Design of Floating Offshore Wind Turbine (FOWT) "SelfAligner"

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Abstract

German company CRUSE Offshore has invented floating foundations for wind turbines that self-align their positioning to the wind

The construction, installation and maintenance of durable foundations are responsible for much of the costs associated with offshore wind farms. These expenses rise even further when turbines are to be installed in deep water. One solution to this problem is the use of floating foundations that are moored to the seabed. Now, German company CRUSE Offshore is offering a durable, tough and simple solution optimized for mass production. The technology is being developed, simulated and optimized in cooperation with renowned Hamburg University of Technology (TUHH), Institute for Fluid Dynamics and Ship Theory, Institute for Ship Structural Design and Analysis as well as DNV GL, aerodyn, Jörss – Blunck – Ordemann and Fraunhofer CML. The project is funded by the German Federal Ministry for Economic Affairs and Energy (BMWi). The consortium expects immediate cost reductions – for investment, construction and installation.

High stability despite reduced complexity

The Floating Offshore Wind Turbines (FOWT) are semi-submersible, self-aligned platforms stabilized by 5,000 tons of ballast water – even in conditions of high wind and five-meter waves the accelerations at the hub height of 100 meters do not impair operations. Holding the foundation in position is a single-point mooring hook-up that is also utilized for power transport. The hook-up, which is based on proven technology from the offshore oil and gas industries' turret buoy, is also part of an elaborate design that ensures continual alignment of the FOWT's rotor – this self-aligning process is aided by the symmetrically profiled tower. In combination, these factors allow to dispense with the 360-degree yaw bearing required in traditional turbines, therefore reducing production and maintenance costs significantly. At the same time, the downwind rotor eliminates the danger of blade/tower impacts and allows choosing more flexible and cheaper materials for the blades.

Easy to build and repair anywhere in the world

The SelfAligner floating turbines also promise considerably easier installation in water depth up to the depth of the continental shelf. The completed, ready-to-operate FOWTs can be towed to their positions. In a simple maneuver they are hooked up to the single-point mooring connectors without requiring jack-up vessel assistance. For large repairs or upgrades, the units can be towed back to the shore. Major offshore maintenance and construction work is eliminated. Whenever tasks need to be performed at sea, the FOWTs are boarded via their leeward floaters, which – in comparison to a fixed body – can be accessed in rougher weather conditions. The approach and transfer maneuvers are easier and require less sophisticated equipment, therefore increasing safety and bottom line results at the same time. The units can be built at existing shipyards anywhere in the world. Their simple design enables the use of automated yard modules mass production methods.

Little environmental impact

To top it all off, marine life will be grateful for the use of SelfAligner's floating foundations. Underwater construction noise, a serious problem for some animals, is a matter of the past. The suction bucket anchorage system, if seabed condition is suitable for this type of anchor, is easy to install and to remove. Also, the mooring system covers only a small area of the sea floor, leaving it almost completely intact. The FOWT is suitable for two- and three-blade downwind turbines.

Keywords: *Renewable*

Biography

2018 – Present, CEO of the CRUSE Offshore GmbH, spin off from LINNHOFF Offshore AG, take over FOWT

SelfAligner Project, Coordinator of the German government funded research program HyStOH.
2015 – 2017, CTO of the LINNHOFF Offshore AG, development of floating self adjusting wind turbine, initiator and coordinator of the German Federal Ministry for Economic Affairs and Energy funded research program with the Hamburg University of Technology, Fraunhofer, DNV GL and several engineering offices.