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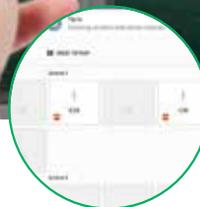
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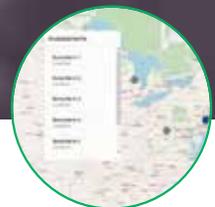
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## Powering up for CLEANPOWER 2022

The wind is definitely blowing through San Antonio, Texas, this month, as the home of the Alamo plays host to this year's CLEANPOWER 2022. After the in-person show was canceled in 2020 and a somewhat modest in-person event was held late last year, this is the first time CLEANPOWER can debut in all its glory.

In the past, the show was mostly dedicated to wind, but now, with the wind, solar, and energy storage industries merging under the umbrella of American Clean Power, this year's show will bring together a lot of diverse companies under one roof to highlight the amazing expertise that makes up the many facets of the renewable energy sector.

An amazing amount of planning and coordination goes into this annual event, and the 2022 show has a lot in store for attendees and exhibitors alike.

In last month's issue, we talked with Rod O'Connor, American Clean Power's chief commercialization and engagement officer about what attendees could expect from this year's show.

He said CLEANPOWER's programming bring together not only the different technologies that make up the renewables mix – onshore wind, offshore wind, solar, storage, and transmission – but also the different segments within the industries: manufacturers, construction firms, owner operators, utilities, financial firms, corporate buyers and more.

ACP views this mixing of sectors to be a benefit to everyone – the wind-energy sector included. But there will be a lot of specific focus on wind. There are estimates that 95 GW of onshore wind will be built between now and 2030. At the federal level, ACP is at the cusp of advancing policy to significantly accelerate the development of wind and other renewable energy projects.

As a primer for the show, our May inFocus topic shines a spotlight on CLEANPOWER 2022. Make sure and check out our cover article by John Hensley. In it, he discusses how the wind industry is powering forward, despite some delays and disruptions.

And with CLEANPOWER in mind, we reworked our monthly Conversation feature and asked several exhibitors at the show what attendees should expect from their booths. It turned out to be popular and a fun way to share some extra show information. Make a note and swing by their booths.

I am excited about renewing industry relationships in San Antonio, as well as meeting some new experts as I walk a few miles each day on the show floor.

Be sure and stop by our booth (#3154) and say hi. I hope to meet all of you at the show and discuss opportunities for editorial content to share with our readers. See you in San Antonio, and as always, thanks for reading!



**Kenneth Carter, editor**

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## Avangrid's Nagy receives Andrew Linehan award

From ACP

Dr. Laura Nagy, Avangrid Renewables' Senior Director of Permitting and Environmental, was named the 2022 recipient of Andrew Linehan Award for Environmental Excellence during ACP's recent Siting and Environmental Compliance Conference in Round Rock, Texas.

Nagy was recognized by her renewable energy peers for her leadership, commitment to environmental responsibility, and dedication to improve the siting and environmental practices of the clean-energy industry during an awards ceremony March 30.

The Andrew Linehan Award for Environmental Excellence is presented in memory of Andrew "Andy" Linehan, a champion and leader in the siting and environmental community, who lost his battle with cancer in 2010. Through Linehan's leadership and overall enthusiasm for the industry and the environment, he represented the epitome of environmental and professional excellence. The award in his honor recognizes leaders in the siting and environmental community who exhibit similar qualities and who are constantly striving to improve the siting practices of the clean-energy industry.

Upon receiving the award Nagy said that she was overwhelmed and grateful to be named the 2022 recipient in honor of Linehan.

"I appreciate the support from everyone in the industry and their support of the work everyone does to solve (siting and environmental) challenges," she said.

As with many in the clean-energy industry, a driving force for Nagy's work is minimizing the negative impacts of global climate change on wildlife and our environment.

"It's exciting for me to be a part of the solution to global climate change," Nagy said.

Nagy knew Linehan well, sharing that he was a solution-oriented professional who aimed to bridge the gaps between agencies, industry, and NGOs to achieve environmental stewardship and advancement of the wind industry.



American Clean Power is the voice of companies from across the clean-power sector that are powering America's future. For more information, go to [www.cleanpower.org](http://www.cleanpower.org)



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# DIRECTION

THE FUTURE OF WIND



One of the initiative's projects will continue the deployment of a near real-time whale detection system to provide timely alerts on the presence of baleen whales such as the humpback. (Courtesy: Shutterstock)

# US Wind to launch offshore wind research partnership to study effects on marine life

Baltimore-based US Wind, Inc. will partner with University of Maryland Center for Environmental Science (UMCES) for three research projects aimed at understanding the potential effects of offshore wind development on marine mammals, fish, and birds. US Wind pledged \$11 million in funding over 10 years, and the research will take place in US Wind's 80,000-acre federal lease area off the coast of Ocean City, Maryland.

"As US Wind works to develop offshore wind off Maryland's coast, it's imperative that we do so responsibly," said Jeff Grybowski, US Wind CEO. "We're thrilled to be partnering with UMCES on industry-leading environmental research that will enhance protections for marine life as we develop this clean energy resource for the region."

"Partnering with a leading environmental research institution like UMCES is an exciting building block in our efforts to collect much-needed biological information in our lease," said Laurie Jodziewicz, US Wind senior director of Environmental Affairs. "The planned work will go a long way in filling knowledge gaps that still exist about offshore wind's effects on the marine environment. We're excited to get started."

US Wind's funding will support three projects, all planned to kick off this year, to understand the potential environmental effects of offshore wind development in the Mid-Atlantic.

"We're really pleased with this continued partnership with US Wind on important questions related to the environmental impacts of offshore wind development," said University of Maryland Center for Environmental Science President Peter Goodwin. "We look forward to working with them along with state and federal agencies to help make the best decisions to minimize impacts to the environment."

The three UMCES research projects include:

► **Commercial and recreational fisheries monitoring:** An eight-year program to evaluate the extent that black sea bass change their aggregation behaviors before, during, and after construction. Black sea bass are structure-oriented with large aggregations occurring on artificial reefs and wrecks. Turbine foundations will add three-dimensional structure within US Wind's lease where very little exists. This research project will assess the benefits and potential fish aggregation effects. It will also test black sea bass fishing with ropeless gear, an important technology to reduce whale entanglements.

► **Near real-time whale detection:** This initiative will continue the deployment of a near real-time whale detection system to provide timely alerts on the presence of baleen whales (North Atlantic right whales, and humpback, fin, and sei whales) for a 12-month period from 2022 to 2023. The project is a partnership between UMCES and Woods Hole Oceanographic Institution that uses quiet mooring technology, whale vocalization detection algorithms, and telecommunications to transmit frequent alerts on the presence of baleen whales. The initiative enables real-time data collection through the buoy system that was initially funded by the Maryland Energy Administration and deployed by the Maryland Department of Natural Resources.

► **Passive acoustic monitoring array:** This long-term project will support passive acoustic monitoring to detect dolphins and large whales such as North Atlantic right whales to understand their presence and migration patterns in and around the lease area and the potential effects of construction. Working with Cornell University's Center for Conservation Bioacoustics, two types of listening devices will be deployed to determine the occurrence and position of large whales and dolphins, and to detect the tonal echolocation clicks of small cetaceans including porpoises.

Additionally, this project will deploy equipment to listen for passing fish, sharks, rays, and turtles that have been implanted with transponders for broader scientific research.

"The Department appreciates the coordinated research into safer equipment and marine wildlife monitoring," said Catherine McCall, director of the Maryland Department of Natural Resources Office of Ocean and Coastal Management. "The ongoing deployment of Maryland's whale monitoring buoy provides daily detections and helps resource managers protect sensitive species."

These UMCES-led research projects build on the environmental baseline work US Wind is doing to better understand the environment in and around its lease area and mitigate potential effects of offshore wind development on marine life and avian species. One such initiative includes aerial digital surveys to identify birds that may be displaced or avoid the wind farm once the turbines are installed. These research and monitoring programs also inform the comprehensive analyses the federal government must do to approve the construction and operation of offshore wind projects.

"The Maryland Energy Administration (MEA) is pleased that offshore wind developers are investing resources to support scientific understanding of the nexus between offshore wind development and the environment, wildlife, ecosystems, and habitats off the coast of Maryland," said Mary Beth Tung, Ph.D., Esq., Director of MEA. "US Wind's investment complements the research initiatives funded by MEA and administered by DNR, which total more than \$15 million and have been carried out since 2014."

Monitoring these populations is a critical step in conservation to measure changes, track threats, and evaluate the success of wildlife management. The projects were selected based on their efficacy and ability to

complement existing research efforts in the scientific community. All data will be made available to government and academic researchers, and reports and information will be made publicly available to help protect these important species and ecosystems for generations to come.

**MORE INFO** [uswindinc.com](http://uswindinc.com)

## Swire Energy Wind names commercial team leader

Jan Harrestrup has been named Swire Energy Services wind division's Head of Commercial.

Harrestrup will be responsible for global business development, contract management and sales, in addition to procurement and the general management of SES Danish entity, Swire Energy Services A/S.

Harrestrup was head of sales at B&R Automation Denmark. His career includes commercial and business development roles across 16 years in the wind sector covering Europe, the United States, and Asia, including VP Business Development at DEIF Wind Power Technology.

"I am very proud to join Swire Energy Services at this key time in its development. I am enthused to join a fantastic team and support the vision to become the service partner of choice for the global wind industry," Harrestrup said.

Based in Denmark, Jan joins the senior management team for the Wind division and will report to Sabine Weth, vice president Offshore Wind.

"I am delighted to welcome Jan as Head of Commercial. It is an exciting time for our division as we look to further develop and expand our presence in the wind market, the appointment of Jan to this role is a key element in our pursuit of our ambitious strategy and future growth," Weth said.

Operating in 30 countries and employing more than 750, Swire Energy Services is an integrated service provider supporting the global energy



Jan Harrestrup has been named Swire Energy Services Wind's head of commercial. (Courtesy: Swire Energy Services)

industry. Swire Energy Services wind division provides end-to-end services designed to optimize the performance of onshore and offshore wind farms, and includes blade inspection and repair, wind turbine maintenance, and HV and electrical services.

**MORE INFO** [swirees.com](http://swirees.com)

## Collegiate offshore wind competition set for May

The U.S. Department of Energy's Collegiate Wind Competition (CWC) will take place May 16-18, 2022, in conjunction with the American Clean Power

Twelve competing teams will represent their colleges and universities at the 2022 competition. (Courtesy: U.S. Department of Energy)

Association's CLEANPOWER 2022 Conference & Exhibition in San Antonio, Texas.

The competition helps prepare college students for jobs in the wind-energy industry through real-world experience with wind-energy technology, project development, finance, communications, and outreach.

The CWC teams will compete in three contests that support the theme of siting, outreach, and development challenges associated with fixed-bottom offshore wind energy projects:

### ► The Turbine Prototype Contest:

Teams design and build an offshore wind turbine prototype to test in an on-site wind tunnel and sea simulation tank.

► **The Project Development Contest:** Teams develop a site plan and cost-of-energy analysis for a hypothetical offshore wind farm.

### ► The Connection Creation Contest:

Teams partner with wind-energy industry professionals, raise awareness of wind energy in their local communities, and work with local media to promote their accomplishments.

"The signs point to a thriving future for offshore wind energy," said Elise DeGeorge, a competition manager at the National Renewable Energy Laboratory. "As students confront the challeng-

es of the 2022 CWC, they will develop the skills they will need to seize those opportunities and succeed in this growing industry.”

Twelve competing teams will represent their colleges and universities at the 2022 competition. Pennsylvania State University will defend its 2021 overall first place and Project Development Contest wins, while Kansas State University and Virginia Tech University will defend their respective Turbine Prototype Contest and Connection Creation Contest wins.

In addition to the 12 competitive teams, four teams will participate as “learn-along” teams, meaning they are not eligible for awards but may submit the same deliverables and receive feedback on submitted projects from competition judges.

**MORE INFO** [www.energy.gov/eere/articles/2022-collegiate-wind-competition-teams-plug-offshore-wind-energys-electrifying](http://www.energy.gov/eere/articles/2022-collegiate-wind-competition-teams-plug-offshore-wind-energys-electrifying)

## Energy agency: Clean energy spending up 50%

Clean energy spending earmarked by governments in response to the COVID-19 crisis has risen by 50 percent over the past five months and now stands at more than \$710 billion worldwide, though there are imbalances between regions, according to the latest update of the International Energy Agency’s Sustainable Recovery Tracker.

This unprecedented amount of enacted spending is more than 40 percent larger than the global green spending contained in the stimulus packages that governments enacted following the global financial crisis in 2008.

Advanced economies account for the bulk of this effort, with more than \$370 billion intended to be spent prior to the end of 2023, a level of short-term government spending that would help keep the door open for the IEA’s global pathway to net zero emissions by 2050.

Across emerging and developing economies, however, the total amount

of fiscal resources being dedicated to sustainable recovery measures is one-tenth of the amount in advanced economies, reflecting their very different financial and economic circumstances. In emerging and developing economies, about \$52 billion of sustainable recovery spending is planned by the end of 2023, short of what is needed in a pathway toward the 2050 zero-emission goal. The gap is unlikely to narrow in the near term, as governments with already limited fiscal means now face the challenge of maintaining food and fuel affordability for their citizens amid the surge in commodity prices following Russia’s invasion of Ukraine.

“Countries where clean energy is at the heart of recovery plans are keeping alive the possibility of reaching net zero emissions by 2050, but challenging financial and economic conditions have undermined public resources in much of the rest of the world,” said Fatih Birol, the IEA Executive Director. “International cooperation will

be essential to change these clean energy investment trends, especially in emerging and developing economies where the need is greatest.”

Even in advanced economies, some of the earmarked funds risk not reaching the market within their envisaged timelines. Delays in setting up government programs, ongoing supply chain disruptions, labor shortages, and financial uncertainty have clogged project pipelines.

In addition, consumer-facing measures — such as incentives for building retrofits and electric vehicles — are struggling to reach a wider audience because of issues including red tape and lack of information. “Governments who can remove red tape and quickly set up effective programs will be the ones to reap the benefits and position themselves in the new global energy economy that is emerging,” Birol said. ↵

**MORE INFO** [www.iea.org](http://www.iea.org)



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IN FOCUS

CLEANPOWER 2022

WIND INDUSTRY  
**POWERS  
FORWARD**  
DESPITE DELAYS,  
**DISRUPTIONS**





# *While disruptions and delays kept the U.S. wind market from meeting expectations, 2021 still neared records as federal and state leaders helped offshore wind to finally take off.*

By JOHN HENSLEY

In 2021, disruptions from COVID-19 affected wind markets around the world. Increasing commodity prices and the meteoric rise in freight costs pressured manufacturing margins and weighed heavily on project economics. Further, supply-chain disruptions delayed projects worldwide but had an acute impact in the U.S., India, and Taiwan.

In the U.S., wind-capacity installations were down compared to expectations as more than 5 GW of wind projects expected online in 2021 were delayed. There were and continue to be many factors causing delays, including rising commodity prices, record high freight costs, shipping and logistics bottlenecks, policy uncertainties — such as expiration of tax credits for wind projects and the fate of the Build Back Better Act — and interconnection queue delays.

Yet despite all this, 2021 was the second biggest year for wind installations on record, surpassed only by 2020. The U.S. wind market installed 4,374 wind turbines totaling 13,400 MW and brought more than 60 land-based wind-project phases online.

The 13,400 MW installed in 2021 brought the U.S. to 135,843 MW of cumulative operating capacity. Many of these wind projects are concentrated in the central plains of the U.S. where world-class wind resources are located. Texas vastly exceeds all other states' operating wind capacity with 35,969 MW operating. The next closest state for total operating capacity is Iowa with 12,219 MW, less than a half of Texas. A total of 23 states now belong to the gigawatt-club, with seven states containing more than 5 GW of operating wind power. There is commercial wind operating in 41 U.S. states and Puerto Rico.

Most notably, 2021 brought significant progress for the U.S. offshore wind industry. In March 2021, the Biden administration announced a goal to deploy 30 GW of offshore wind by 2030, while nine states set even more ambitious offshore wind-procurement targets during the year.

The Bureau of Ocean Energy Management (BOEM) held its largest single offshore wind-lease auction to date and advanced plans for additional lease sales in seven regions across the U.S.

2021 brought significant progress for the U.S. offshore wind industry. (Courtesy: Dominion Energy)

## MORE THAN 60 LAND-BASED WIND PROJECTS ADDED IN 2021

Wind developers brought 63 project phases online, including repowers, totaling nearly 13.4 GW in 2021. These projects were spread across 21 states, including nine states that added 500 MW or more. Texas led all states in new wind power, installing more than 3.3 GW. Oklahoma followed with more than 1.4 GW, and New Mexico placed third, adding more than 1.368 GW. The three largest wind projects built in 2021 were the 1,056 MW Western Spirit Wind project built in New Mexico, the 508 MW White Mesa project built in Texas, and 384 MW Isabella I & II project built in Michigan.

Developers commissioned more than 3.8 GW less wind power in 2021 compared to a record 2020, representing negative 22 percent year-over-year growth. Two reasons for this decrease are that the Production Tax Credit expiration drove a record year in 2020, and supply chain issues forced many projects set to come online in 2021 to be delayed until 2022.

U.S. wind-power capacity has increased nearly three-fold in the last 10 years and is 51 times larger than it was in 2001.

## OFFSHORE WIND-CAPACITY PROCUREMENT SETS RECORD IN 2021

Nearly 8.5 GW of offshore wind capacity was procured in 2021, beating out the previous record of roughly 7 GW achieved in 2019. Total offshore wind procured through 2021 sits at nearly 17.5 GW.

In January 2021, New York announced Equinor's Empire Wind 2 (1,260 MW) and Beacon Wind (1,230 MW) projects as winners of the state's second offshore wind solicitation. These projects build upon Equinor's success in the state's first solicitation, where the company's Empire Wind 1 (816 MW) was selected. New York is scheduled to hold a third round of procurement in 2022.

In June 2021, New Jersey announced the winners of the state's second offshore wind solicitation. Atlantic Shores (1,510 MW), a partnership between EDF and Shell, and Ørsted's Ocean Wind 2 (1,148 MW) were selected. New Jersey, originally scheduled to hold a third round of procurement in 2022, has delayed that procurement until the first quarter of 2023 as it awaits the results of an offshore-transmission solicitation.

In December 2021, both Maryland and Massachusetts announced the results of their latest rounds of offshore wind solicitations. In Massachusetts, Avangrid's Commonwealth Wind (1,232 MW) was selected. An additional 400 MW also was awarded to Ocean Winds and Shell's Mayflower Wind project. Ocean Winds itself is a partnership between EDP and ENGIE. Mayflower Wind was previously awarded 804 MW in a previous solicitation, bringing the project's total planned capacity to 1,204 MW. In Maryland, the state chose Ørsted's Skipjack Wind 2 (846 MW) and US Winds' Momentum Wind (808.5 MW).

## BOEM HOLDS LARGEST AUCTION

In February 2022, six lease areas in the New York Bight were awarded in BOEM's largest single offshore wind-lease auction to date. The auction raised \$4.37 billion in revenue and brought new entrants to the U.S. offshore wind market such as Invenergy, energyRE, RWE, National Grid, TotalEnergies, and Global Infrastructure Partners.

The market took a step forward in 2021 as the first commercial-scale offshore wind project, Avangrid and Copenhagen Infrastructure Partners' 806 MW Vineyard Wind project began onshore construction in November. The project had received a Record of Decision (ROD) from BOEM in May 2021. South Fork Wind, a 132 MW Ørsted and Eversource project, also received a ROD in November, allowing construction to move forward. Onshore construction began in February 2022.

There are currently two offshore wind projects online in the United States — Ørsted's 30-MW Block Island Wind Farm off Rhode Island and Dominion Energy's 12-MW Coastal Virginia Offshore Wind Pilot off Virginia, the latter of which came online in early 2021. There are 18 projects in development that have secured offtake, totaling nearly 17.5 GW. In total, there are currently 26 active leases on the East Coast, stretching from Massachusetts to North Carolina in various stages of development.

In October, Secretary of the Interior Deb Haaland introduced BOEM's Offshore Wind Leasing Path Forward 2021-2025. The plan outlines the agency's goal to hold lease auctions in seven regions across the United States. Following the New York Bight lease sale, BOEM was scheduled to hold a lease auction in the Carolina Long Bay region May 11, 2022. The auction will be for two leases totaling roughly 110,000 acres that could result in at least 1.3 GW of offshore wind capacity.

Next in BOEM's Path Forward is a lease auction in northern and central California, tentatively scheduled for September 2022. In November, BOEM announced its designation of the Morro Bay Wind Energy Area (WEA), located approximately 20 miles off the central California coast. This WEA, along with the Humboldt WEA (designated in July), are both set to be included in the forthcoming lease auction.

This process was advanced in January 2022 when BOEM released draft EAs for both the Humboldt and Morro Bay WEAs. Further down the pipeline, BOEM also plans to hold lease auctions in the Central Atlantic (2023), Oregon (2023), and the Gulf of Maine (2024).

## NINE STATES HAVE SET OFFSHORE PROCUREMENT TARGETS AT NEARLY 45 GW

States continue to be the main drivers of offshore wind development in the United States. In the first quarter of 2022, Louisiana announced an offshore wind goal of 5 GW installed by 2035 as part of the state's first ever Climate Action Plan.



Wind developers brought 63 project phases online, including repowers, totaling nearly 13.4 GW in 2021. (Courtesy: ACP)

To date, nine states have set offshore wind-procurement targets totaling nearly 45 GW. Previously, in June 2021, North Carolina Gov. Roy Cooper issued an executive order establishing North Carolina's first offshore wind development goal of 2.8 GW off the North Carolina coast by 2030 and 8 GW by 2040.

In September 2021, California Gov. Gavin Newsom signed AB525 into law, which directs the state to establish specific goals for offshore-wind production in 2030 and 2045 and puts the Golden State on track to lead the U.S. on floating offshore wind.

A formal offshore wind goal is expected in the coming years. Similarly, Oregon Gov. Kate Brown signed a bill in June 2021 that established a goal to “plan for the development” of up to 3 GW of floating offshore wind.

## WIND-POWER FORECAST FOR 2022 AND BEYOND

Moving forward, the average market consultant forecast calls for 93 GW of land-based wind-power capacity to be built from 2022 to 2030. Forecasts range from a low of 78 GW to a high of 127 GW. Years 2023 and 2024 are expected to be the most challenging with annual build expectations ranging from 7 GW to 11 GW. Declining production tax

credit value, persistent supply chain challenges, and competition from solar and storage all contribute. The market will be further weighed down in the middle of the decade by high interconnection costs, long transmission-study wait times, and congestion in wind-rich regions. New transmission lines coming online in the middle of the decade and continued coal plant retirements will help to jolt activity in the second half of the 2020s.

The offshore-wind market is largely driven by state policy support, solicitation schedules, and seabed leasing availability. By 2030, industry consultants forecast 24 GW of offshore wind to be operational. The average consultant forecast falls short of the Biden Administration's 30-GW target.

Forecasters point to long development timelines, anticipated delays, supply chain bottlenecks, and other factors. Alleviation of these constraints are expected to boost anticipated build closer to the 30-GW target. Multi-gigawatts annual installations are expected starting in 2024, while 2029 is anticipated to be the peak year for new offshore wind additions at more than 4 GW. ↴

## ABOUT THE AUTHOR

John Hensley is vice president for Research and Analytics with the American Clean Power Association.

# NEW CONSTRUCTION METHODS FOR OFFSHORE FOUNDATIONS AND TOWERS

The innovative design of the spar buoy foundation includes an integrated system that allows the tower, nacelle, hub, and blades to be self-erecting, eliminating the need for an expensive crane ship. (Courtesy: AMF Concepts)

*New wind farms 50 to 100 miles offshore will be supported by either semi-submersible or spar-buoy floating foundations. These foundations and towers, supporting the wind-turbine generator's nacelle and blades, incorporate new construction methods and materials resulting in lifespans measured in millennia rather than decades or centuries.*

By ANDY FILAK

Offshore wind farms are at the heart of the world's new environmentally sustainable floating infrastructures. Their efficient energy output will attract other new floating industries looking for offshore real estate, including desalination and water storage, hydrogen production and storage, liquid-air manufacturing and storage, data-center computing, storage, cooling, and much more. The long-term success of these future offshore green industries is dependent on floating foundations and support infrastructures that will last a millennium with zero maintenance. The materials and construction methods discussed in this article will focus on infrastructure to support large 18-MW to 20-MW direct-drive wind-turbine generators (WTG), but the concepts and applications can be easily modified for other offshore industries.

## A BRIEF HISTORY OF TODAY'S WIND MARKET

The United States (U.S.) and European Union (EU) countries have been very competitive in the wind-energy market. The U.S. has more land available to support vast wind farms, but individual countries within the EU do not, resulting in their fast-paced development of offshore wind-energy production. The EU's focus on offshore installments resulted in the development of monopile and jacket-style fixed-bottom foundations, as well as the design of substantially larger WTGs due to the absence of the land-based restriction of a 100-meter blade tip height. Over time, this advancing technology in offshore wind has allowed EU countries to commercialize their products for marketing worldwide. They now have contracts for 80 percent of the fixed-bottom leases on the East Coast of the U.S.

After almost 9,000 fixed-bottom installations in the EU, new shallow-water sites with depths of 60 meters or less (the depth limit of a jack-up installation vessel) are becoming quite rare. With 80 percent of the world's proposed wind-farm sites in deep water, the EU is furiously working on semi-submersible and spar-buoy-style floating foundations. There are many contenders with designs for both foundation systems.

Unfortunately, most current designs were generated from the metals industry, a material that does not perform well in a marine environment. As companies scale up their 5-MW WTG prototypes, the assembly and deployment of the foundations have become high-cost drivers. Going forward, a greater focus on new production methods and materials is paramount.

## TRANSITIONING TO FAR OFFSHORE FLOATING WIND FARMS

Wind-energy production far offshore will require innovative solutions to address challenging construction circumstances. U.S. naval architects and oil-and-gas engineering groups working on semi-submersible and spar buoy foundations certainly appreciate extreme sea conditions and have a clear design solution when it comes to addressing the yaw, roll, pitch, and heave of extreme sea states. Unfortunately, to assemble an effective semi-submersible foundation at scale would be incredibly cost-prohibitive, considering that the plan dimension of the structure is greater than two football fields (see Figure 1). In the past, lifting a 6-MW to 8-MW WTG nacelle onto a fixed-bottom foundation could be achieved with a crane barge, but the height and weight requirements of the new 18-MW to 20-MW WTG nacelles call for a crane ship, with a prohibitively costly day rate and an availability that could be restricted by other commitments or Jones Act requirements.

## HISTORY INSPIRES A NEW LONG-LIVED MARINE CONCRETE

University labs and their material scientists, along with many private industry labs, have finally found the correct material and construction methods that work well for the offshore industry. Their search for a long-lived marine concrete took them to Rome, Italy, studying the volcanic ash and rock that made up historic concrete structures. The concrete dome of the Pantheon has withstood the test of time for more than 2,000 years, and the harbors outside of Rome include concrete breakwater structures footed deep in saltwater, which are estimated to be more than 1,000 years old.

Today, 100 percent of the concrete used in fixed-bottom and floating structures is made using ordinary portland cement (OPC). The OPC (binder) is the paste that holds traditional concrete together, but it has deficiencies when used in marine environments. Sodium, sulfates, and chloride compounds in sea water directly attack the calcium components of OPC, and this chemical reaction essentially rots the concrete.

A new high strength material called cold fusion concrete (CFC), is the solution. This CFC material was developed by Geopolymer Solutions around proprietary geopolymer concrete technology. This geopolymer binder contains as little as 2 percent calcium and is instead made up of inexpensive

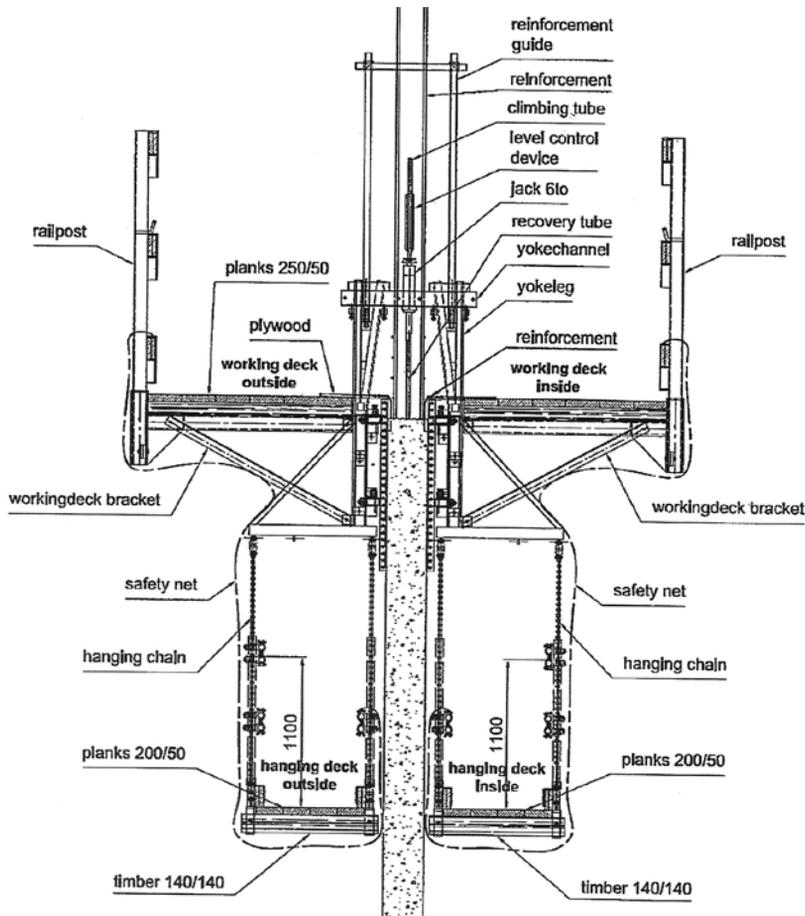


Figure 1: Typical cross section of general slip formwork for U.S. spar buoy. (Courtesy: AMF Concepts)

and widely available ingredients including aluminosilicates, fly ash, granulated ground blast furnace slag (GGBFS), zeolites, and water glass (anhydrous sodium metasilicate). The advantages of CFC are concentrated around durability and strength. CFC contains no OPC and, instead, is a dry cementitious material activated with water rather than chemical-liquid activators. The extremely low permeability and high strength of CFC produces a material with a lifespan in sea water, which will be measured in millennia rather than decades and centuries. The CFC materials, when produced and applied correctly, become the most durable material available in the construction industry. Its CFC chemistry is unequivocally superior, producing a binder that requires no air entrainment or placement vibration (self-consolidating) to achieve its strength.

The environmental sustainability of this product is further enhanced by the fact there is a 90 percent reduction in the carbon footprint associated with production of CFC compared to OPC. The curing of CFC can be performed conventionally or with low-voltage electrical current that expedites the strength accumulation and further reduces the carbon footprint.

## LIGHTER WEIGHT AND STRONGER REBAR REINFORCEMENT

When selecting reinforcement materials to complement CFC, a nonmetallic rebar made from readily available basalt stone is the substance of choice. Basalt (generic solidified volcanic rock) is found all over the Earth and is a key component of the mix, enhancing the durability of the structure.

When heated to a temperature of approximately 1,500°C (2,730°F), basalt liquefies and can be extruded through a palladium die to produce soft, flexible threads. The threads are laid in parallel and locked together with epoxy to produce basalt rebar — a waterproof, chemically resistant, fireproof material with a tensile strength three times stronger than steel rebar. Compared to a similar diameter steel rebar, basalt rebar is seven to nine times lighter, but of equal strength.

Basalt fiber, much like nylon fiber, is chopped into variable lengths and used in the mix design for added strength. The CFC geopolymer binds to the basalt on a chemical level, in addition to mechanical bonding, further enhancing the structural integrity. For an offshore wind farm, the basalt bars are produced and bent in a portable construction plant in the back harbor. This facility also serves as the location for the slip forming of the tower component for the WTG, including the efficient installation of the tower internals.

## BENEFITS OF SLIP-FORM CONSTRUCTION

Traditional metal structures require cutting, bending, welding, and costly handling to build a component. A new proposed construction technology, slip forming using CFC eliminates all of this and can produce the same strength requirement faster, at less cost, and with a longer lifespan. Slip forming is the continuous pouring of concrete into a form that is creating the product. When using CFC, slip forming enables nonstop, cast-in-place production of concrete structures with no cold joints. Slip forming has a superior performance to jump-forming and other formwork systems by using unique discrete form elements. This slip-forming application relies on both the workability and quick-setting properties of the CFC concrete. The concrete needs to be workable enough to flow into the form and set up quickly enough to emerge from the form with a high degree of structural integrity and strength. This strength

is paramount since the freshly set concrete must permit the formwork to slip past it without disturbance while also supporting the downward pressure of the new concrete being continually placed.

### INNOVATIVE DOWN-SLIPFORM TECHNOLOGY

In traditional slip forming, the structure being formed is being created upward. To produce concrete infrastructures large enough to support an 18-MW to 20-MW direct-drive wind-turbine generator (WTG), the structures will have to be created going downward. As the continuous pour of the CFC proceeds, the slip-forming process pushes the newly formed structure downward into the sea. This new construction method is initiated on a submersible dry-deck barge (DDB) and is then completed on a custom-built construction vessel outside the supply harbor at a sea depth greater than the length of the designed structure. The formwork assembly consists of two work decks — a lower one for placing both the concrete and horizontal basalt rebar into the slip formwork and an upper

deck to feed down the vertical basalt rebar and direct the placement of the concrete boom's trunk. The entire work-deck assembly and formwork are raised as a single unit using hydraulic jacks, which climb steel pipes embedded in the cured concrete. When the slip is complete, these pipes are removed.

The down-slip forming method for any CFC floating structure is achieved by using a closed-end hull bottom structure, referred to as the starter-hull base, to support the jack rod load as well as the downward pressure from the two deck slip-form assemblies. This starter-hull base will be formed with conventional steel formwork. The starter-hull base will be cast on the center plate of a submersible dry-deck barge (DDB). A custom-designed wood plate is positioned under the starter-hull base to absorb the crush weight of the accumulating weight. The hydraulic jacks raise the decks and formwork assembly at a rate that allows the CFC to achieve a controlled cure rate by the time the formwork is slipped off.

Once the down-slip forming is under way, the starter-

► **The environmental sustainability of this product is further enhanced by the fact there is a 90 percent reduction in the carbon footprint associated with production of CFC compared to OPC.** ►

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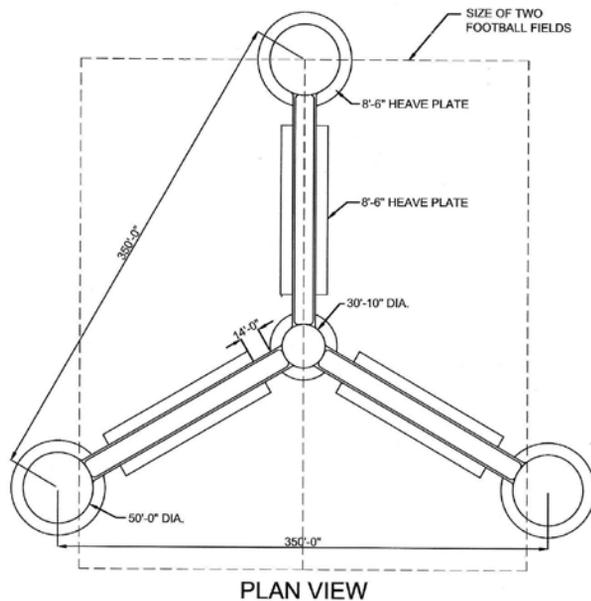
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## SLIP FORM SEMI-SUBMERSIBLE FOUNDATION

2/20/22



CONCEPT DRAWING

AMF CONCEPTS

Figure 2: Slip form semi-submersible foundation. (Courtesy: AMF Concepts)

hull-base is slipped to 60 feet and then stopped. A system of ballast tanks on the DDB is then flooded and the barge is sunk to an effective float-off depth. The starter-hull base is then floated off and moved into the aft well of the construction vessel where the down-slip forming will be restarted and continued until the structure reaches its design depth.

### ACHIEVING A SLIP RATE OF ONE- TO FOUR- FEET PER HOUR

This is accomplished by several factors such as ensuring a longer life in the forming panels by applying a PVC coating, and assuring that all the vertical rebar is designed for pre-tied cages with plastic spacer wheels and guide alignment systems to ensure appropriate spacing. All bars will be tied with plastic clip rebar tie guns. Each of the pre-tied vertical cages will be lifted to the top work deck in cage-lifting racks. The cages will then be placed in vertical guide fixtures and lap-tied to the previous cage.

All vertical cages can be handled by one rod buster. What makes this possible is that the basalt rebar is three times stronger and eight times lighter, enabling use of a smaller bar. Another factor is that CFC concrete will not require vibrating, which gives the inside and outside rod busters (placing and tying the horizontal bars through the yokes) more room to work.

The largest factor is the geopolymer CFC mix, which is designed to allow low-voltage electrical current to pass through the concrete to heat and accelerate the cure time. This electrically enhanced curing greatly expedites the slip process to achieve a down-slip-forming speed of one to four feet per hour, depending on the complexity of the pour, rather than the much slower six to eight inches per hour achieved when slip forming traditional ordinary portland cement.

This incredibly efficient down-slip-forming process results in previously unimaginable cost savings and accelerated time to market. Instead of 12 to 16 feet of conventional slip forming per 24-hour day, the down-slip forming process supports the production of 100 feet of structure per day (up to eight times faster).

### SLIPFORM WORK DECK AND CONSTRUCTION VESSEL DECK ALIGNMENT

During the down-slip-forming process, the slip-forming work deck assembly will always be at an elevation to allow a member of the crew to step down onto the construction vessel's main deck. This variable elevation is achieved by computer software that controls a measured water ballast placement in the hull while, at the same time, accounting for concrete placement, rebar, and crew weight.

The down-slip-formed structure is always floating free in the aft well of the construction vessel and is lightly supported by four tube-rollers. These rollers are equally spaced around the inside wall of the aft well. Each solid rubber roller is eight feet long, turning on a 10-foot long, 10-inch diameter stainless steel pipe. The rollers turn on sintered metal bearings allowing them to move laterally on the stainless-steel pipe. In an acceptable working sea state, dynamic positioning of the construction vessel via Azimuth thrusters will hold the well in position.

### DOWN-SLIP FORMING THE SPAR BUOY FOUNDATION

The spar buoy floating foundation consists of cylindrical double-hull structure with an 80-foot outside diameter and a depth of 600 feet or more. After the aforementioned starter-hull-base is slipped off the dry-deck barge (DDB) and moved to the aft well of the construction vessel, the continuous down-slip forming resumes until the spar buoy structure reaches a depth of 600 feet.

When the spar buoy construction is complete, a large high-capacity pipe plug is placed on top of the buoy. The internal water ballast is then pumped out, allowing the spar buoy to float horizontally in preparation for tow out to the wind-farm site.

Crews will work in three eight-hour shifts, 24 hours a day, to make up one workday.

- ▶ To pour, cast, and strip the starter-hull formwork on the dry-deck barge (DDB) will require one workday.

- ▶ Placing the double-deck slip formwork on the starter-hull will take two workdays.

▾ Floating off the starter hull from the DDB will require one workday.

▾ Moving the starter-hull into the production well of the construction vessel, restarting the slip, and continuing the down-slip forming to its completion at a 600-foot hull depth will require six workdays (deeper hull depths scale linearly in time, so an 800-foot hull depth would require eight workdays).

▾ Placement of the high-capacity pipe plug in the top of the spar buoy and pumping out the water ballast to achieve a horizontal float requires one workday.

▾ Total construction time for a 600-foot spar buoy floating foundation is just 11 workdays.

The innovative design of the spar buoy foundation includes an integrated system that allows the tower, nacelle, hub, and blades to be self-erecting, eliminating the need for an expensive crane ship.

## DOWN-SLIP FORMING THE SEMI-SUBMERSIBLE FOUNDATION

The semi-submersible foundation (SSF) is a triangular structure with a pontoon affixed to each of the three points of the triangle. The direct-drive wind-turbine generator (WTG) and blade-support tower are normally placed in the center of the triangle, although this tower can have other placements such as the center point of one of each of the sides or on top of one of the three pontoons. The SSF concept described here is designed to support an 18-MW to 20-MW WTG. (See Figure 2)

The SSF consists of seven make-up components and all can be constructed using the down-slip-forming method described earlier. These components include three pontoons, three floating struts, and one tower WTG support structure. All components are designed to be assembled and connected while floating in water using a cold fusion concrete welding process to form a weldment. The individual components have a six-inch void on each end, and when joined with another component, the one-foot juncture allows for more CFC to be added. Since CFC bonds to itself, no cold joint is created, and the resulting bond is stronger than the individual components.

The total build-out time for this complete semi-submersible concrete foundation (not including the tower) is just eight 24-hour workdays.

In addition to the cost savings associated with such a short construction and assembly period, the SSF can be constructed without the added expense of a crane ship. However, unlike the spar buoy floating foundation, once the SSF foundation is completed, a crane ship is necessary to assemble and install the nacelle and blades of an 18-MW to 20-MW WTG at sea.

## ZERO MAINTENANCE REQUIRED ON THE FLOATING FOUNDATIONS AND TOWERS

Some of the highest long-term cost drivers in deep water far offshore wind farms are crew transportation and farm

maintenance. Boats with catamaran hulls will be required to transport crews safely and quickly in higher sea states, and these vessels are costly to purchase and operate.

The nacelle, hub, and blades of the WTG require routine maintenance, but the CFC semi-submersible and spar buoy floating foundations described, as well as the CFC tower structures for the WTGs, have been designed with materials that contain zero steel and will be maintenance-free for a millennium.

Using CFC floating foundations greatly reduces the total number of trips required to maintain the wind farm.

## LONG LASTING STATION KEEPING ANCHORS

Since there is a wide range of sea floor conditions at the extreme depths of a far-offshore wind farm, only two anchor systems are recommended for use at these depths. The first system is a CFC chain or gravity anchor with a link length of eight feet and a link thickness of a foot and a half. This gravity anchor is constructed in a back-harbor construction plant using conventional steel formwork.

The second system is a CFC suction caisson anchor. The caisson anchor is an open bottom tube sealed at the top and embedded by suction in the sea floor. This caisson anchor can be down-slipformed at sea.

After the tube is formed, a high-capacity pipe plug is inserted on one end, the internal water is pumped out, and the anchor can be towed to the desired site. This anchor is quicker to install and remove than other methods and can handle multiple mooring lines.

Using CFC materials for these anchors not only extends their lifespans to a millennium, but it will reduce the capital cost associated with traditional mooring and anchoring.

## SUMMATION

▾ The CFC concrete floating foundations, anchors, and towers to support a WTG of up to 20 MW or more will need no maintenance or replacement for a millennium.

▾ An independent cost opinion revealed that the production systems and materials chosen for these floating foundations will reduce the cost by a minimum of 40 percent.

▾ The CFC concrete semi-submersible and spar buoy floating foundations can be constructed and assembled in the water without the added expense of a crane ship and without expensive harbor real estate.

▾ The CFC concrete spar buoy construction design includes an integrated method to set its own tower, nacelle, hub, and blades — without the use of a crane ship. ✎

## ABOUT THE AUTHOR

Andy Filak is a principal with AMF Concepts. He can be reached at amfconcepts@gmail.com or 310-373-5004. For other relevant articles previously published in Wind Systems see “The Greening of Offshore Wind Farm Construction” (December 2021) and “Elevating Hub Heights of Offshore WTGs Without Elevating Cost” (August 2021).

A photograph of several offshore wind turbines in the ocean at sunset. The sky is a warm orange and yellow, and the water is dark with white-capped waves in the foreground. The turbines are silhouetted against the bright sky.

# HOW WEATHER-DECISION SUPPORT IMPROVES SAFETY AND REDUCES RISK

The weather directly influences the insurability of offshore wind farms. (Courtesy: StormGeo)

# Understanding and managing the weather is the key to safe and successful offshore wind projects.

By ANNA HILDEN

Offshore wind development is booming. Following a significant surge in demand for renewable energy and a growing wind-energy market, developers increasingly shift to offshore locations to capture stronger and faster winds. Several European countries already leverage the powerful offshore winds of the North Sea; China connected close to 17 GW of offshore wind capacity to the grid in 2021, and although onshore wind farms are currently more prevalent in the U.S., the country's future seems to favor offshore wind. The Global Wind Energy Council (GWEC) reports that offshore wind has the biggest growth potential of any renewable energy technology and forecasts that 235 GW of new offshore wind capacity will be installed over the next decade under current policies.

As the industry heads for deeper waters, new challenges emerge for wind-farm operators. In offshore environments, extreme weather and rapidly changing conditions regularly challenge both personnel safety and operational efficiency. To ensure safe operations and avoid costly project delays, offshore wind-farm operators become increasingly dependent on accurate and site-specific data on critical weather parameters.

## HOW THE WEATHER AFFECTS OFFSHORE WIND-FARM OPERATIONS

Similar to their onshore counterparts, weather plays a significant role in the operations and maintenance of offshore wind farms. In contrast to onshore wind, however, the weather is not only one factor but often the deciding factor when planning, constructing, and operating offshore wind farms. Working in highly unpredictable environments, offshore developers and operators need to collect and understand data on everything from winds, waves, and currents to tidal waters, lightning, and tropical cyclones.

From the complex construction phase to the demanding operational phase, the weather is the main limiting factor for offshore wind operations. First of all, the challenging environment of offshore wind farms creates significant safety hazards for installation and maintenance crews. For example, although strong winds are necessary for successful offshore operations, they can also significantly increase the safety risk for on-site teams working on wind-turbine installation or maintenance. Unlike onshore wind farms, technicians cannot access offshore wind turbines by car but instead require small crew transfer vessels, larger service operation vessels, or helicopters to go back and forth between the shore and the wind farm. Accessing a wind turbine from a helicopter or small vessel during strong winds and high waves is not without risk for technicians.

Another safety hazard is lightning, a particularly challenging weather phenomenon, especially during the summer. As most of us know, it is unsafe to do maintenance

work atop a steel wind turbine in the middle of the water when thunderstorms rage and lightning strikes. But, as the saying goes, lightning bolts can appear to hit from the clear blue sky, striking at any time, at any place, and without any warnings. For the unprepared maintenance worker, sudden lightning strikes can be fatal.

Second, the weather directly influences the insurability of offshore wind farms. Potential physical damage, accidents, and natural hazards are not only challenging for offshore wind-farm developers and operators but are also unsettling for insurance companies. To manage weather risks, insurance companies require local, dedicated weather forecasting for all wind-farm projects.

Third, the harsh and severe weather at offshore wind farms may disrupt project development progress and business continuity, first and foremost, because it determines when installation and maintenance teams can access the wind-farm area and wind turbines. For example, high and destabilizing waves can make it next to impossible to load, transport, and install wind turbines during the construction phase. Wind-turbine lifting and installation also require winds below a certain limit at the lifting height — typically above 100 meters. Waiting for safe and suitable weather windows can add costly delays to a project.

As harsh and severe weather challenges both personnel safety and business continuity at offshore wind farms, developers and operators need accurate weather forecasts to understand the challenging environment and efficiently manage optimal weather windows. Especially in the U.S., accurate weather forecasting becomes increasingly important as the offshore wind industry moves into regions strongly affected by hurricanes following the recent greenlighting of wind auctions offshore the Carolinas.

## FINDING THE RIGHT WEATHER WINDOW

Understanding and managing the weather windows at offshore wind farms is critical to project success. Rely on too optimistic weather forecasts, and you risk having to abort the operation to ensure the safety of your crew. Rely on too pessimistic forecasts, and you risk missing out on working opportunities. Both lead to unnecessary time delays and increased operational costs.

Missing out on a weather window — the ideal time to work on wind-farm installations and maintenance — is costly for offshore wind developers and operators. If the missed weather window occurs during the construction phase when specialized vessels operate in the wind-farm area, installation costs will rise high. In addition, if installation and maintenance crews must return before they have completed their work, costly project delays will occur. Time is money, and lost opportunities quickly translate into lost revenue.

Although the accurate prediction of weather is essential



For the unprepared maintenance worker, sudden lightning strikes can be fatal. (Courtesy: StormGeo)

for the safe and timely completion of offshore wind operations, missed or misjudged weather windows are common in the industry — often because of inaccurate weather forecasts. When it comes to offshore wind, general weather forecasts from traditional media outlets are rarely sufficient. Detailed, accurate, and site-specific met-ocean data is required to find the right weather window for offshore wind development and operations.

### ADVANCED WEATHER INTELLIGENCE FOR OPTIMIZED WEATHER WINDOWS

Offshore wind developers and operators who want to ensure safe and effective operations should consider leveraging advanced weather intelligence platforms from an experienced weather forecaster. Armed with accurate forecasts and trend analyses, offshore wind players are better equipped to increase their confidence when making weather-sensitive operational decisions and ensure they are ready to go whenever a weather window opens.

Experienced wind-farm developers increasingly un-

derstand the importance of managing the weather with advanced weather intelligence to improve their offshore operations. For example, accurate and real-time weather forecasting boosts Ørsted's Block Island Wind Farm in the U.S. The Danish developer relies on precise forecasting to support the maintenance of the turbines, defining weather windows for sailing, accessing turbines, and lifting components.

The American power and energy company Dominion Energy, delivering clean, safe, reliable, and affordable energy to more than 7 million customers worldwide, is another example. The Virginia-based company relies on accurate weather insights to support the daily operations at the wind farm.

What these and many other experienced wind-farm players all have in common is their reliance on weather forecasters to collect and visualize all necessary weather parameters in easy-to-understand dashboards, provide effective long-range forecasting that alerts to weather windows, and help to reduce costs and increase safety from the planning stage

to full-cycle project operations.

There is no controlling the weather, but wind-farm developers and operators should try to manage weather windows as accurately as possible. To do so, they should rely on accurate and reliable weather predictions from experienced weather forecasting vendors. Understand and manage the weather better, and your wind-farm development and operations will become more efficient, experience less downtime, and ensure the safety of installation and maintenance crews on-site. ✈

#### ABOUT THE AUTHOR

Anna Hilden is global industry manager of Offshore Wind for StormGeo, a 24/7 weather intelligence provider. With over a decade of industry experience, Hilden provides advanced meteorological services to clients in the renewable energy sector for safe and more efficient offshore operations. For more information, go to [www.stormgeo.com](http://www.stormgeo.com).



Missing out on a weather window — the ideal time to work on wind-farm installations and maintenance — is costly for offshore wind developers and operators. (Courtesy: StormGeo)

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PROFILE

EMERSON

# ENHANCING OPERATIONAL READINESS

The acquisition of Mita-Teknik was complementary to Emerson's existing automation portfolio and supports the company's ability to help customers digitally transform operations and meet sustainability goals. (Courtesy: Emerson)



*By offering control systems, power-generation software, and more, Emerson drives innovation that makes the world a safer, smarter, and more sustainable place.*

By **KENNETH CARTER** ▸ Wind Systems editor

**W**hen a company's drive for innovation leads it to make the world a healthier, safer, smarter, and more sustainable place, it stands to reason what that company produces should follow through on that monumental task.

By focusing on software and technologies for the power and water industries, Emerson is striving to do just that.

"Our driving force has always been control systems and software for power generation," said Jason Blackburn, Director of Global Product Marketing for Emerson. "We've traditionally been focused on conventional power, and now that focus includes supporting customers' net-zero targets. Emerson's solutions help customers confront the transitional challenges associated with meeting their sustainability goals by balancing the addition of more renewable energy — wind, solar, and battery storage — in their portfolios."

## MOVING INTO WIND

Blackburn explained that Emerson's stellar reputation in the power industry, combined with an extensive global service network, enables the company to be well-positioned to help customers optimize the management of renewable resources, especially wind-turbine generation.

"Over the past few years, we've been looking to extend our wind capabilities and exploring questions such as: Are there companies that fit with our automation profile? Are there companies that don't necessarily make the equipment, but are leaders in building or providing automation platforms for wind OEMs and wind operators?" he said. "We examined the market, and we found our answer in Mita-Teknik, a leader in control automation for renewable power generation with a broad, comprehensive portfolio of solutions and services for wind."

"Mita-Teknik makes turbine and pitch control systems for wind-turbine OEMs with a full suite of condition monitoring, SCADA, and asset performance management software that monitors wind parks to help determine asset health and optimize performance regardless of turbine type," Blackburn said.

The acquisition of Mita-Teknik was complementary to Emerson's existing automation portfolio and supports the company's ability to help customers digitally transform operations and meet sustainability goals. It also aligned with Emerson's long history of similar strategies that enable the company to offer a superior product for customers who want the option of maintaining and operating their assets independently without relying on OEMs.

"We liked Mita-Teknik because not only is the organization a major provider to OEMs, but it also has an extensive collection of solutions that can be used for retrofitting and modernizing wind controls," Blackburn said. "This capabil-

ity is of great interest to our utility customers who want to self-operate and self-maintain their assets."

## COMBINING COMPANY STRENGTHS

Another reason for Emerson's acquisition was Mita-Teknik's long, successful history in the wind industry and its work with other early Danish wind innovators to build wind-specific control systems.

"Mita-Teknik, founded in 1969, was one of the first companies to develop a wind-turbine controller," Blackburn said. "The organization is headquartered in Denmark, a country that is known as a pioneer in the wind industry."

By combining Mita-Teknik's wind expertise and a strong presence in Europe and Asia, with Emerson's world-class power generation leadership, especially in North America, Emerson significantly expanded its global reach in renewable energy, particularly in the wind sector.

"We have a lot of synergies with regard to longstanding customer relationships with utilities and the owners and operators of wind farms in North America," Blackburn said. "Mita-Teknik has the best technology portfolio for wind generation. Integrating automation systems and software, industry leadership, and expertise into tailored, comprehensive solutions will help our customers in North America operate their fleets better."

## UNLOCKING ASSET DATA

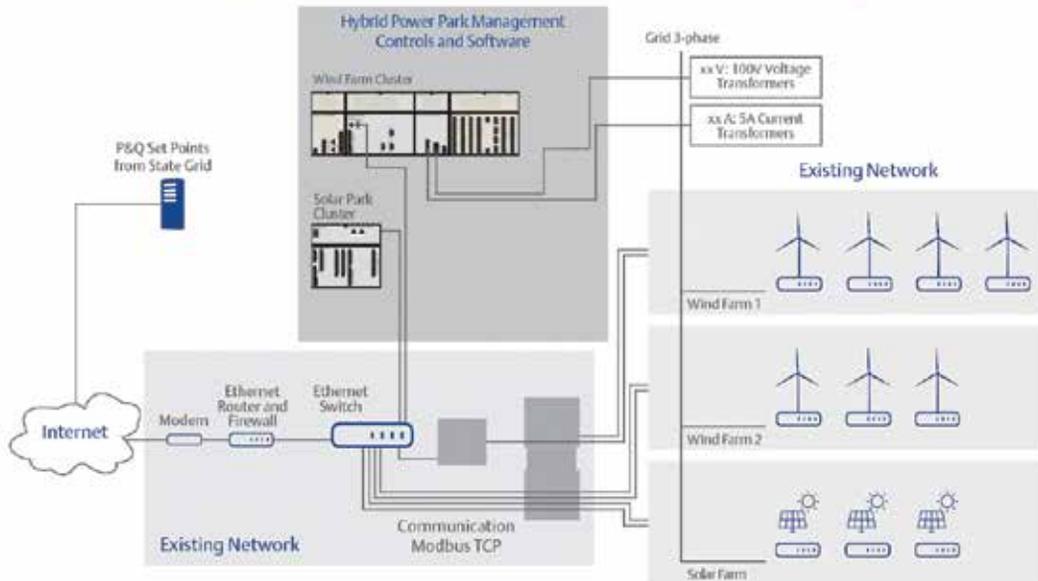
Many of Emerson's customers operate fleets of multi-OEM wind turbines, each using different automation systems, particularly on the SCADA or asset-management level, according to Blackburn. The OEM systems typically don't provide access to all the data that customers need to operate their wind fleets efficiently and cost-effectively. Emerson's solutions help customers tackle that challenge by offering software that works with 750 different turbine types, providing owners or operators a clear view of operations from an individual turbine to a full wind farm or a fleet of farms.

"Emerson's wind solutions resolve two major customer pain points at the same time," he said. "We offer a single pane of glass to view assets across the entire fleet that provides more insight than customers can normally get from their OEM solution."

As assets age, customers will experience new challenges on the control side of the turbine.

"Owners and operators want to extend the lifecycle of their wind assets and control components, but they are faced with several issues," Blackburn said. "One is difficulty obtaining obsolete spare parts. Another is, oftentimes, the customer's OEM-provided control system is a black box. In other words, they cannot make modifications because the system is locked down."

## Power-to-X: Hybrid Renewable Resource Management



Emerson’s strategy is to be ahead of the changes happening in the industry and to be the go-to automation partner for delivering power-to-X, single resource, and hybrid solutions that provide more value to global customers. (Courtesy: Emerson)

That’s where Emerson sees opportunities to provide full operational visibility that helps customers safely run a turbine differently to help improve its performance. Emerson does this by installing enhanced control strategies and software that optimize wind-turbine and wind-farm output to provide the lowest cost of energy.

### REPLACING THE CONTROL SYSTEM

Emerson’s retrofit solutions replace legacy control systems with an open platform that enables customers to implement control strategies that optimize turbine output and extend lifespan.

“Our advanced control algorithms can increase AEP (annual energy production),” Blackburn said. “This includes optimization software that mitigates misalignment by autotuning the yaw position, resulting in a 2- or 3-percent increase of normal outputs over time as well as a long list of other improvements.”

According to Thomas Andersen, vice president of Renewable Energy Technologies for Emerson, customers have be-



With a long history of delivering power-industry-specific software and technologies, Emerson has been able to grow its install base to where it is today — automating more than 1.4 million MW of total global power. (Courtesy: Emerson)

come savvier and more informed over the years about what to expect from their existing systems.

“In the last five to seven years, we have seen more interest from wind owners and operators to better understand their assets,” he said. “They want access to all the turbine data so they can analyze and optimize their production and lifecycle management.”

## THE NEED FOR MORE DATA

Data access and management become even more important as many renewables are hybridizing with a mix of wind turbines, PV solar, and battery storage to optimize energy output, according to Andersen. For successful hybrid operations, the operators must know, in detail, what is going on with each asset in real-time.

“Customers cannot get data from the OEM’s black box, and that’s what has been driving the retrofit market,” he said. “Our retrofit strategies provide full access to operational data. When combined with our vendor-independent SCADA system, the result is a comprehensive solution that delivers value across an organization, from a high-level KPI report for management to an engineering analysis tool that optimizes turbine operations.” As an example of the services Emerson can perform, Blackburn noted a customer in Alaska with a set of older, remote turbines that needed to reduce turbine trips and improve performance; however, the OEM system did not allow access to the controls to reset the turbine after a trip.

“Before the acquisition, we worked with Mita-Teknik to replace the customer’s OEM-turbine controls,” he said. “As a result, they’ve experienced an increase in availability, and they are no longer dependent on the OEM, enabling them to operate their wind fleet as they want to operate it. We also implemented advanced control features that were not included with the original OEM system.”

## “ONE-STOP SHOP”

To that end, Andersen pointed out that Emerson is one of the few companies that has components to supply all the electrical equipment used in an asset, including pitch systems, control systems, and condition-monitoring systems.

“Outside of the turbine structure, we provide a SCADA system and asset management software. This makes us a one-stop shop for our customers,” he said. “They don’t have to pick and choose from different manufacturers and then struggle to get the disparate systems to function properly together. We deliver an integrated, tested system that is tailored to meet the unique characteristics of each turbine or farm. Our ability to simulate and calculate loads like those used when designing a brand-new turbine reduces risk.”

## 130-YEAR HISTORY

Although Emerson’s history with wind is fairly recent, its track record with other platforms that built up its power industry expertise has existed since 1890. Emerson as a company has two main platforms: Automation Solutions and Commercial and Residential Solutions. Emerson’s renewable energy technologies and expertise, including wind, are part of the Automation Solutions platform that focuses on process, hybrid, and discrete industries.

With a long history of delivering power-industry-specific software and technologies, Emerson has been able to grow its install base to where it is today — automating



Emerson installs enhanced control strategies and software that optimize wind-turbine and wind-farm output to provide the lowest cost of energy. (Courtesy: Emerson)

more than 1.4 million MW of total global power. This is further enhanced by the Mita-Teknik acquisition, according to Blackburn.

Emerson’s solutions also automate about 12 billion gallons of water and wastewater treatment daily, an important function since a growing trend for the water industry is to operate around the clock with more reliable, resilient power. Water and wastewater plants are beginning to explore the use of onsite microgrids, which can include wind generation. Emerson’s microgrid integrated automation solutions platform controls and monitors all power-generating assets as well as water and wastewater treatment processes, providing customers with numerous operational and maintenance benefits.

## RENEWABLES FUTURE

With its recent expansion into the wind industry, Emerson expects to continue to play an important role in the renewable sector by supporting its customers with their decarbonization efforts. Wind power is a key component of that, according to Andersen. “We are an automation leader for manufacturers, OEMs, and owners of wind turbines with our ability to deliver a wide array of solutions and services,” he said. “We will continue to be a trusted adviser for many years to come. There’s no doubt that going forward we will see more hybrid power generating and energy storage plants that will require innovative technology to optimize operations. Our strategy is to be ahead of the changes happening in our industry and to be the go-to automation partner for delivering power-to-X, single resource, and hybrid solutions that provide more value to our global customers.”

An important aspect of that is the ability of those with wind-power generators to have greater control and insight into the operation of their turbines, according to Blackburn.

“In my opinion, customers who have owned and operated farms over the years, are in the best position to know the unique environments they operate in and the performance of their assets,” he said. “There’s a tremendous opportunity for customers who want to self-operate their facilities without reliance on the OEM. Our goal is to be the leading software and controls provider for the customers who want to do that and accelerate their journey to smarter, more sustainable operations.” ✌

## MORE INFO

[www.emerson.com/en-ca](http://www.emerson.com/en-ca)

## CLEANPOWER 2022 exhibitors

► **Why are you exhibiting at CLEANPOWER and what should attendees look forward to at your booth?**

*“This is the largest North American wind show, so it’s the event to be at to network and follow up with customers.”*

American Clean Power’s annual renewable-energy-industry show, CLEANPOWER 2022, is scheduled to hit San Antonio, Texas, May 16-18. The show will bring thousands of industry experts and insiders to Texas in one place — many for the first time since the pandemic — where they will be on hand with knowledge to take wind, solar, battery storage, and more into 2022 and beyond.

*Wind Systems* reached out to several exhibitors and asked them to share their plans for CLEANPOWER 2022. If you’re at the show, be sure and stop by their booths for more information.





## AMSOIL

BOOTH #946

► **Dustin Carlson**, Sales Manager

As an industry leader, AMSOIL Industrial is excited to participate again at CLEANPOWER 2022, as it is one of the best gatherings to help educate wind-energy professionals about the challenges of lubrication in the wind industry. Our AMSOIL-dedicated wind team will help educate attendees to help optimize their lubrication program.

We'll guide you through the entire process from proper oil changeover to understanding oil analysis. Maximizing operational efficiency and dialing in maintenance programs is what we do.

Stop by our booth to find out why more customers choose AMSOIL lubricants and greases to protect their wind-turbine assets. Technically driven. Customer focused. No. 1 in global wind gearbox oil reliability and performance.



## BACHMANN ELECTRONIC CORP.

BOOTH #3023

► **Brian Hill**, General Manager — North America

Bachmann is exhibiting at CLEANPOWER in order to see old friends and meet new ones. We will be sharing our newest solutions, including cutting-edge SCADA and controls retrofit solutions that allow you to update older turbines with current technology and cyber security along with full access to the data and parameters available for your assets.

As the industry moves forward with energy-storage solutions and hybrid projects, Bachmann can be there to help you connect, dispatch, and protect the grid, while meeting the ever-changing requirements of grid operators.



## DYSON CORP.

BOOTH #739

► **Chip Harman**, Director of Sales & Marketing

At Dyson, we understand what it takes to support the wind industry. Our staff has decades of wind experience and is here to provide help from concept through completion.

With two manufacturing sites strategically located

near major installations in the Midwest and the Southwest, Dyson is able to react to unexpected changes in demand while remaining price competitive. We are your partner for wind-tower foundations.



## ELEVATOR INDUSTRY WORK PRESERVATION FUND

BOOTH #2932

► **Carisa Barrett**, National Coordinator

The Elevator Industry Work Preservation Fund is a labor management cooperative that provides resources to the International Union of Elevator Constructors and their signatory contractors. This will be our 10th year at CLEANPOWER, formerly WINDPOWER.

Our focus is promoting safety for the people who work on and ride elevators/wind-turbine lifts by focusing on training and education and to provide a resource to wind-farm owners and operators in finding installation, repair, maintenance, testing, and compliance inspection companies for the lifts in the turbines.

We sit on the code bodies that write the codes for elevators in all industries. Our goal at these events is to educate the stakeholders on the safety codes that govern these elevators/lifts and to promote a highly trained workforce for all their wind-turbine elevator needs.



## EMERSON

BOOTH #841

► **Thomas Andersen**, Vice President of Renewable Energy Technologies

As a global automation leader, Emerson drives innovation that increases wind-turbine availability and AEP. Our multi-brand solutions include field-proven wind SCADA & APM software, turbine retrofits & pitch controls, comprehensive cybersecurity solutions, and expert support.

Customers using our software and technologies own their data and have full visibility into a single turbine, a farm, or geographically dispersed wind-fleet operations.

A recent installation delivered fast results by reducing O&M costs by 65 percent, increasing availability and supporting the delivery of reliable wind power. Visit us to discover a clear approach to more sustainable wind operations that amplify production and revenue.



## GASTOPS

BOOTH #1766

► **Cedric Ouellet**, Director of Energy & Industrial

This is the largest North American wind show, so it's the event to be at to network and follow up with customers. As we return to normalcy in a COVID world, we will showcase our new MS3500 and Gastops Connect capability. At our booth you can see OEM-approved ODM/MetalSCAN retrofit solutions for your fleet; a closeup look and product demo of our new fifth-generation MS3500 series, which is now standard on most OEMs; and a real-life demo of our new Gastops Connect portal and service offerings.

## HEICO

BOOTH # 3038

► **Luke Reed**, Sales Manager, North America

We firmly believe the most-costly bolted joint is the one that fails. The HEICO Group maintains a global focus on engineering and manufacturing critical fastener solutions for



the renewables industry. We currently partner with all OEM tiers, their suppliers, and the power producers to prevent bolted joint failures under the most extreme operating environments. HEICO was also an early adopter of the APQP4Wind quality architecture,

which parallels our existing IATF 16949 quality certification. Here at CLEANPOWER, we are eager to show our HEICO-LOCK® Wedge Locking Systems and our HEICO-LOCK® Tensioning Systems – accepted and employed throughout the renewables industry.

## MALLOY

BOOTH #2865

► **Cory Mittleider**, Wind Business Unit Manager

We want to share our experience and offer our help to solve the toughest bearing problems found in the wind industry. We will have sectioned full-size model of a failed blade (pitch) bearing as well as a model of an



upgraded blade bearing so we can discuss the details of both the failure and the solution. We will also have information on gearbox bearings, main bearings, and generator bearings. Stop by for a detailed discussion of any bearing application.



## PEARCE RENEWABLES

BOOTH #2145

► **Daryl Ragsdale**, VP, Business Development

As the leading independent solutions provider to our nation's critical infrastructure, Pearce Renewables is your partner of choice to keep your critical assets operating optimally. Pearce Renewables, formed last year through five strategic mergers and acquisitions, provides full life cycle operations, maintenance, and engineering services, as well as spare parts and technical training for wind, solar, energy storage, and EV charging asset owners, developers, managers, OEMs, and EPCs. Attendees will be impressed by our best-in class team, providing a comprehensive list of critical services, including commissioning, PMs, campaign programs, large

correctives, composite repairs, MCE, repower, engineered solutions, and catastrophic response. ↪

## Visit us at CLEANPOWER 2022

*Wind Systems* will be at ACP's annual renewable-energy-industry show, and we hope you'll stop by our booth (1259) to chat with our staff. We look forward to seeing you there.





33 monopiles needed to be upended one by one from their horizontal orientation on the deck of the installation vessel so that they could be used for construction of Japan's first large scale commercial wind farm project. (Courtesy: Akita Offshore Wind Corporation)

## ► CONSTRUCTION

### Monopile upending complete for offshore wind project in Japan

As part of the Akita Noshiro offshore wind-farm project's construction phase off the coast of Japan, Akita Offshore Wind Corporation required 33 monopiles to be upended on the deck of the offshore installation vessel so that they could be used for construction of Japan's first large scale commercial wind-farm project.

This was the first time SPMTs had been used for this type of operation in Japan, so strong engineering support from a global team experienced in offshore wind operations would be vital

to ensure a safe operation. In particular, close monitoring of tolerances was required throughout, to ensure the SPMTs were not subjected to high levels of torsional load during these highly precise maneuvers.

The operations took place about one kilometer offshore between Ports of Akita and Noshiro, Japan, with main marshalling station in Akita. The 33 monopiles needed to be upended one by one from their horizontal orientation on the deck of the installation vessel.

The monopiles were first loaded by a crane into a cradle and the upending frame, in horizontal orientation. Next, SPMTs connected to the upending frame and the crane hook to their other end. Then the SPMTs were driven forward as the crane hoisted up until

safe operational limits were reached.

As each monopile was larger than the deck of the vessel, there was a need for the upending operation to stop and have the crane rotate 180 degrees. To ensure a safe maneuver, it was necessary to minimize the risk of torsion.

The Mammoet engineer team used steering modes that are not in everyday use, allowing the trailers to be put into carousel mode; free-wheeling to follow the motion of the crane above, to which the monopile was still attached. This phase was executed safely and successfully.

During this phase, surveyors monitored the position of the crane hook to reduce the risk of the crane hook being out of level. Each time, the SPMT was driven forward while the crane was

hoisted up until each monopile was free from its upending bucket.

The operations were controlled in the final stages between crane and SPMT operators so that the monopile lifted out of the frame once it was almost vertical. Each monopile was then lowered via crane only into the water for sail-off to the installation site.

Mammoet's global network provided the client with expertise and equipment from Japan, the wider APAC region, as well as the United Kingdom. This allowed the customer to benefit from the expertise behind some of the world's most technically challenging offshore wind projects, but also a supplier that could mobilize resources locally.

The Akita Noshiro offshore wind-farm project is expected to provide more than 140 MW of energy a year. Its power will be supplied to approximately 130,000 homes, with commercial operation expected to start in 2022.

**MORE INFO** [www.mammoet.com](http://www.mammoet.com)

## CONSTRUCTION

### Kardie brings tallest aerial platforms to North America

Kardie Equipment, a TGM Wind Company and the largest distributor of the Bronto Skylift in North America, will increase its fleet by more than 65 percent with the purchase of additional aerial work platforms, including Bronto's new S341HLA, which reaches 104 meters (341 feet). This expansion makes Kardie Equipment the sole owner and distributor of the tallest aerial platforms in North America.

"The new aerial lifts will be used to serve customers across numerous industries including wind-turbine generation, transmission and distribution, petrochemical refining, aerospace, and more," said Kevin Darby, founder of Kardie Equipment/TGM Wind Ser-

VICES. "Increasing our inventory of aerial work platforms is critical to meet the rapidly growing demand of both new and existing customers."

The average hub height of wind turbines in North America is 295 feet and rising, because increased altitude means increased wind speed and more power generated. The Bronto S341HLA,

a truck-mounted 341-foot aerial work platform, is the ideal solution to the increasing height.

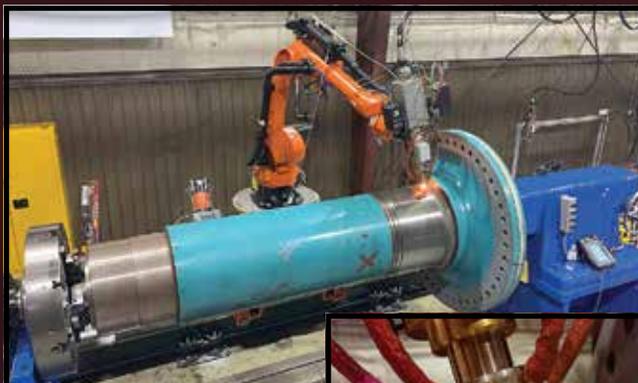
"It has been a privilege to be a part of Kardie Equipment/TGM Wind's growth as their exclusive supplier," said Roberto Quintero, sales and marketing director at Bronto Skylift. "Kevin's entrepreneurial spirit has



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Kardie Equipment is the sole owner and distributor of the tallest aerial platforms in North America. (Courtesy: Kardie Equipment)



Developers around the globe are using WindCube to reduce risk, improve bankability and decision-making, and make better investments. (Courtesy: Vaisala)

been the backbone of this rewarding journey, and together with his team, they have consistently exceeded expectations.”

The Bronto S341HLA features two telescopic booms, a 6-section main boom, a 3-section cage boom, and an extendable platform with 1,500-pounds safe working load. Mounted on a U.S.-sourced chassis, they can maneuver safely in worksites and regular road traffic. In addition to a maximum working height of 341 feet, the S341HLA’s horizontal outreach is 105 feet.

**MORE INFO** [www.kardieequipment.com](http://www.kardieequipment.com)

### INNOVATION

## WindCube Lidar suite maker Leosphere is now Vaisala

Leosphere, maker of the WindCube Lidar suite, is now Vaisala, as it completes integration with Vaisala, who purchased the company in 2018.

From Lidars, sensors, and systems to digital services and actionable intelligence, Vaisala’s enhanced range of comprehensive offerings for wind and solar energy applications provides industry-leading integration, scalabil-

ity, and data quality. The WindCube suite’s accurate and reliable intelligence arms decision-makers with the insights needed to innovate, evolve practices, improve accuracy and efficiency, and meet renewable energy challenges with confidence.

“Backed by its 85-plus-year proven track record and global leadership, Vaisala is a leading wind and solar technology partner, driving the successful evolution of renewable energy for a healthier, greener, and more innovative future,” the company said in a press release.

**MORE INFO:** [www.vaisala.com/en](http://www.vaisala.com/en)

### INNOVATION

## Perceptual Robotics launches autonomous drone

Perceptual Robotics will launch the DOT autonomous drone, designed to undertake in-depth turbine inspections and analyze the data collected. The company has had DOT in development since its inception. The new drone system has been designed to collect high-quality data from turbines in less than 20 minutes, while offering low operational costs for customers and minimal training for operators. Another key element is DOT’s safety features as the system has been designed to avoid potential collision with the turbine.

DOT is named after two prominent female engineers: USA’s Dorothy Vaughan, a mathematician and NASA’s first black manager, and Britain’s Dorothy Spicer, the first woman to gain an advanced qualification in aeronautical engineering. The exclusive software product, designed by Perceptual Robotics, allows drones to use laser and camera sensors to understand the environment the device is in, plan its trajectory and efficiently collect the data required from the turbines.

DOT’s design allows it to manage the drone’s cameras and automatically



The DOT drone inspection system will be ready for shipping to customers in May following its showcase at Wind Europe. (Courtesy: Perceptual Robotics)

control how it takes photographs. The software can be linked to a tablet device to set up a turbine inspection and receive data. The system reduces the need for skilled operators to undertake inspections, therefore lowering the chance for human error.

DOT was officially unveiled at the Wind Europe event April 5-7, 2022, in Bilbao, Spain. From its stand at 3-E28, Perceptual Robotics will host demonstrations of the DOT drone system and showcase the set-up process via a tablet. The drones will be put through complete simulated missions of turbine inspections, displaying the speed of data collection and the quality of gathered images.

“DOT represents the pinnacle of processing turbine inspection data, combining state-of-the-art data analysis with fast, high-quality imagery and a software system that totally manages the movements and activities of the drone device. We also wanted to make DOT simple and easy for our customers to use ‘off the shelf’, thereby removing dependence on the skills of the operator to determine the quality of the turbine inspection,” said Kostas Karachalios, Perceptual Robotics CEO.

**MORE INFO** [www.perceptual-robotics.com](http://www.perceptual-robotics.com)

► **INNOVATION**

## Wind turbine prototype reveals spiral airfoil

Golden Ratio Turbine Concepts (GRTC), a fluid flow spiral rotor inventor, recently revealed its advanced 3-D Spiral Wing Airfoil in its newest vertical axis wind turbine (VAWT) prototype. This is the latest version of VAWT devices in the company’s “Cyclonic” VAWT Group.

All GRTC turbines incorporate their patented extended spiral leverage arm feature that develops more rotor torque force in less space.

“The new spiral airfoil is a compound blend of transverse spiral line segments, which are intersected by vertical arc segments to form a partially closed area of space having a low cross section reflective convex outer surface that creates a lift force similar to an airplane wing,” said GRTC spokesman James Walker.

“These wings overlap each other in succession like the spiral bands of a cyclone and produce an overall turbine profile that facilitates smooth airflow pressure, resulting in a very quiet turbine.”

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Golden Ratio Turbine Concepts revealed its advanced 3-D Spiral Wing Airfoil in its newest vertical axis wind turbine. (Courtesy: Golden Ratio Turbine Concepts)

The company is focused on developing small on-site devices that use their increased torque to begin generating power in lower wind speeds without noisy blades, contending that their spiral design has more torque than a propeller blade radial design because the distance from the outer spiral tip to its inner linking point is longer than the distance of a radial blade tip to its inner linking point.

GRTC expects a time when increased global energy demands and decreased supplier reliability cause supply chain failure.

Oil independence and developing small on-site and clean-energy solutions are wise investments for a better future.

On-site hybrid wind and solar power is a logical choice for meeting increased electrical needs in homes, offices, schools, hospitals, stores, and factories. Quiet GRTC “Cyclonic” VAWTs can be a part of that energy solution.

#### MORE INFO

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

#### INNOVATION

## Electro Industries releases software update

Electro Industries/GaugeTech (EIG) recently released V.5.00.0110 of its CommunicatorPQA® power monitoring software. This release primarily supports the Nexus® 1450 Cyber Secure power quality meter’s version 4.1 firmware.

The meter’s firmware release adds IEC 61850 Ed. 3 protocol support and GOOSE messaging to the meter’s advanced capabilities. In addition to this important feature, the CommunicatorPQA® software release supports improved system stability and minor enhancements.

Electro Industries recommends that all CommunicatorPQA® 5.0 customers update to the latest version of the software to access the newest features.

**MORE INFO** [www.electroind.com](http://www.electroind.com)

#### MAINTENANCE

## Snap-On torque wrenches made for harsh environments

Snap-on Intrinsicly Safe ControlTech™ Torque Wrenches are engineered and tested for operation in Class 1 Division 2 hazardous environments (where flammable gases, vapors or liquids may potentially be present). Intrinsicly safe equipment is defined as “equipment and wiring which is incapable of releasing sufficient electrical or thermal energy under normal or abnormal conditions to cause ignition of a hazardous atmosphere mixture in its most easily ignited concentration.”

Snap-on’s Intrinsicly Safe ControlTech™ Torque Wrenches comply with key safety standards, including: IEC60079-0, IEC60079-11, UL121201, and CAN/CSA C22.2 No. 213-17, UL 508 (Part One), and CAS C22.2 No. 14-13. The wrenches’ battery packs meet UL 2504 standards.

Designed for repeated use, the wrenches are accurate to ±2% clockwise, ±3% counterclockwise, providing data on the exact torque applied – something mechanical wrenches cannot do.

The wrenches come with a selection of interchangeable ISO/IZO heads to handle a variety of torquing applications. The wrenches are also Bluetooth® compatible, enabling recording of torque and turn-angle data. Data transfers using Snap-on’s CONNECTORQ app increase quality and traceability.

Key performance features include:

- ▶ Torque and angle combo modes to achieve torque, plus angle, in a single motion.

- ▶ Calibration factor for extensions and adapters.

- ▶ Dual side LED indicator lights with configurable settings for operational guidance.

- ▶ Easy-to-read LCD screen, LED indicator lights; audible beep and han-

dle vibration work together to signal when torque is within the targeted range.

- ▣ On-board rechargeable NiMH battery and smart charging system via USB

- ▣ Ingress protected for water and dust rated to IP55.

- ▣ Meets or exceeds ISO 6789 standard.

- ▣ All-steel body designed for industrial use.

- ▣ Two-year wrench warranty; one-year battery warranty.

- ▣ Battery cap with integral drop-prevention attachment point.

- ▣ Angle range zero to 360°.

Three models of wrenches are available:

- ▣ ISO shank; 9 x 12 mm (CTECH-W1UA135); 60-1,195 torque range (in.-lbs.); 5-99.6 torque range (ft.-lbs.); 6.8-135 torque range (Nm).

- ▣ ISO shank; 14 x 18 mm (CTECH-W1UB400); 177-3,540 torque range (in.-lbs.); 14.9-295 torque range (ft.-lbs.); 20-400 torque range (Nm).

- ▣ Sealed fixed ratchet; 3/4" (CTECHW1UR650); 288-5,753 torque range (in.-lbs.); 24-479.4 torque range (ft.-lbs.); 32.5-650 (Nm).

MORE INFO [www.snap-on.com](http://www.snap-on.com)

## ▣ MAINTENANCE

### AMSOIL INC. renews APQP4Wind Certification

AMSOIL INC. has renewed its certification with APQP4Wind, a non-profit organization founded by the world's leading wind-turbine manufacturers and suppliers. Its mission is to standardize and simplify processes that ensure product quality across the wind industry. The organization facilitates and strengthens relationships between manufacturers and suppliers to increase efficiency.

"We're excited to continue our relationship with APQP4Wind," said Dave Meyer, vice president, AMSOIL Wind



Three models of ControlTech Torque Wrenches are available. (Courtesy: Snap-on Tools)

and Industrial Business. "Our certification demonstrates the quality of our products for wind assets. It offers additional assurance to our wind customers that they're getting the best possible lubricants for their equipment."

AMSOIL was the world's first lubricant supplier to earn APQP4Wind cer-

tification, in 2021. Today, it is one of two lubricant suppliers to have earned the designation.

When AMSOIL INC. entered the wind industry in 2005, wind-asset managers were struggling to find a wind-turbine gearbox lubricant capable of delivering superior protection

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





Nearly half the wind turbines in the U.S. use AMSOIL products. (Courtesy: AMSOIL)

without requiring frequent and expensive oil changes.

Many asset managers could expect a high percentage of their gearboxes to fail within the first 10 years of a 20-year design life, driving up operating costs. AMSOIL developed a synthetic gearbox lubricant that delivers protection and longer service life in the demanding conditions in which turbines operate. It has a proven record of more than 10 years of continuous run time with no additive top-offs.

**MORE INFO** [www.amsoilindustrial.com](http://www.amsoilindustrial.com)

## MANUFACTURING

### Siemens Gamesa opens France manufacturing facility

Siemens Gamesa has started manufacturing both its patented offshore Direct Drive wind-turbine nacelles and IntegralBlades at its new manufacturing facility in Le Havre, France. The world's first facility to encompass both offshore wind-turbine nacelles and blade manufacturing under one roof, it is the largest industrial renewable energy project in France.

A dedicated installation hub is also under finalization on the same plot, allowing direct load out of wind-turbine components to French offshore wind-power plants. Locally in Le Havre, the first 500 positions out of the 750



Siemens Gamesa has started manufacturing of both its patented offshore Direct Drive wind turbine nacelles and patented IntegralBlades at its new manufacturing facility in Le Havre, France. (Courtesy: VINCI Construction France)

total direct and indirect jobs to be created have been filled. The remaining 250 positions are expected to be filled by early 2023.

“Producing our first offshore wind-power components in Le Havre is electrifying,” said Marc Becker, CEO of the Siemens Gamesa Offshore Business Unit. “This investment serves as a major driver of the economic growth story in Normandy and in the French offshore wind industry. With the world’s first offshore nacelle and blade factory under one roof, we can unlock the power of wind for our customers and the people of France. We are energized to lead the way, especially coupled with solid orders and the government’s recent French Offshore Sector Deal.”

Siemens Gamesa and local partners UIMM Le Havre, AFPI, and AFPA have created a dedicated training center for new employees and the new offshore

wind specific competencies that are needed. This investment in people is the first training center in France solely dedicated to the production of wind turbine nacelles and blades.

“The first nacelles and blades headed for the Bay of Saint Brieuc and the Fecamp projects are tangible proof of the power of commitment to renewable energy in France,” said Filippo Cimitan, managing director of Siemens Gamesa France. “The French Offshore Sector Deal recently signed by the French government commits to 18 GW to be installed by 2035 and for awards growing from 2 GW per year from 2025 onwards. The growth path is crystal clear. We look very much forward to executing our strong French offshore order pipeline with components from the plant.”

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MANUFACTURING

## Vestas partners for turbine blades in Brazil

Vestas has strengthened the flexibility of its global manufacturing footprint with a supply agreement with LM Wind Power, a manufacturer of wind blades.

The multi-year agreement includes production of V150-4.2 MW turbine blades for primarily the Brazilian market with the flexibility to export if applicable.

LM Wind Power will supply the blades from its factory in Ipojuca, in the state of Pernambuco in Brazil.

With production scheduled to commence in the second half of 2022, the new production will add local jobs, spur direct and in-direct investments in the Brazilian supply chain, and ex-



Vestas and LM Wind Power's multi-year agreement includes production of V150-4.2 MW turbine blades for primarily the Brazilian market. (Courtesy: LM Wind Power)

pand Vestas' global manufacturing setup.

“This partnership is a good example of how we develop and expand the wind-energy supply chain to drive the needed scale of renewables by increasing the use of standardized components and shared manufacturing operations between OEMs, thereby adopting a similar approach to the

automotive industry,” said Tommy Rahbek Nielsen, executive vice president & chief operating officer of Vestas. “We have chosen to work with LM Wind Power because of their proven and extensive design and engineering capabilities as well as their proven global footprint.”

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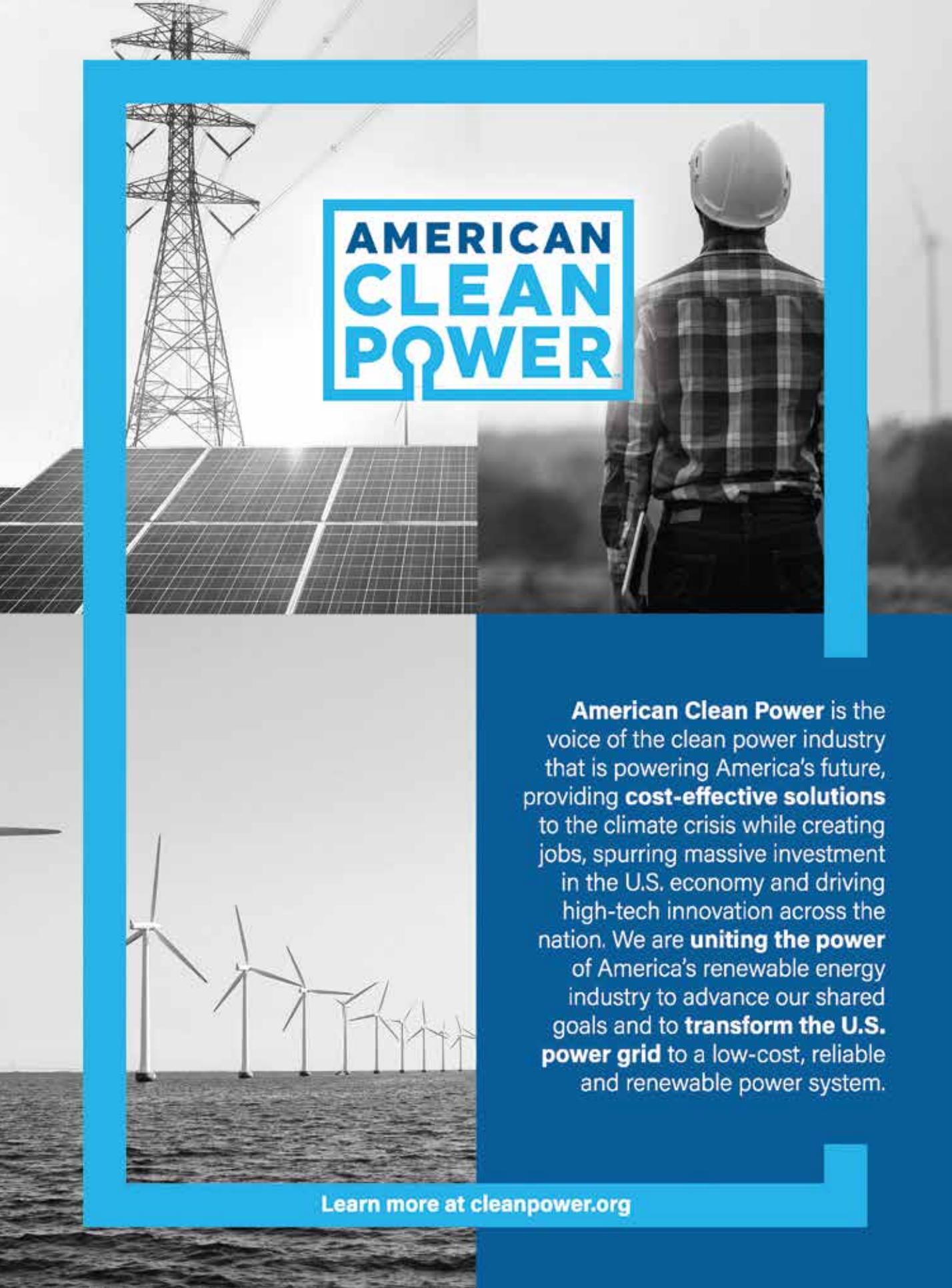
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THE FUTURE OF WIND

# TACKLING SOME OF WIND'S CONSTRUCTION CHALLENGES

Crosby's newly named acquisition, Crosby Airpes, began with onshore designs for lifting beams for the nacelles and later moved to yoke blade clamps for the installation of the blade, often considered the most complicated part of turbine installation. (Courtesy: Crosby)

*The wind sector is one of the world's most demanding industries, so in order to conquer some of the difficulties involved with manufacturing and installing towers, monopiles, and transition pieces, it will be necessary to standardize the methods in which common elements and specific equipment are handled.*

By **KENNETH CARTER** ▸ Wind Systems editor

**A**s offshore wind takes off in the U.S., it becomes even more vital that the infrastructure is in place to ensure wind farms are constructed as safely and as efficiently as possible.

The Crosby Group — with its recent acquisition, Airpes — is expanding its expertise and move into the wind-energy segment.

“The Crosby Group is a leading manufacturer of fittings for lifting, rigging, and securement,” said Crosby CEO Robert Desel. “Those are used across many, many, many, many industries, including wind. Basically, anything that’s getting lifted by a crane, there are Crosby fittings involved in that somewhere. It could be steel for a stadium, or it could be a nacelle for wind, or it could be a blade or something in offshore oil and gas.”

Having years of experience historically with oil and gas, both on land and offshore, The Crosby Group has the DNV certifications and many other credentials needed for offshore work, according to Desel.

“We’ve always had those products,” he said. “Obviously, as of late, more and more of those products are moving into the wind-energy segment, but many of the products that we make would work in any industry. Also, anything that a floating wind installation needs to be anchored or moored to the seabed, we make all of those mooring fittings to connect that to the seabed.”

## **SPECIALIZED EQUIPMENT**

With Airpes’ expertise being mostly focused on wind energy, its specialized equipment has been fitted to work with Crosby’s hardware to complete onshore and offshore installations.

Airpes has worked in the lifting market for about 20 years, according to Josep Compte Guillen, managing director and co-founder at newly acquired Crosby Airpes. The company began with onshore designs for lifting beams for the nacelles and later moved to yoke blade clamps for the installation of the blade, often considered the most complicated part of turbine installation.

That innovation is what has enabled Crosby to take its fitting equipment and marry it with Airpes’ ability to engineer specific tools for turbine parts.

“The very thing that happens is the OEMs ask us for a design,” Guillen said. “Usually, we get an RFQ for the solution they need, and we design from the beginning, and we offer our solution. If we want the project, we have to make the design from zero to manufacturing the first value prototype.”

## **ONSHORE VS. OFFSHORE**

Onshore projects all have similarities, and even though offshore projects aren’t as mature as their onshore counterparts, there are still certain absolutes to consider, according to Desel.

“You’ve got different sea conditions; you’ve got different vessel characteristics, so I think the offshore projects are a little bit different from one another,” he said. Airpes builds the lifting tools that are custom designed to the specification of the blade or the nacelle that a Siemens or a Vestas or a GE would make.”

Those lifting tools must take into account the integrity of the part being lifted, according to Desel.

“The blades, as you can imagine, are very fragile,” he said. “The way you pick up and move those needs to be tailored to the shape and dimensions and the weight and center of gravity of that blade. What Airpes does is they’ll work

with Siemens Gamesa, for example, to build a lifting tool for a specific series of blades, and that lifting tool could be used over and over and over again. They offer service, repair, maintenance, and retrofit to ensure that lifting tool can have a very long life, but it would be a different tool for a GE blade or a different tool for a Vestas blade, because of the characteristics of those blades. The process onshore is fairly similar. The tools would be different based on the geometry of the blades and the manufacture of the blades.”

## **UNIQUE CHARACTERISTICS**

Even though many projects may have similarities, each wind-farm project has its own unique characteristics based

▾ **For the U.S. market — and this is kind of a broad commentary — we have a lot of work to do to build the infrastructure and the capabilities around vessels and constructing vessels and ports to support the kind of vibrant offshore wind industry that you see in Northern Europe.** ▸

on the depth of the water, according to Desel.

“Are they using jack-up vessels? Is it floating or is it non-floating? What is the size of the turbines?” he said. “One common thing that we see in offshore vs. onshore is one, you have less time. Because of the cost of the vessels and the infrastructure, you have to put these up very quickly. Two, you have less space. You’re basically working on a vessel. Even though you have the vast ocean out there, there’s no stable operating platform. Whereas on land, you can stage stuff all over the land. The speed and the space are the things that are very different with offshore vs. onshore.”

Guillen agreed with the different complexities of offshore vs. onshore.

“For offshore, some manufacturers are installing and switching some turbines in less than 20 hours,” he said. “This is an amazing job. It’s very safe; it’s quick. It’s very exciting to get a project for offshore. And under the Crosby name and Crosby experience, we are going to be able to get more projects in this market than we did before.”

### PUSHING FOR U.S. ADVANCEMENT

Admittedly, offshore wind is a much more vibrant market in Europe, which means that a lot of the expertise needed for offshore development in the U.S. will naturally start in Europe.

“The big players in marine installation, many of them

are European,” Desel said. “For the U.S. market — and this is kind of a broad commentary — we have a lot of work to do to build the infrastructure and the capabilities around vessels and constructing vessels and ports to support the kind of vibrant offshore wind industry that you see in Northern Europe in particular. And listen, I have no issue with that expertise coming from Europe, but I do think we have an opportunity to build expertise here. It is a lot of European companies assisting the U.S. power or project teams in doing the installation. I think we’re going to have to build that capability here. Crosby’s committed to doing its part for our little piece of that value chain to build more capability on the ground in the U.S. with U.S.-made products and U.S.-supported products to support the wind industry generally, but obviously offshore is where there’s quite a bit of growth opportunity.”

And that growth opportunity will more than likely make way for a lot of potential when it comes to the U.S. industrial market in general, according to Desel.

“I think it’s going to bring some much-needed investment to ports and to vessel construction and to a whole host of areas,” he said. “We’re committed to doing our part. Our forging plant, which is, I think, probably the largest lifting hardware forging plant in the world, is in Longview, Texas. We sell our products through local distribution. Many of those companies are small, family-owned businesses. As off-

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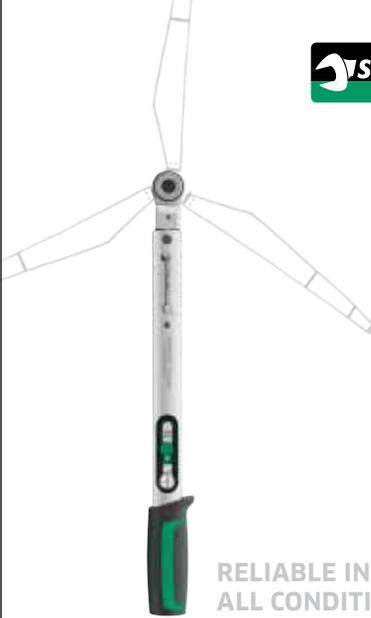
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With Airpes' expertise being mostly focused on wind energy, its specialized equipment has been fitted to work with Crosby's hardware to complete onshore and offshore installations. (Courtesy: Crosby)

shore wind starts to develop in different parts of the country, that plant in Texas is going to be there as support. Then, just as importantly, our local family-owned distributors are going to be participating in that value chain as well, since they're very close to the point-of-delivery of the product."

### FUTURE TURBINE CONSTRUCTION

The fact that Crosby's products are so adaptable to wind-specific jobs will certainly help expedite future turbine construction, according to Desel.

"We try to make our product very, very, very ubiquitous," he said. "Now, there are some things that are very tailored, like the product that (Airpes) makes is extremely tailored because of the bespoke nature of the blades. Everything else around that connects to the crane – could be a shackle, could be our camera systems that we mount on one of Airpes' products, could be our load cells to help understand how much weight and whether it's getting out of balance. Those could be used across multiple, multiple industries. Obviously with our history in offshore, all of our product is offshore ready and certified. That makes it more usable. Then when it comes to floating, our mooring products historically came out of the oil and gas industry where you have big oil rigs that need to be moored, and they need to be secured, and we make the connections. We are actively in the process of repurposing those to work on floating offshore wind."

Basically, some elements are ready to go, while others will require some adjustment, according to Desel.

"(At that point), you have the very, very highly-engineered, custom solutions that Guillen and his team in Barcelona design and manufacture, which are unique to a Siemens

Gamesa blade or unique to a Vestas nacelle or whatever the case may be," he said.

### STANDARDIZING EQUIPMENT

Part of what will help advance the offshore wind industry will be the eventual standardization of equipment, similar to what has occurred within the offshore oil and gas industry, according to Desel.

"If you look at oil and gas, there's a very mature supply chain that supports that," he said. "There are three or four different drilling models that you can use. There are some standard approaches to the market, and then people can scale up around those standards. We make a product that originally was built for a mobile offshore drilling unit that can be used in any mobile offshore drilling unit anywhere in the world. Doesn't matter who made it or where it's operating. In floating offshore wind, we don't have that standardization yet. I mean, every day, I feel like I see another concept on floating turbines in the news."

The solution, Desel said, is to pare all these designs down to a few scalable, viable solutions that the industry can support, because if every floating offshore farm is of a completely different design, it's going to be inefficient to scale and support.

"Just like when Guillen does a blade clamp that's designed to lift that certain blade type hundreds of times, they don't change the blade design on every single wind turbine," he said. "No one would be able to do that. I think we need more standardization and more scale. Then, I think we've got to build out some of this infrastructure and be a little bit more locally self-sufficient in some areas. And as I said, The Crosby Group is committed to doing its part." ✎



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