grid and to use that clean electricity to power Canada's vehicles, buildings, and industry, and help our U.S. neighbors do the same.

Syncing Up the Data

Project aims to standardize wind-turbine information in Canada.

By Marianne Rodgers, Alexander Medd, and Tom Levy

At the end of 2015, Canada had commissioned more than 11,000 MW of wind-power capacity, and even more wind farms will be coming online in the coming years. Although the wind industry supplies approximately 5 percent of Canada's electricity needs, to date it has not benefited from a broad and consistent understanding with respect to its performance, especially when compared to data that is available for traditional forms of energy.

While some sources of information do exist with regards to wind-energy data, these tend to conflict with each other and typically underestimate basic details such as tracking current installed wind-energy capacity. With the current federal and provincial focus on climate change, it is increasingly important to have access to reliable and consistently produced baseline data for renewable energy — in particular wind energy — which is one of the fastest growing sources of new electricity in Canada. Moreover, as wind parks transition from construction to operation and maintenance, the need for comparative statistics also increases. Power generation is a competitive business, and when electricity prices are low, wind energy has extremely low margins due to lack of fuel costs. So it is critical to track all causes and occurrences of downtime to direct process improvements and forecast future expenditures.

Wind turbines at North Cape, PEI.

RECOGNIZING A NEED

The Canadian Wind Energy Association (CanWEA), along with CanWEA members who are wind-farm owners and operators throughout Canada, have recognized the need for standardized reporting to support wind-industry internal benchmarking, preventative maintenance, and research.

In 2014, CanWEA initiated a pilot project to collect key performance indicators from wind-turbine owners within the CanWEA membership. There is a precedent for this type of wind-energy data collection in other countries — for example, SPARTA, which is run by private companies in the UK, and CREW, which is run by Sandia National Laboratories in the U.S.

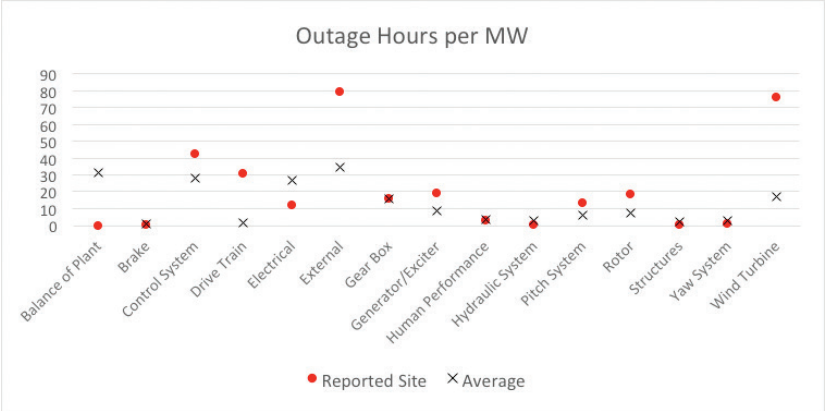


Figure 1. Representative plot depicting typical data of outage hours per megawatt that could be shown as part of a report to the owners/operators, with the values for each wind farm for each of the 15 categories in gray and the average value and reported site values highlighted.

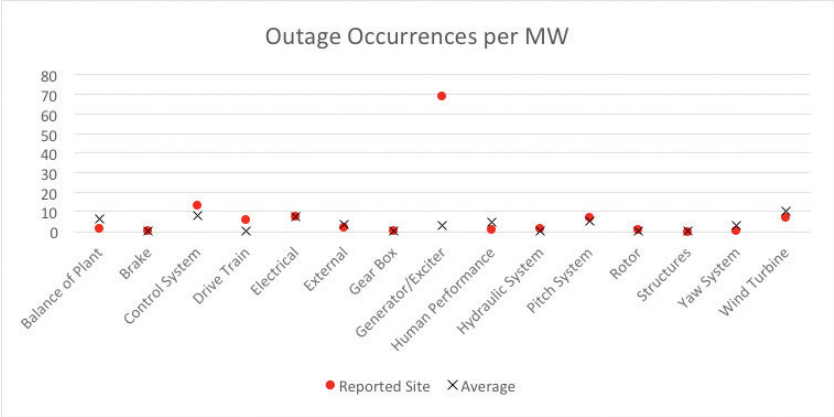


Figure 2. Representative plot depicting typical data of outage occurrences per megawatt that could be shown as part of a report to the owners/operators, with the values for each wind farm for each of the 15 categories in gray and the average value and reported site values highlighted.

CanWEA has non-disclosure agreements for data collection with CanWEA member wind-turbine owners and operators who comprise 30 percent of the installed wind-energy capacity in Canada.

Canadian wind-turbine owners and operators who took part in this pilot study agreed to adopt the existing Generating Availability Data System (GADS) format, which is a program developed by the North American Electric Reliability Corporation (NERC) that acts as a database where all conventional electricity generators with plants of greater than 20 MW capacity contribute.

This format was selected not only because the document is well-prepared, but because NERC soon will require wind plants 75 MW and larger with a commissioning date of January 1, 2005, or later to report their performance and availability metrics. GADS data has been used for other types of generation for reports that provide industry and policy makers with a quantitative baseline of the distribution, capabilities, and status of that generator type. While GADS data for wind farms will be collected by NERC, it is unclear what information will be available for research.

For example, with regards to the Electricity Supply and Demand (ES&D) database, NERC collects, maintains, and annually publishes its data, including 10-year projections. However, there is little interpretation or analysis. Rather, the data is presented "as is." While these data are useful, their utility is limited to system planners and a select few researchers. Therefore, policy makers and individual owners are expected to have a more challenging time with regards to unlocking the full value of NERC-published data for their own purposes.

The Wind Energy Institute of Canada (WEICan) has recently taken a leadership role in the pilot phase of this project, working with CanWEA in collecting, integrating, aggregating, and analyzing data from 28 wind farms across Canada from 2014 and 2015, which comprised approximately 13 percent of the installed wind capacity in Canada. Participants receive a yearly report showing how their wind farms' performances compare to the Canadian average. All data is confidential, and representative data is used for public reports. This project is helping to establish a standard for wind-energy data collection and analysis in Canada.

OBJECTIVES

The data collected as part of this project has the potential to provide insight into wind-farm performance and availability to CanWEA, wind-turbine owners and operators, government officials, and research laboratories. There are many possible benefits from the consistent, reliable and aggregation of wind production and availability data in Canada.

From an owner's perspective, these data will allow individual companies/owners to benchmark their performance and direct preventative maintenance. These data can also aid CanWEA and the broader wind industry with respect to external communica-

tions with various stakeholders (for example: public, government, and utilities).

While policy makers do not have access to this data currently, it is clear that access to aggregated baseline wind-energy data could help inform climate-change discussions and could be used to support future energy research related to the wind-energy industry within Canada.

It is hoped that as the dataset grows and its value is demonstrated, more CanWEA members who are turbine owners and operators in Canada will elect to be part of this program.

GADS FOR BENCHMARKING

One of the main functions of the program is to help wind-farm owners benchmark their performance. The ability to benchmark performance and direct maintenance efforts using GADS is heavily reliant on the data structure. In this project, operators submit data to WEICan, and outages are sorted into 132 codes, ranging from catastrophic gearbox failures to burnt-out tower navigation lights.

The 132 codes are then distilled into 15 categories with broad classifications such as electrical and gearbox. Downtime and occurrences also are split into three categories: planned, forced, and maintenance to provide a refined look at outage types. Participants in the program are provided reports based on the 15 categories, which compares their individual outage occurrences and downtime per category with the average of all data submitted. Comparisons are made on a per-megawatt basis and on a per-turbine basis to make accurate and useful comparisons between turbines of different sizes.

Other indicators such as capacity factor, availability, and site conditions also are compared. Examples of plots that are part of these reports are shown in Figure 1 and Figure 2, where representative plots showing outage hours per megawatt and outage occurrences per megawatt are shown, respectively. In these plots, the relevant values are shown for each of the 15 categories for each wind farm, with the average value and the site being reported individually highlighted.

Based on the reports, wind-turbine operators will be able to see where their turbine fleet is excelling or falling short in terms of maintenance requirements and outages compared to other wind farms taking part in the project. As the number of participating parties increases and multiple years of data are accumulated, the value of trends, performance benchmarking, and overall accuracy of the dataset will improve.

EMERGING TRENDS

While much of the wind-energy capacity in Canada has been commissioned in 2009 or later, a significant number of wind turbines across Canada are either off warranty or will be coming off warranty over the next number of years. In addition to the growing fleet of operating wind turbines in Canada (6,000 and counting), provinces are expected to slow down procurement of more wind projects for at least a few years. During these times, the GADS data collection program will be important as it is prudent for the wind industry to make rational and timely investments in operations and maintenance activities, which includes, among other things, collecting performance metrics (for example: production, availability, and outage data). It is expected these data can be used to support internal benchmarking and decision making, and they can help ensure investments are made appropriately in long-term operations and maintenance activities.

As the database for GADS expands year-after-year, trends will begin to emerge for downtime and occurrences for wind farms. Along with the data collected from owners and operators' internal programs, correlating the outage trends found in GADS to maintenance expenditures will help wind-farm operators forecast their maintenance costs for their fleet. Having this knowledge will then aid operators in estimating the actual economic service life of their fleet rather than relying on the approximately 20-year life typically quoted by manufacturers, but that has yet to be broadly tested in Canada.

Economic service life differs from mechanical life in that it takes into account the running costs of the plant and allows the operator to determine when it is most cost effective to decommission the existing fleet and take on the capital cost of new turbines to replace the existing turbines, as opposed to continuing to maintain an aging fleet with presumably out-dated technology, whose O&M costs will only continue to grow. The operators should then be able to direct their efforts at a specific group of turbines that seem to be problematic or direct their efforts toward improving, for example, the reliability of the pitch system on their entire fleet of turbines.

GADS FOR POLICY DEVELOPMENT

Given the Canadian government's renewed emphasis on data-based decision-making, the Canadian implementation of GADS could become an extremely important tool for energy and environmental policy. As the number of wind farms participating in the Canadian performance and availability benchmarking data pilot increases, a clear, data-based picture of the Canadian wind industry as a whole will begin to form.

CanWEA is considering making project data available to policy makers as part of an expanded program

Wind turbines at North Cape, PEI.


WEICan

going forward. With the current focus on climate change, the aggregated project data would provide policymakers with an accurate baseline of renewable energy in Canada. Additionally, when the aggregated data from this work is compared to GADS results from traditional generation methods such as natural-gas turbines, it would allow policy makers to make direct comparisons of generation methods and base their policy on an impartial and standardized data source.

GADS FOR RESEARCH

Although each wind farm results in less than 20 data points in this work, the data arising from multiple wind farms across Canada over several years provides many rich research opportunities.

CanWEA also is considering making project data available to research organizations other than WEICan as part of an expanded program going forward. Access to such aggregated data would allow researchers to take a deeper look into trends, beyond the aforementioned reports. Factors such as seasonal effects, turbine size, turbine age, and provincial differences could be examined. When these data are correlated to other data sources, such as condition monitoring tools and weather/climate characteristics, it could be used to develop tools to help determine the service life of the turbines.

THE FUTURE OF GADS IN CANADA

Owners, operators, and the Canadian wind industry can benefit from compiling detailed baseline availability data through an established format, such as GADS. These data will continue to be collected and analyzed for wind farms in Canada with aspirations to have all wind farms report. The wealth of data obtained will be critical to ensuring an informed view of wind energy, helping demonstrate the economic viability of wind power in Canada, and help continue to increase the market penetration of this renewable resource.

WEICAN: CANADA'S STRONG WIND RESOURCE

WEICan is a not-for-profit, independent research institute whose mission is to advance the development of wind energy across Canada through research, testing, training, and collaboration. With federal funding from the Department of Natural Resources' Clean Energy Fund, the Institute has built a state-of-the-art $25 million, 10 MW wind park with a 1 MW/2 MWh battery energy storage system. The Institute's site has a strong wind resource and a 300-degree exposure to the Gulf of St. Lawrence, which allows for relatively low turbulent winds.

OFFSHORE

BOEM's Renewable Energy Program

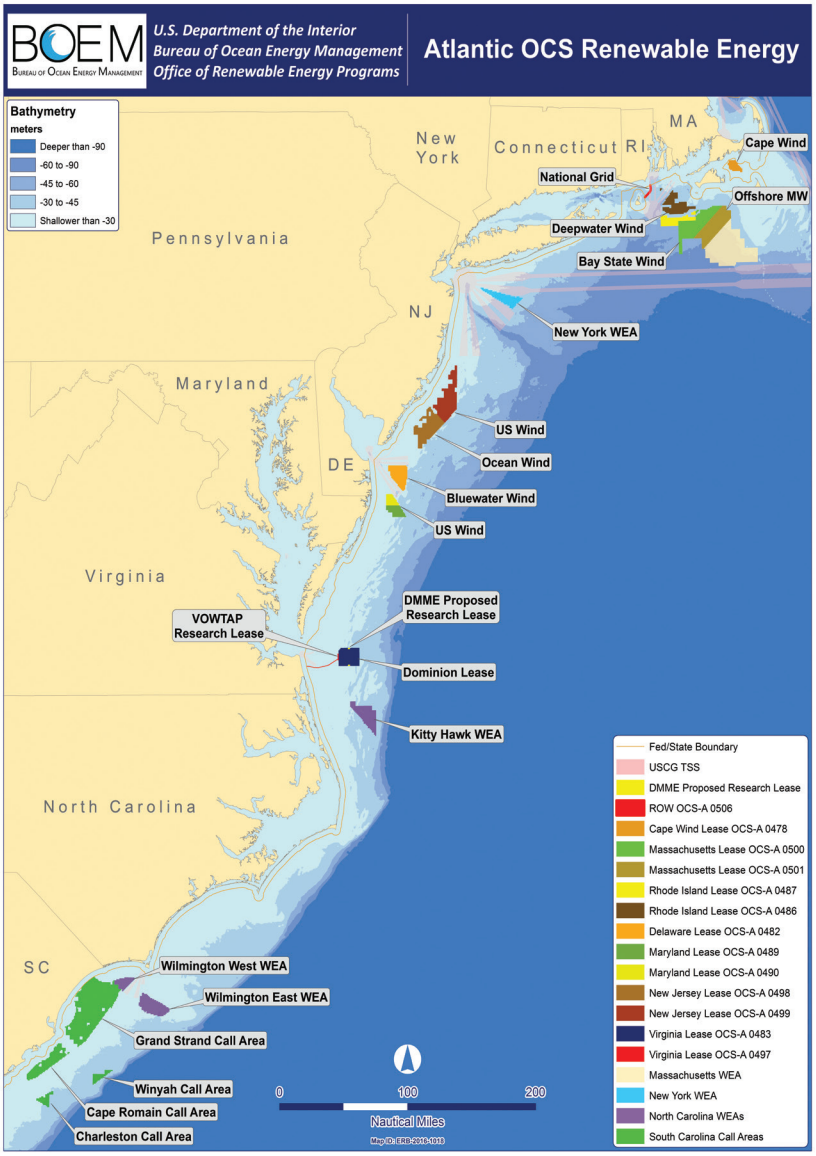
A compelling future awaits offshore wind in the United States.

By Jim Bennett

Renewable energy is of critical importance to the nation's security, economy, and environment. Commercial wind energy is no longer simply an aspirational vision for a sustainable energy future. It is a reality onshore and is becoming a reality offshore.

The Block Island Wind Farm in Rhode Island waters will be the United States' first offshore wind facility. This offshore project may set the stage for a long-awaited and even more expansive development of wind-energy facilities on the federal Outer Continental Shelf (OCS). Because offshore wind is an abundant source of environmentally friendly domestic energy, it is well-positioned to contribute to the economic growth and energy independence of the nation.

The Bureau of Ocean Energy Management (BOEM), through the passage of the Energy Policy Act of 2005, has the responsibility to oversee renewable energy development on the OCS by granting leases, easements, and rights-of-way for such projects. The Energy Policy Act requires that BOEM ensure offshore renewable energy activities are carried out in a safe and environmentally responsible manner that provides a fair return to the United States for the use of the OCS.



REGULATORY FRAMEWORK

On April 22, 2009, BOEM published the regulatory framework to govern the OCS renewable energy program. Since that time, BOEM has established Intergovernmental Renewable Energy Task Forces, identified wind-energy areas off seven states, and awarded wind-energy leases off the Atlantic coast covering more than 1 million acres.

BOEM now has 11 leases along the East Coast for the development of commercial-scale wind facilities on the OCS. In addition, BOEM anticipates conducting a lease auction by the end of the year for a wind-energy area offshore New York, and early next year BOEM expects to see a lease option for a

wind-energy area offshore North Carolina (Kitty Hawk). With these leases in place, every state adjacent to the OCS from Massachusetts to North Carolina will have at least one area available for commercial wind-farm development.

In the past year, interest in offshore wind energy has emerged in the Pacific Ocean. This includes an unsolicited proposal for a wind farm off the coast of California as well as three offshore Hawaii. Recently, the state of California has joined with BOEM to put together an Intergovernmental Renewable Energy Task Force to develop offshore wind resources.

To date, BOEM has established 11 Intergovernmental Renewable Energy Task Forces in the Atlantic and two in the Pacific. These task forces include federal and state agencies, local governments, and federally recognized tribes to promote open dialogue and data sharing and ensure concerns are identified as early as possible to eliminate or reduce potential environmental and multiple-use conflicts.

BOEM engages its Task Forces through its planning, leasing, and plan-review procedures to discuss important topics such as Wind Energy Area (WEA) delineation, auction processes, planning and operations oversight, environmental compliance and safety monitoring, and decommissioning of facilities.

REVIEWING PLAN

With a number of leases in the Atlantic now in the hands of industry, BOEM has been actively reviewing lessees' plans for offshore site-characterization surveys and wind-resource assessment activities. Those results will be incorporated into future construction and operations plans.

Ensuring that renewable energy resources are developed in a responsible manner is a priority for BOEM. BOEM's Environmental Studies Program provides support for this effort by funding studies that compile available information, identify knowledge gaps, and analyze potential impacts to natural and cultural resources from offshore renewable energy development.

One such study, Real-time Opportunity for Development Environmental Observations (RODEO), looks at the environmental impacts of commercial wind-energy facilities in real time in order to benefit future development. BOEM anticipates releasing the initial results of RODEO in 2017.

MAJOR MILESTONES

BOEM has accomplished major milestones in the years since President Barack Obama's 2009 announcement, and it has more to look forward to.

Most recently:

- In May, the U.S. took an important step toward increasing the use of offshore wind resources. Building on ongoing talks between the United States and Denmark regarding offshore wind, BOEM, on behalf of the United States, signed a Memorandum of Understanding (MOU) with the government of Denmark to strengthen cooperation and information-sharing on wind energy. The MOU promotes information sharing, best practices, and policy initiatives to support the development and regulation of offshore wind-energy resources.
- In June, BOEM announced that it plans to hold a lease sale for 81,130 acres offshore New York for commercial wind-energy leasing later this year.
- Also in June, in consultation with the Hawaii Intergovernmental Renewable Energy Task Force, BOEM issued a Call for Information and Nominations to gauge the offshore wind industry's interest in acquiring commercial wind leases in two areas spanning about 485,000 acres of submerged lands in federal waters offshore Oahu.
- In August, BOEM announced a Proposed Sale Notice and Request for Interest for commercial leasing of about 122,405 acres offshore North Carolina (Kitty Hawk) as well as a Request for Information regarding potential wind-energy leasing offshore California.

Such milestones will help ensure the U.S. will have a bright renewable energy future. Of course, this future will require more than just BOEM. As an organization, BOEM looks forward to working closely with federal, state, local, and tribal partners to make this future a reality, while ensuring all uses (e.g., commercial fishing, vessel traffic, critical habitat areas) are also properly considered.

BOEM will be relying heavily on industry, environmental organizations, and other members of the public to provide it with important information for existing and upcoming offshore wind projects and related planning efforts. Such input will be carefully considered by all levels of leadership as BOEM works to achieve its mission to ensure responsible renewable energy development on the OCS.

From the inception of the federal OCS Renewable Energy Program, the forecast for offshore renewable energy activities has been optimistic. Now, with a clearly defined leasing-and-review process in place, appropriate technology available, favorable economics, leases in hand, and actual steel in the water, the U.S. is turning that corner at last.

CONVERSATION

Walt Musial

Principal Engineer, Manager of Offshore Wind
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Could you give us some background on the National Renewable Energy Laboratory (NREL)?

NREL is a national laboratory that is owned by the U.S. Department of Energy. It's the only DoE lab that is solely dedicated to the development of renewable energy ... wind energy being one of them, and offshore wind being a subset of wind energy.

How did you become involved with NREL?

I came here in 1988. I was previously working as a wind-energy test engineer in California where the wind industry started. It began there because of some lucrative incentives that were sponsored by the state of California as well as the federal government. And most of the industry — including the European industry — began there in California, so when things started to evolve in California, I moved out there, and I worked there for five years, and then came to NREL.

What are the advantages of offshore wind vs. onshore wind?

A lot of it is geographic. Onshore wind — or land-based wind — is available, and it's very abundant. There are geographic expanses of land where there isn't a lot of human and environmental conflict. And so we see the development of land-based wind has taken place and taken hold very strongly in the Midwest where there's a lot of wind. There's land-based wind that's evolved in approximately 40 different states. But when you look at the potential for land-based wind to be a large-scale player, the constraints are pretty high when it comes to conflicts with existing human use in high-density population areas.

Offshore wind can circumvent some of those barriers by placing wind turbines off the coast of some of the most populated cities in the country. Large-scale power generation can occur with fairly short transmission lines to population centers.

What are the biggest challenges in building and operating offshore wind farms?

Offshore wind is at a much earlier stage of development. Probably the biggest challenge is getting the costs down. Those costs are high because it's more expensive in many ways to put a turbine in the ocean where you have to navigate some logistics as well as severe conditions during operation and during installation. So those are the challenges that the industry is facing, but they have made quite a bit of progress on that. That's in regard to the implementation of the technology.

Explain the process that goes into finding a proper site for an offshore wind farm?

It's not that different from locating a wind farm on land. The conflicting uses and interference with either environmental or human-use factors are different for offshore than they are on land-based systems. And so they have to be mitigated.

Things that we worry about offshore are physical constraints such as bathymetry (water depth), and making sure there's enough wind at the sites to begin with to make it economical. But then you get into issues with: Is it going to interfere with sensitive fisheries or marine sanctuaries? Is it going to conflict with aviation or military use? Is it going to interfere with populations that might object to the visual impact of the wind farm? Avian issues are always a concern. They have not been shown to be a bigger issue with offshore wind farms to this date. But there is always something. We have to make sure that we're not putting turbines in flyways where birds migrate.

We worry about marine mammals especially during the construction phase. It's not as much a siting problem, but it's more of a procedure you have to follow to avoid conflicts with marine mammals.

There's always a negotiation and consideration to where the best sites are. And there are two ways you can do that: You can go to the sites that have been pre-selected by the Bureau of Ocean Energy Management (BOEM) — those are the wind-energy areas. Or you do an unsolicited proposal for another site that would have to be vetted through the same process. Everything that BOEM leases on the outer continental shelf has to be done through a competitive-leasing process.

Other than being the first offshore wind farm in the U.S., what makes the Block Island Wind Farm unique?

First of all, they located the five turbines that they're installing in state waters. So it doesn't have to go through the federal regulatory process. They're off the southeast coast of Block Island. They don't have a huge amount of visual impact on the island, but there are some houses that are going to be looking right at them. The other thing is that just a small fraction of the energy coming from one of the turbines will power the entire island. So they're bringing the power from the wind farm to the island, and they connected Block Island by cable to the mainland. So those wind turbines will power all of Block Island, and they're going to be supplying power to the southern part of Rhode Island as well.

What challenges has the U.S. experienced in its pursuit of offshore wind?

The U.S. has been pursuing offshore wind opportunities since 2001. Cape Wind put in their first proposal back in 2001. And it came about because interest was generated by the Europeans going to commercial offshore wind farms back in the same timeframe. So, since Cape Wind began — and they really were the pioneers for the U.S. development — there's been a process underway and evolving, and it has taken a lot of time because there's a lot of bureaucracy creating a whole regulatory framework for a whole new technology that includes the entire outer continental shelf.

And I think also, there's been a lot of cost volatility that made the price of offshore wind farms uncertain over the last decade. Projects have been located in challenging sites, and issues and uncertainties with the logistics of installing turbines have had a disparity between the estimated cost and the actual cost over the first few projects. I think now that the project costs are much more well-known and there's a European supply chain and the risks have gone down, the costs have started to come down. I think we're going to see that the U.S. market is going to take advantage of that and start to emerge.

Can you explain floating wind and its advantages?

Floating wind takes advantage of resource areas that are in deeper water. And that means you don't need a foundation that goes all the way to the seabed. They're floating on buoyant foundations that are moored to the seabed. They're less dependent on exact water depth and bathymetry, and that generally opens up about 60 percent more resource area. It more than doubles the amount of area that's available for offshore wind development if you can get the cost of this technology down at least comparable to the fixed-bottom option. So to do that there's a lot of technology development that's needed, and it's at a much earlier stage of development than the fixed-bottom systems.

Can you share a bit of what we can expect from your panel at AWEA Offshore Windpower 2016?

My panel brings together four of the leading technology developers of floating technology that are active in the United States. And we're going to have a good discussion about the state of that technology and the opportunities that floating wind turbines present.

Is NREL involved in other future offshore wind projects?

We like to be connected to industry partners and to get experience in the field. But our main mission is to try to be a little bit out in front of the industry and try to anticipate issues that maybe the industry is not facing today but may be facing 10 years from now.

But we've been doing work with the Aqua Ventus project in Maine, which is a pilot project that's being sponsored by the Department of Energy. It's a public/private partnership that will possibly put in the first full-scale turbine in the United States and that's scheduled — if it goes forward — to be put in in 2018.

We have been involved in several of the other advanced technology demonstration projects that the DoE has been sponsoring. Fishermen's Energy is putting a pilot project near Atlantic City. They're waiting to get approvals for that project, and that's part of their program as well.

We've been working very closely with the Bureau of Ocean Energy Management — which has jurisdiction to the outer continental shelf — and helping them cultivate the regulatory regime and the regulatory space and mature that process, so it's ready for commercial development.

A Temporary Solution

Siemens teams with Herchenbach to build semi-permanent warehouses on site for wind-turbine repairs.

By Laura Wilms

The repair of wind-turbine generators involves transporting damaged components long distances to repair workshops. As the components are often large, this logistical effort results in enormous costs.

Siemens Service Wind Power has opted for a different solution: The leading manufacturer of wind-turbine generators has teamed up with temporary building manufacturer Herchenbach to develop a semi-permanent warehouse that will be used for repairs and maintenance at the turbine's site.

Wind energy is one of the leading forms of renewable energy. And with good reason: Wind is an inexpensive and clean raw material with an endless supply. The investment costs of wind-turbine generators also pay for themselves quickly. But that only can happen if the generators run as smoothly as possible over their service life of 20 to 25 years. High maintenance costs, on the other hand, quickly lead to higher operational costs that translate into reduced revenues for turbine-generator operators.

"Wind-turbine generators must be a worthwhile investment, both from an ecological and an economic point of view," said Mark Borkenhagen, project manager at Siemens Service Wind Power, the world's leading manufacturer of wind-turbine generators. "Advancements in

Herchenbach temporary buildings can be installed without any foundation on almost any surface.

Siemens

rotor-blade design and generator technology have already allowed us to continuously improve the efficiency of our wind-turbine generators. However, in order to make wind power competitive versus conventional forms of power generation, every cent that we can save in terms of maintenance is crucial."

MINIMIZING MAINTENANCE COSTS

A key factor in this respect is the replacement and repair of individual components. Previously, when a repair became necessary, the damaged large parts of wind-turbine generators had to be transported to workshops as special heavy loads, in most cases involving long trips from wind-farm sites. Each heavy load had to be registered with the relevant local authority and was only allowed to be transported at night.

"The wind-turbine generators stand idle until the repaired parts are returned," Borkenhagen said. "And each hour of downtime causes significant losses."

So Siemens Service Wind Power started looking for an alternative. The answer seemed simple enough: install a temporary building for repairs on the actual wind-farm sites. A temporary and convenient repair site would help avoid the expensive and time-consuming transportation of heavy loads.

Siemens wanted to use the new semi-permanent warehouse solution in Europe, so it had to be possible to quickly install and dismantle the building, so it could travel from wind farm to wind farm as required. The warehouse also had to be able to withstand extreme wind loads and be big enough to house the — sometimes huge — turbine parts as well as the repair equipment.

"Wind-turbine generators have a diameter of over four meters, measure three meters in height and weigh (88 tons)," Borkenhagen said. "Such dimensions do not fit into any standard temporary building. What was required was a special solution."

Siemens chose Herchenbach Industrie-Zeltebau GmbH, a manufacturer of temporary buildings and semi-permanent warehouses made from aluminum, to tackle this challenge. Other divisions of Siemens already had worked successfully with Herchenbach in the past. The result of this project was a special Herchenbach Heba-Fix® temporary building, 33 feet wide and 49 feet long with a side height of 21 feet.

LOWERED THROUGH THE ROOF

The main design challenge was the question of how to get the wind-turbine parts into the building since they

wouldn't fit through the sidewalls due to their massive size. Siemens Wind Power initially wanted to build the temporary warehouse around the generators for each repair.

"This would have been very time-consuming, thus unnecessarily prolonging the downtimes again," Borkenhagen said. In addition, the complexity and vulnerability of assembling a building around such a large main component was a risk.

So Herchenbach developed a special temporary building solution. The basis is a corrosion-free, premium-quality aluminum frame and a combination of high-quality PVC industrial-grade tarpaulin in the roof as well as trapezoidal sheet metal and tarpaulin walls. This allows the roof to be partially opened up, so the parts needing repair can be lowered into the building through the roof opening with a crane.

This involves pulling a part of the roof tarpaulin out of the aluminum frame, a task performed manually by three-to-four employees fairly easily. However, the frame and the components had to be planned and designed with particular precision for this purpose.

"Even when the roof tarpaulin is temporarily removed, the structure has to remain stable in spite of high-wind loads," said Tobias Raeber, managing director of Herchenbach. "We therefore incorporated robust steel trapezoidal sheet-metal walls and further reinforcements into the lateral middle sections of the temporary building at the point where the roof tarpaulin can be pulled out. These provide additional stability, making the building withstand high loads."

Another advantage of the Herchenbach temporary buildings is they can be installed without any foundation on almost any surface. This is a crucial factor, particularly at wind farms, where simple compacted gravel surfaces or smaller asphalted parking areas are available. This is made possible by the building's comparatively lightweight aluminum frame (in contrast to steel) and a special ground-anchoring solution. During installation of the structure, steel-base plates are fixed at regular intervals by driving nine earth pins up to 4.3 feet into the ground through each plate.

EUROPE-WIDE USE

In addition, temporary buildings from Herchenbach are ideally suited for temporary use at different locations because of their modular design.

"All components are bolted or fitted together; nothing is permanently welded," Raeber said. "This means that the buildings can be quickly dismantled at any time and put up again at other locations."

And hardly any spare parts are needed, he said.

This approach already has proven itself in practice. The temporary building supplied to Siemens Service Wind Power was installed for the first time — within 24 hours — in fall 2015 in the Picardie region of northern France. After four repairs, it was uninstalled. The building was then put into storage until its next use in January in Tinglev, Denmark.

"Here, too, the installation went smoothly," Borkenhagen said. The structure will remain in place in Denmark until it is needed at another location.

"We have therefore achieved our objective of rotating the new temporary building around the various wind farms in Europe," Borkenhagen said. "And that really does work without too much time-consumption, and our costs are a fraction of what they were with the old method of transporting heavy loads."

SgurrEnergy Gets O&M Contract for Inch Cape Offshore Met Mast

Leading renewable energy consultancy, SgurrEnergy, has secured an operations and maintenance (O&M) contract for the Inch Cape Offshore Met Mast off the coast of Angus, Scotland.

Installed in 2014, the offshore met mast gathers accurate wind resource, velocity and directional data, and oceanographic data to inform the development of the 784 MW Inch Cape Offshore Wind Farm.

SgurrEnergy, a Wood Group business, was appointed by met mast supplier Drace Infrastructures UK Limited on behalf of Inch Cape Offshore Limited (ICOL). The scope of the 16-month contract includes offshore inspection and maintenance, recertification, project management, weather forecasting, data recovery, and detailed reporting through SgurrDataPortal.

In addition, the role includes the provision and installation of calibrated instrumentation and spares as well as onshore monitoring and coordination from SgurrEnergy's 24/7 control center in Glasgow. The SgurrEnergy 24/7 control center will track the movement of vessels and personnel offshore.

"We are pleased to welcome SgurrEnergy to our O&M team on this innovative offshore met mast project," said Hugh Morgan, asset manager at Inch Cape Offshore Limited. "Continued application of best practice O&M management of this asset is essential in order to continue to provide valuable data and in doing so, to significantly increase the confidence

The offshore met mast gathers accurate wind resource, velocity and directional data, and oceanographic data for the Inch Cape Offshore Wind Farm.

and certainty of the Inch Cape Offshore Wind Farm's wind resource."

"We are delighted to have secured this contract for the Inch Cape offshore met mast, and will look forward to working closely with ICOL and Drace to ensure the high availability of detailed and accurate data," said Robbie Gibson, director of asset management at SgurrEnergy. "Being awarded this contract further strengthens SgurrEnergy's position as a leading turnkey offshore O&M service provider."

The project is expected to bring benefits through a reduction in greenhouse gas emissions, energy supply and security, and economic benefits from job creation and infrastructure development through the project life.

Source SgurrEnergy

For more information,
go to www.sgurrenergy.com

PERSPECTIVE

Maturing the Wind Industry: OEM Aftermarket Support after Midlife

By Shawn Lamb

While at my local automobile service shop waiting for my truck to be serviced, I drew some parallels between the well-established automotive industry and the up-and-coming wind industry — specifically about the lack of options for post-warranty, aftermarket support.

For example, at a repair shop, I have two options: Within the warranty period, the manufacturer requires a certified OEM shop for repairs, or I risk voiding the warranty coverage. After my warranty expires, I may choose to continue on with the OEM or find a non-OEM shop. If I trust the third-party mechanics and if they perform good quality work and, most importantly, if they have much more reasonable prices than the OEM shop, then I probably will leave the OEM. When I have to replace parts, I am aware the independent shop may have to purchase them from the manufacturer, but they also may suggest after-market parts that will save money or perform better. The American automotive industry is a good example of a matured industry that uses free-market solutions to help the owners succeed.

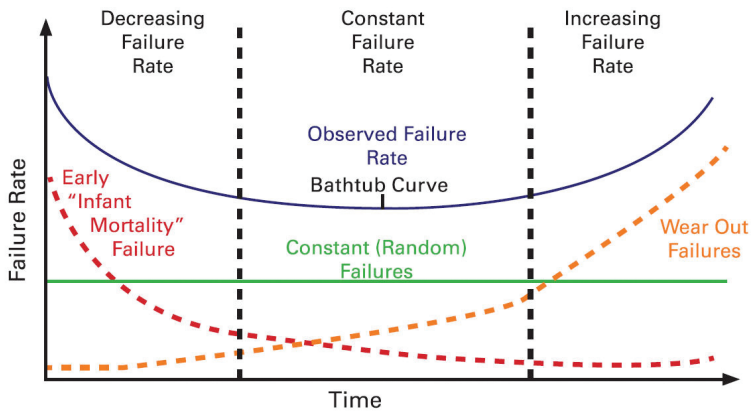


Figure 1: Failure Rate Evolution

Now imagine if my truck had to be maintained only by the OEM or suffer a major degradation in performance and get cut off from industry expertise and spare-parts availability. Imagine the vehicle manufacturer refusing to work with any independent shops and making it so difficult for these shops to function that your vehicle couldn't be fixed and would have to sit in the back lot, rusting. This would be an impossible situation for the owner and obviously would factor into future purchasing decisions as well as recommendations to colleagues, friends, and family. The latter situation is analogous to our burgeoning wind industry.

Many wind owners and operators are forced to find cheaper service and spare-parts solutions after the warranty period ends just to meet their operational expense (OPEX) budgets. These options might include a third-party indepen-

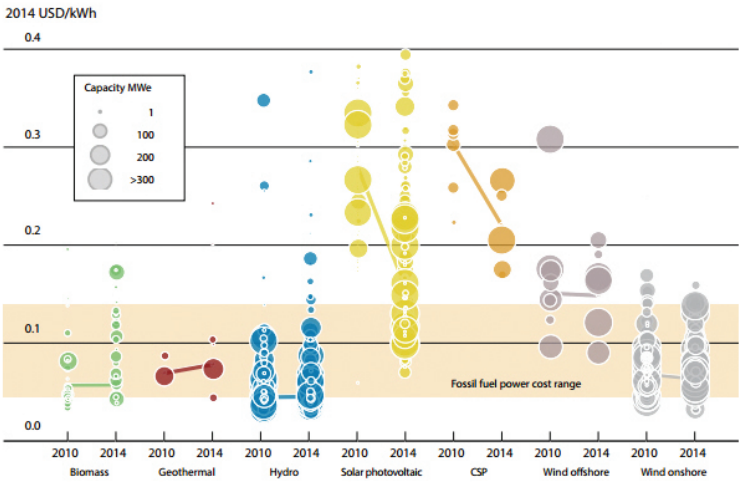
dent service provider (ISP) or performing maintenance and repairs with their own crews. It's at this crucial point that the OEMs need to have an aftermarket presence. Their expertise and experience are important in order for the owner to weather the storm of end-of-life problems that show up in 10 to 20 years.

Many of the OEMs have no turbines in the megawatt class old enough to benchmark the midlife and beyond. Both the owner and the OEMs are in uncharted territories when it comes to turbines 10 years old or older in the megawatt class. The OEMs are still beta testing their models on the owners and operators. However, when the owners may assume that their financial models are stable, they negate the uncertainty of these unproven machines.

It's understood most OEMs want to not only sell a wind turbine, but also make another income from service and parts. This works nicely for the owners and operators who contract a "full-service agreement" over many years. This helps ensure OEM support in order to transfer the risk and stabilize the financial model. Many OEM companies and sub-suppliers will work with owners to develop strategic relationships early on, but in the later years, the profit margin is not there to support a full O&M contract by the OEM.

Owners can decide what they want to do with their assets post warranty (usually two to five years). Options include: hiring an ISP to maintain their assets, staying with the OEM on an "extended warranty," or even self-performing with their own workers and back-office support. In order to be competitive, the independent power providers (IPP) will sell wholesale electrons below 2 cents/kWh on a spot market. These margins are slim, and many IPPs are struggling to make a profit at or above projections.

The wind industry as a whole is being driven to sell wholesale closer and closer to grid parity, or the average for conventional power plants. The future of wind as one of the cheapest sources of electricity also implies site operations must be one of the most efficient in power generation.



The pressure to make a profit is increasing as margins disappear. Add to that the fact most sites in the U.S. given a Production Tax Credit (PTC) from the government also will be facing a completely new OPEX budget after 10 years. OEMs and their sub-suppliers will need to adjust their businesses to support independent aftermarket efforts by the third-party suppliers, owners, and operators. This is imperative for the longevity and maturity of the wind industry.

Antaira Expands with New Ethernet Switches

Antaira Technologies — a global leading developer and manufacturer of industrial device networking and communication product solutions for harsh environment applications — is expanding its industrial networking infrastructure family with the LNX-2012GN-SFP series.

Antaira's new LNX-2012GN-SFP industrial gigabit managed Ethernet switch series has been designed to fulfill applications in harsh or outdoor environments. This unit has one of the highest density SFP fiber port counts in the market for a DIN-Rail unit. The extensive SFP fiber connectivity is ideal for centralized connection of multiple devices, especially in environments with a lot of electrical noise. Some applications where the LNX-2012GN-SFP switch works well included power-utility, factory-process control automation, windmills, mining infrastructures, and ITS — roadway traffic control-monitoring applications.

Antaira Technologies

Antaira's new LNX-2012GN-SFP.

The LNX-2012GN-SFP series is a cost effective 20-port industrial gigabit managed Ethernet switch line that supports a 12~48VDC power input range. Each unit is designed with eight 10/100/1000Tx Fast Ethernet RJ45 ports and 12 100/1000 dual-rate SFP slots for fiber.

With a 40-gigabit backplane speed, the LNX-2012GN-SFP supports jumbo frames and wide bandwidth for large Ethernet data packet transmissions. These switches are also made with high-density port counts for edge-level connectivity solutions.

The LNX-2012GN-SFP product series provides high EFT, surge (2,000 VDC), and ESD (6,000 VDC) protection. These units are built to have a dual-power input design with reverse polarity protection, and there is also a built-in relay warning function to alert maintenance when any ports break or power failures occur. This makes it ideal for applications requiring high reliability and distance extension.

This product series is pre-loaded with "Layer 2" network management software that supports an ease-of-use Web Console or Telnet through the serial console by CLI configuration. This high-density managed switch line provides the ring network redundancy function with STP/RSTP/MSTP and the Super Ring redundancy protocol that supports a <30ms network recovery time, eliminating the compatibility issue for any existing network concerns. In addition, the built-in SNMP, VLAN, IGMP, QoS features support network planners to increase data transmission performance within the network.

The LNX-2012GN-SFP series is backed by a five-year warranty, and the units are IP30 rated, compact, fanless, DIN-Rail, and wall mountable. Each series is built to withstand industrial networking hazards such as shock, drop, vibration, electromagnetic interference (EMI), and extreme temperatures. There are two operating temperature version models for either standard temperature (mi-

nus 10 to 70 degrees C) or extended temperature (minus 40 to 75 degrees C). The models are 96.4 millimeters by 105.5 millimeters by 154 millimeters and weigh 2.7 pounds.

Source Antaira Technologies

For more information, go to www.antaira.com

Joint Project to Standardize Floating Turbines

DNV GL, the world's largest resource of independent energy experts and certification body, has launched a new joint industry project (JIP) together with 13 global partners to mutually develop a recommended practice for the coupled analysis of floating offshore wind turbines.

Despite the fact the wind industry has a strong focus on the development of floating offshore wind turbines, it is still missing a widely recognized and unified approach for the practical methods to build and validate the numerical models in accordance with the requirements in the standards.

Standardization is a key milestone to guide the industry toward the development of reliable floating wind turbines. Guidance includes setting up minimum requirements for the design on new concepts that can help investors' evaluation and supporting the more mature technologies toward a safe and secure commercialization.

The project is the first of its kind, bringing together multiple stakeholders from the wind, oil and gas, and maritime industries, making it the most interdisciplinary project that engages in the technical advancement for floating offshore wind projects to date.

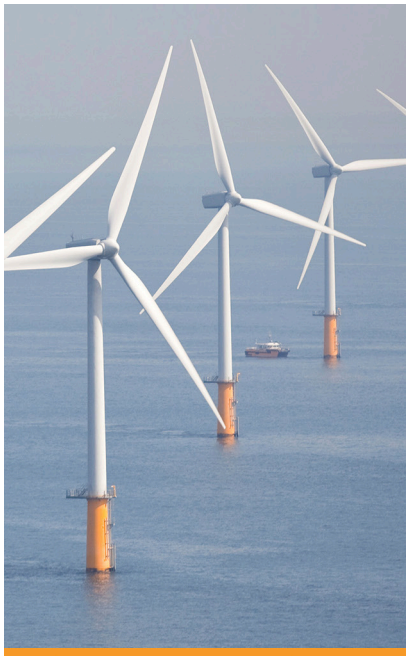
The participants come from a broad range of industries, including utilities, component manufacturing, engineering consultants, maritime research institutes, shipyards, and academic research.

Companies contributing to the development of the new recommended practice include:

- Ramboll
- Ideol
- EDF
- MARIN
- STX Solutions Europe
- Esteyco
- NAUTILUS Floating Solutions
- Dr. Techn. Olav Olsen
- National Renewable Energy Laboratory (NREL)
- GICON®
- Glosten
- Atkins
- MARINTEK

"Ramboll supports this joint industry project and will contribute to this effort by providing our knowledge and experience in the design and analysis of floating wind turbines, covering coupled simulation as well as our structural, mooring, and cable expertise," said Denis Matha, floating wind-turbine specialist from Ramboll. "We expect that this project will provide an excellent platform to jointly develop a recommended practice by addressing the key issues and bringing together the expertise of key stakeholders."

"We are happy to join this JIP and share our years of experience coupling multiple wind turbines with our patented floater," said Ideol CEO Paul de la Guérivière. "We have been convinced for a long time of the benefits of a common framework for the loads analysis of floating wind turbines and are confident that such efforts will lead to substantial gains in efficiency and cost. The recommended practice should strongly help the floating off-



The analysis of floating wind turbines is a complex challenge.

shore wind industry and accelerate the development of commercial-scale floating wind farms."

The new recommended practice will build on the experience from the application of the Offshore Standard DNV-OS-J103 "Design of Floating Wind Turbine Structures" published in 2013 and will contain methods and ways to fulfill the requirements set in DNV-OS-J103.

Since its publication, the offshore standard DNV-OS-J103 has been used broadly for the design of floating wind-turbine structures. At the time of publication, the practical experiences in the field of floating offshore wind energy have been rather limited in providing reliable information on validating numerical models for the turbine construction and reliable insight on the level of complexity required at each individual project stage.

Over the last three years, the industry has greatly advanced, moving the commercialization of the new technology forward, as the world's first floating wind farm demonstration projects have since been launched.

Based on the latest knowledge and practical know-how, the joint approach of developing the future recommended practice will greatly reduce the risk of inadequate analysis, leading to substantial time savings. Further advantages stem from the focus on the design of floating wind turbines and the validation of numerical models in respect to their subsequent certification. The coherent structure of the recommended practice also provides a unified cost structure for the project development process.

"The analysis of floating wind turbines is a complex challenge that requires the integration of different technologies and disciplines," said Luca Vita, project manager of the Joint Industry Project and senior engineer at DNV GL — Energy, Renewables Certification. "The lack of a common agreement on the optimal approach to conduct these analyses during the different stages of the design process adds potential risk factors and time delays in the project development, but also in the cost evaluation of new conceptual designs. This project provides a unique platform to mutually develop an invaluable recommended practice which will be beneficial to each industry stakeholder, taking the wide-ranging spectrum of interdisciplinary skills and business objectives of each participant into account."

"We are very happy to continue our commitment to making floating wind power a reality and a large scale energy technology," said Johan Sandberg, Segment Leader — Floating Wind Turbines at DNV GL — Energy. "Understanding coupled analysis is a key part of designing and optimizing a floating wind turbine, and it is encouraging that the industry's interest in this has been so strong. The partners in this project contribute with a wide range of valuable competences, which will make the result effective and credible."

Source: DNV GL

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

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First-Ever UK Built Offshore Turbine Blades Arrive

Blades designed, tested, and manufactured on the Isle of Wight arrive at MHI Vestas' pre-assembly facility in Belfast ready for installation at Dong Energy's Burbo Bank Extension project.

The first six 80-meter-long blades for the 258 MW Burbo Bank Extension project recently arrived at the MHI Vestas Offshore Wind pre-assembly facility in Belfast, Northern Ireland. The blades for the V164-8.0 MW turbines — which were designed, tested, and manufactured at the MHI Vestas blade factory on the Isle of Wight — will be the first locally built blades installed at a UK offshore wind-power plant.

The MHI Vestas factory on the Isle of Wight is where the unique skills and processes were developed that are necessary to produce blades on a large scale.

"It's a significant milestone for the industry to see the world's largest blades in serial production arriving in Belfast ready for installation," said CEO Jens Tommerup. "This marks the first time locally manufactured major components for offshore wind turbines are being used in the UK."

"Through investment and collaboration with our partners in the Solent region, we have created jobs, increased training opportunities, and stimulated growth throughout the entire supply chain," Tommerup said. "We believe that our efforts reflect the stimulation and growth that the UK has targeted with the continued investment in offshore wind power."

"By building a strong, competitive UK supply chain, we are creating jobs, attracting investment, and providing the certainty and confidence businesses need," said UK Energy Secretary Greg Clark. "We are committed to our world-leading offshore wind industry, and now we have the first-ever offshore wind-turbine blades built in the UK by MHI Vestas."

"Belfast Harbour is delighted to welcome MHI Vestas and to have the privilege of handling the world's largest blades in serial production," said Joe O'Neill, Belfast Harbour's commercial director. "In 2013, we completed the development of a 200,000 m2 offshore wind terminal, the first bespoke facility of its kind in the UK in order to facilitate this style of operation. Supporting the growth of the renewable energy sector is something we are proud to be a part of and look forward to working with MHI Vestas to ensure the successful completion of the Burbo Bank Extension project."

Work at the pre-assembly site started in April, and since then the first towers have been fully assembled, tested, and pre-commissioned, ready for offshore installation.

Source MHI Vestas

For more information, go to www.mhivestasoffshore.com

Nordex Secures 243 MW Order for U.S. Wind Farm

The Nordex Group has secured a new, 243 MW wind-turbine order for the United States. The manufacturer has completed an agreement to supply 81 AW125/3000 turbines to a wind farm in Texas.

The turbines are designed for IEC-2, medium-wind sites. Each turbine will be equipped with a 125-meter rotor and installed on an 87.5-meter tubular steel tower. Installation is expected to begin in early 2017.

This latest deal continues the strong growth of the AW3000 platform in Texas. Other recent orders for AW3000 turbines in the state include the 300 MW Green Pastures wind complex owned by Capital Dynamics, the 165 MW Cameron wind farm owned by IKEA, and the 93 MW San Roman wind farm owned by Acciona.

The U.S. is one of the most important wind markets in the world. The outlook for U.S. wind energy was strengthened by the long-term extension of the federal Production Tax Credit (PTC) in late 2015. With this policy in place, market observers expect wind installations in the U.S. to grow by more than 10,000 MW per year.

Nordex sees great potential in the United States due to the group's extended product portfolio that now includes turbines from Acciona Windpower. U.S. customers are particularly enthusiastic about the AW3000 and Delta generation products. To date, Nordex Group has installed a total of 2,380 MW of wind turbines in the U.S.

The Group has installed more than 18 GW of wind energy in more than 25 markets. In 2015 Nordex and Acciona Windpower generated combined revenues of 3.4 billion euros. The company employs a workforce of about 5,000. The manufacturing group owns factories in Germany, Spain, Brazil, and the U.S., and in the near future will operate one in India. The product range focuses on onshore turbines in the 1.5 to 3 MW class, which are designed for the market requirements in developed and emerging countries.

An AW 125/3000 turbine.

Source Nordex SE

For more information, go to www.nordex-online.com

Siemens Gets Follow-Up Onshore Project in Australia

Siemens has been awarded a contract to supply, install, and commission 32 wind turbines, each with a capacity of 3.2 MW and a rotor diameter of 113 meters, for the Hornsdale Stage 2 onshore wind farm in South Australia.

Stage 2 is an addition to the Hornsdale Stage 1 wind-farm project, for which Siemens signed a contract in August 2015. The customer for both wind-power plants is Neoen Australia, a business of the French company, Neoen.

With a capacity of 100 MW, Hornsdale Stage 2 will be a major contribution to the Australian Capital Territory's (ACT) target of 100 percent renewable energy by 2020. Installation of the wind turbines is scheduled to begin in December, with the start of operations expected by June 2017. Siemens will then be responsible for service and maintenance of the wind turbines within the framework of a long-term service agreement.

The direct drive units will add a capacity of 100 MW to the Hornsdale wind-power plant near the South Australian town of Jamestown.

"We are delighted that Neoen entrusted Siemens to also supply the second stage of the Hornsdale wind project with our proven direct drive wind turbines," said Thomas Richterich, CEO Onshore at the Siemens Wind Power and Renewables Division. "Hornsdale Stage 2 is a good example of collaborative customer

The direct drive units will add a capacity of 100 MW to the Hornsdale wind-power plant near the South Australian town of Jamestown.

partnership combined with the best technology for the benefit of society, the economy, and the environment."

The wind-power plant will be installed near the South Australian town of Jamestown, about 124 miles north of Adelaide and will achieve a record low price of 77 Australian dollars per MWh — around 5.2 euro cents per kWh. The Hornsdale wind farm Stage 1 was signed at a fixed price of 6.1 euro cents per kWh in 2015. The enabling factors for the low energy price are excellent wind resources, important synergies with the first stage of the Hornsdale wind farm as well as optimal finance and equity structures. Once operational, Hornsdale Stage 2 will contribute to the achievement of carbon-neutral targets by selling the generated power to the Australian Capital Territory (ACT Government).

"Hornsdale Stage 2 is another great example of the global strength of France and Germany working together to provide clean energy for 70,000 Australian homes and new employment, training, and investment opportunities in South Australia and the ACT," said Xavier Barbaro, Neoen's global CEO. "With almost 40 percent of the country's clean energy produced by wind farms, Australia's renewable energy footprint is increasing in size and global relevance — making it a great place to invest and do business." The CO2 emissions saved by the Hornsdale wind farm upon completion will be equivalent to taking either 290,000 cars off the road or planting 1.9 million trees.

Source Siemens

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

All-Terrain Crane Erects 14 Turbines at a Mile-High Altitude

The AC 1000 All Terrain Crane drives to the top of the Pretul.

The Terex® AC 1000 all-terrain crane recently proved it was virtually predestined to erect large wind turbines in hard-to-reach areas.

Before Austrian crane service provider Prangl could even begin erecting 14 turbines for the Enercon-operated wind farm site on the ridge of the Pretul mountain in Austria, it first had to get the nine-axle unit to the site.

A description of the route already had made it clear getting there wouldn't be easy. The site was at an altitude of one mile with slopes up to 18 percent. And the whole journey was made up of narrow and mostly unpaved winding roads peppered with steep bumps and deep depressions.

Even with these adverse conditions, the Prangl team, which was performing the job on behalf of Enercon, planned for the whole climb to take no more than two hours — two and a half tops. And this despite the fact that it was the first time Prangl was using the all-terrain crane. Nevertheless, Prangl Site Manager Peter Glier was optimistic.

"The AC 1000 is designed precisely for this kind of thing," he said. "It won't have a problem getting there."

PERFECT DRIVE DESIGN

The Prangl site manager's confidence in the crane's abilities was not unfounded.

"Thanks to a sophisticated drive design in which every axle can be steered, our nine-axle AC 1000 is more than a match for any extreme route," said Terex Sales Manager Robert Puchner, who was present at the debut of Prangl's new crane with a fellow team member in case on-site support was needed. "On top of this, every axle has its own independent suspension, meaning that the crane can easily handle tough bumps and depressions."

Crane operator Heinz Schuller in particular said he was thrilled with the AC 1000 crane's cross-country mobility and gradeability, which he got to experience first-hand as he drove the crane to the work site in a convoy with 10 escort vehicles within one day.

"Even driving the new crane on the freeway made me realize how impressive it is," Schuller said. "Despite its size, it has extraordinary straight-line stability and excellent handling performance. And the suspension is tuned perfectly."

But the moment of truth wouldn't come until the last few miles, when it had to drive up the mountain. In addition to the numerous bumps and depressions, the winding roads also proved to be a unique challenge: Two of the passes were so narrow that it was only possible to drive through them in reverse.

The Prangl team, which has a wealth of experience with mountain projects, used a tried-and-true technique.

"Whenever we need to cross a stretch like that, we first find a maneuvering point that we can drive into and then back off from in reverse," said Peter Glier, who already has used this trick several times with his team when dealing with difficult uphill drives.

The last stretch in the route was so steep that the Prangl team set up a truck as a tractor in front of the crane out of caution.

"The engine on the AC 1000 is more than powerful enough to handle that kind of thing, so it wasn't a matter of the engine output not being sufficient," Glier said. "Instead, our concern was that the wheels could start spinning due to how steep the slope was."

Once at the top, Schuller still had nothing but good things to say.

"The AC 1000 more than proved itself," he said. "Its outstanding transmission enabled it to smoothly handle even critical situations, such as driving on steep, unpaved mountain passes."

AMBITIOUS ERECTION SCHEDULE

Once there, the actual lifts were a matter of routine for the Prangl team and its crane. After two setup days with two team members, the crane was ready to start lifting.

It was able to easily lift all steel sections, nacelles, and rotor blades — with maximum weights of 64 tons — to the required height of up to 256 feet while working with a radius of 69 feet.

Given the special local weather conditions and the small time slots when crane operations are possible, the crane — which was able to be moved quickly and with little effort — let the Prangl team achieve its ambitious schedule of erecting 14 wind turbines in three months.

The AC 1000 — as a result of its well-engineered design — demonstrates how projects can be quickly and efficiently carried out.

Source Terex

For more information,
go to www.terex.com

Alliant Energy to Invest $1 Billion in Iowa Wind Project

Iowans will soon see a significant increase in clean, economical wind generation from Alliant Energy.

Alliant Energy CEO Patricia Kampling and Gov. Terry Branstad announced the utility will invest about $1 billion to expand its wind-energy operations in the state.

"Our customers expect low-cost, clean energy, which is exactly what this project will bring to the communities we serve," said Doug Kopp, president of Alliant Energy's Iowa utility. "Wind has no fuel costs and zero emissions, making it a win-win for Iowans and the Iowa economy."

Alliant Energy's Iowa utility is seeking regulatory approval to expand its Whispering Willow Wind Farm in Franklin County and possibly develop wind energy in other areas of the state. The five-year project will add up to 500 MW of clean energy to economically meet customer needs. The company is seeking approval now to maximize the value of renewable energy tax credits to benefit its customers.

The new wind project is part of Alliant Energy's vision for a clean-energy future. From 2005 to 2030, Alliant Energy is targeting a 40-percent reduction in carbon dioxide emissions. In addition, the project will generate tens of millions of dollars in property taxes and result in more than 1,500 jobs at the height of construction — boosting Iowa's economy while supporting customers seeking to use more renewable energy.

Source Alliant Energy

For more information,
go to www.alliantenergy.com

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AD INDEX

Coping with Cables

Mitigation for offshore wind-turbine cables is critical.

By Kenneth Carter

Transporting the power generated by offshore turbines takes a lot of cable — miles and miles of it, in fact.

Damage to even a small section of that cable — whether from manufacturing, construction, or environmental factors — can cause a disastrous and costly disruption.

At the Wind Energy Update's Offshore Wind O&M Forum in London last November, Thomas Bruun, Dong Energy's senior manager with Technical Integrity Management, discussed how measures are being used to inspect cables in order to keep them healthy and help ensure problems are kept to a minimum.

And with some wind farms boasting more than a 100 miles of cable, there's a lot of potential for failure, Bruun said.

"One of the things we have to have under control is the visibility of these risks," he said. "We need to have visibility of the risks we are dealing with. And two, we need to know how to mitigate those risks. And three, we need to be in control."

Cable mitigation isn't easy, and it's definitely not inexpensive, but it's a necessary function that ultimately could save a lot more than it costs when a cable fails.

"We think we are always aware that it's very costly to do mitigations in this field," Bruun said.

Dong Energy has a system in place designed to find and repair problems as quickly as possible.

"We have a contingency plan … where we have cable storage in place with these limited number of cables we're looking at," Bruun said. "Then we have vessels and repair supplies. Then we have approval from MMOs (Marine Management Organizations) to actually go and do it."

Critical cables connect these wind turbines.

Bruun said it's important Dong has the organization and the processes in place, so it actually knows how to cope with unscheduled maintenance.

"And what we have seen — we have actually used it sometimes — for now that it actually keeps the organization very effective, but also very calm when it does happen," he said. "Early on, we were running around in small circles."

Bruun said another way of controlling risk is by taking what they learn back to the cable design phase.

"One of our key tasks in Dong is actually taking the knowledge back to our design group to optimize it," he said.

Dong has several projects going where the data obtained from those projects will be used to affect what it does next year, according to Bruun.

In the future, Bruun said Dong wants to see advancements and new methods for checking cable integrity as well as different ways to deal with cable failure and damage when they happen.

"Then for the control of course, having new and more reliable failure-detection systems in place so we can actually detect it fast and start repairing," he said.

Another area Bruun said would be advantageous when it comes to cable mitigation is seeing the industry aligned more with spare parts, so it's not dependent on manufacturers.

"The last thing is better and more flexibility in repair vessels and repair methods which should allow us to have a faster repair time when it occurs in the field," he said.

Dong is responsible for 1.7 GW of offshore wind power with the goal of increasing that to more than 6.5 GW by 2020, so making sure cables are always working at their optimum capacity is critical.

And when a cable does fail, it's even more important to have contingency plans in place to replace or repair it as quickly as possible.

Offshore Wind Europe is November 22-23 in London. It is the continent's biggest commercially focused event attracting more than 300 of the industry's most senior executives. They are expected to discuss CAPEX and OPEX reduction for European offshore assets companies including E.ON, Siemens, JDR Cables, A2SEA, K2 Management, Bibby Marine, Global Marine Services, and SMD. For more on Offshore Wind Europe, go to www.windenergyupdate.com/offshore.

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