Floating Wind – what's it all about?

Dublin Offshore

1 Sector Description

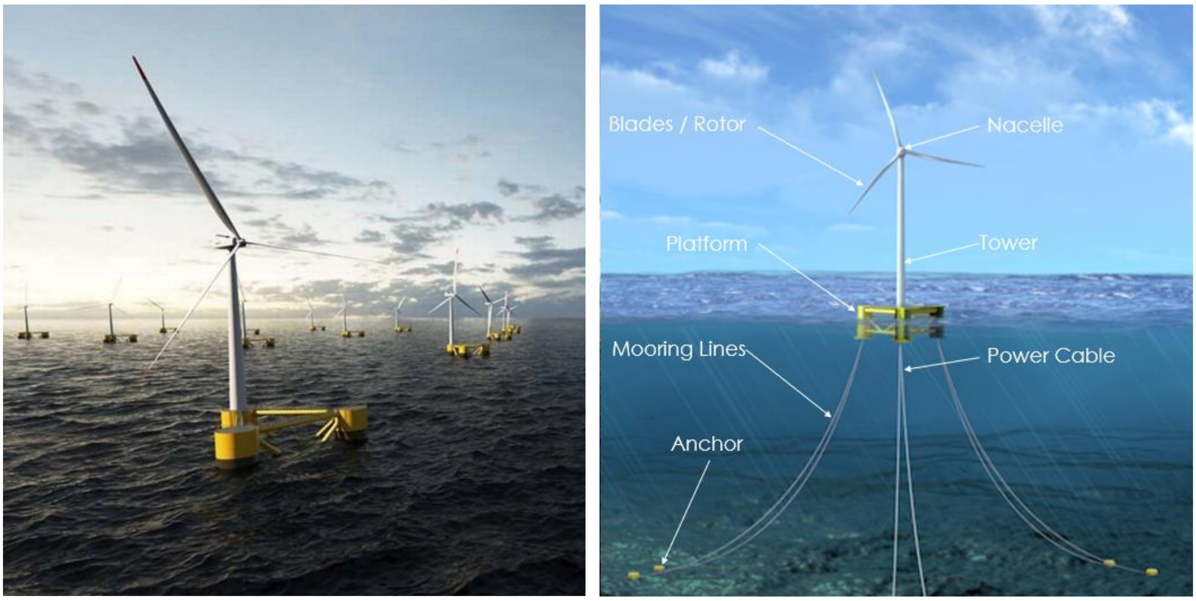


Figure 1 - Floating Offshore Wind Platforms & Key Components

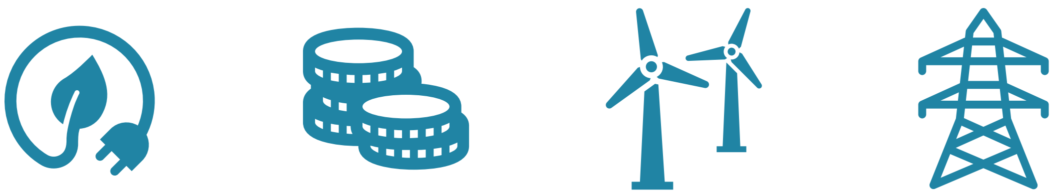
Floating Offshore Wind (FOW) is a technology on the rise, with installed capacity increasing and costs plummeting. Offshore Wind is an established renewable energy technology with the majority of installed capacity to date provided by fixed offshore wind. However, the suitability of seabed conditions for offshore wind and the nature of regulations concerning competing uses and environmental protection limit the future growth of fixed offshore wind.

Some key advantages of floating wind turbines is that it greatly expands the locations for wind energy as the turbines are no longer constrained by shallow waters. Furthermore, by installing turbines further out to sea, you can also capture more powerful and more reliable winds. Another advantage of floating wind power is the ability to construct the turbine in port, using quayside cranes. The turbine can then be towed into position. This results in an opportunity cost saving on the highly specialist heavy lift vessels that are required to assemble a turbine at sea.

The key challenge for the floating offshore wind industry is to reduce the cost of energy to be competitive with other forms of renewable generation such as fixed offshore wind, onshore wind and solar.

2 Market Overview

Floating wind is attracting increasing investment and political support because it can access the estimated 80% of total offshore wind energy generation potential that is in waters depths greater than 60 meters. There, wind is more consistent which increase the capacity factor for the farm however the water depths are too great to install traditional bottom fixed foundations. Building of projects at these sites will be essential to reach the European Unions Net Zero targets by 2050. DNV GL's Energy Transition Outlook Report 2020 predicts that, by 2050, floating wind will reach:



250 GW Installed Capacity	€40 / MWh Levelised Cost of Energy	20% of the total Offshore Wind Market	2% of the worlds power supply

Figure 2 – Market Outlook

Forecasts from industry specialists the Carbon Trust show that a potential global FOW capacity in excess of 7GW could be installed in the current period to 2030 and accelerating to an additional 62GW in the following decade to 2040. This represents a total addressable market for FLOW of €852 billion to 2040.

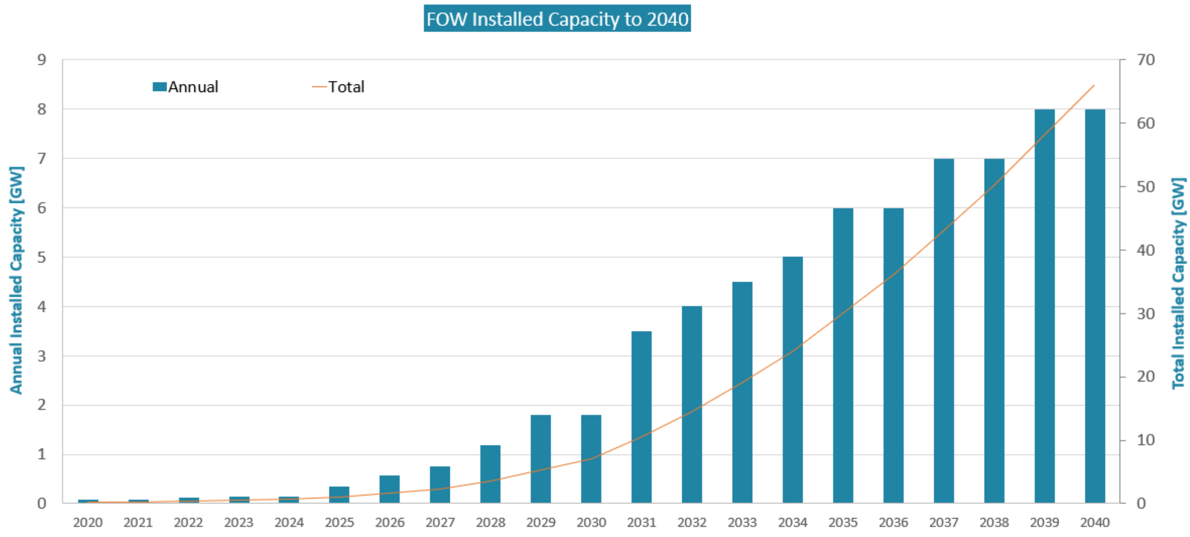


Figure 3 -Installed Capacity Projections

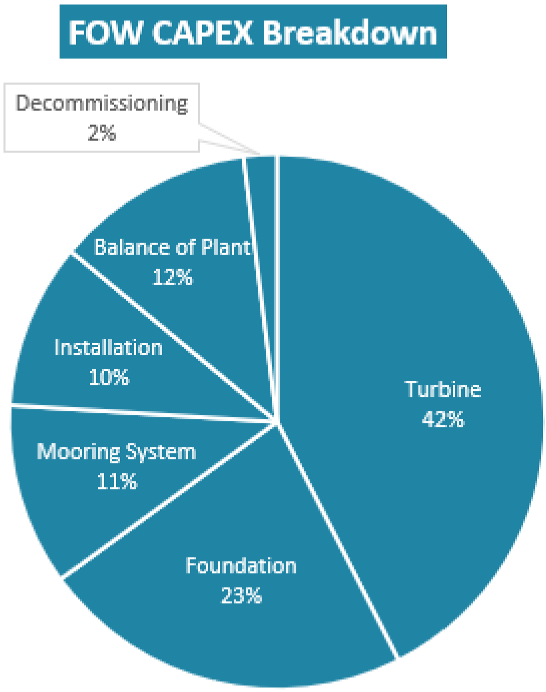


Figure 4 - Cost breakdown for typical fixed & floating offshore wind projects (source: Carbon Trust)

3 Levelised Cost of Energy

The Levelised Cost Of Energy (LCOE) is a measure of the average net present cost of electricity generation for a power source over its lifetime. The lifetime costs of energy production are divided by lifetime energy production. This value allows the side-by-side comparison of different technologies with varied life spans, project sizes and capital costs. Gas, coal, solar and wind projects can all be compared with representative values. LCOE comparison considers the cost of capital as a project advances, with financing costs accounted for using the weighted average cost of capital, to reflect the true present cost of finance, and of the energy produced.

When looking at developing different energy projects, the LCOE gives a clear economic indication of the feasibility of a project. The formula for calculating the levelised cost of energy is displayed as:

$$LCOE = \frac{\sum_{t=0}^{n} \frac{I_t + M_t + F_t}{(1+r)^t}}{\sum_{t=0}^{n} \frac{E_t}{(1+r)^t}}$$

LCOE = Levelised Cost of Energy

I_t = Investment cost at time t

M_t = Operations and Maintenance cost at time t

E_t = Energy Generated at time t

r = discount rate of the project

t = time (in years)

F_t = *Fuel expenditure at time t (= 0 for wind energy)* *n = lifespan of the system (in years)*

Investment cost (I_t) roughly translates to capital expenditure (CAPEX), and Operations and Maintenance cost (M_t) is related to the operational expenditure (OPEX). According to a recent National Renewable Energy Laboratory[1] (NREL) study on the cost of floating wind energy the target cost per MWh is between $44 to $76 by 2050. This requires in excess of a net 17% reduction in LCOE cost based on today's target – approximately 6% of this will come from CAPEX, 3% from OPEX. Clearly innovations are required to achieve these cost reduction targets.

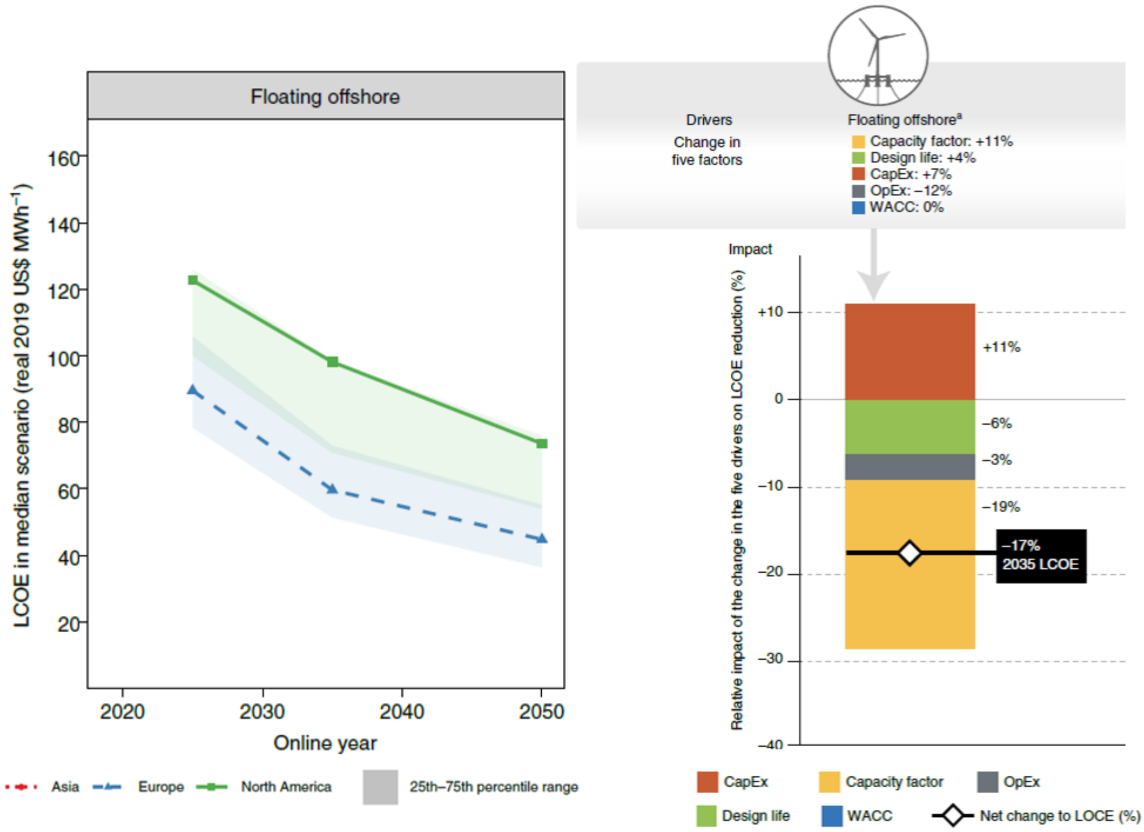


Figure 5 - FOW Cost Projections to 2050

[1] NREL – Wind Energy Cost Prediction to 2050, Wiser et al, 2021

4 Floating Foundations

There are four main floating foundation concepts currently being designed for future deployment of floating wind - Spar-Buoys, Semi-subs, Barges and Tension Leg Platforms. At this stage in the development of the nascent floating wind industry no clear type has proved it will become the standard.

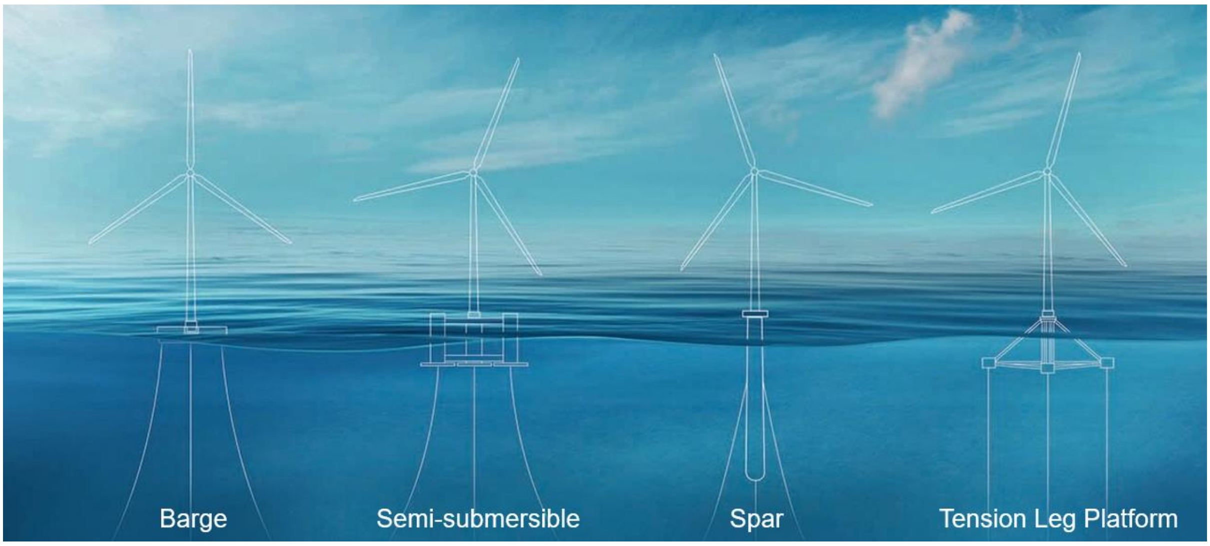


Figure 6: FOW Foundation Types [Image Credit : DNV GL]

With the exception of Spar foundations, all other foundation concepts can theoretically be towed into ports with relatively shallow channels and quayside water depths in order to allow the Wind Turbine Generator (WTG) to be installed using cranes or other lifting concepts such as a Jack-up vessel. This is the preferred assembly concept within the floating offshore wind industry as it allows for safer and cheaper installation of the WTG to the foundation by removing the requirement to install the WTG on to a foundation already in place offshore at the wind farm site, thereby removing the need for expensive heavy lift vessels operating offshore.

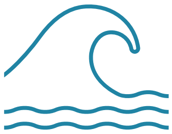
Spar foundation concepts require deeper water, the draught of the Spar itself can easily reach 100m+ and for optimum use with future predicted WTG of 15MW+ would require water depths at the wind farm site of 150m+. The Table below is adapted from Wind Europe's Floating Offshore wind report 'Ports a key enabler for the floating offshore wind sector' and the Carbon Trust's Joint Industry report 'Summary report phase 2'. The table shows the order of popularity of each type of design concept based on number of designs in each category.

Table 1: FOW Platform Designs

	Number of Platform designs	Percentage of designs
Semi-Sub / Barge	32	63%
Spar	12	24%
TLP	7	14%

5 Our Work in Floating Wind

Dublin Offshore have been working extensively in Floating Wind for several years and offer services across all phases. Our focus is reducing cost and risk on these flagship projects.



Platform Design

Mooring Design

Ports & Logistics

Installation Planning

- Owner's Engineer
- Project Management
- Technical Management
- Foundation Design
- Mooring Design
- Installation Analysis

- Logistics Planning
- Port & Harbour Assessment
- Site Assessment
- LCOE Modelling
- Deployment Planning
- Industrialisation

Contact us on hello@dublinoffshore.ie to discuss your project needs.