“Collaboration in the North Sea Powerhouse”

Webinar CIGRE UK, 7 June 2023

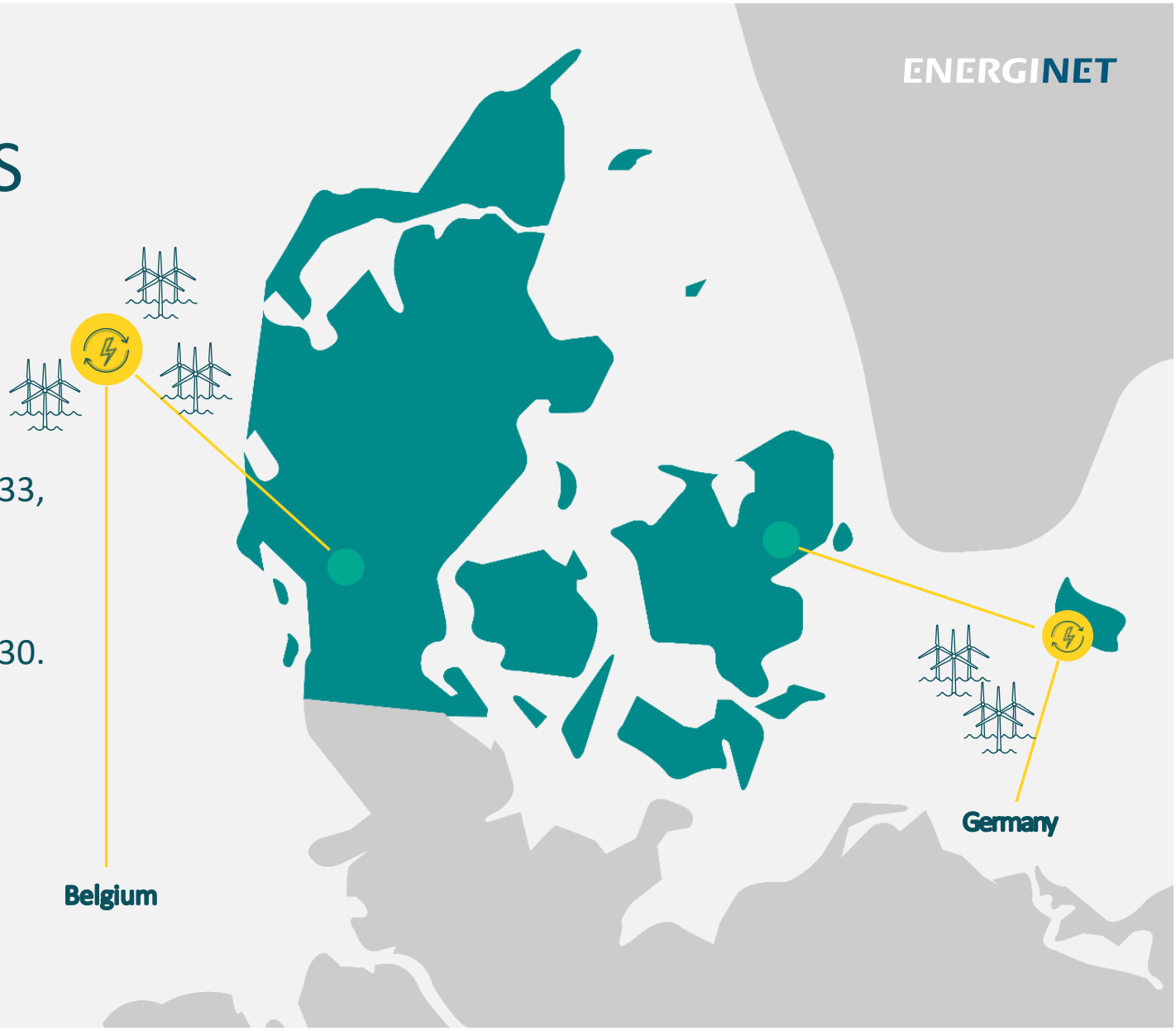
Peter Weinreich-Jensen – “The World’s First Energy Island Concept – Denmark”

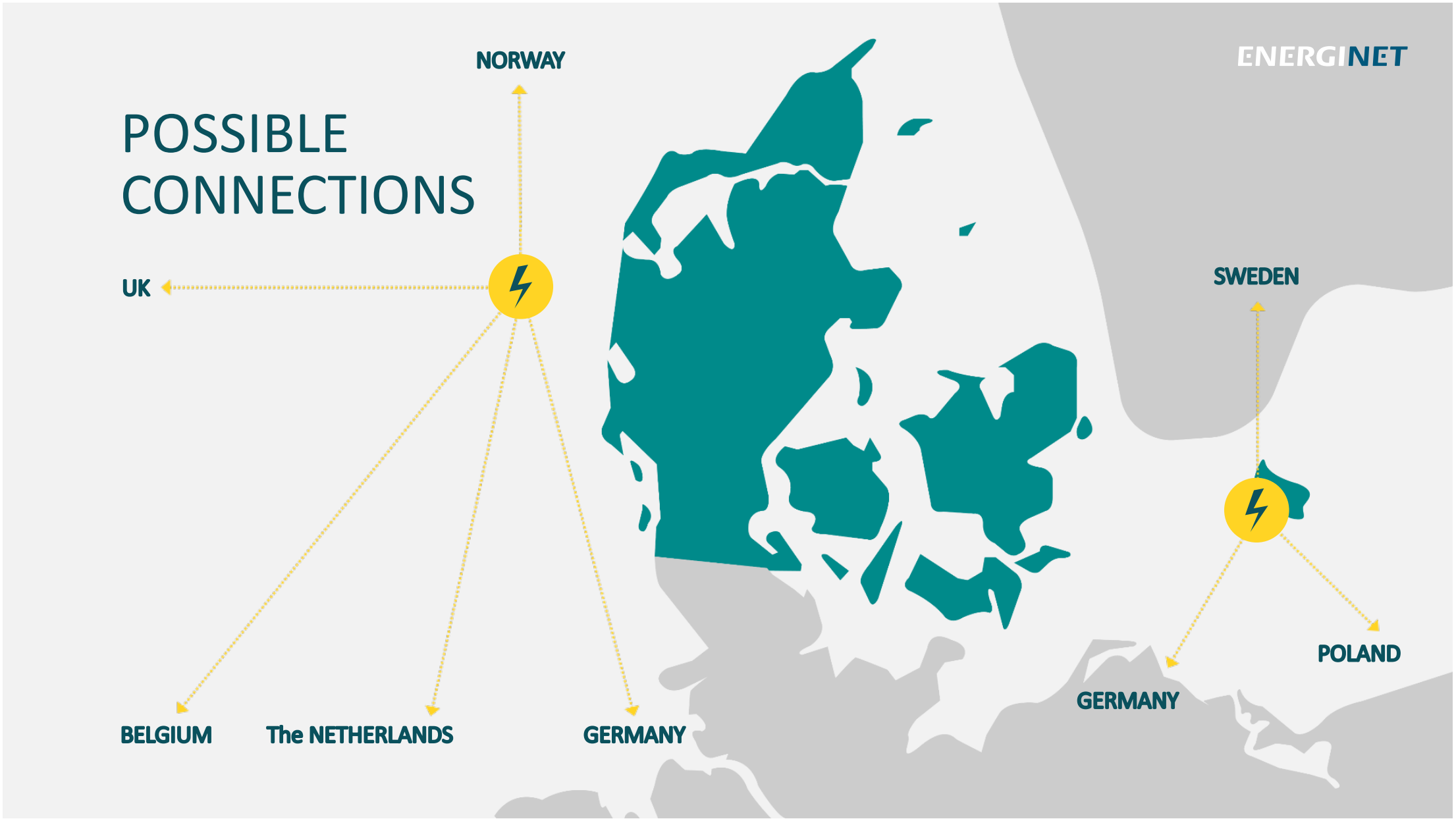
cigre
United Kingdom

ENERGY ISLANDS IN DENMARK

Energy Island North Sea:
3 GW offshore wind power in 2033,
Later up to 10 GW.

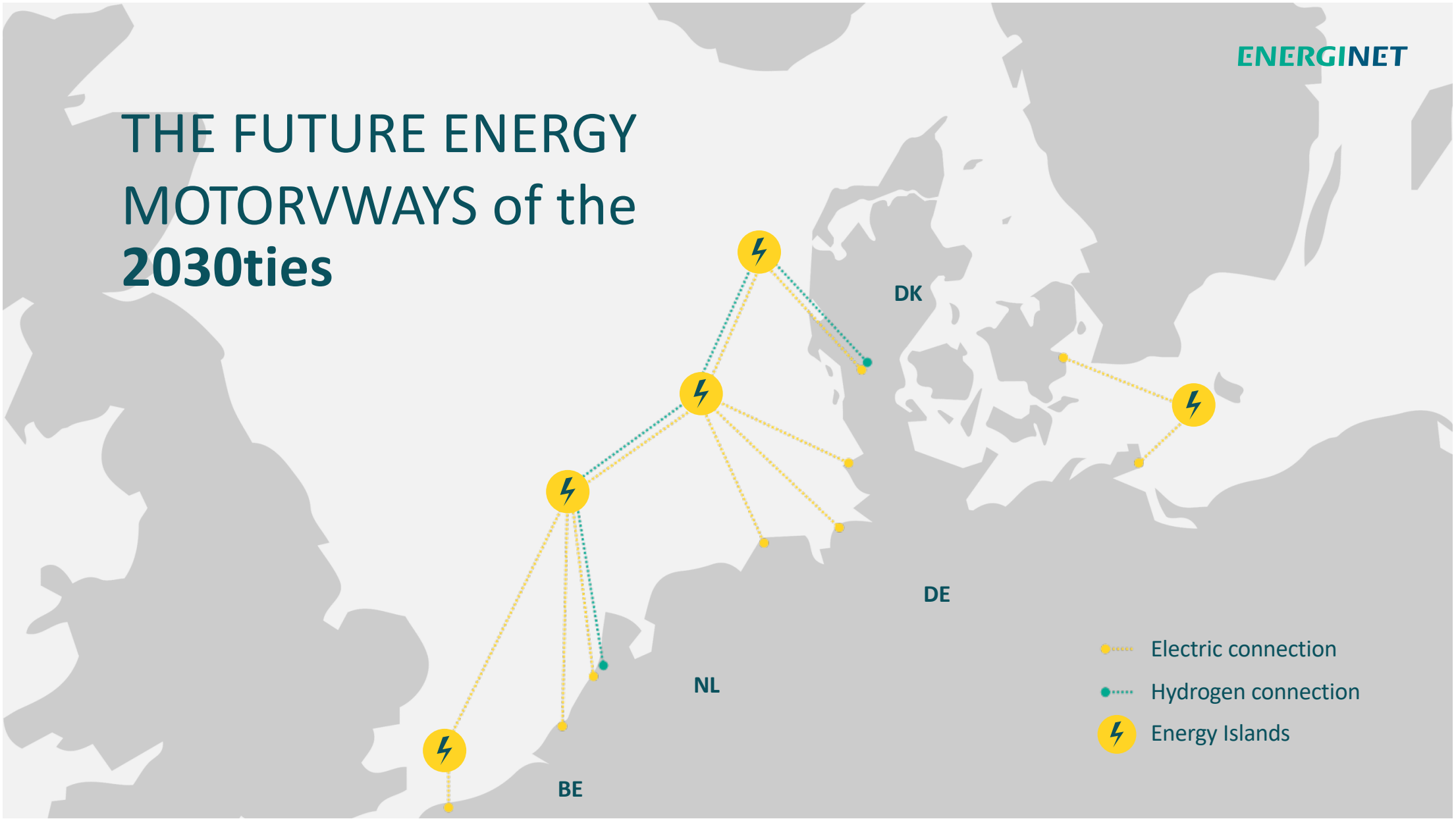
Energy Island Bornholm:
3 GW offshore wind power in 2030.




ENERGINET
POSSIBLE CONNECTIONS
NORWAY
UK
SWEDEN
BELGIUM
The NETHERLANDS
GERMANY
GERMANY
POLAND

ENERGINET

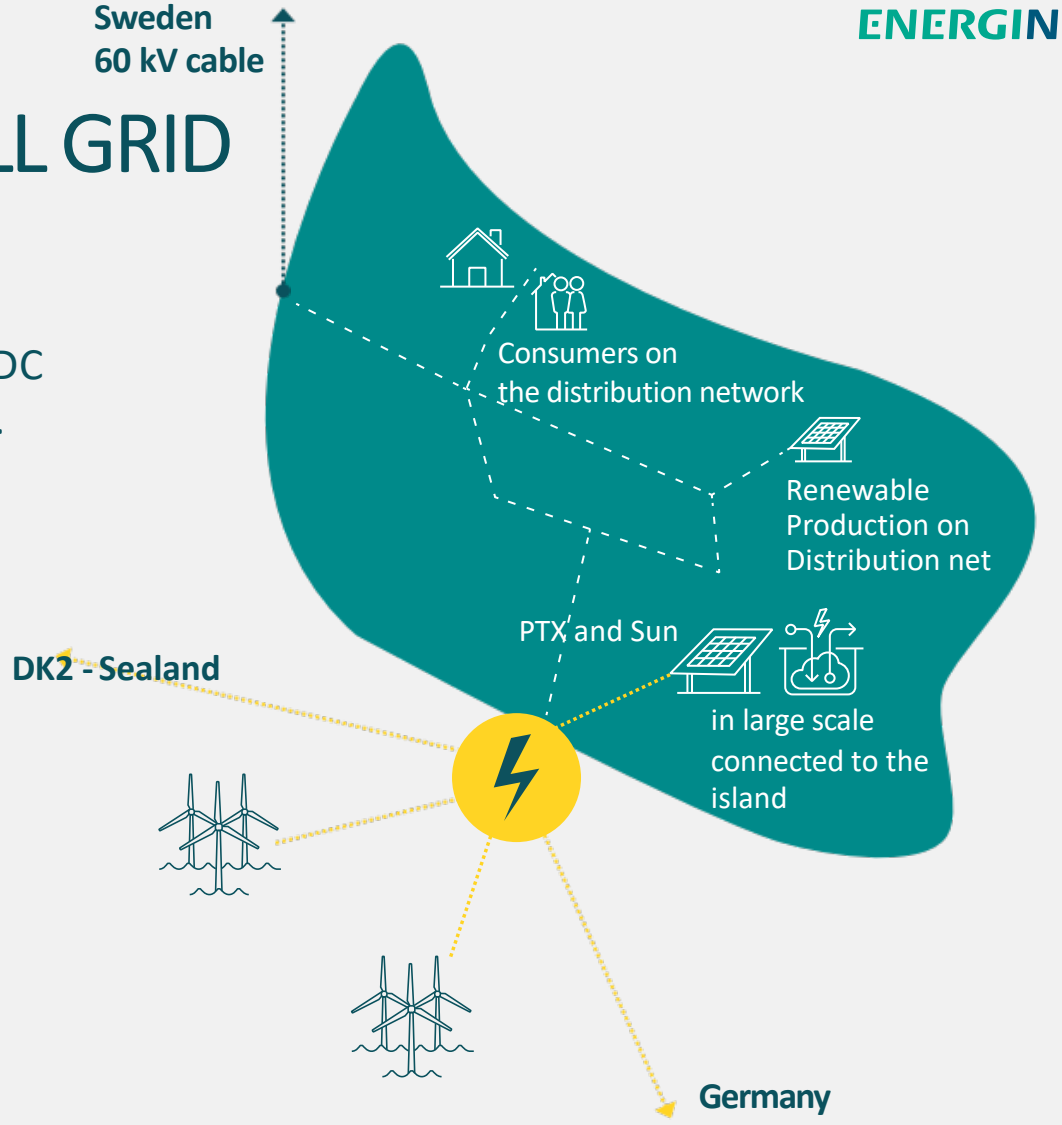
THE FUTURE ENERGY MOTORVWAYS of the **2030ties**



CONNECTION TO A SMALL GRID

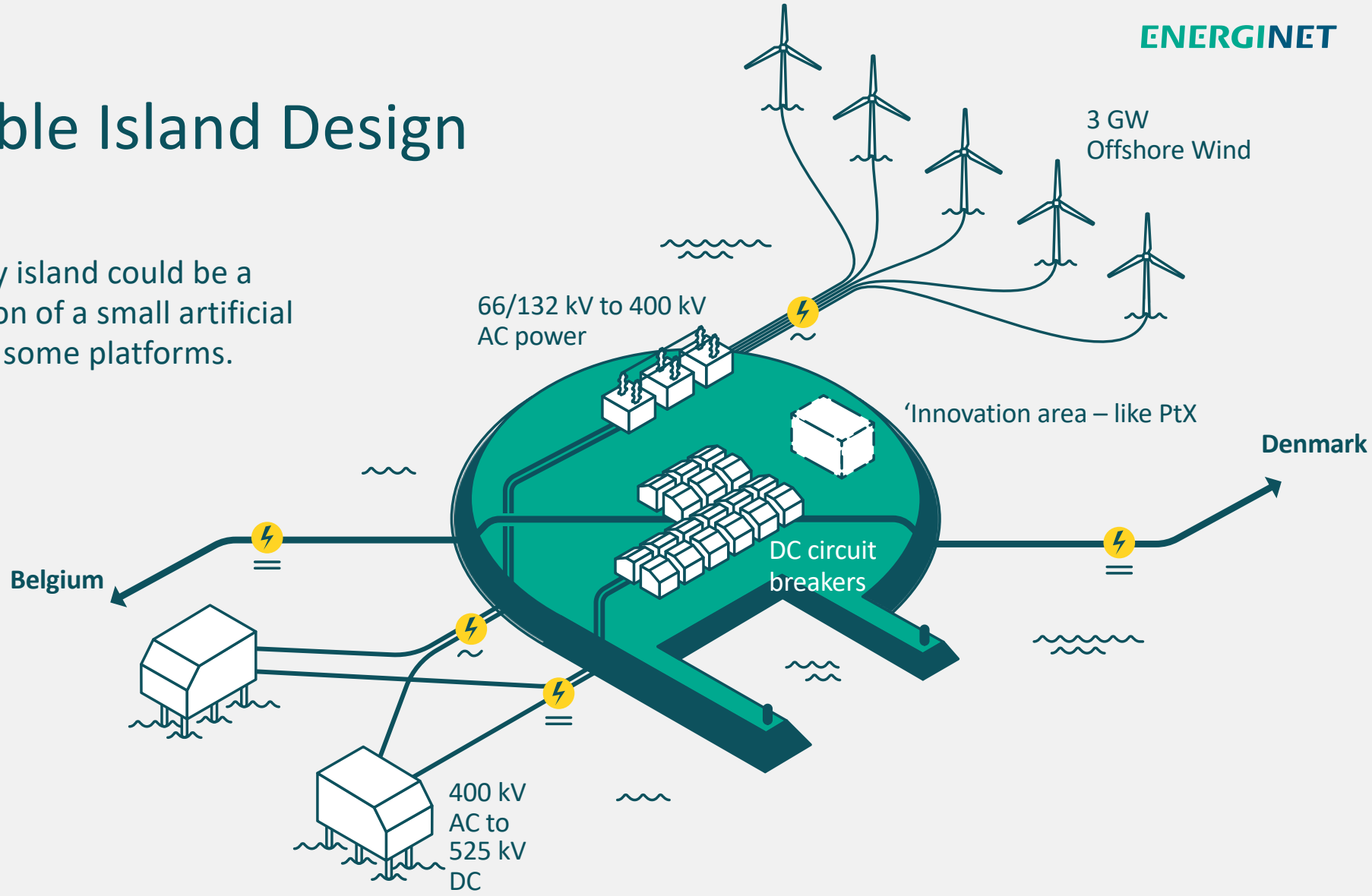
Connection between a 400 kV connected HVDC system and a small 60 kV distribution system.

This will be tested on
The Bornholm Energy Island



Possible Island Design

The Energy island could be a combination of a small artificial island and some platforms.



Collaboration in the Northsea Powerhouse
Worlds First Energy Island Concept – Denmark

Seen from an OEM we recommend to use a project like the Bornholm Energy Island to test the future Energy Motorway of the 2030ties:

- Test the HVDC Multivendor / Multi terminal capabilities disconnected from commercial project.
  New features need to be tested outside projects, where you need to be able to connect offshore wind generation to the transmission network with tough timelines.

- An existing island have more physical space available. The testing may result in more space necessary.
  - We can test the HVDC systems from multiple OEM to be connected on the DC side
  - We can test a DC circuit breaker in full scale.
  - We can try to implement the "InterOPERA" developed control system.

Collaboration in the Northsea Powerhouse
Worlds First Energy Island Concept – Regulatory Challanges

- Hybrid offshore wind farms with offshore interconnectors can relieve the pressure on the grid by utilizing the grid better.
- Normally an offshore wind farm is usually connected to one bidding Zone. If the owner of the windfarm produces more electricity than the grid can handle the TSO compensates them for the lost income.

- In the case of hybrids two cables leave offshore - one to Denmark and one to Belgium for example. The bidding zone is not the country but the offshore Wind Farm itself.

- The TSOs calculate the optimal dispatch and the capacity allocated to each transmission line for every hour of the day. Again, grid capacity constraints in the normal bidding Zone can affect the capacity allocation on the transmission line thereby creating an upper limit to how much electricity the offshore Wind Farm can export to Mainland. When the export capacity becomes lower than the wind's generation then the price drops towards zero.

- The TSO still sells the electricity at the market price, but the offshore Wind Farm gets zero. This makes hybrids unattractive.
- We need to design a market system where wind farm owners are guaranteed access to the grid. If they do not have access to the grid the owners should be compensated.