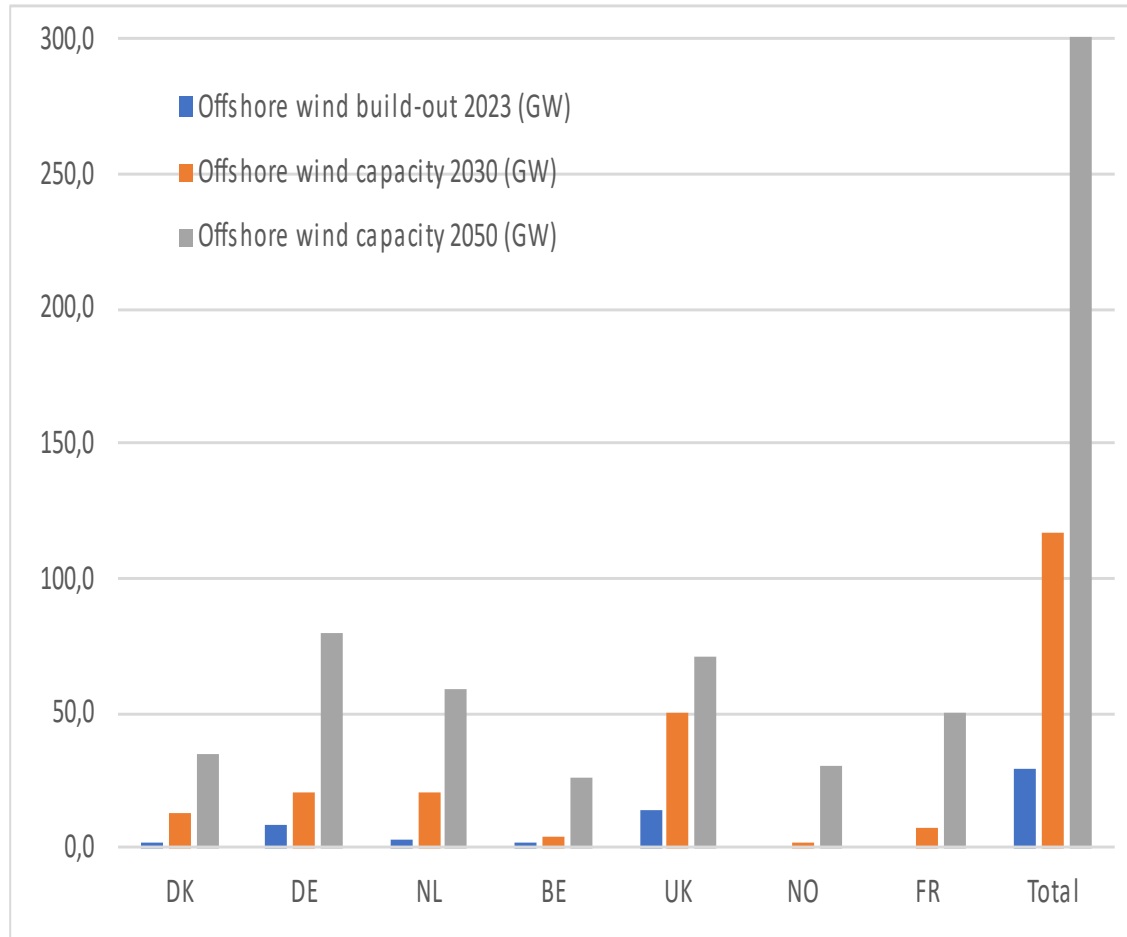


# Energy future in the North sea



Sigurd Bunk Lauritsen  
Market Manager, Sweco Denmark

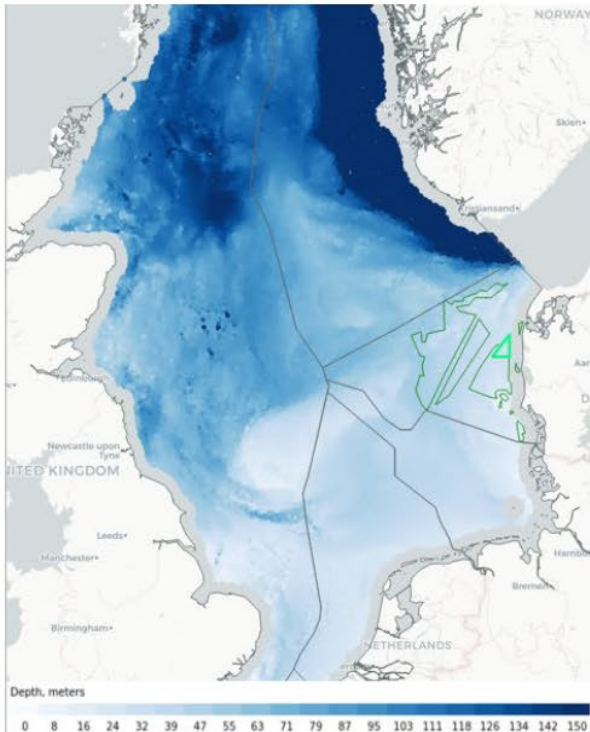
# EU Strategy and Framework for Offshore Wind



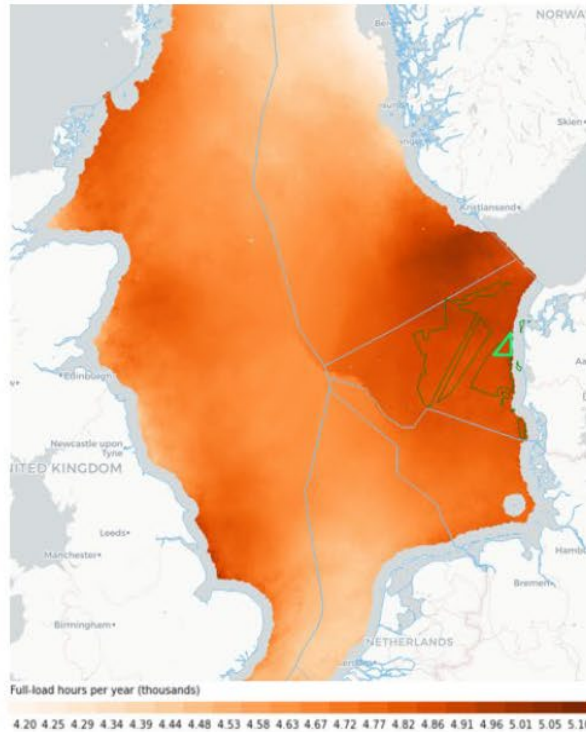
- European Green Deal, Carbon neutral 2050.
- EU Strategy for Energy System Integration (2020).
- EU Hydrogen Strategy (2020)
- Hydrogen Directive, Renewable Energy Directive, Electricity & Gas Markets Directives, Trans-European Transport Energy Networks Regulation, .....
- In February 2022 EU launched the new strategy for offshore wind with the aim of increasing the capacity from ~12GW (2021) to 300GW in 2050. This was seen as a joint development for the North Sea, The Baltic Sea, the Mediterranean and the Atlantic.
- REPowerEU (May 2022) – independence of Russian gas and oil, electrolyzers to 17,5GW in 2025. Offshore wind again pointed out to be the main driver and North Sea to become the Green Power Plant of Europe.
- EU and ministers of Denmark, Germany, Belgium and the Netherlands agreed to 65 GW by 2030 and 150 GW by 2050 for those 4 countries.
- EU and ministers of Poland, Germany, Denmark, Sweden, Finland, Estonia, Latvia, Lithuania signed 30 August 2022 the Baltic Sea Declaration for offshore wind to develop 19,6GW in the Baltic Sea up to 2030 (2,2GW in 2021) with a potential of 83GW by 2050.

# Why Wind in the North Sea?

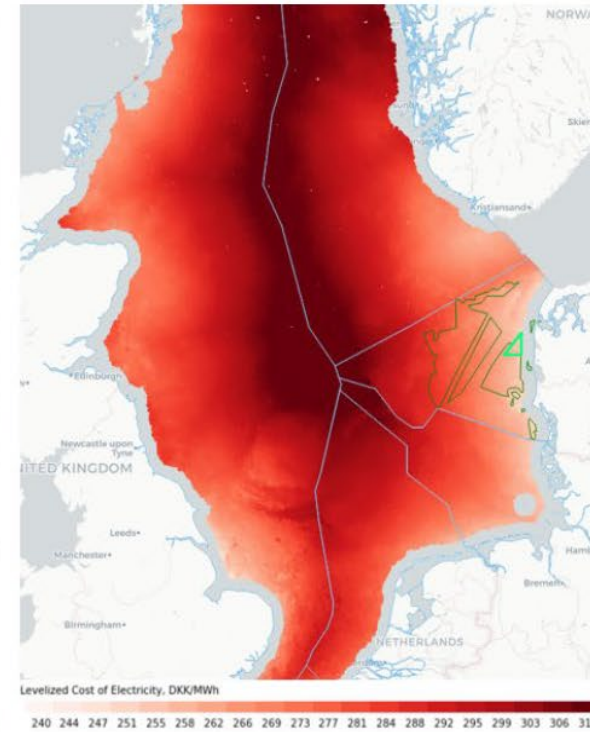
- Probably some of the best wind schemes in the world
  - Wind blows 90% of the time during winter months and 80% of the time during summer months.
  - The winds are strong – for 70% of the time above 12 m/s. and for 40% of the time during winter above 17 m/s.
- In most part relative low water levels (8-50m), allowing for monopiles.
- Highest LCOE's in the world.
- Eminent sea for huge energy production. Already heavily populated by oil and gas platforms and marine pipelines.



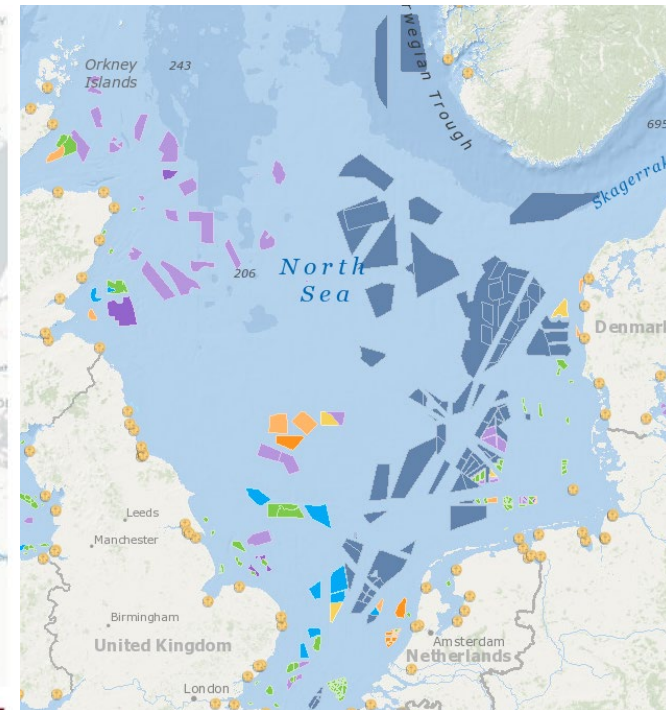
Water Depths



Full Load Hours



LCOE



Wind Farm Licence **SWECO** 

# Energy Island(s) - The Political decision – February 2021

## Denmark strikes deal on £25bn artificial wind energy island

Thanks to an inter-party agreement, the clean energy hub in the North Sea is set to be the largest construction project in Danish history



▲ A simulation of Denmark's clean energy island, due to be completed before 2033. Photograph government



The Danish climate minister closing down the oil industry for good

→ Read more

*"This is truly a great moment for Denmark and for the global green transition," Denmark's climate minister, Dan Jørgensen, said in a statement.*

The future energy island in the North Sea must be constructed as a dammed island **owned in close public / private cooperation**

Denmark on a **large scale must seriously be able to export and in the future store and convert green**, Danish electricity.

World-class **security of supply** and **optimized infrastructure** development.

The **first phase can handle a minimum of 3 GW** and must eventually be able to hold **10 GW**.

Energy Island North Sea is a development project on an unprecedented scale with a long-term perspective and sufficient room for innovation

**Energinet** establishes, operates and owns the transmission network which will connect the energy islands to the mainland in Denmark and abroad.

**Market conditions without public support**

Shall **support lower energy prices** and not result in price increases

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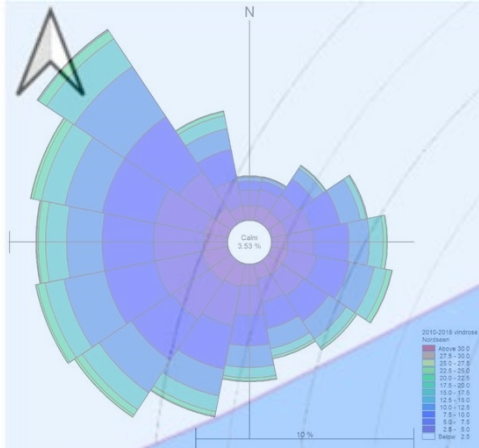
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Today, Belgium and Denmark are working on "Energy Islands" and Germany has established 11 offshore HVDC Converter Systems.

# Wind and waves around the energy island



## Vest Nordsøen II + III

Windrose at site

Water depth  $\approx$  25-30 m

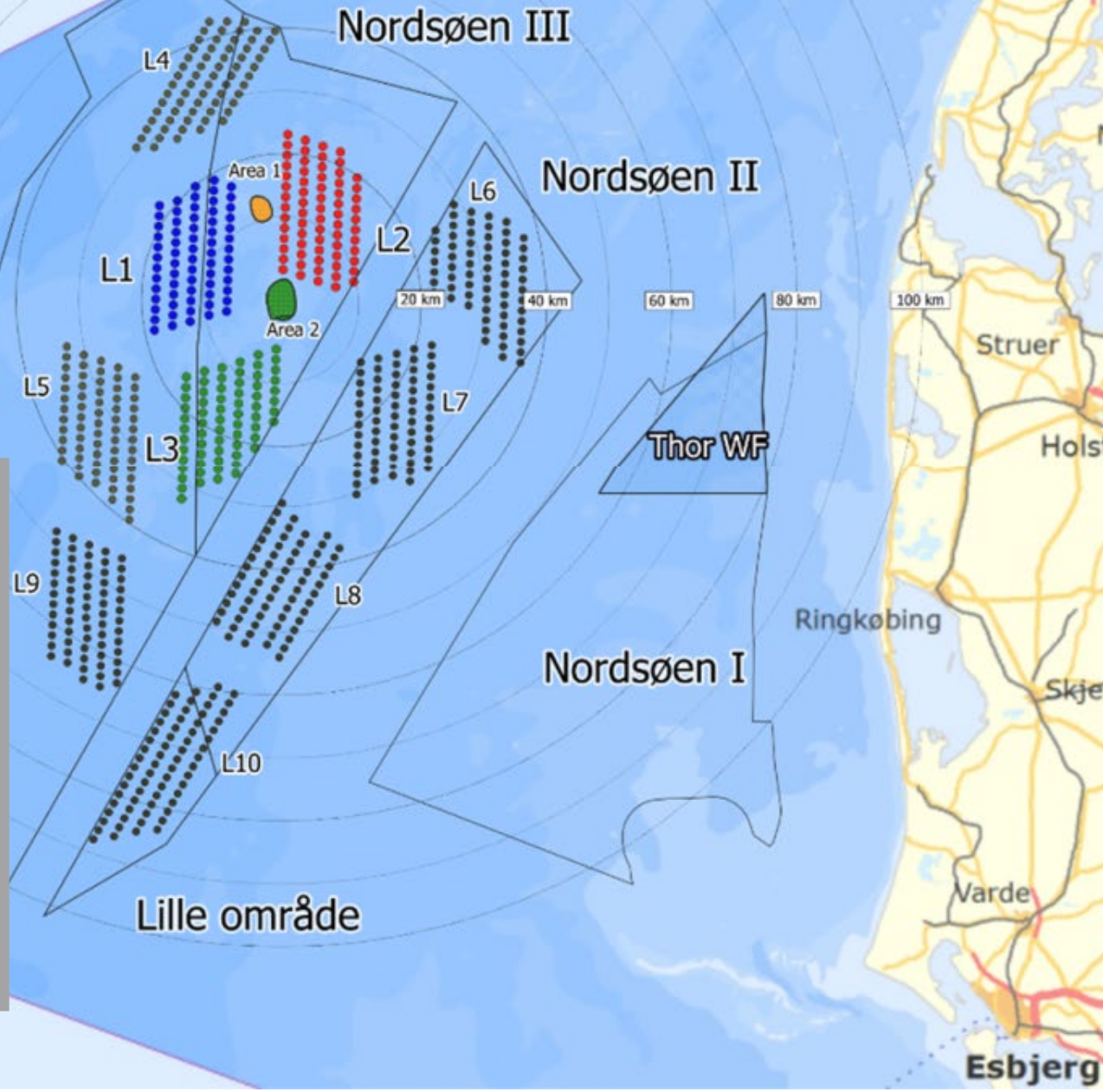
Preliminary wave analysis indicate:

- $H_s^{100 \text{ år}} \approx 10 \text{ m}$  ;  $T_p \approx 16 \text{ s}$
- $H_s^{1 \text{ år}} \approx 7 \text{ m}$  ;  $T_p \approx 12,5 \text{ s}$

$\sim$ 86 in/out going cables from the island

Export to:

- 4 GW to DK (room for 2 GW already)
- 1 GW to NL (agreement in place)
- 2-3 GW to B (under negotiation)
- 2-3 GW to D (initial discussions)



# The investment (~236 Billion DKK (~32 billion EUR))

Windfarm 10 GW



105 bill. Dkk  
~45%

Energy Island (Caisson)

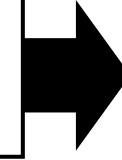
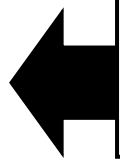


11 bill. Dkk  
~5%

Transmission system



95-120 bill. Dkk  
~50%

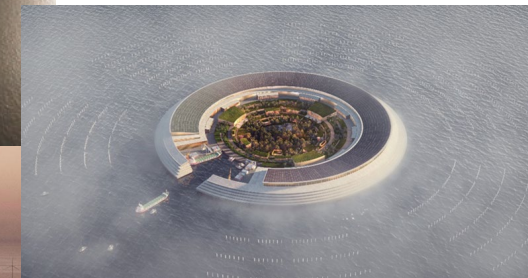
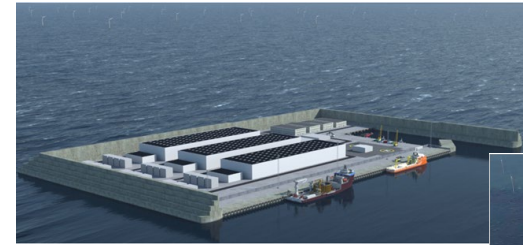


# The alternatives

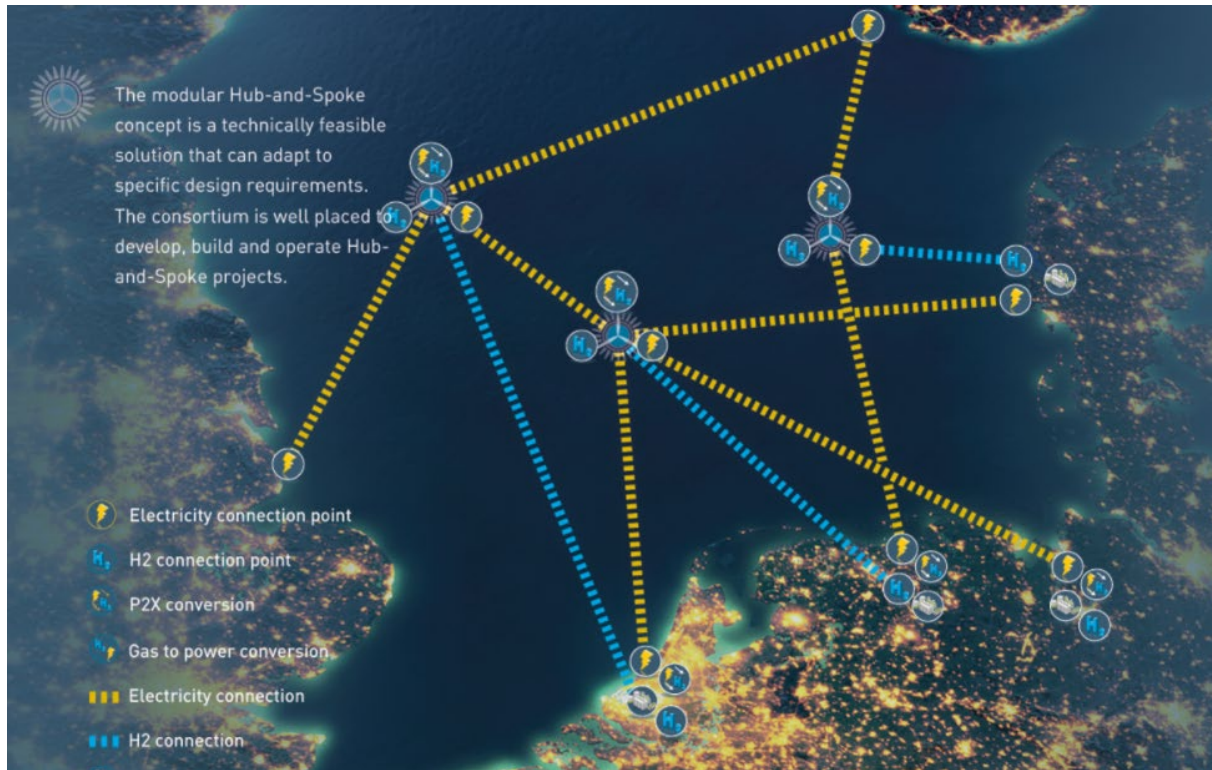
- An artificial island
- Lifetime 80-100 years – Manned
- Can be a better and more secure concept under harsh conditions
- Can act as a wind farm hub
- Many solutions have to be invented and designed for the purpose
- Can be protected



- 5-7 of these "boxes" for 1,5-2,5 bEUR each
- Lifetime 40 years
- Un-manned - No wind farm hubs
- More mature technology and scalable
- We know how to build them
- Vulnerable for attacks



# North Sea as the Future Energy Cluster



- The vision is there. It is not without problems:
  - The main power grid in the countries around the North Sea shall be developed to handle huge volumes of intermittent power.
  - The grid investments will be significant
    - in Germany the North-South backbone is under significant strengthening.
    - Other countries will have to do the same.
  - An incident leading to an unplanned outage on one HVDC system (1-2 GW capacity) can cause imbalance in the whole European transmission grid and result in major black outs.
  - New technology to be developed to handle such events.
- Hydrogen production and transmission has to be seen as an element in the wind build-out in the North Sea.
  - Electrolyzers and pipelines for hydrogen is more cost effective than HVDC converters and HVDC grids.

