Right-sizing offshore wind installations

With a steady growth off offshore wind energy and turbine sizes and components increasing continuously, installation challenges are also getting bigger. Being able to efficiently install offshore turbine towers, nacelles, and blades in a high wind environment requires new initiatives and solutions. NOV's Sjøhest Wind Blade Installation solution lowers the cost, time, and complexity of offshore turbine blade installs, while avoiding the need for oversized installation vessels.

Increasing demand for renewable power is prompting offshore wind farms to install bigger wind turbines, with higher towers and larger blades. Installing 115m long blades on 140m tall towers raises the risk of delays and downtime due to wind. Of all the equipment making up an offshore turbine, the blades are most susceptible to wind loads. As a result, blades currently take the most time to install with conventional wind turbine installation vessels (WTIVs).

These challenges have prompted a partnership between GustoMSC and NOV Lifting & Handling in Norway to develop a more efficient offshore turbine blade installation strategy. The result is the Sjøhest, Norwegian for 'seahorse', a smaller, more efficient Wind Blade Installation (WBI) solution that makes blade transportation and installation safer and faster.

Easing harbor bottlenecks

The Sjøhest solution replaces large, high-capacity WTIVs with a dedicated newbuild NG-5500XL jack-up vessel or smaller converted jack-up. In combination with the alternative storage of blades on deck, longitudinal instead of transversal, this smaller WBI vessel affords greater flexibility and speed for blade loading and transport in the harbor.

The cranes on conventional WTIVs have lift capacities of 1,600 to 2,500 tons to accommodate loading heavy towers and nacelles. However, these cranes are oversized for lifting blades, which typically only weigh 70 to 80 tons each. Using such a large, expensive installation vessel to lift relatively light loads is an inefficient use of resources.

The Sjøhest's WBI jack-up is dedicated solely to blade loading, transport, and installation. As a result, the loading and mobilization of the towers/nacelles can be handled separately from the blades, at two separate onshore mobilization hubs. This option allows for greater logistic flexibility and more optimal use of onshore loading space, an important consideration as increasingly longer blades require larger hubs.

The Sjøhest solution also avoids the time and costs associated with crane usage. The blades are rolled, not lifted, onto the WBI jack-up deck during loading.

The new installation solution loads the blades longitudinally on the deck, in the same direction as the forward movement of the jack-up out of the harbor. As a result, the loaded jack-up can move easily out of the harbor without interrupting the movement of other vessels.

Conventional WTIVs, by contrast, place the blades transversally on the deck. Loading in this way results in 50-60 m of blade hanging off the side of the vessel, restricting harbor traffic, raising collision risks, and increasing transportation costs.

Advancing safety and time-savings in the field

In the field, the Sjøhest solution calls for deploying the WTIVs to install the towers and nacelles, followed by the dedicated WBI jack-up vessel to perform the blade installation.

The solution integrates several pieces of technology with a proven track record of performance in the oil and gas industry. However, NOV and its project partners modified this technology to improve the safety and efficiency of every blade installation.

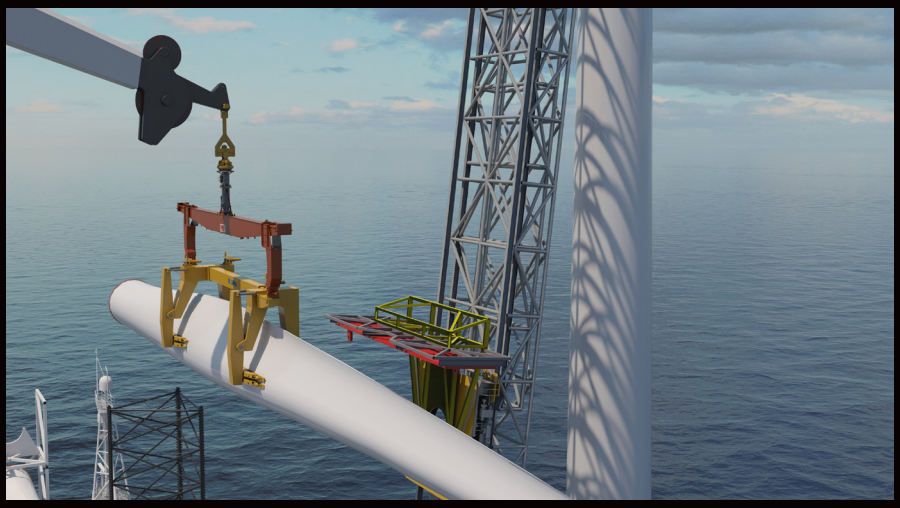
One efficiency-saving technology is the WBI's telescopic leader boom. Just as a seahorse uses its strong grasping tail to resist ocean currents, the Sjøhest relies on the leader boom to minimize the effects of wind and waves by connecting the WBI to the installed tower.

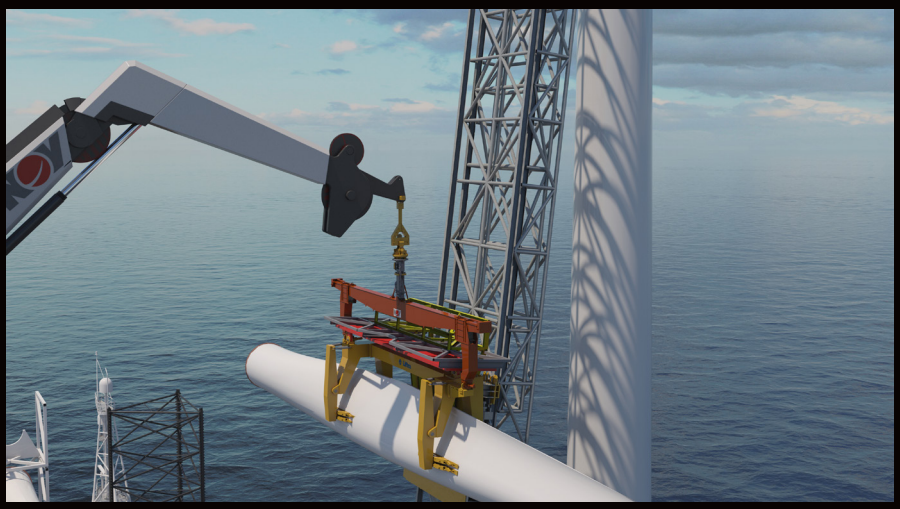
In traditional installations on a WTIV, the vessel, blades, and tower all move independently in response to changing wind currents and waves.

This slows down the installation process and raises the risk of increased downtime and damage to the blades.

Leader booms have been successfully applied in offshore oil and gas operations for more than 20 years. But for wind applications, NOV Norway and GustoMSC made design modifications to ensure a robust WBI/tower connection that minimized installation risks. The connection aligns the movement between the WBI leader boom and the tower, allowing the separate components to move as one connected unit.

This unique connection affords safer and more efficient blade installations. It also allows installation to continue in wind conditions that would slow down, or completely stop, operations from a WTIV.





The WBI vessel is also equipped with a knuckle boom crane. This proven technology picks up individual blades from the rack using a blade-handling tool designed by Danish blade-installation tool specialist Liftra. The tool ensures safe handling of the blades during installation to maintain their structural integrity for a 15 to 20 year service life.

The knuckle boom crane moves the blade and handling tool to a trolley positioned on the leader boom. The blade and tool are transferred to the trolley in one action, an industry-first operation, patent pending.

The trolley then horizontally transports the assembly up along the leader boom and toward the nacelle. As it climbs, the assembly rotates to place the blade in a vertical position. At the top of the boom, the blade is set into and bolted to the rotor. The nacelle rotates to place the next open rotor slot above the leader boom and the trolley descends back to the WBI to pick up the next blade assembly, with no delays or downtime. All three blades can be installed on a turbine in just one day.

Splitting installation efforts between a WTIV and the Sjøhest solution provides significant efficiency benefits in the field. The larger WTIVs can be dedicated solely to tower and nacelle installations, while the WBI jack-ups install blades in another part of the field at the same time. By performing these separate installation operations in parallel, the solution decreases the total time required to install a wind farm.

Keeping pace with future wind power demands

As global power demands continue to rise, wind operators foresee a need for larger offshore farms with bigger turbines. Plans for 20MW wind projects are already in the works, and new wind turbines are being designed to accommodate 140m long blades.

While the Sjøhest solution was developed to optimize blade installations for today's turbines, it was also designed for the next generation. As towers get taller, for example, the length of the telescoping leader can be easily increased to accommodate blade installs at greater heights.

The solution also promises to give aging WTIVs a new lease on life. Vessels that were built a decade ago or longer are quickly becoming too small for the new generation of towers and nacelles. But by installing the Sjøhest equipment on their decks, these vessels can perform installations for longer blades entering the offshore wind farm market.

At a time when offshore wind developers require fast, reliable, and cost-effective construction options, the Sjøhest WBI solution offers blade installation services optimally sized to field demands.

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