

Application of SBM's floating wind concept

Adapting Tension Leg technology to provide an economical solution for floating wind power

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SBM Offshore



EXPERIENCE MATTERS



Who is speaking?



Leading contractor of floating and mooring systems for the offshore energy industry



FPSO (43)



Operation & Maintenance



Brownfield Services

Local partners a priority

60 years of innovation

> 500 floating projects delivered

Global presence

Sound financial basis to underpin projects

>10 years of marine renewables technology development



Floating Gas Solutions



Semi / TLP (10)



Terminals (>450)



Turret Mooring Systems (57)



Offshore Installation (>50 years)



Renewable Energy

Technical collaboration



Coupled
aero - hydro



Innovation - R&D

Offshore wind expertise

Institutional and Academic network

Aero-hydro coupling :
Deeplines WindTM

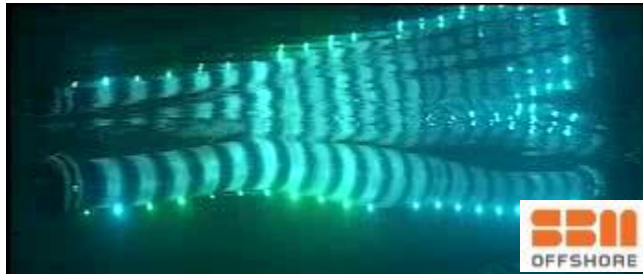
TECHNOLOGY



PROJECT
EXECUTION (EPCI)

OPERATIONS &
MAINTENANCE

FINANCE & LEASE

10 years of marine renewables technology development in SBM



- SBM has invested in technical development of marine renewable energy **since 2006**
- Developments in wave energy, floating wind (divestment of subsidiary in 2013), and OTEC
- In 2016 SBM launched a **Renewable Energy Product Line**
- **Objective:** Build on offshore expertise and experience to provide safe, reliable, economical solutions to the Marine Energy market
- Two focus markets
 - Floating Offshore Wind → 
 - Wave Energy → 

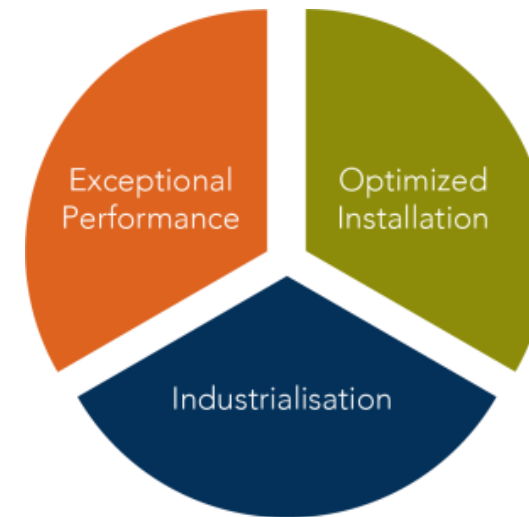
SBM's wind floater – introduction to concept and main design principles



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- Light = cheap
- Low accelerations / motions at nacelle
- Transparent structure to minimize wave action
- Catenary cable
- Field proven components
- Mass ratio decreases with larger WTGs
- No active ballast
- Limited footprint

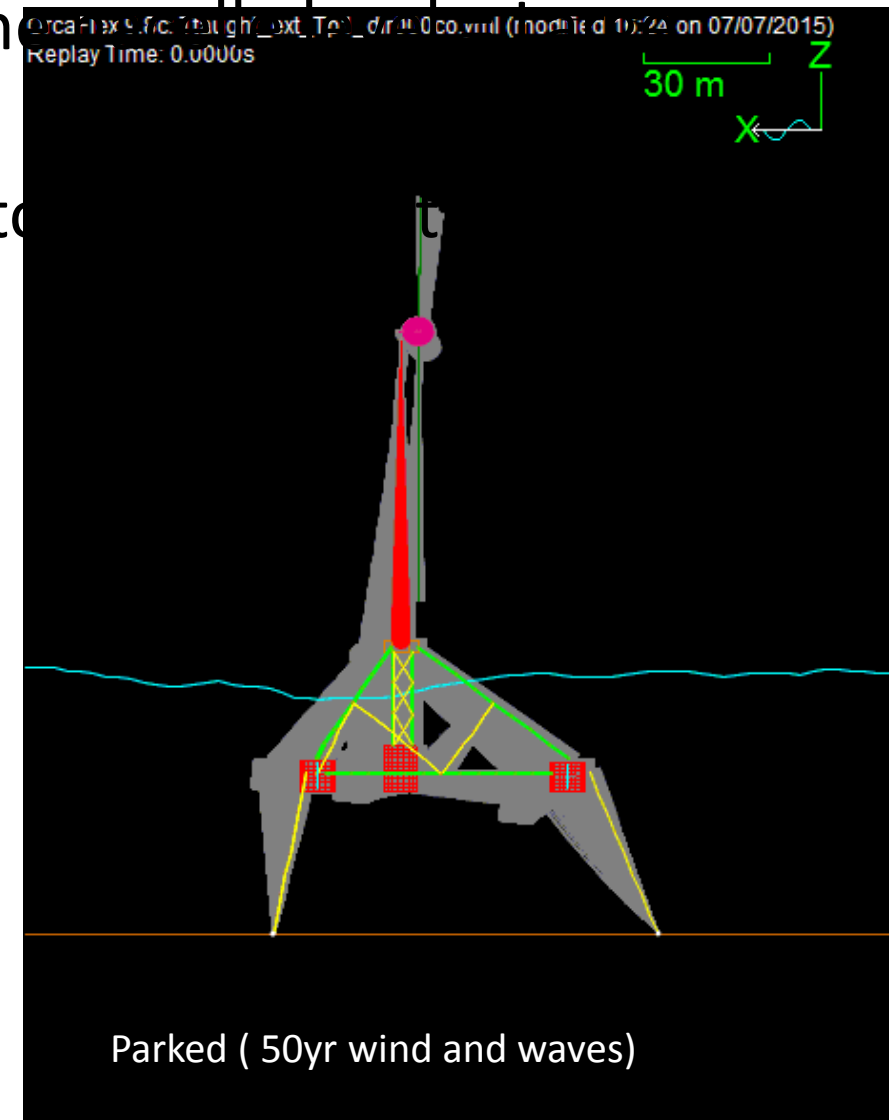
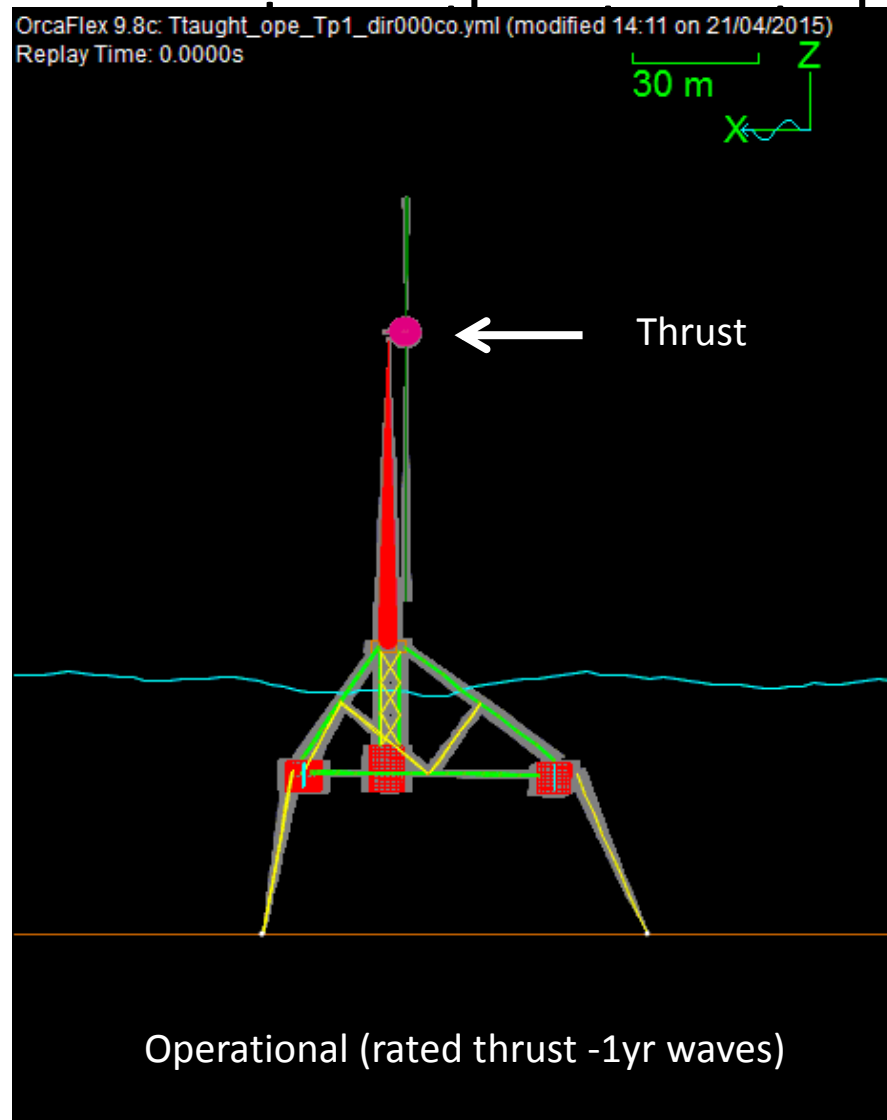
Three design principles



- Catenary installation
- Small draft for WTG installation @quay
- Wet tow to site with WTG integrated & with conventional means
- Use of conventional anchors

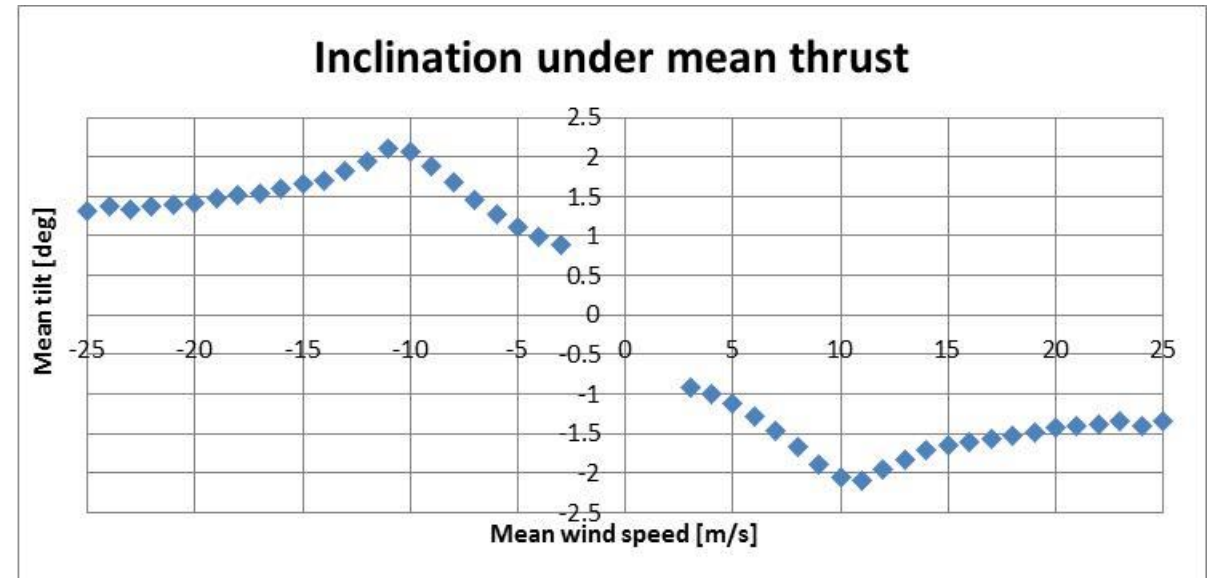
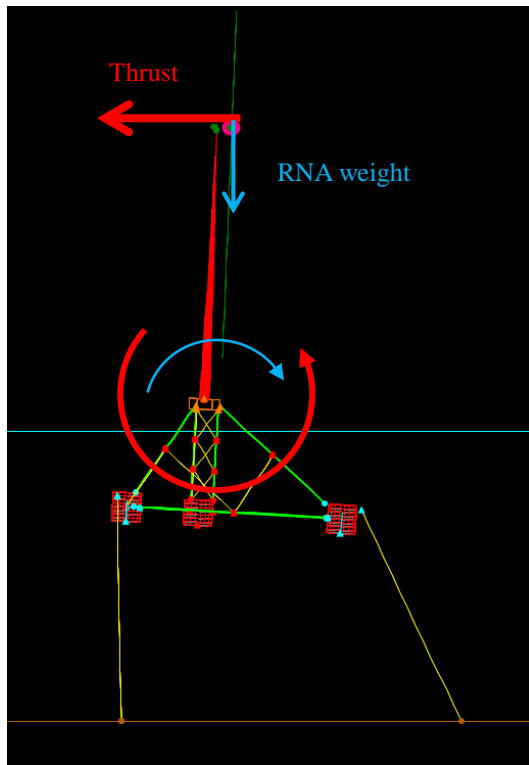
- Modularity and low complexity components for supply chain based and flexible assembly
- No dry-dock
- Assembly with standard yard means

Special mooring configuration – adapting TLP to wind turbine loading



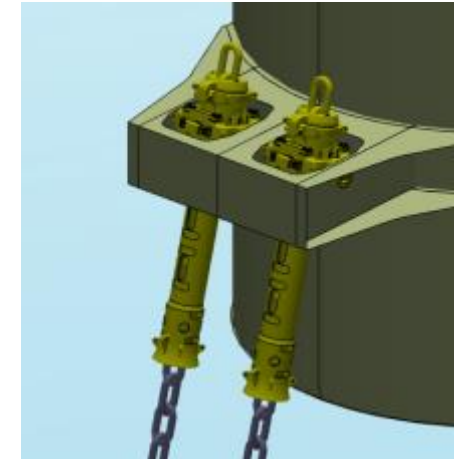
Counter pitching effects and benefits

- Decreases tower base moments
- Realigns the plane of rotor to vertical

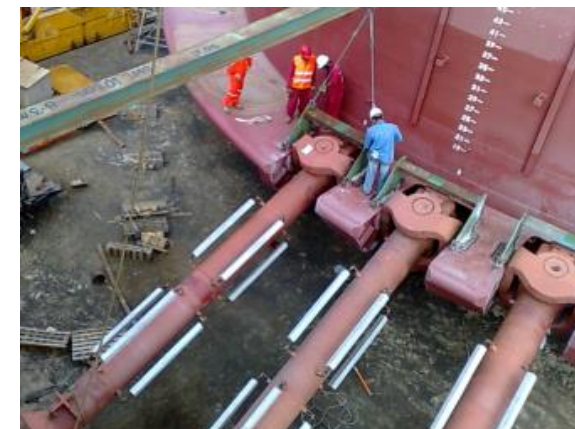


Mooring system with truly tested components

- Mooring system arranges in 3 bundles of 2 lines
- Use of conventional mooring components (chains, wire ropes) thanks to the low level of tensions
- Use of field proven accessories to limit OPB fatigue in mooring chains
- Extensive experience of mooring system design



Component	SBM Experience (years)
Cylindrical floating bodies	50
Bracings / jackets	30
Chain connectors and ratchets	50
Mooring accessories	50
Gravity anchors	50
Suction piles	30
Transition pieces with turbines	30



Commercial scale floating wind plants require different capabilities

Commercial size
FOW power plants

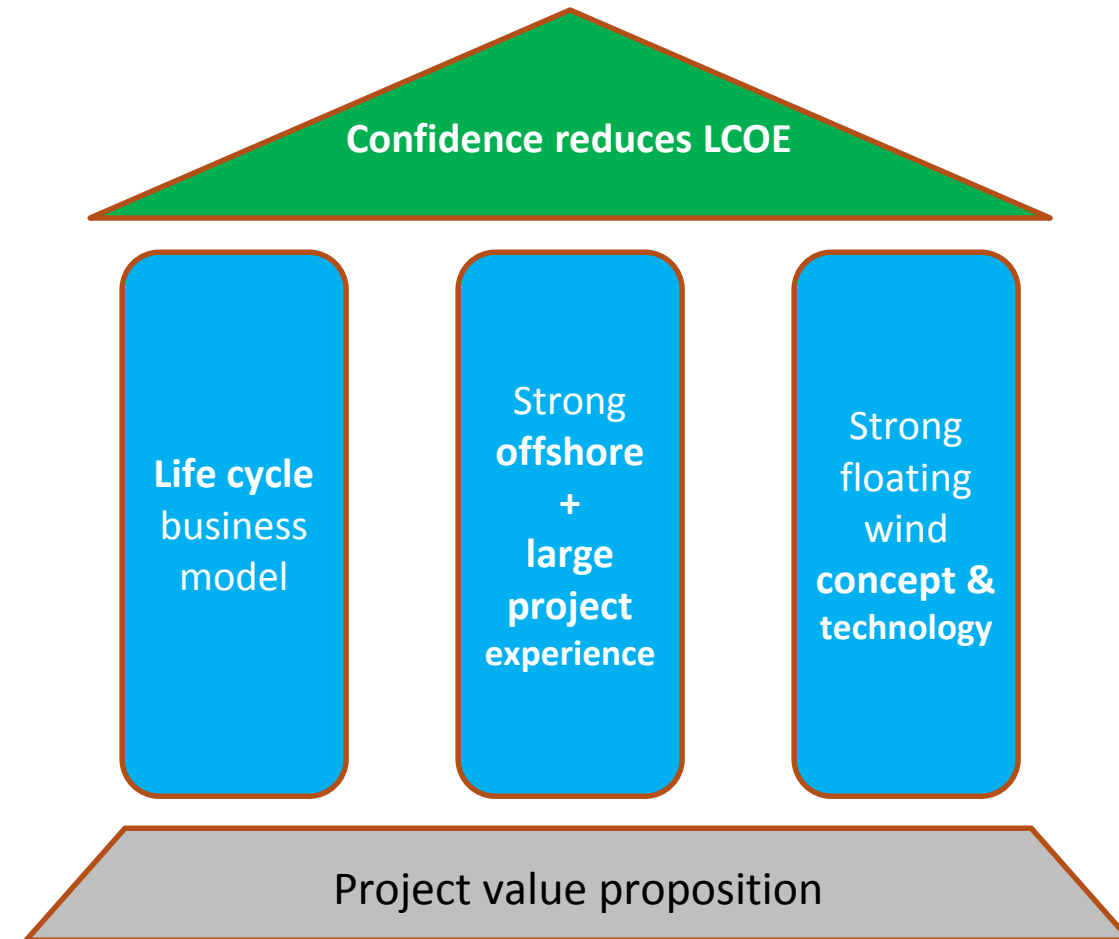


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~ **x2** SBM Generation 3 FPSOs
in a comparable schedule



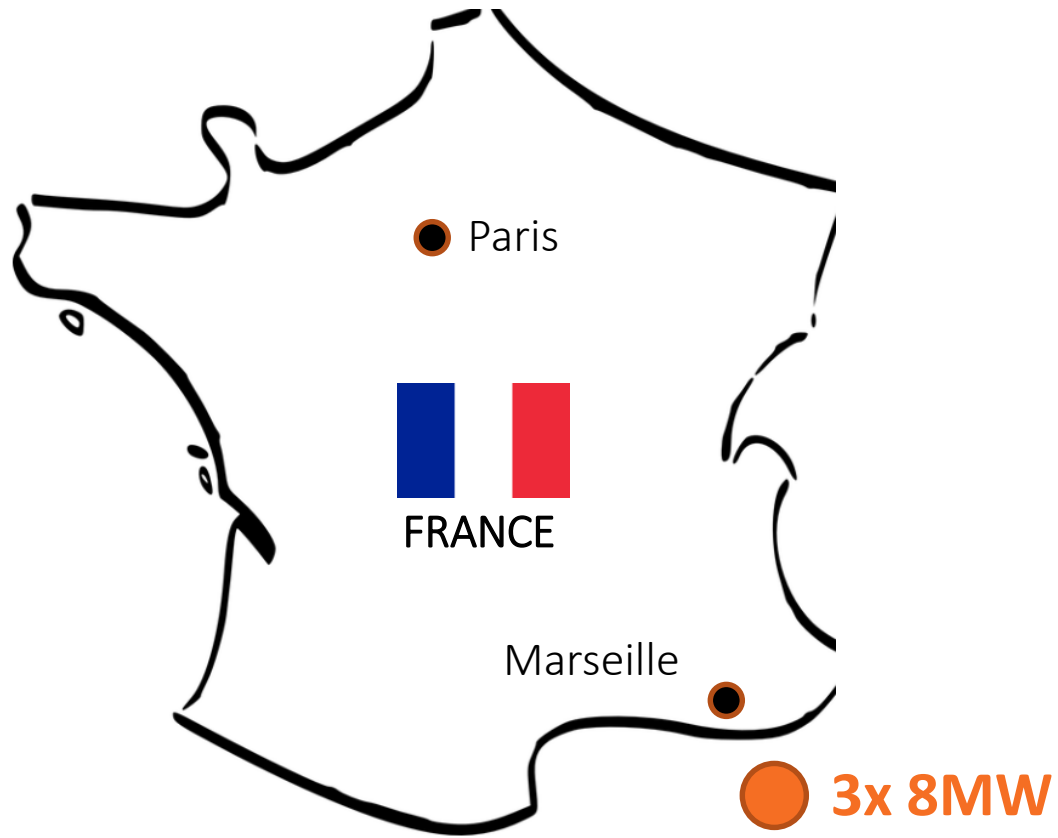
=> Big volume of work to be planned and executed different to
fixed offshore wind



...and thought for large scale industrialization and installation



SBM Offshore selected provider of wind floaters for the Provence Grand Large project offshore France



Thank you



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