Defining and optimizing strategy for floating wind installation in challenging environmental conditions

Raf Somers, Engineer-Advisor & Project Manager
IMDC - Tractebel
“With its international, independent and multidisciplinary expertise, IMDC with partner companies provides as Owner’s Engineer and Consultant Engineer integrated and tailor-made expert advisory services and innovative solutions for your offshore wind projects (fixed and floating)”
Offshore Activities

1. Wind farm and Wind turbine and foundation design
2. Floating wind
3. Offshore substations and platforms (HZ...)
4. Tidal energy converter
5. Floating offshore PV
6. Wave energy converter
7. Transport & installation
8. O&M strategy and coordination, vessel design
9. Port (re)development
10. Subsea cabling and landfall
11. Onshore substation
12. Power transmission

Floating Wind Solutions

Installation in challenging conditions
### Environmental expertise
- Environmental Impact Studies
- Measurement campaigns
- Safety analysis

### Wind turbines, Wave & Tidal Converters expertise
- Wind/Wave/Tidal resource assessment
- Layout optimisation
- Electricity output

### Electrical expertise
- Electrical & Topside design
- EPC for electrical HV/MV equipment
- Grid connection
- Grid stability & behavior
- Cable trajectory
- Cable laying/burial assessment & techniques

### Port infrastructure
- Design
- Master planning

### Foundation structure expertise
- Geotechnical & geophysical data analysis and soil parameterization
- Hydrodynamic, morphodynamic & magnetometric surveys
- Set-up of design basis
- Conceptual, Basic & Detailed Design for floating and fixed foundations (MP, GB, Jacket)
- Scour protection system

### Electrical expertise
- Geotechnical & geophysical data analysis and soil parameterization
- Hydrodynamic, morphodynamic & magnetometric surveys
- Set-up of design basis
- Conceptual, Basic & Detailed Design for floating and fixed foundations (MP, GB, Jacket)
- Scour protection system

### O&M
- Operating and maintenance planning & support
- Review as-built documentation
- Monitoring and maintenance plan
- Subsea cables & cable condition assessment.
- Engineering studies
- On-site support: Inspections (WTG, blade, gearbox, yaw misalignment, power curve verification, …)

### Services
- Contracting
- Quality Assurance
- Construction & commissioning follow-up
- Interface Management
- Workability analysis
- Certification follow-up
- Decommissioning planning
- Due Diligence and Lender’s Engineering services
- Tender management, contract awarding and negotiation
- Concession files and permits elaboration
- PMO type services

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**Floating Wind Solutions**

**Raf Somers**

The Marriott Marquis, Houston  1-3 March 2022

**Installation in challenging conditions**
Our Expertise Applied on Floating Wind Projects

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Installation in challenging conditions
Quay Side Installation

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Installation in challenging conditions
Types of Installations at Ports

• Grounded Installation
  • Seabed foundations to be installed at quay
  • Stable working conditions
  • Environmental site conditions less critical during installation
  • Applied @ Ferrol (Portugal) on WindFloat Atlantic Project for WindPlus

• Floating Installation – Emergency Grounding
  • No foundations needed (if bed can bear load)
  • Environmental site conditions can become critical during installation
  • Flexible working conditions
  • Applied @ Rotterdam (The Netherlands) on Kincardine OWF Project for Cobra Inte’national
Installation Site Characterization

- Water depth
- Waves & Currents
- Wind conditions
- Seabed Geotechnical conditions

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Installation in challenging conditions
Design / Verification Steps

• Determine all loads acting on turbine & floating platform
  • External loads, depend on site conditions: wind, waves, water level, currents, ...
  • Loads depending on ballast water in floating platform’s ballast tanks

• Convert those to loads acting on the seabed or foundation
  • Applying laws of structural mechanics

• Define subground strength & stiffness

• Geotechnical stability calculations of sub ground
  • Bearing capacity / curved slip sliding surfaces
  • Horizontal sliding & overturning

• Hydraulic rock stability calculations for foundation bed
Foundation Beds – Grounded Installation

- Installed on seabed prior to arrival of floater
  - Rock placed on seabed in different layers
  - Correct placement monitoring
- Floater must be grounded/refloated slowly with controlled (de-)ballasting
- After installation foundations can be removed

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Installation in challenging conditions
Other Services

WindFloat Atlantic Project

Capacity: x 4
Unit cost: x 1.75
Life extension: x 5

- Sizing ("smaller" platform)
- Structural optimizations
- Other improvements on equipment, accessibility, mooring, installation, O&M
Coordination management during construction

- Mooring the platforms
- Construction of the bed layers for stabilization of platforms at port
- Ballasting and stabilization of platform
- De-ballasting and mooring of platforms
- Survey, installation and removing the bed-layers during assembly of platforms
- Site-manager during unloading and assembling the turbines
Support during Commissioning

- Contacts with the local and official authorities, licenses, rescue plans
- Follow and participate in commissioning of floaters (shipyards)
- Organize and coordinate use of CTV during offshore installation phase and afterwards
- Close contact with the maritime authorities and coast guard
- Monitoring and following the environmental issues, bird radar, bats
- Weather forecast monitoring in order to schedule operations
Operations and Maintenance (O&M) Manager

- Define O&M strategy and prepare implementation
  - O&M based at nearby port
  - Onshore based O&M strategy with CTV support service
  - Fully dedicated team able to operate the offshore windfarm 24/7
- Manage and coordinate the daily O&M activities for the WTG and the floaters.
- Follow up the execution of the new O&M building activities
- Training: wind turbines and wind energy
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