SBM OFFSHORE

Floating Offshore Wind

A green resource for sustainable development

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OFFSHORE

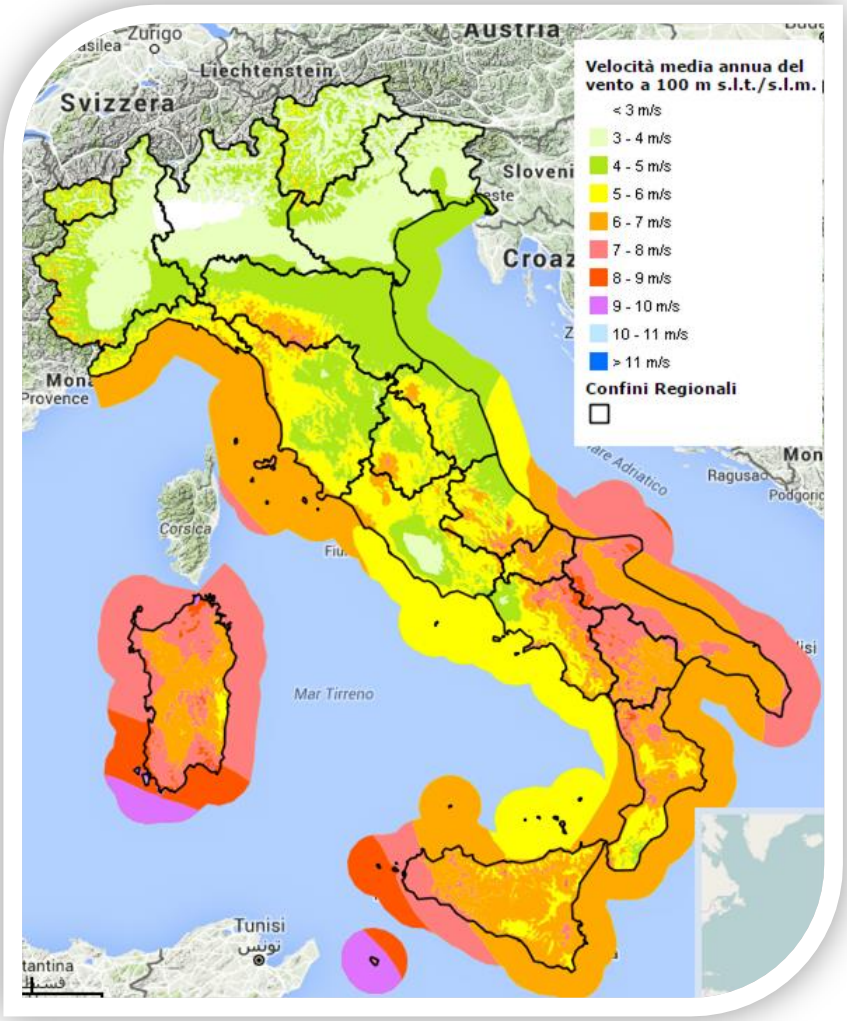
Offshore Wind as a resource

- There is an exceptionally **high potential for offshore wind**, worldwide, and the **majority** of the resource sits in **deep water**.
- The European industry has a **40% share of all wind turbines sold globally** and lead the world in offshore wind with **over 90% of today's offshore wind farms**.

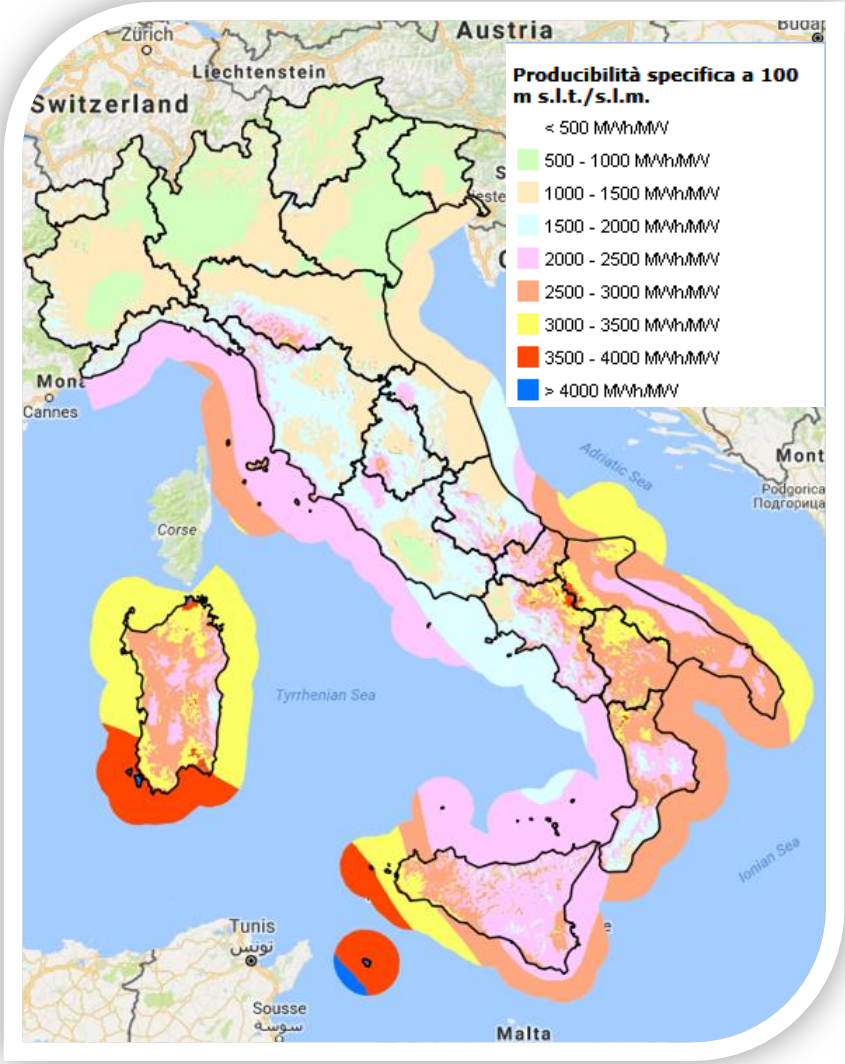
COUNTRY / REGION	SHARE OF OFFSHORE WIND RESOURCE IN +60m DEPTH	POTENTIAL FOR FLOATING WIND CAPACITY
Europe	80%	4,000 GW
USA	60%	2,450 GW
Japan	80%	500 GW
Taiwan	-	90 GW

Source: WindEurope, Floating Offshore Wind Vision Statement - June 2017

Offshore Wind in Italy

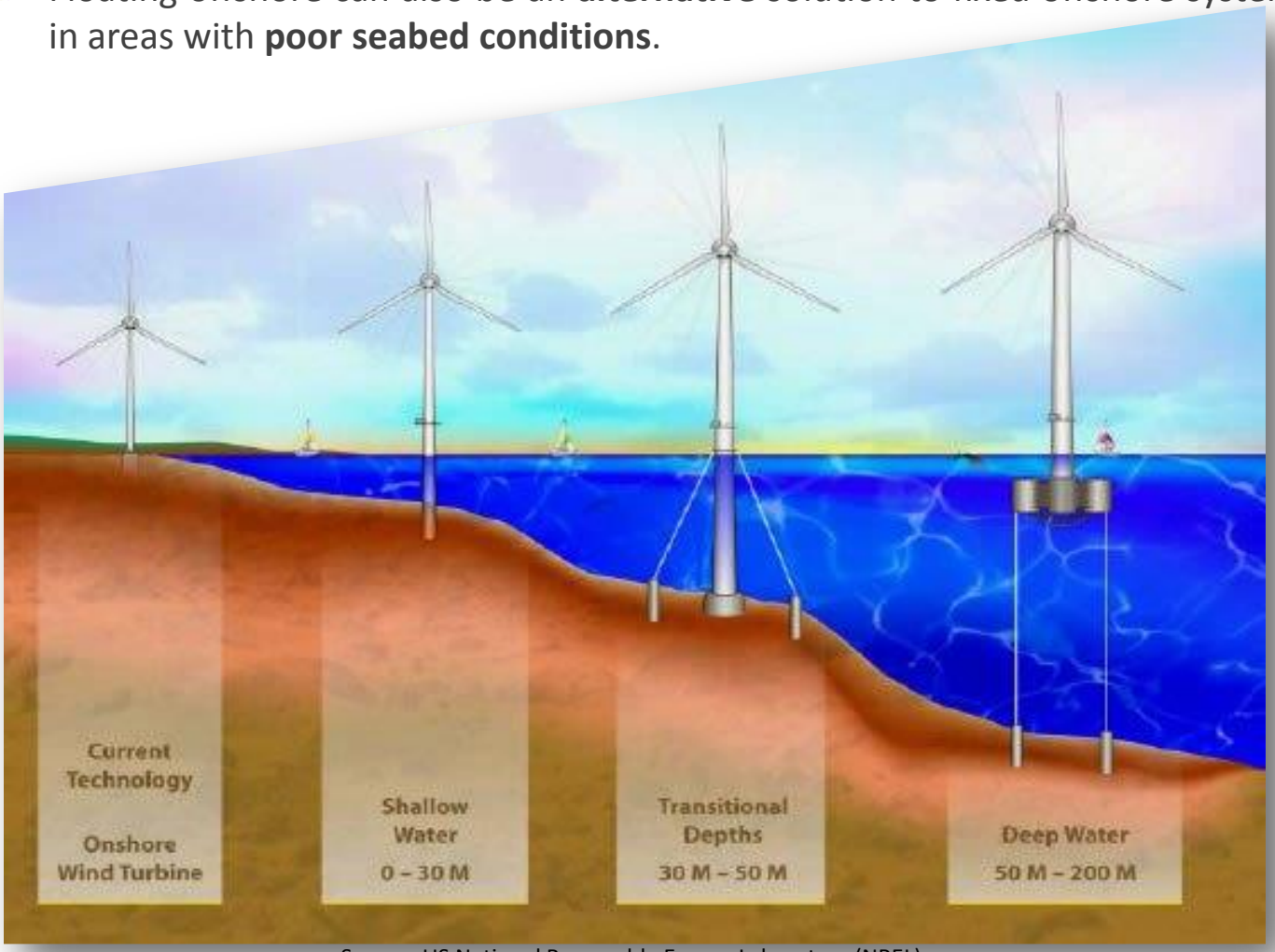


Source: Atlante Eolico Interattivo - RSE



Floating Offshore Wind Systems

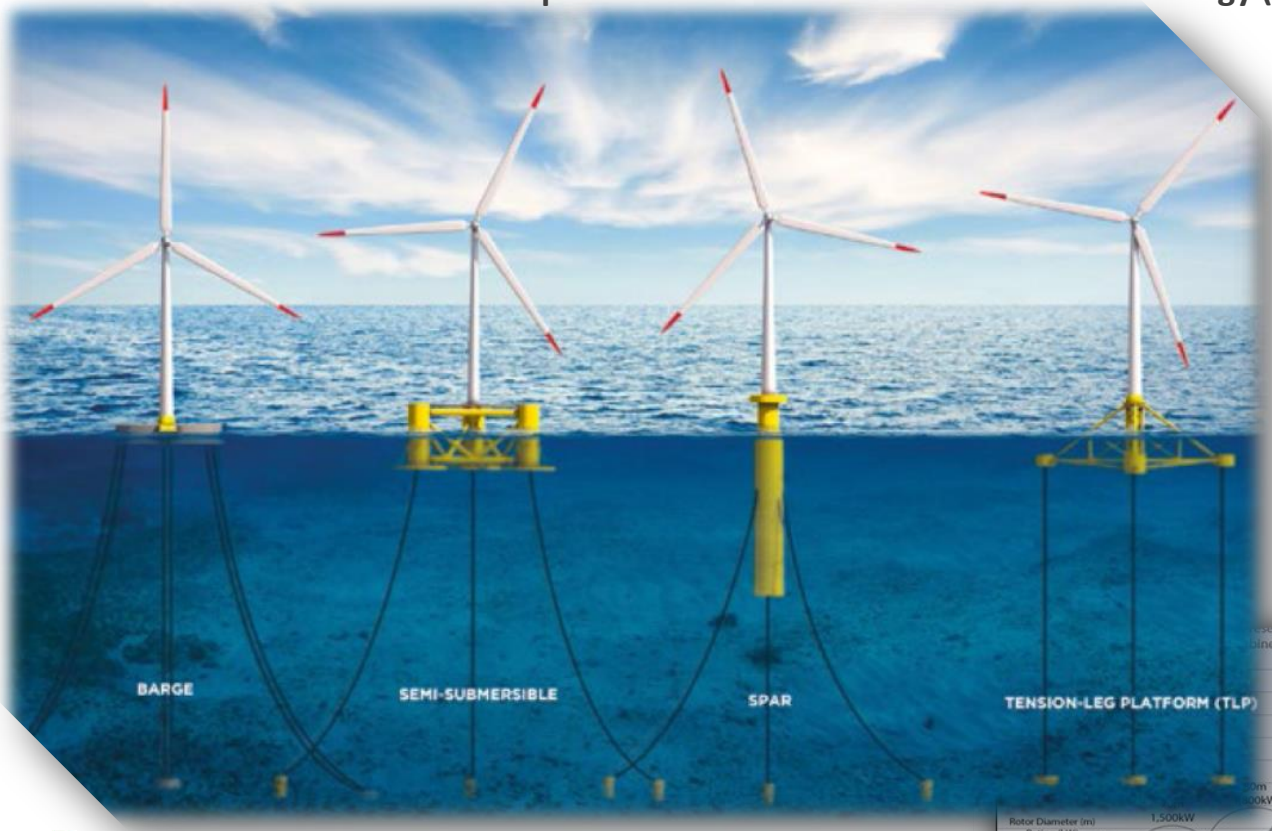
- In **deep water**, **floating** offshore systems are the **only viable solution**.
- Floating offshore can also be an **alternative** solution to fixed offshore systems in areas with **poor seabed conditions**.



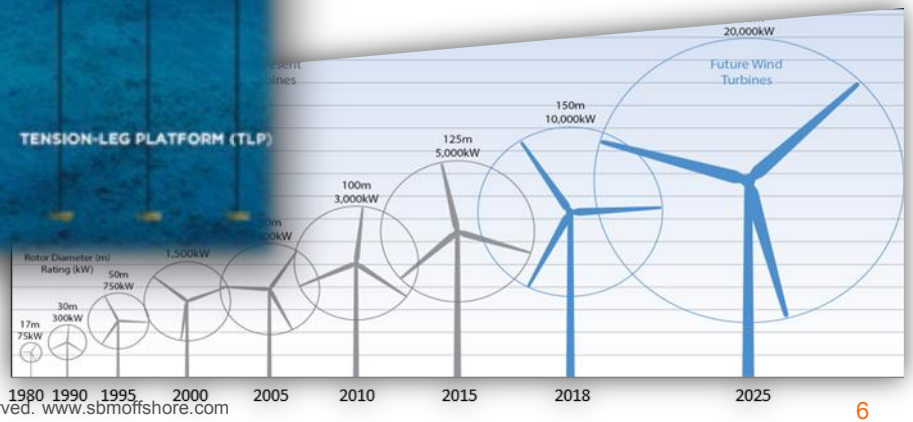
Source: US National Renewable Energy Laboratory (NREL)

Advantages of deep water floating offshore wind

- Turbines can tap into areas where **winds are stronger** and the **flow is more consistent**.
- The **abundance of space** allows using large wind turbines and configurations that **minimize wake effects**.
- Both factors have **positive effects** on the **levelised cost of energy (LCOE).**



- In **far-from-shore** project, **noise** and **visual pollution** will be **less of a concern**.
- Floating offshore wind farms have a **potential** to act as **refuges for fish** and can be **decommissioned without permanent environmental impacts**.

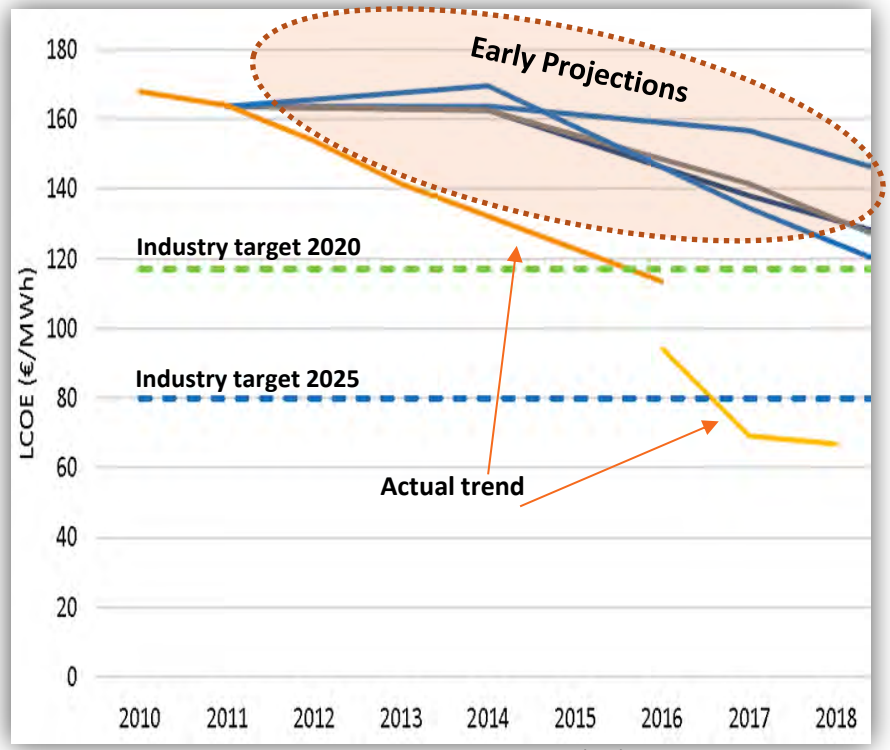


- As turbines are located on floating structures, there will be **fewer risky operations** taking place **offshore** or **below sea** level.

What allowed fixed offshore wind industry to succeed?

Success factors	
Scale Effect & Learning Curve	Products optimization and decrease of LCOE thanks to the increase of volumes.
Technology innovations	Increasing turbines size and electrical systems performances, optimized installation and maintenance strategies.
Competition	Top-down pressure on prices fostered efficient procurement practices.
Financing	Bankable assets with a low perceived risk. Innovative financial models and interest from diverse investors had positive effects on financing costs.
Market economics	Low interest rates, low commodities price and less competition from other sectors (e.g. Oil&Gas).
Project de-risking	Site development activities (e.g. consent, permitting, site data) prepared by governments reduced project and investment risks.
Site conditions	Recent projects have benefitted from proximity to shore and/or shallow water in highly windy locations.

LCOE Trend

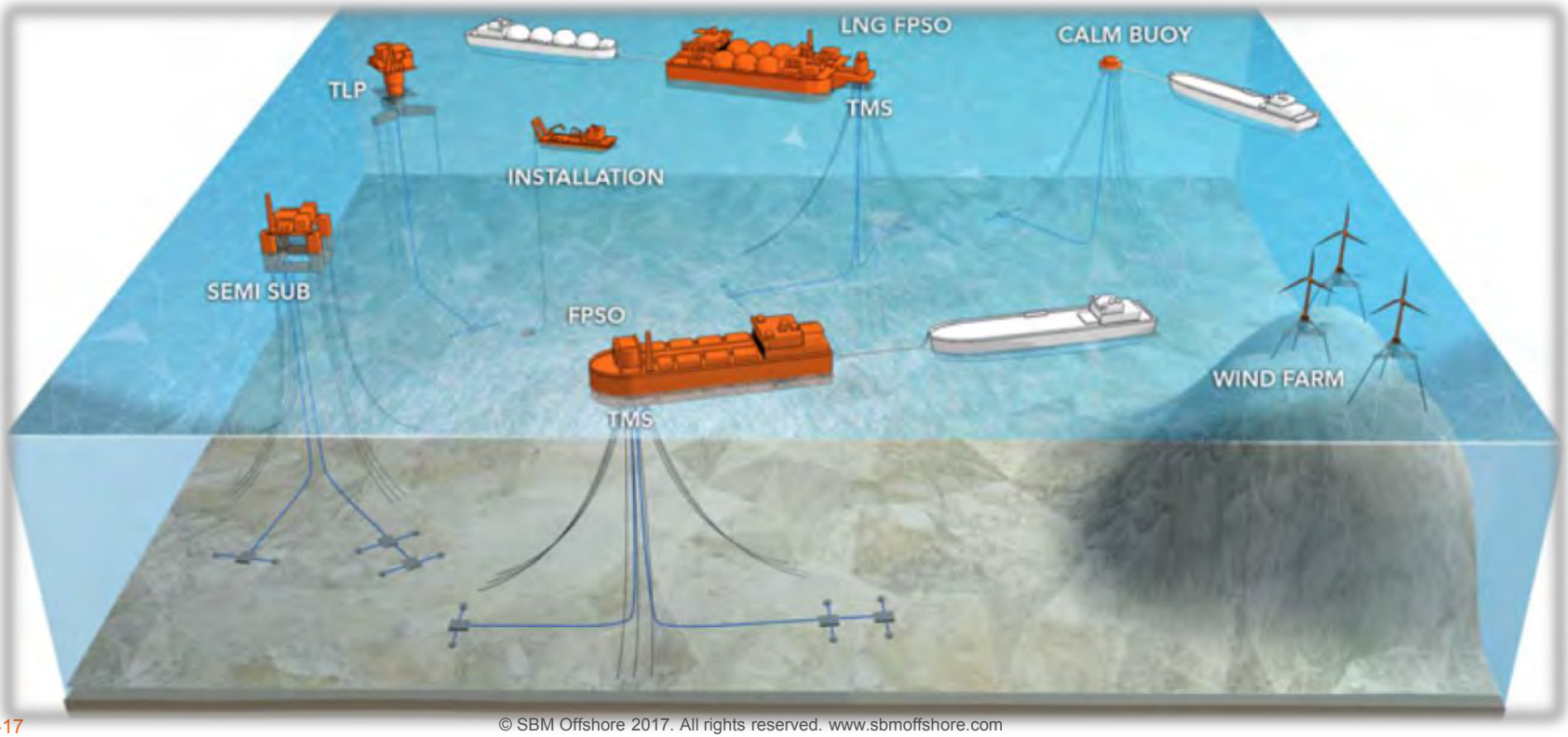


Source: The Crown Estate (UK)

Actual LCOE trends beat the most rosy expectations

Why SBM and the offshore industry can take this challenge

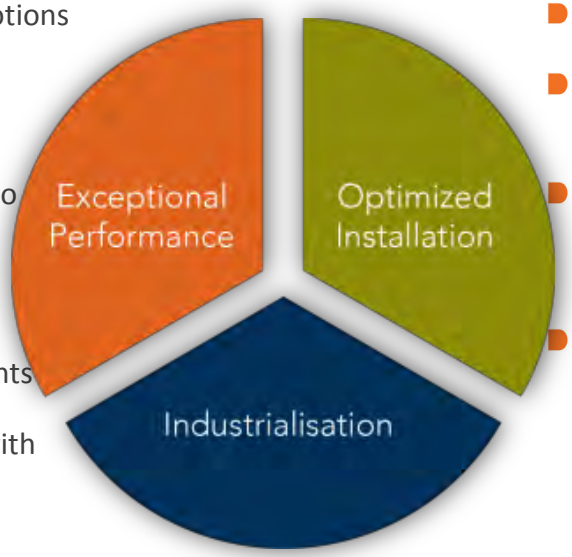
- The development of the wind energy industry has many **similarities** to the **Oil&Gas** industry and share **similar challenges**.
- Both began as **land-based** industries that eventually **took the step offshore** before moving into **deeper water** as long as the **technology advanced**.
- **SBM** is the **world leader** in designing, delivering and operating **Oil&Gas floating offshore facilities**, with more than **300 contract years** of cumulated operation experience and **2900m of maximum water dept**.



SBM wind floater – concept and main principles

Adapted TLP – the benefits but not the downsides

Three design principles

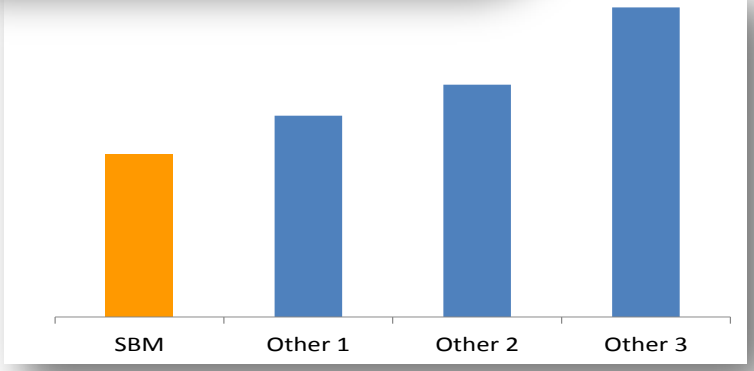


- **Low accelerations** / motions at nacelle
- **Light = cheap**
- **Transparent** structure to minimize wave action
- Catenary cable
- **Field proven** components
- Mass ratio decreases with larger WTGs
- No active ballast

footprint

- **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



Primary steel mass of lightest main floater concepts carrying 5MW WTG (steel only)

Strong coupled design capabilities

Floating wind farms are large offshore projects

Commercial size floating wind farm

An installed power of 200-400MW requires from 25 to 50 units.
The total installed weight is between 70000 and 140000t

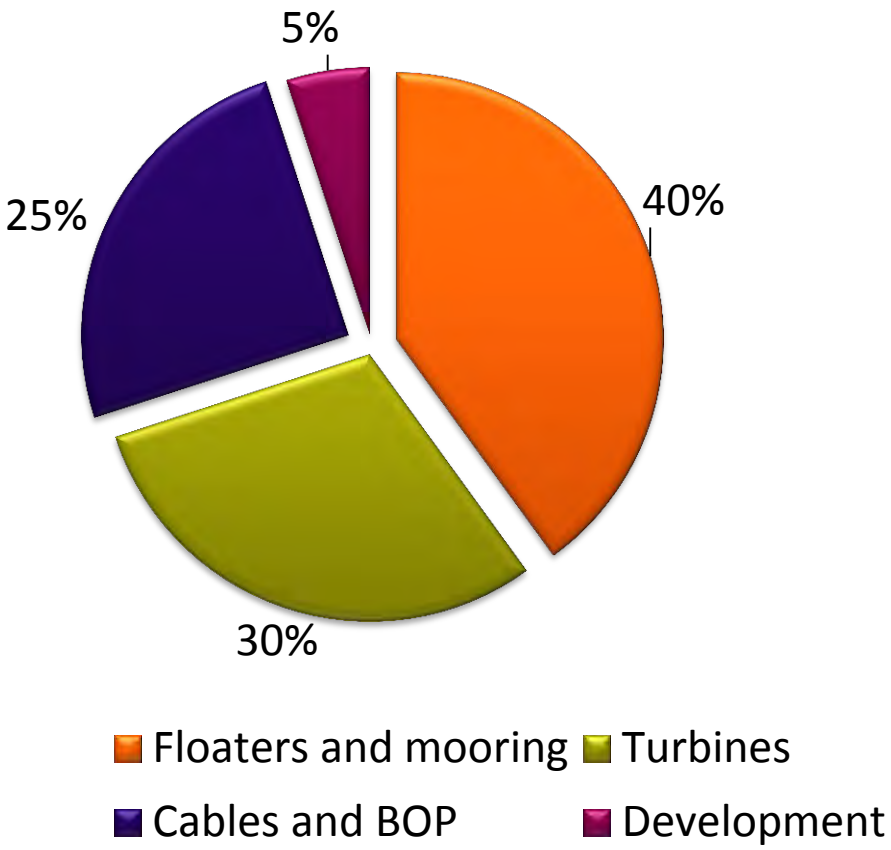
1 or 2 last generation FPSOs in a comparable time schedule

7 to 14 Tour Eiffel

35000 to 70000 SUV

Development costs

% of development cost



Economic benefits

- '***In terms of growth and job creation part of the answer is certainly through the blue economy.*** *This sector is booming, and at times of crisis and pressure, this is rare good news*' [Jose Manuel Barroso, former President of the European Commission]

- The **offshore wind industry** has the potential to support **local development** and **jobs creation**, even at relatively conservative levels of deployment and domestic supply chain growth.

- In particular, the following areas are considered:
  - **Power electronics**: power transmission equipment, transformers, industrial control systems, etc.
  - **Fabrication** of floaters, electrical substations and ancillary equipment**;**
  - **Assembly** of large wind turbine components such as turbine blades, nacelles, towers, etc.;
  - **Supply of materials and safety equipment**: steelworks, composites, paints, resins, plastics, bridges, bolts, nuts, and other similar materials;
  - **Installation, logistics, and transportation**: erection, port facilities, tugs and supply boats, shipbuilding and repair, Operation&Maintenance via onshore base;
  - **Services**: engineering, procurement, diving, legal and regulatory, financial, interface with power grid operators, educational, and outreach.

- The reasoning should also be extended to consider the impact of the **positive externalities** (e.g. the wind farm creating repairs for fish) whereof other sectors could benefit (e.g. fisheries).

- This will be **possible** with a strong **commitment from policymakers** towards floating offshore wind solutions.

Thank you

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