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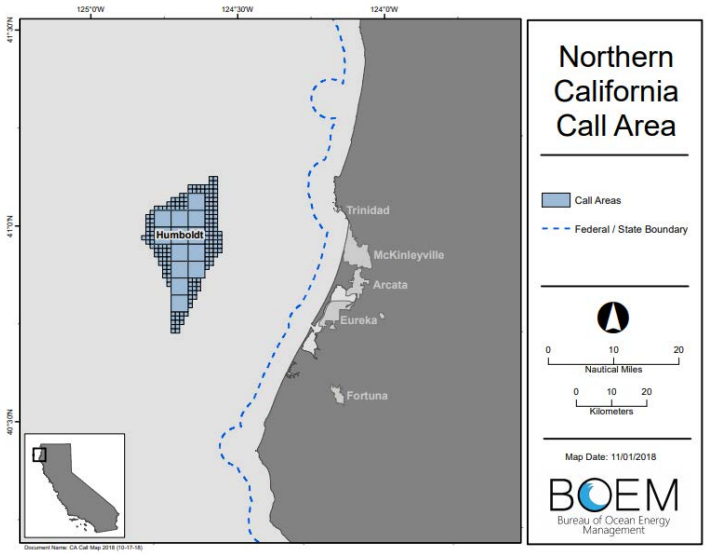
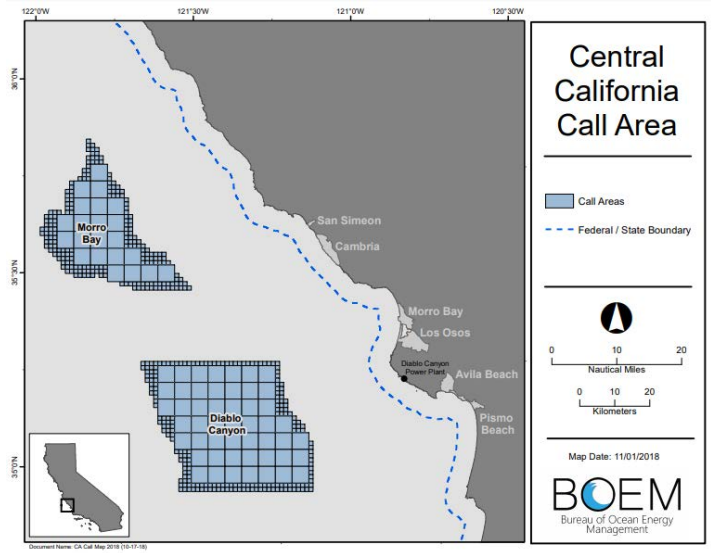
A Project Developer Perspective on Floating Foundation Innovation

3 October 2019

MagellanWind

The First US Floating Wind Market





Strong fundamentals

- Enormous electricity market – world's 5th largest economy uses >250 TWh/year
- Consistent ambitions to lead on climate
- High quality offshore wind resource

Challenges

- Price-competition from solar and low-cost land-based wind via long-distance transmission

California may be first to pose a challenge that will become apparent in many markets:

> *"For deep water floating wind farms the yardstick will not be costs compared with bottom-fixed offshore wind, the yardstick against which floating wind will have to compete is solar PV and storage."*
>
> -- Henrik Stiesdal, Offshore Wind Journal (Nov. 2018)

Floating Foundations Prototypes Perform Well But Cost Cuts Are Needed

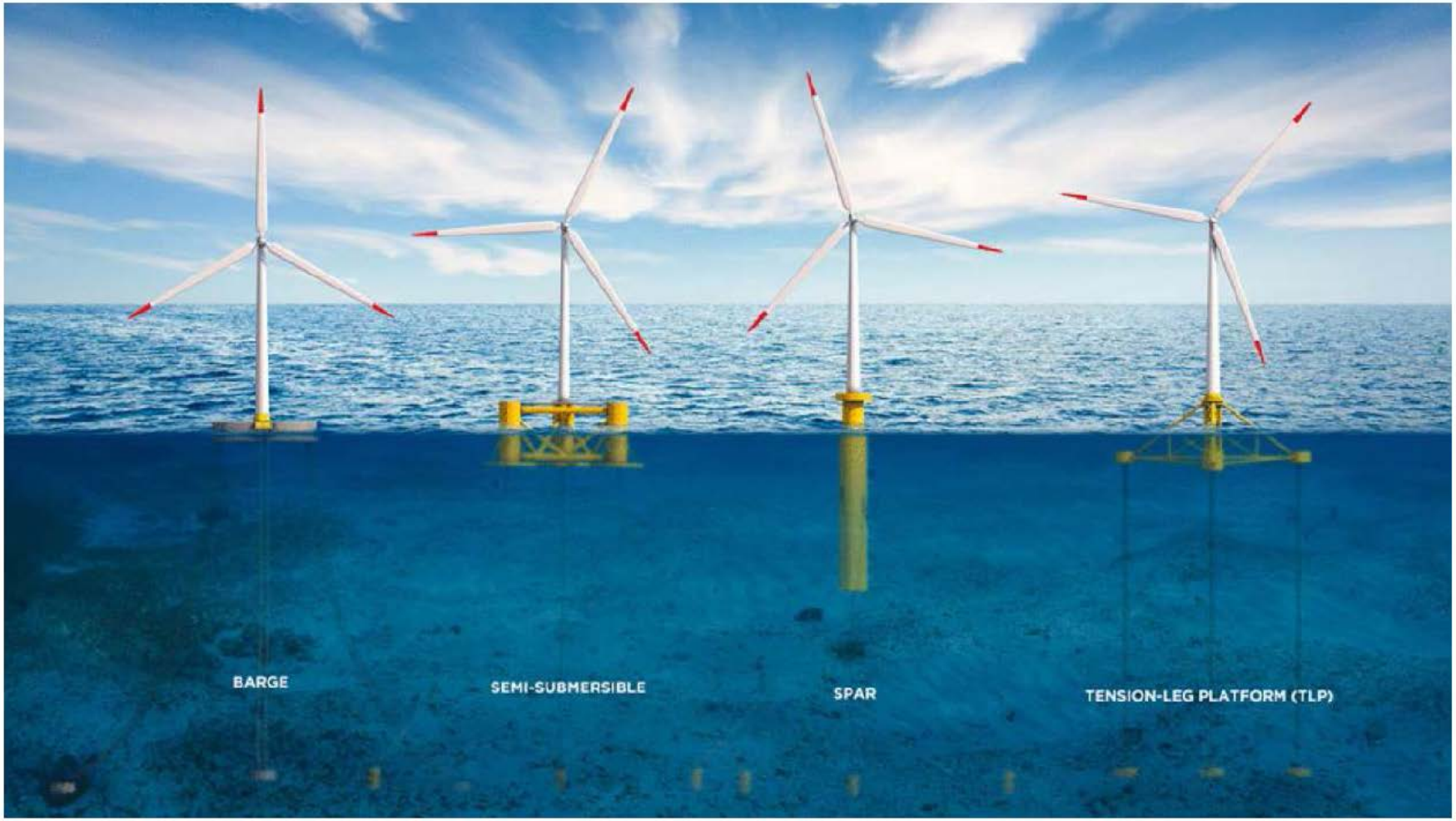
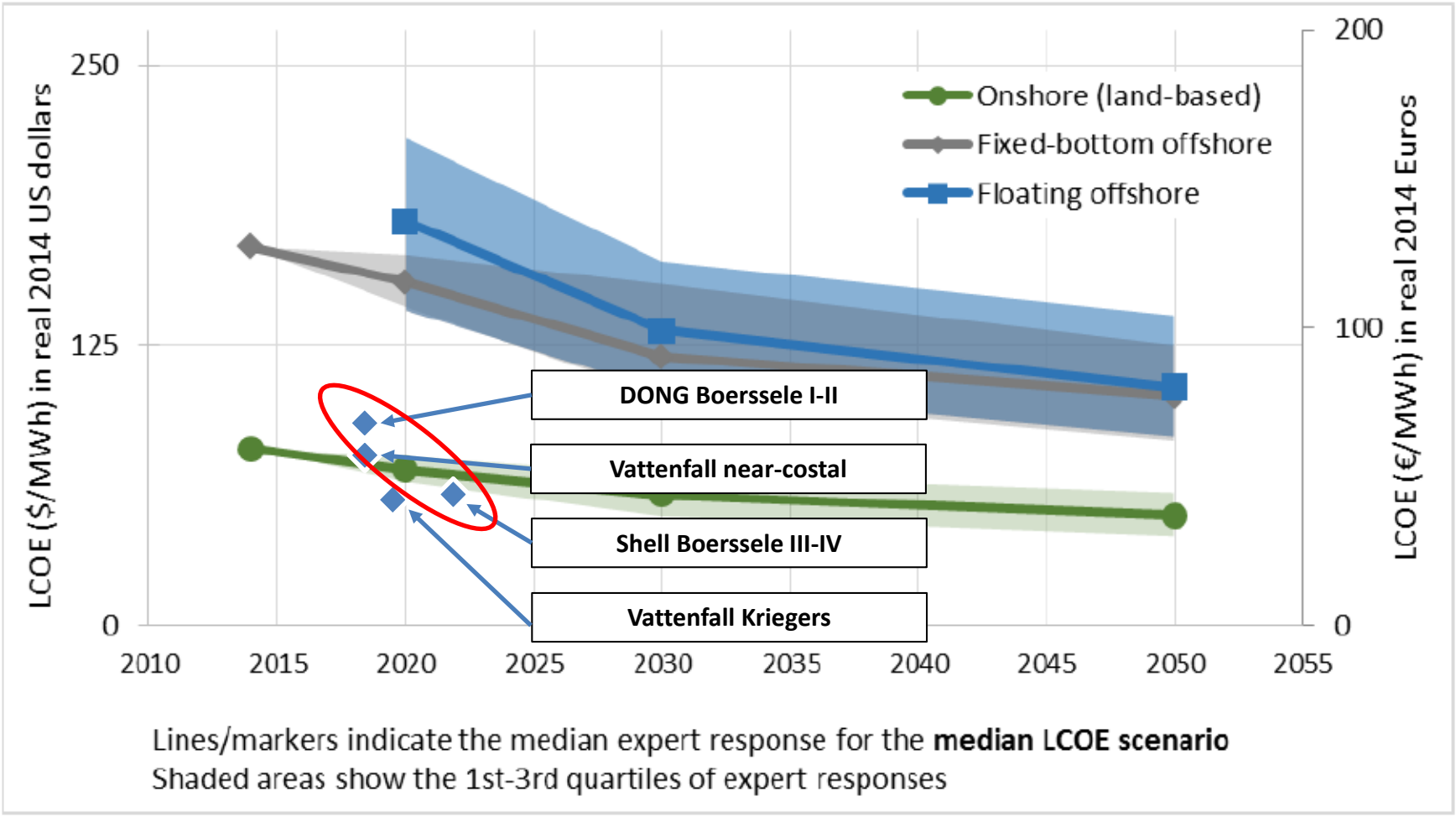


Image: WindEurope

1st Game Changer: Falling Costs for Common Systems



Source: Berkeley National Lab

2nd Game Changer: Foundation Innovations

Surging R&D investment:




. . .

Evaluating rapidly advancing floating foundation technology:

- All-in costs, including materials, assembly, deployment, O&M, and decommissioning
- Design maturity when choice is required
- Scalability and fabrication logistics
- Also, in some situations, local content and environmental impacts (especially impacts of mooring systems)

Photos: Equinor, Principle Power, Hitachi and Ideol

Cost Reduction Through Industrialization

Mindset

- Conventional thinking
  - We have designed this structure – now, how do we build it?
- SOT approach
  - We need to manufacture this way – now, how do we design it?

Concept

- Modular – all components factory-made, transported by road
- Components assembled at quayside without extensive welding
- Turbine mounted in harbor and towed to site, no installation vessels
- Weight 1000-1500 t for 6 MW turbine

TetraSpar Assembly and Installation

The TetraSpar Demonstrator

Stage 1 - 2016
- Concept
- Initial validation

€ 0.2m

Stage 2 - 2017
- Design
- Tank test OK

innogy

€ 18m

Stage 3 - 2020
- Prototype
- Full validation

Stage 4 - 2021
- Pilot project
- Release

Prototype

- Siemens SWT-3.6-130, 3.6 MW rated power, 130 m rotor diameter
- Status 30.05.19: Fabrication start June 2019, installation scheduled for April, 2020
- Foundation contractor: Welcon