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Wind Systems goes even greener

By the time you read this, we'll be at least six weeks into 2021, and as far as the future of renewable energy is concerned, I feel like it's the beginning of a brighter — and greener — future. And by green, I mean both ecologically *and* economically.

At *Wind Systems*, our February issue marks the beginning of a step into a greener future as well.

I mentioned at the end of last year that we were taking bold steps to decrease our carbon footprint, and February is the beginning of that decision: Welcome to the first digital-only issue of *Wind Systems*.

Beginning this year, *Wind Systems* will publish six issues in a digital-only platform with the six remaining issues of the year being a print-digital issue combination. To add to our commitment to lower our carbon footprint, the six print issues will publish on 10-percent recycled paper.

This, by no means, marks a change in the quality and quantity of the latest and best information about the wind-energy industry that we will be bringing to

you every month.

Just take a look at what this issue has to offer, and you'll see that our task to bring you interesting and informative wind-industry news is still very much our primary mission.

Lightning is a constant problem for wind turbines. Allen Hall with Weather Guard Lightning Tech takes a look at how continued maintenance is the only real way owner-operators can protect their investment, even with technical advances that aid in reducing lightning damage.

Along those lines, Olympus' Masakazu Wada shares his insights on how to improve wind-energy production through videoscope inspections.

And Blair Loftis of Terracon discusses a new type of wind-tower foundation that could provide construction cost savings while performing longer.

And in Crosswinds, I had the pleasure to talk to Jessica Adkins, an attorney with Sidley Austin LLP, where she advises companies on developing, financing, and investing in renewable energy and battery-storage products. In the article, she maps out how corporations and local governments are taking matters into their own hands when it comes to procuring and generating green energy.

Also, be sure to check out this month's company profile on Ørsted and how it is making major inroads into U.S. offshore and onshore wind projects.

You'll find all that and more in this month's issue. It may be digital, but it's still 100-percent *Wind Systems*.

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

Kenneth Carter, editor

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AWEA becomes American Clean Power

The American Clean Power Association (ACP) officially launched January 1, 2021 and will represent more than 800-member companies from across the renewable energy sector in its first year. The group reflects the diversity and scale of the modern renewable energy marketplace. ACP will work in close collaboration with other clean-energy trade organizations and advocacy groups.



Heather Zichal
(Courtesy: ACP)

To shepherd the new organization, ACP named Heather Zichal as the organization's first Chief Executive Officer.

"Solving climate change means leading a clean-energy transformation, which will rebuild America's economy," she said. "American Clean Power

will be the leading voice for creating jobs, spurring massive investment and driving innovation, while bringing us closer to the carbon-free future we need. This is a pivotal moment to unite the entire clean-power supply chain behind one organization to ensure renewable energy continues to grow into the dominant source of energy for America. No job could be more inspiring."

Zichal has had a long career battling global climate change and brings deep experience in the public and private sector. Most recently, she served as the executive director of the Blue Prosperity Coalition, a global network of governments, NGOs, scientists, and ocean experts working to advance sustainable, blue economy goals. She previously served as the vice president of Corporate Engagement for The Nature Conservancy (TNC), coordinating engagement with multilateral corporations to advance innovative approaches to some of the world's most complex sustainability challenges. In government, Zichal served as deputy assistant to the President for Energy and Climate Change during the Obama administration, where she coordinated the administration's energy and climate policy, as well as the groundbreaking Climate Action Plan.



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

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DIRECTION

THE FUTURE OF WIND



Offshore wind is expanding to new regions and, with onshore wind already present in all parts of the world, the integration of Vestas and MHI Vestas Offshore Wind includes combining, expanding, and simplifying existing functions within Vestas to meet market demand and create synergies. (Courtesy: Vestas Wind Systems A/S)

Vestas takes next steps in integration of onshore, offshore wind

As the leader in onshore wind and with a vision to become the global leader in sustainable energy solutions, Vestas plays a key role in large-scale deployment of renewables across the globe. To address the climate crisis however, the build-out of renewable energy must accelerate, and Vestas therefore wants to extend its leadership to encompass offshore wind. As a first step in this journey, Vestas has acquired MHI Vestas Offshore Wind (MVOW) and following closing of the agreement, which took place on December 14, 2020, Vestas has begun the integration of Vestas and MVOW into one organization based on one shared operating model and unified culture.

Offshore wind is expanding to new regions of the world and, with onshore wind already present in all parts of the world, the integration of the two companies includes combining, expanding, and simplifying existing functions within Vestas to meet market demand and create synergies. Through this integration, the company is building a stronger and more competitive Vestas across its onshore and offshore businesses, and its planning has shown synergies across several functions, which unfortunately entail redundancies.

Consequently, Vestas intends to lay off approximately 220 colleagues primarily in Denmark and Great Britain, with the majority being in Denmark. No layoffs are expected of hourly paid employees.

“Since we announced the agreement to acquire MHI Vestas Offshore Wind, we have meticulously planned how we can build a united and strong Vestas organization that can lead and scale up in both onshore and offshore wind,” said Henrik Andersen, group president and CEO of Vestas. “I want to thank everyone for their hard work and dedication during a difficult period where my colleagues have contributed to both the integration planning and execution of commercial

commitments. We have now started implementing our integration plans, which unfortunately includes letting around 220 hardworking colleagues go. It is never easy to make such a decision or say goodbye to good colleagues, but integrating and simplifying two companies inherently creates overlaps between functions, and it’s therefore necessary if we want to create a competitive and scalable organization.”

The organizational integration will continue throughout 2021 and include a consolidated and simplified organizational setup, which was scheduled to be announced internally February 1. The new organization will also adopt a strong focus on creating a unified culture rallied around accelerating the energy transition and Vestas’ values of passion, accountability, simplicity, and collaboration.

Vestas will now go into a consultation process with relevant employee representatives and was expected to have clarity for most employees by the end of January. Due to certain legal processes and requirements, the process may, however, take slightly longer outside Denmark. Following the announcement, Vestas employs more than 29,000 globally and about 6,000 in Denmark across onshore and offshore activities.

MORE INFO www.vestas.com

Enel Green Power brings two new U.S. wind farms online

Enel, through its U.S. renewable subsidiary Enel Green Power North America, has begun operating a 199-MW expansion of the Cimarron Bend wind farm in Clark County, Kansas, making the overall 599-MW facility the largest renewable plant owned by the Enel Group currently in operation worldwide.

The 236.5-MW White Cloud wind farm also began operations in Nodaway County, Missouri. The two wind farms bring Enel’s total renewable capacity added in 2020 across the U.S. and Canada to 865 MW. The investment in the construction of White Cloud amounts to about \$380 million, while that of the Cimarron Bend expansion amounts to more than \$281 million.

“We are progressing at full speed toward a sustainable energy future,” said Salvatore Bernabei, Enel Green Power CEO. “In a challenging year across all sectors, our teams have demonstrated exceptional dedication to the achievement of our business goals while continuing to prioritize health and safety. These milestones further prove our track record in the development, construction and operation of high-quality generation assets, enabling the accomplishment of sustainability targets by us and our renewable energy offtakers.”

The start of operations at the Cimarron Bend expansion, on which construction began in the second quarter of 2020, further cements Enel Green Power’s status as the largest wind operator in Kansas by managed capacity. The overall 599-MW facility is expected to generate a total of more than 2.7 TWh per year, equivalent to avoiding about 1.7 million tons of CO₂ emissions. Enel will sell the facility’s energy output through a 150-MW power purchase agreement (PPA) with Evergy, an investor-owned utility based in Kansas City, Missouri, and a 30-MW PPA with the Missouri Joint Municipal Electric Utility Commission (MJMEUC), a joint action agency [1] of the Missouri Public Utility Alliance (MPUA) [2].

White Cloud, on which construction began in summer 2019, is due to generate about 950 GWh annually while avoiding the emission of more than 621,000 tons of CO₂ per year. Enel Green Power North America signed a PPA with Associated Electric Cooper-

ative Inc. (AECI) in which the Springfield, Missouri-based electric cooperative will purchase the entire energy output from the plant.

In Missouri, Enel also operates the 300 MW Rock Creek wind farm in Atchison County, which sells its entire output to Evergy.

The construction process for Cimarron Bend and White Cloud followed Enel Green Power's Sustainable Construction Site model, a collection of best practices aimed at minimizing the impact of plant construction on the environment.

The Cimarron Bend construction site team adopted a recycling program and is set to be donating office supplies as well as equipment to local schools in need with the aim to extend the products' useful lives alongside diverting them from landfills. The White Cloud operations and maintenance (O&M) building is a refurbished and repurposed space, an approach adopted to reduce the costs and environmental impact from construction of new O&M buildings.

In the final stages of construction, Enel closely monitored the emergent COVID-19 pandemic and responded to protect the health of its workers and the community. While abiding by the guidance of public officials, the company implemented strict travel guidelines and enhanced sanitation, as crews implemented safe working habits and physical distancing instructions. Furthermore, Enel North America announced more than \$1.3 million in contributions to relief efforts across the U.S. and Canada.

Enel Green Power has three projects under construction in the United States: the 299-MW Aurora wind farm in North Dakota and two solar-plus storage projects in Texas: Lily (181 MW) as well as Azure Sky (284 MW).

As part of the Enel Group's three-year strategic plan announced in November, the company is planning to bring an additional 3 GW of renewable capacity online in North America by 2023.

MORE INFO www.enelgreenpower.com

Siemens Gamesa seals first wind project in Ethiopia

Siemens Gamesa has signed its first wind-power project in Ethiopia with state-owned electricity company Ethiopian Electric Power (EEP), strengthening its leadership in Africa as the country begins to expand its green energy capacity to meet ambitious renewable targets.

The 100-MW Assela wind farm will be between the towns of Adama and Assela, approximately 150 kilometers south of the capital, Addis Ababa, and will contribute to clean and affordable power for the country's electricity grid.

The country has set an ambitious target to supply 100 percent of its domestic energy demand through renewable energy by 2030. According to the African Development Bank, Ethiopia has abundant resources, particularly wind, with a potential 10 GW of installation capacity and having installed 324 MW at present.

"Siemens Gamesa is intent on expanding its leadership across Africa, and in turn help a growing transition to green energy across the continent," said Roberto Sabalza, CEO for Onshore Southern Europe and Africa at Siemens Gamesa. "So, we are extremely pleased to begin work in Ethiopia and look forward to collaborating with both EEP and the country to continue to promote their drive to install more renewables and meet transformational energy targets."

According to a Wood Mackenzie forecast, about 2 GW of wind power would be installed in Ethiopia by 2029.

The wind farm will be made up of 29 SG 3.4-132 wind turbines and is expected to be commissioned by the start of 2023. The project will generate about 300,000 MWh per year. Siemens Gamesa will provide full engineering, procurement, and turnkey construction.

The Assela wind project will be financed by the Danish Ministry of Foreign Affairs via Danida Business

Finance (DBF) adding to a loan agreement signed between the Ethiopian Ministry of Finance and Economic Cooperation (MoFEC) and Danske Bank A/S.

Ethiopia has many renewable resources covering wind, solar, geothermal, and biomass, and the country aspires to be a power hub and the battery for the Horn of Africa.

The country's National Electrification Program, launched in 2017, outlines a plan to reach universal access by 2025 with the help of off-grid solutions for 35 percent of the population.

Siemens Gamesa is among the global leaders in the wind power industry, with a strong presence in all facets of the renewable energy business: offshore, onshore, and services. With more than 107 GW installed worldwide; Siemens Gamesa is an ideal partner for Ethiopia at this critical juncture in the East African nation's accelerating energy journey.

MORE INFO www.siemensgamesa.com

Ashtead appoints CFO, expands management team

Ashtead Technology recently appointed a chief financial officer (CFO) and five managers for newly created roles across its international team.

The appointments underline the integrated subsea technology and services company's strategic growth plans to cement its leading position in the global offshore energy market and build on its recent success in new and emerging markets, including in offshore wind and decommissioning.

Ingrid Stewart assumed the new CFO position, bringing 23 years of corporate finance experience to the Aberdeenshire headquartered business, which employs 170 people around the world.

Stewart spent eight years with EnerMech Group as corporate development director where she managed

the completion and integration of multiple acquisitions for the firm, as well as developing and executing long-term strategies.

Prior to this, she was a member of the senior U.K. management team at Simmons & Company International, becoming the investment bank's first ever female corporate finance director in 2009.

A specialist in subsea construction, IMR, and decommissioning services, Ashtead Technology has acquired five businesses since 2017 and, as a result, boasts one of the largest equipment fleets in the industry and a depth of associated services capability.

In her new role, Stewart will work with the senior team to position the company for further growth and further leverage existing capability.

"After watching the business successfully grow through acquisition over the past few years and increase its foothold in the offshore renewables and decommissioning sectors, I



Ashtead Technology CFO Ingrid Stewart. (Courtesy: Ashtead Technology)

am thrilled to be joining the talented team at Ashtead Technology," she said. "The company has significant growth potential, and I'm looking forward to supporting its future aspirations."

The new Aberdeenshire based managerial hires across Ashtead Technology include Lili Hughes as group QHSE manager, Stephen Booth as decommis-

sioning BD manager, and asset integrity project manager Michael Gibson. In addition, Mark Vela has joined as U.S. operations manager in Houston, and Dan Davies has taken up his new role as NDT market manager within the company's inspection solutions team in Bedfordshire, England.

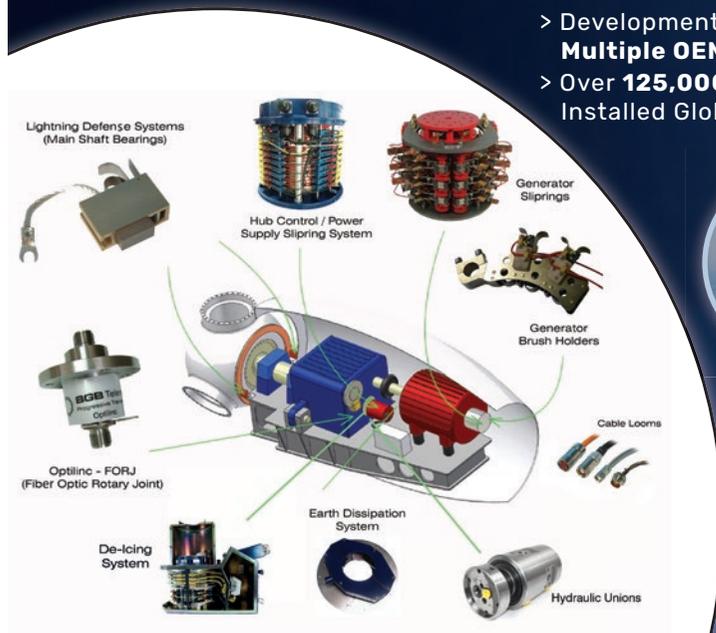
"Ingrid's substantial corporate finance and energy industry experience will make a significant contribution to our growth ambition as we further integrate and invest in our global operations to support the increase in business in offshore wind, decommissioning, and oil and gas," said Ashtead Technology CEO Allan Pirie. "Bolstering our management team in the U.K. and the U.S. will ensure we are well equipped to support our clients as we navigate the current challenges and capitalize on the opportunities presented by the energy transition and the blue economy." ✎

MORE INFO www.ashtead-technology.com

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TURBINE MAINTENANCE ▶ O&M OPERATIONS

PREVENTING LIGHTNING DAMAGE TO TURBINES

Dust, in particular, is a lightning magnet, and the cleaner the blades, the fewer opportunities exist for dust to settle onto the blade and attract lightning. (Courtesy: Shutterstock)



Even though there have been many technical advances that aid in reducing lightning damage to wind assets, the bottom line is continued maintenance is the only real way owner-operators can protect their investment.

By ALLEN HALL

Wind-turbine damage caused by lightning strikes seems unavoidable. After all, wind-turbine farms by their nature are located in a very active weather zones. But with today's maintenance methods and lightning protection techniques, the actual downtime caused by lightning damage can be significantly reduced. It all comes down to knowledge and proactive decision making.

CHANGING HOW WE THINK ABOUT LIGHTNING DAMAGE

In a recent interview, DNV-GL engineer Alex Byrne explained that when teams assess new project sites, "We can forecast what we expect the lightning damage to look like at the site ... and how the presence of turbines impacts lightning."

In other words, it's not a question of whether lightning will affect a site, it's when — and how great an impact the lightning will have.

The longer turbines are in service, the more critical maintenance becomes to maximizing its productive lifetime. Striking a balance with aging equipment is tricky, however. For example, owners of mature equipment have found that although power curve upgrades and other retrofits designed to increase Annual Energy Production (AEP) are effective, they increase the risks associated with lightning strikes.

Fortunately, there are a number of practical measures that can reduce the risk of lightning damage or other catastrophic failures, even when blade aerodynamics have been modified, either by design or by normal wear. Most of those measures also contribute to improving production and reducing lifecycle costs.

The bottom line: Maintenance is the only real "insurance" owners have that their investment will continue to generate power (and profits).

PROTECTIVE MEASURES FOR BLADES

Regardless of manufacturer, age, or size, blade maintenance

is critical. More than 40 percent of all structural damage reports cite blade damage.

The resulting downtime has obvious and immediate impacts on revenue, but when such failures repeatedly occur, they can have long-term detrimental effects on operations, especially if customers seek more reliable energy providers.

Generally, damage in wind blades can arise due to manufacturing defects, precipitation and debris, water ingress, variable loading due to wind, operational errors, lightning strikes, and fire. Early detection and mitigation techniques are required to avoid or reduce damage in costly wind-turbine blades. This article provides an extensive review of viable solutions and approaches for damage mitigation in wind turbine blades.

The most obvious and economical maintenance exercise to maintain turbine blade integrity is to clean and inspect blades regularly.

From a maintenance standpoint, the cleaner the blades, the easier it is to see minor cracks and other issues that should be addressed before they become more concerning

(and costly). But even before deterioration can occur, the dirt itself presents significant dangers.

CAN DUST AND DIRT ACTUALLY ATTRACT LIGHTNING?

Dust, in particular, is a lightning magnet, and the cleaner the blades, the fewer opportunities exist for dust to settle onto the blade and attract lightning. Though we commonly only think of metallic items as being conductive, the truth is that dirt and dust have enough conductivity that, when caked on a blade, they will begin to attract lightning.

Oil, salt, and dirt all find their way into minute fissures, contributing to both blade deterioration and higher conductivity, which is attractive to lightning.

Regular cleanings and inspections help ensure blades are free of contaminants and buildup.

Cleaner blades also mean cleaner drains. Effective drain operation is critical to blade longevity, because any amount of water trapped inside the blade creates an attractive path for lightning to travel through.

During a lightning storm, strong electrical fields are at work. Even in the absence of direct lightning strikes, the electric field is amplified near the blade tips, where air can ionize and form energetic, high-voltage streamers and leaders.

Those streamers or “near strikes” create permanent fissures in the blades’ structure. Although many of those fissures are too small to easily see with the naked eye, over time, storm activity will cause multiple fissures, rendering the blade electrically porous. Its compromised dielectric strength makes it more susceptible to being penetrated by lightning.

While inspecting blades regularly and keeping them reasonably clean will help identify problems early to address premature wear, there are many other critical steps to mitigating the risks lightning poses to turbine blades and other equipment.

WATER PRESENTS ADDITIONAL THREATS

Wind turbine blades, like building foundations, are susceptible to many problems caused or exacerbated by water ingress. As water enters the blades through pre-existing cracks or surface defects due to erosion, some moisture enters the interior of the blade, while some is absorbed by the core.

During ensuing freeze-thaw cycles, retained moisture enlarges microcracks in the composite, which leads to debonding of the fiber-matrix interface or delamination on the surface.

However water is introduced, it poses multiple threats to the blade. In addition to moisture creating a clear path for lightning to travel and deteriorating the composite structure, it also allows corrosion to form. When dirt, corrosion, or any contaminant sits anywhere along a lightning down-conductor’s path, especially in contacts or joints, then lightning could damage the down-conductor.

Regular cleaning and inspections will help identify



A wind-turbine blade showing delamination at the tip following a lightning strike. (Courtesy: Weather Guard Lightning Tech)

when and where repairs should be applied to minimize surface deterioration.

RETROFITS AFFECT AERODYNAMICS, EXACERBATE LIGHTNING RISKS

Power-curve upgrades, winglets, trailing edge serrations, and other retrofits are intended to increase blade and turbine performance by improving airflow and aerodynamics. They're proven effective, either by providing a power boost, or, in the case of trailing-edge serrations, a noise-dampening effect that allows turbines to be operated at a greater velocity, so they can increase power production without exceeding noise limits.

Thanks to their proven results and demand to increase both production and equipment life, retrofits are becoming fairly common. However, owner/operators who are unfamiliar with how retrofits change the way lightning interacts with turbine blades may not realize that retrofits warrant updates to the blades' lightning protection systems as well.

Fortunately, installing segmented lightning diverter strips at the same time the retrofits are installed proactively addresses the problem, while adding only a minimal incremental expense compared to the total retrofit costs.

BEWARE AGING BLADES

Like dirty blades and some aerodynamic modifications, leading edge damage changes airflow behind the blades. These changes can cause the ionized stream of air off the receptor to be dispersed — making it hard for lightning to follow.

There is a direct correlation between the efficiency of the lightning receptors and the blade's aerodynamics. Small metal receptors near the blade tips need to create an arc in the air — a “smooth” stream of ionized air for the lightning to follow.

Factory-fresh blades enable smooth airflow over the receptors, producing a clean (or mostly clean) ionized stream of air behind the blade.

The “smoothness” of the air is very dependent on the condition of the blades — the newer the better. Lightning reliably follows a smooth stream of ionized air. But as blades age, a combination of turbulence and leading edge damage occurs, so air is dispersed less evenly. Wear depends on dozens of factors, but generally after about five years, blades are worn to a point where they are no longer creating a smooth arc.

Absent a smooth arc to follow, the receptor is significantly less effective and the down conductor becomes more attractive to lightning, which always seeks the path of least resistance to the ground.

When lightning, even small leaders, strikes the blade, it will start splitting open. The cycle will continue until one of the strikes renders the blade useless. Costly downtime ensues.

Installing segmented lightning diverter strips, which create a continuously ionized air stream for the lightning



A wind-turbine blade tip with three StrikeTape lightning diverters installed. (Courtesy: Weather Guard Lightning Tech)

to follow, can prevent this cycle from occurring.

CONSTANT IMPROVEMENTS CONTINUE TO REDUCE RISKS

While monitoring data for changes in operation is important, we know that maintenance does not always have a predictive component. In other words, you can only prepare for lightning and other catastrophic events, you can't monitor it away.

In the past two decades, we have gained a deeper understanding of lightning behavior and the associated risks to people and equipment, we've also seen and will continue to see tremendous improvements in technology, training, and maintenance practices. As in any rapidly-growing industry, best practices and standards will emerge slowly, so now and for years to come, wind-energy professionals will rely on networking and “tribal knowledge” to determine the best maintenance practices and lightning protection measures for each operation.

Bjorn Hedges, who manages two wind sites in Washington and chairs ESIG's Wind, Solar, and Energy Storage Operations and Maintenance (O&M) Users Group, said he sees “perpetual improvement” in operational, safety, and maintenance practices. He attributes the rapid advances to a growing number of third-party equipment manufacturers and services and more so, to networking and sharing of the industry's collective knowledge both in formal organizations like the ESIG Users Groups and in informal conversations among experts throughout the industry.

There may never be a complete and up-to-date maintenance guide for preventing lightning damage in wind operations around the world, but today and always, industry experts are willing to share their expertise to see continued growth and improvement in the field. ✌

ABOUT THE AUTHOR

Allen Hall is an aerospace and electrical engineer with more than 20 years of experience in lightning protection. As the founder and CEO of Weather Guard Lightning Tech, Allen discusses industry news and technology with other experts on the Uptime podcast. He can be reached at 413-217-1139 or allen.hall@wglighting.com.

THE IMPORTANCE OF BEING PROACTIVE

A typical wind-turbine gearbox contains three shafts: the low-speed shaft, the intermediary shaft, and the high-speed shaft. (Courtesy: Olympus)

Improving wind-energy production through videoscope inspections of wind turbines.

By MASAKAZU WADA

A wind turbine's gearbox, generator, and blades are the focus of intensive maintenance because (1) they're subject to a lot of stress and wear and (2) they are costly parts to repair.

Although gearbox failure is relatively rare — once a decade on average — the downtime for a wind turbine while waiting for this part to be repaired can be almost half a year. (According to a 2018 report by Deloitte Thomas, the average downtime of gearbox failure is 167 days as the delivery time of a new gearbox or gearbox parts is long.)

A typical 2.4-MW wind turbine generates about a \$1,000 worth of electricity per day, so several months of downtime can be very costly in terms of lost revenue. Catastrophic gearbox failure, such as a fire due to overheating, is also a possibility. In that case, the wind turbine may be permanently out of commission.

MINIMIZE COSTLY DOWNTIME

Between up-tower visits for oil sampling and noise checks, the condition of wind turbines is typically monitored using a supervisory control and data acquisition (SCADA) system or a condition monitoring system (CMS). The SCADA or CMS device collects vibration and oil inline data from the wind turbine to help predict or detect faults in the blades, main bearings, and gearbox up to 30 days before a failure.

However, SCADA and CMS error information does not pinpoint the exact faulty part or specify the failure conditions. Furthermore, a 30-day warning in the case of gearbox failure could still leave the wind turbine out of commission for several weeks while waiting for parts. Supplementing a preventative maintenance strategy using a remote visual inspection (RVI) device to see inside the gearbox can give inspectors an earlier and more precise indication of the faulty component.

INTERNAL VISUAL INSPECTION SUPPORTS INTELLIGENT DECISION-MAKING TO PREVENT FAILURES

With a nearly six-month delay in the delivery and replacement of certain gearbox components, the earlier inspectors can determine which part is needed, the shorter the downtime for the wind turbine. And knowing the potential failure conditions enables inspectors to make proactive and informed decisions about the parts' purchase and maintenance plan. Periodic borescope or videoscope inspections during low wind season, for example, can help monitor any internal deterioration in the gearbox and possibly prevent equipment failures.

A TIP TO SAVE TIME IN WIND-TURBINE INSPECTION

Videoscopes offer intelligent illumination, maneuverabil-

ity, and oil-resistance that help inspectors save time and improve the probability of detection of internal flaws in wind-turbine gearboxes. With the introduction of an oil clearing tip adaptor for the videoscope, inspections can continue without losing time in tip extraction and manual cleaning when the scope tip comes into contact with oil.

Inspecting inside the gearbox of a wind turbine is among the most time-consuming and difficult videoscope inspections. The combination of large size, dark conditions, reflective metallic surfaces, and the presence of oil all make detecting damage difficult for inspectors.

Wind-turbine gearboxes are particularly vulnerable to damage owing to their extreme operating conditions. High speeds and high stresses mean small defects can easily lead to gearbox failure or even to turbine fires. Measurement tools such as vibration sensors can monitor potential damage continuously, but only remote visual inspection (RVI) provides a thorough analysis of the state of a gearbox (Figure 1). So where does an inspector look when inspecting a gearbox?

INSIDE A WIND-TURBINE GEARBOX

The function of the gearbox is to convert the slow rotation of the blades and the low speed shaft into a fast rotation to drive the generator. This process takes place in a series of transmissions (Figure 2). During an inspection, each transmission needs to be thoroughly examined, including the gear teeth and the bearings that support the shafts.

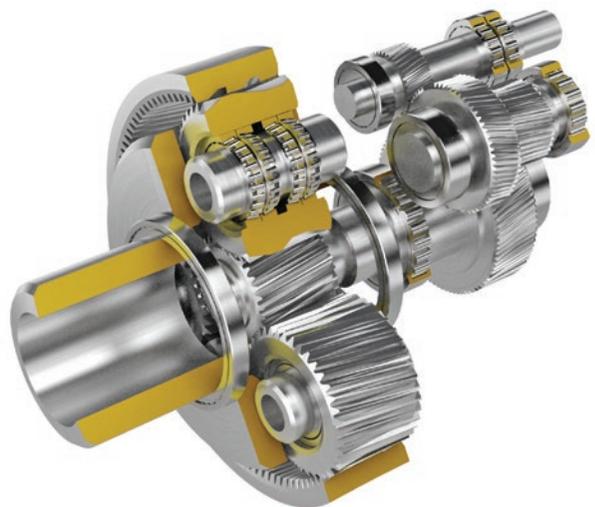


Figure 2: Gearing up: The turbine's generator is driven by the blades through a series of transmissions.



Figure 1: A look in the gear[box: Turbine inspectors use videoscopes as a quick, efficient way to detect gearbox damage.

A typical wind-turbine gearbox contains three shafts: the low-speed shaft, the intermediary shaft, and the high-speed shaft. The low-speed shaft is directly driven by the blades and only rotates at a speed of between 20 and 30 revolutions per minute (RPM). However, in adverse weather conditions, the low-speed shaft needs to be able to absorb the extra stresses caused by strong winds. The high-speed shaft, on the other hand, is better protected against adverse weather but is still vulnerable between 1,500 and 1,800 RPM.

All three shafts are surrounded by stage bearings; these provide support to the different shafts by preventing lateral motion. Some of these bearings – the planetary stage bearings supporting the low-speed shaft, in particular – are in difficult-to-access locations from an inspector's point of view.

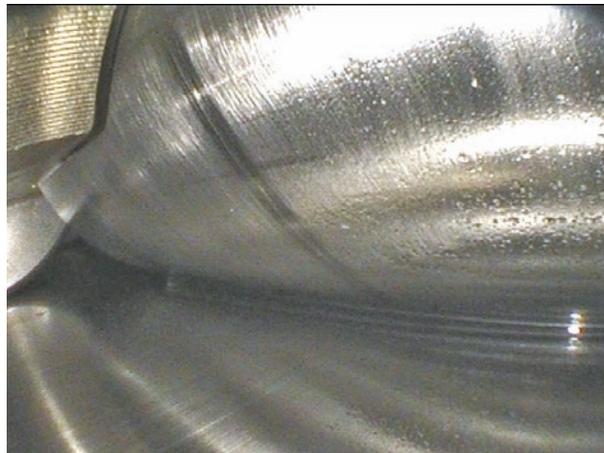
CREATE SHARP IMAGES WITH THE OIL CLEARING TIP ADAPTOR

During operation, all gears and bearings are lubricated with oil. This means that during inspection the tip of the videoscope may come into contact with oil, which can lead to blurred images. When this happens, the inspector must retract the tip for cleaning and reinsert the scope tip into the gearbox and attempt to find its last location. As an alternative, the oil can be drained from the gearbox before the inspection begins, but this also adds to the overall inspection time.

To save time for inspectors, a dedicated oil clearing tip adaptor for the videoscope will help eliminate the risk of blurred images, so oil on the scope tip is no longer a concern.



Figure 3: In the spotlight: Adaptive illumination improves the probability of detecting flaws in dark spaces.



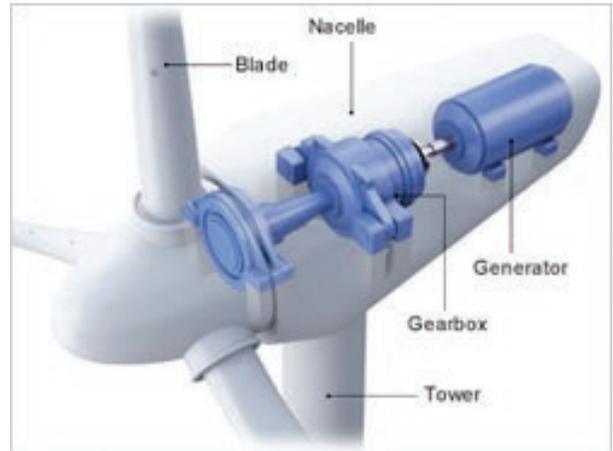
View inside a gearbox on the videoscope screen. (Courtesy: Olympus)

The oil clearing capability works by using capillary action through grooves on the side of the tip adaptor. As a result, oil is drawn away from the lens without the need for tapping or cleaning while the scope tip is inside the gearbox.

SMART ILLUMINATION AND MANEUVERABILITY

To reach every corner of the gearbox – and to take images that give reliable information about the state of the different components – videoscopes need to operate to the best of their capabilities. One important capability is illumination; the combination of large, dark spaces and highly reflective metallic surfaces poses a challenge when trying to produce images with the optimal brightness and contrast for reliable damage detection.

To address the issue of uneven brightness across the field of view of the camera, the image processing of the videoscope should automatically adjust the light intensity. The intelligent illumination processor provides light output on



Internal gearbox inspection using a videoscope. (Courtesy: Olympus)

the conditions within the gearbox, which helps to produce clearer images with less noise and improve probability of detection (Figure 3).

Another major obstacle for fast inspections of large systems, such as gearboxes, is poor maneuverability of the scope tip. During the inspection, the operator spends a significant amount of time maneuvering toward a target. This means flexible and fast articulation can reduce the time required to move the scope tip, so more time can be spent on visual inspection and capturing images.

Combining adaptive articulation with an intuitive interface on the videoscope will help improve the inspector's hand-eye coordination. Good maneuverability and adaptive illumination make it easy to move through narrow openings without damaging the scope tip.

SUMMARY

Videoscopes fitted with an oil clearing tip adaptor are well suited to deal with all the complicating factors of wind-turbine gearbox inspections: size, complexity, lighting conditions, narrow openings, and the presence of oil. However, the speed and precision of the inspection rely heavily on several key features of the videoscope, such as adaptive illumination, intuitive maneuverability, and oil resistance. The Olympus IPLEX RX videoscope is equipped with these features to save time and help to produce clearer images, thereby improving probability of detection and contributing to wind-turbine safety. ✎

ABOUT THE AUTHOR

Masakazu Wada is Olympus Marketing Manager, Remote Visual Inspection. Wada provides global technical support for remote visual inspections. With almost 30 years of experience in application support for the aviation and power-generation industries, Wada pays close attention to the customer workflow to offer simple, effective solutions. For more information, go to www.Olympus-IMS.com.

REDUCING COSTS FROM THE GROUND DOWN

Compared to the gravity spread foot wind turbine foundation, the CPHP foundations require up to 70 percent less concrete and reduce earthwork related to excavation by up to 80 percent in the CPHP. (Courtesy: Terracon)



A new type of wind-tower foundation could provide construction cost savings while having the benefit of performing longer.

By BLAIR LOFTIS

To lower the levelized cost of electricity (LCOE) generated by wind energy, the next generation of wind-turbine foundation solutions should be optimized to reduce the design and construction costs of wind turbines. These advanced foundation solutions help fill the gap following reduction in the production tax credit (PTC) benefits and lower capital expense for the power system construction.

REDUCING COSTS

Over the last decade, wind-energy pricing has declined by 70 percent, which is a remarkable achievement. However, wind must now compete with its renewable cousin, utility-scale solar, which has achieved a cost profile comparable to that of existing natural gas generation. P&H foundations are a strategy key to lowering the capital cost requirement of wind projects, which in turn, will better position wind power in a highly competitive market.

Patrick & Henderson (P&H) soil- and rock-anchor foundations and the Collar-P&H tensionless pier (CPHTP) foundations are the next generation of wind-turbine foundations. There is a P&H solution for most every onshore wind project, providing construction cost savings with superior long-term performance. The cost of utility-scale wind projects is about \$2 million per turbine installed. The turbine foundation accounts for approximately 17 percent of the cost, so the cost savings of P&H foundations are a significant positive impact for the project.

Compared to the gravity spread foot wind turbine foundation, the CPHTP foundations require up to 70 percent less concrete and reduce earthwork related to excavation by up to 80 percent in the CPHTP. The savings are greater the larger the wind turbine generator, higher the tower, and longer the blades, all of which fit the current market trends. For example, the break point for meaningful cost savings of a P&H foundation compared to a spread foot is realized at a turbine size exceeding 2 MW. However, the savings in concrete alone for a 4.5-MW land-based application would be more than 325 cubic yards. Overall, these alternative foundation designs represent a savings of anywhere from \$250,000 to \$400,000 per foundation depending upon site conditions and turbine size. (Figure 1)

SITE COMPATIBILITY

To consider the viability of a CPHTP foundation for a wind turbine, the first step is to assess the site compatibility. One of the foundations (Collar-P&H tensionless pier, rock anchor, or soil anchor) will be compatible in nearly all situations and will provide cost savings compared against the gravity spread foot foundation. Still, it is a “horses for courses” de-

termination that is required to ensure the most appropriate option is selected.

This is simpler than it might seem. Two criteria must be met to verify compatibility for the CPHTP foundation. First, the depth of groundwater must be below the termination of the excavation. Second, soil conditions must be favorable, which means self-standing soils (minimal sloughing or caving when excavated). If these conditions cannot be met and the site exhibits weak, saturated or non-self-supported soil or rock that cannot be excavated, then one of the two anchor solutions will be more appropriate.

After the initial compatibility analysis, a more detailed design is initiated, which takes into consideration anticipated geohazards, grading and drainage plans, loading, and constructability and applies these as weighted factors to preliminary foundation design calculations.

GEOTECHNICAL CONSIDERATIONS

P&H foundations are not your grandmother’s foundation. The geotechnical investigation for design considerations requires specific applications. Geotechnical exploration should include in-situ test methods to obtain direct measurements of the foundation soil’s stiffness and shear strength parameters. Typically, vane shear testing or cone penetration test with pore water pressure measurement (CPTu) is performed in saturated cohesive soils. In the case of highly dense soils and rock, soil/rock pressure meter testing should be performed.

Laboratory testing of the samples obtained during the characterization should include isotopically consolidated undrained tri-axial tests with excess pore water pressure measurement and constant rate-of-strain (CRS) tests for fine-grain soils. Slake durability tests should be performed for shales and other clay-bearing rocks, and in-situ permeability should be determined for any rock mass.

Ultimately, the geotechnical engineer will divide the area into zones based on the subsurface profile from boring logs, soundings, in-situ test results, and laboratory test results. Then, geophysics comes into play for confirmation of the previously designated zones. Using the multichannel analysis of surface waves (MASW) method or any other equivalent method, shear wave velocity and small-strain shear modulus profiles are obtained for each zone (typically three MASW readings per zone). The final assessment is produced in the form of a heat map that portrays locations in “green” as compatible, “yellow” as marginal, and “amber” as incompatible for the foundation option being considered. It is unlikely that the heat map will reveal that any of the P&H foundation types (CPHTP and P&H soil- and rock-anchor) will not be suitable for the site.

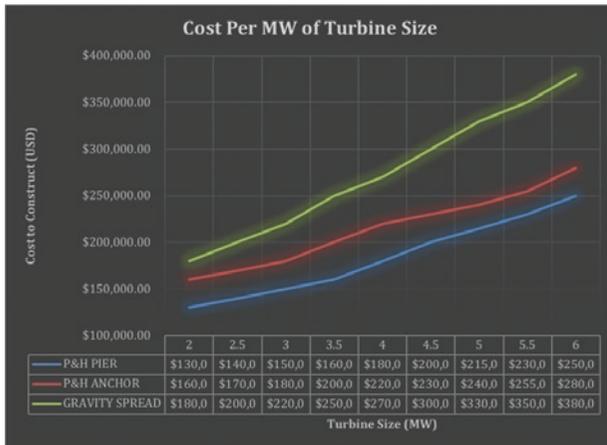


Figure 1

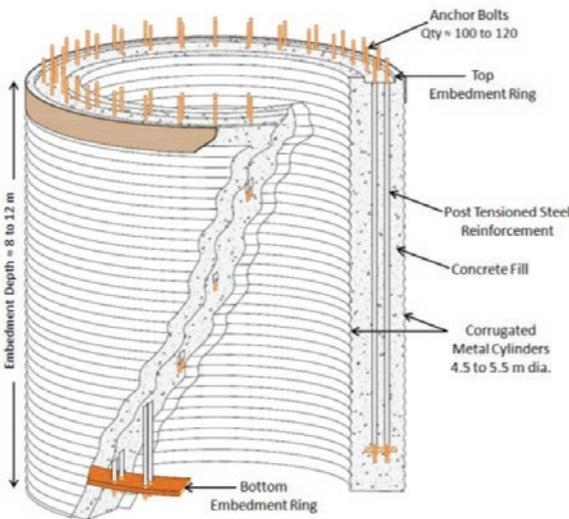


Figure 2

THEORY AND DESIGN ATTRIBUTES

The most common application of P&H foundations is the CPHTP. This is an intermediate foundation system. The depth-to-length (D/L) ratio of the PHTP falls between the criteria for shallow and a deep foundation, and as such, cannot be categorized as either one. The response of the PHTP to the loading from the wind turbines is resisted through deformation of the foundation itself and the rigid body movement. The PHTP system configuration is basically a confined concrete mass between two corrugated shells; the confinement is achieved by prestressing the anchor bolts that go through the tower flange to an embedded ring at the bottom of the foundation. (Figure 2)

Structural concrete of the foundation is kept in compression through post tensioning of the anchor bolts. In general, this is a significant benefit over the spread-foot foundation, because it eliminates the need for costly structural steel and

provides better response to fatigue loading. For any material with grain matrix, as the stresses remain in the compression side of the loading spectra, the damage due to small amplitude repetitive loading is minimized.

Design calculations for the PHTP foundation are performed using closed-form solutions and finite element simulations (FEM). The closed-form solutions rely upon assumptions, such as elastic half space, to predict the foundation response to loading. The FEM is performed by running simulations to predict the response of the foundation to various anticipated loading conditions.

Design calculations include two main components: geotechnical stability and internal structural analysis of the pier. The calculations goal is to ensure the existing P&H Pier foundations have an adequate factor of safety against global stability (a safety factor of two or greater) and meets serviceability requirements through providing adequate rotational stiffness and minimizing differential settlement to meet or exceed the turbine manufacturer requirements.

Design elements for P&H rock anchor and soil anchor are similar, relying upon a prestressed concrete cap and a grouted ground anchor soil or rock anchors. The pre-tensioning of the soil/rock anchors improves the subgrade under the cap by compression and provides adequate resistance to limit the movement of the cap and thus meets the global stability and serviceability requirements. The numerical simulations and closed-form solutions determine the depth, diameter, and quantity of the anchors.

RISK REDUCTION

Another advantage of the CPHTP is the inherent global stability. The geometry of the CPHTP will prevent possible catastrophic failure such as overturning, sliding, and bearing capacity. It is unlikely that driving moments will mobilize the passive wedge and overcome resisting moments from passive earth pressure above the rotation point of the rigid body. The resistance for sliding is also resisted by the passive earth pressure, which will be significant, and it will satisfy the required safety factor. The diameter and depth of the PHTP will also ensure the development of sufficient axial capacity to resist vertical loading and prevent bearing capacity failures of the underlying material.

The CPHTP foundation solution is beneficial in seismically active areas because it provides a better seismic response than a gravity system foundation or deep foundations. The geometry of the PHTP and the flexibility will prevent rocking movement, and it will also provide enough resistance to the deformation as the seismic wave propagates.

In addition, in liquefiable soils, it is unlikely for the PHTP to be sheared by lateral spread due to the size of the foundation, the confinement from the CMPs, and the prestress in the anchors.

Another advantage is the foundation’s response to erosion and scouring. Significant issues have occurred on wind projects in or near foothills or mountainous areas such as Palm Springs and the Tehachapi areas of California that



The CPHTP foundation solution is beneficial in seismically active areas because it provides a better seismic response than a gravity system foundation or deep foundations. (Courtesy: Terracon)

are prone to heavy episodic rains. Erosion events from extremely swift surface water flow have removed several feet of soil exposing and, in some cases, undermined gravity foundations. For the CPHTP the first two to four feet of the soil profile is intentionally replaced by a concrete collar.

REPOWERING APPLICATIONS

Due to the geometry and relatively small diameter of these foundations (18 feet for the CPHTP and 30 feet for the anchor foundations) it is common to reuse the same foundation for a new larger wind turbine. Minimal and inexpensive modification are used for the addition of a supplemental collar. This extends the life of the original foundation and saves considerable time and expense.

INDEPENDENT REVIEW

These foundation systems have undergone favorable independent review by Sargent & Lundy and UL Renewables (formerly AWS Truepower). A basis of design review for the PHTP is being conducted by DNV-GL and is expected to be complete in early 2021. ✎

ABOUT THE AUTHOR

Blair Loftis is vice president, national director — Power Generation & Transmission at Terracon and is responsible for overseeing Terracon's Power Generation & Transmission market sector. This includes coordinating Terracon's professional services and technical expertise to assist clients in the siting and design of renewable generation, conventional generation, and electrical transmission projects. Loftis has worked in the energy sector for 20 years.

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Ørsted operates the Block Island Wind Farm, the first offshore wind farm in the U.S. (Courtesy: Ørsted)

Ørsted is a global leader in offshore and onshore wind development and brings years of essential experience to guide regulators, business leaders, and the general public as the industry grows within the U.S.

By **KENNETH CARTER** ▸ Wind Systems editor

When a decades-old company completely revises its entire business model with the goal of making the world a better place, it's important to point out just how rare that is.

But Ørsted began that journey 10 years ago when it realized a drastic change was not only important, but paramount, according to Francis O'Sullivan, senior vice president of strategy with Ørsted Onshore North America.

"A decade ago, Ørsted was a large fossil fuel energy company that significantly contributed to Europe's greenhouse gas emissions," he said. "Yet, in a world where the sea levels are rising, natural disasters are becoming more extreme, and glaciers are melting, Ørsted realized that its business structure wasn't sustainable. The company recognized that it had a unique ability as a major energy provider to address climate change by investing in carbon-neutral energy sources. As Ørsted has moved to the U.S. market, it has brought its cornerstone technologies (offshore wind, onshore wind and solar P.V.) to shape the broader American energy landscape. After one of the most impressive and successful business transformations, Ørsted became the most sustainable company in the world in 2020."

GREEN-ENERGY PORTFOLIO

Since that time, Ørsted has developed an impressive renewable energy portfolio across the globe, and it is making major inroads in the U.S. market as well, officially rebranding itself from DONG Energy to Ørsted in 2017, according to O'Sullivan.

"We have made significant progress in living up to our new namesake," he said. "Since 2006, we have reduced our coal consumption by more than 80 percent and reduced our greenhouse gas emissions by 86 percent. Renewables account for 89 percent of our energy generation today. In January of 2020, Ørsted was recognized for our transformation when ranked the world's most sustainable company in the Corporate Knights Global 100 index. For the second year in a row, CDP also recognized the company as an A-List climate leader. By outperforming more than 7,300 global companies with billion-dollar revenues, Ørsted proved that our strategic and fundamental business transformation from fossil fuel to green energy could make an environmental difference while remaining highly profitable."

Ørsted is the global leader in offshore wind development, with more offshore wind farms than any other developer in the world, according to O'Sullivan.

"By 2022, we expect to have 9.9 GW of offshore wind capacity stemming from developments across Europe, the U.S., and Taiwan," he said. "We entered the U.S. market in 2015

with our trademark offshore developments and have since expanded our portfolio to include utility-scale onshore wind, as well as PV and energy storage, making us the first dedicated pan-renewables company in the U.S. market. In the U.S. alone, we have the potential to deliver clean energy to the seven states on the East Coast that have committed to building more than 15 GW of offshore wind capacity by 2025. We operate the Block Island Wind Farm, America's first offshore wind farm, and have been awarded over 2,900 MW of capacity through five offshore projects."

ONSHORE ASSETS

While on the onshore side of wind energy, Ørsted operates 1.7 GW of wind assets in the U.S., according to O'Sullivan.

"By 2025, we aim to have 5 GW of onshore wind and solar capacity in our portfolio — and we're just getting started," he said.

As the largest offshore wind developer globally, Ørsted has provided wind energy as a reliable energy source throughout Europe for decades, according to O'Sullivan. This resource — both onshore and offshore — has quickly become a strategic cornerstone of the company's diverse and flexible energy portfolio in the U.S.

"With a robust and diverse pipeline of projects — both from a regional and technology perspective — Ørsted has built a strong North American platform to complement its existing footprint across Europe," he said. "By 2025, we aim to have 5 GW of onshore wind, solar, and storage capacity across the country, in addition to 15 GW of offshore wind capacity globally."

In 2020 alone, projects Ørsted has added to its pipeline include:

▸ **Plum Creek Wind Farm:** In June 2020, Ørsted completed its 230-MW Plum Creek project. The wind farm consists of 82 turbines, and its location in Wayne County represents the company's first parlay into resource-rich Nebraska — a growing market for renewable energy and among the top five states for wind power, according to the American Wind Energy Association.

▸ **Sage Draw Wind Farm:** In April 2020, Ørsted completed its Sage Draw Wind project, a 338-MW wind farm that straddles Garza and Lynn counties in West Texas. Positioned in oil-rich West Texas, Ørsted's Sage Draw is an example of how the renewable energy industry and more traditional oil and gas providers can coexist to reduce the area's broader carbon footprint.

▸ **Willow Creek Wind Farm:** In September 2020, Ørsted made significant strides on its Willow Creek wind farm, completing the 103-MW project in Butte County, South Dakota.



In September 2020, Ørsted made significant strides on its Willow Creek wind farm, completing the 103-MW project in Butte County, South Dakota. (Courtesy: Ørsted)

▀ **Western Trail Wind:** Also, in September 2020, Ørsted made its final investment decision on Western Trail Wind, the company's largest onshore wind project to date.

▀ **Haystack Wind Farm:** In October 2020, Ørsted expanded its footprint in the Southwest Power Pool with the acquisition and final investment decision of Haystack Wind in Wayne County, Nebraska.

▀ **Muscle Shoals Solar Project:** In July 2020, Ørsted continued to expand its solar footprint via the acquisition of the 227-MW Muscle Shoals solar project in Colbert County, Alabama.

▀ **Old 300 Solar Center:** In December 2020, Ørsted took its final investment decision on the Old 300 Solar Center in Fort Bend County, Texas.

▀ **Permian Energy Center:** Throughout 2020, Ørsted made significant headway on its Permian Energy Center, the company's first start-to-finish utility-scale solar and battery storage project. The project sits on more than 3,600 acres in Texas's Permian Basin and is designed to hold nearly 1.3 million solar modules.

Along with Ørsted's major onshore projects, for offshore, Ørsted in June 2020 constructed and installed the first offshore wind turbines in U.S. federal waters on behalf of Dominion Energy's Coastal Virginia Offshore Wind proj-

ect. In 2020, Ørsted also announced the opening of the U.S. Innovation Hub in Providence, Rhode Island, to identify, foster, and finance enterprises related to offshore wind. The Hub is focused on next-generation technology and related innovation in the offshore wind energy field. The Hub is dedicated to leveraging external innovations to advance renewable energy.

OFFSHORE POTENTIAL

That advancement is made even more incredible by the fact that only a few short years ago, only a single state was interested in building an offshore wind farm, according to O'Sullivan.

"Today, Ørsted has offshore wind contracts with states from Rhode Island down to Maryland and onshore wind projects in Texas, Nebraska, and South Dakota," he said. "States have started to set ambitious targets for green-energy production as governments have realized the nearly limitless wind-energy potential. We are here to help make the transition to a greener future."

Ørsted is on a mission to maintain a uniquely robust and diverse energy portfolio, according to O'Sullivan, where the company is striving to make the right solution available by combining energy resources in the most efficient, cost-ef-

fective, and reliable way possible to meet the system's needs. This is especially true in break-through markets such as Texas, where oil and gas have traditionally reigned supreme, using the state's vast natural resources — in this case, the wind and sun — to drive Ørsted's vision of a green-powered world.

“Ørsted also recognizes that, as the U.S. economy continues to evolve, wind and solar power are creating the careers of the future,” he said. “The U.S. currently faces an unprecedented economic crisis, making job creation as essential as ever. Post-pandemic, Ørsted believes that green energy will pave a path to economic recovery in the wake of a downturned economy. Across the U.S., Ørsted is investing in large infrastructure projects that require a network of domestic suppliers, and in some cases, an overhaul to the current manufacturing facilities. Ørsted is proactively seeking to stimulate local economies and create jobs.”

SUPPORTING CLEAN-ENERGY JOBS

With more than 120,000 U.S. workers in wind-powered careers, Ørsted has pledged to support this continued job growth with its project portfolio as well as through direct community engagement, according to O'Sullivan.

And O'Sullivan emphasized that part of that growth involves Ørsted working diligently with its customers in order to provide reliable and stable energy solutions.

“We work closely with our customers and developers to fully understand and inspect every aspect of the pipeline, which helps us ensure minimal disruptions and delays when developing the project and allows us to identify any issues quickly should they come up,” he said. “Starting in June 2019, Ørsted began working with a customer headquartered outside the U.S. who was struggling to capitalize on the robust virtual PPA market in the U.S. due to the market-to-market accounting challenges. Alongside that corporation's appointed third-party adviser, we developed a suite of structural solutions that ultimately enabled the customer to lock in a competitive price for renewable energy while minimizing their market exposure and their financial exposure to volatile power prices. Collaboration, both internal and external, proved tantamount in finding the solution that best fit the customer's needs.”

CULTURAL AND ENVIRONMENTAL SHIFT

It is important to remember that it wasn't too long ago that Ørsted, formerly DONG Energy, was one of the most fossil-fuel-intensive energy companies in Northwest Europe.

However, a growing societal focus on climate change, the launch of the EU 2020 energy policy goals, and a growing consensus about the need to transform global energy systems led Ørsted in 2008 to formulate a radical vision of transforming its business model from fossil fuels to green energy, according to O'Sullivan.

“Understanding the limitations of the Earth's finite resources, such as oil and gas, Ørsted was inspired to rethink its business strategy and henceforth embarked on its im-



Ørsted's Permian Energy Center is the company's first start-to-finish utility-scale solar and battery storage project. (Courtesy: Ørsted)

pressive transformational journey,” he said.

In 2017, DONG Energy rebranded to Ørsted with a revitalized commitment to shift its power source by developing green, independent, and economically viable energy systems, according to O'Sullivan.

“Ørsted's decision to divest from fossil fuels and its commitment to be carbon neutral by 2025 and have a carbon-neutral footprint by 2040 has revolutionized how big energy companies think about decarbonization and their ability to limit global warming,” he said.

LOOKING TO THE FUTURE

Today, as one of the world's leading renewable energy companies, Ørsted supplies more than 15 million people with clean energy, according to O'Sullivan. The company's goal is to increase this figure to 30 million by 2025, deliver the future of energy, and be a trusted partner in the communities it serves.

“Ørsted's vision is to transform the way we power the world,” he said. “We've been in the U.S. for about five years, and it's a huge opportunity both for Ørsted and for Americans who can benefit from the green-energy advancements made in Europe. The U.S. is forecasted to experience significant renewables growth in the coming years. Wind and solar energy are cost-competitive and one of the fastest-growing sectors of the economy. Our portfolio diversity will provide us with an excellent base to offer the right solutions for the expanding customer landscape. We will continue to be open to opportunities that are complementary to our existing footprint.”



Michael Wyession

Geophysicist and professor of earth and planetary sciences in Arts & Sciences ▸ Washington University

‘With wind and solar having already reached grid parity, the future’s so bright you gotta wear shades.’

Geophysicist Michael Wyession, professor of earth and planetary sciences in Arts & Sciences at Washington University in St. Louis, Missouri, teaches a popular undergraduate course called “Energy and the Environment” and is author of The Great Courses lecture series “The Science of Energy: Resources and Power Explained.” Wyession breaks down President Joe Biden’s 9-point energy plan, point-by-point, and provides his perspective on what is most doable:

▸ Reverse the Trump damage and then some.

Biden wants to initiate, reinstate and/or increase vehicle fuel economy standards, methane pollution limits, and bans on new oil and gas leases. Car companies have been focusing their R&D on meeting high mileage standards, particularly by a shift to electric vehicles (EVs), so they don’t mind high standards as long as the playing field is level. Big petroleum companies are frustrated with the lack of compliance by smaller fracking firms, so they support stricter methane release controls.

The lack of enthusiasm by oil companies for the sale this month of oil leases in the Arctic National Wildlife Refuge was stunning. *This is all doable.*

▸ Push legislation toward economy-wide net-zero greenhouse gas emissions by 2050.

Any legislation in today’s incredibly partisan U.S. Congress is a challenge, but particularly on this contentious topic. However, technological advances have made wind and solar power cheaper than any fossil fuel, including natural gas, and there are now multiple pathways for this to happen, as identified in last month’s report from Princeton University’s ‘Net-Zero America’ project. *Possible.*

▸ Re-engaging with other countries on climate efforts, including rejoining the Paris accords.

Rejoining is not as easy as you might think, but four years

gives this administration plenty of time. Biden will have a tougher time convincing other countries that he can set enough things in motion to prevent another major setback should an administration as anti-science as Trump’s return in 2024. *Likely.*

▸ Invest \$400 billion over 10 years in clean energy and innovation.

For the past 50 years, U.S. presidents have always invested in energy sources in one form or another. The government supported about \$100 billion in energy-related R&D during 1973-2002, with half going toward nuclear power and the rest split between fossil fuels and renewables. The second Bush administration shifted this in 2002-08, spending nearly all of \$72 billion on subsidies for coal, oil, gas, or corn-based ethanol. The Obama administration shifted the other way, spending 75 percent of energy funding on renewable energy technologies and energy efficiency, and we can expect more of the same from Biden. However, \$400 billion is a huge amount of money – about twice the cost of the Apollo program in today’s dollars, and the economy is too badly wounded to start this any time soon. *Too ambitious; partial success.*

▸ Accelerate the deployment of clean-energy technology within the U.S. economy.

Biden wants to make buildings more energy efficient and install half a million public EV charging stations by 2030. This is strongly supported by Biden’s proposed nominee for Secretary of Energy, former Michigan Gov. Jennifer Granholm, an effective leader who pushed for EVs in Motown as a way to create jobs and boost the economy during the killer recession a decade ago. Granholm’s focus has long been in moving away from fossil fuels and toward renewable energy sources. Biden credits her with saving the Detroit auto industry and a very large number of jobs. And everybody likes



President Biden's plan encompasses a full overhaul of the energy industry, including developing wind and solar at all scales. (Courtesy: Shutterstock)

jobs. If Biden successfully delivers on establishing an Advanced Research Projects Agency-Climate (ARPA-C), it will be a big boon for R&D in all renewable energy tech areas (nudge, nudge, McKelvey School of Engineering). *Very likely.*

► **Make environmental justice a priority across all federal agencies.**

Enter Granholm, again: Part of her big push for major wind and solar power projects in Michigan was based on the historic inequities of health and environmental impacts of fossil fuels on minority communities. Biden's future administration runs on diversity. Granholm (who is from Canada) and the nominee for DOE Deputy Director Arum Majumdar (who is from India), a Stanford professor of engineering who started the Advanced Research Projects Agency-Energy (ARPA-E) under Obama/Biden, are both immigrants: *They'll get the job done.*

► **Hold polluters accountable.**

Biden will direct the EPA and Justice Department to pursue corporations involved with large greenhouse gas emissions. This kind of litigation is complex and slow, but it might help push major U.S. oil companies to begin to embrace renewable energies (the way their European counterparts already have). *Not likely, but may scare corporations to change old practices.*

► **Create 10 million good-paying, middle-class, clean-energy union jobs.**

Obama created a total of 12.5 million jobs in eight years; Biden wants more than this in four, with 10 million in energy. However, Biden's plan encompasses a full overhaul of the energy industry, including modernizing the electric

grid (a big priority for Majumdar), building small modular nuclear reactors, decarbonizing agriculture and heavy industry, and enacting carbon capture and storage, as well as developing wind and solar at all scales. That would mean a lot of jobs. It also would mean borrowing a lot more against the national debt. *Too ambitious; maybe in eight years.*

► **Repair fossil fuel industry communities.**

Biden is committed to helping coal communities in areas of health (with black lung programs) and employment (with modern job retraining efforts). However, Biden needs the votes from Joe Manchin, moderate Democratic senator from the big coal state of West Virginia. This should do it. *Likely.*

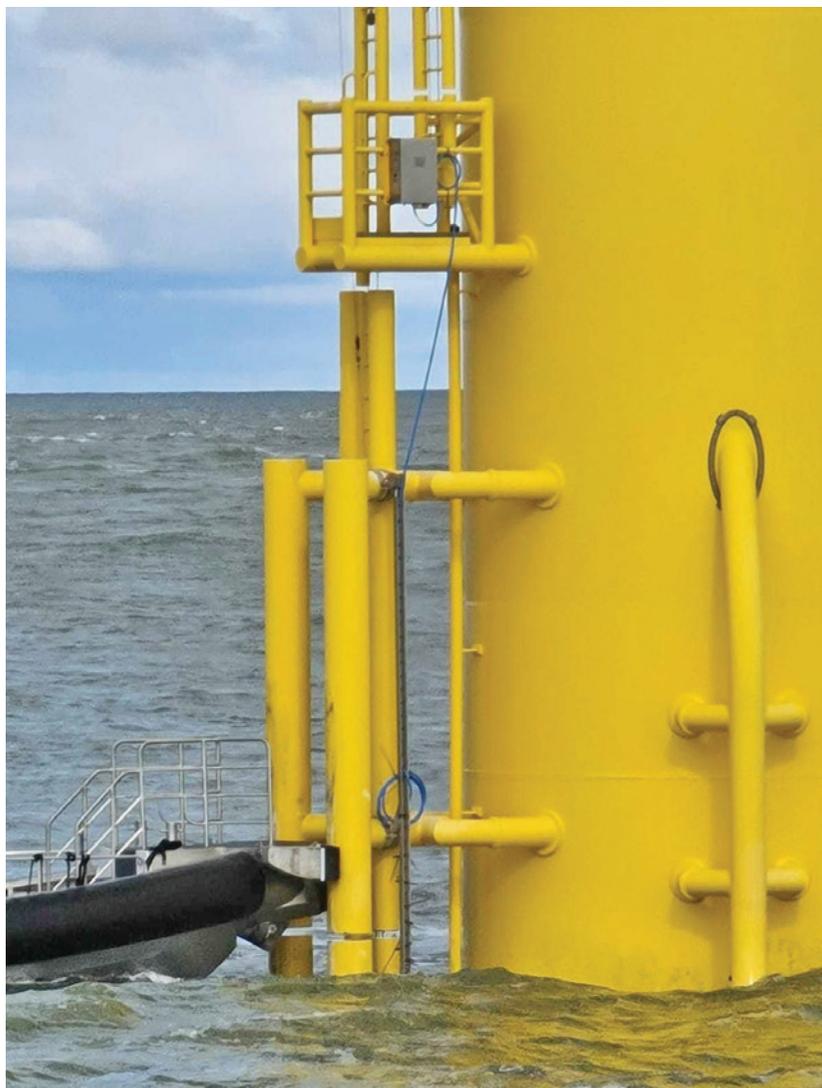
IN SUMMARY

Wysession notes that Biden's plans are very aggressive, but many items are likely to succeed. With the game-changing recent senate victories in Georgia, these aspirations have become much more possible.

"Trump's energy 'policy' ranged from non-existent to ignorant, with reactionary (and failed) attempts to bolster the collapsing coal industry and sell off protected land for oil and gas leases," Wysession said.

"Anything Biden does will be a vast improvement," he said. "With wind and solar having already reached grid parity, the future's so bright you gotta wear shades. Let's just hope all of Washington's Republicans haven't gone blind from staring at eclipses." 🙌

This article courtesy of Washington University in St. Louis, Missouri.



Subsea Innovation's Dynamic Bend Stiffener (DBS) is a retrofit assembly that is installed onto turbine cables of an offshore wind farm. (Courtesy: DLM)

INNOVATION

DLM launches logging system for wind-farm array cables

Dynamic Load Monitoring (DLM), of Southampton, U.K., has manufactured two bespoke monitoring systems that have been installed by dive teams on subsea bend stiffeners at an offshore wind farm. The equipment has been

commissioned, with the first round of data due to be collected in March 2021.

The bespoke products were delivered to Darlington, U.K.-based Subsea Innovation, a manufacturer of subsea equipment, which was challenged by the end user to provide a system to prevent array cables — they connect the site's turbines together — from breaking. Subsea Innovation's Dynamic Bend Stiffener (DBS) is a retrofit assembly installed onto turbine cables of an offshore wind farm, which are subject

to tidal loads that have been causing the power cables to prematurely fail or reduce in efficiency.

Subsea asked DLM to devise a method to monitor forces on the cables and the movement they experience over time, log the data over the course of a year, and make it periodically accessible. The system comprises three dual axis shear pin load cells, two accelerometers, and a programmable logic controller (PLC). The shear pin load cells are dual-axis shear pins that measure forces across two planes in the positive and negative directions. The working load limit (WLL) of each plane is 50kN, in both the positive and negative direction.

"The DBSs connect directly to the turbine bell mouth and encapsulate the cable at the J-Tube exit, and restrain the cable at the point of failure," said Mike Brend, project manager at Subsea Innovation. "The cables are exposed to undesirable bending without a DBS and beyond the expected MBR (minimum bending radius), hence the solution is required to combat such occurrences."

"We do regularly put systems together like this for projects, incorporating load cells with other instrumentation and sensors; we probably do two or three projects a year of this kind, but the functionality and use is always different," said Martin Halford, managing director at DLM. "In this case, we reviewed what off-the-shelf instrumentation and sensors were available, but in the end opted for our recently designed DL-3.0 data-logger, and integrated it into bespoke subsea enclosures."

There are eight DL-3.0 data loggers per system (two for each load pin and two for the accelerometers). The logged data is collated and logged again as a package in a PLC enclosure mounted further up on the turbine platform. From this enclosure, there is an ethernet port on the side that enables a user to plug in a PC to download the data periodically when the platform is accessed. Each system also

includes a stainless-steel subsea junction box.

“The development of the new data logger came at the right time as it just so happened that it met both the angular measurement requirements of the system, but also logged this data along with load data,” Halford said. “To collate all the information and make it accessible, we decided to use a Siemens [ET200SP] PLC as we have extensive experience using controllers with other offshore projects, noting their reliability and robustness.”

“I love these kind of projects — and our engineers do, too,” he said. “It is really what we are geared up to do as a company and it differentiates us from some of our competitors.”

MORE INFO dlm-uk.com

INNOVATION

Natural Power launches DARC bat curtailment system

Leading renewable energy consultancy and service provider, Natural Power, has launched DARC (Detection and Active Response Curtailment)—bat smart curtailment technology to simultaneously reduce bat fatalities and energy losses at wind farms.

In its efforts to progress wind-farm projects stuck in development due to bat concerns and reduce the impact of wind farms on bat populations while increasing the energy production and revenue potential, Natural Power brought together a team of bat experts and technology and software engineers to develop this new service.

“What we were trying to solve was a complex puzzle across multiple disciplines,” said Jim Adams, president of Natural Power in North America. “It required a deep understanding of bat behavior, as well as interactions with wind-farm operational controls. We had to design our DARC service to have



Using bat monitoring data and wind measurements from a wind-farm site, DARC is able to quantify the impact of various curtailment strategies, comparing the impact on energy loss and bat fatalities of blanket curtailment and DARC. (Courtesy: Natural Power)

no mechanical impact on the wind turbines and to maintain the highest level of cybersecurity that our clients expect.”

Following a proof-of-concept deployment in 2019 and supported by the U.S. Department of Energy (DOE) as well as the National Renewable Energy Laboratory (NREL), Natural Power worked with Alliant Energy to install and operate a full system from August to October 2020 at the English Farms wind farm in Iowa.

While the exact production numbers for the 69 wind turbines at English Farms are not public, for a wind farm of similar size with average wind conditions, DARC will easily increase the energy production by more than 5,000 MWh per year. Natural Power is confident that through upgrades al-

ready planned during 2021, this will further increase.

“Having the DOE critically review our study design and reports ensures our clients will receive unbiased results on the DARC system,” said Christine Sutter, head of Wildlife Technology at Natural Power. “Access to NREL’s GE 1.5MW wind turbine gave us the ability to test the impact of the system far beyond what we would normally be able to do in field deployments.”

“Furthermore, working with Alliant Energy enabled us to use its historic bat activity and wind data to forecast the environmental and financial benefits of DARC,” she said. “Their confidence in Natural Power also gave us the opportunity to gain the necessary endangered species research permit from the U.S. Fish and Wildlife Service

for the study under the DOE umbrella.”

Results from the full-scale deployment have also served to validate the suitability analysis tools that provide an early estimation of the energy increase through DARC at a specific project. Using bat monitoring data and wind measurements from a wind-farm site, DARC is able to quantify the impact of various curtailment strategies, comparing the impact on energy loss and bat fatalities of blanket curtailment and DARC. This can then be reflected in the financial analysis of a development project to show the benefit DARC can bring to a wind farm.

The acoustic monitor sits on top of the nacelle and listens for bat calls. When it detects bat activity, it sends a signal to the DARC server where it is processed alongside other SCADA signals from the turbine and meteorological data. The server then decides whether the turbine should shut down or not. If it forces a shut down, the blades will slowly come to a stop before lying motionless for 30 minutes. If more bat activity is detected during this time, the turbines will continue to lie still for 10-minute increments until no activity is detected. The turbines will then start up again.

MORE INFO www.naturalpower.com

MAINTENANCE

PSG names Dale Bartelson senior VP of sales and marketing

Pure Safety Group (PSG), the world's largest independent height safety product development, manufacturing and training company, recently hired Dale Bartelson as senior vice president of sales and marketing.

Bartelson will oversee sales, business development, training, customer service, and commercial marketing for PSG in North America and Latin America.

Bartelson has close to 20 years of experience in the industrial and safety



Dale Bartelson. (Courtesy: PSG)

markets. Prior to joining Pure Safety, he held a variety of sales and channel leadership positions at 3M, including national sales manager for the corporation's Industrial and Safety Markets Center. His experience also includes developing Fastenal's safety portfolio, before taking on director-level positions at GOJO and Capital Safety, the fall protection company that was acquired by 3M in 2015. Bartelson holds an undergraduate degree from Winona State University and an MBA from the University of St Thomas.

“Dale has a deep commitment to delivering safety solutions to customers,” said PSG CEO Jeff Ward. “He is a trusted resource in the safety community among businesses wanting to contin-

ually advance their safety portfolio and approach. His knowledge of fall protection products and innovation, and his ability to partner with companies to plan, particularly for their height safety needs, makes Dale an asset to our customers and our growing organization.”

MORE INFO www.puresafetygroup.com

MAINTENANCE

John Leahy joins GEV board to support its growth ambitions

GEV Wind Power recently announced the appointment of John Leahy to the Board of GEV Wind Power.

Leahy is a seasoned private equity executive with leadership experience across various disciplines enjoying an outstanding record of value enhancement across well-known companies including the luxury travel brand Tumi and Rank Hovis McDougall, owner of brands such as Hovis bread, Bisto gravy, and Mr Kipling cakes.

As chairman, he led the transformation and growth of LM Windpower from a local producer to the global No. 1 wind-turbine blade manufacturer with a turnover of 1.2 billion euros, producing approximately 20 percent of the world's installed rotor blades.



David Fletcher, GEV Wind Power CEO (right) welcomes John Leahy. (Courtesy: GEV)

“We are delighted to welcome John to the Board of GEV, bringing his 12 years of experience leading LM Wind Power to our organization,” said David Fletcher, CEO of GEV Wind Power. “We look forward to John helping us to shape our growth strategy going forward, with the aim of achieving our goal of being the global partner of choice to our clients, for all blade maintenance requirements.”

“I am thrilled to be re-engaging in the wind-energy sector and to have the opportunity to continue my focus on rotor blades and being part of the transformation of this area of maintenance over the coming years, as the industry continues to consolidate and mature,” Leahy said. “GEV is well supported and has an excellent platform to lead this process, and I am looking forward to working with David and his team.”

An independent service provider of blade-maintenance services, GEV Wind Power is recognized as one of the leading blade maintenance operators across its core markets of Europe and North America. GEV’s service offerings vary from straight forward surface conditioning to complex structural repairs using a range of access methods.

MORE INFO www.gevwindpower.com

MAINTENANCE

Sentry offers O&M services within independent division

Sentry Electrical Group, Inc. now offers operations and maintenance (O&M) services for existing renewable energy infrastructure throughout the United States and into Canada. The organization’s 15 years of proven experience positions Sentry with the expertise and reliability to deliver safe, quality operations and maintenance services to original equipment manufacturers (OEM) and independent power producers (IPP).



Sentry Electrical Group, Inc. O&M services for existing renewable energy infrastructure in the U.S. and Canada. (Courtesy: Sentry Electrical Group)

As an independent service provider (ISP), Sentry offers O&M operations under the leadership of Director George Tapia. Tapia comes to Sentry with more than 10 years of experience, including field technician, field resource manager, and business development and operations professional.

“I am thrilled to build and lead the Sentry O&M field services division,” Tapia said. “Sentry’s proven industry reputation puts us in a position to safely provide customers these services with quality, professionalism, and reliability.”

Thanks to Sentry’s established industry reputation, offering O&M services originated from requests of customers. The organization will continue to build its O&M team with accomplished managers and skilled technicians.

“We are so excited to offer the renewable energy industry our new

O&M services as an ISP,” said Sentry President Norm Cowden. “With these services, we will not only be maintaining, but also advancing, the already established wind and solar infrastructure. We are confident in our ability to safely and reliably deliver quality services to new and existing customers no matter the complexity of the need. By expanding our service offerings, we are providing customers a more comprehensive scope of work.”

MORE INFO www.sentryelec.com

MAINTENANCE

AMSOIL becomes APQP4Wind-certified lubricant supplier

AMSOIL INC. is the world’s first and

only lubricant supplier to earn APQP-4Wind certification. APQP4Wind is a non-profit organization founded by the world's leading wind-turbine manufacturers and suppliers. Its mission is to standardize and simplify processes that ensure product quality across the wind industry. The organization strengthens and facilitates relationships between manufacturers and suppliers to increase efficiency.

"We've worked hard to reach this milestone," said Dave Meyer, vice president of AMSOIL Wind and Industrial Business. "Being the world's first lubricant supplier to become an APQP4Wind member demonstrates the quality of our products for wind assets. It offers additional assurance to our wind customers that they're getting the best possible lubricants for their equipment."

When AMSOIL INC. entered the wind industry in 2005, wind-asset managers were struggling to find a wind-turbine gearbox lubricant capable of delivering superior protection without requiring frequent and expensive oil changes. Many asset managers could expect a high percentage of their gearboxes to fail within the first 10 years of a 20-year design life, driving up operating costs.

AMSOIL developed an innovative synthetic gearbox lubricant that delivers superior protection and significantly longer service life in the demanding conditions in which turbines operate. It has a proven record of more than 10 years of continuous run time with no additive top offs, which helps turbine gearboxes last as designed, or longer, reducing maintenance and costs. AMSOIL also formulates hydraulic oil, grease, and other products for the wind industry.

Today, AMSOIL is the industry's pre-eminent lubricant supplier, with nearly half the wind turbines in the U.S. using AMSOIL products and global shares rising steadily in China, India, Brazil, and Europe. AMSOIL also has more original equipment manufacturer (OEM) approvals than most other lubricant manufacturers, and many operators now specifically require



The Murtomaki wind project will consist of 15 V162-6.0 MW turbines. (Courtesy: Vestas)

use of AMSOIL synthetic lubricants in their wind assets. Earning APQP-4Wind membership is the company's latest achievement as it continues to support and strengthen renewable energy.

"Our APQP4Wind membership will only help improve our standing in the industry," Meyer said. "We look forward to working with the organization and its other members as we continue to improve our products and processes for this market."

MORE INFO www.AMSOIL.com

► MANUFACTURING

Vestas seals EnVentus order for 90-MW Finland project

Vestas has secured a 90 MW order from new customer Ålandsbanken for the Murtomaki wind project.

The project comprises 15 V162-6.0 MW turbines maximizing the yield under the permitted tip height and a 30-year active output management 5000 (AOM 5000) service agreement. Leveraging the upgraded rating of the EnVentus platform, the tailored solution is designed to ensure an industry-leading level of energy production for the lifetime of the project at a highly competitive levelized cost of energy.

Winning the second deal with the upgraded V162-6.0 MW wind turbines, Vestas reinforces its presence in Finland's wind market and surpasses 600 MW in orders of EnVentus turbines in the country.

"Murtomäki wind farm with Vestas turbines is the first investment of the newly established Wind Power Fund of Ålandsbanken," said Juha Känkänen, investment director of Ålandsbanken Funds. "We would like to thank the Vestas team for its efforts in bringing down the levelized cost of energy and constructive approach during contract negotiations."

The project has been developed by YIT Suomi Oy and will continue to be a part of their project development process until completion in 2023.

"This project strongly supports our climate goals, since the Murtomäki wind farm produces an amount of renewable domestic electricity that is equal to the consumption of approximately 15,000 single-family houses annually," said Harri Kailasalo, EVP, Infrastructure Projects, YIT. "During the construction and production period, the project also has a significant positive economic impact on the town of Pyhäjärvi."

"I would like to thank our new, well-established business partners Ålandsbanken and YIT Suomi Oy for the trust they placed in us," said Nils de Baar, president of Vestas Northern & Central Europe. "We are certain that the competitiveness of the V162-

6.0 MW turbine together with the key focus on Finland and our long-term service offering ensures maximum value for our customer's business case.”

The contract includes supply, installation, and commissioning of the wind turbines as well as a VestasOnline® Business SCADA solution, lowering turbine downtime and thus optimizing the energy output.

Turbine delivery is expected to begin in the second quarter of 2023, while commissioning is planned for the third quarter of 2023.

MORE INFO www.vestas.com

MANUFACTURING

Port of Albany to be first offshore tower manufacturing site

New York Gov. Andrew Cuomo recently announced in his 2021 State of the State a historic offshore wind investment that included the selection of the Port of Albany as the first offshore wind tower manufacturing site in the nation. This major renewable energy and economic development project will further the governor's green energy agenda, create hundreds of jobs, and become a key part of the governor's \$644 million statewide public and private port investments.

This project will transform the Port's 80-acre expansion site in the Town of Bethlehem into a world-class manufacturing facility and maritime operation. The project will also develop land in the Port's existing district and use recently improved maritime enhancements to support this endeavor.

Components of the project will include a new state-of-the-art wharf, a new bridge, new and improved internal roadways, and more than 600,000 square feet of manufacturing space in four buildings. A joint venture between Marmen Inc. and Welcon A/S with partner Equinor Wind US LLC will lease the entirety of the project



Historic wind-energy investment in New York will transform the Port of Albany's 80-acre expansion site in the Town of Bethlehem into a world-class manufacturing facility and maritime operation. (Courtesy: Port of Albany)

site where they will fabricate offshore wind towers.

The manufacturing operation will make use of the wharf and quayside facilities for load out of their products onto transport and installation vessels. The products will be shipped via the Hudson River maritime transportation network to offshore wind development sites in the ocean. This project will have capacity to supply New York State projects and other offshore wind projects along the Eastern Seaboard.

Construction is expected to begin in 2022. The construction of the facilities and development of the site is expected to create 500 jobs. Once complete, the project will create 300 full-time employees in well-paying manufacturing jobs.

The project partnership is committed to supporting local workforce development, training, and recruitment programs directly accessible to the nearby environmental justice community in the City of Albany's South End. The development of this site will serve as a positive economic anchor to the future of the historically underserved South End.

Marmen Inc, Welcon A/S, Equinor, and the Port of Albany bring together nearly a century of safe, reliable, and experienced maritime administration

capabilities together with a world leader in offshore wind development and a proven wind-tower manufacturing team that has global experience. This partnership will make substantial investment to develop this offshore wind-manufacturing hub in the heart of New York State along the Hudson River that is within a day's shipping to the wind-energy area development site in the Atlantic Ocean.

The total project investment is expected to be more than \$350 million.

MORE INFO www.portofalbanyny.us

MANUFACTURING

Test bench of blade bearings successful in regular operation

The Fraunhofer Institute for Wind Energy Systems IWES recently completed a successful series of accelerated tests on rotor blade bearings at the bearing test bench in Hamburg. Within the scope of research and industry projects, bearings were subjected to dynamic endurance tests to increase their reliability and gain insights into the causes of wear. The first bearing

tests were thoroughly successful with both the test method developed by Fraunhofer IWES and the test bench itself proving their worth. Accelerated test procedures allow the institute to acquire vital insights into damage mechanisms that can reduce future development costs and yield losses.

The accelerated testing of rotor blade bearings as part of research and industrial projects at Fraunhofer IWES has been a success. During testing, the load is applied to a bearing by means of six hydraulic cylinders on the BEAT6.1 (Bearing Endurance and Acceptance Test) test bench with up to 50 MNm of static load. The test bench also simulates the movements of a wind turbine during operation together with the associated load changes. This accelerated test can thus recreate loads equivalent to 20 years of operation in just four to six months. Since its commissioning in May 2019, the Fraunhofer IWES has tested a range of bearing types for a 7.5 MW wind turbine.

In the HAPT (Highly Accelerated Pitch Bearing Test) research project, the institute concentrated first and foremost on the use of IPC (individual pitch control) for rotor blade bearing endurance tests. IPC is a measure aimed at reducing wind-turbine loads: It aligns the loads of the individual rotor blades against each other in order to reduce the loads acting on the wind-turbine structure. The test results for the first bearings have shown that the wearing behavior can be recreated successfully on the test bench.

“During the tests, we demonstrated that the load application works with a dynamic accuracy of 0.1 percent,” said Dr. Matthias Stammler, senior engineer at the Fraunhofer IWES. “We were also able to test our continuous operation concept to great success. In addition, we gained valuable insights into the development of wear in blade bearings, which can subsequently prevent wear.”

Testing of the rotor blade bearings for the first industrial projects highlighted bearing-specific challenges, which provide customers with key insights into damage mechanisms. This,



Offshore wind deployment has moved down the cost-learning curve. (Courtesy: DNV-GL)

in turn, allows future development costs to be lowered and yield losses to be reduced.

The Fraunhofer IWES testing concept is continuously being optimized and expanded. For example, the institute is set to test a novel type of bearing in a next step: T-solid bearings.

“T-solid bearings boast a higher fatigue life compared with four-point bearings,” said Hubertus Frank, head of Technology, IMO Group. “We are now looking forward to putting this design through wear endurance testing in comparison with four-point bearings to check its operational suitability.”

MORE INFO www.iwes.fraunhofer.de

► CONSTRUCTION

Standardized solutions help yards become cost-effective

To unlock floating wind’s massive potential, ship yards in Korea, Japan, China, and elsewhere require standardized solutions that support serial

production and modularization for competitive, responsive project delivery. The term “constructability” summarizes this need.

With some major floating wind projects likely to begin construction by 2023, the well-known DNV GL class for ships and offshore structures rules can provide reassurance on cost and risk when making development choices. For example, the company’s new class rules for floating offshore wind turbine installations (DNVGL-RU-OU-0512) combine offshore, energy, maritime, and digital expertise into an integrated rule set. These rules complement DNV GL’s existing verification and certification services and standards for floating wind, thus providing well-tested rules and standardized processes for the new structures. In this way, both experienced and new players in the offshore project ecosystem can have a familiar framework to integrate new processes into existing production structures with confidence.

Owners, yards, original equipment manufacturers (OEMs), and others are used to working with DNV GL’s standards, are familiar with the process,

and know the acceptance criteria. Studying the benefits of such familiarity in the oil and gas industry, it was found that using a new standard instead of an existing one increased the uncertainties and cost of project phases in the yard.

The new rules are timely. Floating wind is moving up the agenda for governments worldwide as they set targets to decarbonize their energy systems and promote green jobs growth for economy recovery.

As a part of these efforts, some yards might initially be looking to win as much work associated with floating wind as possible. However, they may be hesitant if this threatens to tie up their traditional ship and offshore capacity, as these wind projects will often be large-scale, intensive, multi-year projects. On the other hand, yards already have an excellent project and supply chain management track record and could use these skills to manage the needed capacity for floating wind projects.

Other yards might tender for more of the fabrication work, but could also potentially spread some of this work among subsidiary yards to maintain their capacity. Additionally, and depending on the OEMs, yards may also bid to integrate the floater with the tower and possibly also the wind-turbine nacelle and blades, essentially undertaking the full commissioning of the unit at quayside before float-out.

Substantial quayside space and deep berths will be needed for marshalling and assembling structures with deep drafts. Large projects might support investment in yard infrastructure to create capacity and enable local content. Smaller projects may make yards think twice about the scope and scale of what they bid for.

To support decision making, DNV GL's new class rules cover all potential floater (hull) designs for floating wind: barge, semi-submersible, vertical floating columns (spar) and tension-leg platform.

Class rules also work with design and construction follow-up to verify that a unit was built according to de-

sign. Some owners now request class because it can also apply to operations follow-up, so that learnings from operations can be fed back through frequently updated rules.

DNV GL's new class rules are designed to scale as they consider not just the individual units but the entire floating wind field with data-based services and condition-based monitoring and through linking with fatigue

methodology sensor data. For tow-out, floating wind will involve large-scale use of existing ships, such as tugs. However, some specialist mobile units will be needed for maintenance work offshore, and there may be a need for a new class of crane vessel with enormous reach for floating wind-turbine installation. ↵

MORE INFO www.dnvgl.com



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CROSSWINDS

THE FUTURE OF WIND

TAKING THE GREEN-POWER LEAD





More and more, corporations and local governments are taking matters into their own hands when it comes to procuring and generating renewable energy.

By **KENNETH CARTER** ▸ Wind Systems editor

After years of the federal government being a leader on the path to renewable energy, corporations and local governments now are taking a larger role in getting more green power on the grid.

During 2020, there was a 45 percent increase in the installation of renewable projects over the previous year, and with corporations and local governments on board, even more renewable energy is likely to see reality, according to Jessica Adkins of the global law firm Sidley Austin LLP, where she advises companies on developing, financing, and investing in renewable energy and battery-storage projects. Adkins is based in Houston, Texas.

Before Adkins began practicing law, she was an engineer, a skill that she has found to be a significant help as she advises on structuring viable renewable projects in complex power markets.

“We have a large team at Sidley that works with a full range of participants in the industry, both on transactional and regulatory matters,” she said. “Clients include everything from private equity investors, infrastructure funds, sponsors, developers, IPPs, banks, tax equity investors, power marketers — the full range of folks that are involved in the market.”

RENEWABLE ENERGY FROM THE SOURCE

And even though there are quite often many hoops to jump through in order for corporations to procure green energy, many corporations have become sophisticated consumers able to effectively navigate the process, and new solutions are being developed to simplify renewable energy procurement to enable others.

“Corporations are going out, and they’re looking to buy electricity to power their own facilities, which often means going directly to generators,” she said. “And through that way, they’ve become a significant driver of new generation. Sometimes, smaller companies can’t necessarily go and directly buy from generators because they might not have enough load to make that work; they may procure it through other mechanisms. For example, a number of retail electric providers are working on streamlined solutions that allow corporations to procure renewable energy from specific sources directly from their retail energy provider just like the corporation procures any other power.”

Many corporations have become sophisticated consumers of renewable energy and are able to effectively navigate the process while new solutions are being developed to simplify renewable energy procurement. (Courtesy: Shutterstock)



With wind and solar resources being extremely abundant in red states, it is important that the economic advantages of renewables are made clear. (Courtesy: Shutterstock)

In addition to businesses procuring energy from renewables, they also want their supply chains to follow suit, according to Adkins.

“They’re asking all their suppliers to procure renewables as well,” she said. “There’s GHGP (Green House Gas Protocol) reporting that people do to track greenhouse gas emissions. So, that’s the first bucket that we were talking about: Buying renewable energy to power your own facilities. That would be reducing what’s called Scope 2 emissions. And then, when you’re looking at your supply chain and asking your suppliers to become green, that’s what you call Scope 3 emissions. I really think you’re seeing corporations doing it themselves, and then, through the influence that they have driving change, other corporations (go green) that might not even have become motivated to do it in order to keep their corporate customers happy.”

FEDERAL VS. STATE AND LOCAL

With an incoming Biden Administration expected to be much more favorable to a U.S. renewable future, Adkins stressed that the machinations that get renewable projects going are often on the state and local levels.

“I think that governmental incentives can always accelerate the transition to renewable energy, but that change is going to continue regardless of the government support,” she said. “And I would say when we talk about the government, there are two levels: The Biden Administration is obviously the federal level, but we’re also seeing a lot of support at the state level, which is certainly continuing. Continual favorable policies in both the federal and state level are going to be helpful.”

Some of the options states have are in setting mandates and offering subsidies, according to Adkins.

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Giving Wind Direction

WIND SYSTEMS

“They can also set mandatory required amounts of renewable energy, which is what we see in the renewable portfolio standards,” she said. “They can obviously increase the portfolio standards, which is going to drive renewables. If you have regulatory requirements to comply with, that’s going to drive renewables regardless of what the federal tax incentives are. If people have to do it for compliance reasons, they’re going to do it. There are obviously states that are being very aggressive in terms of adopting renewable energy portfolio standards and targets.”

RED-STATE RESOURCES

With wind and solar resources being extremely abundant in red states, Adkins said it is important that the economic advantages of renewables are made clear.

“One of the interesting things about wind and solar resources is that when you look at the country and do an overlay of the red states and blue states and where the best resources are for renewables, then you see quite a bit of resources in red states,” she said. “(In many red states), you don’t necessarily see opposition in terms of just building new generation facilities.”

For example, Texas has one of the highest penetration rates of renewables in the country, but there aren’t a lot of state-level incentives, according to Adkins.

“In Texas, it’s economics; it’s easy to get a project done there in terms of permitting, etc.,” she said. “And there are a lot of great resources in terms of wind and solar. So, it’s really just the convergence of all of those factors. The renewable portfolio standard in Texas was met quite a long time ago, so there is way more renewable generation than is required by state law.”

THE NEED FOR INCENTIVES

Where significant incentives might have been necessary to spark renewable energy growth 10 to 20 years ago, they are continuing to become less of a factor, although they still can be a vital part of getting a project going, according to Adkins.

“Projects that are being built right now are still being built with incentives,” she said. “For example, with respect to solar — pretty much what you’re going to be seeing built between now and the end of 2025 — is going to have some sort of significant tax incentives associated with it. This is due to the phase out of the solar investment tax credits coupled with deadlines by which projects must be placed in service in order to receive the tax credits. That’s one of the reasons we’re having a lot of activity right now in solar.”

With wind, it’s been a slightly different story of late, although there are still incentives pushing wind, according to Adkins, as the ability to receive the 60 percent production tax credit amount was extended a year in the year-end legislation.

“There was a lot of activity in wind just getting projects brought online (last) year,” she said.

OFFSHORE POSSIBILITIES

And with the buzz of offshore wind still exciting many in the renewables sector, the involvement of local businesses and governments will still be an important piece of the puzzle, according to Adkins.

“The recent extension of the 30 percent federal investment tax credit for offshore wind projects that begin construction before 2026 will obviously help,” she said. “But then there are also state policies that support it, which are going to help as well, because, just like any other facilities, in order to build these, they are going to have to have long-term commitments to buy that energy. To the extent that we get aggressive policies at the state level that support offshore wind procurement, that would help support that.”

To get local businesses on board with offshore wind, it’s going to take education and getting residents to understand the economic, as well as the environmental, impacts, according to Adkins.

“Some people may not like the thought of looking out and seeing wind farms, so education will help people understand what that’s going to look like and how it’s going to impact other activities such as fishing,” she said. “I think especially if there’s a push in some places in the U.S. where there are not great onshore resources for wind or there’s not enough land, etc., places that might not otherwise have access to wind energy, certainly through offshore, can augment their ability to have it.”

CORPORATE COOPERATION

Part of possible corporate cooperation with the implementation of offshore wind could involve offshore oil and gas, according to Adkins.

“They’re certainly well-positioned from all their offshore experience,” she said. “I know we have seen some joint ventures between onshore wind developers and offshore oil and gas. I think part of it though, for them, a lot of it’s their capital allocation, and where are they going to be able to make the most money. That has historically been a complaint for oil and gas companies that they can’t get the same return on capital in the renewable industry as they can in oil and gas. But one nice thing about offshore projects is that they have the potential to be huge projects and deploy significant amounts of capital.”

How such companies might involve themselves with renewable projects remains to be seen, but the opportunities are available if those corporations see it as economically feasible, according to Adkins.

“I think that oil and gas companies are taking a couple of different approaches there,” she said. “Some just use renewables to help power their core business. They might use, for example, solar panels to power remote drilling operations because it’s a more cost-efficient power source. Then, you do have some others that have been a little bit more vocal about it and trying to figure out how they can position themselves to be a full part of the energy transition.”

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