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## FROM THE EDITOR

## Offshore development in the U.S. continues to grow

eems like every day, there's another announcement about developments in U.S. offshore wind.

Most recently, the Department of the Interior announced the approval of the Revolution Wind offshore wind project in New England.

According to the American Clean Power Association, New England is a wind-resource rich area that must be used if the U.S. hopes to achieve its ambitious clean energy and economic goals.



This project is a great example of multiple federal and state agencies coming together in a collaborative fashion to solve permitting challenges in an efficient and timely manner, and can serve as a model for future projects in the pipeline, ACP continued. Predictable permitting for offshore wind projects off the coast of New England is needed to ensure the region continues serving as a leader in offshore wind development.

The project is expected to provide carbon-free power to more than 350,000 homes in Connecticut and Rhode Island while creating more than 1,200 jobs during construction.

Offshore wind is especially important for readers interested in what our September issue has to offer. And we have included many interesting articles to prep you for ACP's Offshore WINDPOWER Conference & Exhibition in Boston, Massachusetts, October 3-4.

A lot of September's content takes a look at several aspects of the burgeoning offshore wind sector in the U.S., including supply chain challenges and the development of offshore wind in the Gulf of Mexico.

Especially of interest in the U.S. offshore sector is our Conversation feature. Chartwell Marine Managing Director Andy Page discusses his company's soonto-be-a-reality CTV vessel that is specifically designed and built in the U.S. for the exciting challenges to be tackled in developing U.S. offshore wind farms.

In addition to our offshore articles, this month's issue also preps you for Canada's tradeshow as well. Electricity Transformation Canada is CanREA's annual conference in Calgary October 23-25.

To get you in the mood for that show, I talked with CanREA President Vittoria Bellissimo on the state of Canadian wind and other renewables and what challenges Canada will continue to tackle in order to meet some ambitious net-zero goals.

Enjoy those articles and much more, and, as always, thanks for reading!

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## FYI

## Oregon inches closer to offshore wind development

### From American Clean Power

The American Clean Power Association recently released a statement from Josh Kaplowitz, vice president of Offshore Wind, on the release of two draft Wind Energy Areas (WEA) off Oregon's South Coast by the Bureau of Oceanic Energy Management (BOEM).

"This is a monumental step for the state of Oregon in charting its clean energy future," Kaplowitz said. "The release of these draft WEAs for Oregon's south coast is a step closer to establishing a sustainable offshore wind sector in Oregon and on the West Coast and is important in meeting Oregon's goal of developing 3 GW of offshore wind by 2030. We applaud BOEM for its continued dedication to studying these areas and working closely with stakeholders, Tribes, and the state of Oregon to find the best locations to lease for floating offshore wind development."

The draft WEAs cover approximately 219,568 acres offshore southern Oregon with their closest points ranging from approximately 18-32 miles off the coast.

"With these ambitious goals and the urgent need to cut our carbon emissions, it is critical that BOEM optimize the amount of these areas available for lease," Kaplowitz said. "This will help our industry develop a West Coast supply chain to revitalize the maritime sector and create good-paying clean-energy jobs while delivering significant economic, environmental, and health benefits to millions of Americans."

Due to the deep waters off of Oregon's coast, these areas are also an opportunity to accelerate U.S. leadership in floating technologies. The draft WEAs announced would tap up to 2.6 GW of Oregon's potential.

"ACP looks forward to working with BOEM to ensure the final WEAs for Oregon's South Coast allow Oregonians to fully benefit from offshore wind development," Kaplowitz said.



American Clean Power is the voice of companies from across the cleanpower sector that are powering America's future. For more information, go to www.cleanpower.org





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INDUSTRIAL SOLUTIONS

## DIRECTION

THE FUTURE OF WIND

## ALLETE Clean Energy enters new segment after Seattle agreement

ALLETE Clean Energy has entered a new customer segment after signing a five-year power purchase agreement (PPA) to sell wind power to Seattle City Light, the company's first municipal customer.

Seattle City Light, among the top-10 largest municipal utilities in the nation with more than 493,000 customers in Seattle, will purchase power from ALLETE Clean Energy's 50-MW Condon wind site in northern Oregon. The PPA also includes an agreement to jointly explore adding solar energy and/or energy storage capacity at the Condon site.

"We're excited to provide affordable, renewable wind energy to Seattle City Light from our Condon wind site and proud to help Seattle City Light meet their sustainability goals as we advance the clean-energy future," said ALLETE Clean Energy President Nicole Johnson. "This agreement also furthers our strategy of leveraging our existing wind sites with potential for complementary renewable additions and gaining new contracts."

ALLETE Clean Energy completed a refurbishment project at the Condon wind site in 2019 to extend its operating life and requalify the site for federal production tax credits. The project included equipment and system upgrades necessary to maintain its high operating availability and clean-energy production performance.

"Seattle City Light prioritizes creating our energy future on behalf of and in partnership with our customers and the communities we serve," said Emeka Anyanwu, Energy Innovation & Resources Officer. "To meet reliability, affordability, and environmental responsiveness goals, we strive to leverage resources like the Condon project to expand our supply mix with renewable energy resources supporting our efforts to enable decarbonization through electrification of transportation, buildings, and industry. In doing so, we will help communities to shift further away from fossil fuels, meeting the climate crisis head-on."

ALLETE Clean Energy also serves five Fortune 500 companies from its Diamond Spring and Caddo wind sites in Oklahoma and a number of large electric utilities from its other wind sites.

ALLETE Clean Energy owns, operates, and has delivered build-transfer projects totaling more than 1,500 MW of nameplate wind capacity across eight states. The company is well-positioned to drive additional clean-energy sector growth.

MORE INFO alletecleanenergy.com

## BOEM announces three final wind-energy areas

As part of the Biden-Harris administration's goal of deploying 30 GW of offshore wind energy capacity by 2030, the Bureau of Ocean Energy Management (BOEM) recently announced three final wind energy areas (WEAs) offshore Delaware, Maryland, and Virginia, which were developed following extensive engagement and feedback from states, Tribes, local residents, ocean users, federal government partners, and other members of the public. If fully developed, the final WEAs could support between 4 and 8 GW of energy production.

The three WEAs total about 356,550 acres. The first WEA (A-2) is 101,767 acres and 26 nautical miles from Delaware Bay. The second WEA (B-1) is 78,285 acres and about 23.5 nautical miles offshore Ocean City, Maryland. The third WEA (C-1) is 176,506 acres and about 35 nautical miles from the mouth of the Chesapeake Bay, offshore Virginia. A map of the final WEAs can be found on BOEM's website.

"BOEM values a robust and transparent offshore wind planning process, which requires early and frequent engagement with Tribal governments, the Department of Defense, NASA,



The three WEAs total about 356,550 acres. (Courtesy: BOEM)

## DIRECTION



EverWind Fuels, a Canadian large-scale green hydrogen project, announced the purchase of three wind farm development projects. (Courtesy: EverWind Fuels)

other government agencies, and ocean users," said BOEM Director Liz Klein. "We will continue to work closely with them, and all interested stakeholders, as we move forward with our environmental review."

BOEM partnered with the National Oceanic and Atmospheric Administration's National Centers for Coastal Ocean Science (NCCOS) to develop a comprehensive, ecosystem-based ocean planning model that assisted in the selection of the final WEAs.

This model leveraged best available data on natural resources, ocean industries such as fisheries and energy production, and areas of national security activities to identify areas with high wind-energy resource potential while reducing potential impacts to other ocean users and sensitive environmental resources.

This comprehensive approach not only provided valuable insights about

the seascape and uses of the ocean region, but also facilitated greater transparency and positive coordination with government partners and ocean stakeholders through direct engagement and incorporation of their feedback into the NCCOS model.

The final WEAs are in comparatively shallow water. BOEM may identify additional WEAs in deepwater areas offshore the U.S. Central Atlantic coast for future leasing once further study of those areas has been done.

**MORE INFO** www.boem.gov/renewable-energy/state-activities/central-atlantic

## Wind capacity grows in Texas, Wyoming, and Iowa

Nationwide wind power capacity is projected to grow exponentially in the

coming years, with Texas, Wyoming, and Iowa leading the charge.

As renewable energy continues to command center-stage attention and massive financial investment, wind power has proven to be an indispensable tool in the clean energy toolbox.

With this in mind, Texas Real Estate Source, a Texas real estate, travel, and lifestyle website, analyzed installed and projected wind power capacity data in all 50 states and ranked them by total projected capacity, capacity per capita, and capacity per square mile. The study found that Texas, Wyoming, and Iowa lead the country in wind-power capacity.

Texas is the top wind-powered state in the country with 44,974 MW of projected wind-power capacity. This is more than triple the capacity of second place, Oklahoma, however, due to the large and ever-growing population.

Wyoming leads the nation in wind-power capacity per capita with 6,679 MW projected to serve a population of 581,381. Wyoming's 6,679 MW ranks sixth in total projected capacity, but as the least-populated state in the nation, it vaults to No. 1 in projected wind-power capacity per capita at 0.011 MW.

Iowa has the most wind-power capacity per square mile. Iowa has a projected 13,444 MW of wind power across only 56,273 square miles of land, or 0.24 MW per square mile. To compare, Texas is third in the country, with 44,974 MW across a vast 268,596 square miles of land.

"It's no surprise to see Texas significantly outpacing the nation in installed and projected wind power capacity," a spokesperson from Texas Real Estate Source said. "The combination of boundless land, favorable wind patterns, and highly-respected research institutions has made it the perfect place for wind-power adoption. It's revealing, however, to see the per capita and per square mile rankings. They give us a more complete picture of which states are at the forefront of wind power development."

MORE INFO www.texasrealestatesource.com

## EverWind Fuels buys three wind projects

EverWind Fuels, a Canadian largescale green hydrogen project, recently announced the purchase of three wind-farm development projects: Windy Ridge, and in partnership with Membertou, Bear Lake, and Kmtnuk, together representing about 530 MW. The wind farms will represent a private investment in new, clean, renewable energy generation in Nova Scotia to power Phase 1 of EverWind's green hydrogen and ammonia project.

Highlights of the development include \$1 billion in private investment to deliver additional renewable energy to Nova Scotia; about 650 construction jobs and 30 full-time jobs; support for Nova Scotia's 80 perent renewables by 2030 standard; new generating capacity, and development of EverWind's green hydrogen and ammonia production facility.

"The global fight against climate change requires us to work together to get long-term investments in clean, renewable energy over the finish line," said Trent Vichie, CEO of EverWind. "This investment helps Nova Scotia move more quickly and cost-effectively toward its clean-energy transition. The power generated at these three new developments will also ensure Ever-Wind's green hydrogen and ammonia will meet the strictest international standards for green fuels, including European RFNBO criteria. It is a win for our project, a win for the province and, ultimately, a win for the planet."

"Membertou is proud to partner with EverWind Fuels in the Bear Lake and Kmtnuk wind-farm developments," said Chief Terry Paul, Chief & CEO of Membertou. "As majority owner, Membertou will inform the development process, and along with our partners, we will work to progress the transition to green energy in Nova Scotia and the world. This development will provide a necessary source of energy, and will create economic benefits for the people of Membertou." The wind farms will be developed and built in partnership with Renewable Energy Systems Ltd., which has been working with municipalities, corporations, First Nations, and government authorities in Canada since 2003, including extensive work in Nova Scotia.

"RES is excited to partner with EverWind to deliver these farm developments," said Peter Clibbon, Senior VP of Development for RES in Canada. "RES brings significant experience in wind-farm development, particularly in Nova Scotia. We are pleased with the advanced state of development for the wind farms and are excited to take these developments through to commercial operations.

Both wind projects are well advanced through the Nova Scotia Power interconnection process and are currently undergoing environmental assessment field investigations to allow for the commencement of a full EA process in fall of 2023." The three new wind projects will increase the total amount of wind-generated electricity on Nova Scotia Power's grid and bring Nova Scotia Power closer to meeting the provincial mandate of 80 percent renewable energy sales by 2030.

Any green power in excess of Ever-Wind's requirements can be made available to Nova Scotia Power for consumption by customers and provide benefits in terms of cost provided by the recently passed Canadian Government Investment Tax Credit for renewable generation.All power for EverWind's Phase 1 of production will be supplied from newly built renewable energy sources.

"Every wind project we consider building is conditional on ensuring that we do not remove a single watt slated for domestic residential, commercial, or industrial usage from Nova Scotia's grid," Vichie said.  $\checkmark$ 

MORE INFO everwindfuels.com

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## IN FOCUS

CANADA 🚩 OFFSHORE

## TAKING ADVANTAGE OF RENEWABLE ENERGY POTENTIAL

A wind farm west of Pincher Creek2. (Courtesy: CanREA/Jaq Murillo) In Canada, renewable energy is growing quickly – twice as fast in 2022 as it did the previous year – but it has the potential for so much more, as Canada accelerates its progress on the pathway to net-zero.

By KENNETH CARTER 💌 Wind Systems editor

head of Electricity Transformation Canada, the country's largest renewable energy and storage conference, *Wind Systems* sat down with the Canadian Renewable Energy Association's President and CEO Vittoria Bellissimo to discuss the potential of renewable energy across Canada today. Canada continues to make major inroads into moving the country to a net-zero carbon future.

For proof, look no further than what Canada has accomplished in 2022, with 1.8 GW of wind and solar power added to the grid by the end of last year.

"For renewables in general, last year was a big success story," Bellissimo said.

"The total growth in capacity was we got to 1.8 GW of new installed capacity in 2022, which is a significant increase from the previous year where it had been 1 GW. And an interesting part of that is that 98 percent of the growth was in Western Canada, with 75 percent of the growth in Alberta alone."

That 98 percent in Western Canada included 1,391 MW in Alberta and 387 MW in Saskatchewan. In Eastern Canada, Quebec added 24 MW of total growth, while 10 MW was added in Ontario, and 2 MW in Nova Scotia.

#### DIFFERENT JURISDICTIONS

Canada has added an impressive amount of clean energy to its grid this year. However, that progress is not without its challenges, especially in certain jurisdictions, Bellissi-





Canada's wind and solar capacity grew almost twice as fast in 2022 compared to the year before. (Courtesy: Siemens Gamesa)

mo said. "Take Quebec for example," she said. "Quebec is a legacy hydro system. They have a very clean electricity grid, but they recognize that there is going to be a lot of electrification, and they will need to add generation to their mix. They're looking to add 100 TW/h of additional energy to their system, and they're looking to buy wind, so they'll be buying a gigawatt a year for 10 years. That's a big undertaking, and CanREA is going to be there to support them in that challenge."

Ontario is also facing growing energy demands, according to Bellissimo. "Ontario has been buying up capacity, but it is going to need more energy," she said. "So, as we move forward into the fall and into the winter, we expect to see consultations on another large-scale RFP, but for energy instead of capacity." In Manitoba, a nearly 100 percent clean hydro and wind jurisdiction, Bellissimo said the province is looking to meet the shift to electrification, and it is planning to buy renewables.

"Moving further west, Saskatchewan is doing two things: They're buying renewables through an RFP process, and they're also introducing a renewable access service, which will allow customers to buy their own," she said. "It is a very The draft Clean Energy Regulations were designed to achieve a net-zero electricity grid by 2035, in close collaboration with provinces, territories, Indigenous partners, industry, and otherst.

unique situation from province to province and from territory to territory."

#### SHORT OF GOALS

Canada's wind and solar capacity grew almost twice as fast in 2022 compared to the year before, but it still isn't meeting the growth rate expressed in CanREA's report, "Powering Canada's Journey to Net-Zero: CanREA's 2050 Vision." That report states Canada must deploy more than 5 GW of new



Wind energy grew by 7.1 percent (1 GW) in 2022 to a new total of more than 15 GW of installed capacity. (Courtesy: Siemens Gamesa)

wind and solar every year to meet net-zero GHG emissions by 2050. Despite those ambitious goals, the progress made to date is still a good sign Canada is taking climate change seriously, with more significant growth in wind and solar deployment expected.

In fact, CanREA's data team is tracking more than 2 GW of projects under construction across Canada, plus another 6 GW of projects in advanced stages of development. That amounts to a total forecast of more than 5 GW of wind, 2 GW of major solar, and 1 GW of energy storage expected in the next few years. At the same time, CanREA is working with federal and provincial governments to unlock many more gigawatts of additional opportunities.

"We are working hard to make sure that wind, solar, and energy storage advance across the country," Bellissimo said. "Each province has its own unique electricity policy. CanREA is working hard to ensure all provinces receive individualized treatment, while opening up access to the most affordable new resources.

"Electricity policy is largely under provincial jurisdiction, but the federal government also has a hand in it — for example, our national carbon policy," she said.

"This is why CanREA has policy experts working with governments at the provincial and federal levels to drive change."

#### DRAFT CLEAN ENERGY REGULATIONS

Bellissimo spoke at the launch of Canada's draft Clean Energy Regulations, unveiled by Minister of Environment and Climate Change Steven Guilbeault on August 10 in Toronto.

## CANADA

"Canada has committed to a net-zero electricity grid in 2035," she said. "There are some allowances in the draft regulations to run fossil generation in certain instances, and that includes small and remote communities with a small generation of less than 25 MW those are instances where most of the generation is used on site.

"There are a few other instances, but, for the most part, the draft regulations are a signal to the market that we need to build a clean electricity grid, and we need to do that right now."

Wind, solar, and energy storage are affordable solutions that can be rapidly deployed to meet clean-electricity goals, according to Bellissimo.

"Customers need to integrate as much as they can," she said. "We've got these affordable, variable resources, and the grids should be looking to integrate them. CanREA understands concerns around growing electricity costs. We advocate for wind, solar, and energy storage because we share these concerns. In fact, the study that accompanied the draft Clean Energy Regulations shows the federal government believes we can get to a net-zero grid in a very affordable way."

The draft Clean Energy Regulations were designed to achieve a net-zero electricity grid by 2035, in close collaboration with provinces, territories, Indigenous partners, industry, and others.

#### PACE AND SCALE RECOGNIZED

In its August study, the Canadian government recognized the pace and scale required to transform the country's electricity sector, as well as the economic and job-creating opportunities that will accompany this shift.

Canada's electricity grid is one of the cleanest in the world, according to the Honorable Steven Guilbeault, Minister of Environment and Climate Change, who announced the study. More than 84 percent of Canada's electricity is generated from non-emitting sources, such as hydro, nuclear, wind, and solar. The draft regulations are designed to decarbonize the rest of the grid, while meeting the growing demand for power. If successful, more than 340 metric megatons of greenhouse gas pollution will be cut between 2024 and 2050, the federal government release said.

According to the study, new rules for cleaner power, similar to what the U.S. and G7 partners are doing, will stimulate investments in renewables, as well as in energy-storage

## CURRENT STATE OF THE INDUSTRY — GROWTH AND FORECASTS



Overall, the wind, solar and energy storage sector grew by 10.5 percent in 2022.

As of December 31, 2022, Canada had an installed capacity of more than 19 GW of utility-scale wind and solar energy.

Canada added more than 1.8 GW of new generation capacity in 2022, significantly larger than in 2021 (1 GW).

CanREA is forecasting the addition of more than 5 GW of wind, 2 GW of major solar, and 1 GW of energy storage capacity in the short term (2023-2025).

CanREA is working hard to unlock massive opportunities for renewable energy in the coming years.

systems and other new technologies, such as small modular reactors and carbon capture and storage. "Renewables really are the most affordable type of new generation," Bellissimo said. "We now live in a world of abundant and affordable variable resources, and the new challenge is how to integrate more of them into our electricity systems.

Some of the things that we're working on at CanREA include integrating energy storage into our systems. We represent wind, solar, and storage across the country, and the more energy storage we can get on the system, the more variable resources we can integrate." Ontario is a great example of an energy storage success story, according to Bellissimo. "Ontario ran a large procurement for storage — the biggest energy storage procurement in North America; they've procured over 700 MW to date, and they're looking to get to 2,500 MW," she said. "I think other jurisdictions across the country can learn from their success."

#### OTHER BENEFITS

Canada is seeing other benefits to renewable integration as



CanREA's data team is tracking more than 2 GW of projects under construction across Canada, plus another 6 GW of projects in advanced stages of development. (Courtesy: CanREA)

well, according to the draft study. Earlier this year, Volkswagen committed to building one of the largest battery factories in the world in Southern Ontario, due to Canada's ability to supply clean and affordable electricity. The plant is expected to create 3,000 direct jobs.

More than \$40 billion in new tax credits and other major federal investments are expected to help drive economic opportunities through the construction of new power sources and retrofitting of existing plants, according to the study.

The Canadian government is working with provinces and territories to roll out this funding in a way that supports affordable clean electricity across the country. If provinces and territories take full advantage of these tools, federal funding is expected to offset more than half the cost of the new investments needed under the draft regulations.

The draft regulations also maintain the need for household affordability, with Canadians expected to save on energy costs when they switch from oil and gas to renewables.

As Canadians use more clean electricity, they are expected to spend about 12 percent less on energy by 2050, according to the study. The government is also helping households reduce their bills with home retrofit programs, zero-emission vehicle purchase incentives, and more. "As a pan-Canadian member association, CanREA is happy to see that these regulations are drafted in such a way as to set the destination, which is net-zero, but to let provinces and companies pick their path to get there," Bellissimo said. "The approach can be very different in different jurisdictions. "We are experiencing challenges in some provinces, such

as Alberta's unexpected moratorium on project approvals,

## WIND GROWTH IN 2022

Renewable energy growth to 2022 & forecast to 2024



Wind energy grew by 7.1 percent (1 GW) in 2022 to a new total of more than 15 GW of installed capacity.

Western Canada blew ahead of the pack in 2022, thanks to significant growth in Alberta (nearly 605 MW) and Saskatchewan (377 MW), as well as some (24 MW) new wind in Quebec.

This year's growth was not on par with CanREA's 2050 Vision, which calls for the addition of 3.8 GW of wind annually.

Across Canada: As of December 31, 2022, Ontario had more than 5.5 GW in total installed wind capacity, powering nearly 1.5 million homes. Quebec had nearly 4 GW. Alberta had a new total of 2.6 GW, Saskatchewan had 804 MW of installed wind capacity, and Nova Scotia had 616. announced in August. However, we're seeing forward momentum in many jurisdictions. British Columbia is looking to buy renewables, so that's a favorable environment for our members. Quebec, Manitoba, and even Ontario are looking to buy renewables. Nova Scotia is seeking renewables as well, and also has a Green Choice Program."

Nova Scotia's Green Choice Program is a variant of the corporate renewal PPA, according to Bellissimo, which allows large electricity customers to purchase clean electricity from new, renewable energy projects through an independent and competitive process.

"There's a real interest all around the planet for customers, companies, individuals, everyone, to buy green energy directly," she said. "I think some jurisdictions have recognized that this means they need to open up their system to enable it to happen, and Nova Scotia is on it. Saskatchewan is working toward it. Ontario is going to talk about it soon. Alberta has enabled it. I think it will grow."

#### **BEYOND CANADA**

As Canada's renewable infrastructure continues to grow, it is important to realize that the need for renewables doesn't stop at the Canadian border. It is necessary that Canada works with its neighbor, the U.S., to tackle climate change on the global stage. So, is Canada looking to collaborate with the U.S. in order to get more renewables on the grid?

"That's a good question, and I think it's a bigger question than just getting renewables on the grid," Bellissimo said. "I think it's more of a value-chain discussion. In April, I participated in a Canada-U.S. summit, and one of the big things that we talked about there was critical minerals, and how we can integrate the supply chains for critical minerals and take advantage of all the cross-border trade that we already do between Canada and the States. That's a big area for collaboration. CanREA has been watching the States carefully with the introduction of the Inflation Reduction Act. We are hoping that Canada can play a larger role in integrated supply chains for all the critical minerals that we'll need to develop our clean-energy future."  $\prec$ 

#### EDITOR'S NOTE

This year, Electricity Transformation Canada conference and exhibition is moving to Calgary, October 23-25, 2023. As the largest renewable energy and energy storage event in Canada, it is expected to attract key stakeholders looking to advance the global electricity transformation. Participants will include utilities, system operators, governments, end-use sectors undergoing electrification, and a variety of energy professionals. For more information, go to electricitytransformation.ca.



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OFFSHORE

## EXPLORING WIND POTENTIAL IN THE GULF OF MEXICO

Edison Chouest celebrates reaching the 50-percent completion milestone of the ECO Edison earlier this year. (Courtesy: Edison Chouest Offshore) Despite challenges, wind energy in the Gulf of Mexico could be the beginnings of major offshore development in the region and beyond.

**By JOHN BEGALA** 

he August 29 federal auction of Wind Energy Areas (WEAs) in the Gulf of Mexico marked the first major opportunity for offshore wind developers to plant their flag in this high-potential region.

The three lease areas totaled roughly 301,746 developable acres, enough to support 3.7 GW of offshore wind generation, an amount that would deliver reliable clean energy to the region's overburdened grid, not to mention bring new jobs and economic activity to the Gulf and invigorate decarbonization efforts.

However, the full potential of the Gulf goes beyond the positive outcomes listed above. Investing in renewable energy in this region — the heart of the country's oil and gas industry — is the spark that can ignite a wave of offshore wind industry innovation.

### SUPPLY CHAIN STRENGTHS

Gulf companies have long been recognized for their ability to develop and adapt to new technologies through the booms and busts of the offshore oil sector. And already, many of those companies are turning their attention to the offshore wind industry as they recognize the value of their expertise in this new arena. According to Network research, 23 percent of offshore wind contracts in the U.S. market are already going to Gulf firms, and more than \$1 billion in investments are flowing to Gulf shipyards or fabrication yards.

Take the ECO Edison for example, the first American-built Service Operation Vessel for offshore wind, which is under construction by Edison Chouest in Houma, Louisiana, but will later be based out of New York. In Texas, the first U.S.-made offshore substation was built by Kiewit Offshore Services near Corpus Christi, Texas, and, this summer, was transported and installed in New York's South Fork Wind project, one of the first utility-scale farms to get underway in U.S. waters. Still to come, the first U.S. Wind Turbine Installation Vessel, one of the rarest vessels worldwide, is also underway at the Keppel AmFELS shipyard in Brownsville, Texas.

Notably, the Gulf is already home to a significant portion of the country's overall vessel construction and maintenance operations. In the future, the region could also become a testing site for alternative fuels and other decarbonization work, including using renewable sources to power oil and gas rigs.

### **OVERCOMING CHALLENGES**

Of course, challenges to developing offshore wind in the Gulf do exist. Developers will have to contend with both lower-than-average wind speed environments and hurricane-force winds, and any new projects must work around existing offshore infrastructure in the region. Finally, a clear path for offtake and grid connection in Louisiana and Texas must be established before any projects are able to get underway.

Despite such barriers, interest from developers and OEMs in the Gulf was apparent even before the August auction. The Final Sale Notice from the Bureau of Ocean Energy Man-



The first American-made offshore wind substation at ProvPort in Providence, Rhode Island readying for installation. (Courtesy: South Fork Wind)

### **IN FOCUS**



A closeup of the ECO Edison — the first American-built Service Operation Vessel for offshore wind — under construction in Houma, Louisiana, earlier this summer. (Courtesy: Business Network for Offshore Wind)

agement identified 14 potential bidders that qualified to participate, less than other recent auctions, but still a significant amount of interest given the region's challenges.

As Power Advisory President John Dalton shared in an August LinkedIn post prior to the auction, "clearly the GOM isn't for everyone."

"Success in the GOM auction is likely to be determined by those that can unlock value in an uncertain market, have a natural hedge, or are able to be patient as market opportunities develop," he predicted.

#### WEA OPTIONS

With the first lease sale complete, attention is now being paid to the other WEA options that were not included in the initial round. By identifying future sites in advance, BOEM has created the opportunity for a more regular, annual cadence of offshore wind leasing in the Gulf. Such an approach would generate greater confidence within the supply chain that there are more opportunities still to come.

Regardless of how future leasing in the Gulf pans out, companies in the region have already shown that they don't

want to miss out on the new business potential that comes with the offshore wind industry. The Business Network for Offshore Wind has highlighted some of those firms and explored the topic of offshore wind development in the Gulf at length in a new report, "Unlocking the Gulf of Mexico's Offshore Wind Energy Potential." The report was published in August and is available to the public at offshorewindus.org.  $\prec$ 

#### EDITOR'S NOTE

The Aug. 29 auction mentioned in this article had not yet taken place as of press time. An updated version with information about the results of the sale is available at windsystemsmag. com.

#### **ABOUT THE AUTHOR**

John Begala joined the Business Network for Offshore Wind in 2022 and serves as the vice president for federal and state policy. In his role, he helps coordinate the Network's relationships with top federal and state government officials to facilitate the development of a domestic supply chain for the offshore wind industry.

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## PROFILE

ARCVERA RENEWABLES

## FOUR DECADES OF EXCELLENCE IN RENEWABLE ENERGY PROJECTS

ArcVera Renewables executed the technical analysis for the Leeward Renewable Energy 60.9-MW Crescent Ridge Wind project in Tiskilwa, Illinois, a full-scale wind farm repowering that required the removal of the entire existing wind turbine, including the supporting tower structure. (Courtesy: ArcVera Renewables) ArcVera Renewables contributes to the world's renewable energy future by guiding its clients to successful project development and operational outcomes while accelerating the deployment of wind, solar, and storage facilities globally.

By KENNETH CARTER 💌 Wind Systems editor

eeping a wind farm up and running is a monumental task made up of a myriad of smaller — but by no means less important — tasks. The same is true for solar, battery, green hydrogen or hybrid renewable facilities.

ArcVera Renewables keeps a handle on many of those tasks with experience and expertise that runs deep.

"If you think of anything technical, we probably do it," said John Bosche, president and principal mechanical engineer at ArcVera.

Developers, owner-operators, and sometimes turbine vendors make up the bulk of ArcVera's client base. The company's expertise is applied to all manner of renewable energy projects globally, and covers from inception — prospecting — through development, financing, and operations.

#### **RESOURCE ASSESSMENT**

For wind energy, ArcVera is mostly known for its meteorological and energy resource assessment speed, fidelity, and accuracy, according to Bosche.

"That's kind of our bread and butter," he said. "But we're also involved on the engineering side of things. We do a lot of independent engineering associated with project finance, including technology risk analysis. We do due diligence related to mergers and acquisitions or just the sale of a project. Part of that is we do a lot of wind-turbine technical due diligence design review."

Other tasks that ArcVera performs involve failure analysis as part of a warranty or insurance claim, according to Bosche.

"Sometimes we even engage as an expert witness in an arbitration, when those come up," he said.

#### POWER PERFORMANCE TESTING

Another major aspect of ArcVera's expertise is power performance testing, according to Bosche, which the company has been doing since 2001.

"We have a deep bench and a lot of knowledge when it comes to power performance testing," he said.

Most of ArcVera's power performance testing still involves legacy techniques with met masts, though the company is seeing an increase in testing with Lidar as well; Lidar was recently approved as a viable option for wind measurement.

"Lidar can save a good bit of money, and it can make things easier for sure," he said. "For sure, it's an emerging trend. And, even newer, is doing tests with the nacelle Lidar. I was on the standards committee that wrote the standard for how to take wind measurements using the nacelle Lidar."

An interesting aspect of wind energy is that the technical methods used can often come full circle with innovative advancements, according to Bosche.

"Everything old becomes new again," he said. "Another topic I worked on with the standard committee 10 or 15 years ago was doing a test using the nacelle anemometer. That kind of fell out a favor for a lot of years, but now we're seeing renewed interest in doing nacelle anemometer testing."

Even with its involvement on the technical side of things on a wind farm, ArcVera also has experience in repowering wind farms, as well as decommissioning them, according to Bosche.

"We have a financial analyst, so we do financial analysis that often goes together with the due diligence or project optimization work we do, such as with hybrid renewables projects; however, we're not attorneys; we're not accountants; we're not involved in that part of the commercial side of the industry," he said.

#### DEEP ROOTS

ArcVera has been a company since 2017, but its roots go back to near the very infancy of commercialized wind energy in 1979, which means the expertise that makes up ArcVera spans decades, according to Bosche.

"The vast majority of people on our staff have at least 10 years of experience, and many of us have 30 or more years of experience," he said. "But generally, with a few exceptions, the vast majority of our staff have more than 10 years of experience, and they are senior, recognizable people in the industry. This experience leads to insights that many cannot otherwise benefit from."

ArcVera then takes that expertise and meshes it with its clients' needs, according to Bosche.

"We are responsive to deadlines — we always meet deadlines that we commit to," he said. "And we are flexible. If a client wants something that's not quite part of the standard analysis, the answer is always yes. We'll do what they need. We are very attentive to client needs, and that goes along with that very senior scientific knowledge."

Bosche also points out that even though ArcVera's beginnings are in the U.S., the company very much has an international presence.

"Our roots are in the U.S. and it's definitely still where most of our work is, but we have offices now formally formed in Brazil, South Africa, and India," he said. "And from there, we do work elsewhere in South America from

### PROFILE



The 54-MW Ventus Wind project — El Salvador's first constructed wind project. Located in Metapan, El Salvador, the project was developed by Tracia Networks and commissioned in July 2021. ArcVera has extensive experience in Latin America and supported the Ventus project with its technical services expertise from prospecting through development and financing. ArcVera Renewables engages its technical know-how internationally, with established offices in São Paulo, Brazil; Bangalore, India; and Cape Town, South Africa. (Courtesy: ArcVera Renewables)

the Brazil office, elsewhere in Africa from the South Africa office, and elsewhere in Asia Pacific from the India office. The Brazil office has been around for over a decade, and it is a significant portion of our overall business at the company. The South Africa and India offices are newer and they're growing quickly. We are dedicated to the global success of the renewables business."

#### EVOLVING WITH THE INDUSTRY

ArcVera and the companies that make up its history have definitely come a long way from the beginnings of the industry, according to Bosche.

"At the very beginning, people literally were measuring the wind using kites," he said. "And analysis was done with pencil and paper or spreadsheets at best. We've had to adapt and evolve, and we've actually tried to be thought leaders and lead the way as methods advanced to better ways of measuring the wind, better ways of analyzing it with better computer models."

For wind flow modeling, for example, ArcVera doesn't use linear models or CFD models that don't properly account for atmospheric stability, according to Bosche.

"You can kind of trick them into accounting for atmospheric stability, but we use a full physics atmospheric model called WRF, and it is far and away the most accurate way of modeling wind flow across the wind site."

And although other companies use WRF or run mesoscale models that account for atmospheric stability, ArcVera runs it at a much higher resolution, according to Bosche. ■ We are flexible. If a client wants something that's not quite part of the standard analysis, the answer is always yes. We'll do what they need. We are very attentive to client needs, and that goes along with that very senior scientific knowledge.

"We run it at a 200-meter resolution or better, which is kind of comparable to the scale of an actual wind turbine," he said. "With that resolution, you can really see the variation of wind across the site at the relevant scale of the optimization of wind turbine placement."

The result of that increased resolution means specific modeling points are included and captured in the model, where in, for example, a more common resolution of 1 to 1.5 kilometers may miss certain topographical features that could essentially interfere with a wind farm's energy production, according to Bosche.

"We feel like we really are industry-leading when it comes to wind flow modeling and other types of analysis," he said. ArcVera has also been researching wake modeling, with Bosche saying the company has done some cutting-edge research to show that wakes persist much longer and much farther than legacy wake models have suggested in the past, especially with offshore wind.

And the same can be said with Arc-Vera's goal to stay current along the engineering side of the wind industry, according to Bosche.

"As I mentioned, I'm on the IEC committee that writes the standards for how to do power curve testing, and I'm regularly meeting with the world's best experts on power curve testing and staying current with cutting-edge technology, whether it's nacelle Lidar, ground-mounted Lidar, etc.," he said. "We are staying current with technology and even leading the industry to develop that new technology."



ArcVera's CEO and Principal Atmospheric Scientist, Gregory Poulos, at a wind-farm construction in progress. The ArcVera technical leadership team prefers to engage directly in work in progress, traveling to project sites as the technical scope of work requires. (Courtesy: ArcVera Renewables)

#### **CUSTOMER NEEDS**

Staying on top of that technology also goes hand-in-hand with staying flexible with customers' needs, no matter if those needs involve a common task or something unique to the client, according to Bosche.

"Sometimes there are recurring tasks; if somebody wants a bankable wind resource assessment, and it's in flat terrain in Kansas, it's kind of turn the crank but we can usually find something unique to address — we've done that a hundred times before, and we can do it again," he said. "But often, the requests are much more complicated than that - maybe they don't have very much wind data collected on site yet, the terrain and meteorology are complex, or maybe it's a site with some unusual ice conditions or something like that. We always strive to do what the client needs and not just try to fit their project into a box of a standard product that we have available. We start with the custom needs of the client. If there's something off the shelf or standard that can work for them, great. But we don't ever make that assumption at the beginning of our project."

#### OFFSHORE DEVELOPMENT

And as more offshore wind projects grow off the U.S coast, Bosche said ArcVera is making waves in that development as well.

"We have a dedicated business development person for offshore," he said. "We have engineers with offshore experience; we have meteorologists with offshore experience. We've tailored all of our meteorological modeling to be relevant for offshore. I mentioned the nacelle Lidar power curve testing that we've been involved with. That's the appropriate way to do a power curve test offshore, so we're fully set up and ready to go for doing power curve testing offshore. We have the pieces in place. We have actually worked on quite a few offshore projects already, and it's growing quickly." And with those developments, Bosche said he predicts a very bright future for ArcVera in not just wind, but all across the renewables sector, solar, storage, and green hydrogen. "At least for the next 10, 20 years, we anticipate being very busy," he said. "Our goal is to — and it's written into our culture statement — use our brains to help our clients accelerate the deployment of renewable energy globally. That's our intention always."

From a consulting firm perspective, Bosche said he has seen competitors get acquired by multinational consulting firms, while ArcVera has continued to stay modest in size, which has been essential to ArcVera's success.

"We continued to stay nimble while they were growing and being acquired and consolidating, and that was part of why V-Bar and Chinook Wind merged back in 2017, so that we could grow in the face of a consolidating industry," he said. "It allows us to do more R&D. That R&D is absolutely critical to innovation and making our customers more successful. We spend a significant fraction of our annual revenue on R&D to stay at the forefront of the industry, and we've been able to do that because of scale. And we think it makes an interesting place for us in the industry as a really 100 percent, renewables-focused, independent consulting firm, but with the scale to have an international presence and to do good R&D."

MORE INFO arcvera.com

## CONVERSATION

## Andy Page

Managing Director 💌 Chartwell Marine



## "We had confidence that we could design a boat that could be built in the States, having built some already."

U.S. offshore vessel operator, builder, and owner Edison Chouest Offshore recently launched construction of the U.S. offshore wind industry's first ever mini-crew transfer vessel (CTV), designed by Chartwell Marine. *Wind Systems* recently talked with Chartwell Managing Director Andy Page about the specifics of the new CTV, and what it will mean for offshore wind development in the U.S.

#### How did the collaboration between Chartwell and Edison Choeust Offshore happen in order to get the CTV project going?

It was a bit of a journey really, as usual. In 2019, we were fortunate to participate in a competition for developing a future-proof small craft, which could be launched and recovered from a ship. We worked with the Carbon Trust through the Offshore Wind Accelerator (OWA) program, designed to reduce the offshore wind cost through research, development, and demonstration (RD&D). The initiative aims to overcome market barriers and establish industry best practices. The current phase involves participation and funding from nine international energy companies: EnBW, Equinor, Ørsted, RWE Renewables, ScottishPower Renewables, Shell, SSE Renewables, and Vattenfall — who together account for 75 percent of Europe's installed offshore wind capacity.

They hosted a competition. We were one of the winners as was Robert Allen with a methanol-fueled vessel, and ESNA with its surface effect ship technology. With the award, we were able to design a new type of craft. We were able to model-test that craft, actually run it in a huge ocean basin tank, free-running with 3D-printed scaled propulsion system, electric motors, and with remote control and a motion monitoring system on board. We could actually drive it in the seas that we expect to see in the North Sea but also on the Eastern Seaboard in the U.S.

That's how the craft initially started to exist. In the same timeline as doing that, we've been building boats with Blount Boats with Atlantic wind transfers as CTVs, which were getting noticed. In 2016, we were fortunate to win the most significant work boat at the work boat show in New Orleans with the Atlantic Pioneer. Subsequently, we launched the Atlantic Endeavor at the beginning of 2020. So, Chouest started to see work in CTVs in the Northeast, and they also started to hear about the daughter craft that we've been designing as part of the Carbon Trust project.

Those were two influencers. And then both Equinor and Ørsted were very familiar with our design. Equinor and Ørsted are were both chartering vessels from Edison Chouest, and we delivered a daughter craft for a European operator, which Equinor chartered for the Dogger Bank Wind Farm, which is currently the largest wind farm under construction in the world. The success of that boat being launched influenced confidence between Equinor and Ørsted separately and, of course, their supplier Edison Chouest.

All of these industry dynamics brought us together, and I then was fortunate to meet Michael Braid, who was based in the U.K. working for Chouest at the time. He's now moved to the States, and I was able to present and explain the boat design. I met with other European colleagues that worked within the Chouest group, and we were able to engineer a solution that was right for Chouest's methodology and also for their ultimate customer, Ørsted, going forward.

#### Were there any challenges to adapting the design for U.S. waters, particularly when it came to complying with the Jones Act?

Fundamentally, the boat needs to be built in America. We've had great success of doing that with Blount Boats and Derecktor Shipyards so far, and we're also building with St. John's Shipbuilding in Florida. We had confidence that we could design a boat that could be built in the States, having built many already. We then needed to work with Chouest for them to build it within their own shipyards, of which they have many.

Some of the changes we had to make were some of the plate thicknesses, changing the measurements to Imperial rather than metric, working with the U.S. Coast Guard and trying to procure as much material and equipment from the U.S. rather than from Europe.



Chartwell's design responds to the increasing demand in the U.S. offshore wind market for low-emissions, cost-effective support vessels, with the catamaran's optimized hull form offering efficient fuel use as well as stability and maneuverability in choppy waters. (Courtesy: Chartwell Marine)

A U.S. supplier, Nautical Design & Consulting, based in Louisiana, is doing the systems engineering onboard the vessel to make sure that hatches, sea strainers, valves, pipe work, all of that content is being engineered and procured from local vendors in the U.S.

And that's probably the main things that we did to try to maximize the amount of U.S. content but, moreover, make sure that the boat can be serviced and maintained and not be reliant on a componentry we can't get in the U.S. Very much of the mentality is we are a proven trusted company, and we don't want have a component that we can't deliver on our work scope.

#### What are the main features of the CTV, and what makes them unique as compared to other vessels in this category?

So critically, crew transfer boats go quite quickly. They take people, and they want to take them comfortably, but in the same sense they also have to almost perform tugboat-esque activities.

They have to push on to an offshore structure. They have to maintain their position; they need to be highly maneuverable, and they need to be able to safely transfer persons from the boat to an offshore structure. It's quite a unique work scope that not many other boats don't need to have. It is rare that you've got to have such a duty cycle where you've got to go really fast and then you need to just have torque and hold on to an offshore structure. Chartwell, in terms of our operational experience in offshore wind, has experience in excess of 12 years. We understand the challenges in working offshore. We understand the power requirement, the type of shape of craft, how the dynamics affect onboard comfort, and how they affect the ability to transfer people. That's what really has driven us into designing this boat for this operational requirement.

## What type of research and planning went into the design of the vessel?

If I look at the boat that we're building, it has really unique features. It has a very, very high freeboard — bow freeboard in particular — which is quite unique for a vessel of this size. Traditional boats in this size category would be much lower physically. If you were to put it alongside the most conventional commercial and leisure boats in the marina, this boat would sit very high above.

Freeboard is something we've researched heavily, and we've tested computationally and physically both at scale and at full scale. We have looked at the propulsion choice

## CONVERSATION

and how that is integrated into the form, trying to make sure that our propulsars don't come out the water when we're pushing on the offshore structure, while trying to keep them as submerged as possible, and how the flow interacts with the propellers to maximize efficiency. It also gives us that bollard push that we need to stay on the offshore structure.

For this particular requirement, the vessel also has to function with a unique feature — Ørsted's patented Pict

(GUS) Get-Up Safe system. GUS is used to pick personnel up off the deck rather than the personnel using a ladder to get up and down the turbine.

We, together with Chouest, and Ørsted, recommissioned our models that we originally did our primary model testing with, and we set them up to reflect the Get-Up Safe operation.

We changed the bow fender to suit the type of fender we will use in collaboration with Get-Up Safe. We also matched the most recorded wave frequency and period and height that we expect to see offshore.

We set the sea state to match what we thought would be the most predictable wave conditions offshore, and then we were able to test the boat in the tank to replicate that and then that gave all parties the confidence to move forward with the project. That was a great example of tri-party industry collaboration and really trying to make operations as predictable as possible within the means you've got. You never know until you've built the boat, but by doing the steps, the computational studies, the model testing, hopefully you make it as predictable as possible.

## ✓ Is there a lot of trial and error involved in that process?

There is, yeah — trying different fender types, different shapes, looking at the implications of angle of approach. If you're in a head sea condition or bow quarter, on the beam, what are the implications on the vessel? In terms of the boat, it all comes down to the operator, the person driving that boat and their skill, their precision. In relation to the Jones Act, it all comes down to that individual, that U.S. citizen, who's going to drive that boat.

They're the individual who's going to really deliver a service. That's what the critical word in offshore wind; Service. We come up with a boat, and the builder builds the boat, but ultimately, it'll be Chouest that provides the Service, and their masters and crew will be the key component.

We call it a mini CTV or a small CTV because it's performing crew transfer functions. I think a lot of people traditionally think of a daughter craft as being a fast rescue craft or a lifesaving piece of equipment. Of course, this would assist in the event of being needed for search and rescue purposes, but its primary function is to transfer personnel from the ship to turbines or to substations offshore.

#### What projects is the CTV being built for?

The CTV is being built for Ørsted, and their U.S.-based joint venture partner, Eversource Energy, set to begin operation in summer 2024.

The daughter craft onboard the service operation vessel (SOV) can be deployed to efficiently maneuver crew across the Revolution Wind, South Fork Wind, and Sunrise Wind offshore wind farms in the Northeast US, under development by the joint venture.

## Why is the CTV referred to as a daughter craft?

We call it a mini CTV or a small CTV because it's performing crew transfer functions. I think a lot of people traditionally think of a daughter craft as being a fast rescue craft or a life-saving piece of equipment. Of course, this would assist in the event of being needed for search and rescue purposes, but its primary function is to transfer personnel from the ship to turbines or to substations offshore.

Let's say you're using the ship, and it has its walk-to-work system deployed. It's at one particular turbine, let's say Echo 4 for example, and, all of a sudden, we hear that there is a technical issue on Delta 6. Mobilizing the ship would mean retracting the gangway — the walk-to-work system, moving the ship, taking it off DP, moving it slowly at less than 10-12 knots to its next position, and redeploying the gangway.

That takes a long time. The turbine may have lost some time in service because of the time it took to get the ship there, but also the ship is better placed, performing the routine maintenance on the asset and being there for an ex-

tended period of time. Using the daughter craft, you can put it in the water, drive it to the turbine, send your technicians and troubleshooting team to go and work on the turbine and then go back to the ship. That's a typical operational requirement.

Additionally, if you simply need to go and get some equipment, some hardware, we have provisions for cargo onboard the CTV, the daughter craft.

If we need to go and collect some stores or run various other errands that maybe required, that's the kind of work that this boat will typically do. It also might be used for reconnaissance work. Do we want to go and see what's happening with the weather? Can we get some extra prediction from the CTV? If we're doing initial transition from construction to O&M, it's very likely there are other assets offshore. This boat can perform functions between the different assets, the different ships, maybe barges, etc., to help be part of the working day offshore.

#### How will the CTV adapt to different turbine configurations that it's obviously going to face during its mission?

The turbines themselves should all be uniform, like a standard. They should all be the same on this particular wind farm, but the substation has a different setup to the turbines. So we've actually designed a unique fender arrangement that can handle both the substation and the turbines. We've worked very closely with Chouest and with Ørsted to develop the shape required for that.

That's part of the unique feature of this craft. If, for whatever reason through the life of the ship and therefore the daughter craft, let's say whatever the charter term comes to an end, Chouest may want to remobilize the ship somewhere else, then the fender is configurable. We can change it to suit a different wind farm. For example, if it ever ended up down in Virginia, their turbines may be different to what we have on the Ørsted site. We've planned for those circumstances potentially occuring.

#### ✓ I know you are working with Ørsted, particularly with this one now, but is there any industry response outside of that that seems favorable to wanting to use this craft in their future projects?

Absolutely. We've had great success working for Equinor with our daughter craft, also with SSE in construction in Europe. We are expecting, as more SOVs come into usage in the U.S., a lot of those ships utilizing a mini CTV on board, collaborating with the ship. It's an appealing craft. It suits the market and hopefully we will see many more being built as the U.S. market develops.

## ✓ Is there anything else you'd like to mention that we didn't discuss?

If you could credit two of my colleagues as well: Robin Saunders and Thomas Payne, because they have been heavily involved in the design throuhout. Robin collaborated with Chouest in the outset, and Tom has actually been responsible for the engineering, working closely with the ship builders at Chouest, with the engineering of the kit set, as we call it. We make an IKEA-style kit set, which the shipyard assembles the boat from, and that takes a lot of brain power to deliver, so he deserves some credit for that.

MORE INFO chartwellmarine.com

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President Biden celebrated the U.S. offshore wind supply chain during a steel-cutting ceremony for the Acadia, the first U.S.-built subsea rock installation vessel for offshore wind. (Courtesy: Business Network for Offshore Wind)

### **CONSTRUCTION**

## Biden celebrates offshore wind at Philly Shipyard

President Joe Biden recently celebrated the advancement of the U.S. offshore wind supply chain during a steel-cutting ceremony for the Acadia, the first U.S.-built subsea rock installation vessel (SRI) for offshore wind. The vessel was ordered by Business Network member Great Lakes Dredge and Dock Corporation (GLDD) and is being constructed at the Philly Shipyard in Pennsylvania. During the ceremony, Biden celebrated the \$16 billion of investments made during his administration in offshore wind manufacturing, shipbuilding, and ports, noting substantial growth in the supply chain that is now creating jobs in Indiana, Kansas, Louisiana, Pennsylvania, Texas, and New England.

GLDD's investment into the \$246 million vessel garnered the company a 2022 Ventus Award for Supply Chain Advancement for the vessel's new efficiency standards and innovation with its large capacity, accurate placement technology, innovative battery, and alternative fuel system. Headquartered in Houston, GLDD has been in operation for more than 130 years. This vessel construction represents the company's diversification into offshore wind and will fill a substantial need in the growing offshore wind industry.

"The Biden-Harris administration is helping make offshore wind a reality by bringing certainty to the permitting process, making investments in ports and transmission, and incentivizing domestic manufacturing," said Business Network for Offshore Wind CEO Liz Burdock. "Congratulations to Great Lakes Dredge and Dock Corporation for this achievement; we look forward to seeing the vessel finish construction and commence operation in 2025."

Biden also announced the Final Sale Notice (FSN) for setting up an August 2023 auction. These will be the first federal lease areas auctioned in the Gulf of Mexico and, once developed, could support up to 3.7 GW of offshore wind generation.

Despite having no active lease areas, the Gulf has been a leader in developing the U.S. offshore wind supply chain. The Network reports that 23 percent of



TDI-Brooks has increased vessel capacity by adding a 75-meter DP2 vessel, R/V Nautilus. (Courtesy: TDI-Brooks)

contracts in the U.S. market are going to Gulf firms and about \$1 billion in investments are flowing to Gulf shipyards or fabrication yards.

"Today's release of the Final Sale Notice for the Gulf of Mexico Lease Areas marks an exciting new front for offshore wind in the United States," said John Begala, the Network's vice president for Federal and State Policy.

"With its long history of offshore construction, engineering expertise, and environmental monitoring and data collection, introducing the Gulf of Mexico and the region's experienced professionals to the offshore wind market will drive new innovations and opportunities for the industry. BOEM's inclusion of the supply chain, workforce, and fishery bidding credits demonstrates their continued commitment to seeing offshore wind develop in an equitable and inclusive manner."

#### **CONSTRUCTION**

## TDI-Brooks increases vessel capacity

TDI-Brooks has increased its vessel capacity by adding a 75-meter DP2 vessel, R/V Nautilus (formerly Nautical Geo), to its fleet. The market for subsea services remains strong, coupled with increased demand from clients and the need for increased capabilities. The vessel can potentially offer a variety of offshore assistance with subsea services, construction aid, exploration, production, ROV and diving support, and scientific marine research and survey mapping, along with military support.

This vessel is about 60 percent through its retrofit period in Las Palmas. It will finish its shipyard period in late September and then transit to



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Funding rounds from EnerKite and Kitemill have attracted a combined 2 million euros with more than 1,000 investors globally. (Courtesy: Airborne Wind Europe)

Trinidad for several geotechnical coring projects. One of these programs will involve spudcan analyses using the recently delivered Manta-200, deployed through the Nautilus mid-ship moonpool.

The Nautilus is a vessel with one North American MCK-1240 upper forecastle deck STBD side SWL 7.1ton crane, large accommodation (46 berths) and deck capacity.

The vessel will be outfitted with TDI-Brooks' complete geotechnical tool kit including a suite of innovative geotechnical tools for soil sampling and measurement.

These include 0.5- and 1-meter box corers (BC), 6- and 9-meter piston corers (PC), 20-meter jumbo piston corers (JPC), cyclic t-bar instrument (TBAR), piezocone penetrometers including a 40-meter CPT-Stinger and 10-meter Gravity CPT tool (gCPT), Geomil Manta-200 CPT, Neptune 3K & 5K vibracorers and TDI-Brooks' designed pneumatic vibracorer.

The Nautilus will have a Teledyne RESON full ocean depth multibeam

echosounder (MBES) for surveys to approximately 2,500 meters water depth for performing hydrographic marine, surface geochemical "seep-hunting" (SGE) and seabed heatflow surveys (HF).

The Nautilus will be operated within a robust Safety Management System. All of TDI's vessels are regularly vetted by client marine assurance groups and are a part of the OCIMF Offshore Vessel Inspection Database (OVID).

MORE INFO www.tdi-bi.com

### ▼ INNOVATION

## Wind energy tech developers attract major investments

Airborne Wind Energy (AWE) is accelerating toward commercialization as two leading technology developers attract major global investment through crowdfunding initiatives, Airborne Wind Europe (AWE) reported. The Brussels-based trade body said latest funding rounds from EnerKite and Kitemill have attracted a combined 2 million euros with more than 1,000 investors globally.

Kitemill recently unveiled designs for its first commercial scale KM2 system capable of taking AWE to utility-scale. The technology is set to feature in the 7.5 million euro Norse Airborne Wind Energy Project (NAWEP), backed by the EU Innovation Fund, with a total of 12 KM2 units due for installation.

"We are thrilled to see two of our leading AWE technology members attracting large levels of international attention," said Secretary General Kristian Petrick. "AWE is about to become a game-changing solution unlocking large untapped wind resource at high altitudes enabling more energy to be extracted at lower carbon intensity and eventually at lower cost. We are inviting other potential investors to join this journey right now as we aim to help Europe and other areas of the world accelerate net-zero electricity production and security of supply."

A recent white paper conducted by BVG Associates, on behalf of Airborne Wind Europe, projected the AWE market to reach around \$100 billion (92.39 billion euros) by 2035-2040 and several hundreds of billions soon after. Based on the assumption that AWE follows the same trend as the established wind turbine market 40 years ago, BVG further estimates the cumulative global deployment of AWE could reach 5 GW by 2035 and at least 177 GW by 2050.

New and disruptive AWE technology offers unique benefits compared to traditional wind-energy systems. Research indicates that harvestable high-altitude wind power is about 4.5 times stronger than ground level resources. AWE also allows for continuous adjustment of harvesting altitude seeking the best available wind resource. This high-capacity factor ensures a more consistent and stable energy supply alleviating intermittency issues experienced by more established



EGA's "Beat the Heat" program is a summer-long effort across the company. Employees are trained to detect the early signs of heat stress in themselves and others. (Courtesy: Emirates Global Aluminum)



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### THE BUSINESS OF WIND



3DPRINTUK is the first 3D printing service bureau in the U.K. to be certified carbon neutral. (Courtesy: 3DPRINTUK)

renewables, and supporting future hybrid energy models.

In addition, AWE substantially reduces material consumption by up to 90 percent. This has a positive impact on overall costs, manufacturing, transport, and logistics operations, as well as the carbon footprint and environmental impact.

Another strong benefit is the versatility of AWE technology. Being scalable from a few kilowatt to several megawatt, the systems are suitable for a broad range of markets including offshore repowering, floating offshore, mountainous and remote locations.

"AWE technology has potential to drive down the levelized costs of wind energy (LCOE), through a decrease in capital costs (CAPEX) due to low material use, combined with increased capacity factor, easier logistics and quick set-up as well as the high-power density per square-kilometre," Petrik said. "The first commercial AWE systems are already competitive in markets with diesel-based power generation, with experts estimating AWE will reach parity with established onshore wind by the mid-2030s," said Petrik.

MORE INFO airbornewindeurope.org

## EGA provides volunteers wearable tech to beat heat

Emirates Global Aluminum, the largest industrial company in the United Arab Emirates outside oil and gas, recently announced the company has expanded the use of Kenzen, a wearable technology platform, to 350 employee volunteers to "Beat the Heat" this summer.

Heat-related illness is a hazard for anyone working outside in the UAE summer, and can be fatal if left untreated. It is, however, preventable. EGA has focused for more than a decade on eliminating heat-related illness in summer.

Kenzen's wearable technology offers the potential to further protect outdoor workers in the UAE, by continuously reporting core body temperature, heart rate, activity, and other body indicators allowing both the wearer and EGA's safety team to detect heat strain in the body before the early signs can be felt.

Despite industrial processes that generate further heat, and which must run and be tended around the clock, EGA achieved zero heat-related illnesses in 2019 and 2022. In 2021, EGA recorded two cases of heat-related illness requiring treatment at the company's on-site medical centers. In both cases, the employees received rehydration via intravenous drips and fully recovered within hours.

"Heat-related illness is a serious threat to health and even life in our region, and increasingly around the world," said Abdulnasser Bin Kalban, EGA CEO. "Our work has shown that heat-related illness is entirely preventable, even in challenging industrial environments like ours. Wearable technology offers the potential to protect people even more, and I am looking forward to the results of the wider trial we are conducting this summer."

EGA's Beat the Heat program is a summer-long effort across the company's operations. Employees are trained to detect the early signs of heat stress in themselves and others. EGA conducts hydration tests before and during shifts, and employees are encouraged to take regular breaks and cooling showers. Cooling booths, drinking stations, icemakers, and portable air-conditioning units in EGA production areas help keep people cool. "We are delighted to support Emirates Global Aluminum in their mission to prioritize employee health and safety and contribute to cutting-edge research on thermal physiology," said Kyle Hubregtse, Kenzen CEO. "By combining Kenzen's wearable technology with EGA's dedication to workforce well-being, we are setting new benchmarks in heat stress management and advancing the frontiers of occupational health."

MORE INFO www.ega.ae/en

## INNOVATION

## 3DPRINTUK attains carbon neutral status

3DPRINTUK announced early in 2023 its commitment to a sustainable approach to its additive manufacturing (AM) operations and outlined its "Road to Net Zero" plan. The company has announced it has already taken a significant step toward this goal by attaining certified carbon neutral status, the first 3D printing service bureau to do this in the United Kingdom.

Thanks to its partnership with Climate Partner, 3DPRINTUK has gained a better understanding of its carbon footprint and identified ways to reduce it. The company has also been able to offset the emissions that it can't eliminate through its current carbon reduction program.

Through this collaboration, 3DPRINTUK has been able to offset 448,000 kilograms of CO2, equally split between two supported projects: improved cookstoves in Uganda and wind energy in De Aar, South Africa. Both projects contribute to the UN Sustainable Development Goals (SDGs) and have been verified by Carbon Check (India) Private and TUV SUD South Asia Private Limited, respectively.

The improved cookstoves Uganda project aims to replace conventional and less efficient cookstoves in the country with improved cookstoves. Three objectives are being pursued: reducing fuel consumption, improving the health of the population in Uganda, and reducing deforestation.

The aim of the wind-energy project in De Aar, South Africa, is to harness the region's wind-energy potential to balance its energy needs in a sustainable way. The share of electricity now supplied by the wind farm would have otherwise been generated by fossil fuels. The wind-power project avoids about 433,920 tons of CO2 emissions per year. In addition to the environmental benefits, the project assists the local community by creating jobs and improving the access to healthcare.

"We set ourselves some important goals as a leading 3D printing service provider, with the full intent to meet them as soon as practicably possible," said Nick Allen, 3DPRINTUK CEO.



The Electrom® iTIG IV tester is essential for wind farm operators and maintenance technicians for diagnostics and predictive maintenance of generators, as well as auxiliary motors used in cooling systems, automated lubrication devices, nacelle yaw motors, lift/hoist motors, and blade pitch motors.

When performed during a regular maintenance schedule, the surge, DC hipot, and megohm tests give users trending data on winding insulation condition so O&Ms can prioritize wind turbine servicing and schedule maintenance rather than risk unplanned downtime.



windsystemsmag.com

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## THE BUSINESS OF WIND



An aerial view of hybrid CTV, HST Ella. (Courtesy: HST Marine)

"Offsetting our carbon footprint and achieving certified carbon neutrality is a really great start, and we are proud of this achievement, but it remains just the start. We push on."

MORE INFO www.3dprint-uk.co.uk/

# INNOVATION Purus Wind's HST Marine uses Reygar tech for CTV support

Swansea-based HST Marine, a Purus Wind company, is leveraging Reygar's BareFLEET technology to understand and report on the performance of its hybrid Crew Transfer Vessels (CTVs).

HST Marine's commitment to provide low-carbon vessel solutions to the clean-energy industry aligns with the international offshore wind sector's aims to reduce vessel emissions and fuel burn, thereby driving down the overall carbon footprint of building and operating offshore wind farms.

The company has four hybrid CTVs in operation with three more soon to enter service, all of which have Bare-FLEET installed. These vessels are a mix of both controllable and fixed pitch propeller systems that take power from either a high-efficiency electric motor or the main engine, allowing them to operate near silently and with zero emissions in electric only mode.

"We recognize the value of gathering and sharing accurate performance data from our vessels," said Christopher Monan, HST Marine COO. "It supports the company in winning new contracts and enables us to build lasting customer relationships. We have seen reductions in main engine operation of around 50 percent on our hybrid vessels, which has the holistic benefits of lowering fuel consumption, emissions, and noise when in harbor, as well as lengthening service intervals. Being able to demonstrate these efficiency gains with clear and concise performance data is of utmost importance to nurture trust with both new and existing charterer clients, whilst also providing them with essential evidence for their own environmental reporting." New features developed by Reygar within the BareFLEET technology package allow HST Marine to monitor the performance of hybrid. BareFLEET also monitors the electrical power consumption of the hybrid drive, with specific usage and performance statistics included alongside conventional diesel engine performance data. These features enable HST Marine to evaluate the environmental performance of hybrid CTVs against conventional vessels and to make adjustments for further improvement.



Firetrace fire suppression systems detects and suppresses fires in high-risk equipment, such as CNC machines, vehicles, heavy equipment, electrical cabinets, and wind turbines. (Courtesy: Firetrace)

"The transition to hybrid CTVs is an important step towards zero emission targets for the industry as a whole and we have recently delivered a number of BareFLEET systems for new hybrid vessels," said Chris Huxley-Reynard, Reygar's managing director. "It is hugely satisfying to see the technology performing well for HST Marine, providing their teams with the data they need both onboard and onshore."

MORE INFO hst-marine.com

### **MAINTENANCE**

## Emerging wind markets double down on fire protection

The demand for fire suppression to be installed in renewable energy infrastructure is growing in emerging markets where the energy transition is picking up the pace. By contrast, 75 percent of project owners and operators in mature markets, such as the U.S., don't seek out fire protection op-





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tions until they experience a fire event, according to Firetrace International, a leading supplier of fire suppression technology to the global renewable industry.

With markets such as Latin America and the Caribbean anticipating 460 percent growth in large-scale solar and wind power capacity by 2030, and the Indian market having grown by 250 percent between 2014 and 2021, the accompanying appetite to protect new assets with solutions for risks, like fire, is growing in parallel.

The proactive approach to fire risk management in emerging markets is unlike the approach typically taken in mature markets, where investing to protect against fire risk in advance of an event is still relatively uncommon.

Since 2015, weather-related losses have tripled in the U.S., according to data from GCube Insurance's "Hail or Highwater" report, and wildfires have posed the most consistent, year-round threat of damage to assets. Average asset downtime for a wind turbine after a catastrophic event in the U.S. is also 12 to 18 months, at a cost of \$2,000/day in revenue.

And U.S. plans to push renewables farther offshore and farther into rural areas bring project risks into closer alignment with those in emerging markets due to the remoteness of these sites.

"We have noticed that owners and operators of renewable assets in emerging markets are more likely to take precautions to protect their investments than those in the markets we have traditionally served, and there is good reason for this," said Joe DeBellis, Senior Global Sales Manager at Firetrace.

"However, this proactive attitude toward managing risk and ensuring that infrastructure sees out its expected operational lifetime should be universal rather than a trend in nascent renewable energy markets. The reality is that more mature markets are increasingly being exposed to extreme weather and are seeking out more remote locations for the deployment of renewable assets.

In this way, their risk profiles more

closely resemble risk profiles in emerging markets, and they would benefit from adopting similar strategies to safeguard their projects."

MORE INFO www.firetrace.com

## F MAINTENANCE Global Wind Service appoints new HR chief

Global Wind Service (GWS), a provider of turbine installation and service, recently appointed Jens Bolvig as the company's new Chief Human Resources Officer (CHRO).

Bolvig brings experience from the oil and gas industry, with experience working with a global workforce. His expertise will play a crucial role in driving Global Wind Service's commitment to excellence in employee management and ensuring a skilled and motivated workforce.

"I'm really excited to be joining Global Wind Service and becoming a part of the wind industry," Bolvig said. "In such a dynamic and rapidly growing field like wind, it's crucial to have a good grasp of all aspects of GWS and to truly understand our technicians. That's when HR and the work we do in this area become incredibly relevant for the entire company and our business. We're all about building a skilled and motivated workforce, and I can't wait to contribute to that."

"It is a great pleasure to welcome Jens to our executive team as our new CHRO," said Michael H j Olsen, CEO of Global Wind Service. "I am confident that Jens' extensive experience will be a great benefit for us and that his skills and leadership will further enhance our ability to attract and retain top talent, optimize our workforce, and maintain our commitment to safety, quality, and excellence."

Global Wind Service (GWS) is a provider of turbine installation and service solutions for onshore and offshore wind projects dedicated to delivering sustainable and reliable wind turbine solutions that enable the transition to a cleaner and greener energy future.

MORE INFO globalwindservice.com

## MANUFACTURING U.S. offshore wind market report notes milestones

The U.S. offshore wind industry and supply chain reached major milestones in the second quarter of 2023 as installation began on the nation's first two commercial-scale projects using components sourced from U.S. manufacturing facilities. These achievements are the result of a growing supply chain that has seen historic levels of investment in the last few years, including passage of the federal Inflation Reduction Act (IRA).

These and other findings are detailed in the Business Network for Offshore Wind's U.S. Offshore Wind Quarterly Market Report, which documents key investments announced over the past three months, growth in state demand for offshore wind, and notable policy advancements that drove the U.S. market forward between April and June 2023.

The network has also released a complementary Mid-Year Supply Chain Snapshot that highlights the accelerated growth experienced in just the past few years. While the U.S. market achieved a major milestone with the start of installation on the Vineyard Wind and South Fork Wind offshore projects, the Mid-Year Supply Chain Snapshot further profiles the development of the immense supply chain that is supporting the emerging industry. State demand has driven the market forward for years, but actions by the Biden-Harris administration to bring certainty to the permitting process and make historic investments in infrastructure and clean energy development have greatly accelerated supply chain growth.

## SAVE THE DATE

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## The International Partnering Forum (IPF) is the premier offshore wind energy conference in the Americas.

Hosted by the Business Network for Offshore Wind, IPF connects global leaders and businesses in the supply chain, offers unparalleled networking opportunities, and delivers the most timely and relevant updates on the industry. With the rapid expansion of offshore wind on a global scale, IPF attendance helps secure your place as a leader in the industry.

Located in the heart of America's offshore energy industry, New Orleans will host 2024 IPF just as the Gulf of Mexico begins developing its offshore wind market. Gulf companies are already hard at work building America's next energy industry and moving to integrate new technologies like green hydrogen into offshore wind. Embracing its offshore energy past and embracing the future of offshore wind, New Orleans and the state of Louisiana are emerging as a center of experience, expertise, innovation, and heart of this new industry.

## **Registration opens October 30**



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Snapshot details include:

► A 272 percent increase in the number of U.S. market supplier contracts since 2021, according to the Network's Market Dashboard, with 47 percent of that growth occurring since the IRA was signed in August 2022.

♥ 90 percent of contracts in the U.S. market going to companies that are either headquartered or have a presence in the U.S.

► A 169 percent increase in companies that have registered in the Network's free offshore wind supply chain database since 2021, with a 54 percent increase since the IRA was signed.

▶ \$16.6 billion in new market investments made since 2021 — more than quadruple the amount invested previously — with \$7.7 billion of those investments made after the IRA was signed.

▶ A 100 percent increase in the number of vessels under construction or being retrofit in U.S. shipyards since 2021.

"We are proud to say that we have steel in the water, steel in our factories, and steel in our shipyards today," said Liz Burdock, founder and CEO of the Business Network for Offshore Wind. "Thanks to supportive federal and state policies, we are seeing unprecedented growth in the U.S. offshore wind supply chain across the nation. New contracts are signed daily with a vast majority going to small- and medium-sized American companies creating thousands of new jobs. With \$7.7 billion in new U.S. offshore wind investments since the Inflation Reduction Act was signed into law, this is just the beginning.

We will see many more factory openings, port revitalizations, and vessels under construction in the years to come."

The historic commencement of the Vineyard Wind and South Fork Wind projects also yielded additional U.S. supply chain milestones. The two wind farms will feature the first U.S.-manufactured offshore substation, built in Texas, the first U.S.-manufactured export cables, from South Carolina, and the first run of critical steel foundation



Vestas received an order for 45 V150-4.2 MW wind turbines. (Courtesy: Vestas)

and tower components in Rhode Island. Unconnected to these projects, the U.S. supply chain also celebrated the first U.S.-assembled monopile foundation in Paulsboro, New Jersey.

The Network's U.S. Offshore Wind Quarterly Market Report, which includes new data and analysis on market trends and advancements, provides additional context to the quickly developing market and its supply chain. The report details include:

▼ The many recent firsts for the U.S. supply chain, including the first U.S.-built offshore wind substation and monopiles, along with the first cables manufactured for a U.S. commercial-scale project.

✓ New investments in steel manufacturing facilities in Ohio and Baltimore and a California port's ambitious \$4.7 billion plan for a major floating offshore wind facility.

Economic headwinds that have forced projects in Massachusetts and New York to adjust their state financial agreements and led to new legislation passed in New Jersey aimed at supporting one of its projects.

✓ New offshore wind markets adding to the existing 84 GW demand — in Delaware, Illinois, and Maine, which have all considered or advanced new procurement legislation, and Louisiana, which is negotiating with developers to advance projects in state waters.

**MORE INFO** www.offshorewindus.org/ quarterly-report

#### MANUFACTURING

## Vestas gets 189-MW order for U.S. wind project

Vestas has received a 189 MW order to power an undisclosed wind project in the U.S. The order consists of 45 V150-4.2 MW wind turbines.

The order includes supply, delivery, and commissioning of the turbines, as well as a multi-year Active Output Management 5000 (AOM 5000) service agreement, designed to ensure optimized performance of the asset.

Turbine delivery is expected to begin in the first quarter of 2024 with commissioning scheduled for the second quarter of 2024. The customer and project are undisclosed.  $\prec$ 

MORE INFO www.vestas.com/en

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THE FUTURE OF WIND

## USING CNCTECH TO FABRICATE TURBINE BLADES

Overall view of the "BladeMaker" gantry system. (Courtesy: Siemens) In a joint project, Siemens demonstrates how blade fabrication can be achieved simply and economically using high-performance CAD/CAM and CNC technology.

#### By DIRK WÖHRMANN

he climate change and the current energy crises show more drastically than ever before that the world must turn its back on fossil fuels that damage the climate and turn to more renewable sources. Wind energy is a great option. However, to generate more energy from the wind, more wind-energy systems with higher ratings are required as quickly as possible. To achieve this, significantly more efficient and cost-effective production strategies and capacities are necessary, especially when it comes to rotor blades.

It sometimes takes a few days to weeks for a medium-sized rotor blade to be ready to harness the wind. Production processes must be sped up to handle the ever-increasing demand. Rotor blades represent up to 25 percent of the overall cost of a wind-turbine system — which means they offer a high cost saving potential. It is crucial that both key variables are significantly reduced and process reliability increased to minimize the risk of errors and resulting quality defects. The latter is especially important when it comes to wind-turbine service, which is complex and costly both on land and on water.

This is precisely where automation comes into play. Automation has already been used for a long time in the manufacture of other wind-turbine components such as gearboxes, generators, and even tower segments. Today, rotor blades can be up to 100 meters long with blade flange diameters of up to 10 meters, and just as before, they are predominantly fabricated by hand. To do this, huge molds are built in which glass or carbon-fiber materials are manually placed and impregnated with resin to create spar caps and blades. The composite material hardens under vacuum to form a blade half, is stiffened using stays, and paired up with the second half to form the complete rotor blade. The blade must then be reworked, trimmed, ground, touched up, painted, and tested — all of which are time-consuming and laborious steps.

### AUTOMATING THE PROCESS

Can all of these steps be automated? And with acceptable costs? A consortium made up of several companies and research partners within the scope of a joint project sponsored by the Federal Ministry for Economic Affairs and Climate Action asked precisely these questions. Specialists in all of the relevant domains — composite materials and bonding agent manufacturers, process and production technicians — analyzed the complete production process to assess the potential for optimizing the overall process. They defined sub-processes that can be automated and developed an overall system that integrates all of the associated tasks to be able to efficiently fabricate rotor blades.

The Digital Industries Division of Siemens AG took over the area of automation and digitalization. As the world's leading manufacturer of control and drive technology for a wide range of industries, Siemens is also a driving force when it comes to digitalization. The high-end Sinumerik CNC system provides the hardware and software as key elements of the automation solution. Sinumerik is well established in the machine tool industry with the VNCK software as digital twin and the CAD/CAM software platform NX from Siemens with the integrated, virtual NC core software. The portfolio also includes Sinamics converters and servomotors from the Simotics family — which are optimally teamed up with the Sinumerik system.

#### SEAMLESS CAD/CAM-CNC PROCESS

This meant that, right from the word go, a seamless digital workflow was possible over the complete process. Starting with the 3D-CAD design of a new rotor blade type, optimized so that it can be automatically fabricated, this formed the basis for the design of the two halves of the mold all the way up to fast, high precision 5- or 6-axis CNC machining with programs automatically generated in the CAM system.

#### TAILORED FOR CUSTOMIZED ROTOR BLADES

A renowned machine builder created a frame as an example and a machining center with two independent gantries with traversing paths of 25,000 mm x 4,700 mm x 2,000 mm. Siemens specialists then automated the machine, which involved equipping all axes with servomotors controlled by a Sinumerik system. This setup meant individual basic molds for blade halves or smaller blade segments could be automatically machined. The latter are being discussed as a better alternative in terms of production and transport when considering the extreme length of future rotor blade generations.

The two L-shaped gantries manufactured out of extremely stiff carbon fiber-reinforced tubes support and dynamically and precisely move the machining heads that can weigh up to 400 kilograms. Functions integrated in the Sinumerik compensate for weight-related vibration and ensure maximum smooth-running operation. When necessary, the gantries can be simply retracted to facilitate easy access, for example, when pairing blade halves. For example, a bonding system mounted on a platform for heavy loads and arranged in parallel to the longitudinal axis can be traversed in synchronism with the application head.

### ONE CNC SYSTEM CONTROLS EVERYTHING

When simultaneously machining molds on both sides, safety functions integrated in the control system (Sinumerik Safety Integrated) carefully monitor that the gantries do not collide with one another. The same applies to the actual automated blade production and machining on the same system with

### CROSSWINDS

## THE FUTURE OF WIND



Tape laying in the root segment. (Courtesy: Siemens)

the same control system. End effectors that can be quickly and easily exchanged were developed for tasks, which up until now had been manually performed.

The first objective was to be able to lay composite fiber roving or tapes — controlled by the CNC — for the stiffening spar caps and also mats up to 50-inch/1.27-meter wide taken from a roll and used for the outer rotor skin: The mat is individually controlled at seven points as it is unrolled and simultaneously pressed into the appropriate shape. This involves controlling the appropriate number of drive axes. A new handling tool takes previously stacked mat elements and places them on free-form surfaces with reproducible precision and without any creases. Beads of bonding agent are now automatically applied for the stiffening stays, which is not a simple task when considering the sheer dimensions involved.

This process has been automated for the first time, which means that it is now reproducible and can be precisely controlled. Just the same as when impregnating rovings, suitable process parameters had to be determined in complex tests and the appropriate program code written. Manual post-processing steps, such as trimming excess material and smoothing the blade edges, can also be automated to reflect today's digital era.

Application-specific screen forms integrated in the CNC operating system navigate the operator through the various process steps listed earlier, making them easy and safe to handle.

## SIMULATION FOR SAFETY AND SECURITY FROM THE VERY START

The decisive factor to achieve short development and machining times was and still is that all NC machining functions can first be simulated and optimized on a PC using a Sinumerik digital twin. This drastically reduces the risk of costly development mistakes but also damage when machining the blades due to collisions, for example, as a result of programming errors.

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## CROSSWINDS

## THE FUTURE OF WIND



Automated application of bonding agent in the blade. (Courtesy: Siemens)

#### QUALITY UP — TIME AND COSTS DOWN

Significantly automated processes shorten the fabrication of a "standard" rotor blade by at least 10 percent, so the rapidly growing demand can be more quickly and cost-effectively addressed. CNC machining provides precise repeatability and reduces the potential for making errors. This keeps quality at a consistently high level so only perfect rotor blades go into operation in wind parks and operate perfectly over longer periods of time.

Experience has shown that automatically and precisely applying the required amount of bonding agent for the stays can reduce the amount used by at least one third. This also minimizes the level of vapor in the air that negatively affects the health and safety of workers, which, for the higher unit quantities to be achieved, would otherwise be noticeably higher.

#### FROM PROTOTYPE TO BLADE FACTORY

The Fraunhofer Institute for Wind Energy Systems IWES headquartered in Bremerhaven took the lead in this joint project. It is establishing a research facility for highly automated rotor-blade production based on the intelligence gained from the joint BladeFactory/BladeMaker project with Siemens as associated partner. Interested wind-turbine



Discrete tape laying over the complete blade system. (Courtesy: Siemens)

manufacturers, plant and machine builders, or suppliers of composite materials and bonding agents can use this for their own developments and further advance the various processes.

It goes without saying that the generally validated production process can also be applied to other large components as well as other sectors. Parts of prefabricated houses or bridges manufactured out of composite materials could be manufactured much more efficiently than with traditional techniques, for example.  $\prec$ 

**MORE INFO** www.iwes.fraunhofer.de/en/researchprojects/current-projects/bladefactory0.html

#### **ABOUT THE AUTHOR**

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