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POWERING CANADA'S NET-ZERO CARBON FUTURE

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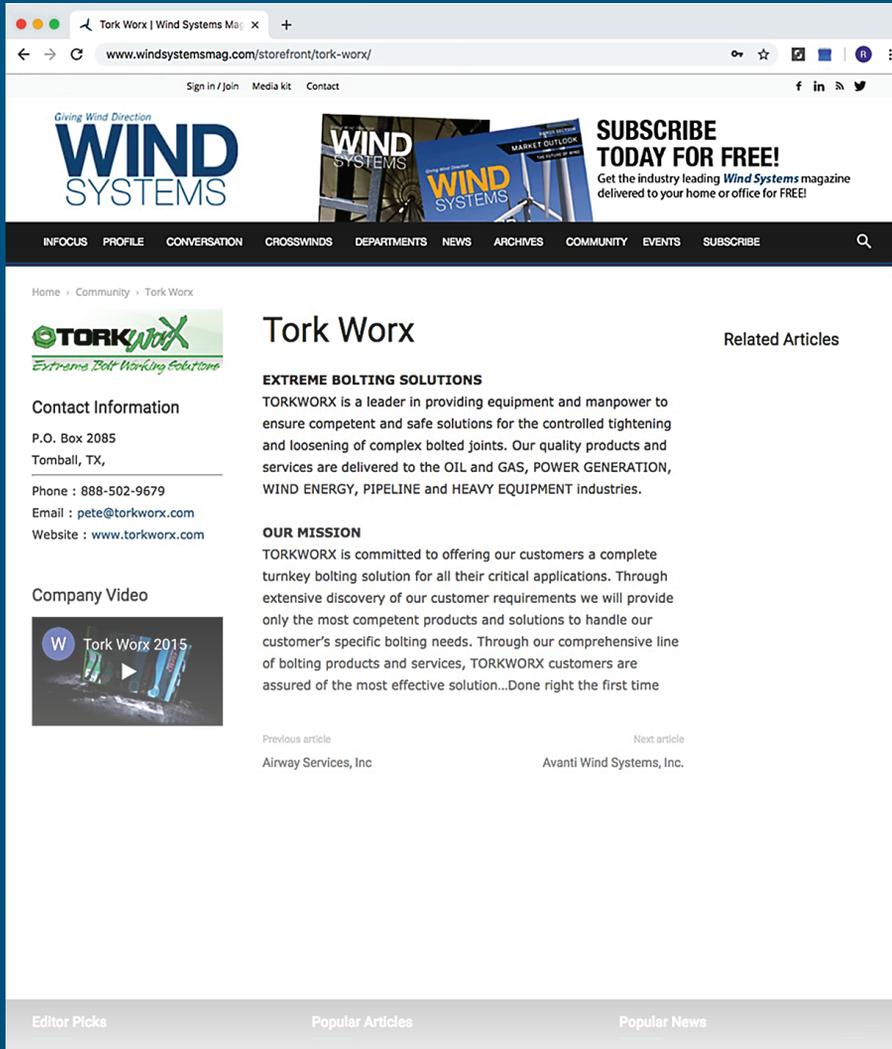
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Coronavirus still keeping us on our toes

As we move into the fall of 2020, it finally looks like this insane year is waning, and, I think I speak for all of us — good riddance.

That doesn't mean a few good things haven't come out of the year. If nothing else, it has forced us to challenge our norms and readjust our way of thinking about almost every aspect of what we do and how we do it.

You may notice that this issue is another combined monthly issue. We realize that many companies are still virtual or simply working at a diminished capacity, so, in order to serve our readers — and the environment — better, we bring you our September/October issue.

This issue normally would have been pegged to AWEA's Offshore Wind 2020 and the Canadian Renewable Energy Association's Electricity Transformation Canada show (which would have been the first time for this combined renewables tradeshow).

Those shows have either been postponed or are going virtual, but that doesn't mean *Wind Systems* will postpone the reason those shows existed in the first place. To keep your appetite whet, this issue offers

some fascinating articles on the state of offshore wind in particular and that of renewable energy in general in Canada.

Starting with our cover article, I had the pleasure of discussing the future of renewable energy in Canada with Robert Hornung. He is the recently appointed president of the Canadian Renewable Energy Association. How the renewable sectors in Canada came to be under one roof is an interesting story. After you check out the state of energy in Canada, keep turning to our Conversation feature where Hornung talks about CanREA and what it means for Canadian renewables.

And on the subject of offshore wind, I don't think you'll come away disappointed since you'll discover several articles on that topic covering some interesting and diverse angles:

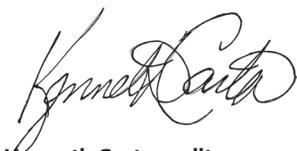
► An article from Avangrid Renewables looks at how the company is developing cutting-edge technology in order to lay the groundwork for the Kitty Hawk Offshore Wind project off the coast of North Carolina.

► A contributor with the Society of Tribologists and Lubrication Engineers reveals some challenges the industry will face when implementing offshore wind.

► And in this issue's Crosswinds article, a University of Delaware team identifies two ideal sites for offshore wind ports in Delaware Bay.

With all that in mind, a final reminder that *Wind Systems* is here to serve you. If you have any suggestions or would like to contribute, please contact me. I'm always looking for exciting articles to share.

Stay safe and healthy out there, and, as always, thanks for reading!



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California energy sector urges investments to prevent shortfalls

From AWEA

The American Wind Energy Association of California (AWEA-California) recently released a statement on behalf of Director Danielle Osborn Mills, following rotating power outages in California. Highlights include:

- The renewable system in California and across the West is not sufficiently built out and was designed around a different set of resources. As a result, the state needs to refocus its planning and procurement processes to enable utility-scale wind, solar, and storage to provide reliable power to California.
- Solar power can produce huge amounts of energy, but the state needs a better plan for providing clean energy in that evening period when the sun sets.
- Wind energy has proven to be a reliable complement to solar and other renewables: There is still plenty of wind power available in New Mexico, Wyoming, and other states, provided we have the transmission in place to bring this power online when we need it.
- Offshore wind is an innovative renewable solution capable of providing vast quantities of energy right when the sun goes down. It is time to jumpstart the planning that will be needed to make offshore wind a reality.
- California relies heavily on solar, storage, and gas — and during the recent blackouts, there is, once again, a push for more storage, microgrids, and other alternatives to back these systems up. State leaders must recognize that we need more renewables of all kinds to keep the lights on.



The American Wind Energy Association (AWEA) is the premier national trade association that represents the interests of America's wind energy industry. For more information, go to www.awea.org.



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DIRECTION

THE FUTURE OF WIND

The 1.5°C target classification is the most ambitious designation available through the SBTi validation process. (Courtesy: Vestas)

Vestas to keep climate targets in line with 1.5°C scenario

As a leading renewable energy company, Vestas recently announced that the Science Based Targets Initiative (SBTi) has validated the company's greenhouse gas reduction targets and confirmed them as in line with the levels required to keep global warming to 1.5°C above pre-industrial temperatures – the most ambitious goal of the Paris Agreement. Vestas is the first renewable energy manufacturer to have its targets validated by the SBTi as consistent with a 1.5°C scenario. The target validation follows Vestas' announcement in January 2020 to become carbon neutral, without the use of offsets, by 2030.

“At Vestas, we are proud to reach this milestone with SBTi; becoming carbon neutral by 2030 is a key element within Vestas' goal of becoming the global leader in sustainable energy solutions, said Henrik Andersen, CEO and president of Vestas. “With several nations and global businesses outlining intentions for a green economic recovery from COVID-19, the renewables industry is set to become a more dominant resource in the global-energy mix. As the world's leading supplier of wind energy, Vestas is determined to ensure that the industry continues to minimize environmental impacts as it scales.”

“Vestas' science-based targets put the company on a pathway to reach zero emissions faster than what science tells us is needed,” said Cynthia Cummis, director of Private Sector Climate Mitigation at World Resources Institute, one of the Science Based Targets initiative partners. “By setting targets that are grounded in climate science, Vestas is positioning themselves as leaders in their sector and setting themselves up for success in the transition to a net-zero economy.”

The 1.5°C target classification is the most ambitious designation available through the SBTi validation process and covers Vestas' targets to reduce emissions from direct operations

(scope 1 and 2 emissions) by 100 percent by 2030 from a 2019 base year. Separately, Vestas' target for reducing emissions from its supply network (scope 3 emissions) by 45 percent per MWh generated by 2030 has also been validated as notably ambitious. In a recent report, the IPCC stipulates that limiting the rise in the global temperature to 1.5°C, as opposed to 2°C, will significantly reduce the risk of extreme impacts from climate change.

The 1.5°C scenario of the Paris Agreement outlines the measures required to limit the global temperature increase to 1.5°C above pre-industrial temperatures. Ensuring that all direct operations are closely aligned with the 1.5°C scenario is necessary for Vestas to ensure the company can remain sustainable as it scales its position within the energy sector's supply chain. A recent report from the Carbon Disclosure Project (CDP) found company supply chains produce on average five times more emissions than direct operations. The research also found increasing the proportion of renewable energy within supply chains is an effective pathway to address emissions.

“Limiting global warming to 1.5°C above pre-industrial temperatures cannot be achieved if all global actors work in isolation; we must adopt a collaborative approach,” said Lisa Ekstrand, head of Sustainability at Vestas. “At Vestas, we recognize that, as a global leader within the renewable industry's value chain, we have a responsibility to be ambitious in our approach to reducing greenhouse gas emissions. This has been the driving force behind devising our strategy for becoming carbon neutral, and for reducing emissions in our supply chain.”

Company cars are gradually being replaced across Vestas with more sustainable alternatives. Close to 100 green service vehicles are now in operation, signaling Vestas' first step within direct operations toward its 2030

goal. Moving forward, Vestas will also be focusing on fulfilling its ambitions for reducing greenhouse gas emissions within its own supply chain, in line with its target of a 45-percent reduction. To support this goal, Vestas has already established partnerships with several suppliers, including DSV, to improve its emission reductions within transport and turbine manufacture.

MORE INFO www.vestas.com

Federal offshore wind lease auctions could reap major benefits

The United States has an opportunity to accelerate offshore wind energy growth and benefit from 28 new GW of clean energy and \$1.7 billion in U.S. Treasury revenue by 2022, a recent study released from research group Wood Mackenzie finds.

Findings from this study confirm additional lease areas are needed to meet demand, reduce energy costs, increase competition, and ultimately generate thousands of jobs and billions in investment. Additionally, the findings offer guidance to decision-makers about new offshore wind leases, which can be a short-term solution to jump start recovery from a coronavirus pandemic-driven economic slowdown.

Commissioned by four energy industry groups, American Wind Energy Association (AWEA), National Ocean Industries Association (NOIA), New York Offshore Wind Alliance (NYOWA), and the Special Initiative on Offshore Wind (SIOW) at the University of Delaware, the study dives into the economic impact of offshore wind activities as a result of potential Bureau of Ocean Energy Management (BOEM) lease auctions in 2020, 2021, and 2022. Based on existing activities and policy assumptions for future offshore wind development, 2 million acres of federal waters in the New York Bight, which

includes parts of New Jersey, as well as California and the Carolinas, could be auctioned for commercial leases as early as this year into 2021. Such leasing could support 28 GW of offshore wind development and generate \$1.2 billion in U.S. Treasury revenue. Other auctions for lease areas in the Gulf of Maine and areas in California could happen in 2022 and would generate an additional \$500 million in U.S. Treasury revenue.

“Policymakers at the federal and state levels right now hold the key to unlocking the full potential of the offshore wind industry that will benefit all Americans,” said Laura Morton, AWEA senior director of Offshore Wind. “We’re on the cusp of a rare opportunity, but the U.S. remains far behind other countries in harnessing offshore wind technology. It’s time for us to unleash this abundant domestic energy source that will deliver tens of thousands of new jobs, revitalize coastal ports, and expand manufacturing opportunities, to reap major economic and environmental benefits.”

Significant capital investment will be put into the U.S. economy to support offshore wind activities. Total investment in the U.S. offshore wind industry will be \$17 billion by 2025, \$108 billion by 2030, and \$166 billion by 2035. From 2022 to 2035, capital investment of \$42 billion will go to turbine manufacturers and the supply chain, \$107 billion will go to the construction industry, and \$8 billion will go to the transportation industry and ports. Annual capital investment for O&M activities will increase to \$2.4 billion in 2035.

In addition to delivering clean energy to millions of households, the offshore wind industry will also contribute a variety of economic benefits to the U.S. economy, including supporting thousands of jobs and billions of dollars in capital investment. If the assumed BOEM auctions in 2021 and 2022 happen, total full time equivalent (FTE) job creation from the resulting offshore wind activities, including development, construction, and operation will be approximately 80,000 jobs



The American Wind Energy Association recently released a series of case studies examining all the ways wind power is helping rural communities navigate these challenging times. (Courtesy: AWEA)

annually from 2025 to 2035.

“American offshore wind is a generational opportunity,” said Erik Milito, NOIA president. “Infrastructure spending, energy security, and shovel-ready jobs with good wages will be unleashed. Importantly, offshore wind development will support jobs throughout the entire U.S. The same shipbuilders, heavy lift vessel operators, steel fabricators, and countless other companies who built the Gulf of Mexico oil and gas sector stand ready to lend their expertise to the American offshore wind industry.”

MORE INFO bit.ly/33qRcf6

Wind poised to help economy recover from COVID-19 recession

Before the pandemic, many rural communities were already struggling with population decline, retention of young people, and economic hardship due to agricultural uncertainty. In the face of COVID-19, these challenges have only grown. However, wind power is providing rural communities with an extra layer of security through land-lease payments and substantial new tax revenue. This extra funding provides the opportunity

to improve roads and infrastructure and invest in schools and other resources that strengthen the community, while drawing new residents to the area. Wind energy is also one of the few industries currently creating new manufacturing jobs.

The American Wind Energy Association recently released a series of case studies examining all the ways wind power is helping rural communities navigate these challenging times.

Offshore wind is another area that has great potential for boosting the post-pandemic economic recovery. In March, AWEA released its U.S. Offshore Wind Power Economic Impact Assessment, which found that by developing 30,000 MW of offshore wind along the East Coast, the U.S. could support up to 83,000 jobs and deliver \$25 billion in annual economic output by 2030. An August 2020 study from research group Wood Mackenzie finds offshore wind in the U.S. overall has the potential to deliver 28,000 new megawatts of clean energy and \$1.7 billion in U.S. Treasury revenue by 2022, which would significantly aid the economy in its post pandemic recovery.

Wind is also helping the U.S. recover from the pandemic more sustainably. As a zero-carbon energy source, the electricity wind turbines generate

avoided an estimated 42 million cars' worth of CO₂ emissions in 2019 alone. Because wind requires no water to produce electricity, it significantly reduces water consumption — saving about 103 billion gallons of water at power plants in 2019.

MORE INFO awea.org

BVG Associates gets funding for N.C. offshore development

The North Carolina Department of Commerce recently selected a team led by BVG Associates to assist in developing a strategic roadmap that will guide the state's efforts in supporting the offshore wind industry.

BVG Associates is a trusted leader in the global offshore wind space with a breadth of experience in all elements of the industry including development, finance, logistics, infrastructure, and analysis.

Over the coming months, the firm will work with state agencies and stakeholders to identify North Carolina's existing infrastructure and manufacturing assets and make recommendations to expand the state's opportunities for securing the offshore wind supply chain.

"North Carolina is already home to 55 companies that support the land-based wind industry, which is a tremendous advantage for the state's ability to transition into offshore wind," said Katharine Kollins, president of the Southeastern Wind Coalition. "The partnership between the state and BVG Associates, as well as the findings of the assessment, will be a monumental step forward in determining how to build on those advantages while driving new clean-energy business and investment to North Carolina."

To bring in-state expertise, BVG Associates has partnered with North Carolina State University's Clean Energy Technology Center and the University's Economic Development Partnership to support workforce and other stakeholder engagement

elements of the analysis.

"N.C. State is proud to share our expertise in clean-energy technologies and workforce development within those industries to this effort, and contributing to the state's broader goal of pursuing the offshore wind industry and its immense economic potential here in North Carolina," said Steve Kalland, executive director of the North Carolina Clean Energy Technology Center. Rounding out the team of experts contributing to the assessments include Lloyd's Register Energy America and the Timmons Group.

The partnership announcement comes on the heels of a study conducted by Wood Mackenzie highlighting the economic impact of leasing additional wind-energy areas for offshore wind development. In the Carolinas alone, development along the coast could lead to more than 40,000 jobs in development, construction, operations, and supply chain, and more than \$45 billion in capital investment. The study was commissioned by four energy industry groups, the American Wind Energy Association (AWEA), the National Ocean Industries Association (NOIA), the New York Offshore Wind Alliance (NYOWA), and the Special Initiative on Offshore Wind (SIOW) at the University of Delaware.

"These findings reinforce the significant economic benefit that offshore wind could provide to North Carolina, and why now is the right time to work toward capturing this unparalleled opportunity for our state," said John Hardin, executive director of N.C. Commerce's Office of Science, Technology, & Innovation. "I look forward to working with BVG Associates on charting a path forward for our ports and manufacturers to support offshore wind development off the coast of North Carolina and across the country."

The North Carolina infrastructure and supply chain analysis will be conducted through the remainder of the year, with a final report scheduled to be published in late 2020. ↵

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Over the last decade, wind energy has been the largest source of new generating capacity in Canada and has become the lowest cost source of new generation. (Courtesy: Canadian Renewable Energy Association)



Collaboration, policy, technology, and economic stimulus in the wake of COVID-19 are all variables in the renewables equation that will push Canada to net-zero greenhouse gas emissions by 2050.

By **KENNETH CARTER** ▶ Wind Systems editor

Canada wants to have net-zero carbon emissions by 2050, and it is pushing those goals with some interesting organizational changes.

And while 2050 may feel like it's a million years away, it's only 30, so the clock is ticking to get policies in place, and in place quickly.

As part of that goal, renewable energy associations decided to merge into one with the recent unification of the Canadian Wind Energy Association and the Canadian Solar Industries Association with the Canadian Renewable Energy Association. Now, wind, solar, and energy storage can speak as one voice to expedite the country's energy aspirations.

"The future of our technologies hinges on a couple of things, and the key driver is going to be climate policy clearly," said Robert Hornung, president of the Canadian Renewable Energy Association. "Canada has made a commitment to net zero greenhouse gas emissions by 2050. Every single study that has looked at that question in Canada says you have to do two absolutely central things to get there: One is you have to decarbonize electricity production, and Canada's in a good position with that; 80 percent of its electricity production is currently non-emitting. But that means there's 20 percent of committing technology that has to be taken off the system. And we believe that wind and solar will capture most of that opportunity going forward."

PART OF THE SOLUTION

But that is only part of the solution in order to get to net zero, because that electricity has to be used to substitute for fossil fuels and other applications, according to Hornung.

"Whether it's in transportation through electric vehicles, whether it's in industrial processes, whether it's in buildings," he said. "And in Canada at a minimum, studies have shown that this would require probably a doubling of electricity production to be able to do that. That represents a tremendous opportunity for our industries because we sort of tick off a lot of those needs."

By implementing multiple renewable alternatives, a reliable product gets provided, and from a policy-making perspective, for climate change in particular, regulatory changes and market frameworks are going to be needed to ensure technologies are competing on a level playing field, according to Hornung.

"Our industries are not scared of competition," he said.



Canada already ranks in the top 10 globally for installed wind energy capacity and in the top 20 for installed solar energy capacity. (Courtesy: Canadian Renewable Energy Association)

“They’re keen to compete. They just want to make sure we’re on a level playing field when we’re doing so.”

For example, in provinces such as Ontario and Alberta, energy storage doesn’t have a fair shot to compete because most jurisdictions don’t actually provide a way for it to receive compensation for the services it provides, according to Hornung. By changing the frameworks to recognize the value that these technologies bring to the system, it creates mechanisms that allow them to be compensated for providing that value to the system.

HELPING CANADIAN BUSINESS

And that can end up being hugely advantageous to Canadian businesses.

“Just with wind energy, we’ve demonstrated how we’re the most cost-competitive source of new electricity generation available in Canada,” Hornung said. “The biggest barrier and the biggest challenge to getting new wind onto the grid is electricity demand. Many parts of Canada have electricity surpluses; electricity growth is slow and obviously has fallen with COVID coming around. When we look at opportunities going forward, again bringing the technologies together, we think it will open more doors because, increasingly, customers like utilities are not just looking for energy. They’re looking for energy and a whole range of services that can be provided to the grid.”

And that means looking beyond long-term power purchase agreements, and getting more creative with contractual arrangements and market mechanisms that can give the ability to provide a broader range of services while opening up potential sources of revenue and driving development opportunities, according to Hornung.

“We think that bringing these technologies together and exploring how we can create regulatory frameworks and market rules that enable these technologies to be deployed and to capitalize on their strengths will essentially grow

the pie for everyone,” he said. “And that’s where they’re interested.”

ENERGY EFFICIENCY

With businesses looking for more creative ways to take advantage of renewables, Hornung emphasized that, although renewable technologies are an important part of the solution, they’re not the whole solution.

“Energy efficiency is clearly going to be critical,” he said. “What energy we do produce and use, we need to use as efficiently as possible. And when we look at a target like 2050 – 30 years away – we need interim targets that we can measure against. We would argue they should be legislated that we move toward, we need to continue. In Canada, we do have a carbon price. We need to continue to have carbon pricing. That price needs to increase over time to continue to send the signal to investors that we need to move away from greenhouse gas. And we need strategic approaches to do things like electrified transportation, which in itself is a large task, and that is not just a matter of changing pricing. There are regulatory changes that are required; there’s infrastructure investments that are required.”

And in Canada, carbon pricing clearly plays a role in getting to that 100 percent renewable goal, according to Hornung.

“We’re already phasing out coal-fired generation through regulation, and we need to think seriously about how we’re going to treat natural gas generation going forward,” he said. “We need to invest in new infrastructure that will facilitate both the deployment of renewables and also their integration, for example, with inter-provincial transmission lines. And we need to recognize that we’re going to have a significant growth as well, coming forward in terms of electricity production. We need to work to make adjustments to our regulatory frameworks to enable that and to account for that. It’s not as simple as saying, ‘We just need the technolo-

gy: I would argue we have the technology in order to move in this direction. What we don't have are the regulatory and market, and, frankly, policy frameworks that enable us to efficiently deploy those technologies to enable us to achieve our goals. That's what we need to work on."

PANDEMIC CHALLENGES

The unfortunate reality of COVID-19 has created its own set of challenges when it comes to the renewable sector in Canada, especially with larger, utility-scale projects, but Hornung pointed out that it has affected other aspects in surprising ways.

"For the larger projects, utility scale projects, the impact has really been on construction schedules and supply chain sorts of issues and availability; these projects are continuing to move forward, but they're increasingly challenged to meet deadlines," he said. "For the behind-the-meter side, I would say the challenge has been larger when you think about, for example, somebody who's putting solar panels on a home, they've just gone through an extended period where homeowners have been very cautious about having somebody come over. It's been tough to do that kind of business."

The sector has been faced with many challenges related to the pandemic, but it is Hornung's hope that Canada will emulate other countries like the European Union and invest in economic stimulus measures that will enable the country to, not just deal with the economic impact of COVID-19, but also help it address other issues such as climate change at the same time.

Government stimulus strategies in response to COVID-19 can serve to create high-quality and widely dispersed jobs, while also putting Canada on a viable pathway to net-zero greenhouse gas emissions by 2050. According to Hornung, this could and should involve:

- Support for labor-intensive work such as the deployment of solar energy and energy storage systems for homes and commercial and institutional buildings across Canada.

- Support for major new electricity infrastructure such as new transmission lines and energy storage projects, which will enable better integration and use of wind and solar energy.

- Support for the electrification of transportation and the production of green hydrogen from wind and solar energy, which could create new industrial opportunities while reducing greenhouse gas emissions from transportation.

"It's our hope that there will be new opportunities emerging from that," he said. "The other point I would make about COVID is that it's obviously posed a challenge for the industry in terms of its own procedures and processes. Everyone's first concern is the health and safety of their workforce. And so, people have had to make adjustments and plan, and I think that the industry has responded very well in that regard to those challenges. It's also had an impact in terms of future prospects in the sense that we have seen a significant decline in electricity demand associated with the economic

downturn resulting from COVID. And there's a lot of uncertainty as to when, or if, that electricity demand will come back. In terms of looking at potential future procurement processes, I think there's a bit more uncertainty about that right now, at least until we have some more clarity about what the economic recovery is going to look like."

Like many countries, Canada has seen an increase in residential electricity demand since residents are spending more time at home or are working from home, which has been more than offset by electricity use in the commercial and industrial sectors, according to Hornung.

WORKING WITH THE U.S.

With Canada moving forward with its progressive energy goals, it's hard not to speculate what kind of impact it might have on North America as a whole when the United States' renewable energy policies are in flux.

"Similar to the U.S., in Canada the policies that are driving action on climate change are not just a question of the federal government; provincial and state governments and municipal governments all are playing a very significant role," Hornung said. "And I would say, from our perspective, we would like to see collaboration between these countries in terms of addressing this challenge. We think one area where Canada can play a particularly important role, vis-a-vis the U.S., is in terms of our non-emitting electricity base. We do see real opportunities for increase. Canada's already a significant exporter of electricity to the United States, but as the United States moves forward and sees things like electrification and transportation and continued growth in that area, we think Canada will have the opportunity to provide more electricity to the U.S. that is non-emitting, that's low cost, and that can help the U.S. in terms of moving to address its own greenhouse gas challenge. From our perspective, we see potentially a significant role for Canada in terms of being a source of clean power for the United States, but also an opportunity to help to balance some of the variability that the U.S. is going to experience as well in terms of bringing more renewable generation onto the grid."

Some of that will be dealt with through energy storage and other tools in both Canada and the U.S., but Canada has a large hydroelectric base that will perform that function in parts of the country, according to Hornung. It has the opportunity to do a similar thing in the U.S.

"We already have seen, for example, agreements between Minnesota and Manitoba," he said, "where Manitoba is using its hydroelectric capacity to help manage the variability of wind energy on Minnesota's grid."

But in Canada, changing the design of electricity markets and the regulatory frameworks that govern them will be a complex and time-consuming process, according to Hornung.

"Success in 2050 depends on decisions taken today – and the wrong decisions could lock us into pathways that will make it impossible to achieve net-zero emissions in 2050 without stranding assets and investment," he said. ↘

A DATA-DRIVEN APPROACH TO OFFSHORE WIND IN THE U.S.

A technician tests and calibrates equipment on the meteorological buoy prior to deployment. (Courtesy: Avangrid Renewables)

Avangrid Renewables is deploying cutting-edge technology in order to lay the groundwork for the company's Kitty Hawk Offshore Wind project.

By MEGAN HIGGINS

Twenty-seven miles off the coast of the Outer Banks of North Carolina, cutting edge research is under way. Kitty Hawk Offshore Wind, a project of Avangrid Renewables, is making substantial progress on the evaluation of the Wind Energy Area (WEA) that the Bureau of Ocean Energy Management competitively awarded to the company in 2017. The WEA is 122,405 acres on the Outer Continental Shelf (OCS). It is estimated that, when fully developed, the Kitty Hawk WEA could yield as much as 2,500 MW of clean, low-carbon energy — enough to power approximately 700,000 homes.

Avangrid Renewables is engaging in a rigorous, data-driven approach to develop the Kitty Hawk Offshore Wind project. In June, the company launched a meteorological buoy with cutting-edge offshore wind assessment technology. The Floating Light Detection and Ranging (FLiDAR) instrumentation buoy collects real-time meteorological and ocean data to inform the development of the Kitty Hawk Offshore Wind project compatibly with the ocean environment.

The FLiDAR WindSentinel™ is an industry-proven technology developed by AXYS Technologies, Inc. that integrates a Light Detection and Ranging (LiDAR) on a moored buoy to provide data on wind speed, wind direction, and turbulence at the turbine hub-height and across the blade span. This buoy is also equipped with a range of other sensors to measure surface wind speed and direction, relative humidity, directional waves, ocean currents, tide, salinity, water temperature, atmospheric pressure, and air temperature.

These measures provide a comprehensive data set of environmental conditions useful for wind resource assessment and wind potential monitoring over time.

SAFEGUARDING WILDLIFE

The buoy minimizes potential impacts to offshore birds and marine mammals by curtailing landing areas for birds, preventing seals from hauling out on the buoy, and avoiding entanglements of marine mammals with the buoy anchor chains.

Avangrid Renewables is committed to a comprehensive, data-informed approach to harnessing an abundant, carbon-free domestic energy resource in a way that is compatible with the ocean environment. LiDAR technology has advanced the wind industry glob-

ally by informing turbine location based on considerations for the unique environmental needs of each site to make projects more efficient. Deployment of this technology to the Wind Energy Area is an exciting milestone for a project that will help ignite the nascent offshore wind industry off the coasts of North Carolina and Virginia.

The buoy will be installed for one year with the possibility of an extended time in a second location within the WEA. The data collected by the buoy will facilitate the design and development of the Kitty Hawk Offshore Wind project. As a part of the company's commitment to openness and transparency with project stakeholders, data from the buoy is available to the public at www.kittyhawkoffshore.com/fishing.

OCEAN FLOOR DATA

In addition to the meteorological data from the buoy, evaluating the ocean floor is critical to inform turbine foundation design. To gather subsea data on the geological conditions of the WEA, survey vessels are conducting geotechnical analyses. The Kommander Susan, owned by Horizon Geosciences, began work in the area on August 6, 2020.

The geotechnical campaign is conducting borehole drilling and sampling to provide further information on the



The meteorological buoy under tow en route to the Wind Energy Area. (Courtesy: Avangrid Renewables)



The FLiDAR WindSentinel™ meteorological buoy at the dock before deployment. (Courtesy: Avangrid Renewables)

ground conditions and physical constraints across the site and to support the detailed survey planning and site characterization activities to be conducted in 2021. Laboratory tests of the collected samples will determine the nature and composition of the terrain.

The meteorological and geotechnical survey work underway is critical to the successful development and operation of the project, an outcome that will deliver substantial benefits to a wide array of stakeholders throughout the region for decades to come.

MEETING CARBON-REDUCTION GOALS

Once complete, Kitty Hawk Offshore Wind will deliver a cost-effective, carbon-free source of energy to major coastal population centers, helping states meet their ambitious carbon reduction goals.

Additionally, the project represents a substantial investment in the economies of Virginia and North Carolina. The project is expected to drive almost \$2 billion in economic activity in the region, including projected construction investment, increases in household incomes, and additional tax revenue at both the state and local levels.

This substantial investment will spur considerable employment: Kitty Hawk Offshore Wind-related con-

struction activities are expected to employ more than 700 people during the construction phase and create or support nearly 1,000 jobs throughout the region once fully operational.

In addition, as Kitty Hawk Offshore Wind and other offshore wind projects are developed, the East Coast will attract companies in the offshore wind supply chain, creating further opportunities for employment and innovation in the mid-Atlantic region.

The future is bright for the offshore wind industry and for the Kitty Hawk Offshore Wind project. The geotechnical surveys occurring now are laying the groundwork for a project that will deliver clean energy and economic growth.

The first phase of Kitty Hawk Offshore Wind could come online as soon as 2026 with a full buildout of the Kitty Hawk WEA — estimated at 2,500 MW — complete by 2030. Once online, the clean energy generated by Kitty Hawk Offshore Wind will provide clean, affordable energy for decades to come. ✌

ABOUT THE AUTHOR

Megan Higgins is Avangrid Renewables' senior director for Offshore Business Development. For more information, go to www.kittyhawkoffshore.com.

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A photograph of several offshore wind turbines in the ocean. The turbines are white with three blades each, mounted on yellow and white support structures. The water is a deep blue, and the sky is a lighter blue. The turbines are arranged in a line, receding into the distance.

CHALLENGES IN IMPLEMENTING OFFSHORE WIND POWER

In the U.S., only one offshore wind farm has been commercialized off the coast of the state of Rhode Island. (Courtesy: @Can Stock Photo/AlexLMX)

Concern about the availability of rare-earth metals in general and neodymium in particular led a study to develop what-if scenarios for its use in wind turbines through 2050.

By DR. NEIL CANTER

Wind power continues to offer a potential alternative approach for generating electricity that is more environmentally friendly. But the severe operating conditions placed on the lubricant in gearboxes needed to convert low-speed wind energy to high-speed energy in the wind turbine have decreased the ability for operating at an optimum level for a long period of time.

This factor is particularly critical because wind turbines are in remote locations, making it very difficult and costly to maintain them. The potential use of wind turbines in offshore farms has a much higher potential for generating electricity than on land but faces greater challenges. One of the operational issues has been the premature failure of gearboxes. In the U.S., only one offshore wind farm has been commercialized off the coast of the state of Rhode Island.

In a *Tribology & Lubrication Technology* article [1], researchers determined that placement of a wind farm in the North Atlantic Ocean would produce a higher electricity output than wind farms of a comparable size on land in a state such as Kansas. The key parameter is the kinetic energy extraction rate, which measures the amount of wind energy available for turbines. The kinetic energy extraction rate is four times higher in the North Atlantic Ocean than on land.

“The U.S. Department of Energy (DOE) published a 2015 study [2] that developed scenarios for producing over 80 GW of offshore wind power by 2050,” said Dr. Tomer Fishman, a former post-doctoral associate at the Yale University School of Forestry & Environmental Studies in New Haven, Connecticut, and a lecturer at the Interdisciplinary Center IDC Herzliya in Herzliya, Israel. “This study envisioned that the U.S. will be able to not only boost wind power but potentially create a domestic industry that would include the potential production of turbines.”

Several factors not covered in the DOE study may reduce the potential for using wind energy, particularly offshore. One of these issues is directly related to the challenges faced in using gearboxes in wind turbines.

“Operational difficulties with using gearboxes in offshore wind turbines led the wind power industry to evaluate the use of direct drive systems,” Fishman said. “This technology initially was more expensive and heavier than gearboxes, but ongoing developments have led to reductions in cost and weight.”

Fishman and his co-author, Thomas Graedel, professor emeritus at the Yale University School of Forestry & Environmental Studies, have now conducted a study to complement DOE’s vision of offshore wind energy and demonstrate that other factors must be considered to predict the future use of wind turbines in the U.S.

NEODYMIUM

The focus of the study conducted by Fishman and Graedel deals with the fact that DOE did not factor in the availability and use of the rare-earth metal neodymium in its 2015 study.

“Rare-earth metals, in general, are considered to be critical raw materials necessary for the long-term growth of the U.S. economy,” Fishman said. “The concern about them is their long-term supply because there is only one country processing most of the rare-earth metals: China.”

Fishman explained that rare-earth metals are less economically available and are needed for critical applications such as computers and electric vehicles. The permanent magnet systems used in direct drive systems are based on neodymium, iron, and boron because they demonstrate the most efficient generation of electricity and enable the design of wind turbines that are lighter and more compact.

Nearly all of the world’s neodymium is mined in China, according to Fishman.

“The supply chain for producing the wind turbines off the Rhode Island coast were prepared from a vulnerable and complex supply chain that started in China and then went through Japan and France before ending up in the U.S.,” he said. “The purpose of our study was to develop what-if scenarios regarding the use of neodymium in wind turbines over the next 30 years until 2050. Approximately 15,500 metric tons of neodymium are predicted to be required during this time. We believe that 20 percent of this usage could be avoided through the development of recycling techniques and more effective magnets.”

The U.S. was divided into five distinct regions (Northeast, Mid-Atlantic, Pacific, Great Lakes, and Gulf) because demand for wind power will not be uniform.

“Each of these regions has its own requirements for wind energy, which will impact the demand for neodymium,” Fishman said.

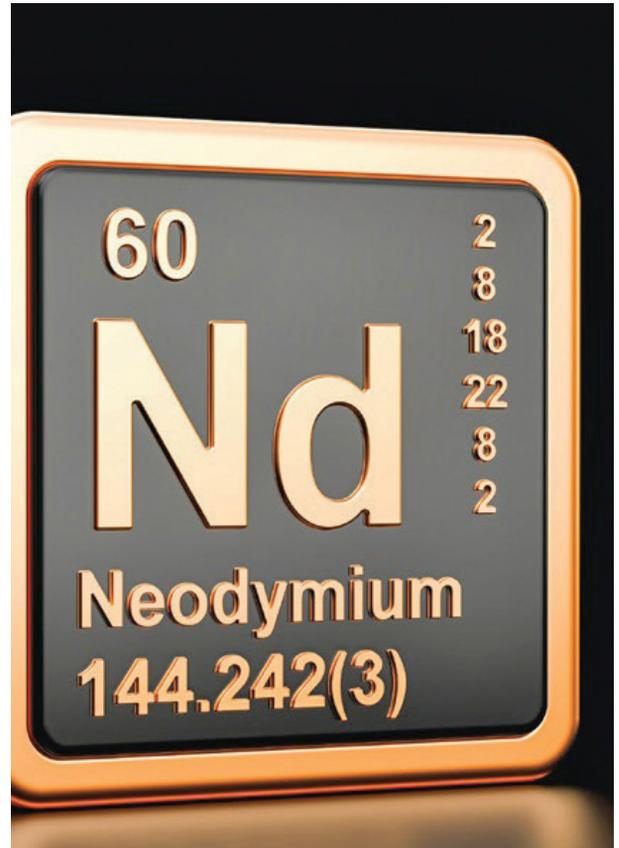
The researchers used a materials flow analysis to evaluate the supply and demand for neodymium.

“This approach represents a framework to account for the demand, supply, and use of neodymium,” Fishman said. “It is similar to how a company will assess earnings, losses, and profitability through accounting practices.”

A second rare-earth metal, dysprosium, also is used in neodymium, iron, and boron permanent magnets to a smaller extent and will face the same supply situation.

“We expressed similar concerns about dysprosium, which enables the permanent magnetic to perform under more severe conditions such as higher stress and higher temperatures,” Fishman said.

The researchers hope that by factoring in the supply and demand for rare-earth metals, the U.S. will be able



A new study extrapolates the use of the rare earth metal neodymium in offshore wind turbines built in the U.S. during the next 30 years. (Courtesy: Yale University)

to develop a successful wind-energy program. Additional information on this study can be found in a recent *Nature Sustainability* article [3] or by contacting Fishman at Tomer.fishman@idc.ac.il. ↵

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ARE YOU MAXIMIZING YOUR EXPOSURE?

The screenshot shows a web browser displaying the storefront for Tork Worx on the Wind Systems Community website. The page features the Tork Worx logo, contact information, and a detailed description of their services. The main content area is titled "Tork Worx" and includes a "SUBSCRIBE TODAY FOR FREE!" banner. Below the banner, there is a "Contact Information" section with the address: P.O. Box 2085, Tomball, TX, and phone number 888-502-9679. A "Company Video" section shows a video thumbnail for "Tork Worx 2015". The page also includes a "Related Articles" section with links to "Airway Services, Inc" and "Avanti Wind Systems, Inc".

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The 30-meter BAR Tech CTV.
(Courtesy: Chartwell Marine)

With Chartwell Marine's newly designed Chartwell 24 CTV, the company is set to be a leading force in transporting technicians and workers to their offshore wind-farm destination.

By **KENNETH CARTER** ▸ Wind Systems editor

The sight of spinning wind turbines off the coast can be a moving example of how human ingenuity can harness the power of nature, but it takes a lot of moving parts to keep those turbines in proper working order.

Case in point: How do you get workers to-and-from those turbines when maintenance is required? After all, a wind farm extends hundreds of meters from the ocean's surface while being miles and miles from shore.

Vessels designed by the experts at Chartwell Marine have been used to ferry technicians and other workers to wind turbines in Europe for years, and they are now set to be used in offshore wind-energy projects in the U.S.

"As a team at South Boats, we delivered the Atlantic Pioneer, which is the first crew transfer vessel in operation in the U.S.A., working on the Deepwater Wind site for Ørsted," said Andy Page, managing director of Chartwell Marine. "We've built on that background with Chartwell, launching a crew transfer vessel range called the Chartwell 24, which we are seeing significant demand for. We have just delivered one and have a second vessel due for delivery in September or October. In the United States, we have a further Chartwell 24 being built at Blount Boats, which is due for delivery in Q3/Q4 2020, with another vessel prepared for build. Further down the line, we have two more Chartwell 24s that we have just started building in the U.K."

THE CHARTWELL 24

The vessels Page refers to as Chartwell 24s are a range of crew transfer vessels that the company expects to be the leader in the burgeoning offshore wind business in the U.S.

"From a Chartwell perspective, I'm extremely proud of the team for designing the Chartwell 24 — to have come up with a vessel range, which is hybrid-ready, right-whale compliant, ABS approved, under 100 gross tonnage, optionally compliant with EPA Tier 4, and crucially, packaged up to enable a cost effective build in the States," he said.

It was important to Chartwell that the hybrid vessel have a functional design in order to develop and bring it to the U.S. market, according to Page.

"We have close links to vessel operators — and to turbine manufacturers and offshore wind-farm site owners," he said. "Given we were building off our experience rather than actually starting fresh, we were able to have various stakeholder group discussions and meetings before we put pen to paper. That collaboration led to us conceptualizing the original hand sketches and drawings — even to this date, the hand sketches are on our website, and they still are very representative of the boat we built."

BEHIND THE DESIGN

With most technicians used to being transported by large

ships or even by helicopter, it was important the CTV designed by Chartwell Marine be comfortable, as well as functional, according to Page.

"First of all, we have to design a vessel which has world-class seakeeping," he said. "We want to limit seasickness as much as possible to maximize technician availability, so ensuring a comfortable ride is crucial. We ensure that the environment within feels comfortable, which is why we design the vessel with onboard technology, allowing personnel to travel out to site with iPads, laptops and gaming/video equipment. There are ample household sockets and USB sockets, together with onboard high-quality lighting, comfortable seats, and other modern, luxurious features."

In operational terms, Page said it's also important that the CTV can push onto the tower, making a good propulsion arrangement and fender connection vital. This also includes having plenty of space for cargo and a variety of payloads, whether it's fuel transfer for running a hose up the turbine for generator refueling or single payloads of spare parts, tools, and other provisions.

"We could even be taking provisions to an offshore platform, substation, or other offshore asset to keep it running," he said. "These are the core activities, and it's packaging that all together that makes a successful CTV."

Essentially, Chartwell wants to offer a memorable vessel, says Page.

"We want to create something that people respect and aesthetically appreciate, which is not always that simple with a work boat," he said. "We have a mission statement to ensure our vessels are efficient, so we're constantly thinking about our end user profile and how customers will operate that vessel in order to maximize efficiency — both in terms of the propulsive efficiency and emissions, and ensuring that we deliver best-in-class value for money."

SUSTAINABLE INNOVATION

But most importantly, Page emphasized that Chartwell strives to ensure its design and operation are sustainable.

"Almost all of our vessels are of aluminum construction, which can be recycled at end-of-life and can be rebuilt into either another boat or into something completely different," he said. "When we're designing and integrating the propulsion system, we are able to offer our customers solutions such as hybrid, electric integration, and foilborne technology."

It's Page's hope that Chartwell's vessels become more of a multipurpose tool as the wind industry pushes farther offshore.

"The boats have grown physically in size, and the number of technicians we're carrying on board the vessels has also increased," he said. "Due to this, we are constantly innovat-



An artist's render of the AWT Chartwell 24. (Courtesy: Chartwell Marine)

ing and staying in touch with developers. There's a strong current of debate about sleeping offshore, about working for longer hours, and integrating with other offshore assets, be it SOVs or offshore substations. There's also been significant development in both the transfer arrangements and the vertical height of the vessels."

And some of these developments already are being implemented.

"There is a desire from the wind-farm owners to get as much out of the vessel as possible," Page said. "It might be that, for certain sites, the boat would do a 12-hour run, coming back, changing crew, and going out again with different personnel. Alternatively, it might be that the boat stays offshore for the whole 24 hours, and the crew sleeps on the

SOV or on an offshore substation, using a rotation system where technicians switch over."

UNDERSTANDING CUSTOMER NEEDS

With those factors in mind, Chartwell approaches its customer base with a desire to understand its requirements, according to Page.

"For offshore wind, the clients in Europe are typically vessel owners already in their specific market," he said. "In the U.S., most of the operators are from a vessel-operating background, but they're either from a fast-ferry world or from a tugboat tradition. The fast-ferry operators are used to traveling at high speed, but they're normally used to a fixed route — A to B — and, obviously, their clientele is quite



The hybrid Chartwell 24. (Courtesy: Chartwell Marine)

different, so working with them is very much about explaining the changes in payload and operational profile. A ferry usually has the exact same payload. Although the number of passengers changes, the fuel levels and cargoes vary little.”

It’s important for Chartwell to be able to understand and adapt to a customer’s way of operating while engaging them on what to expect when moving to an offshore wind scenario, according to Page.

“For a ferry operator, the process of pushing onto an offshore structure is not a normal part of operations,” he said. “They would come alongside, and dock it. In this case, we push the bow on, and keep the thrust on to maintain the boat there. We work with them to explain and develop that skill. Tugboat operators are used to pushing on to assets, but they’re not accustomed to high-speed operations. As a team, we’re forward thinking, and always ensure we understand the user’s experiences. It’s a balance between listening and absorbing what they know and what experiences they can bring to us — especially in terms of their knowledge of working on the U.S. seas — and us providing them with our guidance and understanding of what’s happened in Europe.”

BIG DEVELOPMENTS IN A SHORT TIME

Chartwell Marine has made great strides in the offshore transport industry in its almost three years in existence. In that short time, the company has grown from a team of two to a team of 10. Their core background in high-speed, light, small craft of aluminum or composite construction made Chartwell ideally suited to designing vessels for the offshore wind industry. The company’s continued developments

have pushed Chartwell into other elements of offshore wind including SOV watercraft, SATVs, and higher-speed, long-distance offshore craft.

And as offshore grows in the U.S., Page expects transporting technicians will become even more of a need as sites are built farther offshore with fixed and semi-fixed structures.

“Working with operators to safely and efficiently transport people is going to be important,” he said. “Definitely in Europe, and likely in the States, there will be less reliance on helicopters. I think we’re going to have more requirements for high-speed, safe, waterborne travel to transport personnel and then enable them to sleep offshore and carry out tasks. Then, of course, we need to try and electrify these solutions by using the energy that we’re producing offshore rather than filling up our boat with diesel. We should use the energy we’ve just made to power our vessels.”

Chartwell Marine expects a huge amount of development in that area, so Page points out that Chartwell will need to have the right products to support that.

“We have the Chartwell 24, which is already working as a hybrid platform, and then recently, we’ve partnered with a company called BAR Technologies to design a foilborne, 30-meter vessel and a 50-meter platform,” he said. “With those two assets, we will have a ‘Swiss-army-knife arrangement,’ utilizing the foilborne 30-meter, a 50-meter vessel aimed at longer, more distant voyages, and then a general all-round workhorse in the form of the Chartwell 24. I think with that fleet in our offering, we’ll be able to cater for the full range of developer and operator needs for wind energy on the U.S. East Coast.”



Robert Hornung

President ▸ Canadian Renewable Energy Association

“We believe that there are tremendous synergies between wind energy, solar energy, and energy storage, and by bringing those technologies together, we’re able to provide much more comprehensive solutions for customers.”

On July 1, 2020, the Canadian Wind Energy Association (CanWEA) and the Canadian Solar Industries Association (CanSIA) united within the Canadian Renewable Energy Association to form one voice for wind energy, solar energy, and energy storage in Canada. *Wind Systems* recently talked with newly appointed CanREA President Robert Hornung about the change and why this next chapter in Canada’s renewable energy sector was a necessary step for the country’s energy future.

▸ Why did you feel the time was right to merge into this new organization?

I think there are really three factors: One is that it’s a reflection of the evolution within the membership itself. More and more wind-energy companies are indeed multi-technology companies.

Secondly, as we work to advocate on behalf of the industry, coming together provides us with a stronger and more united voice in terms of going forward. That would be important because, even though our technologies have made really significant progress and moved from margins to mainstream, there’s still a lot more that could be done and still a lot of work to do to make that happen.

And the third reason is that, as we’ve moved to become more mainstream and demonstrated that our technologies are cost competitive, we’re now forced to consider our role as a citizen of the grid more seriously. In particular, we want to address concerns that have been raised around the variable nature of wind and solar generation.

We believe that there are tremendous synergies between wind energy, solar energy, and energy storage, and by bringing these technologies together, we’re able to provide much more comprehensive solutions for customers — whether they be individuals or corporations or utilities or system operators who want to provide a broad range of services to the grid, not

just energy. We think we can do that more effectively together than separately. We think that would be key to creating new opportunities for all of these technologies going forward.

▸ What are your goals as president with this new organization?

Obviously, as with any industry association, we will be involved in advocacy. We will be involved in communications and outreach. We will work to inform and educate both within and outside the membership. We have to be able to go to customers and say, “We understand these are some of the challenges you face. This is how we can help to address those challenges and how, by working together, we can actually provide a more comprehensive solution to some of those challenges for you.”

From our perspective, these technologies should be playing a central role in the transformation of electricity and energy systems going forward in response to a wide variety of drivers that we see in terms of technological change and in terms of customer preferences and obviously, of course, in terms of environmental drivers, like climate change as well. Our overall objective is to ensure that we play a central role in that energy transformation. And from my perspective, that means, as an organization, we have to position ourselves as solutions providers.



► **How will adding solar and energy storage to your mission statement affect wind?**

From our perspective, it helps wind energy in a couple of ways. It comes back to growing the penetration of any of these technologies into the grid. We have to recognize the strengths and weaknesses that each of those technologies have. And we're incredibly fortunate in that there are tremendous synergies available between these technologies.

When we think about the synergies and the complementarity between these technologies, you can look at it in two ways: One is in the form of hybrid projects, which we certainly see growing rapidly in terms of wind and solar in the same facility or solar and batteries or wind and batteries or all sorts of different mixes. But we also consider the complementarity from a system's perspective in the sense that we're not focused on bringing more wind, solar, and storage onto the grid in a project form. We're looking at bringing more of those technologies onto the grid overall, because, even when they're not in the same project, they can help to facilitate the entry of other technologies. Storage is the obvious example there.

Having more storage resources on the grid to manage the variability associated with wind and solar production, regardless of where that storage is placed, opens new opportunities going forward. From our perspective, wind energy was always going to be poised for a significant growth. But wind energy is only going to be part of the story of what the future electricity grid looks like, and in order to grow

the pie for wind energy, we determined that it will actually be easier to do that by working in conjunction with and in collaboration with these other technologies, as opposed to sort of positioning ourselves as competitors.

► **Due to COVID-19 concerns, you recently made the decision to cancel the Electricity Transformation Canada Show. Are you planning on taking some of the scheduled events virtual? And how are you planning that?**

It was an unfortunate decision to have to take, to cancel the show, but it was clearly the right decision. The health and safety of the potential participants or exhibitors in the show has to be the first priority.

We are planning to hold a virtual event in its place, but it won't be Electricity Transformation Canada. This would have been the first edition of Electricity Transformation Canada, and we are determined to ensure that it's launched in a big way when do that in 2021 in Toronto next November.

But as the Canadian Renewable Energy Association, we will hold a virtual event in November of this year. The exact sort of format of that is still being worked on, and we will be releasing details in September in terms of timing and structure of the event. But our goal will be to highlight the role that our core technologies – wind and solar and storage – can play in Canada's energy transformation. ↪

MORE INFO www.renewablesassociation.ca



By working with an innovative local partner in the Brazilian market, ONYX InSight has ensured smooth project delivery for Rio Energy, minimizing disruption with the support of expert local market knowledge. (Courtesy: Rio Energy)

INNOVATION

Onyx InSight to bring advanced predictive maintenance to Brazil

ONYX InSight, a leading predictive analytics and engineering firm in the global wind-energy industry, is introducing advanced sensing technology and predictive maintenance solutions to the Brazilian market through a long-term monitoring deal with Rio Energy, one of the fastest growing energy producers in Brazil.

The predictive maintenance service, which will be delivered in partnership with innovative local operations partner, Filtralub, will be the first of its kind in Brazil and will

enable Rio Energy to achieve savings of up to 30 percent on O&M costs by improving failure detection and optimizing operations, maintenance planning, and asset output. The deal covers predictive maintenance using both ONYX InSight's ecoCMS technology and third-party hardware.

Installation of the advanced sensing technology began in the first quarter of 2020. ONYX InSight will provide an advanced combination of hardware, software, and monitoring services — powered by engineering expertise — and Filtralub operational and installation support to the customer.

By working with an innovative local partner in the Brazilian market, ONYX InSight has ensured smooth project delivery for Rio Energy, minimizing disruption with the support of

expert local market knowledge.

The deal increases the share of Brazil's wind-turbine fleet covered by advanced predictive maintenance. By helping to drive down the levelized cost of energy (LCOE), predictive maintenance can improve owner & operator profitability — ONYX InSight has achieved cuts in LCOE of up to 12 percent.

"Brazil's wind industry is the one of the largest in the world and continues to grow quickly," said Jose Morais, business development manager, Iberia and LatAm, ONYX InSight. "Within this significant installed wind-energy capacity, there is unrealized potential for efficiency savings delivered by predictive maintenance. The high capacity factor in Brazil means owners and operators cannot afford to neglect

turbine health. The latest predictive maintenance technology delivering advanced data analytics and insight will help wind-farm owners and operators to protect their assets and ensure maximum energy production in a competitive market.”

MORE INFO www.onyxinsight.com

▀ INNOVATION

IceWind to sell light commercial, residential turbines in the U.S.

Noted Icelandic wind-based renewable energy company IceWind recently announced its launch in the United States. IceWind’s groundbreaking product, the Freya, is for residential uses, while their Njord line is available for commercial applications such as powering telecommunication towers, outdoor advertising, on-site office trailers, and more.

“We are excited to bring our turbines to America,” said IceWind’s CEO Sæ ör Ásgeirsson. “With a blustery midsection, gusty extremities, and an overall interest in renewable energy, we are looking forward to America embracing our unique wind turbines for both residential and commercial applications. Our recent demo event on the Texas coast over the Independence Day weekend proved that there is great interest among Americans for a robust individual solution to renewable energy.”

The U.S. operation will be based out of San Marcos, Texas, and helmed by Daryl Losaw, a modular home builder, investor, consultant, and entrepreneur.

“When I first saw the IceWind turbines in Iceland, I knew I had to bring them to market in the U.S.,” Losaw said. “They are perfectly complementary with solar, a great stand-alone solution for very windy places, and a handy answer for small-energy outdoor applications that will cut down



IceWind’s Freya is for residential uses. (Courtesy: IceWind)

on carbon from generators, diesel engines, and maintenance calls.”

The current residential model, the Freya, is useful as a supplementary power source, so it will cut users’ power usage and costs, but not fully power the average home. Should customers want or require a complete wind solution, two to three Freyas will power most average small-scale residential power needs excepting central air conditioning for a price comparable to installing photovoltaics (solar). Other residential applications include powering small vacation cabins, separately metered home offices, and small additional dwelling units (ADUs), and backup emergency power when needed. IceWind’s Freya is an excellent solution for residential renewable power as they are silent, aesthetically pleasing, have a 25- to 30-year lifespan, can work both on- and off-grid, require negligible operation and maintenance costs, and can generate power at wind speeds as low as 7.8 mph, a gentle breeze.

The Njord commercial models are ideal for many applications: powering telecommunication towers, electric-

ity for outdoor advertising (lighting, mechanical features), replacing generators used at construction sites and other remote offices, and more. The beauty of IceWind’s products is how sustainable and hardy they are in challenging conditions. Unlike the diesel generators used in these applications, they never need refueling and rarely need maintenance.

MORE INFO www.icewindusa.com

▀ INNOVATION

Glennmont Partners adopts Greenbyte’s monitoring platform

Glennmont Partners, one of Europe’s largest pure renewables fund managers, has adopted Greenbyte’s monitoring platform to oversee the technical performance of its dynamic European wind and solar portfolio. Greenbyte will be fully integrated with Glennmont’s financial and commercial management systems, pulling data



Glennmont operates a complementary portfolio of onshore and offshore wind and solar assets across France, Italy, Finland, and Germany. (Courtesy: Glennmont Partners)

from Glennmont's newest funds with an operational fleet exceeding 1 GW to inform decision-making and create transparency with investors.

European renewables have been identified as a "safe haven" for investors amid market volatility, offering stable long-term returns, backed by high standards of commercial and technical performance. As capital continues to be channeled into renewables infrastructure and portfolios scale up, it is important that fund and asset managers continue to invest in technologies and systems that deliver maximum value to an increasingly diverse set of investors.

Glennmont operates a complementary portfolio of onshore and offshore wind and solar assets across France, Italy, Finland, and Germany. With further investment planned, the geographical scale and diversity of this asset base will continue to grow, underlining the requirement for a versatile asset management system encompassing the technical, financial, and commercial aspects of project operations.

Greenbyte was chosen by Glennmont to support its technical asset management functions. Through its user-friendly platform, Greenbyte facilitates the early identification of issues leading to asset downtime and losses, offering Glennmont a complete list of identified issues for the

company to focus on in the technical management of its portfolio. This ultimately reduces downtime and enables Glennmont to identify value add and value protection projects to undertake within the Funds.

To ensure seamless integration between Glennmont's management tools, Greenbyte's platform will also act as a data input for the fund manager's financial and commercial platforms. Greenbyte's data will be fed directly into detailed monthly reporting on each individual asset in Glennmont's portfolio, allowing complete transparency on asset performance with its investors.

MORE INFO www.greenbyte.com

► INNOVATION

ArcVera's performance testing services receive accreditation

ArcVera Renewables, a leading international provider of consulting and technical services for wind, solar, and storage projects, has received continued accreditation under recognized International Standard ISO/IEC 17025:2017 from the American Association for Laboratory Accreditation (A2LA) for ArcVera's wind-turbine power perfor-

mance testing (PPT) services (Certificate Number 5339.01). A2LA is one of the largest accreditation bodies in the world and is dedicated to the formal recognition of competent testing and calibration laboratories.

This accreditation, which certifies the quality of ArcVera's wind-turbine PPT processes and the competence of its quality management system, is another critical milestone for the company. With A2LA accreditation achieved, ArcVera can now pursue its IECRE accreditation, which the company expects to receive shortly. As well, earlier this year, ArcVera acquired provisional accreditation to test GE wind turbines and is expecting to receive full accreditation pending successful completion of a customer test on GE turbines.

In the immediate term, ArcVera can perform IEC 61400-12-1 compliant tests on GE wind turbines as well as related technical sub-tasks, such as terrain assessments, site calibration, met tower and sensor installation, and review of third-party power curve tests.

As a leader in this field, ArcVera also represents the United States on the IEC committee, which develops standards for wind-turbine power performance testing (61400-12-1), nacelle Lidar power performance testing (61400-50-3), and energy assessments (61400-15).

MORE INFO www.ArcVera.com

CONSTRUCTION

Reygar to supply Ørsted with BareFLEET monitoring system

Ørsted, a global leader in developing and building offshore wind farms, has selected Reygar Ltd.'s innovative BareFLEET remote monitoring and reporting platform to track and analyze the performance of its chartered fleet of Crew Transfer Vessels (CTVs) operating across wind farms in Europe. Reygar is the leading provider of advanced vessel performance monitoring systems to the offshore renewable energy sector.

Ørsted has 9.9 GW offshore wind capacity installed and under construction. By adopting the vessel-agnostic, cloud-based BareFLEET system, the wind-farm developer and operator can be confident of getting the best possible service from the vessels that are chartered.

Ørsted has commissioned Reygar's BareFLEET system to log vessel motion, fuel consumption, and PAX movements. The system will provide an accurate record of events – including transit, push on, transfer, and crane lifts – so that all operational activity may be assessed for improvement or enhancement.

The system will collate data from existing onboard sensors across the firm's varied fleet, supplementing this with motion sensor measurements, observations added manually by the captain and video of transfers.

MORE INFO www.reygar.co.uk

MAINTENANCE

Dropsafe: Systematic approach needed for Drops in offshore wind

Global leader in Dropped Object



Ørsted has commissioned Reygar's BareFLEET system to log vessel motion, fuel consumption, and PAX movements. (Courtesy: Reygar)

(Drops) prevention, Dropsafe, has called for a more systematic approach to tackling Drops throughout the offshore wind supply chain. This follows the publication of 2019 data by the G+ Global Offshore Wind Safety Organisation showing an overall rise in reported Drops incidents in the sector.

Dropsafe maintains that, rather than focusing Drops prevention exclusively on retroactive on-site mitigation strategies such as secondary securing, Drops risks must be considered throughout the full lifecycle of a wind-turbine fleet – from design and manufacture of equipment to installation, operations and maintenance (O&M), and decommissioning.

The G+ 2019 incident data report, released in July, shows that, in 2019, there were 92 Drops incidents, representing an increase of 44 percent from 2018. This upward trend has been attributed to improved reporting but underlines the severity of the threat to offshore-wind personnel, alongside the reputation and financial standing of businesses in the sector.

High potential (HiPo) incidents decreased compared to the previous year, with 38 percent of Drops incidents classified as high potential in 2019 compared to 61 percent in 2018.

Dropsafe has drawn parallels to the experience of businesses in offshore oil

& gas, which saw a comparable trend in Drops incidents 20 years ago. The offshore drilling sector subsequently took decisive action to “self-regulate” on Drops risks. Industry working group DROPS was formed to facilitate systematic action on Drops prevention, leading to an advanced, supply chain wide culture of Drops prevention.

In particular, while Drops prevention technologies such as secondary securing, barriers, netting, and tool tethering are vital, DROPS advocates a hierarchy of controls that starts with designing equipment and processes in such a way that risks are minimized before these systems need to be installed.

MORE INFO www.dropsafe.com

MAINTENANCE

Seacat expands offshore support fleet with Seacat Weatherly

Class-leading offshore energy support vessel operator Seacat Services recently announced the acceptance of Seacat Weatherly, the first next-generation Chartwell 24 catamaran designed by pioneering naval architect Chartwell



Seacat Weatherly is the culmination of a long-term collaboration between South Coast businesses Seacat Services, Chartwell Marine, and shipyard Diverse Marine. (Courtesy: Seacat Services)

Marine to enter operational service. Following her completion at the Diverse Marine shipyard in Cowes and successful sea trials, Seacat Weatherly heads straight to her first charter contract at a major U.K. offshore wind project.

Seacat Weatherly is the culmination of a long-term collaboration between South Coast businesses Seacat Services, Chartwell Marine, and shipyard Diverse Marine, and the product of an industry-wide drive to refine the formula for offshore-wind vessel support. As offshore-wind projects grow in scale, customers are placing increased emphasis on the core metrics that define effective vessel operation, including the safety and comfort of crew transfers, “time on turbine” for technicians, technical availability, and efficiency.

The first of a two-vessel order, Seacat Weatherly is designed to meet — and exceed — the operational standards expected by offshore wind project owners and contractors. She brings a number of key technical innovations to the market, including advanced engine and hull design, a large foredeck, and safety features

such as step-free access, sliding handrails, and unrestricted visibility from the wheelhouse.

This has all been achieved while making use of many of the same components and equipment as her sister vessels in the 13-strong Seacat Services fleet, in order to maintain operational familiarity and ensure effective management of spares and inventory.

“Seacat Weatherly is a fine addition to the fleet, capitalizing on all of the core attributes that have defined the Seacat Services offering to date,” said Andrew Calderbank-Link, operations director at Seacat Services. “Refining vessel designs is vital to meeting the changing needs of the offshore wind sector, and Seacat Weatherly ensures that our crews can bring maximum operational value to our customers from day one.”

“It brings us great satisfaction to see Seacat Weatherly enter service, and we will be monitoring closely how she performs on site,” said Andy Page, naval architect and managing director at Chartwell Marine. “The Chartwell 24 design has been formulated for the industry by the industry to meet the specific requirements of offshore wind

construction and operation, both in Europe and further afield.”

MORE INFO www.seacatservices.co.uk

MAINTENANCE

PSG leaders take on roles with standards organizations

Mathew Moreau, product manager of dropped tools and FME at Pure Safety Group (PSG), has been named chairman of the International Safety Equipment Association (ISEA) Standards Committee for Dropped Objects Solutions. The committee is the first ever to focus exclusively on preventing dropped object hazards in general industry, construction, and other sectors that involve work at height.

In 2018, the committee set the first U.S. standard to establish design, testing, and performance criteria for active systems used to prevent dropped objects in the workplace.

Dropped objects cause 278 deaths and 52,700 injuries a year in the U.S.

alone, according to the latest statistics, making it the third-leading occupational safety hazard.

Warren Faber, engineering manager, has been named vice chairman of the American National Standards Institute (ANSI) committee that sets safety standards for anchorage connectors for active fall protection systems. The committee's work includes standardizing definitions and establishing requirements for design, performance, testing, labeling, instructions, inspection, maintenance, and storage of anchor connectors. Faber was chosen by the committee chairman for the position.

He has been an active contributor on the committee for six years and sits on several sub-committees for standards, including Z359.13 and Z359.14. He also is involved with CSA Z259, the fall protection committee in Canada, where he is an associate member and chairman of CSA Z259.11: standards for personal energy absorbers and lanyards.



Mathew Moreau.
(Courtesy: PSG)



Warren Faber.
(Courtesy: PSG)

“Even though they are voluntary, anchorage standards should be seriously considered in the manufacture and use of these products,” Faber said. “The committee is made up of experienced engineers and government experts who follow a strict and transparent process with the ultimate goal of keeping workers safe while working at height.”

Moreau served on the ISEA committee during its early work on the first dropped objects standard, which was released in 2018. Moreau was with Ty-Flot®, now a PSG company, maker

of dropped prevention products such as tool tethers, tool carriers, and, its most recent invention, the Stronghold® Quick-Switch® system, and he had a long history of involvement with the standard. The patented Quick-Switch design allows tools to be passed between or transported by workers while they stay 100 percent tied off to avoid being dropped.

“I’m honored to serve as chair, given I’ve dedicated my career to finding ways to save lives and prevent injuries caused by dropped tools,” Moreau said, who will have the role through 2021. “Most people aren’t aware of the damage caused by a drop, which costs companies more than \$5 billion a year in workers comp claims. ISEA raises awareness of this hazard and then provides solutions, through standards, on how to reduce or eliminate the issue.”

MORE INFO www.puresafetygroup.com

MANUFACTURING

Siemens delivers technology for seventh North Sea connection

Siemens Energy is supplying the high-voltage direct-current (HVDC) power transmission technology for a further offshore connection in the German North Sea. A corresponding contract was just signed by the German-Dutch network operator TenneT and the BorWin5 Offshore Consortium, consisting of Siemens Energy and Dragados Offshore. In 2025, the platform BorWin5 epsilon, which is part of the BorWin5 project, will begin the low-loss transmission of electricity produced by the EnBW He Dreiht wind farm off the island of Borkum to the Garrel/Ost converter station about 230 kilometers away. The transmission capacity of 900 MW is calculated to serve more than 1.1 million households with electricity.

The project is a further contribution toward decarbonizing Germany's

energy supply. BorWin5 marks the seventh HVDC offshore grid connection project undertaken by Siemens Energy in Germany with TenneT. The scope of supply for Siemens Energy and its Spanish partner Dragados Offshore S.A. includes the turnkey construction and installation of the offshore platform in the North Sea and the converter station on land. The offshore converter station will convert the three-phase alternating current produced by the wind turbines into direct current with a voltage of ±320 kV for low-loss transmission to land. The shoreside converter station in Garrel/Ost will then convert the electricity back into three-phase alternating current for feeding into Germany's power grid.

Siemens Energy will supply the HVDC technology required for the project and build the shoreside station, while Dragados will be responsible for the design, procurement, construction, and installation of the offshore converter platform.

MORE INFO www.siemensenergy.com

MANUFACTURING

China deal takes Vestas past 1 GW of order intake in 2020

Vestas has secured a 101-MW order for a project in China that includes the supply of 42 V120-2.2 MW wind turbines delivered in 2.4 MW Power Optimized Mode, as well as a 20-year Active Output Management 4000 (AOM 4000) service agreement.

With this order, Vestas has reached an order intake in China in 2020 of more than 1 GW.

Deliveries are expected to begin in the fourth quarter of 2020, with commissioning planned for the same quarter. The project and customer names are undisclosed. ↘

MORE INFO www.vestas.com



CROSSWINDS

THE FUTURE OF WIND

ASSEMBLING OFFSHORE WIND TURBINES

A University of Delaware study has identified two prime East Coast locations for marshalling ports in Delaware Bay — sites with the acreage, area, and access to support the infrastructure required for deploying offshore wind farms. (Courtesy: University of Delaware)

University of Delaware team identifies two ideal sites for offshore wind ports in Delaware Bay.

By KAREN B. ROBERTS

The United States offshore wind energy industry is growing, with planned commitments to build 26 GW of offshore wind projects along the East Coast from now through 2035. This is the clean power equivalent of 26 nuclear power plants or roughly 10 times the average electric energy used by the entire state of Delaware.

Marshalling ports — large waterside sites with the acreage and weight-carrying capacity necessary to assemble, house, and deploy the huge wind turbines ready to ship out into the ocean — will be critical to meeting this current and committed demand for offshore wind.

Yet few viable port sites exist along the East Coast that have clear overhead access from port to sea to transport these large turbines — each larger than the Statue of Liberty — and channels deep enough to accommodate the vessels that carry them. Those that do are small in area and will not be able to fully support the existing demand for turbine deployment, nor will they be able to efficiently deploy turbines that are ever-increasing in size, as the industry starts to look beyond the 8-MW turbine to 12 and 15 MW.

TWO LOCATIONS IDENTIFIED

A team of University of Delaware undergraduate students, advised by UD Professor Willett Kempton and energy policy analyst and doctoral candidate Sara Parkison, recently released a report identifying two ideal locations for a marshalling port in the Delaware Bay. The proposed locations include a Delaware site situated north of Delaware City near the Occidental Chemical Corporation and a location on land transferred from the Army Corps of Engineers around Salem, New Jersey.

The UD students, most of whom graduated in May 2020, worked together for more than a year to evaluate the viability and logistics of developing marshalling ports in the Delaware Bay to service the offshore wind sector as part of the Office of Economic Innovation and Partnership's Spin In program.

According to the UD report, both sites have the potential to service offshore wind projects as far north as Connecticut and as far south as the Carolinas, shoring up a critical link in the offshore wind production capability. Each location is large enough to build a port capable of deploying more than 500 MW of clean energy annually, with ample potential to expand.

The UD report comes on the heels of a recent announcement by New Jersey Gov. Phil Murphy about the Garden State's plans to begin developing an offshore wind deployment port in Salem in 2021. The announced New Jersey "Wind Port" is nearly identical to one of the two sites previously identified by Kempton and analyzed by the Spin In team.

"It's exciting to see New Jersey take this huge step for-

ward in clean energy," said Kempton, associate director and co-founder of the Center for Research in Wind (CREW) and a professor in UD's College of Earth, Ocean and Environment.

However, even with the announced marshalling port in southern Jersey, the UD report shows it is likely not large enough to meet market demand for offshore wind energy by 2025. Based on existing power purchase contracts and projected demand, the Spin In team's analysis indicates that the wind industry will require more than 2,000 MW of deployment annually for the region beginning in 2022 and 2023. This will outpace the deployment capabilities of current and planned marshaling facilities, even with the New Jersey port.

An additional marshalling port in Delaware could provide a way forward, enabling the Delaware Bay to meet projected demand for wind power along the East Coast over the next 15 years, the researchers said. The Delaware site is already zoned for industrial use and equipped with roads and railways, a plus for access of workers and materials.

HOW MARSHALLING PORTS WORK

As offshore wind turbines have grown in their capacity to provide clean energy — from an average 3 MW to the current 15 MW designs — so has their size. To build a 500 MW wind project in a year with today's 15 MW turbines requires about 50 acres for movement, storage, and assembly.

To build and maintain offshore wind-power projects also requires skilled people, large components, and specialized installation vessels and marshalling ports. According to Kempton, the idea is to lay out all the wind-turbine components in the marshalling port as items arrive on-site. Then, when all the parts are present, they can be partially assembled, loaded on special installation ships, transported, and installed in an offshore wind farm.

It's a big job, as some turbine components can weigh more than 3,000 tons and each of the turbine's three blades measures 360 feet (110 meters). For comparison, the average blue whale (the largest mammal) weighs approximately 115 tons and is about 80 to 100 feet (24 to 30 meters) long.

Each turbine installation vessel would have a deck area equipped to carry two to four turbines. On the first trip, the crew would use a crane on the boat to lift the pilings (large pipes) off the port surface and transfer them to the offshore site, then pound them into the seafloor using a pile driver. On a second trip, the crew would transfer and install the remainder of the turbine using a crane on the boat.

In reviewing New Jersey's plan, Emma House and Emily Tulsy (both environmental engineering majors) called the site design "very good" but said alternative design options could include building the loading platform, or quay, off the more northern area of the location.

"The northern half of this area is the most protected from

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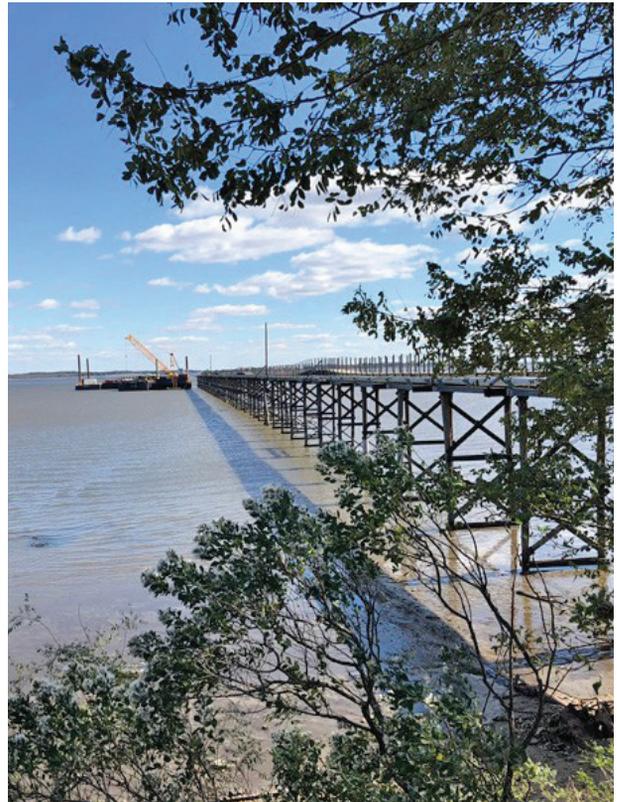
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CROSSWINDS



Looking from the Occidental Chemical Corporation site in Delaware City, Delaware, into the Delaware Bay. (Courtesy: Willett Kempton)

flooding and the most suitable for heavy loads in its current condition, so the land may take less time and effort to prepare for construction,” said House, who is pursuing her master’s in environmental engineering at UD.

Delaware does not have any offshore wind turbines, although the wind turbine installed at UD’s Lewes Campus has informed wind-turbine technology while providing enough clean energy annually to power the campus and about 100 homes in the community.

SPIN IN PROGRAM

Nine students from various majors participated in the Spin In Wind Deployment Port team over the 18-month project, gaining a greater understanding of business demands and experience collaborating in teams. The students credited the interactive nature of the Spin In program and the intensive mentoring provided by Kempton and Parkison with preparing them to work directly and indirectly with various stakeholders, including developers, land owners, public officials, environmental regulators, industry and policy experts, engineers and designers, and more.

OEIP Director David Weir said one thing that set this particular Spin In project apart is the impressive scope of work that the students undertook.

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“New Jersey’s action validates and underscores the quality of the students’ work,” he said. “It wasn’t just putting together a plan or technical report, it was a very detailed study that included hard-core financial and technical work, coupled with interaction with the industry and policy experts, to define the best location to put this capability on the East Coast.”

Sarra Sundstrom (English and en-

vironmental studies) joined the project after visiting more than a dozen offshore and nearshore wind turbines during a study abroad trip to Denmark. Denmark’s successful wind power infrastructure supplies about half of the country’s electricity needs.

“I see the global transition to renewable energies as both necessary and inevitable,” she said.

Zach Roy (energy and environmen-

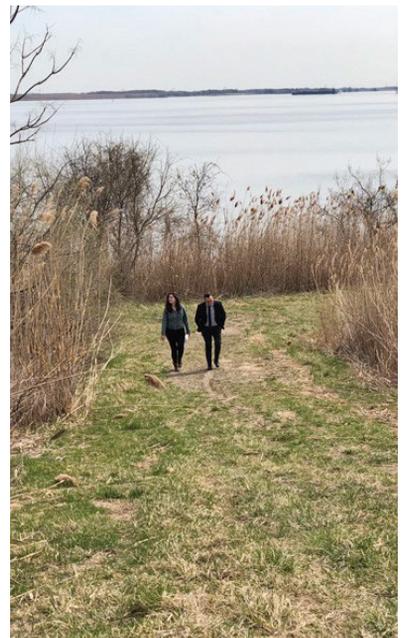
tal policy, and political science) agreed, adding that the team’s interdisciplinary collaboration and focused mindset contributed to delivering a quality end project.

“Our team was successful because we were on the same page about how much is at stake for the future, and the importance of taking action immediately,” he said.

It is unclear if a marshalling port in Delaware will come to fruition. So far, support for wind power in Delaware has lagged behind other states in the eastern U.S. However, Kempton and Parkison continue to pursue research and policy efforts that could allow a role for wind-power initiatives in Delaware, including the Delaware City location identified as an initiative that would support East Coast states that develop offshore wind projects, with ample space to expand as industry demand increases. ✈

ABOUT THE AUTHOR

Karen B. Roberts is with the University of Delaware.



UD energy policy analyst and doctoral candidate Sara Parkison (left) walks with a representative of a wind-turbine manufacturer to inspect a site in Delaware City for possible development as an offshore wind port. (Courtesy: Willett Kempton)

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