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Fabrication, Transport and Installation of Floating Wind Turbines

Alan Crowle (University of Exeter)
and Professor P. R. Thies (University of Exeter)

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Floating wind types, [6]

Steel Semi Submersible[7]

Concrete Damping Barge[14]

Steel Spar[15],[16]

Steel TLP[11]

Steel Submerged Ballast[12]

Concrete Single Point Mooring[13]

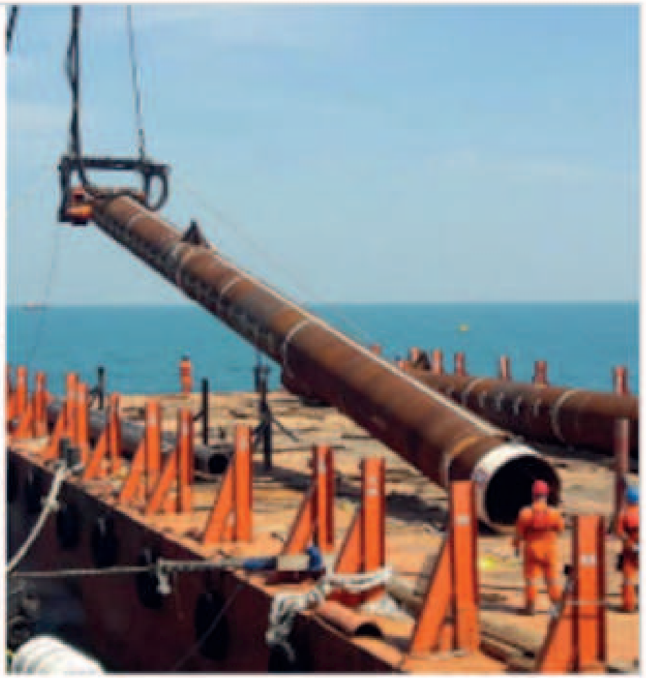
Chains, [6]

THE CHALLENGES
In floating wind, the mooring chain is 220mm in diameter; each link weighs 946kg. Loading and discharging may not be possible with ships' cranes, and load-bearing surface capability on the quayside and in-port storage areas, must be significantly higher.

Offshore, the chain is so heavy that it cannot be winched onto an installation vessel. Instead, it must be lifted. The current fleet of anchor handling vessels few of the fleet today can accommodate this larger chain size. The vessels' chain lockers also cannot store the chain so it must be loaded onto the deck.

Anchors, [6], [7]

However, the handling challenge comes from anchors needed for station keeping for floating wind structures.
Suction piles might be 4 to 6 m in diameter and 15 to 20 m in length
Driven piles can be 2.0-3.0 meters in diameter and up to 20 to 30 m in length, again difficult to transport and store.



Large AHV [6]

Suction pile [18]

Driven pile, [6]

Hywind Tampen

Concrete Substructures in Dry Dock [15]

Solid ballasting of base, topped with water [15]

Laydown area Towers, Nacelles, Blades [15],[17]

Lifting Nacelle. Substructures in wet storage [15],[17]

Blade lifting [15],[17]

Fitting Blade. Completed FOWT wet storage [15],[17]

Tow out. Large tug to pull, others for steering
At least 3 tugs are required during the mooring up [15]

Offshore next to oil platform, [15]

La Grande Large TLP

Large Area Required Onshore Construction, [3], [4], [5]

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Submersible Barge Land to Sea [3], [4], [5]

Harbour tugs move substructure to fit out quay [3], [4], [5]

Offloading blades at fit out quay [1], [2]

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Lay down topside fit out quay [1], [2], [3], [4], [5]

Big cranes lift tower from fit out quay [3], [4], [5]

Big cranes at the fit out quay [3], [4], [5]

Les trois éoliennes flottantes de Provence Grand Large ont été installées en mer avec succès | Provence Grand Large

Inshore cable laying [3], [4], [5]

Tow Out [3], [4], [5]

Installation[3], [4], [5] Normand Installer

In-place
[3], [4], [5]

Discussion

Despite this massive growth forecast, in floating wind there is only about 180MW deployed. Significant barriers to full commercialisation still exist. There are challenges that must be overcome before floating offshore wind will realise its full potential.

Most ports do not have the required area to deliver commercial scale floating offshore wind components without significant investment. To reduce draft of FOWT add temporary buoyancy.

Floating substructures (semi submersibles and barges only) are currently towed back to port for maintenance and repairs. However, this will not remain feasible or economical as wind turbines are located further offshore and the distance to O&M ports increases.

Conclusions

Floating wind developers in the first instance will use existing ports, cranes, installation vessels

There are moves to improve existing ports.
Large onshore cranes are being developed and deployed

Existing anchor handling tugs have been successful. But more are required.
Very large anchor handling tugs are under development, with more storage for chain
Different methods of using existing large crane vessels are being considered

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THANK YOU FOR YOUR ATTENTION

ANY QUESTIONS

ac1080@Exeter.ac.uk

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Abbreviations

FOWT = Floating offshore wind turbine
HVAC = High voltage alternating current
HVDC = High voltage direct current
KV = kilovolt
M = metre
MW = megawatt
O&M = operations and maintenance
T = (metric) tonne

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18. SPT

Abstract

As the floating offshore wind turbine industry continues to develop and grow, the capabilities of established shipyard facilities need to be assessed as to their ability to support the expanding construction and installation requirements. This presentation reviews current infrastructure requirements and projected changes to shipyard and port facilities that may be required to support the floating offshore wind industry. Understanding the infrastructure needs of the floating offshore renewable industry will help to identify the port related requirements, to support the offshore installation operations.

Naval architecture plays an important role in the construction and installation of floating offshore wind turbines. Intact stability, motions, accelerations and mooring loads need to be calculated for each stage of the construction of a floating offshore wind turbine.

Separate shipyards are required for substructure construction and fit-out of the turbines. Marshalling ports are required for mooring components, export cables, inter array cables and maintenance. Large areas are required for the laydown of mooring equipment, turbine blades and nacelles.

The presentation will consider the capabilities of established shipyard facilities to support floating wind farm development are assessed by evaluation of size of substructures, height of wind turbine with regards to the cranes for fitting of blades, distance to offshore site and offshore installation vessel characteristics.

The presentation will discuss the advantages and disadvantages of using large land based cranes, inshore floating crane vessels or offshore crane vessels at the fit-out port for the installation of the turbine. Water depths requirements for import of materials and export of the completed structures will be considered.

The vessels required for ocean transport and offshore installation will be discussed. Various construction vessels are required offshore: anchor handling tugs, cable lay vessels, seabed survey vessels. Specialised cargo ships and heavy transport vessels are required to deliver components to the fit out shipyard.