



Renewable Energy Hubs

IEA Experts' Group on R&D Priority-setting and Evaluation (EGRD) Hosted by the Danish Ministry of Climate, Energy and Utilities

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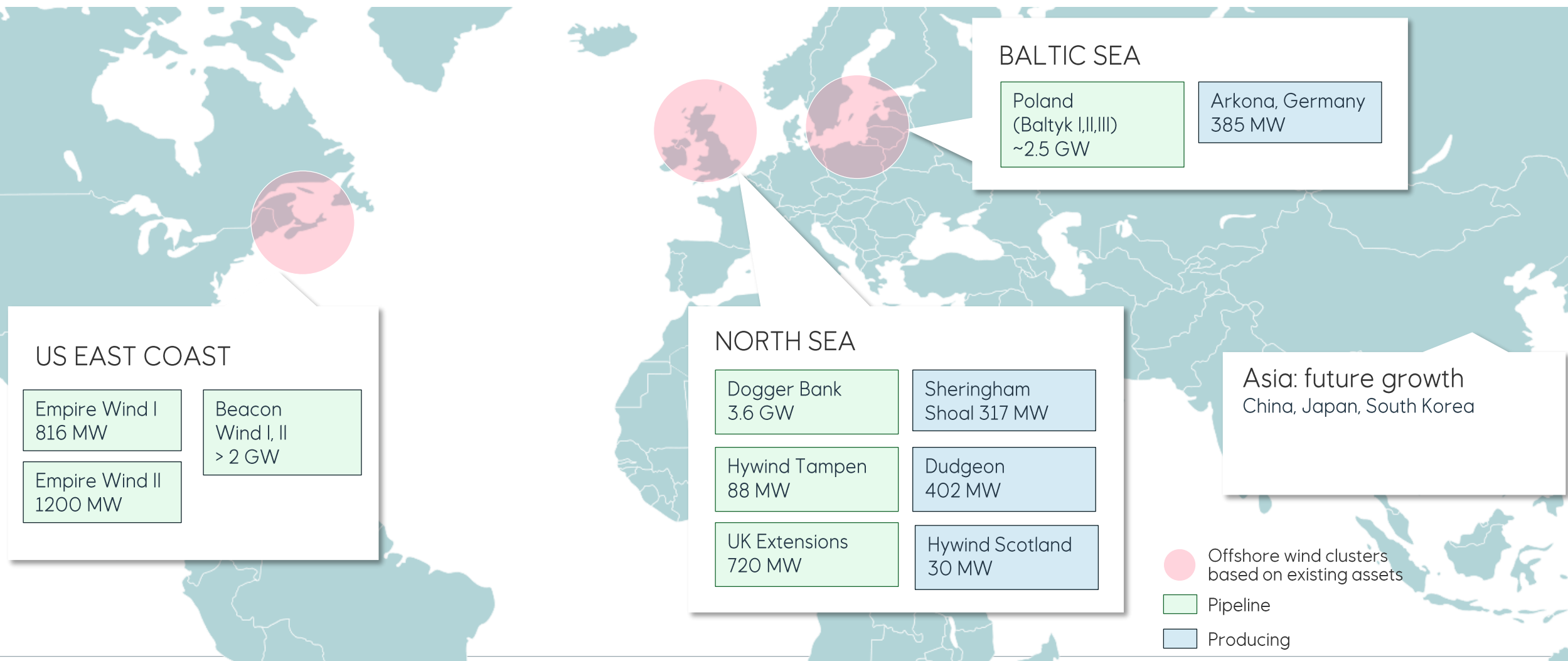
New Energy North Sea Area Development

Agenda

1. Equinor offshore wind portfolio
2. North sea cluster
3. More than offshore wind
4. Hywind Tampen as an example
5. Shaping a North Sea energy hub
6. Hybrid projects – challenges
7. Crystal ball?



Creating value from scale in regional clusters



A strong growth platform in Europe

Developing clusters in North Sea and the Baltic Sea

>60

GW
Expected upcoming
offshore wind auctions

In the North Sea and Baltic Sea, by 2030

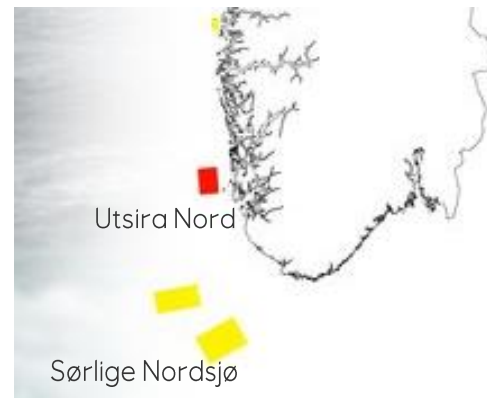


Expected offshore wind auctions and lease rounds in northern Europe 2020-23



Acreage secured / Awarded ●
Producing assets ●

The North Sea: Not only offshore wind, but a world-class energy province



CCS value chain

- Continue to develop Northern Lights
- Private-public partnerships needed for CCS value chain
- Increasing interest among European industries needing deep carbonization

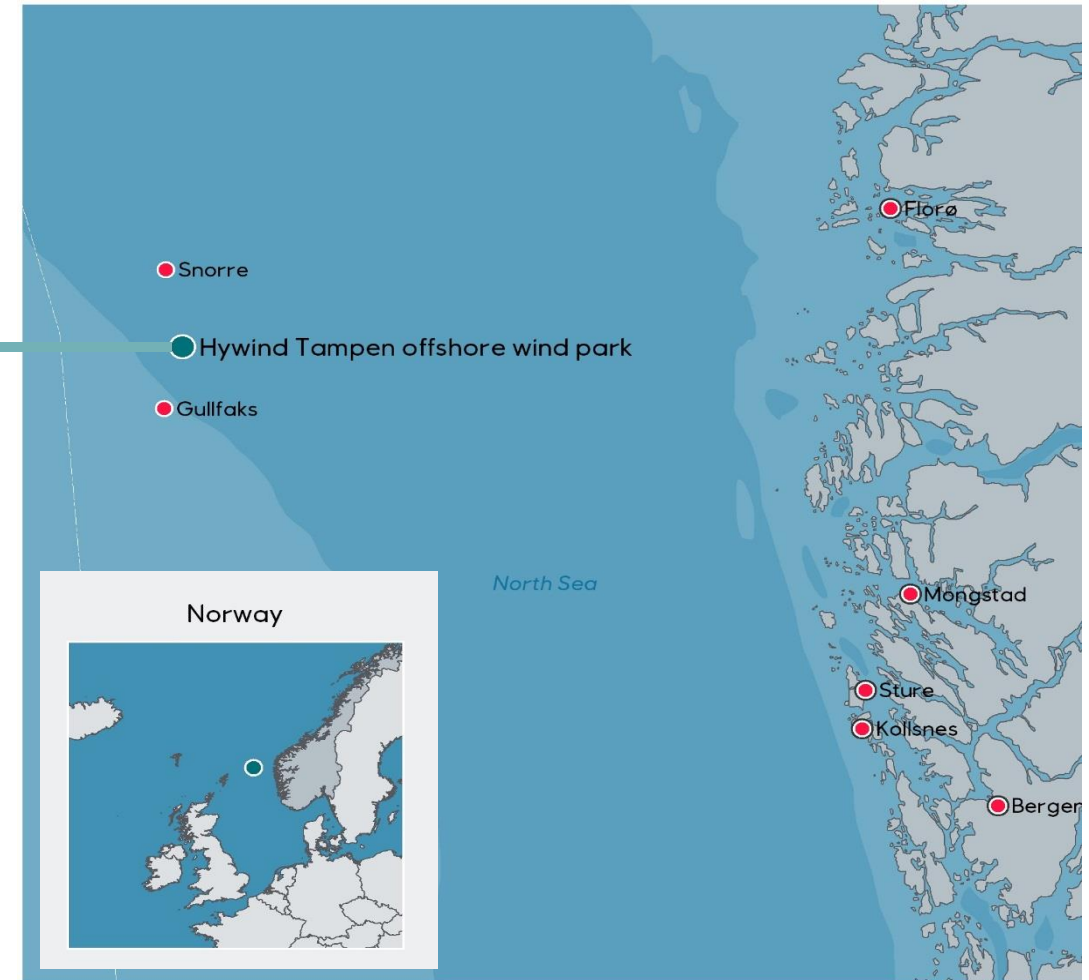
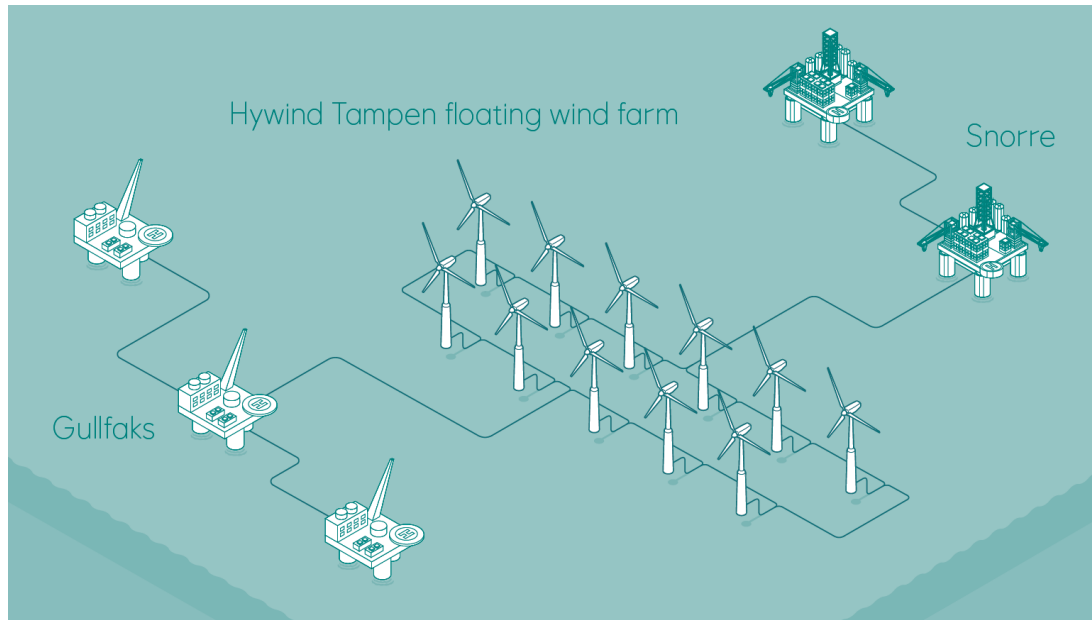
Norwegian offshore wind resources

- Industry must work on cost – scale and industrialization are key
- Policy signals have a key role to play:
 - Ambitions?
 - Leasing model?
 - Commercial framework?

North Sea power hub

- Abundant wind resources – cluster thinking possible
- Link supply and demand in Europe; integrated energy systems
- Develop long term cooperation agreements across boundaries

Hywind Tampen – a floating offshore wind farm integrated with O&G



11 wind turbines

Combined capacity of 88MW

Concrete substructures and shared anchors

200.000 tonne/year CO2 emission reduction

Shaping a North Sea energy hub

- **Maximize value creation from offshore wind portfolio:**
 - Capture value in merchant markets
 - Mature storage and hydrogen for North Sea offshore wind portfolio
 - Leverage future North Sea grid interconnections (hybrid projects)
- **Support efforts to decarbonize North Sea energy production:**
 - Mature a profitable portfolio of wind projects for O&G assets
 - Holistic “broad energy company” approach

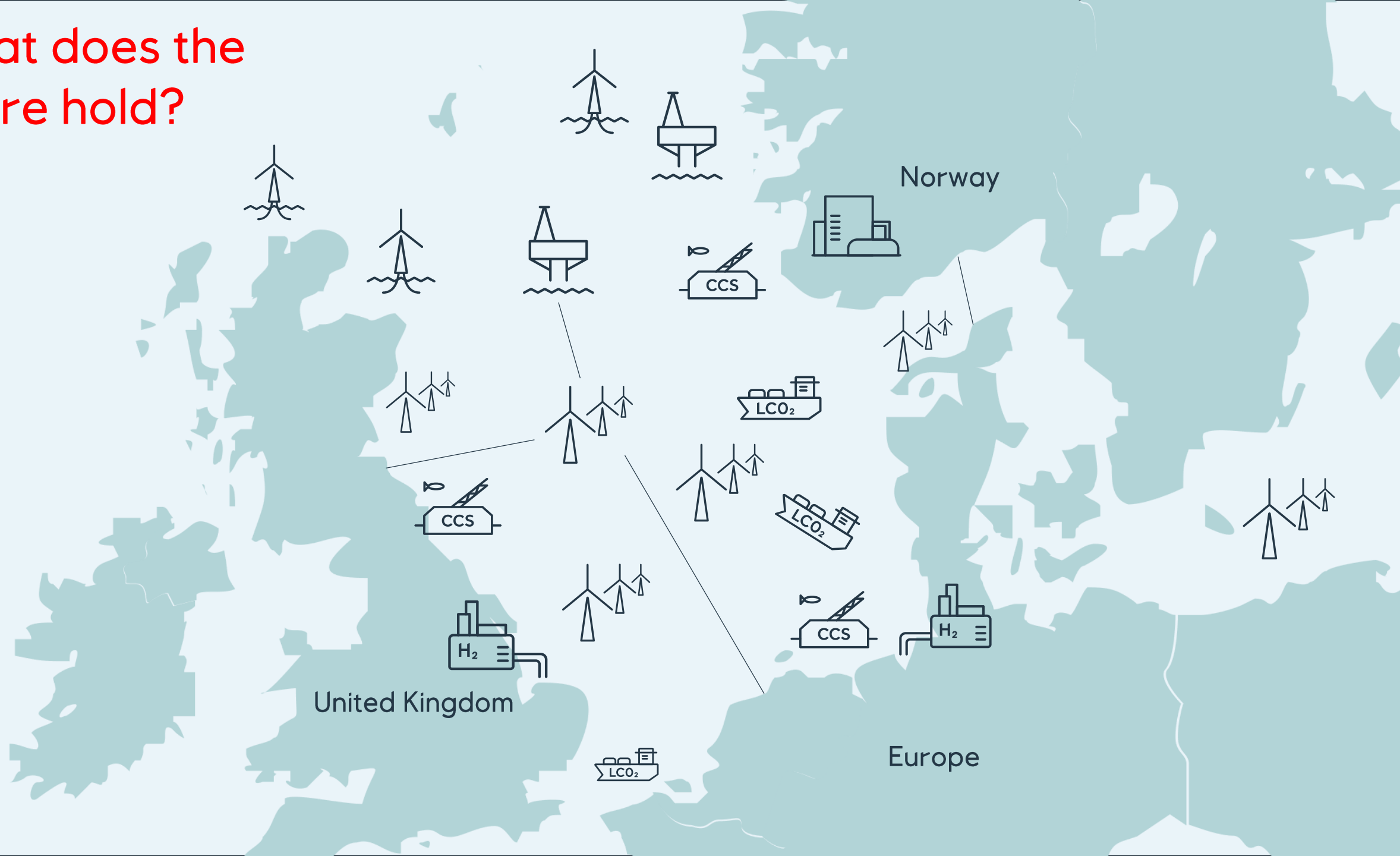


Hybrid projects will be important but, face commercial/regulatory challenges

- Must present an attractive «business case» for the connected countries
- Key issues:
 - How do you split cost & benefits
 - Market arrangement
 - Grid costs/arrangements
 - Need for change to EU electricity market regulations & directive
- Find solutions that provide efficient trade & dispatch – attractive to wind farm developers
- Important to establish first hybrid projects – need for EU facilitation



What does the future hold?





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