Panel 2: Risk, Regulation & Insurance of Floating Infrastructure

Marine Operations Risks of FOWT

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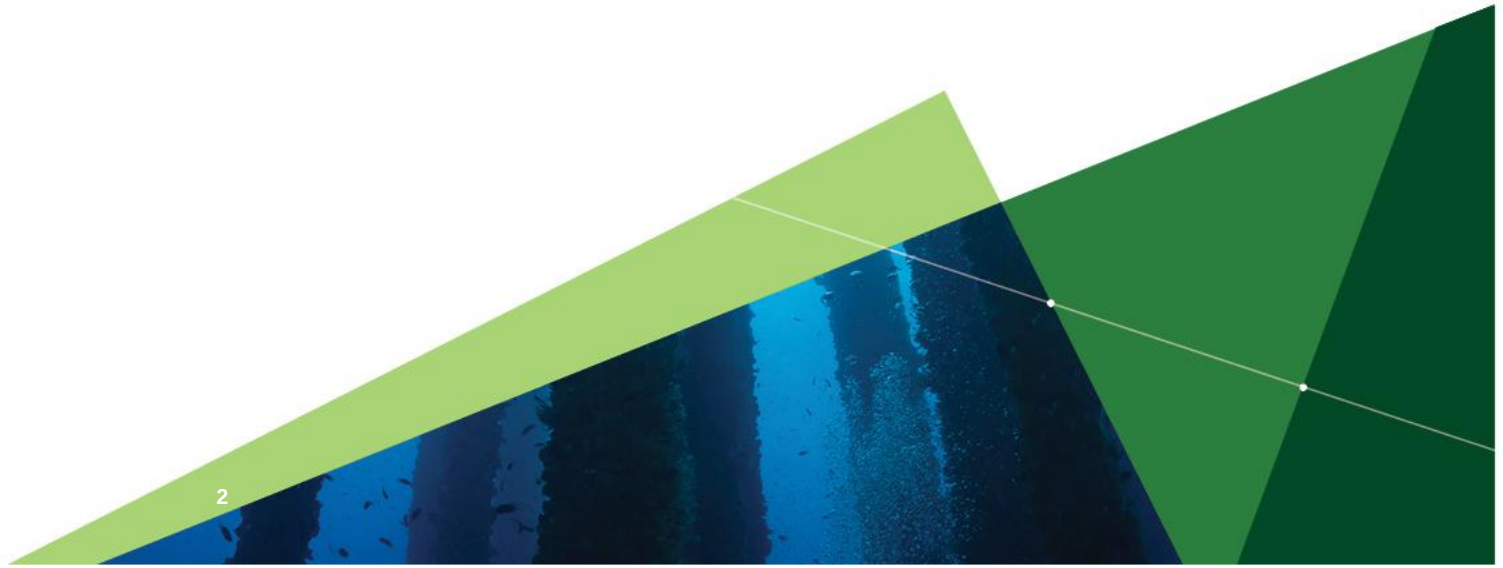
French American Innovation Day (FAID), Boston, USA

18th and 19th March 2019

Agenda

1. Introduction – LOC
2. Brief History of Floating Wind
3. Options and Opportunities
4. General Risks of Floating Wind
5. The 2MW FloatGen Demonstrator Project
6. Challenges of Floating Wind



Introduction - LOC

- No.1 marine warranty surveying firm with >30 Offshore wind farms warranted
- Design engineers and analysts on >30 OWFs through sister company Longitude
- Integrated Turbine Loads Analysis
- Owner's Engineer – RTE – 3 floaters
- Just completed the Infrastructure & Logistics scope for the Carbon Trust Floating Wind JIP for 500MW Farm
- 8 – Projects: Hywind Demo, WindFloat, WindFloat Atlantic, Floatgen, Provence Grand Large, Eoliennes Offshore du Golfe du Lion, Groix - Belle – Ile, Kincardine

LOC Group Companies

Marine Warranty Surveys

Marine Engineering & Consulting

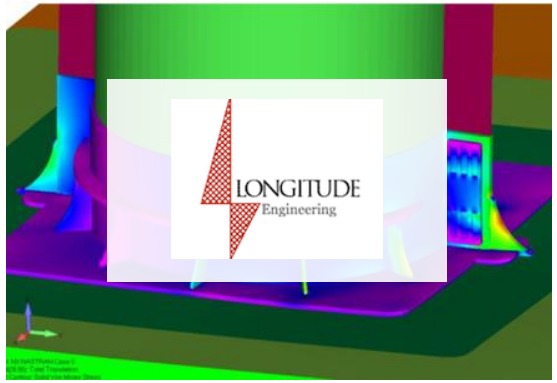
Surveys, Inspections & Audits

Claims, Disputes & Litigations

Marine Casualties

Technical Due Diligence

Project Management



Naval Architecture

Structural Design & Analysis

Marine Transportation

Installation Engineering

Mooring & Riser Design & Analysis

Metocean Analysis

Rig Moving

Risk Control Services

MODUs

Concept development

Pre-FEED and FEED design

Foundation package management

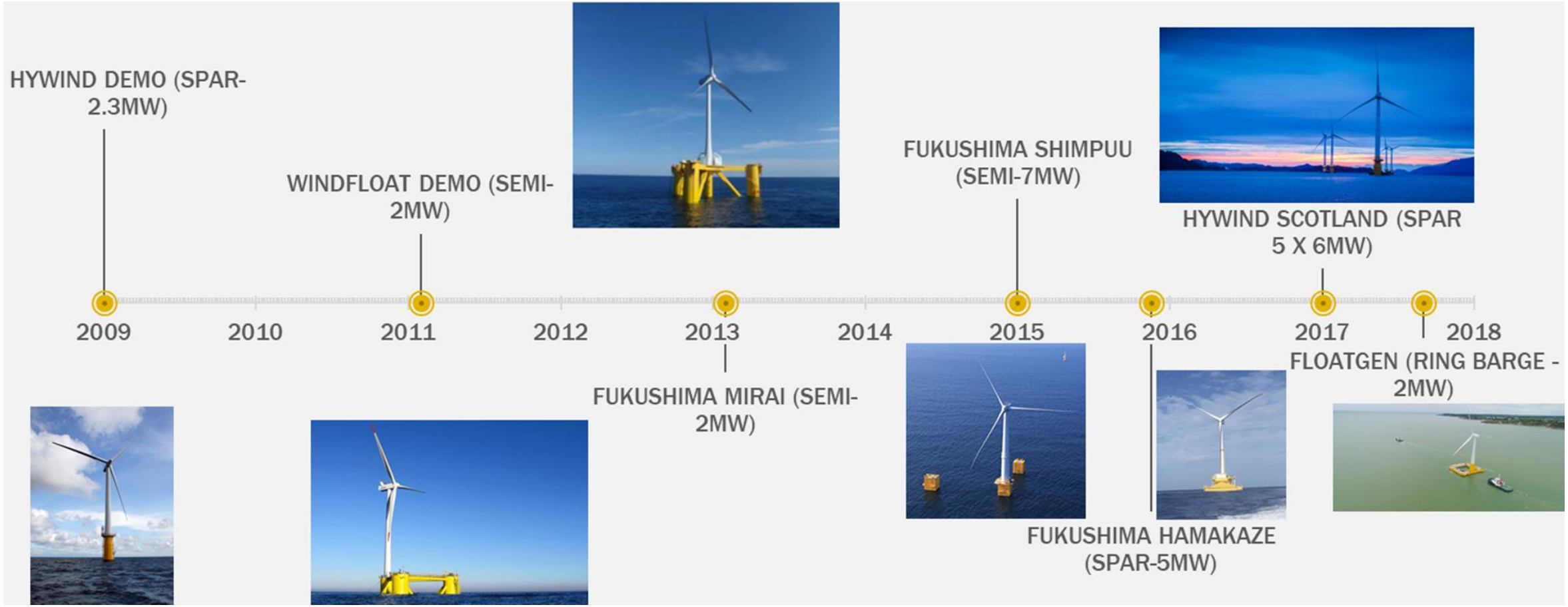
Cables package management

Design software supply

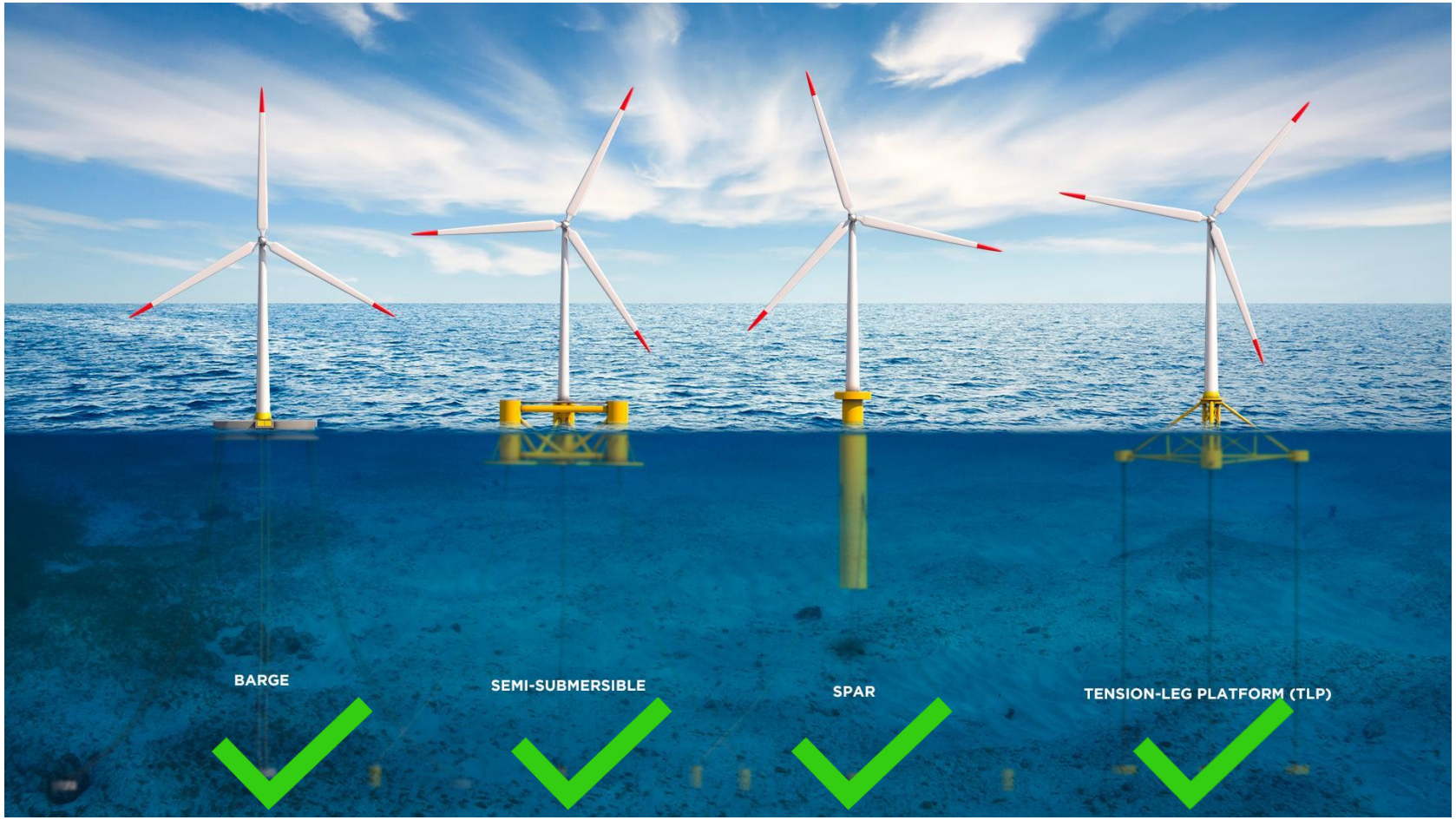
Research and development

Cable design

History of Floating Wind

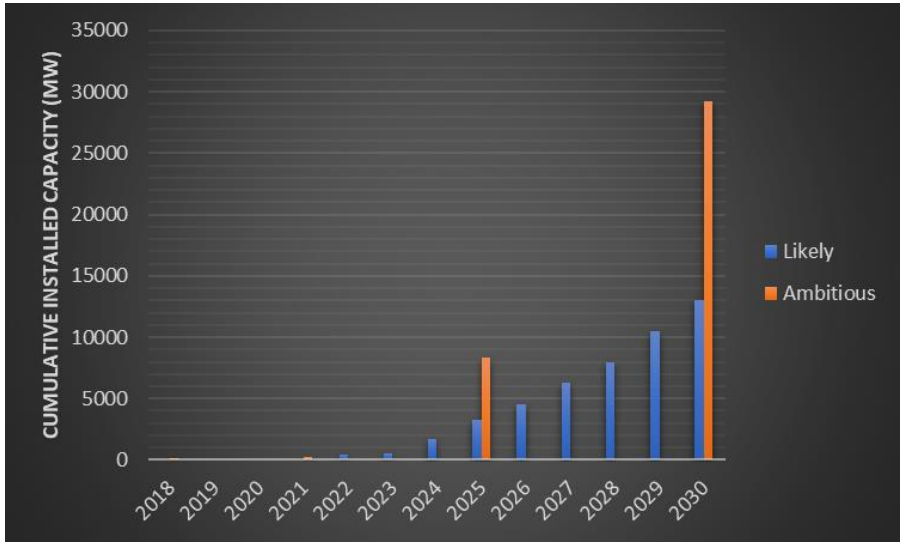


Contemplated substructure types for offshore



Courtesy: www.offshore-mag.com

Opportunity



Courtesy: Carbon Trust and Equinor

- Forecasts of cumulative installed capacity have wide variability
- ~13-30GW by 2030
- Europe (France, UK, Norway, Portugal) to dominate early to 2020
- Asia (Japan, China, Taiwan) to grow fast to 2025 and continue to 2030
- USA entering in mid 2020s and accelerating to nearly equal other regions

- Floating Wind can offer better and stronger perspectives to Energy Provider companies compared to “classic” Fixed-Bottom Offshore Wind, for instance:
  - ✓ Can be installed everywhere around the world, independently of the nature of the coasts (no limit on water depth).
  - ✓ Can be located far away at sea, leading to less visual pollution for people leaving at seaside.
  - ✓ Can be located far away at sea, leading to less impact on other activities of people working at sea.
  - ✓ Geographical areas with stronger and more stable winds.
  - ✓ Larger wind turbines providing more cost-efficient solution.
  - ✓ “Plug-and-play” design, in case of need for heavy maintenance.

General Risks of Floating Wind – Known and Many

Source: Willis Towers Watson					
Technology	Turbines	Moorings	Cables	Vessel	Design Defects
Site	Conditions	Environment	Lack of Wind	Weather Risk	
Operations	Construction	Transportation	Cables	O&M	Decomm
Contract	Certification	Interfaces	Supply Chain	Delay	

- Proper Planning
- Thorough Risk Evaluation
- Lessons Learned from floating wind
  - Demonstrators
  - Pre-commercial projects
- Experience from Offshore O&G / Maritime industry.

The 2MW FloatGen Demonstrator Project

The first full-scale offshore wind turbine installed in France is floating !

- Project Name: FloatGen Demonstrator
- Developer: Ideol (in consortium with 6 other European partners: Centrale Nantes, Bouygues Travaux Publics, University of Stuttgart, RSK, Zabala, Fraunhofer)
- Construction / Installation: 2016-2018
- Location: 12NM from Saint-Nazaire, offshore France (West coast, Atlantic Sea)
- Designed for 50-yr return period conditions: H_S 9m, H_{max} 16.5m

Parameters		FLOATGEN
Location	Construction port	Saint-Nazaire, France
	Installation site	SEM-REV testing site, offshore Le Croisic, France
	Water Depth	32-38m
Foundations	Type	Floating floater Concrete square ring-shaped Damping Pool®
	Dimensions	L40m x B40m x H9.5m
Mooring	Lines	6-off Synthetic (nylon) line
	Anchor	6-off 16t Drag anchor
Wind turbine	Model	VESTAS V80
	Power	2MW
	Rotor diameter	80m

FloatGen "ID1" (Source: live.floatgen.eu)

The 2MW FloatGen Demonstrator Project

The Paris office of LOC Renewables provided Marine Warranty Services on the project, covering the construction, transport and installation phases.

(Source: www.ideol-offshore.com)

Review of methods, approval of operations and attendance to:

- Construction of concrete floater on three (3) barges in Port of Saint-Nazaire, France.

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- Float-out of concrete floater in Port of Saint-Nazaire, France.

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- Loading and transportation and offloading of transition piece and tower sections between Spain and France.

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- Integration of transition piece, tower sections, nacelle, hub and blades onto concrete floater in Port of Saint-Nazaire, France.

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- Prelaying, stretching and abandonment of mooring lines at offshore site.

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(Source: Jifmar)

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- Towing and station-keeping of Floating Wind Turbine.

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- Towing and station-keeping of Floating Wind Turbine.
- Recovery and hook-up of mooring lines.

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- Towing and station-keeping of Floating Wind Turbine.
- Recovery and hook-up of mooring lines.
- Recovery and hook-up of dynamic umbilical.

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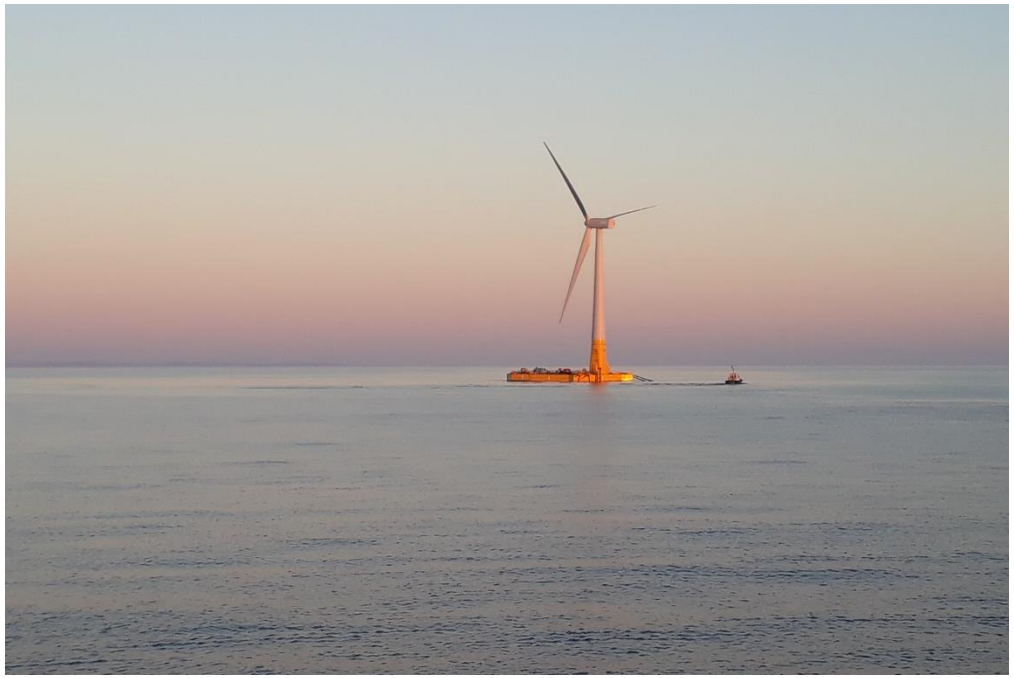

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This also included the survey of all the marine spread (installation vessels, harbour tugs, crew boat, etc.) and participation to risk assessment meetings.

Challenges of Floating Wind

Among others, the following challenges have been faced during the FloatGen Project and/or will need to be overcome in the near future for the development of commercial Offshore Floating Windfarms:

- Local Port Infrastructures: need / will need to be adapted for construction, operation and maintenance works related to Floating Wind – including adequate storage capacity and surface, quay strength, qualified dedicated personnel, local (sub)contractors, etc.
- Marine Spread: Installation vessels, towing tugs, crew boats, etc. need / will need to be made available locally to support all transportation and installation activities, as well as operation and maintenance.
- Local Players: Developers, Contractors, etc. need / will need to develop their “offshore” culture, including planned and detailed engineering process, following recognized standards for safe design and operations at sea.
- Project Acceptance: National Authorities in relation with the Floating Wind Industry need / will need to develop specific regulations. Lack of guidance from the National Authorities can be an obstacle for developers and Floating Wind in particular.

LOC Renewables have required marine and engineering expertise and the unique experience of offshore (wind) projects to lower the risks *to as low as reasonably practicable* (ALARP).

Challenges in scaling to >500MW

01 The construction and maintenance of floating wind farms has significant infrastructure and logistical challenges that are different from fixed offshore wind

02 Infrastructure and logistics will be a key factor in making floating wind technologies cost competitive, but requirements will vary by concept

03 There are limited ports that can accommodate all requirements for the construction of large-scale floating wind farms

04 Re-purposing of low cost jack-up vessels could alleviate onshore crane capacity constraints

05 Substructure fabrication represents the critical path in construction logistics - substructure design and port infrastructure must be suitable for serial production methods

LOC contribution to: https://www.carbontrust.com/media/675857/flw-jip-summaryreport-phase1.pdf

Challenges in scaling to >500MW

06 Current methods for dry dock substructure assembly are unlikely to be economically viable in large floating wind farms - quay side serial fabrication methods will be required

07 Turbine assembly and integration is a key challenge and cost driver

08 Long distance from assembly port to site may imply complex, lengthy and cost wet tow operations

09 Disconnection complexity and port infrastructure requirements are major challenges for tow-to-port maintenance strategies

10 Heavy lift offshore operations will be a requirement for several, if not all, concepts. Developing cost-effective methods is a priority for the sector.

LOC contribution to: https://www.carbontrust.com/media/675857/flw-jip-summaryreport-phase1.pdf

Thank you

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