

A photograph of an offshore wind farm. In the foreground, a large white wind turbine is partially visible, with its blades extending across the frame. In the background, another wind turbine stands in the middle of a vast, blue ocean under a clear sky. The overall color palette is dominated by blues and whites.

PROFILE

SHORELINE WIND

MAKING OFFSHORE WIND DEVELOPMENT MORE EFFICIENT

Shoreline Wind's software can build a virtual copy of an offshore wind farm and create a digital twin of the logistic spread for a specific project. (Courtesy: Shoreline Wind)

Shoreline Wind has developed simulation and schedule optimization technology that aids in designing, building, and operating large-scale wind farms faster and more cost-effectively.

By **KENNETH CARTER** ▀ Wind Systems editor

Developing an offshore wind farm is an endeavor filled with a multitude of tasks, so it's important those tasks be planned in a way to get them right the first time.

The experts behind Shoreline Wind have developed a business model that integrates a vertical-focused digital solution to help ensure offshore wind farms are planned and constructed efficiently and correctly.

"Prior to the introduction of Shoreline Wind, the industry had not seen a solution developed specifically for this purpose and market," said Michael Bjerrum, chief commercial officer and co-founder of Shoreline Wind. "Applications from adjacent industries like oil and gas, refineries, and so on had been tweaked to meet some, not all, requirements of an offshore wind farm. That was the opportunity that we saw, to build a product from the ground up specifically for wind. We wanted to create a product that catered for all players and contained a rich set of features to support the various phases such as design, build, and full lifecycle management of a wind farm."

INITIAL SOFTWARE SOLUTION

Shoreline Wind went live with its first Software as a Service (SaaS) solution in 2016, when it was offered to the emerging offshore wind industry's operators, developers, turbine manufacturers, construction companies, service providers, and consultancy firms, according to Bjerrum. The software could build a virtual copy of an offshore wind farm and create a digital twin of the logistic spread for a specific project, import high-end data, and simulate the construction, service, and maintenance phase.

"The initial simulation solution Shoreline Wind offered to the market quickly became the industry standard for simulating and optimizing construction and service and maintenance in the offshore wind space," he said.

Since Shoreline Wind's software development, the company has been advancing it as it became more popular within the industry, adding features that address even more potentially complicated issues efficiently, according to Bjerrum.

"Today, we're looking more at the day-to-day maintenance of the wind farm, ensuring that operation and maintenance strategies are optimized, minimizing the time a turbine is standing still; we can prioritize technicians' tasks and deploy them, as fast as humanly possible, to a specific wind turbine and get it up and spinning again — reducing the time to repair," he said. "The driver is optimizing availability of the wind farm as a whole, while reducing the operational expenditure (OPEX)/costs. This last element is interesting as our software can react to the shifting markets (price of power) — planning and scheduling maintenance when the price of power is low, allowing for maximum availability

when the price is high — leaving the turbines alone as much as possible."

MOVING PAST THE PLAN

This consideration of O&M needs to begin at the early phase of a wind farm's planning and eventual construction, according to Bjerrum.

"At the planning stage of a wind farm, it's important to take all the data and knowledge you have available, and feed it into your simulation/model," he said. "This is, of course, integral for design and construction — but it's also very important to design your O&M strategy. These stages should overlap, or ideally run in parallel, as the latter may affect the choices a developer makes in the development stage of the project. Decisions such as design of turbines, foundation, accessibility, choice of vessel infrastructure, and so on and so forth. If this approach is followed, when a developer progresses from construction into the service and maintenance phase, they are fully on top of the plan and what needs to happen next. So much will click into place seamlessly, such as having the right skills available (with the correct qualifications and certifications), a best-in-class fleet of vessels, and supporting infrastructure and supply chain (spare-parts utilizing local providers where possible). The earlier the O&M strategy is considered, the better."

WHITE PAPER

Shoreline Wind's expertise in the offshore wind sector has made it uniquely qualified to comment on key challenges that face the industry. In that vein, the company recently released a white paper on its findings. Part of the findings included how the industry will continue to address larger and larger turbines, according to Bjerrum.

"The size and capability of the turbines being deployed offshore has grown tremendously," he said. "I started in offshore wind back in 2008, and at that time, the size of turbines was between 3 and 6 MW. Today, we are seeing the industry install 14 to 16 MW turbines. There is no doubt that turbines have become more sophisticated in a relatively short space of time. However, this does add complexity for operators of wind farms as these units will require more regular and advanced maintenance. It also means that operational efficiencies are much more important for those looking at the bottom line. If a turbine stops production, for whatever reason, the financial impact of that downtime is significantly higher than before, compared to where smaller turbines are present. It's therefore very important to keep turbines operational as much as possible."

LARGER WIND FARMS

In addition to the increasing size of turbines, the offshore



With a strong ability to plan and manage offshore wind farms in place in just a short amount of time, Shoreline Wind is uniquely qualified to continue to move the offshore market forward at an exponential rate. (Courtesy: Shoreline Wind)



In addition to the increasing size of turbines, the offshore wind farms themselves are also growing tremendously in area. (Courtesy: Shoreline Wind)

wind farms themselves are also growing tremendously in area, according to Bjerrum.

“Today, wind farms coming online in Europe can cover up to 800 square kilometers offshore, and even larger wind farms are under development,” he said. “The distance between each turbine is really getting big, which means it takes more time to move between turbine A, B, and C. Operators need to minimize the operational risk by deploying the right people, with the right equipment, at the right time. Repeated failure to do so, which typically happens when O&M strategy is not optimized considering all of the above factors, will lead to greater opex, perhaps even lost revenue, if turbines fail as a result.”

Not only are turbines getting bigger, but they are also getting more sophisticated, which adds another layer of com-

plexity in managing them, according to Bjerrum.

“As we mentioned before, they’re more sophisticated, which means they have more sensors in them, and it’s much more complicated to maintain and operate them,” he said. “But revenue is not the only upside. The wider energy grid system needs to be able to trust the availability of renewable energy production. The availability of bigger and better turbines will mean energy systems can rely on stable and secure production of green energy and make long-term decisions about transition more confidently.”

UPDATING O&M STRATEGIES

In order to deal with all of this, current O&M strategies will need to be updated and advanced to address these continued challenges, according to Bjerrum.

“Many O&M strategies are still based on what the processes were back in the day — very much manual planning, retrospective planning, spreadsheet-based modeling — and unsuccessful site (turbine) visits or completion of maintenance tasks due to bad weather, missing qualifications or equipment,” he said. “Adding a layer of intelligent AI-based planning, bringing in multiple data streams to manage and control both reactive and proactive plans, is certainly where we see the industry going. This is also where we have been able to make significant strides in our current product for O&M operators.”

However, in order to implement plans of this magnitude, a proper course of action must be carefully considered. Options can include modifying O&M strategies up to re-power-



Not only are turbines getting bigger, but they are also getting more sophisticated. (Courtesy: Shoreline Wind)

ing an aging wind farm, according to Bjerrum.

“Re-powering is an interesting area that we are being asked to support our partners, from a strategic point of view,” he said. “This can include many factors to consider such as the changing and optimizing the existing vessel strategy, manpower plan, and so on and so forth. Whereas, changing the O&M strategy is something that can be done fairly quickly and will require less investment to implement. Steps to be taken to optimize the business case could include reducing inspection intervals, for example, and thereby doing more predictive and preventive maintenance strategies.”

INTELLIGENT MODELING

When it comes to dealing with these sophisticated machines that can end up in a wide range of potentially hostile environments, intelligent modeling becomes a key component to a wind farm’s success, according to Bjerrum.

“Systems and strategies need to be adaptable to the location and climate,” he said. “That’s something you can do with intelligent modeling, integrating weather forecasts, historical weather, hindcast weather (wave height, direction, current, tide, and wind speed), etc., into your simulation and optimization model, and thereby do more intelligent planning going forward depending upon the environment.”

Other factors that need to be considered include constraints on infrastructure and workforce, and availability of vessels and ports, according to Bjerrum. “A digital solution and intelligent solution can play a far wider role — operators can now standardize how they operate,” he said. “Operations

in the future will require fewer highly skilled, experienced human interactions to make decisions, meaning quicker, more accurate planning and decision making. By minimizing the experience required in the wider process, operators can better deploy experience where it is more acutely needed, so they can do more with less.”

By doing that, Shoreline Wind can help all stakeholders in the wider supply chain be transparent with each other in order to appropriately share risk as well as any potential upside, according to Bjerrum.

LOOKING TO THE FUTURE

With a strong ability to plan and manage offshore wind farms in place in just a short amount of time, Bjerrum said Shoreline Wind is uniquely qualified to continue to move the offshore market forward at an exponential rate, as well as supporting adjacent industries.

“In 10 years, Shoreline Wind has continued its trajectory, supporting a greater number of offshore wind players by optimizing O&M strategies for a much broader collection of operators and supporting businesses,” he said. “We will also have established a strong presence in onshore wind, as there are many areas of overlap where our technology can positively impact the businesses in this market — potentially a move into solar as well further down the road. We see ourselves taking a much, much bigger role in the green transition movement as a whole.” ✌

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