2017 Wind Energy Systems Engineering Workshop

Where we are today in the Offshore Wind Industry

13/09/2017 | Miriam Noonan

CATAPULT Offshore Renewable Energy

Agenda

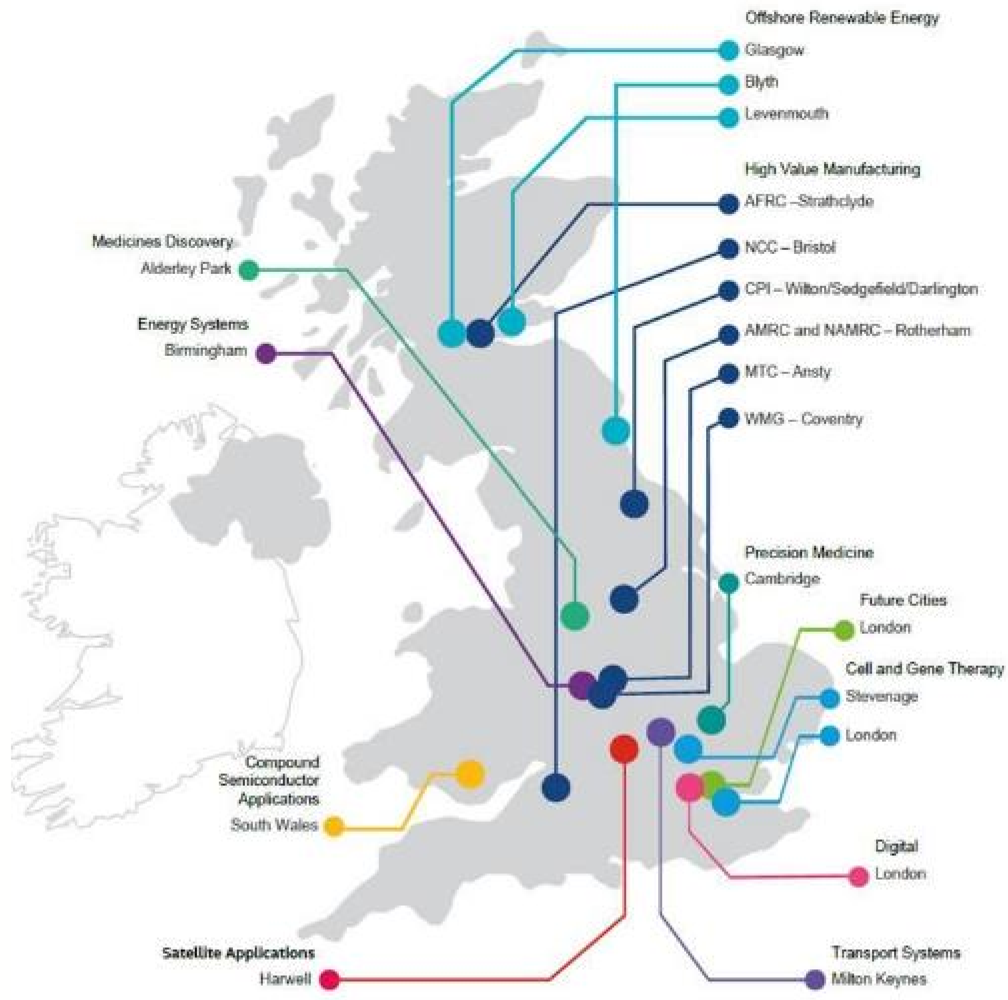
- Brief Overview of ORE Catapult
- Offshore Wind in Europe Overview
- Cost Reduction - What we've seen so far
- Cost Reduction - What do we expect to see in the next 5 years?
- Conclusion

ORE Catapult Overview

The catapult network:
A long-term vision for innovation & growth

10 Catapults

- Established by InnovateUK
- Designed to transform the UK's capability for innovation
- Core grant leveraged with industry and other public funding 140 employees – strong collective experience
- >80 technical experts (research and engineering)



Testing and Demonstration Assets

Dual axis blade testing

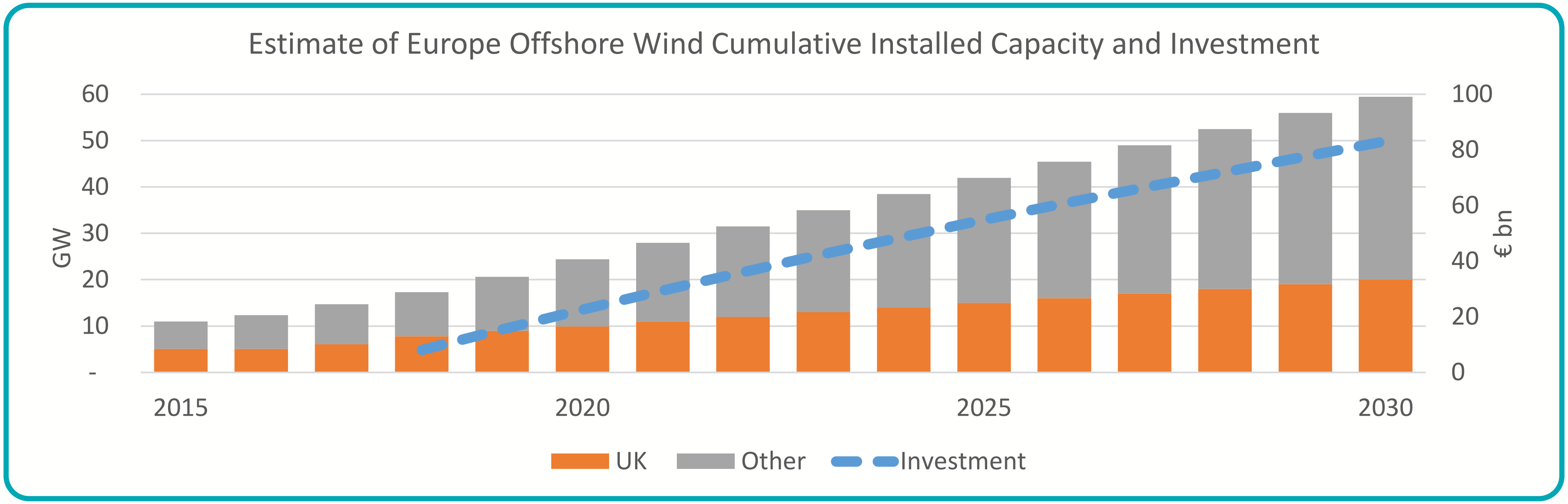
Bearing testing

Novel cables

Real data for real simulations

Offshore Wind Overview

Offshore Wind Deployment in Europe



- Forecast European capacity to ~24GW by 2020 and 60GW by 2030
- Includes 10GW in UK by 2020 and 20GW by 2030
- Estimate average ~€6-7bn per year required

High-level European Context

Upcoming Auction Rounds – Potential capacity

Country	2017 (MW)	2018 (MW)	Total (MW)	Finance
Germany	1,490	1,550	3,100	€7bn
Netherlands	700	700	1,400	€3bn
UK	3,200		3,200	€8bn
Total	**3,750**	**3,750**	**7,500**	**€18bn**

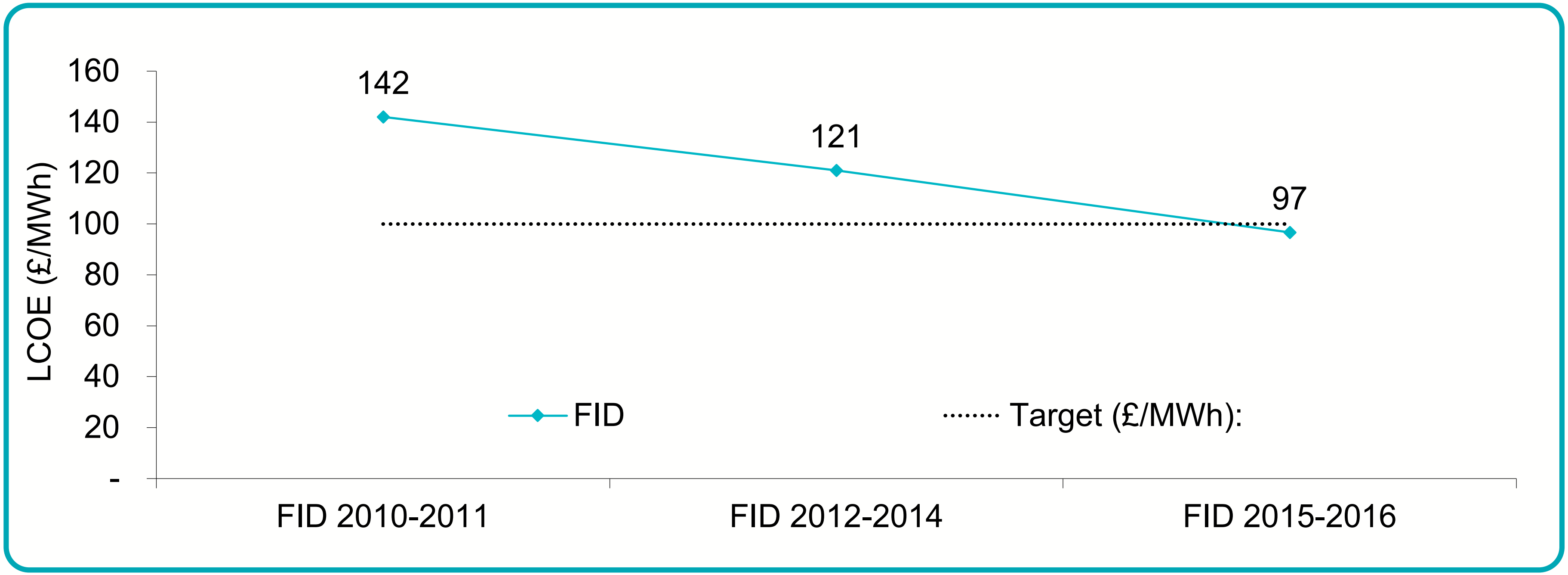
- Between 3 countries, up to 7,500MW available over 2 years of auctions

- Each country has different regulatory regimes
  - In common – competitive bidding
  - Key difference – UK and Germany currently competing sites; Netherlands bidders compete for same pre-consented sites.
  - Germany will be changing to a Dutch-style model for installation from 2026 onwards.

Cost Reduction - What we've seen so far

Cost Reduction Monitoring Framework 2016-17

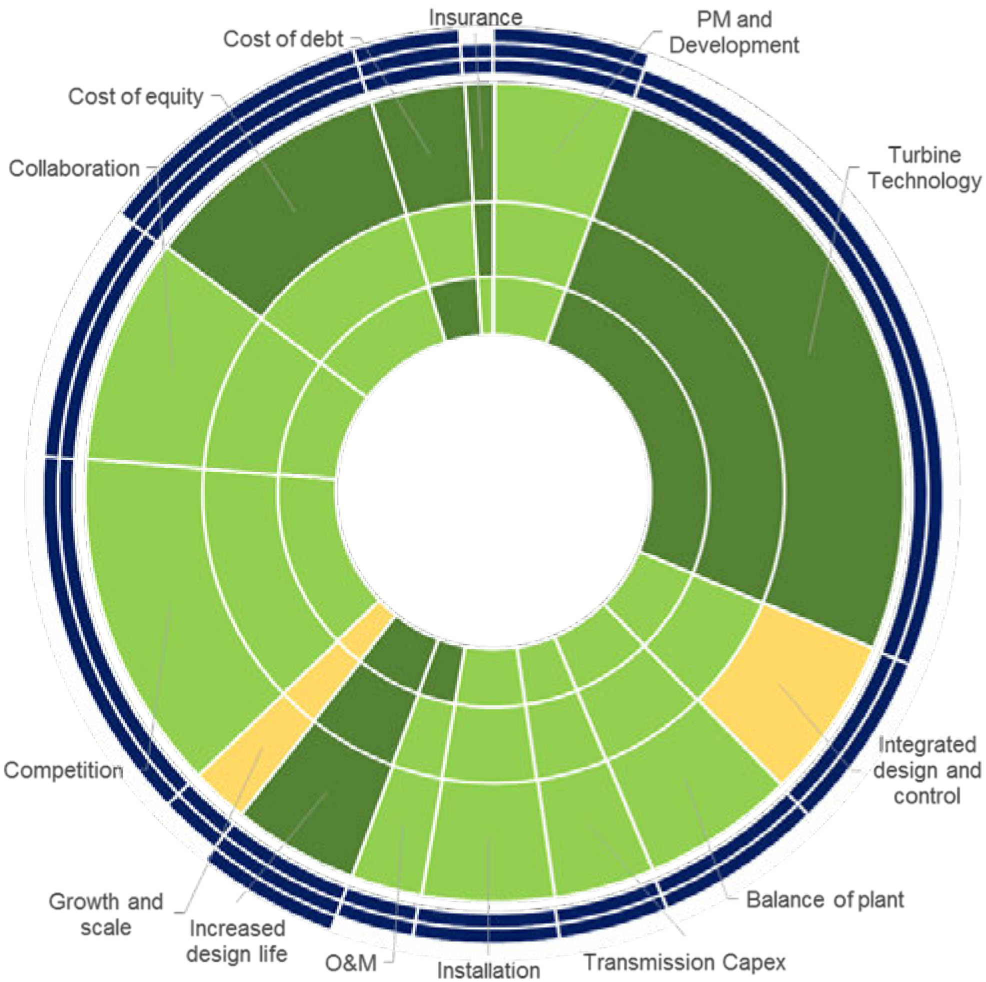
Quantitative Results



- LCOE reduced 32% in 5 years
- £100/MWh target achieved 4 years earlier than anticipated

Cost Reduction Monitoring Framework 2016-17

Qualitative Results



Inner rings: 2014/15
Middle ring: 2016 score
Outer ring: 2020 outlook

Inner and main ring:
- Ahead of target
- On target
- Behind target
- Missed target

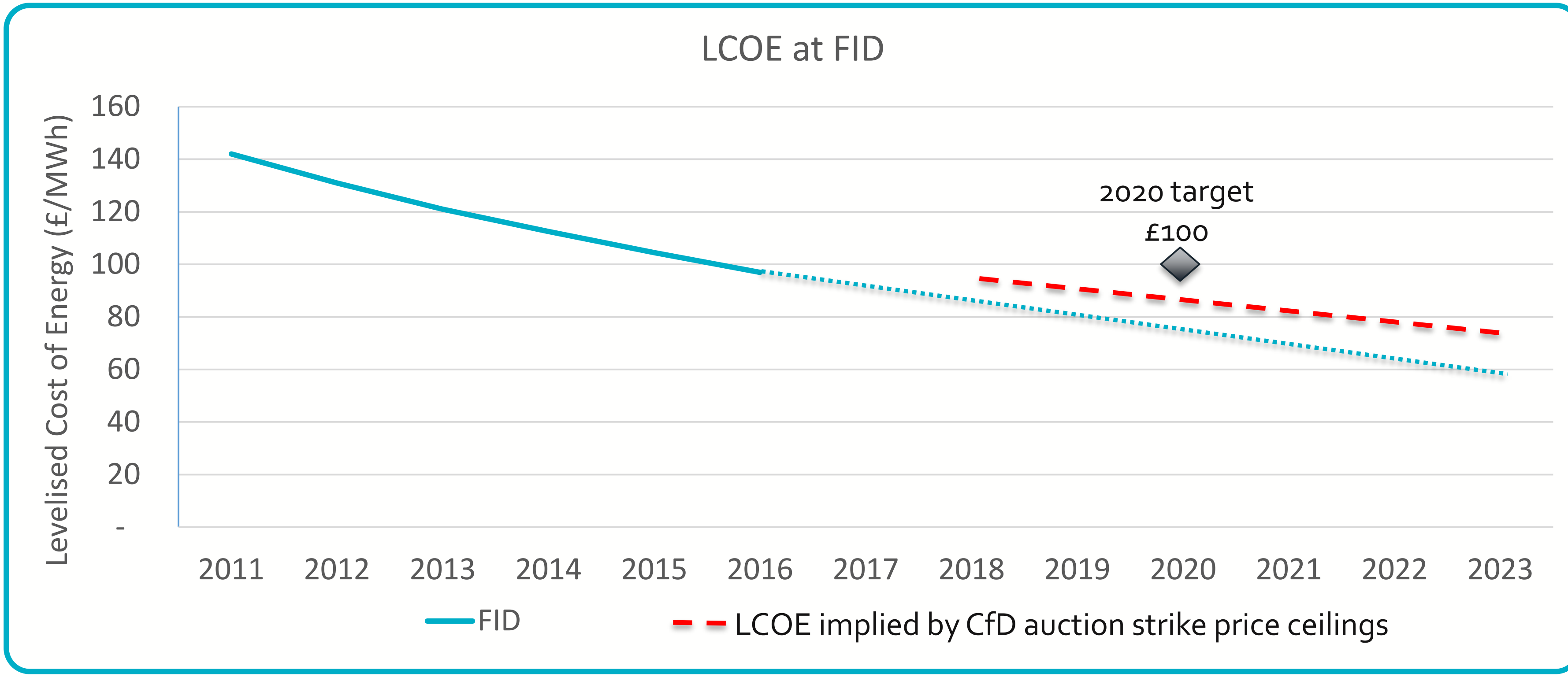
Outer ring:
- High confidence
- Medium confidence
- Low confidence

- Nearly all indicators on or ahead of target
- All indicators medium or high confidence on outlook

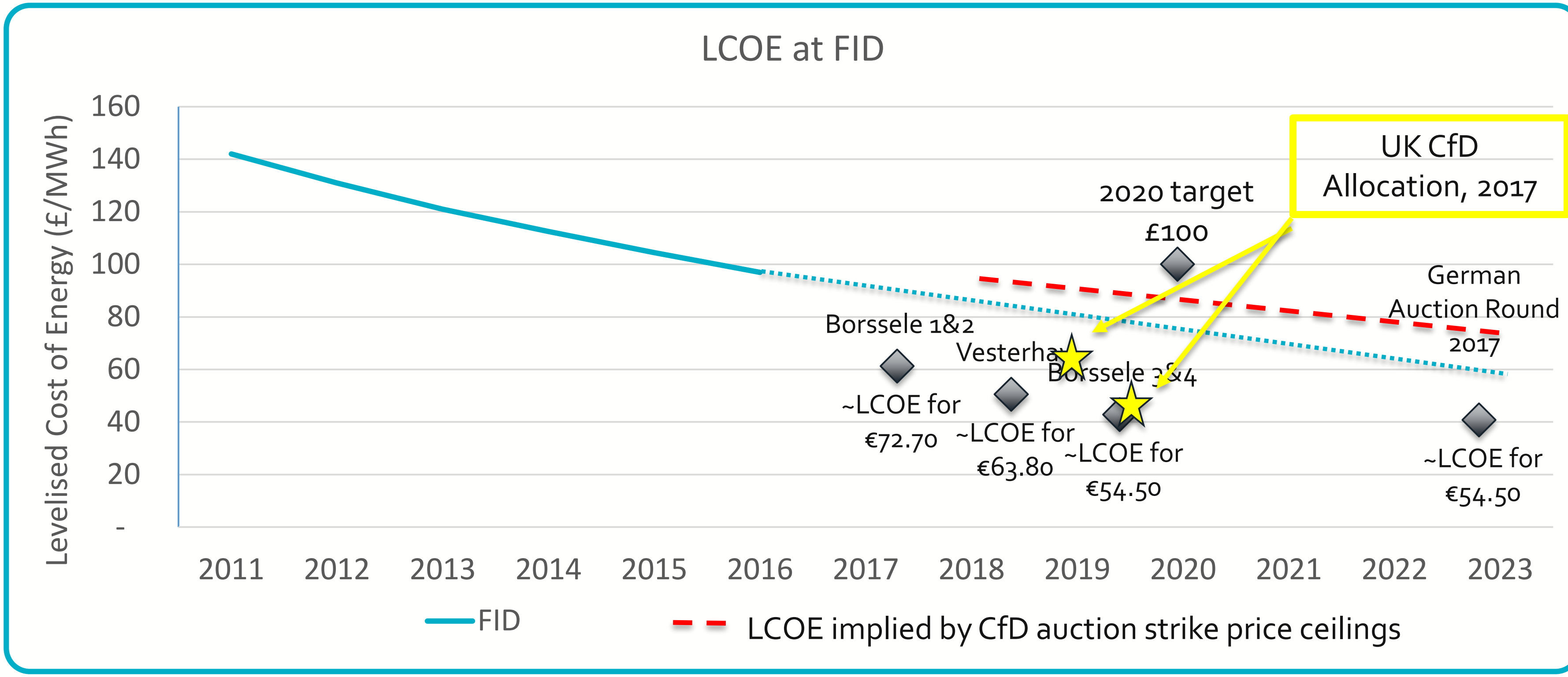
http://crmfreport.com/

Cost Reduction - What do we expect to see in the next 5 years?

Cost Reduction - UK Focus



Competitive Bid Pricing



What's driving this cost reduction?

Technology

- Increasing capacity factor
- Larger turbines
- Longer life assets

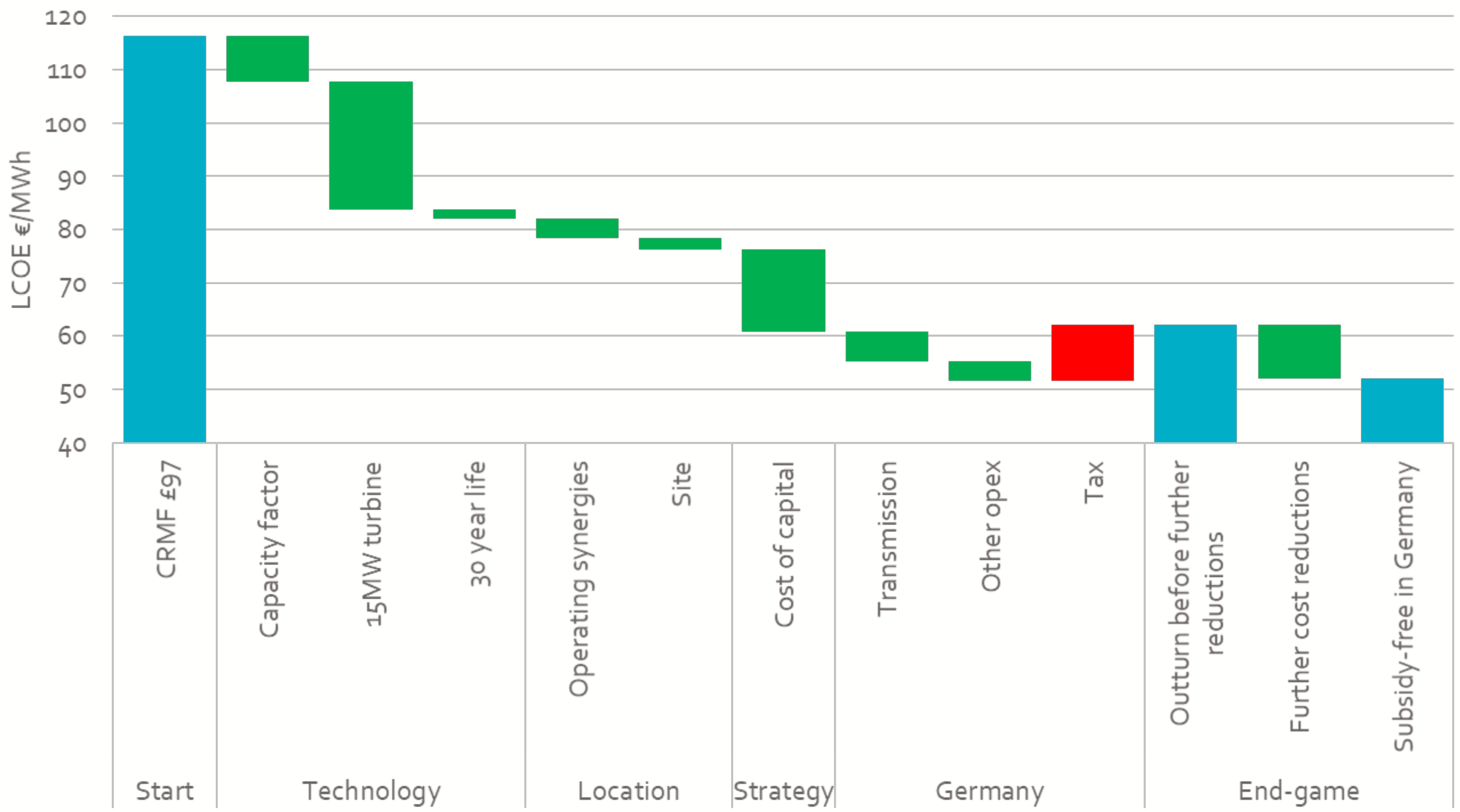
Location

- Operating synergies
- Optimising site locations

Market Confidence

- Lower debt rates
- Lower insurance premiums
- Increasing market competition

Competitive Bid Pricing



So what's next?

Enabling Technologies

Floating Wind
- Deepwater locations
- Simple installation and decommissioning

Larger export systems
- Further from shore
- Higher capacity cables
- Larger developments

Continued Cost Reduction

Efficient Operations
- Improving O&M strategy
- Higher capacity factors
- Specialised vessels

Growing Market
- Established supply chain
- Economies of scale

Statoil, Hywind Scotland

JDR Export Cables

Thank You

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Who we work with

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- MHI Vestas Offshore Wind
- FAB
- GE Energy
- edp renewables
- Global Energy Group
- Ricardo
- Adwen
- SIEMENS
- Atlantis Resources
- subsea 7
- ScottishPower Renewables
- RWE The energy to lead
- JDR
- SSE
- EDF Energy

Research Advisory Group

- Swansea University Prifysgol Abertawe
- The University Of Sheffield.
- The University of Edinburgh
- Cranfield University
- University of Exeter
- Queen's University Belfast
- Imperial College London
- Loughborough University
- University of Strathclyde Glasgow
- University of Oxford

Partnerships & strategic alliances

- The Crown Estate
- EDF Energy
- Green Investment Bank
- energy technology partnership
- Carbon Trust
- EMEC Orkney The European Marine Energy Centre Ltd
- Samsung Heavy Industries

SMEs

- Tekmar
- Invisotech
- Atlantis Resources
- current2current Tidal Power Specialists
- gnosys
- Innovation Nova Innovation Ltd
- ACT Blade Ltd