

TenneT offshore

North Sea Energy Infrastructure: current developments and outlook



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29. 09. 2016

European Office, Brussels

TenneT at a glance



TenneT offshore by 2023



Germany

- Fifteen grid connections for offshore wind farms
- Twelve DC connections, three AC connections
- 4,300 MW at present
- 9,832 MW by 2023 (7,132 MW by 2019)
- NordLink: 1,400 MW (2020)

Netherlands

- Five grid connections for offshore wind farms
- Only AC connections
- 3,500 MW by 2023
- NorNed (2008): 700 MW
- BritNed (2010): 1,000 MW
- COBRA cable (2019): 700 MW

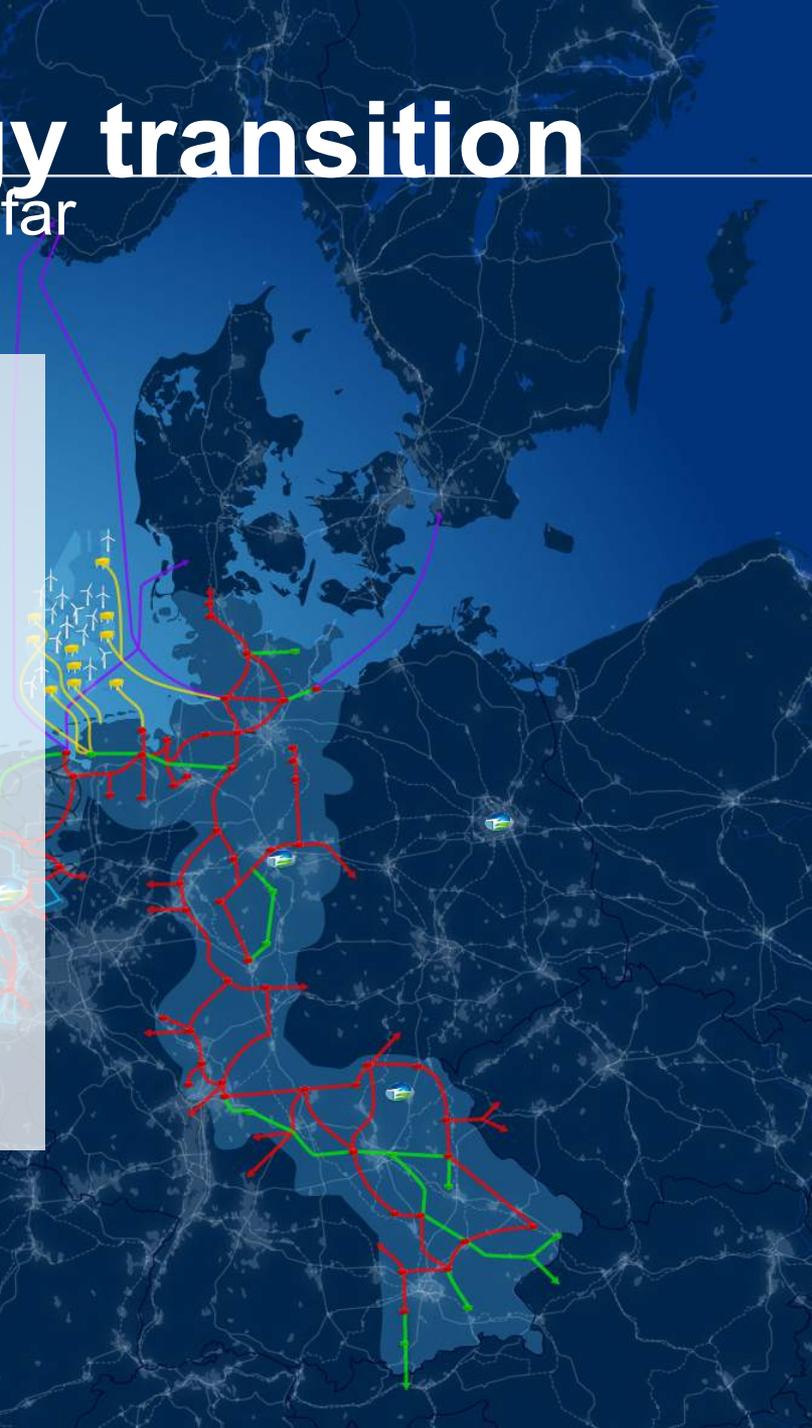


By 2023 TenneT will have realized 17.1 GW of offshore connection capacity (13.3 GW for offshorewind energy, 3.8 GW for interconnection): 13,000 km cable.

The European energy transition

Ambitious goals reachable only with far
Offshore

- EU ambition: 80-95% CO₂ reduction in 2050 compared with 1990 levels
- Large volumes of RES needed:
 - 600 GW offshore & onshore wind power required to cover 50% of the electricity demand (WindEurope)
 - 17 GW needed for Paris agreement implementation by the Netherlands
- The Challenge:
 - How to make far shore wind power cost efficient
 - Environment
 - integration in the energy system



Solution: hub and spoke concept



Hub and spoke delivers

Scale: A large scale European roll-out for offshore wind delivers a significant contribution to cost reduction

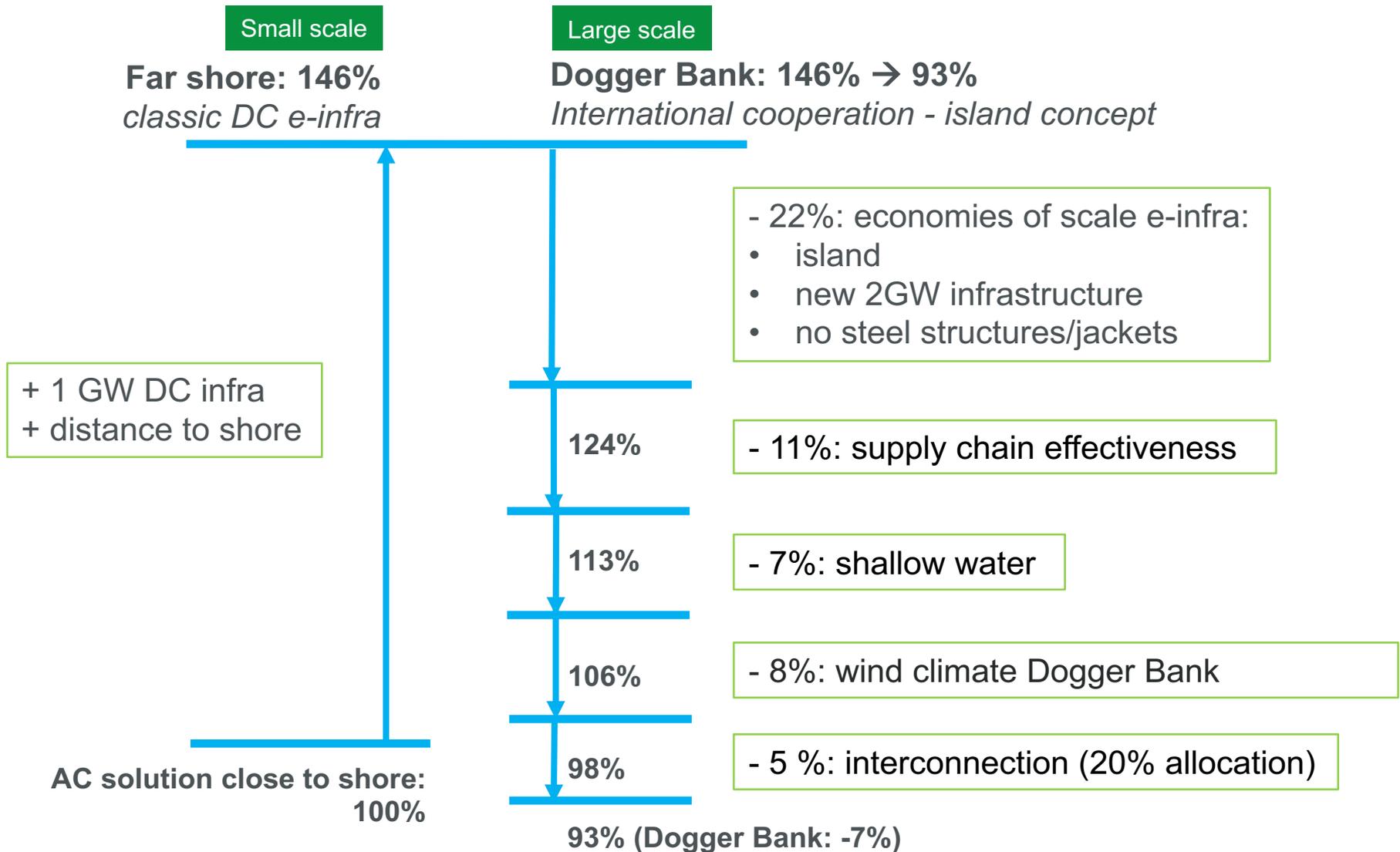
Location: When far shore becomes necessary, shallow waters with better wind conditions contribute to cost reduction

Wind connector: The wind connector combines large scale wind farms with powerful interconnectors for more efficient use of the electrical infrastructure and further European Market integration

Hub function/ island: By building an island, a hub function can be created with virtual near-shore environment allowing more economical AC/DC-solutions contributing to OPEX/CAPEX cost reductions

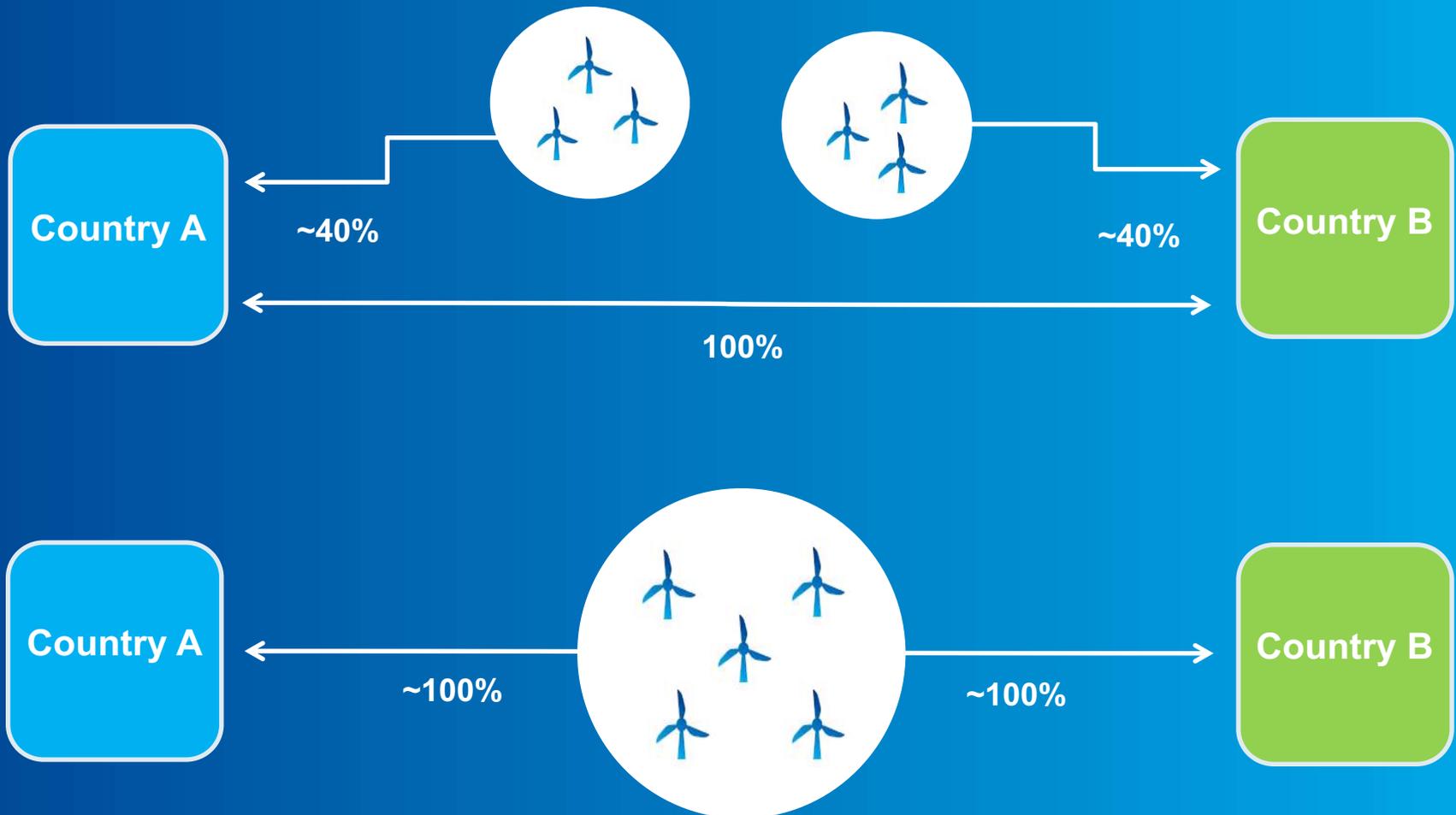


Solution: scale



Solution: the Wind Connector

The *'wind-connector'*: wind infrastructure and interconnector combined in one function



The big step: hub and spoke system



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TenneT is Europe's first cross-border grid operator for electricity. With about 21,000 kilometers of (extra) high-voltage lines and 41 million end-users in the Netherlands and Germany, we rank among the top five grid operators in Europe. Our focus is to develop a North-west European energy market and to integrate renewable energy.

Taking power further

