Offshore Wind

An overview

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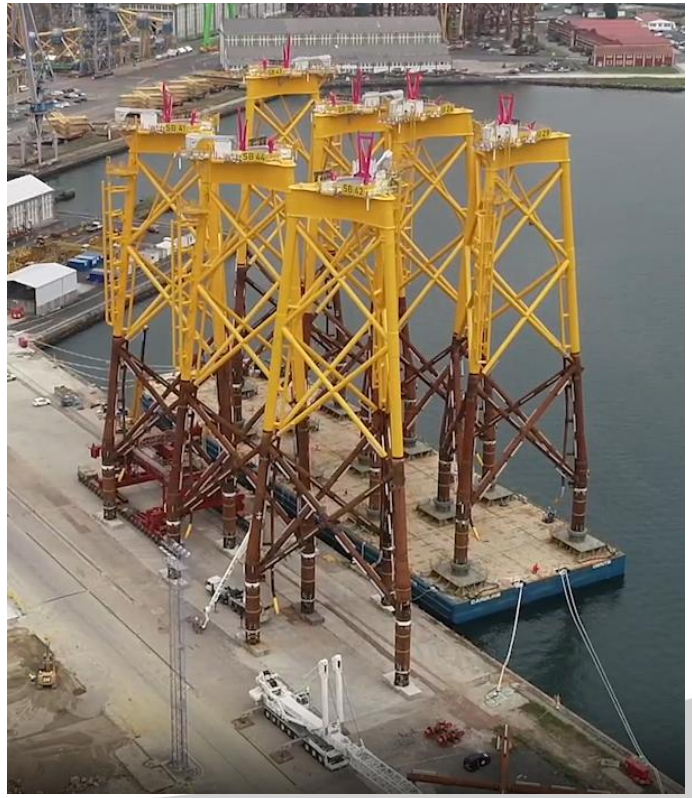
Lloyd's Register

INSTITUTE OF CORROSION

Aberdeen Branch

Corrosion Awareness Day

28 August 2026

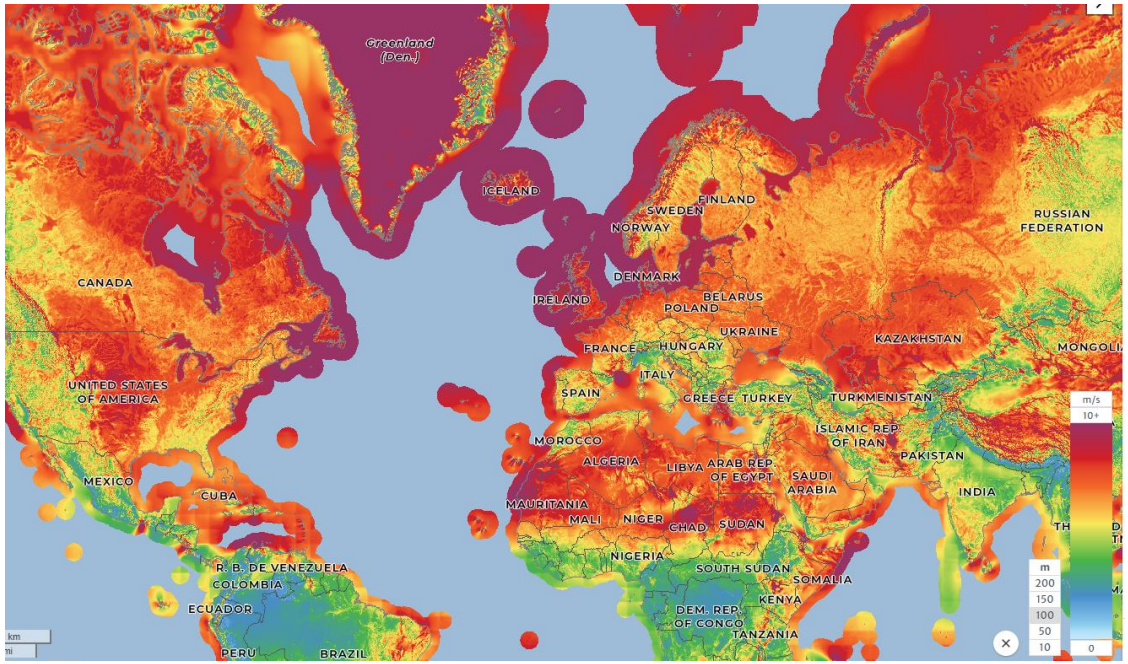


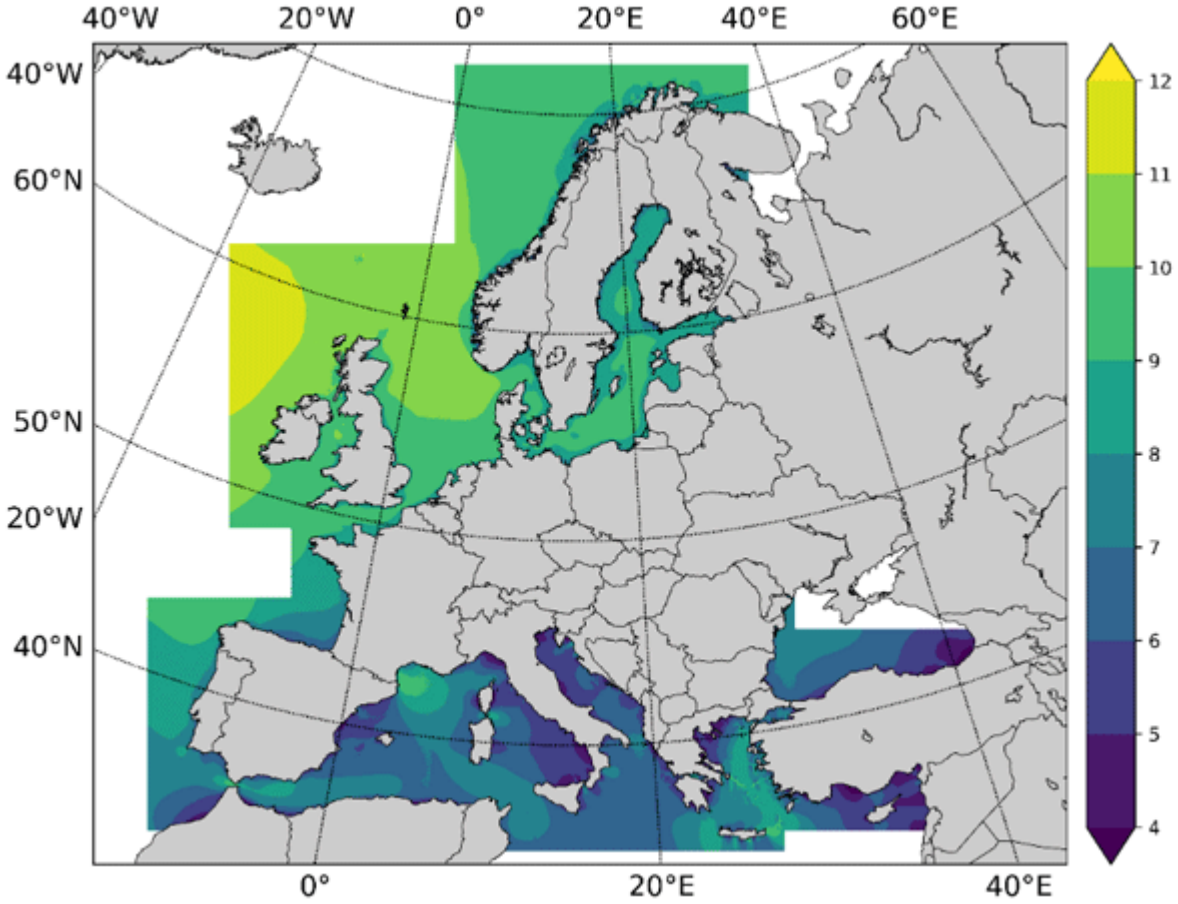
Overview of presentation

Objective is to give an overview of offshore wind:

- What is wind power – where is it
- Wind farm layout
- Fixed Offshore Wind turbines
- Floating Offshore Wind Turbines
- Substations
- The Future

Introduction Offshore Wind





Europe's offshore winds assessed with synthetic aperture radar, ASCAT and WRF

Charlotte B. Hasager ✉, Andrea N. Hahmann, Tobias Ahsbahs, Ioanna Karagali, Tija Sile, Merete Badger, and Jakob Mann

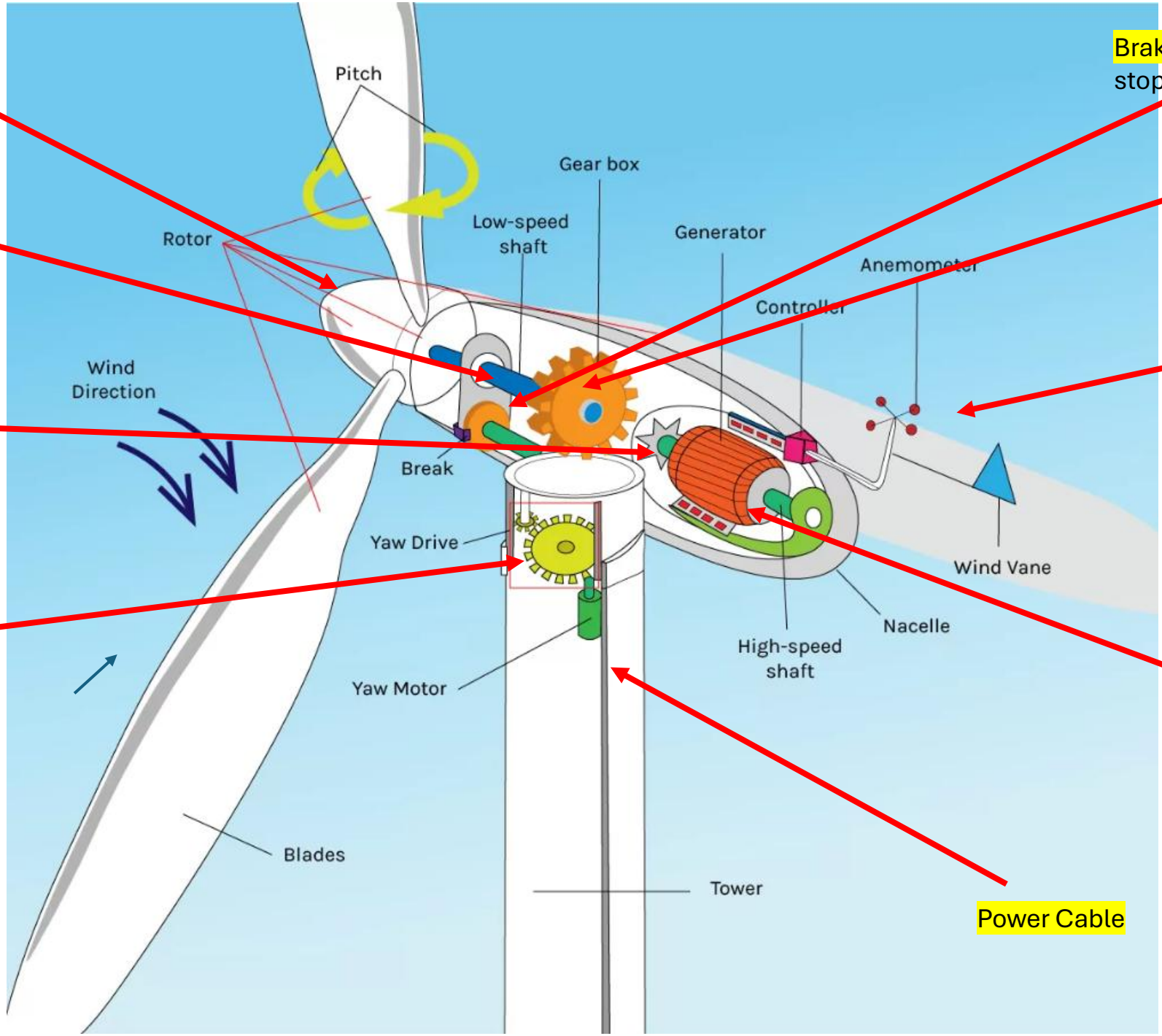
https://globalwindatlas.info/en/about/introduction

Hub: connect blades to main shaft allowing them to rotate together

Low speed shaft

High Speed Shaft

Yaw Drive/motor: to orientate the rotor facing the wind



Brake: for emergency stops/maintenance

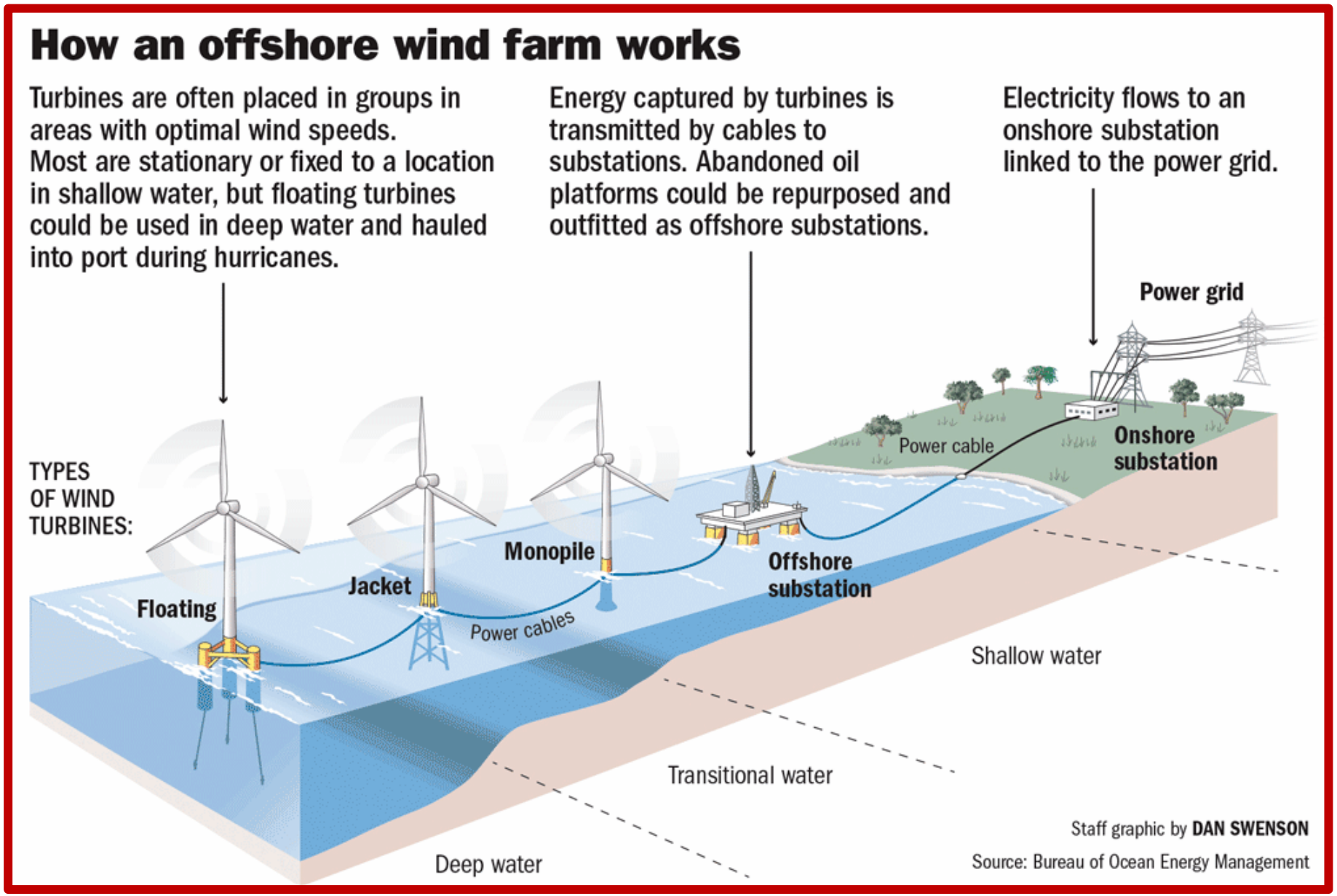
Gear Box= to increase the shaft speed to 'optimal' speed for generator.

Anemometer: for monitoring wind speed and direction

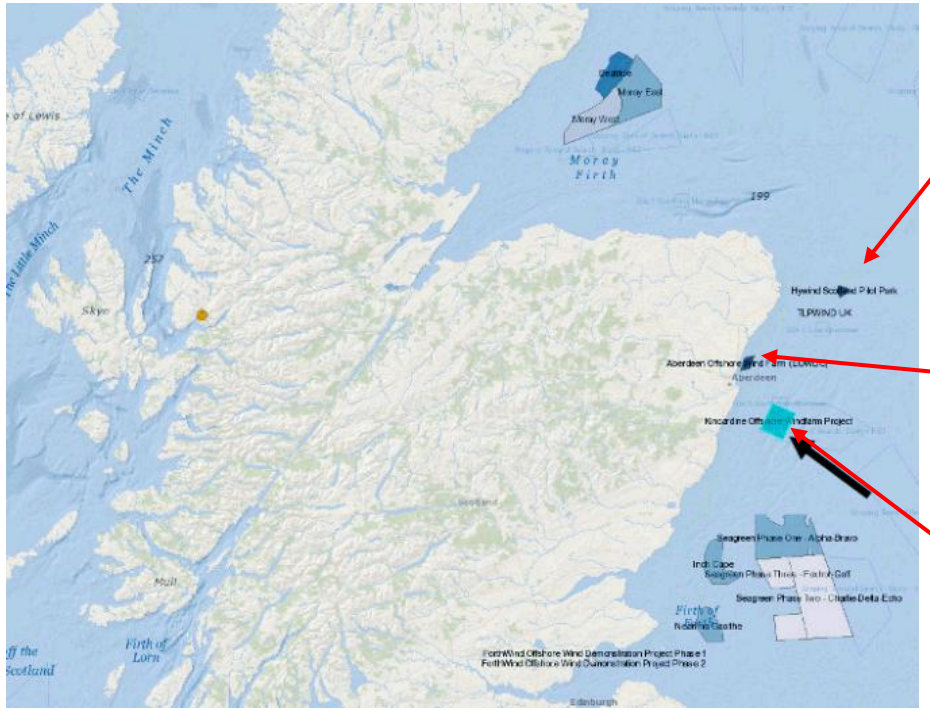
Generator: to convert mechanical energy from blades rotation to electrical energy (by spinning a magnet inside a coil wire)

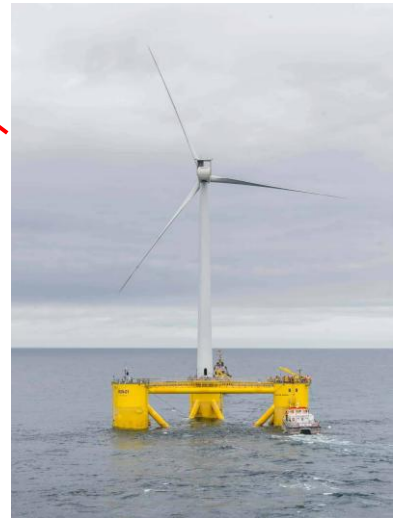
Power Cable

How an Offshore wind Farm Works

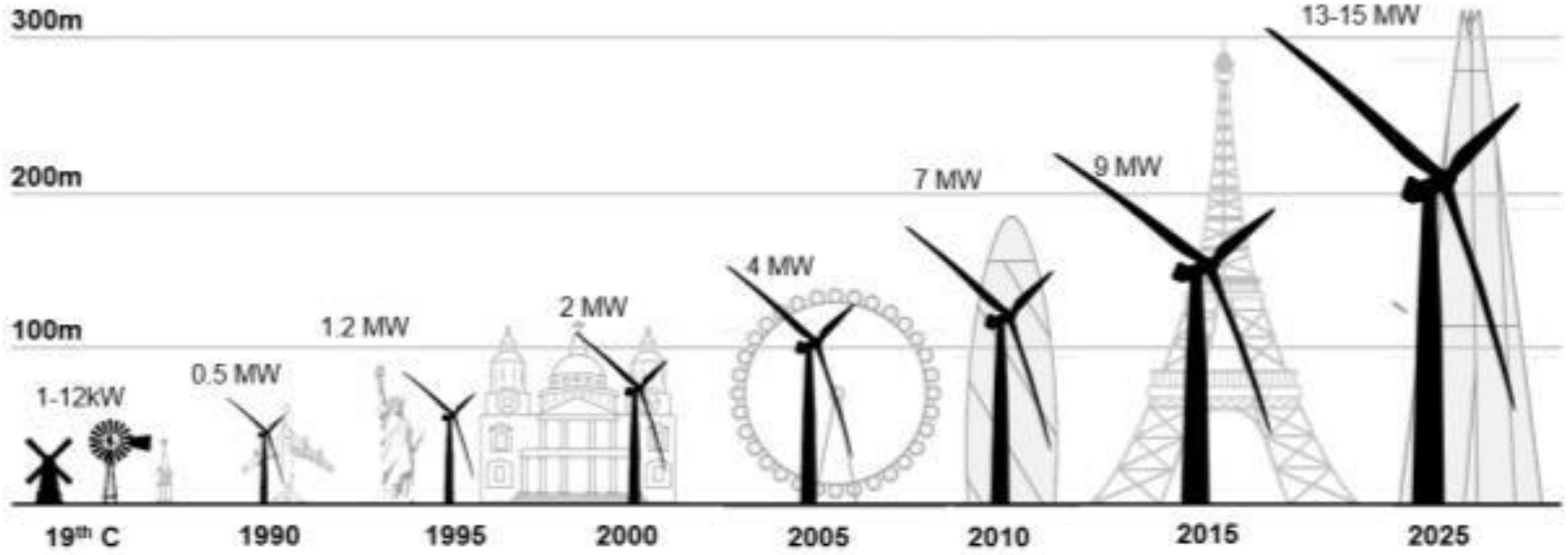


Windfarm layout


Moray East
Moray West
Moray Firth
The Minch
The Little Minch
Skye
Mull
Firth of Lorn
Firth of Forth
Edinburgh
Hywind Scotland Pilot Park
TLPWIND UK
Aberdeen
Seagreen Phase One - Alpha Braво
Inch Cape
Seagreen Phase Two - Charlie Delta Echo
Neart na Gaoithe
FortWind Offshore Wind Demonstration Project Phase 1
FortWind Offshore Wind Demonstration Project Phase 2



Offshore WTG - facts



https://www.researchgate.net/figure/Evolution-of-wind-turbine-size-and-power-output-from-Bloomberg-New-Energy-Finance_fig1_335812782

Substructure and Foundation

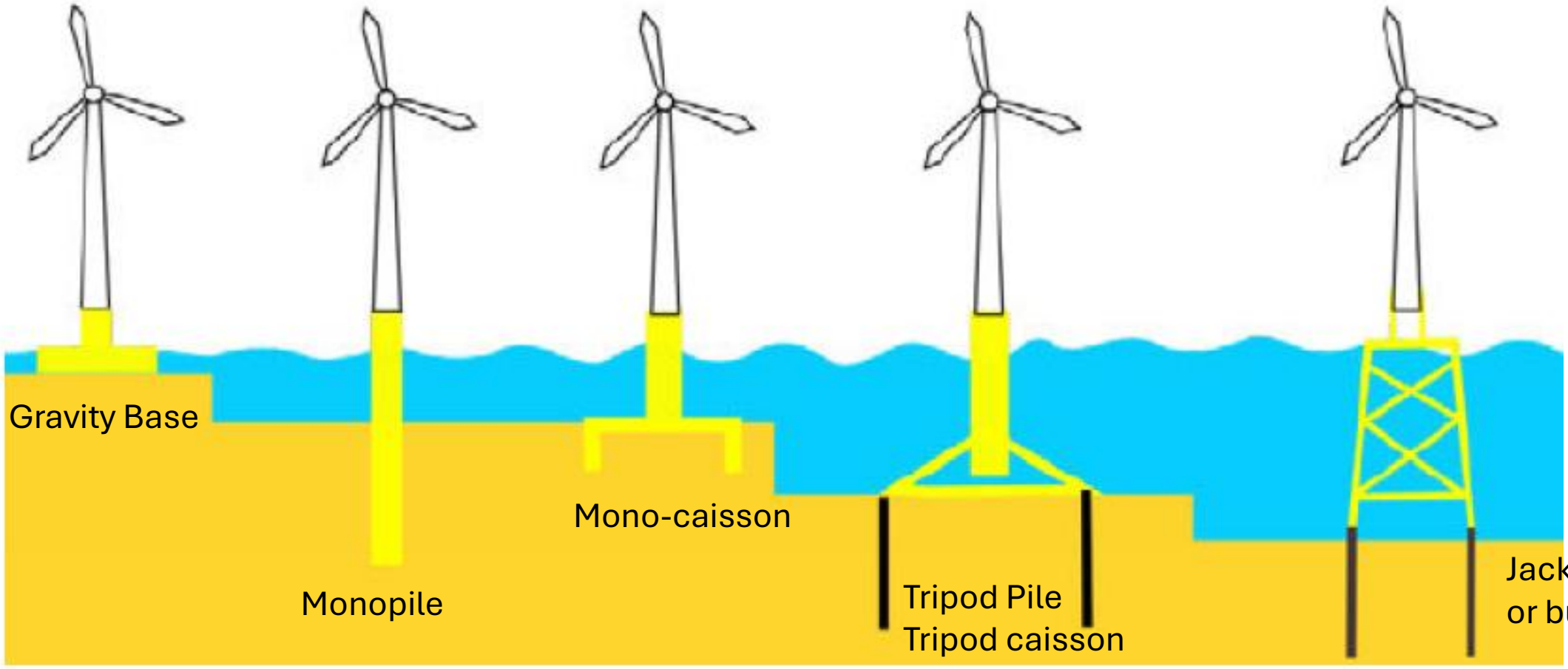
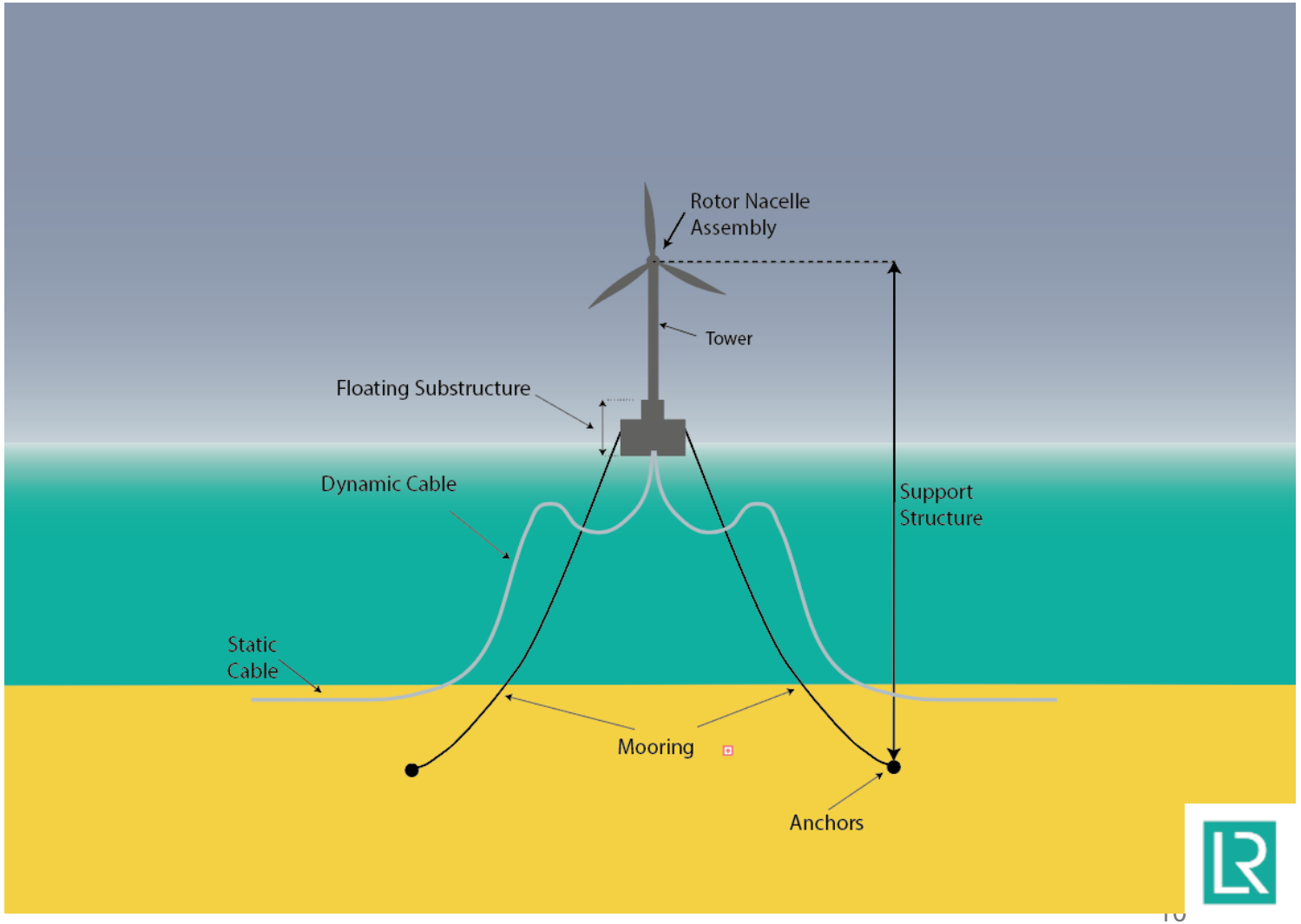


Figure 3.3.1 Examples of foundation concepts

Floating offshore wind turbine (FOWT)

- A few facts:
- Blade tips spin at 90m/second – 200mph – maybe more!
- Design life of 20 to 30 years (maybe more)
- Water depths ~>60m up to 1000m (maybe more)



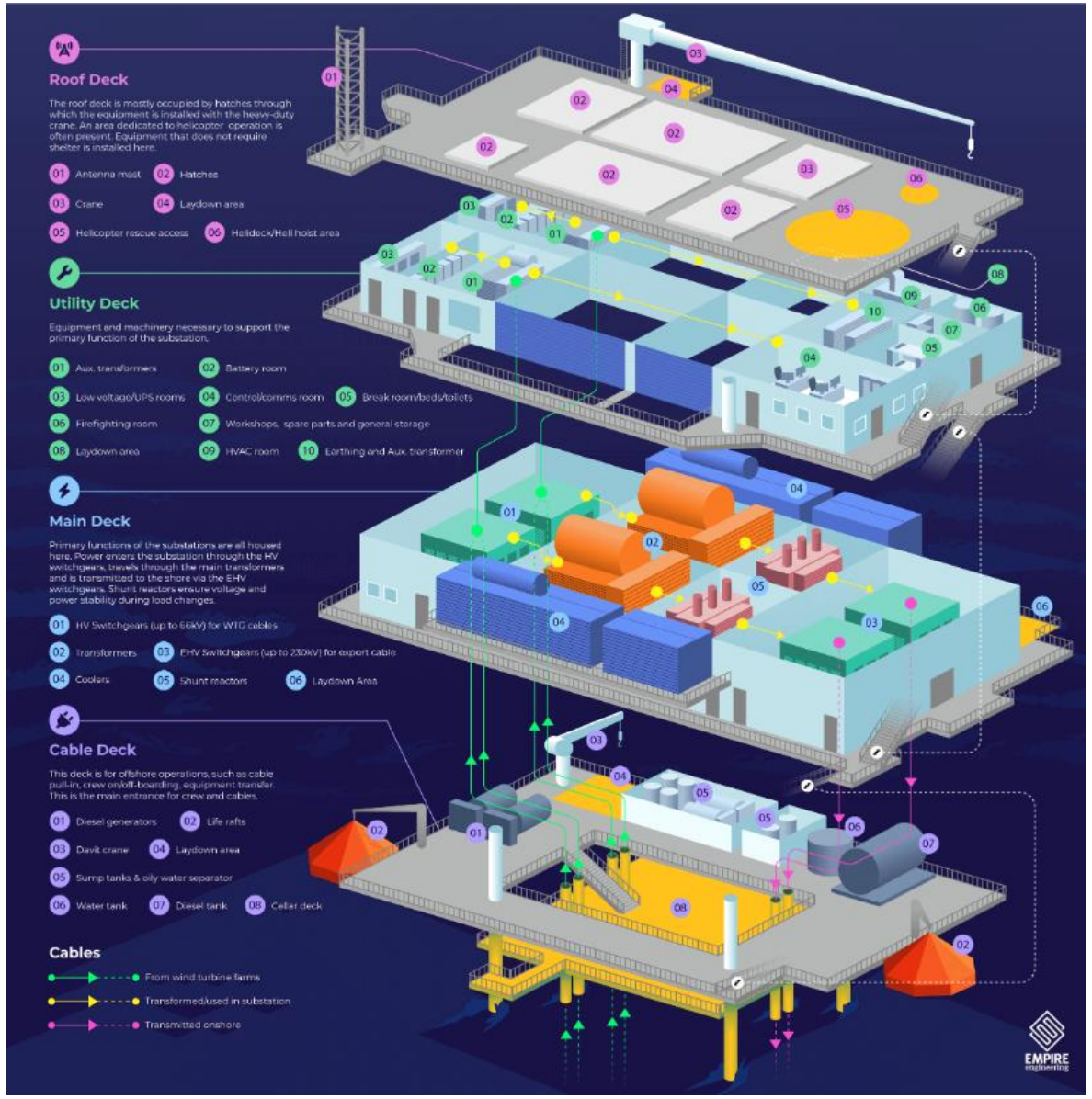
Floating offshore wind turbine (FOWT)

Floating platform | Offshore wind power (bw-ideol.com)

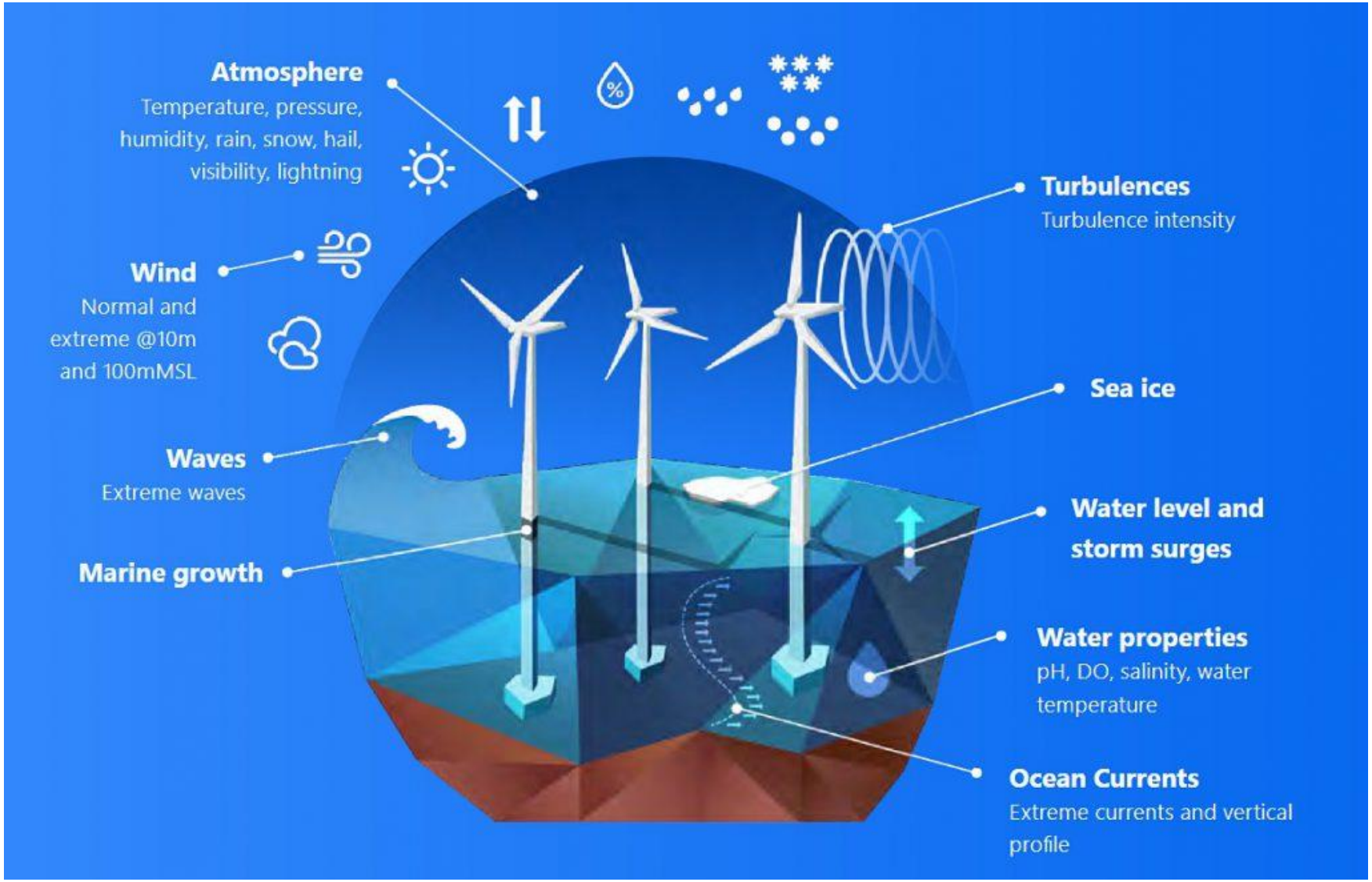
Offshore Substation

Seagreen project – SSE
27 km from shore

Offshore Substation Layout (HVAC)



External Site Conditions – Wind & Metocean

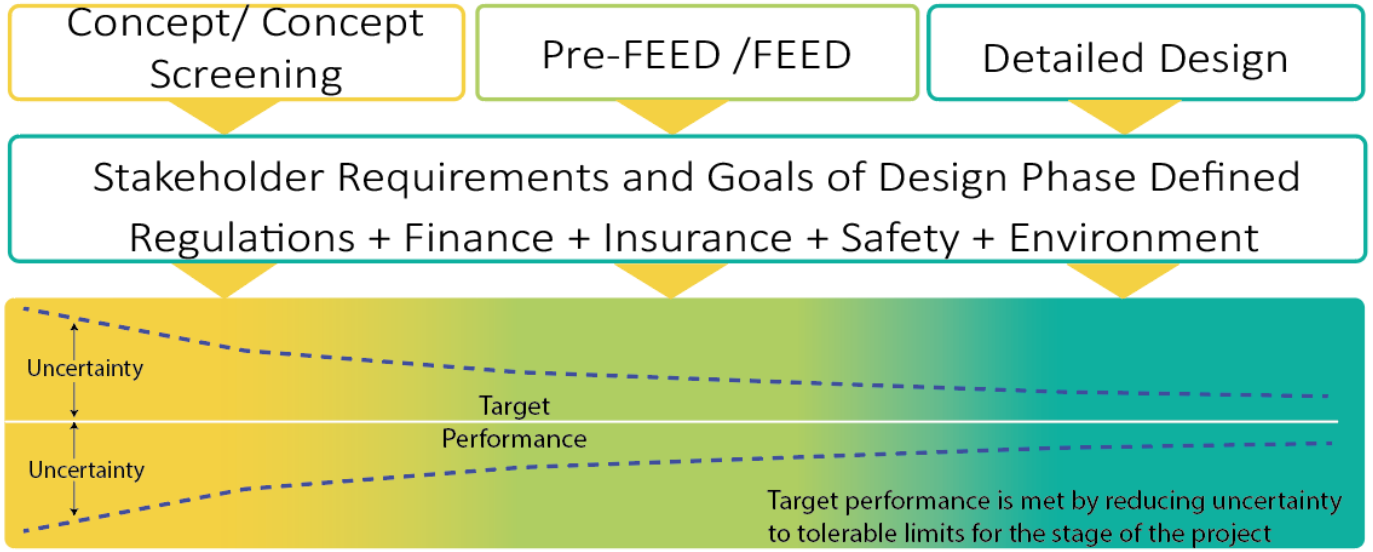


Metocean conditions to consider for offshore wind development. © DHI

Design Process - Phases

- Life Cycle stages
  - Specification
  - External site conditions
  - Design Basis and In Place design
  - Manufacturing
  - Transport & Installation
  - Commissioning
  - Operation and Maintenance
  - End of Life – reuse, recycling, decommissioning

- Design Phases
  - Concept selection /Concept Design
  - Pre-FEED / FEED
  - Detailed Design



Specification – Key Design Goals

- In terms of economics and safety, design goals for offshore wind turbines and offshore wind farms to be met in all phases of project include:
- To produce and export power
  - This will include maintaining a stable platform for the turbine to operate
- Bankable
  - Provide an economic LCOE design and produce expected income
- Insurable
  - (i.e. insurers won't perceive it as high risk meaning it is expensive or impossible to insure)
- Safe for personnel
- *Phases include manufacturing, T&I, hookup & commissioning, operation & maintenance, decommissioning

Specification – Key Design Goals

- Must not damage the environment
  - Inventory of chemicals on board is limited but environmental hazard might be destruction of seabed habitat
- Must not pose a 3rd party risk
  - For example, loss of station keeping and collision or hazard to shipping)
- Other design goals will include operation and maintenance requirements.

Specification – Project Stakeholders

- A project stakeholder can be considered as any organisation or person who may assert a claim on the value of the project. Examples of stakeholders include:
  - Owner, operator, designer, contractors, insurers, financiers, wind turbine provider, operation and maintenance providers, marine users and the shipping industry
- Less obvious examples include:
  - Air traffic control, fishing industry, archaeology, benthic habitat, wildlife groups
- Important not to miss project stakeholders. A late requirement could cause major changes and stakeholder buy-in may be easier to achieve earlier in a project.
- If something is wrong, it may be wrong 100 times over! Very expensive to fix offshore.
  - The wrong crane capacity…
  - Door not wide enough for WTG maintenance…
- Stakeholders may introduce constraints

How Trump's loathing for wind turbines started with a Scottish court battle

The wind turbines were visible in the background when Trump visited the Menie course during his latest visit

29 July 2025

Ports

https://windeurope.org/intelligence-platform/product/a-2030-vision-for-european-offshore-wind-ports-trends-and-opportunities/

Cost of a FOWT

Development and project management	150,000	£/MW
Wind turbine	1,300,000	£/MW
Balance of plant (i.e. support structure, cables, substation)	1,700,000	£/MW
Installation and commissioning	370,000	£/MW
Operations and maintenance	71,000	£/MW/year
Decommissioning	150,000	£/MW

For a 20MW turbine and 20-year design life this totals £76 Million

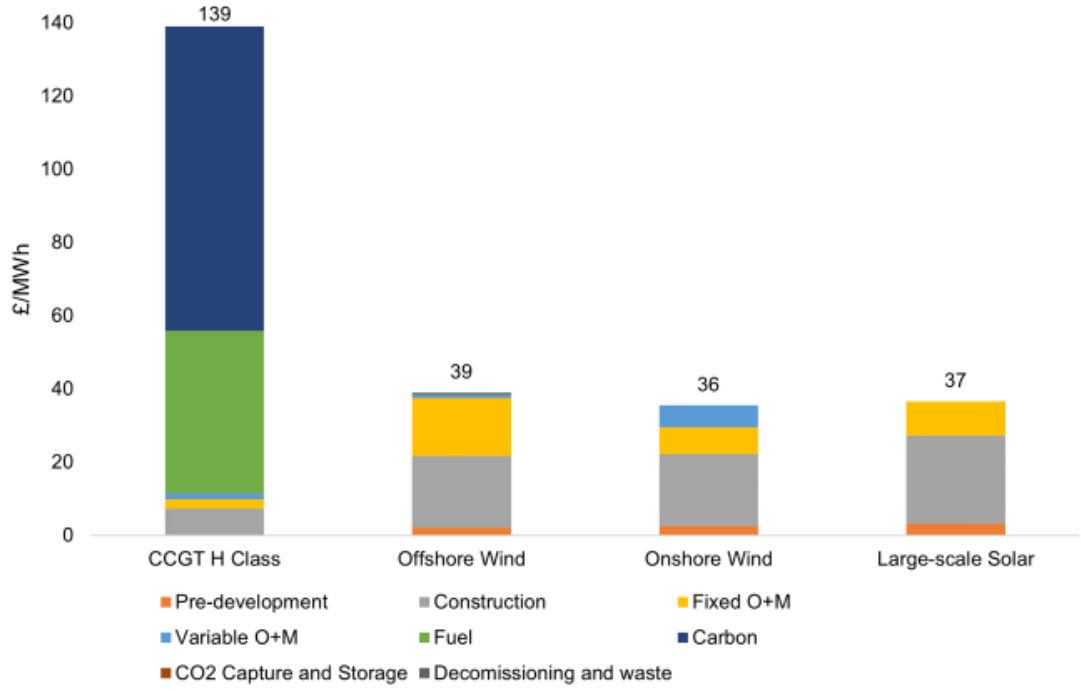
For more details see: https://guidetofloatingoffshorewind.com/wind-farm-costs/

Cost of electricity generation

- Cost of Electricity generation is talked of in terms of Levelised Cost of Energy
- The average price of electricity required to cover the lifecycle cost of a project.
- Strategy of many governments is to draw electricity production away from fossil fuels

Projects commissioning in 2030

Figure 4 - LCOE estimates for projects commissioning in 2030, in real 2021 prices



https://assets.publishing.service.gov.uk/media/6556027d046ed400148b99fe/electricity-generation-costs-2023.pdf

Aberdeen Branch

Thank you for your attention

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