



Value Pool

Efficient Offshore Wind Energy



Efficient wind energy

How to develop wind energy at scale and cost efficiently

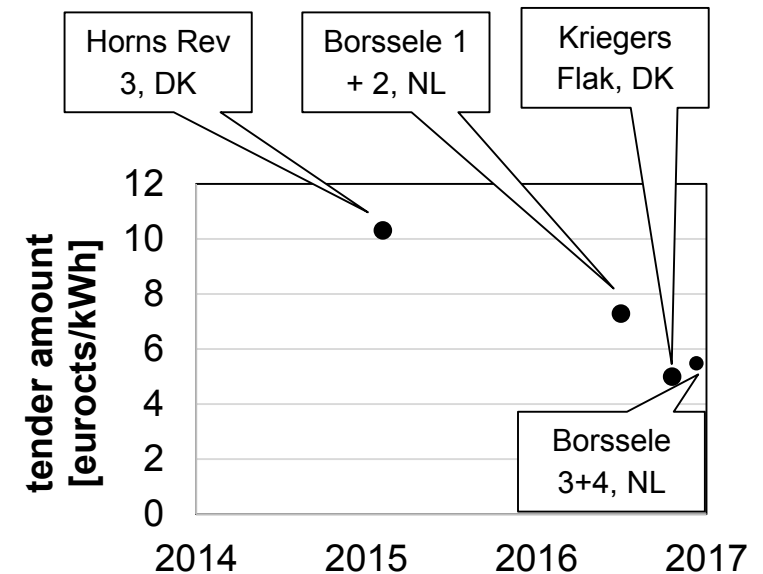
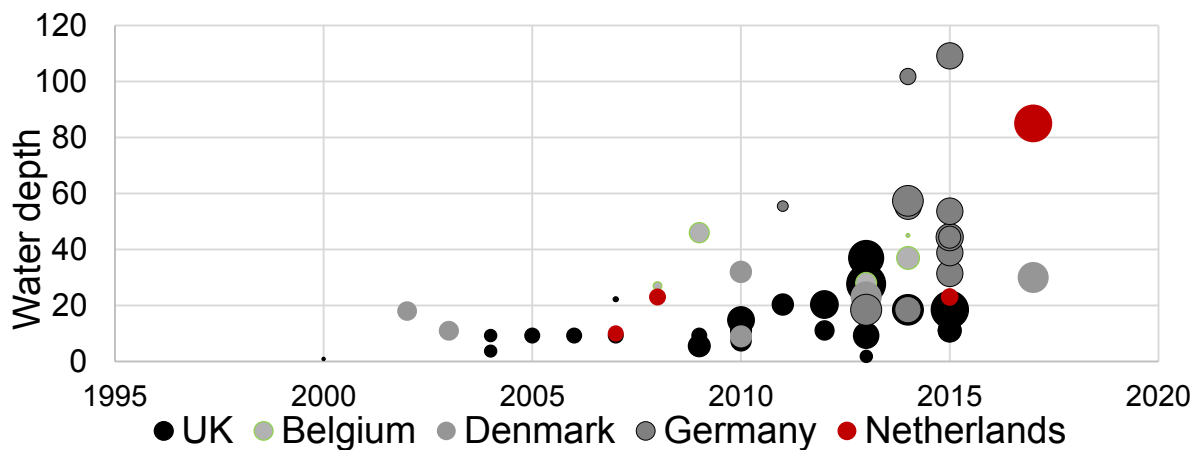
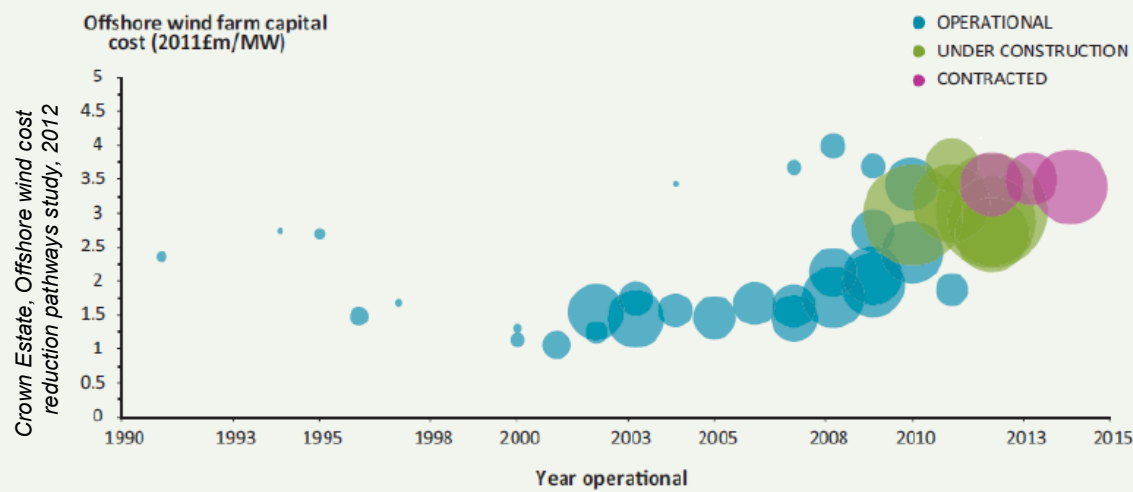


2050–AN ENERGETIC ODYSSEY, DE TRAILER

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Offshore wind is increasing in size and cost are coming down

Exhibit 3.2 European offshore wind farm capital costs by year



Coordination could provide further cost reductions and increase value

1. Support frameworks and finance for offshore wind projects
2. Standards, technical rules and regulations in the offshore wind sector
3. Economies of scale and a stable policy environment
4. Grid development and other offshore infrastructure

1. Support frameworks and finance for offshore wind projects

- Several frameworks have existed in recent past
- Maturing offshore market allows direct tenders
- De-risking by governments plays important role
- Care should be taken that sufficient R&D money is spent under tender regimes

2. Standards, technical rules and regulations

- Standards have focussed on structural integrity
- Tension between rate of innovation and incorporation in standards
- Big differences among countries around North Sea
 - Requirements and Regulations
 - Way of working by relevant authorities
- Examples
 - Operation & Maintenance
 - Safety, Health and Environment
 - Electrical standards (RfG, reliability standards)

3. Economies of scale and a stable policy environment

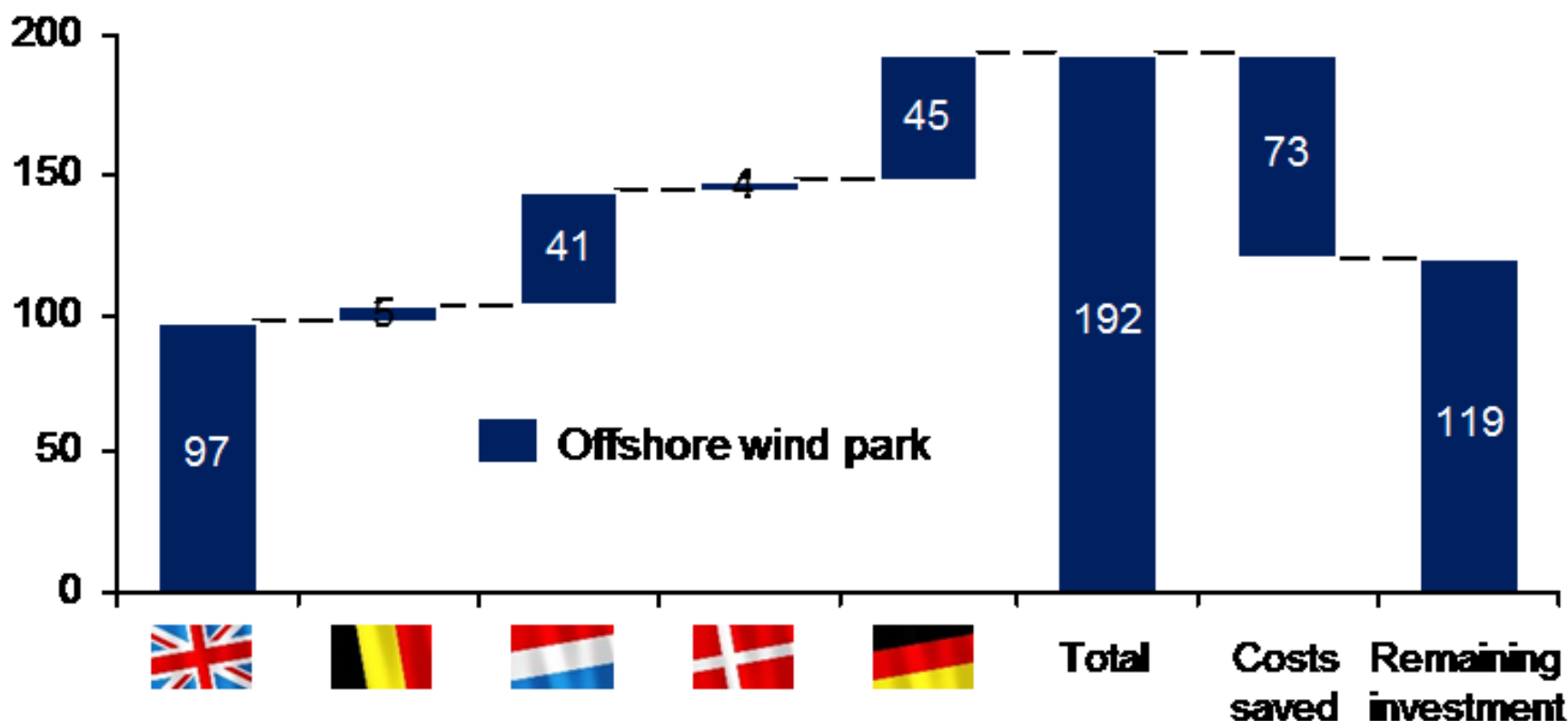
- Market is favourable, offshore wind is needed to meet goals
- Offshore wind contributes to extensive job creation
- Economies of Scale are needed to bring cost further down
- Clear future targets and rate of development are essential for companies to anticipate future developments

4. Grid development and other offshore infrastructure

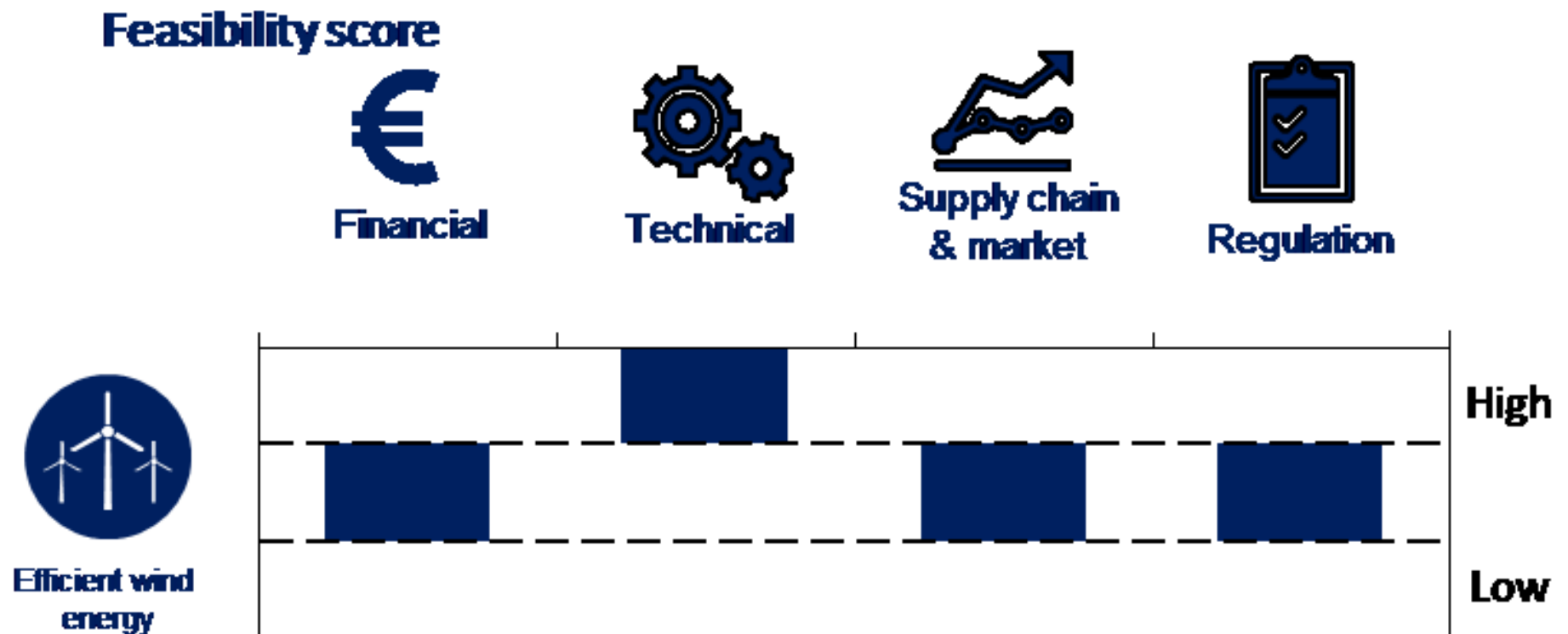
- Large investments in offshore grid are needed to connect to onshore network
- Create offshore island
 - Power conversion
 - Installation and O&M port
 - Storage
- Integrated North Sea Infrastructure
 - Minimize cost of grid infrastructure
 - Increase efficiency of energy markets and value of wind
- Electrification of O&G infrastructure

Offshore wind is increasing in capacity and costs are coming down

**Offshore wind investments per country
(in €b)**



Feasibility score for the efficient realisation of offshore wind in the North Sea



How do you assess the value pool Efficient Offshore Wind Energy?

What are the options?

Identified sub-value pools

- Standards, technical rules and regulations
- Economies of scale and a stable policy
- Grid development and other offshore infrastructure:
 - Offshore island
 - Integrated North Sea infrastructure
 - Electrification

Additional sub-value pools

What is the biggest hurdle?

Financial



Feasibility

Low Medium High



Technical



Feasibility

Low Medium High



Supply chain & market



Feasibility

Low Medium High



Regulation



Feasibility

Low Medium High



Who needs to do what tomorrow?

Who:	
What:	
Explanation:	

Who:	
What:	
Explanation:	

Who:	
What:	
Explanation:	