



Marine Energy Test Centre

Full scale testing in the North Sea

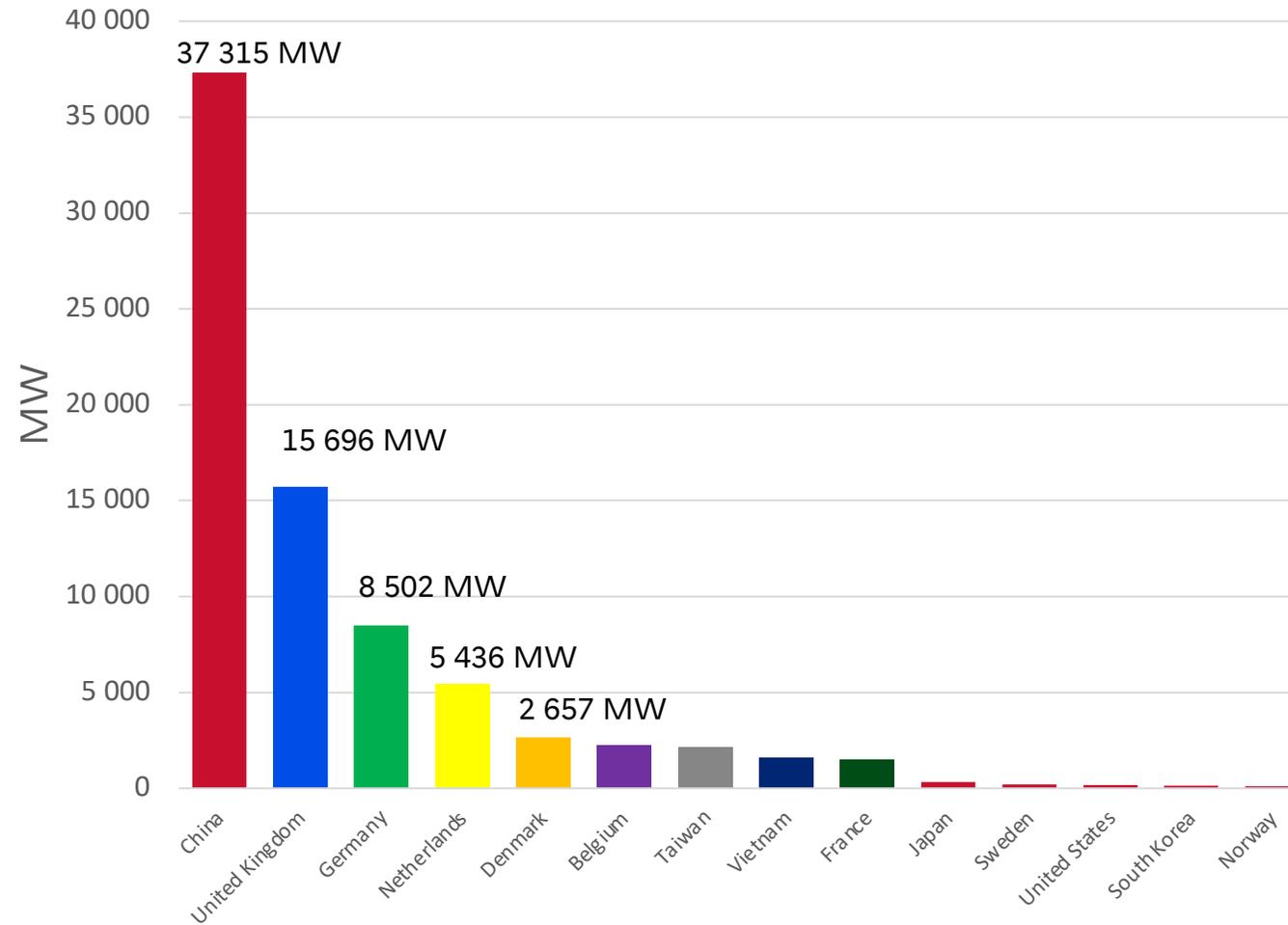
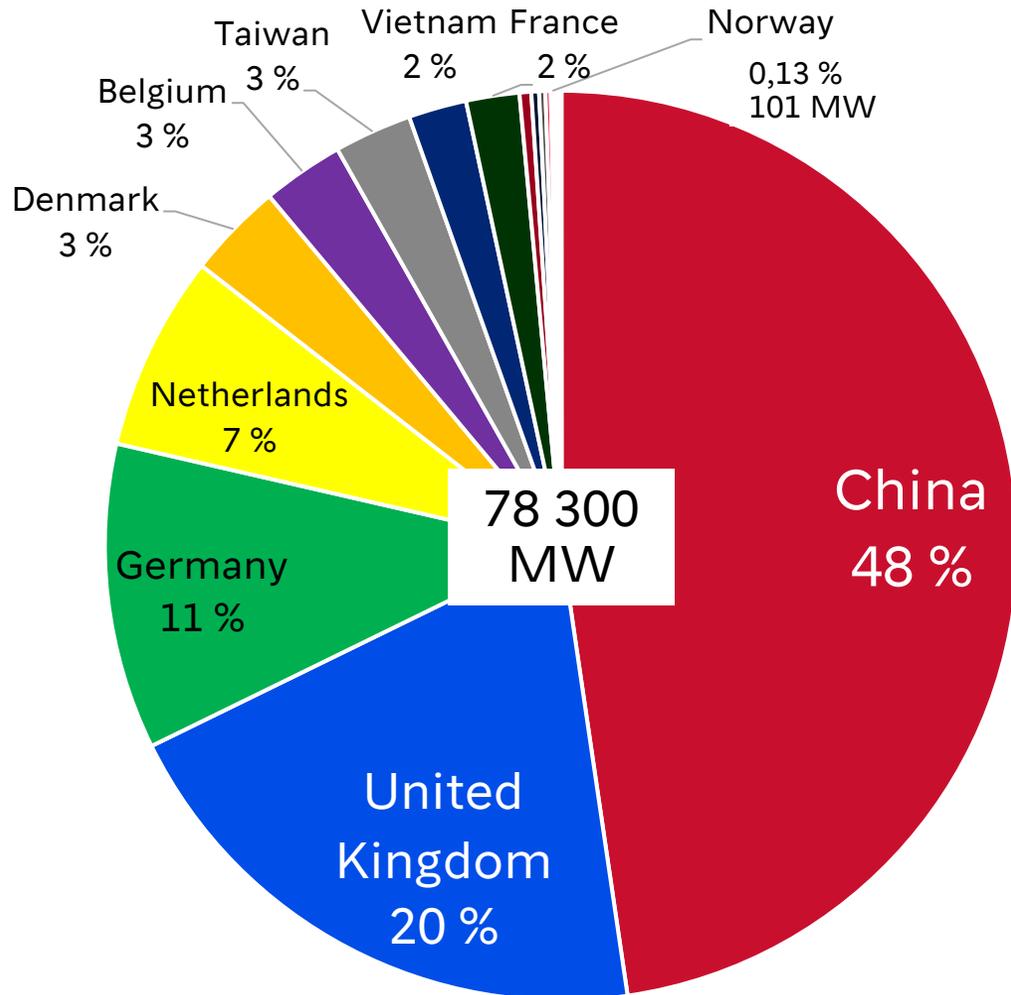




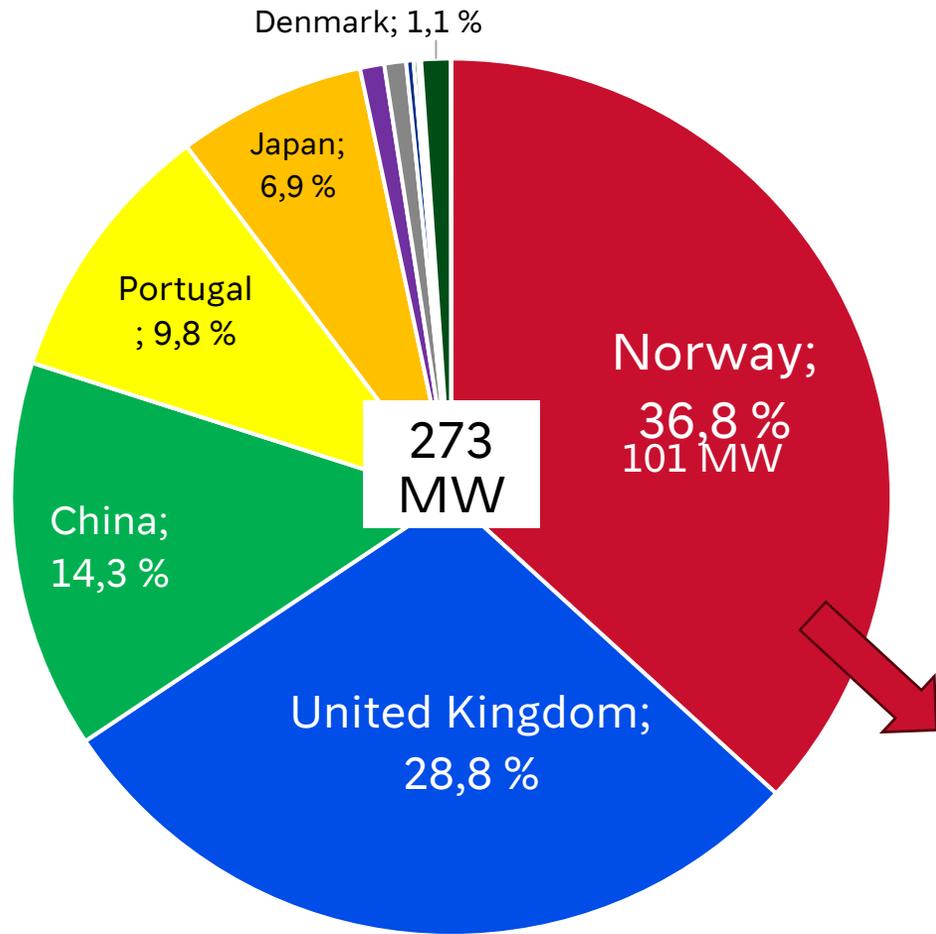
We develop world leading supply chains within offshore wind

**Norway's goal:
30 GW by 2040**

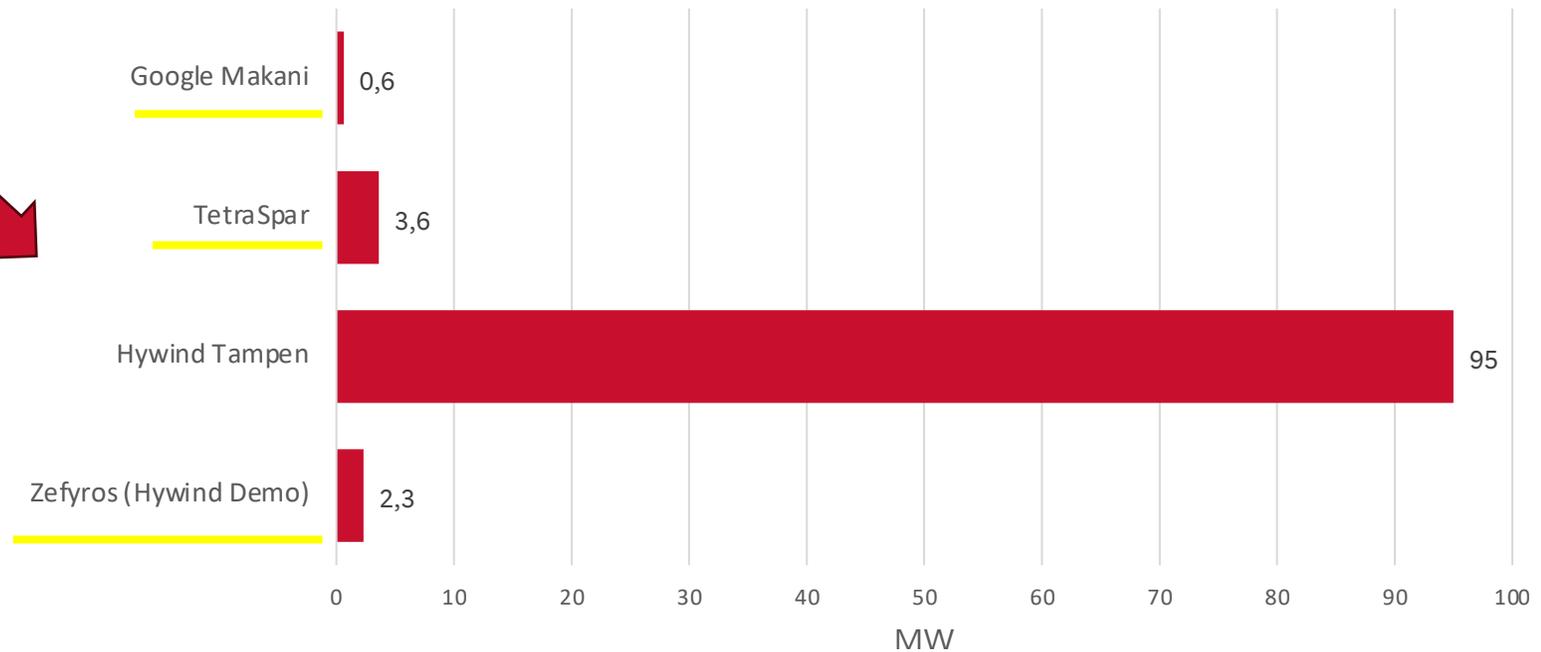
All offshore wind turbines installed worldwide



Floating offshore wind turbines installed worldwide



Norway:
leading nation worldwide within **floating**
offshore wind with **37 %** of installations



Test site concept

To offer location for testing within **floating renewable energy**



Role

Licence owner



Offer

Location & grid connection



Purpose

Facilitate testing & gain experience

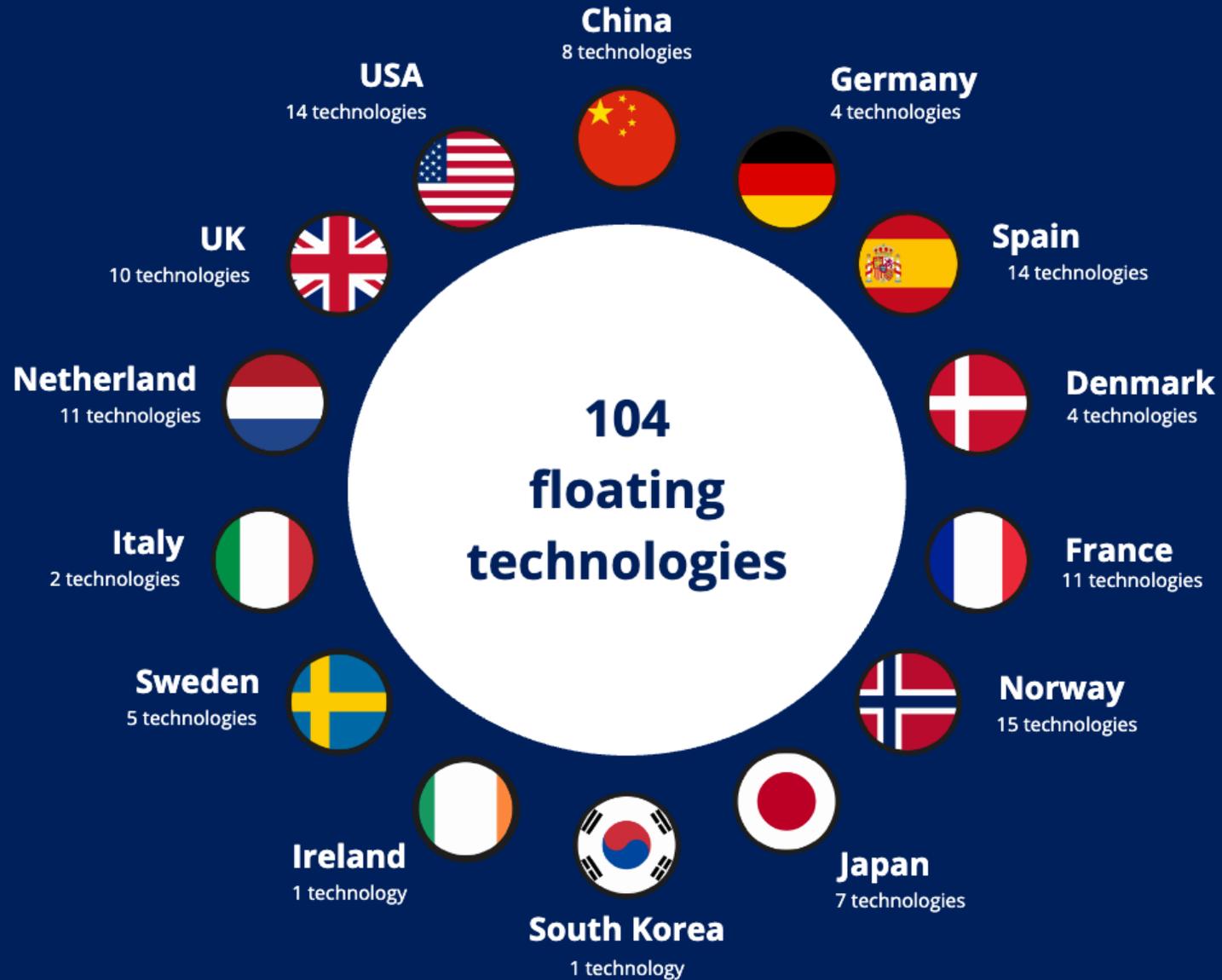


Contribution

Building a new industry

Opportunities for the entire supply chain





METCentre, Karmøy

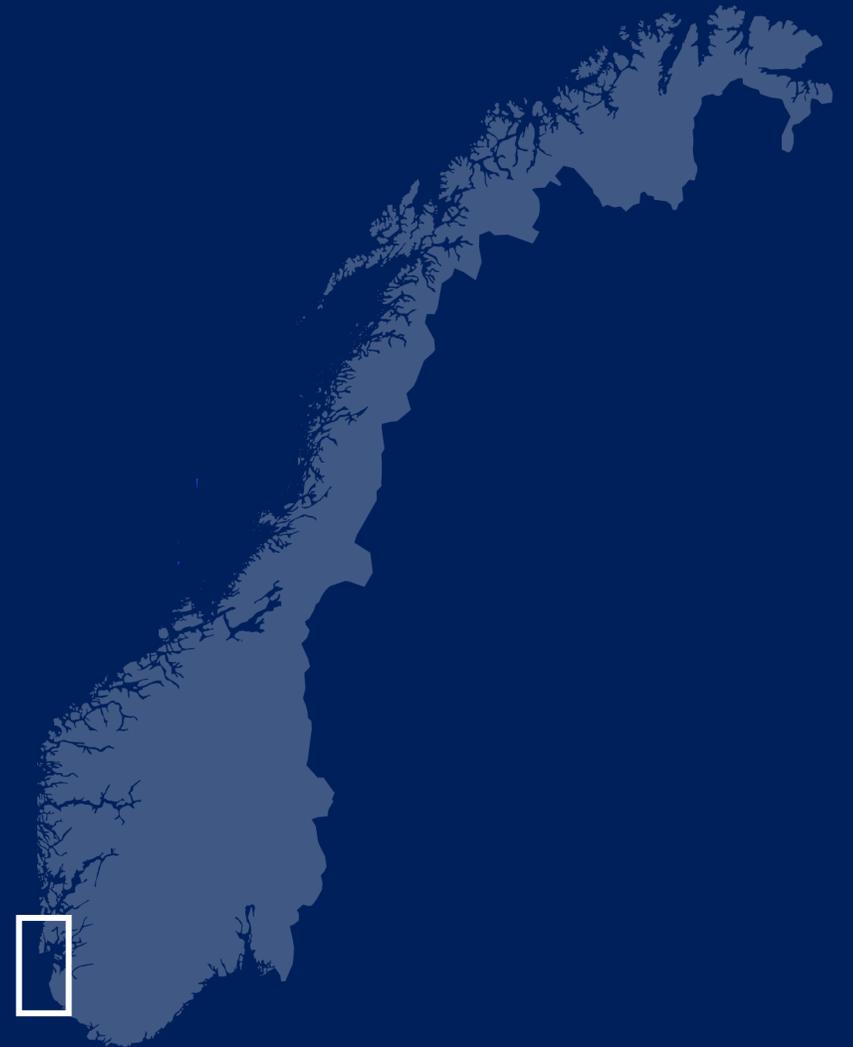
The only area in Norway with a license in accordance with the Ocean Energy Act

Hosting the world's first floating offshore wind turbine

The only floating offshore wind turbines supplying electricity to the grid in Norway



METCentre, Norway



Test sites

Locations and test projects we are currently working on

- Varying conditions
- General vs. custom licence

Concession areas given by The Norwegian Water Resources and Energy Directorate (NVE)

Karmøy

Bokn

Tau

Eigerøy

METCentre, Karmøy

In operation at site

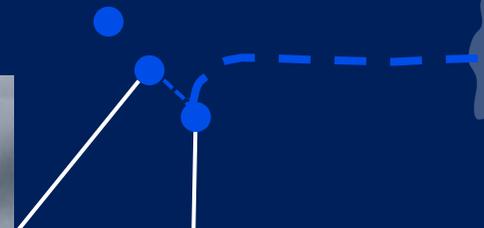
- Zefyros (2.3 MW, 2009)
- TetraSpar (3.6 MW, 2021)
- 22 kV export cable



TetraSpar



Zefyros





- 2,3 MW Siemens
- In operation since 2009
- Owned by Unitech since 2019 (Installed by StatoilHydro)
- 100 m deep draft
- Tip height 106,2 meters
- Rotor diameter 82,4 m
- Hywind Spar floater (steel)
- The world`s first floating offshore wind turbine

**Unitech Zefyros/
Hywind Demo @Karmøy**

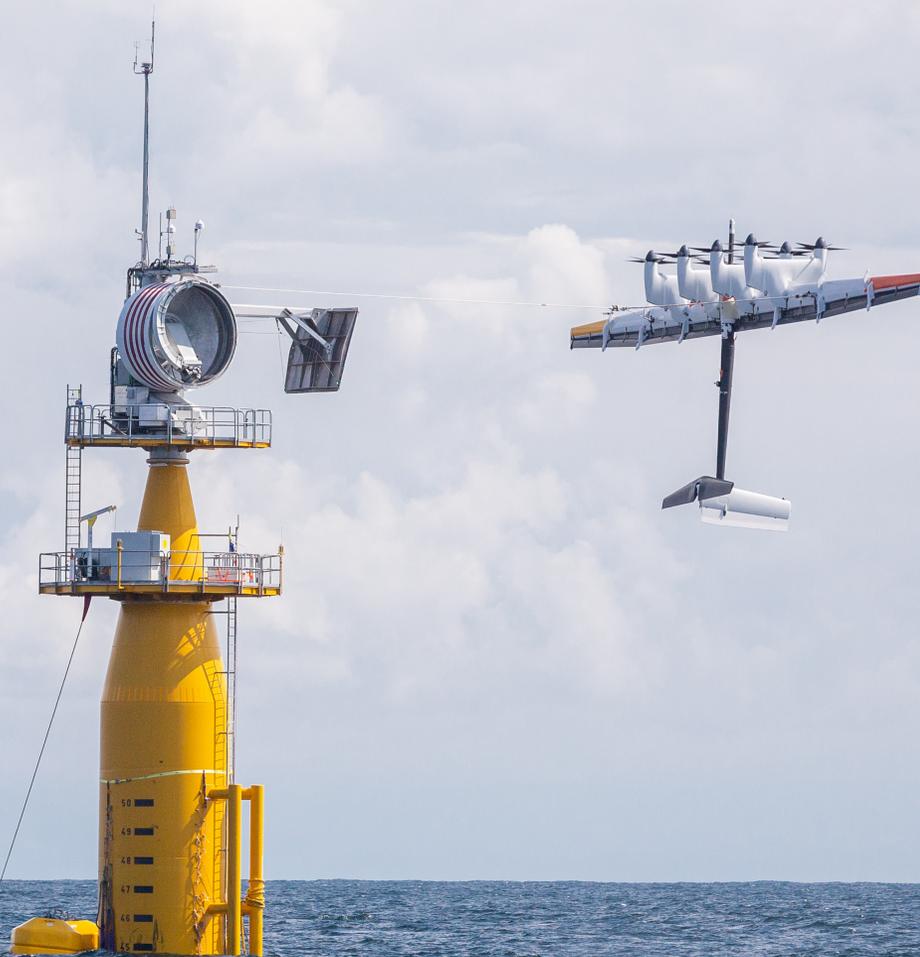
- 3,6 MW Siemens
- In operation since 2021
- Owned by Stiesdal, Shell, RWE, TEPCO
- Semi-spar (steel), with flexible positioning of keel below floater for stability
- Tip height 153 m
- Rotor diameter 130 m
- 66 m deep draft



TetraSpar @Karmøy

Makani @Karmøy

- In operation 2019
- Owned by: Google/Alphabet
- 600 kW - Kite technology
- Foundation-Design: Spar
- 45 m deep draft
- Kite wingspan: 28m
- Wire: 434m.





METCentre, Karmøy

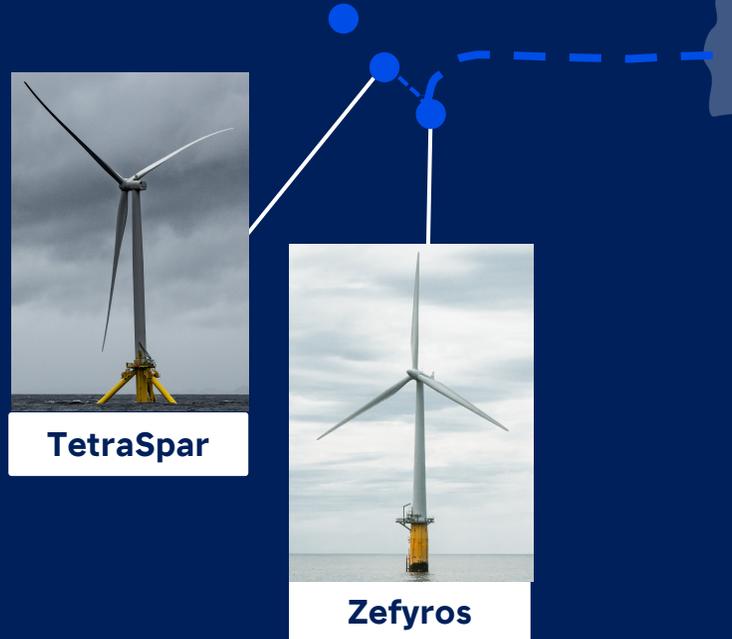
In operation at site

- Zefyros (2.3 MW, 2009)
- TetraSpar (3.6 MW, 2021)
- 22 kV export cable

Further site development

- High demand
- Limited test opportunities

→ Applied for expansion
and new grid connection, 2021



METCentre, Karmøy

Expansion of site with two new licences from Dec. 23

Two new licences approved Dec. 2023

- 1. Offshore energy production:**
3 → 7 test locations at site,
total capacity 85 MW
- 2. New grid connection:**
66 kV cable and
necessary HV equipment

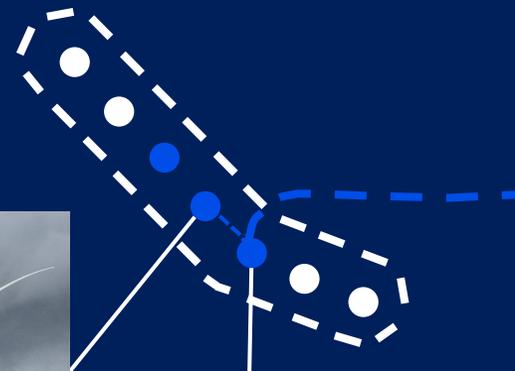
Expropriation right for cable route



TetraSpar



Zefyros

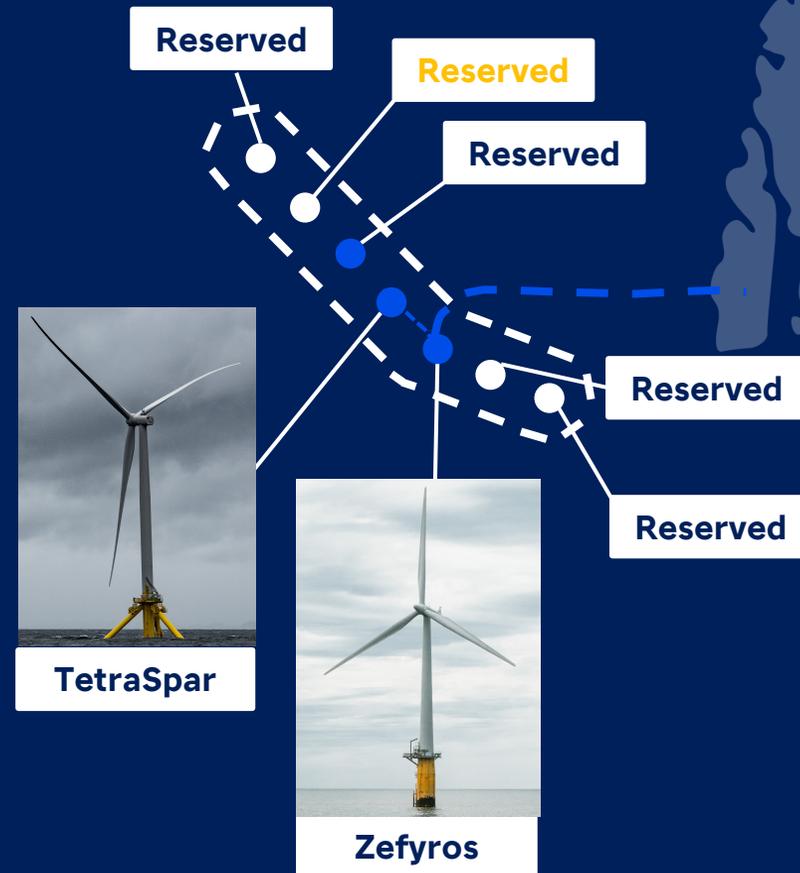


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Upcoming projects

- **Pending demonstrator reservations:**
4 locations (18 MW+)
- **New Grid Connection**
66 kV cable+
Subsea hub solution
(tech. development)

(From 2028)



METCentre, Karmøy

Upcoming projects

Hywind / Zephyros

2.3 MW

Tip height 106 m

Rotor diameter 82 m



2009

TetraSpar

3.6 MW

Tip height 153 m

Rotor diameter 130 m



2021

300 m+

Upcoming projects

Demand: 18+ MW

Tip height 300 m+

Rotor diameter 230 m+

2028 →

Project:

New Grid Connection



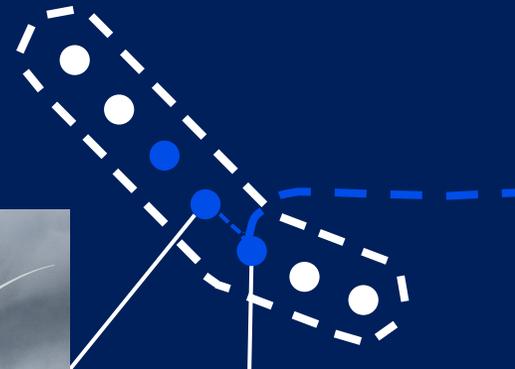
METCentre, Karmøy

Current Grid Connection (22 kV / 15 MW)

Zefyros used as floating hub

- Limited lifetime
- Limited capacity
- Daisy chain - limited flexibility when several units need to connect/disconnect

→ Need for new solution



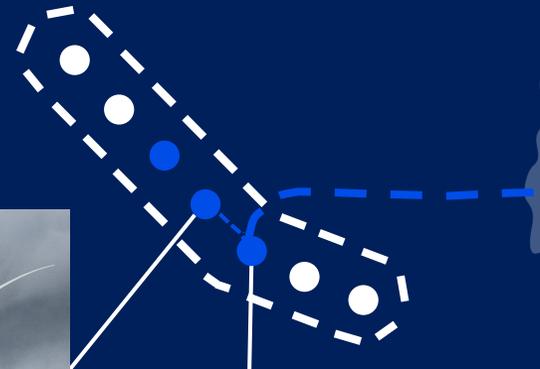
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Need for new Grid Connection (66 kV / 82.7 MW)

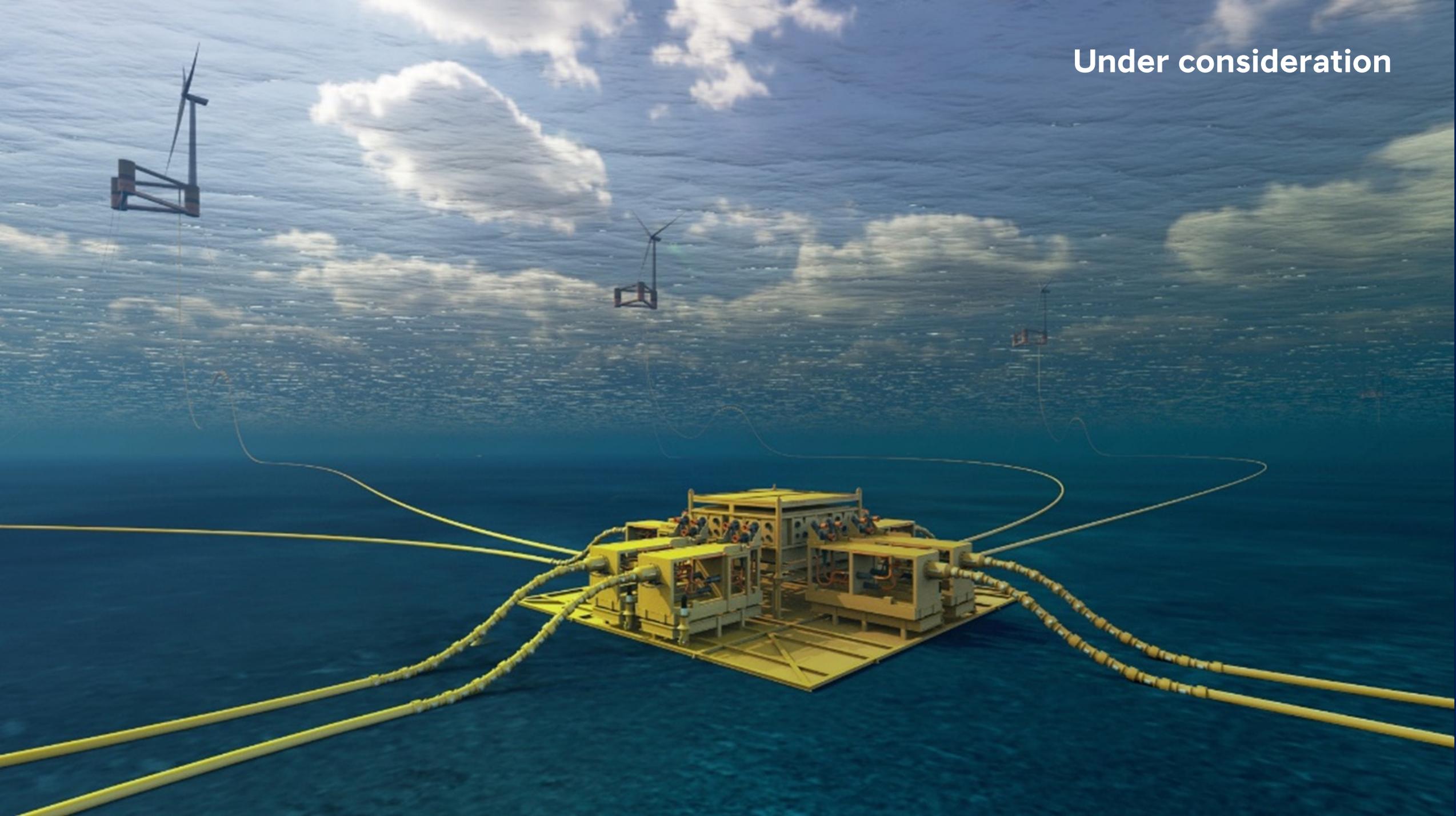
Features

- Connect up to 6 units
- Lifetime of 25 years
- Stable and reliable operation
- Flexibility
- Technology development, incl. connection system and cable

→ Subsea hub



Under consideration



Research Facilitation

“The licensee shall facilitate the conduction of research by external actors in and around the pilot installation.”



Bird monitoring

By Spoor

Insights from
detections:

40K +



Learn:
species and
behaviour



The Institute of Marine Research:



Senter for Forskningsdrevet Innovasjon
Center for Research-Driven Innovation

Development of underwater hub for live environmental monitoring, including:

- Metocean (waves, temperature, current)
- Hydrophone (detect sound/noise from marine life/installations/vessels)

Learn about the impact of the wind turbine installations



Ocean Charger

Testing a new solution for charging battery-powered vessels offshore

- Connect / disconnect













