WHEN TRUST MATTERS

MORUs and class

CMI Gothenburg

Dag Erling Engberg

22 May 2024

Mobile Offshore Renewable Unit (Wind, Current, Tidal, Wave, Solar)

- How DNV handle MORUs:
- Self-propelled unit or offshore installation?
- 1A Column-stabilised unit vs OI Column-stabilised installation
- Permanent station keeping (mooring)
- Flag or no flag?
- MORUs deployed within EEZ → National shelf/ coastal state authority

- DNV certificate works as a standalone technical assurance covering the minimum technical safety (structure, mooring, stability, watertight integrity, marine systems, electrical, fire safety, escape).

MODU vs MORU

Odfjell drilling

Odfjell Oceanwind

DNV

RULES FOR CLASSIFICATION

Offshore units

DNV-RU-OU-0503

Edition July 2022

Floating fish farming units and installations

DNV AS

DNV

RULES FOR CLASSIFICATION

Offshore units

DNV-RU-OU-0512

Edition July 2023

Floating wind installations

The content of this service document is the subject of intellectual property rights reserved by DNV AS ("DNV"). The user accepts that it is prohibited by anyone else but DNV and/or its licensees to offer and/or perform classification, certification and/or verification services, including the issuance of certificates and/or declarations of conformity, wholly or partly, on the basis of and/or pursuant to this document whether free of charge or chargeable, without DNV's prior written consent. DNV is not responsible for the consequences arising from any use of this document by others.

The PDF electronic version of this document available at the DNV website dnv.com is the official version. If there are any inconsistencies between the PDF version and any other available version, the PDF version shall prevail.

DNV AS

DNV

RULES FOR CLASSIFICATION

Offshore units

DNV-RU-OU-0571

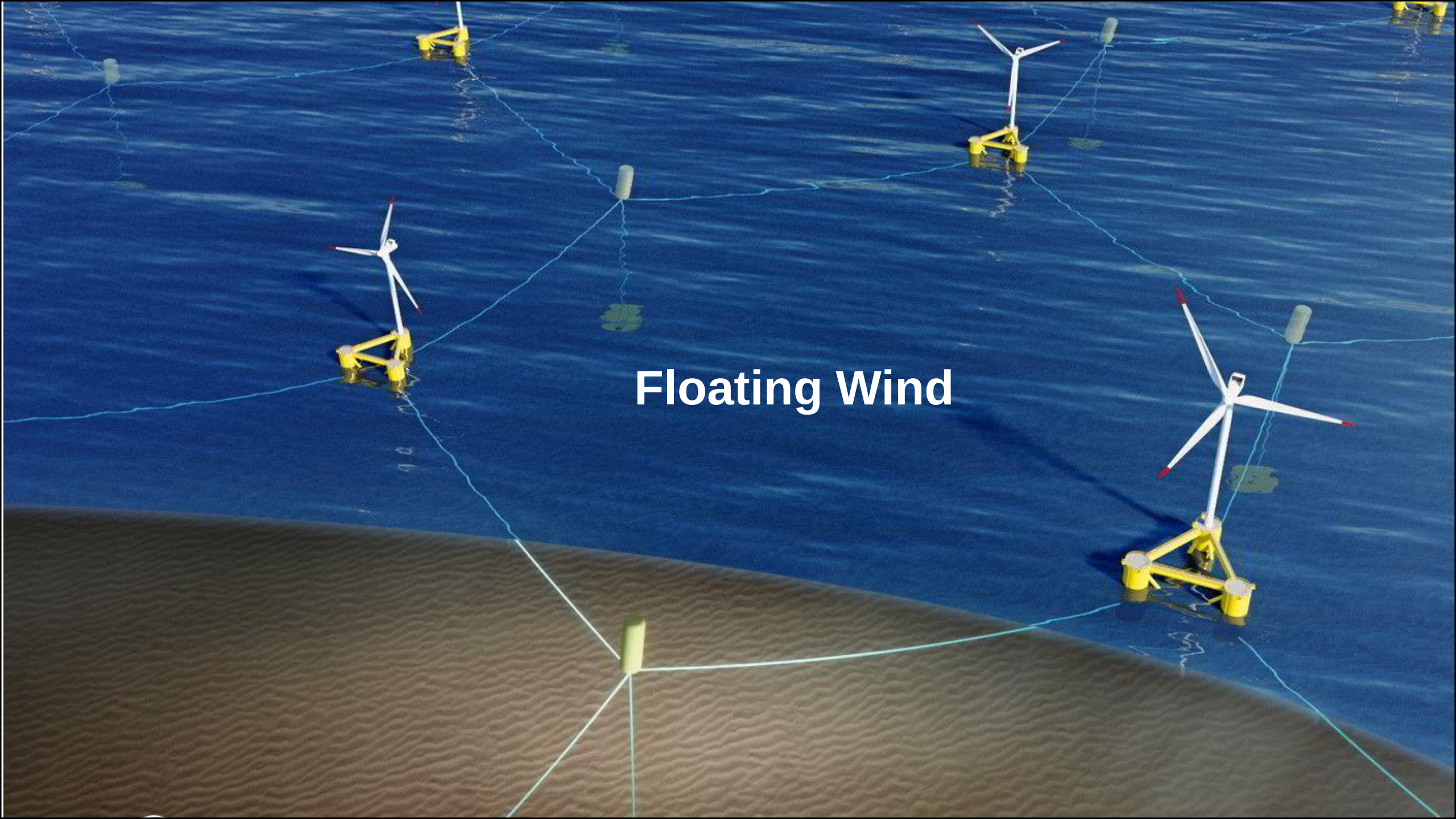
Edition July 2023

Floating infrastructure installations

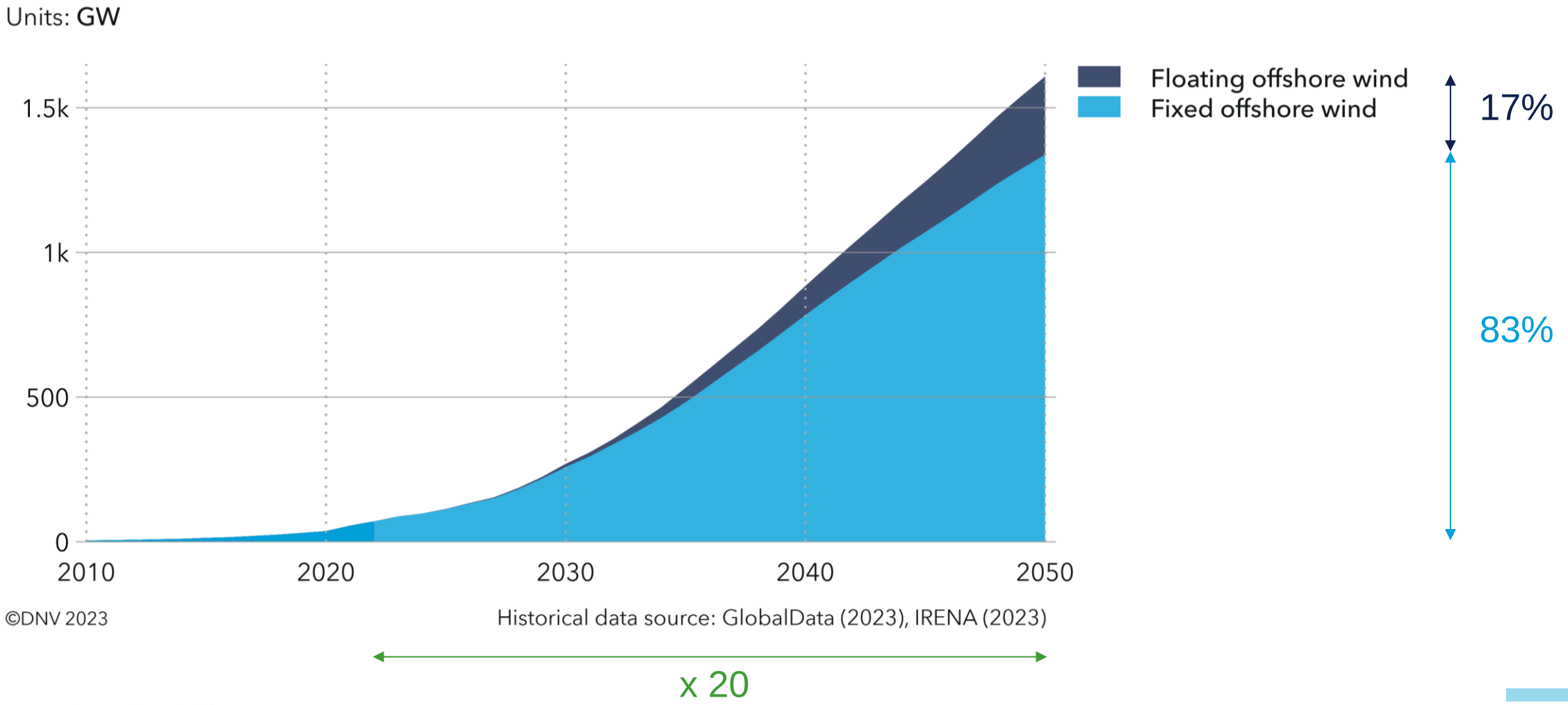
The content of this service document is the subject of intellectual property rights reserved by DNV AS ("DNV"). The user accepts that it is prohibited by anyone else but DNV and/or its licensees to offer and/or perform classification, certification and/or verification services, including the issuance of certificates and/or declarations of conformity, wholly or partly, on the basis of and/or pursuant to this document whether free of charge or chargeable, without DNV's prior written consent. DNV is not responsible for the consequences arising from any use of this document by others.

The PDF electronic version of this document available at the DNV website dnv.com is the official version. If there are any inconsistencies between the PDF version and any other available version, the PDF version shall prevail.

DNV AS

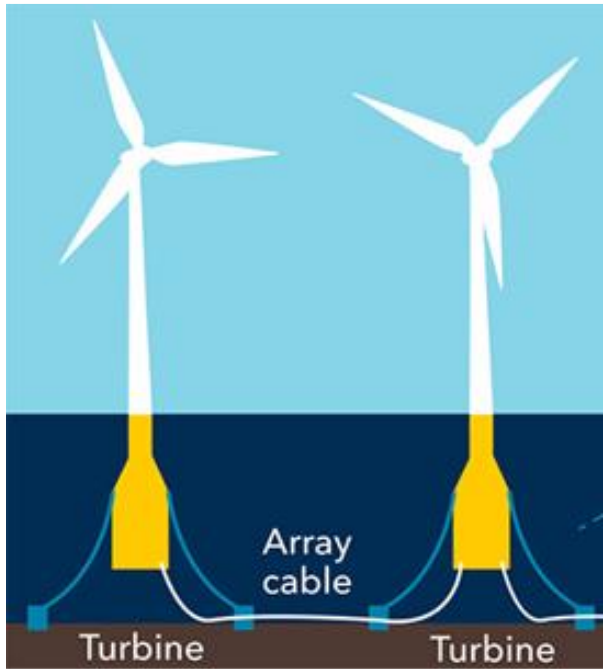

Floating Wind

Global installed offshore wind capacity



~300 GW* floating wind – a supply chain and infrastructure challenge!

20 000 floating turbines



Each on top of a

~4-5000 tonnes floating structure

47 000 km

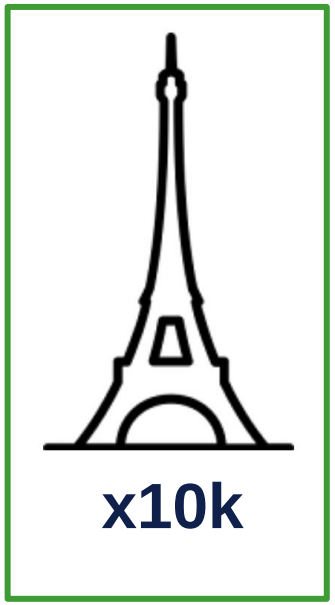
Array cables

70 000 km

Mooring line

100 million

tons of steel



*DNV 2023 ETO estimates 270 GW in 2050

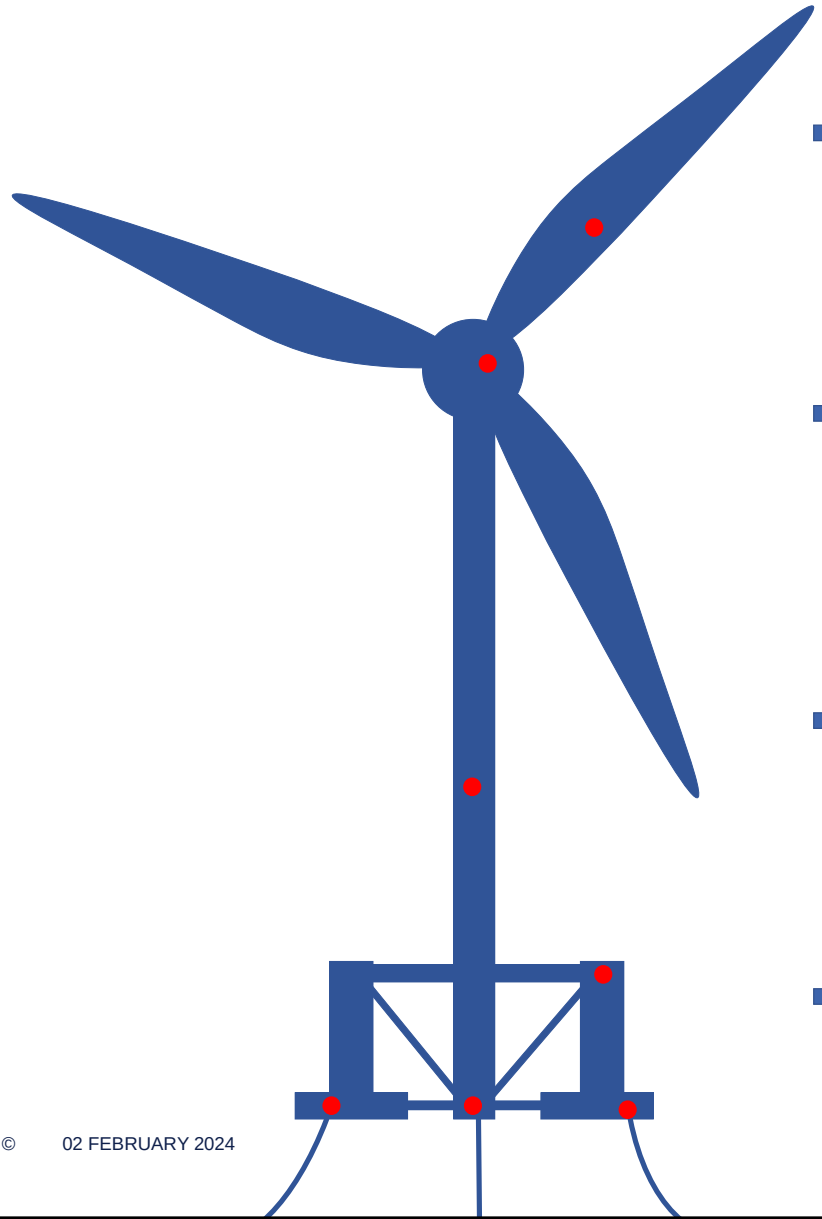
Floating wind is complex – both technically and commercially

- The technical complexity involved should not be underestimated:
  - The added complexity of going from bottom-fixed to floating (fatigue, mooring)
  - To couple the dynamic thrust from the turbine with a dynamically moving foundation
  - Optimized power production (LCOE)
  - Uninterrupted power production (energy security)
  - 20+ years' service life

Classification vs Project Certification in DNV

- Project certification is an established assurance scheme in the wind industry
- Classification is the global maritime certification scheme (ships and floating structures)
- Project certification covers the entire wind farm including cables
- Classification covers the floating structure and the mooring system
- Project certification in DNV integrates the relevant parts from classification (floater, mooring, in-service)
- Best practise from the wind and maritime industry combined
- Optimized, Standardized and Industrialized - yet flexible and robust
- Weld procedures, acceptance criteria, utilizing best practise, removing uncertainties

In-service maintenance, testing and inspection



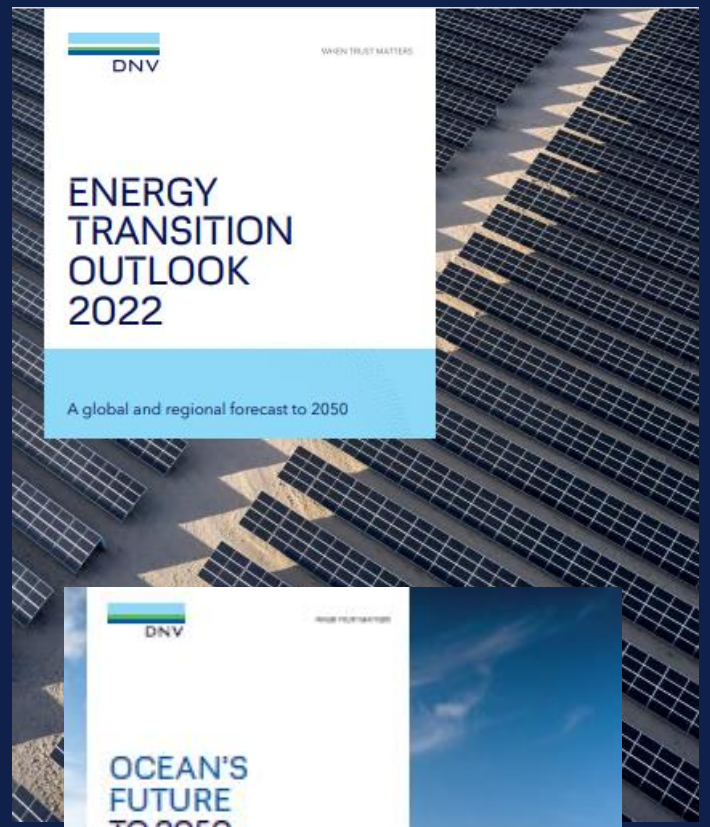
Condition monitoring
Condition based maintenance

Structure monitoring
Structural integrity managemement

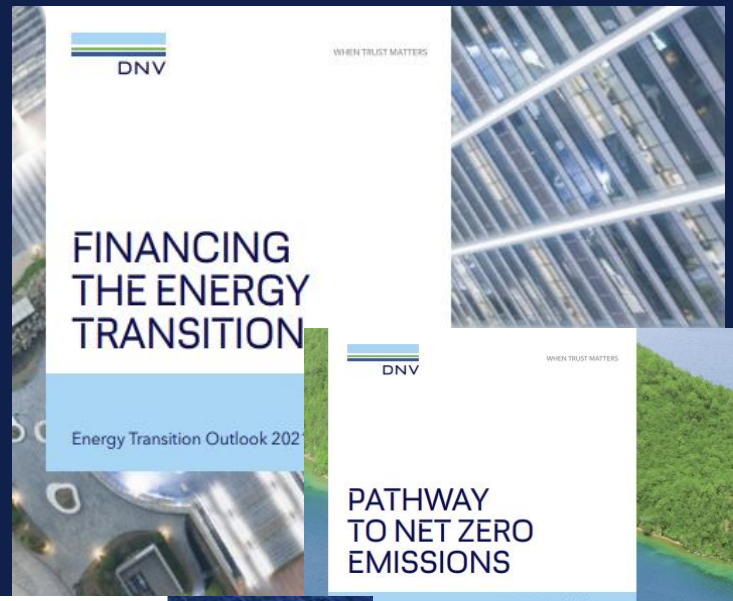
Mooring monitoring
Mooring integrity management

Data management
Data collection, security and quality

- Class/Certification on a continuous basis
- Use sensor data to optimise inspection and maintenance
- Field approach - sample check on individual installations to assess condition of field
- Utilize alternative and remote survey methods

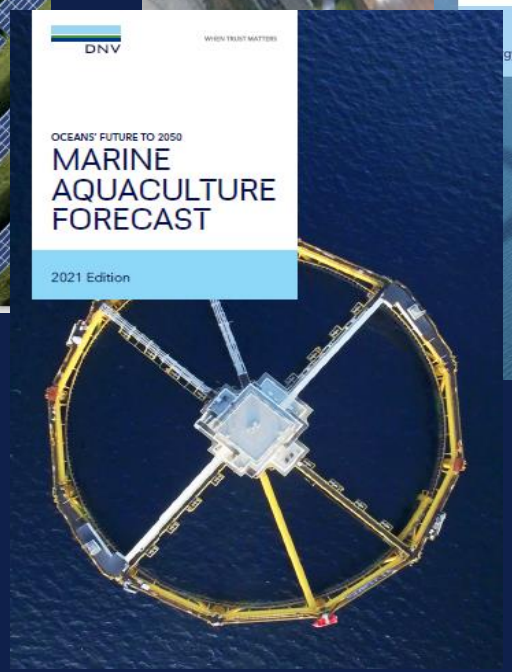

DNV
ENERGY TRANSITION OUTLOOK 2022
A global and regional forecast to 2050

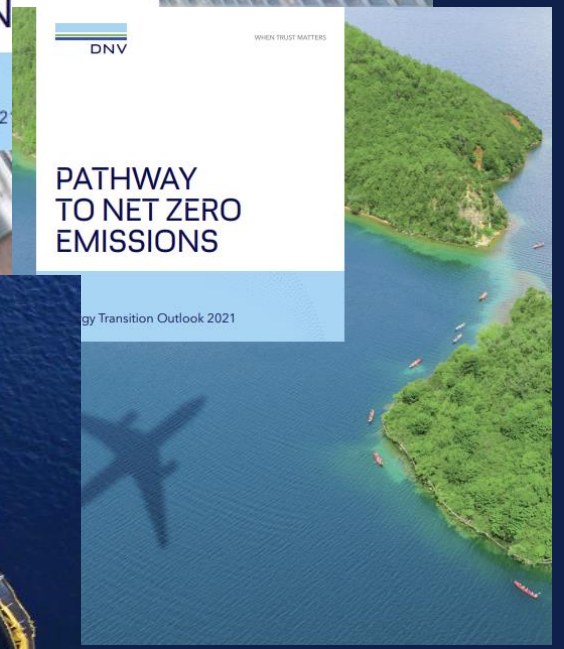

DNV
Energy Transition Outlook 2021
TECHNOLOGY PROGRESS REPORT
A review of 10 technologies setting the pace of the energy transition over the next five years.


DNV
FINANCING THE ENERGY TRANSITION


DNV
OCEAN'S FUTURE TO 2050


DNV
MARITIME FORECAST TO 2050
Energy Transition Outlook 2021


DNV
OCEANS' FUTURE TO 2050
MARINE AQUACULTURE FORECAST
2021 Edition


DNV
PATHWAY TO NET ZERO EMISSIONS

www.dnv.com