# Lessons Learned from Creating an OSW Industry in Europe

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# Introduction to the Carbon Trust

CARBON TRUST

OUR MISSION

# To accelerate the move to a decarbonised future.

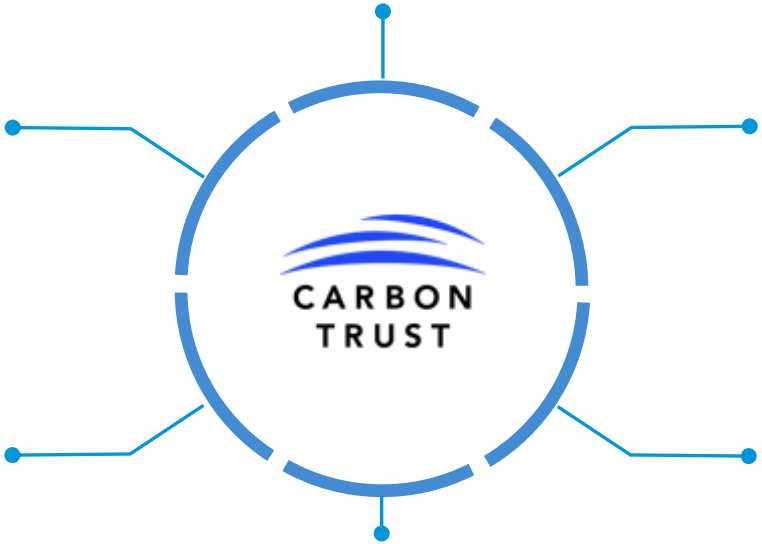
# Services in Offshore Wind

## Programme Management

We are global leading experts in delivering large scale RD&D and collaboration programmes, with a track record of delivering real cost reductions

## Market Insights and Training

Experience delivering market insights to established European developers and international companies to aid in their strategic expansion plans




## Energy Systems and Storage

We are at the forefront of the current energy system advancement, and leading a number of transformational projects to facilitate the move to a more dynamic, versatile system

## Technology Advice

We deliver insights into technology progress and support to help understand market gaps and evaluate solutions – subcontracting technical consultants where necessary

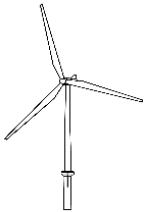
## Policy Advice

We provide strategic policy support and advice in market support, cost reduction and economic development across a number of sectors

## Cost Modelling

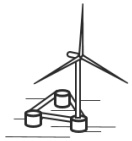
Our in-house LCOE model allows for the cost benefits of innovation to be evaluated, the assessing of market impacts and review technology impacts across a wide range of markets

# World leading offshore wind R&D programmes



## The Offshore Wind Accelerator (OWA)

Carbon Trust's flagship collaborative RD&D programme for bottom-fixed offshore wind.



## The Floating Wind JIP (FLW JIP)

The Floating Wind JIP Overcomes challenges and advance opportunities for commercial scale floating wind

## The Offshore Renewables JIP (ORJIP)

Offshore Renewables JIP aims to reduce consenting and environmental risks for offshore projects.

## The Integrator

The Integrator is designed to examine the interplay between offshore wind, existing infrastructure, and other technologies to highlight opportunities for innovation investment.

## Partners we work with:

BACKGROUND 1

# The Benefits of Offshore Wind

# Why is Offshore Wind favoured by European Governments?

- Scale: 1GW+ projects possible
- Capacity Factor higher than other RE
- Reduced local opposition compared to onshore RE
- Close to coastal demand centres
- Economics – potential for low cost due to economies of scale and other economic benefits such as job creation

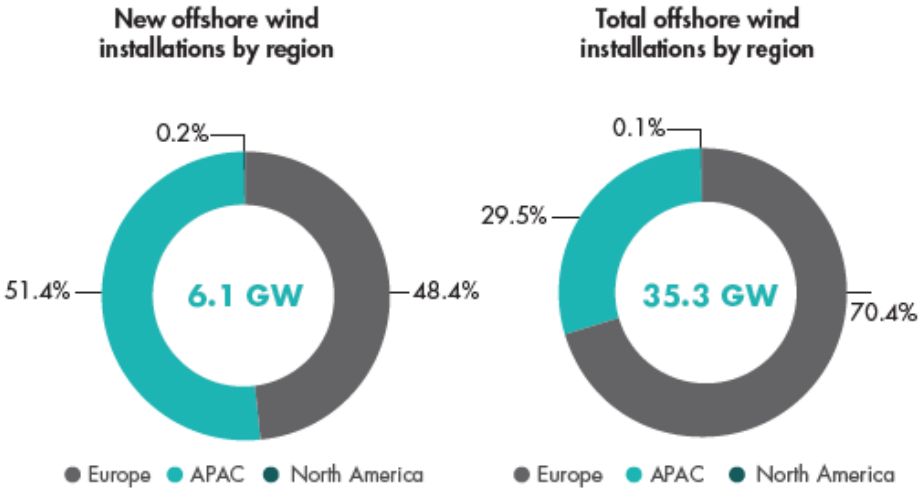

*-Global energy policy is at a turning point similar in magnitude to the Oil Shocks of the 1970s*
*- OSW is well placed to meet fulfil the energy needs of many countries and is particularly suited to meet Japan's energy policy requirements of '3E+S'*

BACKGROUND 2

# Success of OSW in Europe

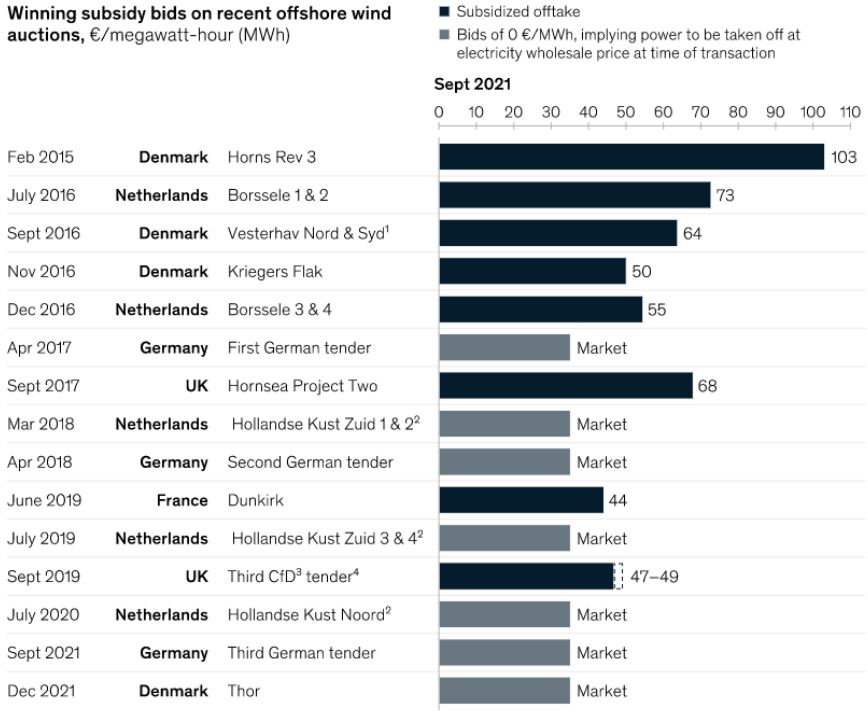
# OSW in Europe has been a Success Story

- The global offshore wind market has been dominated by a few North Sea European nations (Denmark, UK, Netherlands, Germany) and more recently China.
- These nations have rapidly increased installed capacity over the past decade, causing the perception of OSW to change from a small contributor to the energy mix to a central part of net zero plans.
- Successful markets have developed as a result of many factors including:
  - Favourable policies
  - Public and private R&D
  - Innovation
  - Economies of scale
  - Skills and knowledge transfer from Oil & Gas
  - Competitive international supply chain



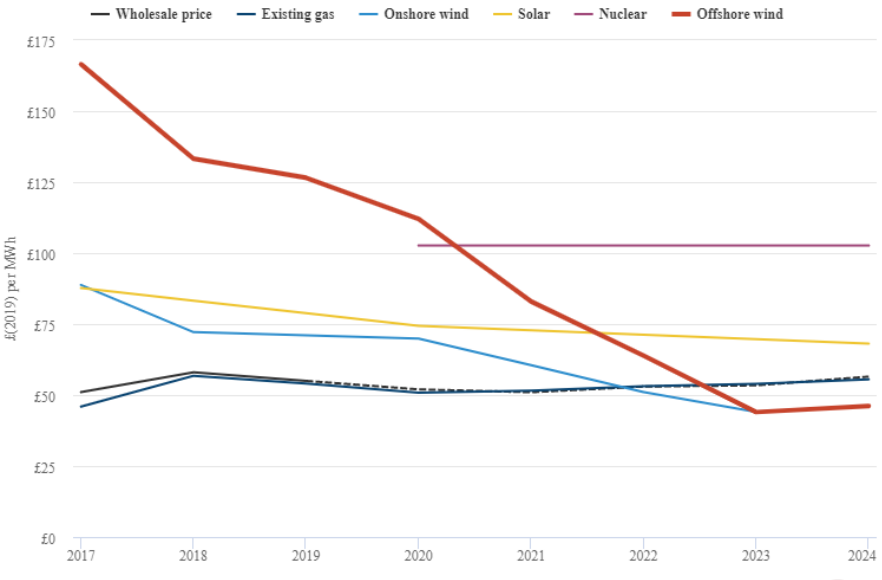

Source: GWEC Offshore Wind Report 2021

# Offshore Wind has achieved impressive cost reduction in Europe




Source: Mckinsey

Comparison of electricity cost by energy source in the UK



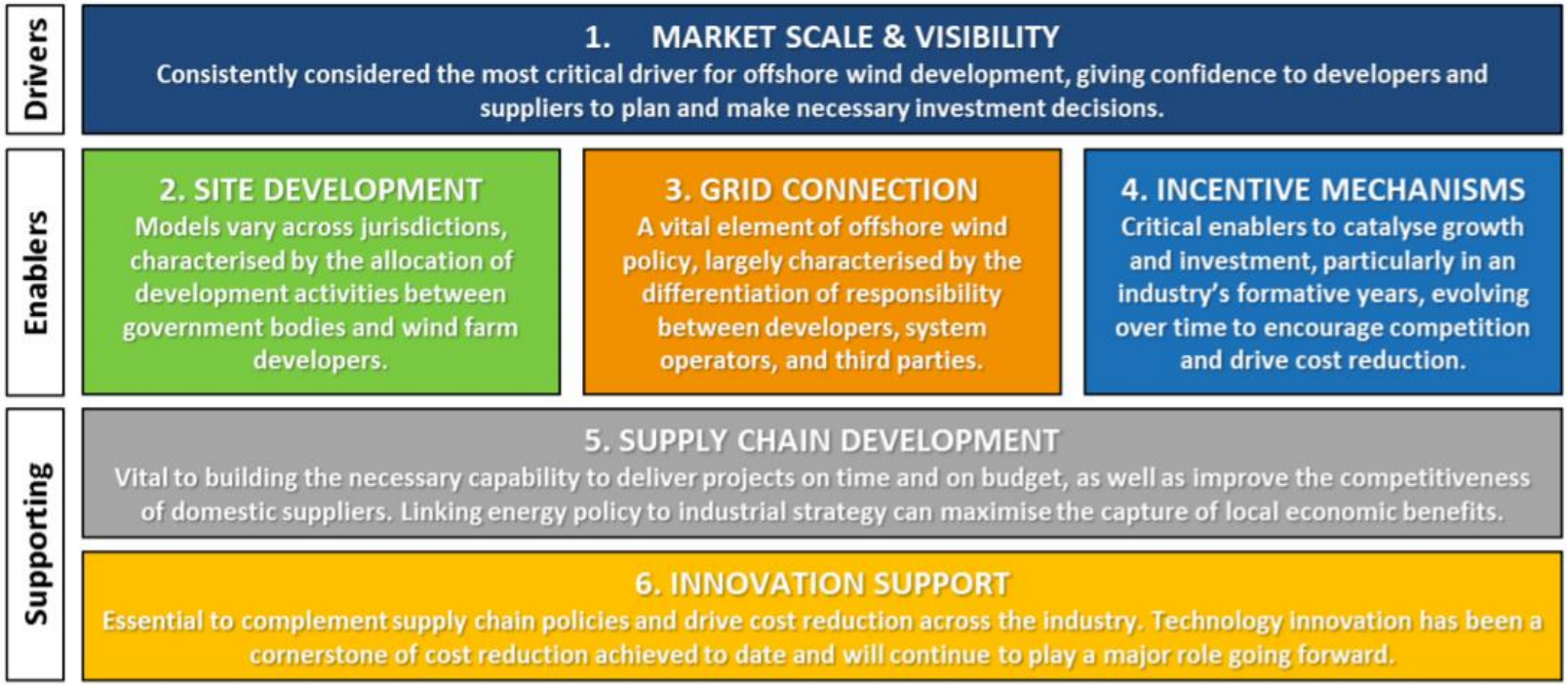

Source: Carbon Brief

LESSONS LEARNED 1

# Policy

# Six Pillars of Offshore Wind Policy Development

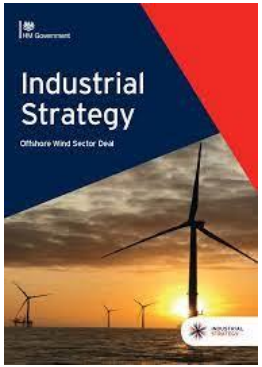
- Effective policy to support sector building can be characterised by six key pillars

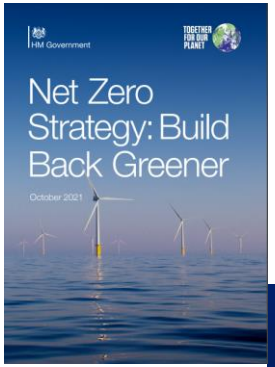


# UK Case Study: Clear Government backing has helped the industry grow

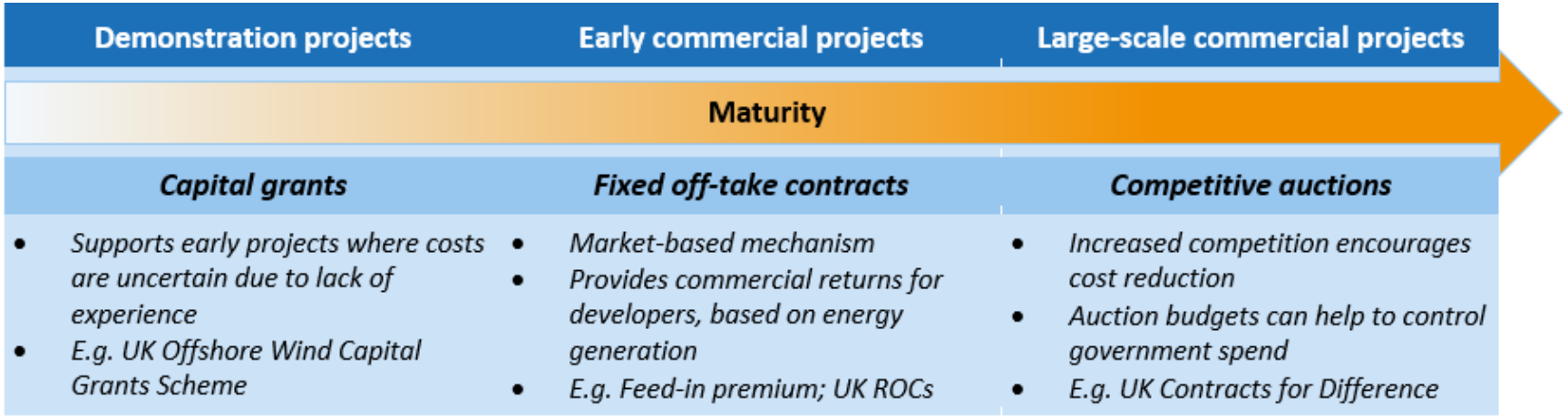
- The UK government has been a very vocal supporter of OSW and this has been key to industry success.
- Clear and ambitious targets have been set. 2030 target set at:
  - 30GW in the OSW Sector Deal (2019)
  - 40GW as part of the Net Zero strategy (2021)
  - 50GW as part of Energy Security Strategy (2022)
- Consistent support through subsidy schemes
- Clarity of permitting and regulatory frameworks

- UK government made a clear choice to back offshore over onshore wind due to its relative merits




# Incentive mechanisms evolve with technology and market maturity




- Governments take on higher risk in immature stages, shifting risk to developers as the technology matures
- Growing **technology maturity** means that emerging markets are expected to go straight to fixed off-take or competitive auctions
- Limited **market maturity** may be a barrier to competitive auctions in more isolated markets

# Case Study: Evolution of UK Subsidy Support

- Subsidy support was reduced **steadily** and **gradually**, until the industry was mature and a competitive supply chain had been developed.
- It wasn't until 9.7 GW of offshore wind had been deployed in the UK that competitive auctions were introduced.
- The introduction of competitive auctions saw prices fall dramatically.
- However, this cost reduction was only made possible due to the stable regulatory framework and support mechanisms that had allowed the industry to develop and mature.

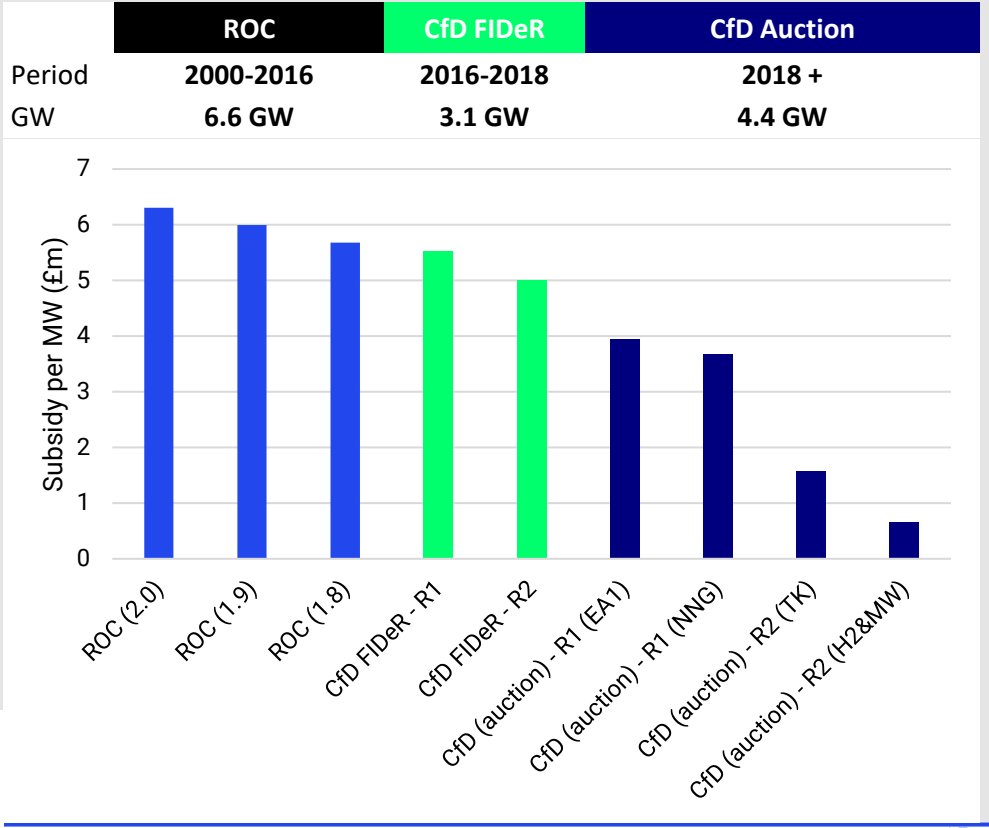


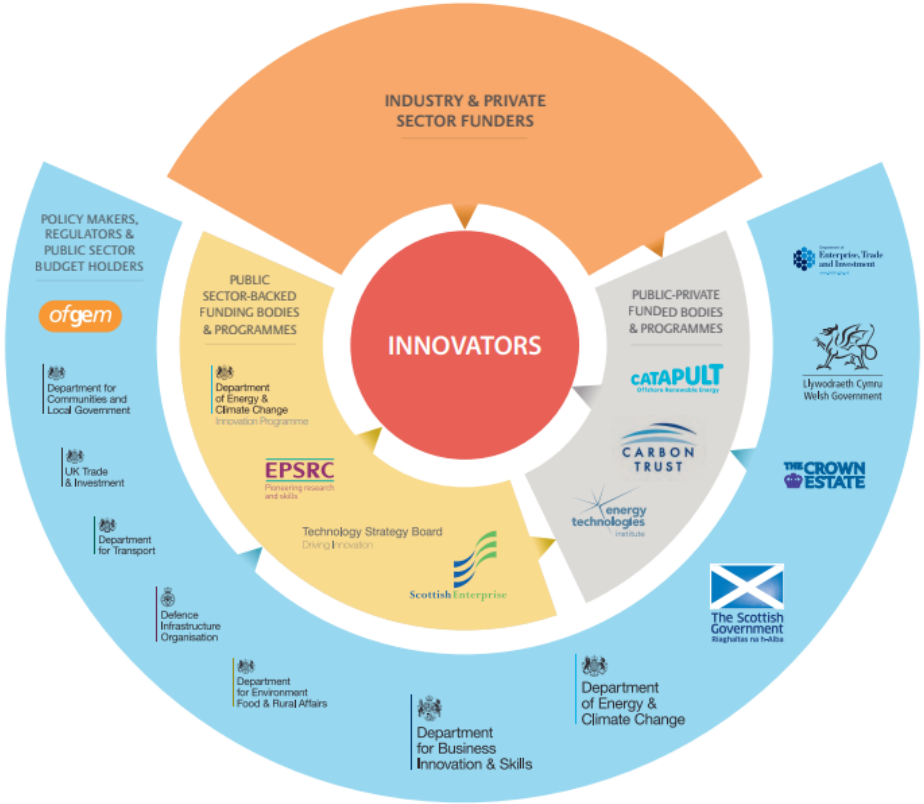

***Chart notes:*** Indicative subsidy revenue/payments calculated to account for the different duration of ROCs (20 years) and CfDs (15 years).
***Assumptions:*** ROC price = £45/MWh. Wholesale price = £45/MWh. Capacity factor = 40%.

LESSONS LEARNED 2

# Market-Pull R&D

# Innovations from extensive R&D have been key to reducing cost and accelerating OSW build-out

- In the UK many public and private bodies have been involved in supporting OSW R&D.
- Early R&D was focused on technology demonstration and relied on public funding.
- However focus quickly moved to **commercialisation,** with R&D largely funded by industry (**market-pull** principle).
- The Carbon Trust has been at the forefront of creating **collaborative industry R&D programmes** for this purpose.




Source: Coordinating Low Carbon Technology Innovation Support (LCICG, 2014)

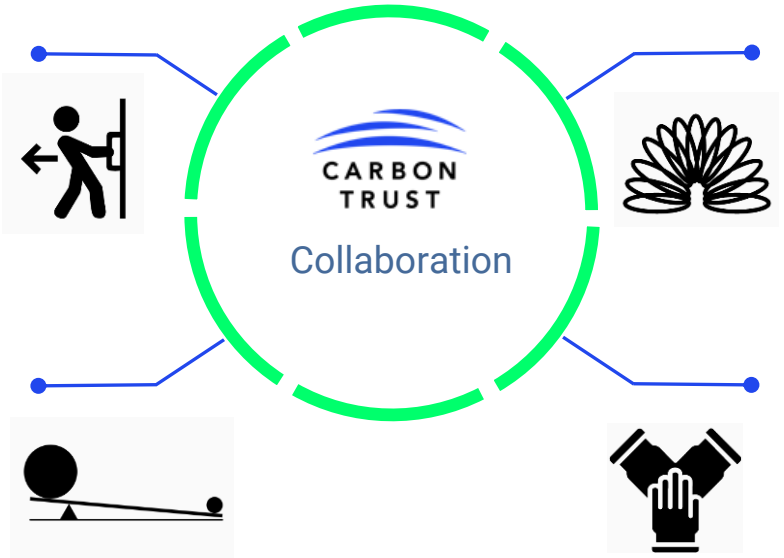
# Benefits of a collaborative programme

## Market-pull principle

- Near market, commercially focused RD&D
- Industry led and industry inclusive
- Industry-wide alignment on key issues provides clarity to the market and creates opportunities for innovators

## Financial leverage

- Joint contributions
- Investment leverage
- Risk sharing




## Flexibility

- Flexible nature and timing of projects
- Broad focus across several technical areas
- Flexible use of funding for the different projects
- Certainty and stability of the process and the resources available

## Knowledge pool

- Large number of technical experts and strategists involved
- Open discussions, knowledge sharing and alignment of ideas at a technical and strategic level
- Open platform to innovators

# Offshore Wind Accelerator (OWA)


**Objective**

Started in 2008 and currently in Stage 4, The OWA programme aims to **continue the cost reduction of offshore wind**, overcome **market barriers**, develop industry **best practice**, trigger the development of new **industry standards** and support the **international expansion** of offshore wind

- **Joint industry project** currently involving 9 developers + Carbon Trust
- Over **£105m total programme spend** to date. Initially both public and privately funded but now 100% funded by the industry partners
- **The largest and most established** innovation programme
  - New **lower-cost technologies**, ready to use
- **Value to government** and industry partners with great financial leverage
  - Efficient vehicle to accelerate innovation

EnBW equinor Ørsted RWE CARBON TRUST SCOTTISHPOWER RENEWABLES sse Renewables TotalEnergies VATTENFALL

# OWA is channelling funding to the supply chain and drives innovations to the market

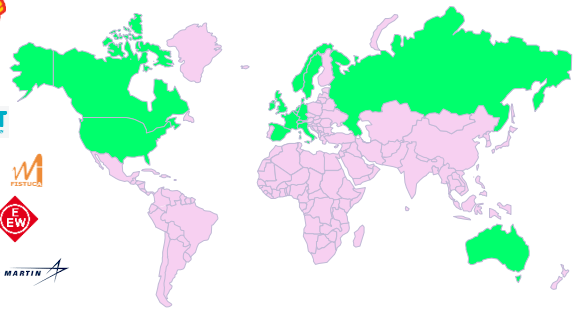
Developers

Research institutions

Innovators and Others

Public bodies

Consultancies



**16 COUNTRIES**

UK | Norway | Germany | Denmark | Belgium | France | Switzerland | Italy | Netherlands | Sweden | Ireland | Spain | USA | Canada | Australia | Russia

**OWA Impact**

**INVESTMENT**
*Public and private; industry led initiative*

**INNOVATION**
*Market driven (or 'pulled')*

**COMPETITIVENESS**
*More supply chain competition and efficiency*

# OWA Impact

**>185** projects

**£105m**

**+200** stakeholders

**+70** organisations

**+80** workshops/conferences

**+320** meetings

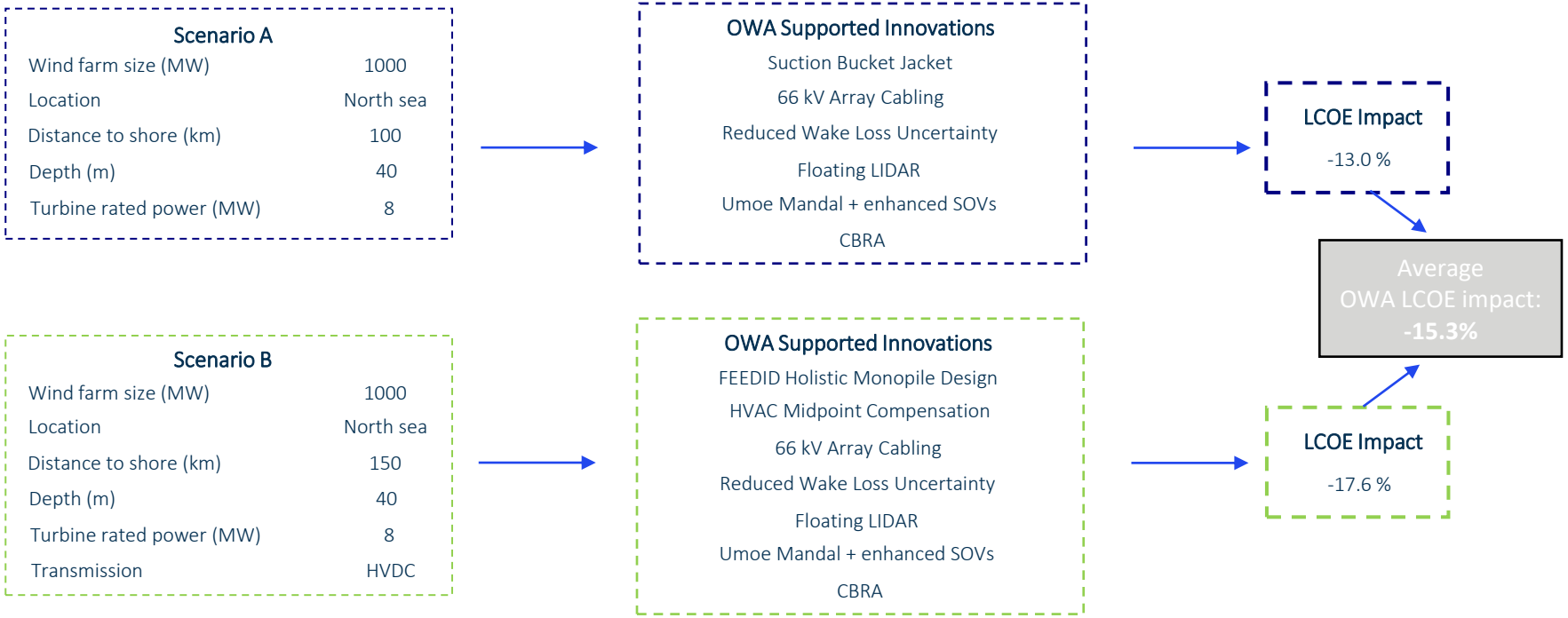


**£34bn** overall savings

**-15%** average LCOE impact

# Additional Information

# OWA Cost Modelling - Estimated Cost Impact



# OWA Case Study of Innovation Support

- Access | Umoe Mandal – WaveCraft Crew Transfer Vessel (CTV)

## SUMMARY

The OWA have been working with Umoe Mandal since 2011 to commercialise WaveCraft – their CTV concept. The programme support enabled significant development and de-risking. WaveCraft progressed from TRL 2 to TRL 9 in about 4 years and is now commercially available for use in offshore wind farms.

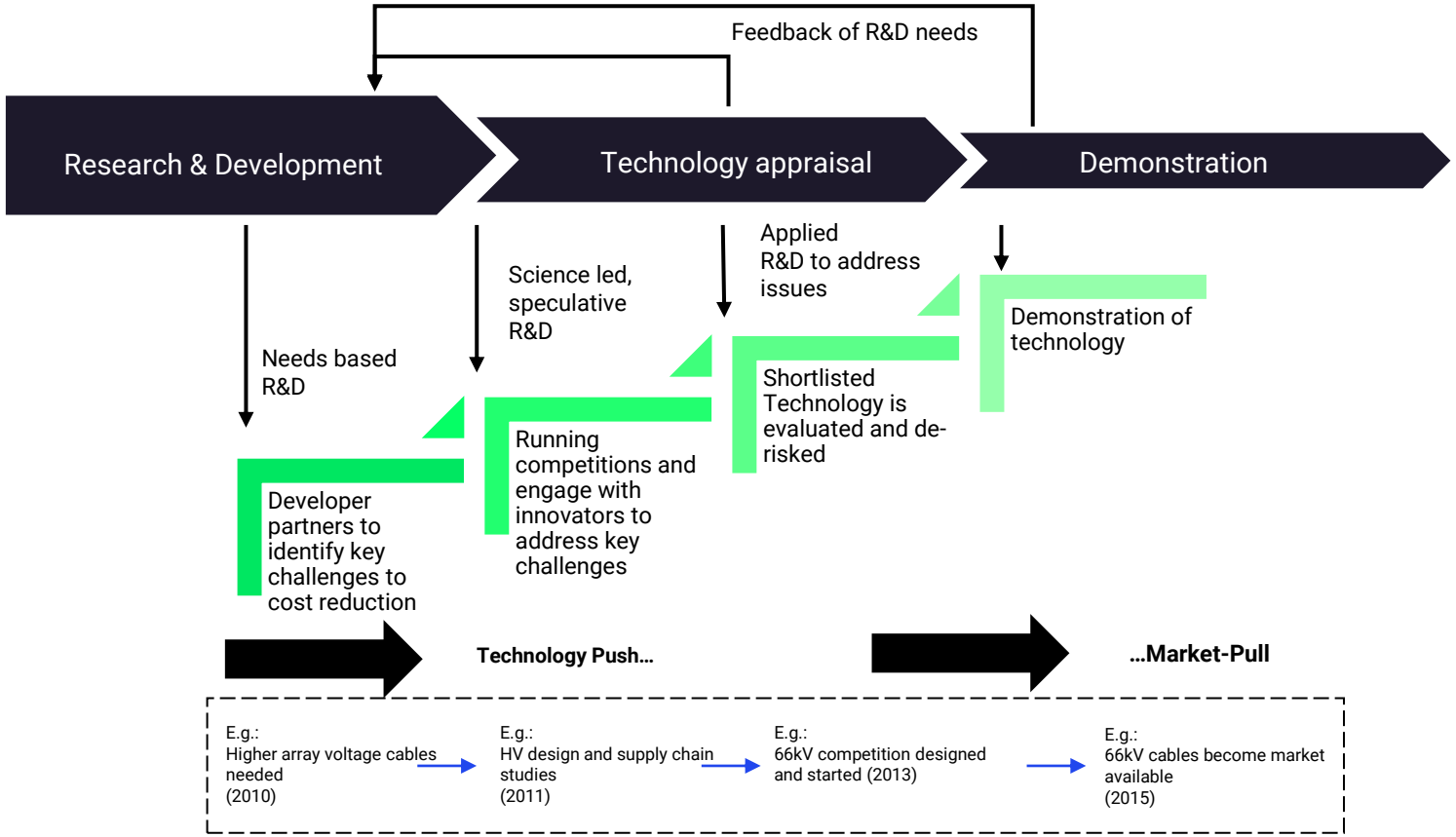
DEVELOPMENT

| 2011 | 2012 | 2013 | 2015 |
|---|---|---|---|
| Umoe Mandal submitted concept for the OWA Access competition | Umoe Mandal selected by OWA; first supported to prove WaveCraft concept | Modelling, scaled testing and design improvement support; first commercial order | **First vessel delivered**; first demonstration at Seawork exhibition |
| TRL 2 | TRL 5 | TRL 7 | TRL 9 |

## IMPACT

- Higher vessel motion stability and transit speeds (up to 35-40kts)
- Higher wave conditions operability (2.5Hs)
- Improved wind farm accessibility
- Potentially signify-cant increase in turbine availability

# The programmatic approach to overcoming key challenges



# Thanks for listening

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