Choosing your foundation concept

EMPIRE engineering

When developing an offshore wind farm, selecting the foundation type is one of the most complex questions a developer has to consider at a very early stage. This is the correct way to approach this question:

STEEL OR CONCRETE FOR YOUR FOUNDATION MATERIAL?

There are pros and cons for both materials, and besides the supply of steel, the local port facilities for the offshore wind farm will be the keyto developers

STEEL

PROS

- Existing supply chains
- Existing knowledge and skills from the oil and gas industry
- Lower technical risks, because of the experience we already have.
- We have experience in steel fabrication for offshore structures.
- Potentially smaller footprint than concrete (dependant on design)
- Quayside facilities are already more adaptable to steel than concrete.
- Easy to recycle

CONS

- Susceptible to corrosion and must be monitored
- More expensive raw material than concrete, with volatile pricing
- Potentially more expensive to fabricate (welding, connections, etc.)

CONCRETE

PROS

- Can be produced and used anywhere (local content)
- Better fatigue performance and longer service life
- Better corrosion resistance
- Lower cost of raw materials and less susceptible to cost variations
- New innovative precast manufacturing techniques make the process more accurate, faster and sustainable (retractable enclosures, 3D Print, etc.)

CONS

- Susceptible to cracks and must be monitored
- Difficult to recycle
- Bigger footprint as it is heavier and larger structure

FIXED OR FLOATING FOUNDATION?

Another key decision is choosing whether to go for a floating or fixed foundation. We are still relatively early in the journey with floating wind. Get answers to the questions below to help make informed decisions.

FIXED FOUNDATION

1 WATER DEPTH OF THE SITE

Water deeper than 30-35m+ will usually eliminate gravity base structures from your foundation options; deeper than that and they become very expensive.

2 SEABED COMPOSITION

Critical to early stage foundation design decisions for fixed foundations. Weak soils can lead to excessive pile penetration and hard layers can limit pile drivability.

3 METOCEAN CONDITIONS

Metocean conditions of the wind farm site are critical for the design of the foundations themselves, specifically for analysing the loads they will be subjected to.

4 THE PROPOSED TURBINES

The bigger the turbines, the bigger the rotors, the more loading the foundations must be able to withstand.

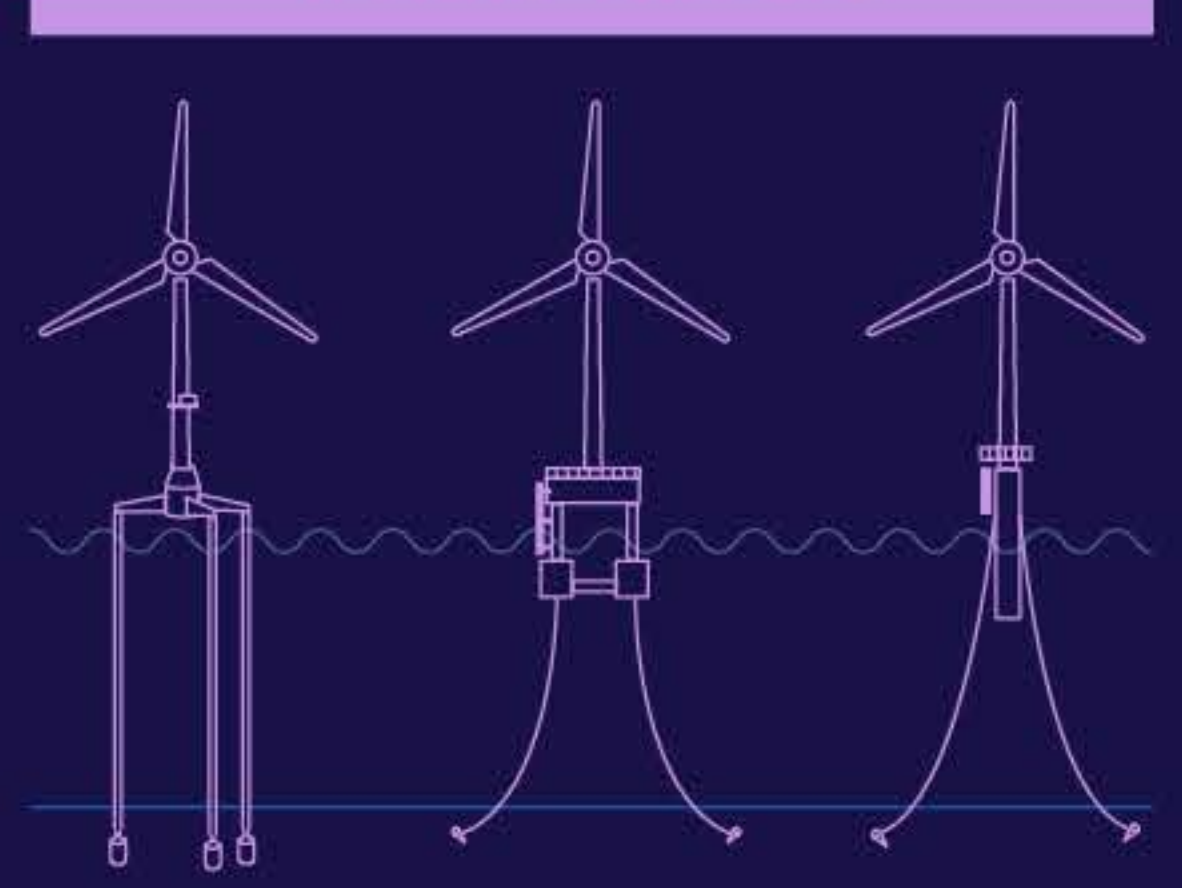
5 LOCAL FABRICATION CAPABILITIES

Usually, with the scale of offshore wind structures, they need to be fabricated close to or at a port, as transporting them on land isn't feasible.

6 THE MARSHALLING PORT

The marshalling port is the launch pad for your installation campaign. There are limited ports with the facilities to store, assemble and launch the vast structures for offshore wind turbines.

FLOATING FOUNDATION



1 WATER DEPTH OF THE SITE

Water depth shallower than 150m will usually eliminate spar buoys. Mooring costs increase with water depth - TLP or taut moorings are more attractive in deeper waters.

2 THE MARSHALLING PORT

Suitable port facilities are the launch pad for your manufacture and deployment campaign. There are limited ports with the facilities to handle and store large floating foundations - efficient assembly processes will be key.

3 THE PROPOSED TURBINES

Interaction between the turbine and the floater is a key design consideration. TLP foundations are more stable, compared to semi-sub structures.

4 METOCEAN CONDITIONS

The hydrodynamic behaviour of a floating foundation in different metocean conditions is a critical design driver. Will your floater be more sensitive to operational or survival load cases?

5 SEABED COMPOSITION

Critical to early stage decisions on anchoring methods. Suction anchors are generally preferred if conditions allow, with rocky substates potentially requiring drilled pile solutions.

6 LOCAL FABRICATION CAPABILITIES

Usually, with the scale of offshore wind structures, they need to be fabricated close to or at a port, as transporting them on land isn't feasible.

FINALISE YOUR CONCEPT

The last steps are the same regardless of if it's fixed or floating.

7 TRANSPORT AND INSTALLATION STRATEGIES (T&I)

Depending on the location of the fabrication yard, transport can be more or less complex.

8 OPERATIONS AND MAINTENANCE (O&M) STRATEGIES

Operation and Maintenance (O&M) requirements are a nice-to-have at the early planning stages of a project, but these requirements are not usually going to make a huge difference between one concept or another.

9 GOVERNMENT REGULATIONS

The government may impose certain design rules or restrictions when contracts to develop OWFs are allocated. These might include restrictions on turbine size, foundation numbers or mooring footprints, for example.

10 FINANCING AND CONTRACTS

The marshalling port is the launch pad for your installation campaign. There are limited ports with the facilities to store, assemble and launch the vast structures for offshore wind turbines.

11 DECOMMISSIONING CONCERNS

Different decommissioning processes will have different costs associated with them. For example, suction buckets offer easier deinstallation and no materials are left in place.

YOU'RE GOOD TO GO!

If you've followed this journey they you should at this point have a good idea of what your foundation should look like.