Decom Tools

The offshore/ decommissioning market from economic and political perspective

A business perspective involving the repowering of a wind park

Harm Korporaal

De Lauwershorst Groep

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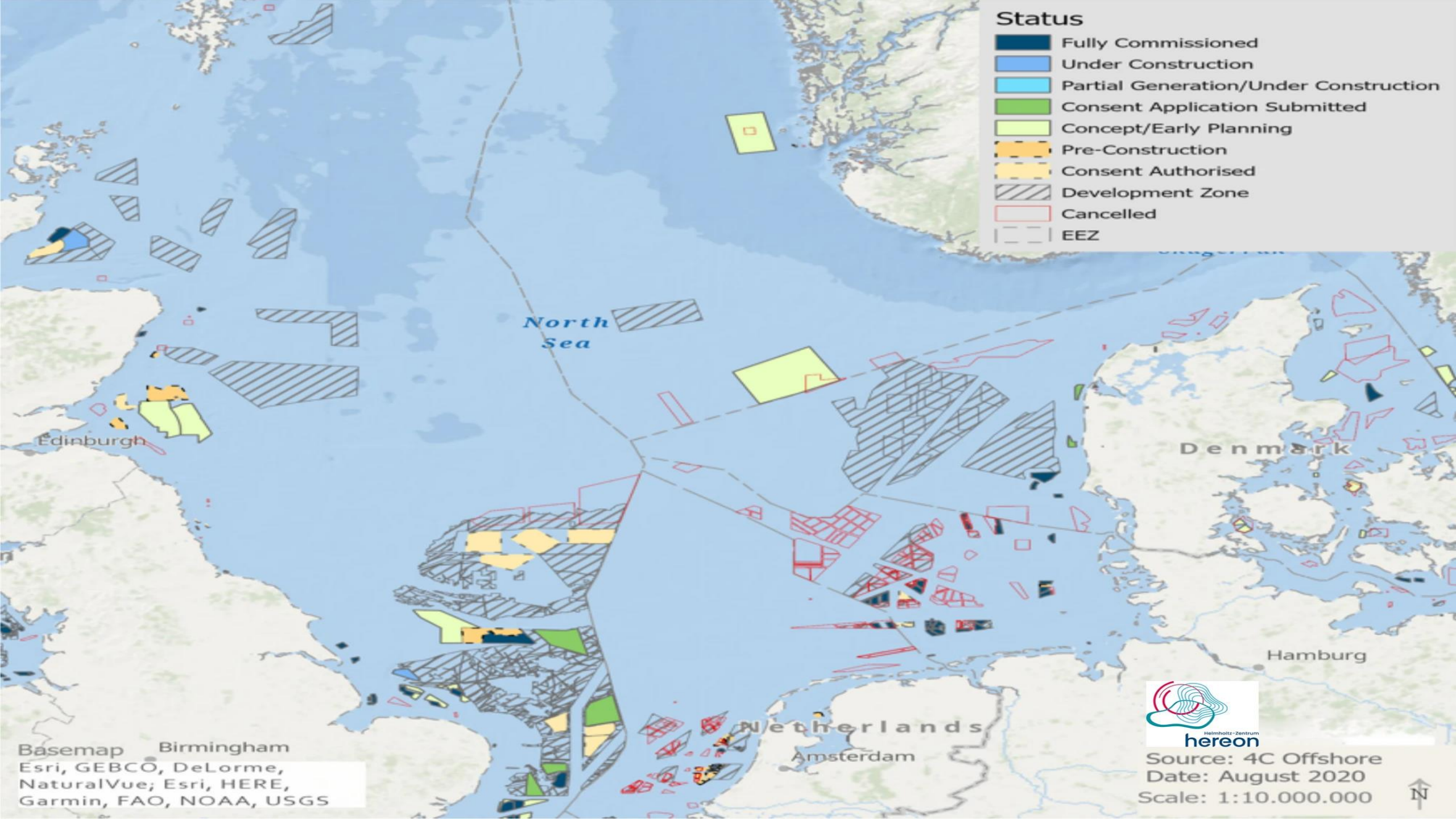
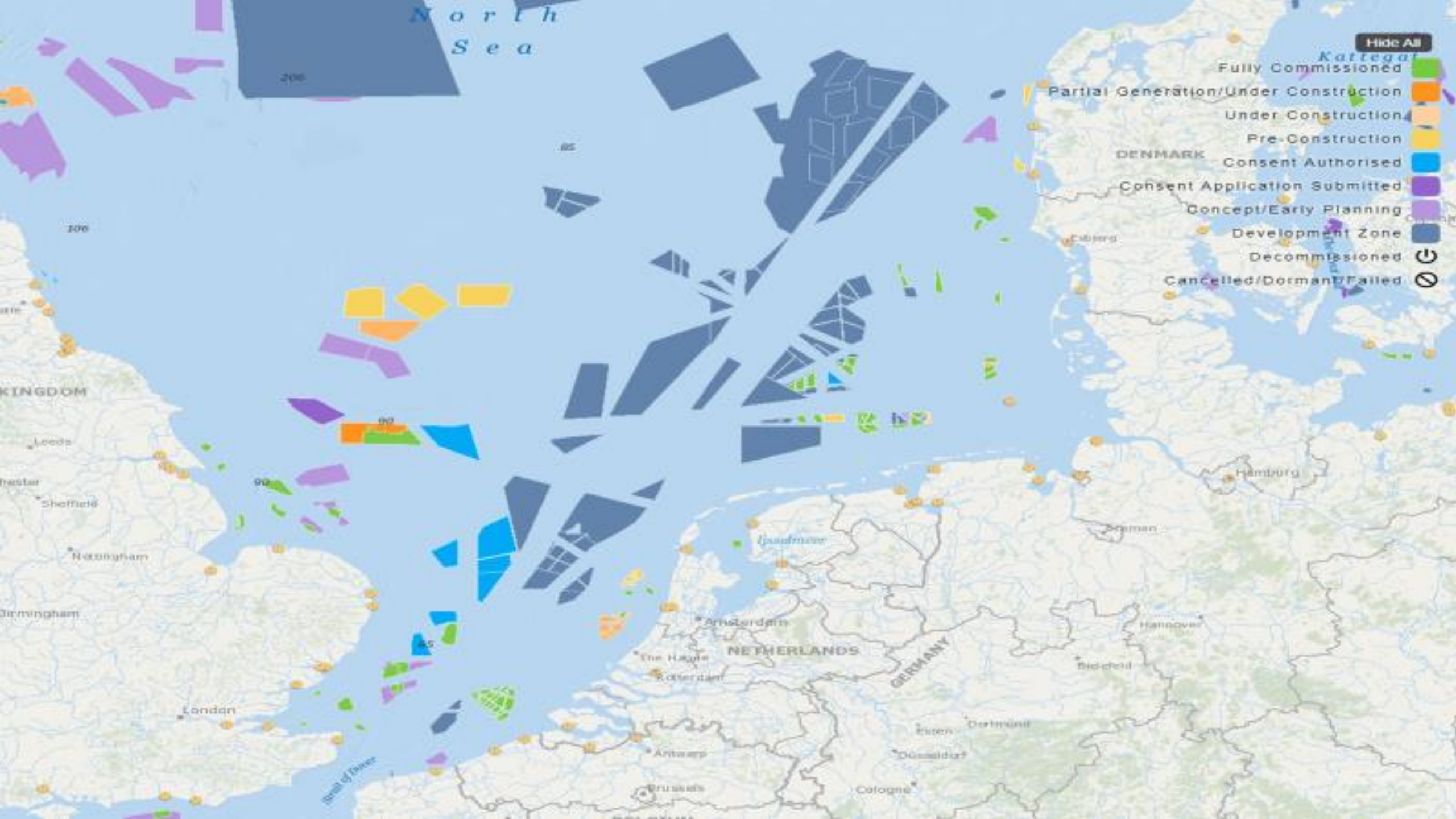

Status
Fully Commissioned
Under Construction
Partial Generation/Under Construction
Consent Application Submitted
Concept/Early Planning
Pre-Construction
Consent Authorised
Development Zone
Cancelled
EEZ
North Sea
Edinburgh
Denmark
Hamburg
Netherlands
Amsterdam
Birmingham
Basemap
Esri, GEBCO, DeLorme, NaturalVue; Esri, HERE, Garmin, FAO, NOAA, USGS
Source: 4C Offshore
Date: August 2020
Scale: 1:10.000.000
N


North Sea
Hide All
Fully Commissioned
Partial Generation/Under Construction
Under Construction
Pre-Construction
Consent Authorised
Consent Application Submitted
Concept/Early Planning
Development Zone
Decommissioned
Cancelled/Dormant/Failed
DENMARK
NETHERLANDS
GERMANY
Amsterdam
The Hague
Rotterdam
Antwerp
Brussels
Cologne
Düsseldorf
Essen
Dortmund
Hannover
Bielefeld
Hamburg
Bremen
London
Leeds
Sheffield
Nottingham
Birmingham
IJsselmeer
Esbjerg

Decommissioning up to repowering

- **1 Why**
  - Laws and regulations
- **2 When**
  - End of life
  - Economical
- **3 What**
  - Type of repowering
- **4 How**
  - projects

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Paper: GAP ANALYSIS

1 Why?

- Laws and regulations
  - Law of the sea
  - OSPAR
  - UNCLOS
  - MARPOL
  - National laws and regulations
  - Environmental laws

- **Decommissioning means bringing the area back to its former shape and form**
- **Full removal of the wind park**

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TAKLIFT 4
TAKLIFT 4

2 When?

- Value for money
- End of lease
- End of life

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HEBO LIFT 7

3 What?

- **New build wind park**
  - New machines

- **Old wind park (end of life)**
  - Decom existing wind park
    - Removing construction

- **Repowering**
  - Refurbishing
  - Partial repowering
  - Full repowering

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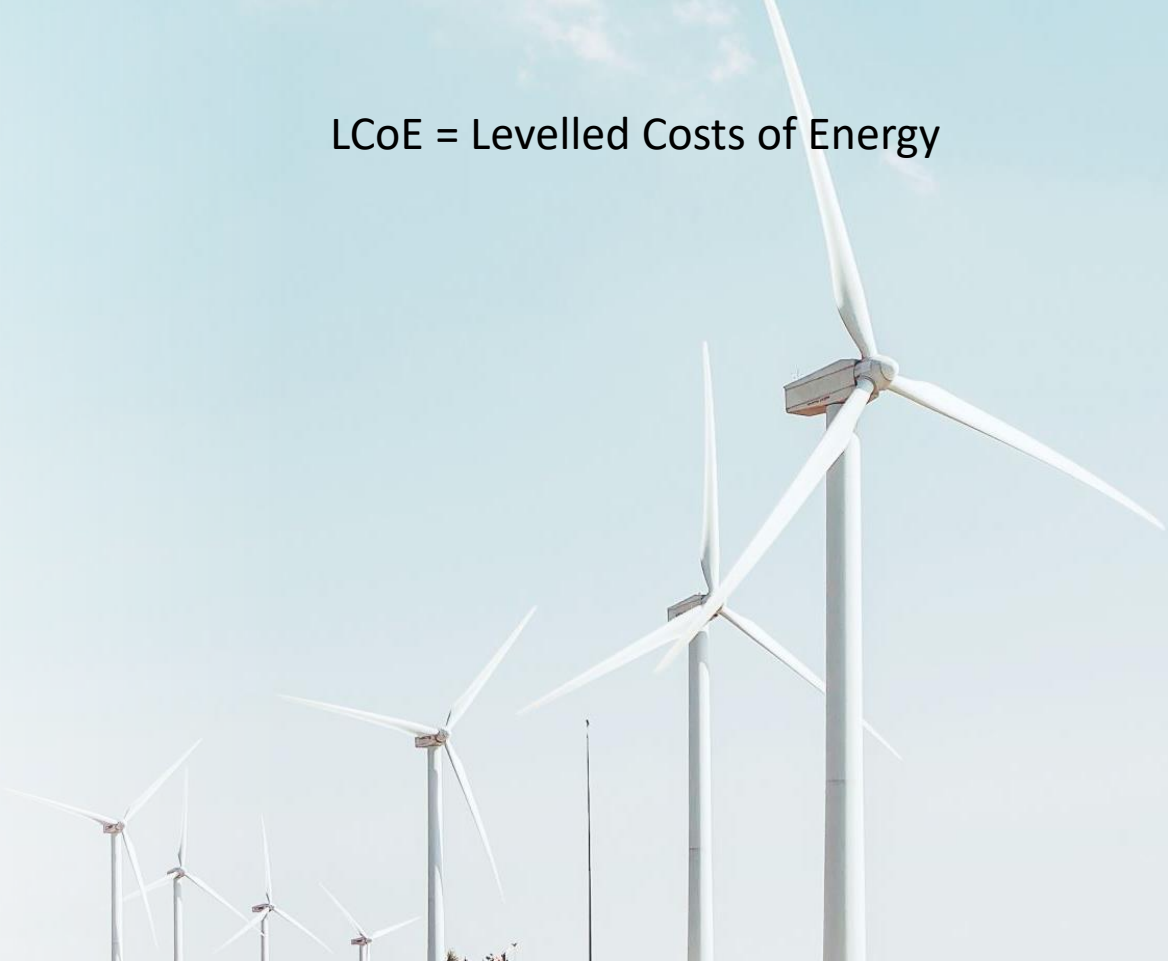
Paper: BUSINESS MODEL REPOWERING

4 How?

- **Design**
  - More MW
  - Wake effect
  - Less turbines
- **Plan**
  - Supply chain
  - Transport
  - Building
- **Financial**
  - R and D, Capex, and Opex
  - Revenue certainty
  - Renewing of bank guarantees

$$LCoE = \frac{Total\ Costs}{Total\ Enery\ Revenue}$$

LCoE = Levelled Costs of Energy



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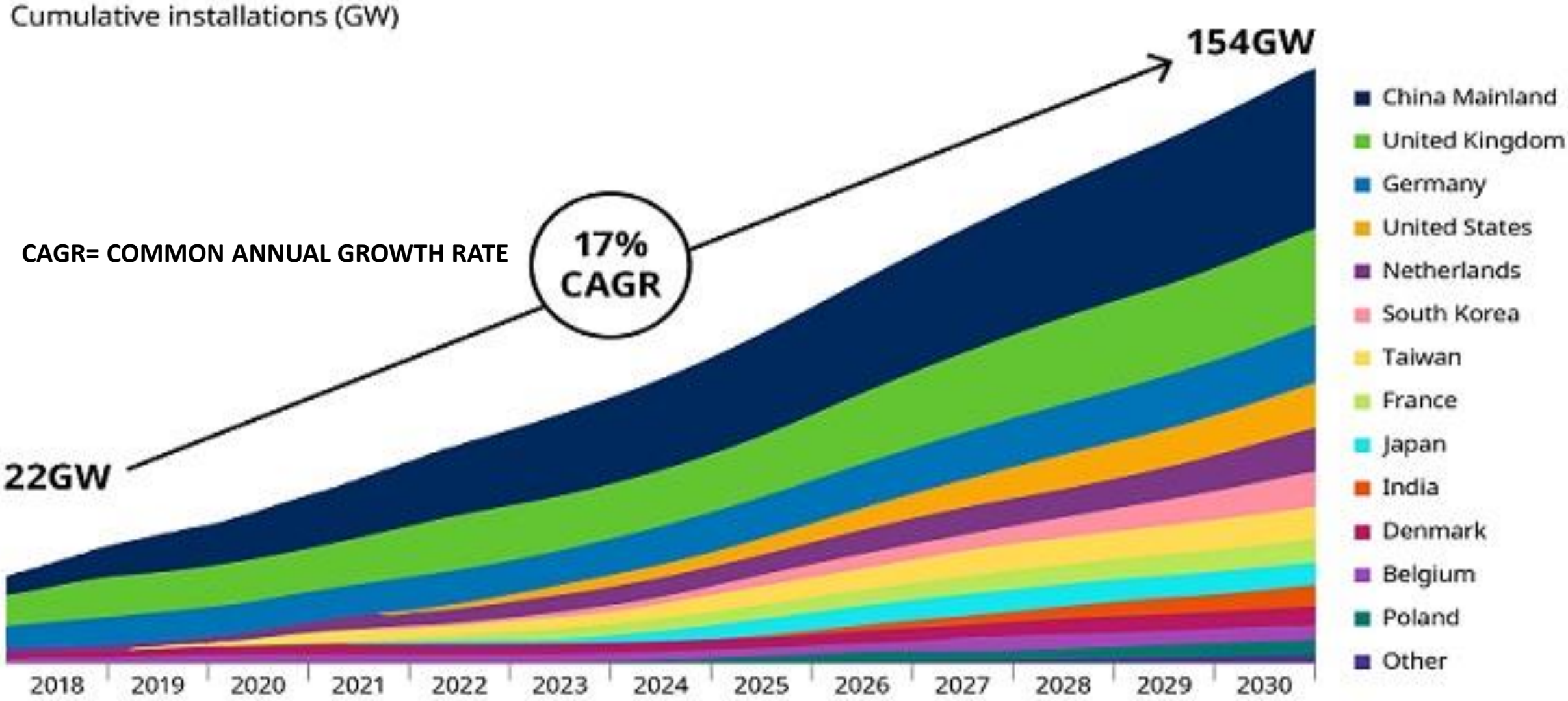
Global cumulative installation forecast

Schroders



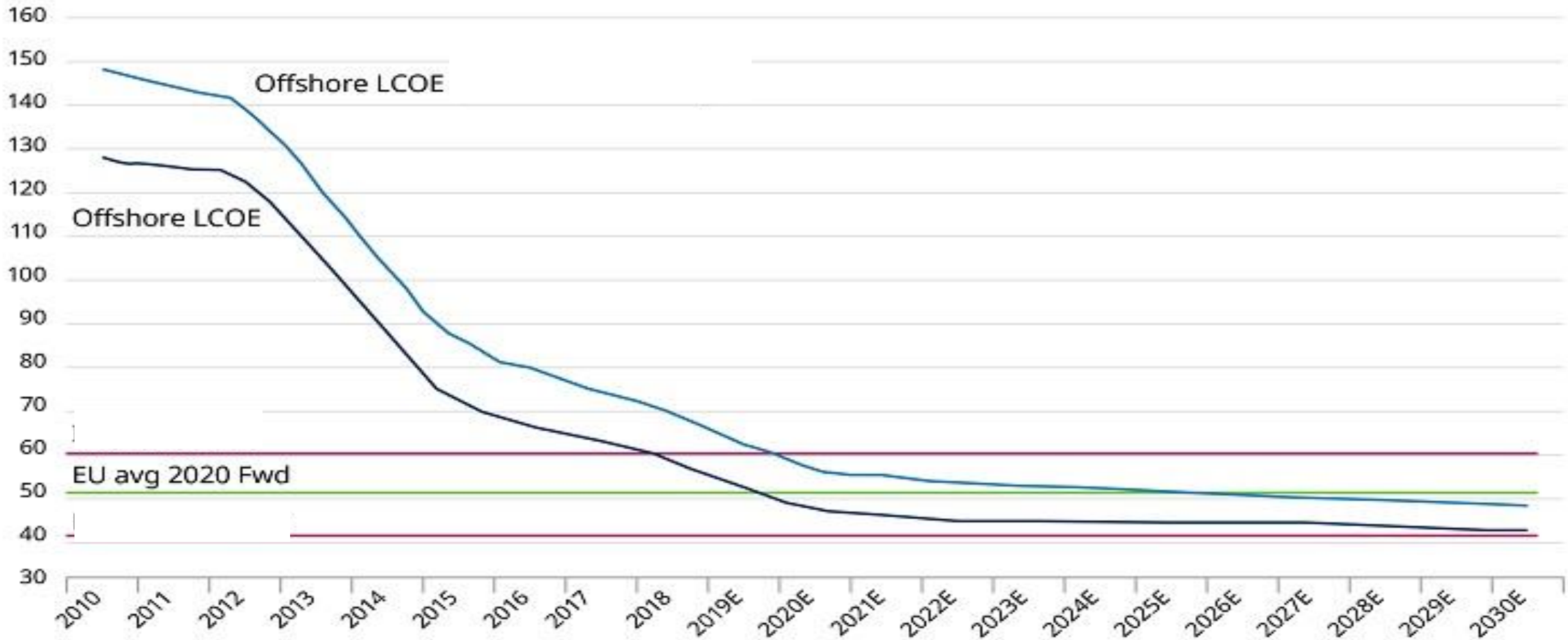
CAGR= COMMON ANNUAL GROWTH RATE

Source: BloobergNEF. Note: 'Other' – Sweden, Ireland, Norway, Finland, Portugal, Spain, Italy. CS1814.

Offshore Wind to be fully in the money by 2024

Schroders

Offshore Wind Levelised Cost of Electricity (LCOE) evolution/projecton vs. Merchant Foward curves in Europe (€/MWh)



Source: Goldman Sachs Global Investment Research, Bloomberg. CS1814.

Special attention

- **Planning Vessels**
- **Economical decisions**
- **Value supply chain**

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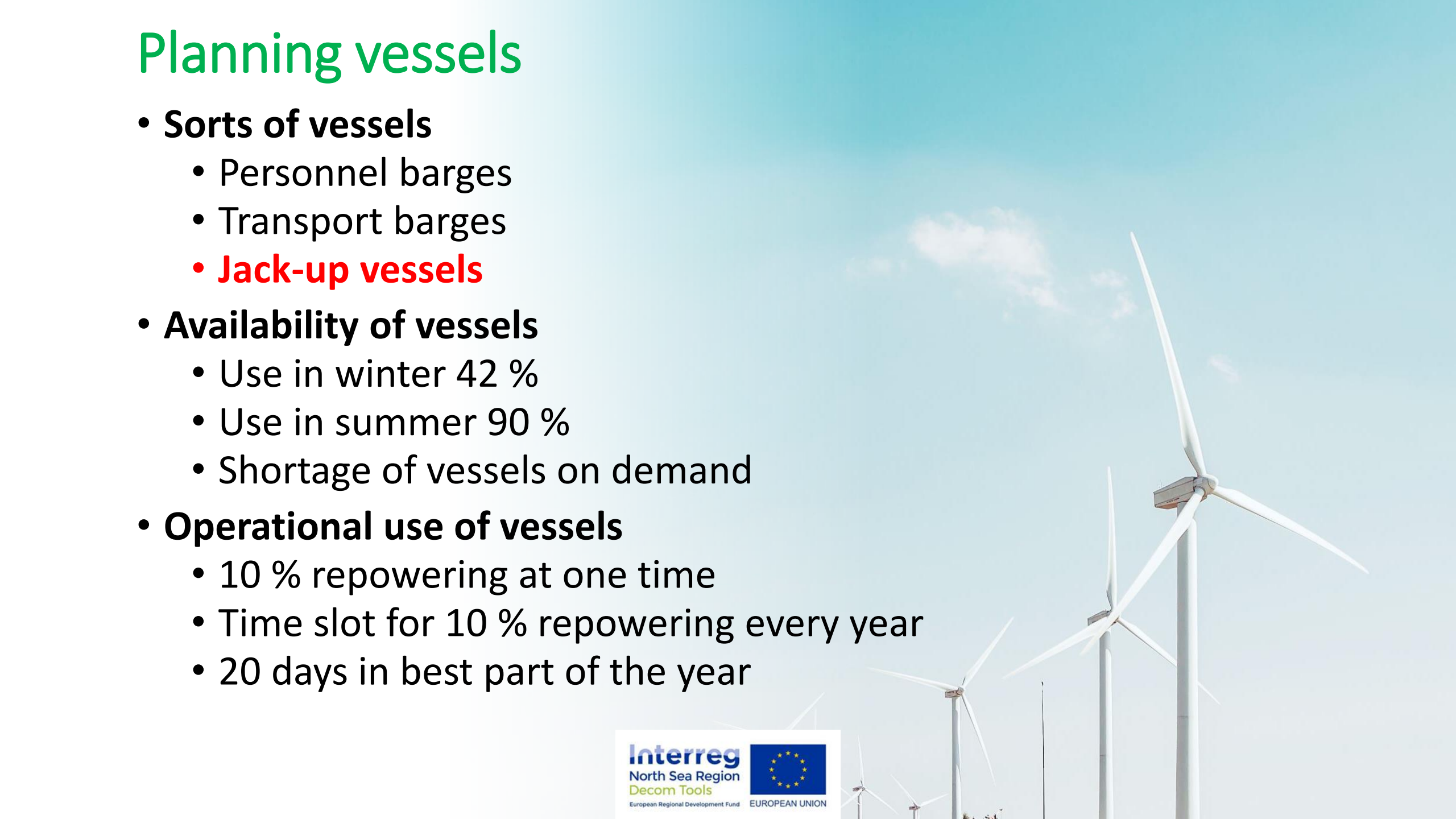
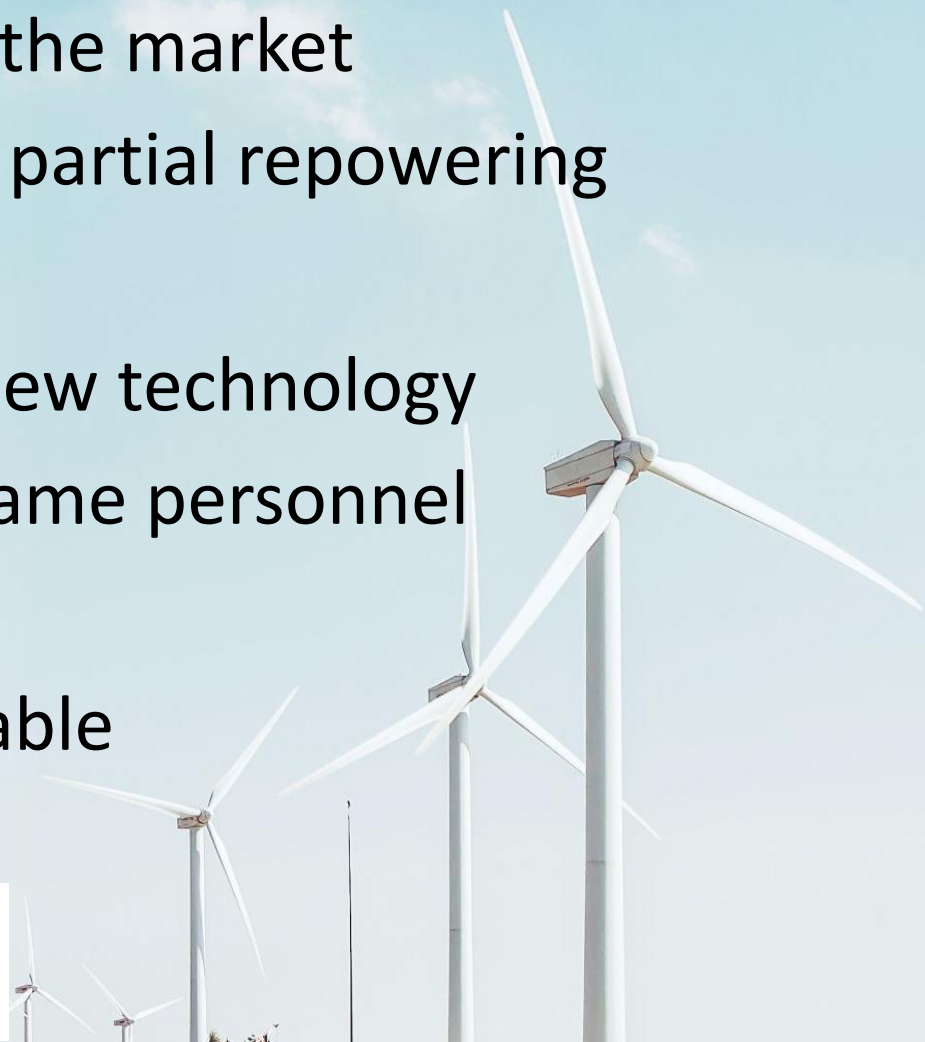
Planning vessels

- **Sorts of vessels**
  - Personnel barges
  - Transport barges
  - **Jack-up vessels**
- **Availability of vessels**
  - Use in winter 42 %
  - Use in summer 90 %
  - Shortage of vessels on demand
- **Operational use of vessels**
  - 10 % repowering at one time
  - Time slot for 10 % repowering every year
  - 20 days in best part of the year



Economical decisions

- **Revenue certainty**
- Keeping the old park capacity in the market
- Spreading the revenue by yearly partial repowering
- **Personnel**
- No disruption due to complete new technology
- Schooling in due course by the same personnel
- **Subsidies**
- Relevant start up subsidies available
- No price cap subsidies needed



Paper: BUSINESS MODEL DECOMM.

Value supply chain

- **Decommissioning supply line**
  - Dismantling on site
    - Vessel transport
      - Wings and hub
      - Turbines
      - Nacelle
      - Piles
  - Port side delivery
    - Offloading
      - Scrapping
      - Transportation
  - Recycling
    - On the port
    - Extern facility

- **Repowering supply line**

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The wind is free, but
wind power is business

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Thank you for your attention

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