LARGE SCALE DEEPWATER OFFSHORE WIND PLATFORMS

Presented by: Elliott Bay Design Group, AMF Concepts, eWind Consultants

INTRODUCTION

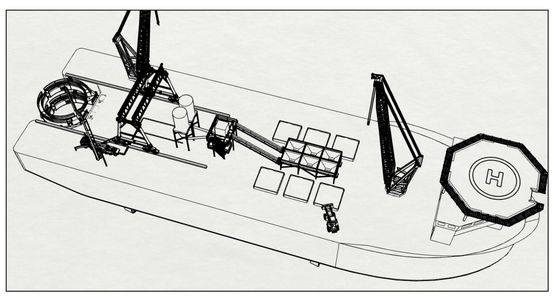
The implications of ever larger wind turbine generators, approaching now 25MW, and installation further offshore in water that exceeds the depth of bottom founded structures, exceeds the capabilities of existing technology. The combination of providing a method for installation of the massive nacelles and increasing the longevity of the floating foundations has led the team to develop a concept using a floating spar foundation which itself is fabricated from geopolymer concrete and basalt reinforcement elements.

10 Megawatts | 25 Megawatts | 300 Meters Tall

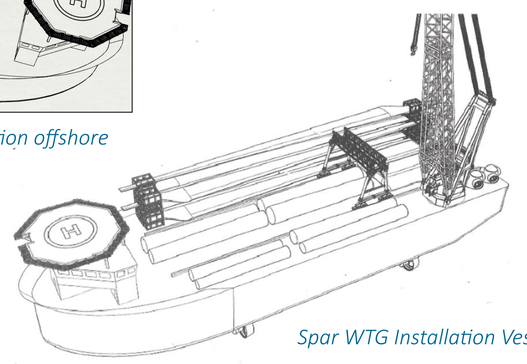
METHODS

The spar buoys will first be fabricated offshore near the installation site using a construction barge enabling slipforming of the spar structure at sea. Geopolymer composite materials with basalt fibers and reinforcing bars provide a foundation with a 100+yr service life in the marine environment, enabled by strong chemical bond to control cracking and non-reactive materials.

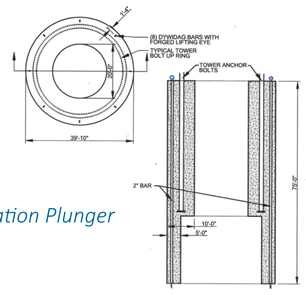
The wind turbine spar, top-section, and nacelle will be assembled on site by the installation vessel. Telescoping of the topsection into the center of the spar floater enables installation of the nacelle with a barge mounted gantry in lieu of a critical heavy lift crane from a floating platform. Demobilization or replacement of the WTG with



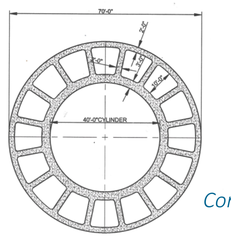
Construction barge used for fabrication offshore



Spar WTG Installation Vessel



Spar Buoy Telescopic Foundation Plunger



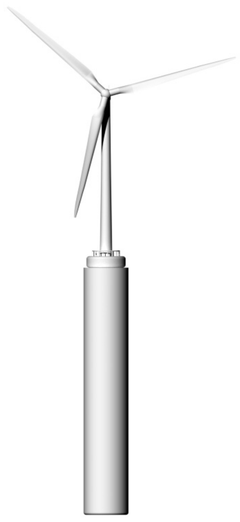
Concrete Spar Buoy Section

RESULTS | SPAR SIZING FEASIBILITY

To investigate the feasibiltiy of the floating spar buoy concept, the team undertook a study to evaluate the spar size that would be required to provide an adequate floating foundations for a 25 Megawatt turbine installation. This initial study was a steady-state analysis that did not consider the impact of wave loading nor cable dynamics.

The turbine installation analyzed had a height from the waterline to the rotor hub of 210 meters, and a rotor diameter of 310 meters. The objective was to design a spar of sufficient size to prevent the installation from experiencing a heel angle greater than five degrees when subjected to the maximum anticipated overturning moment of the spar.

The team found that a spar with a diameter of 26 meters and underwater length (draft) of 300 meters was sufficient to meet the design objective.



25 MW Turbine
300m x 26m Spar Installation

Notional 25 MW Spar and Turbine Installation Characteristics		
Turbine Power	25	MW
Maximum Overturning Moment	5775000	kNm
Hub Height Above Waterline	210	M
Spar Diameter	26	m
Spar Draft	300	m
Assumed Turbine Weight	6,900	t
Approximate Spar Weight	156,000	t

NEXT STEPS

There is an opportunity for all parties involved in the decision making (State, Federal, local agencies, NGOs, environmental specialists, rate payers, public, etc.) to build a US FOSW center of excellence in Washington State with highest local content and economic benefits to mitigate the rolling blackouts and drought facing the West.

Other next steps are finalizing performance, operational, and environmental requirements for the program as a whole, advancing the concept level designs, and verifying anticipated capital and lifecycle costs for both the construction and installation vessels and the spar WTG units. Other next steps are finalizing performance, operational, and environmental requirements for the program as a whole, advancing the concept level designs, and verifying anticipated capital and lifecycle costs for both the construction and installation vessels and the spar WTG units.

Elliott Bay Design Group

AMF CONCEPTS

eWind

CONTACT DETAILS

Andy Filak | AMF Concepts

Andy Zalay, PE | eWind Consultants
andyzalay2@gmail.com
zalaype@gmail.com
(949) 378-0807

John Reeves, PE | Elliott Bay Design Group
jreeves@ebdg.com
(206) 204-1300

WWW.EBDG.COM

BIBLIOGRAPHY

BOEM lease application 28 March 2022
Unsolicited Request for an Outer Continental Shelf Renewable Energy Commercial Lease Under 30 CFR 585-238 Olympic Wind Offshore Wind Project

MOCEAN Report 13032-EWF RFP-002
March 12, 2013, Installation of TLP Based WTG Near Coast of Hawaii

January 2, 2021 Presentation to WA Maritime Blue Joint Innovation Project Deepwater Offshore Wind

"Revolutionizing Deep Offshore Wind Turbines" by Andy Filak and John Reeves. Published in Wind Systems Magazine, May 2017

SCAN ME