



Supergen



Offshore
Renewable
Energy

Panel session 1: Unlocking growth targets

What changes are needed within policy and practice to enable targets for 2030 and beyond to be achieved within the context of ORE? And what is the role of the Supergen ORE Hub

www.supergen-ore.net | [#SupergenORE23](https://twitter.com/SupergenORE23)



Engineering and
Physical Sciences
Research Council

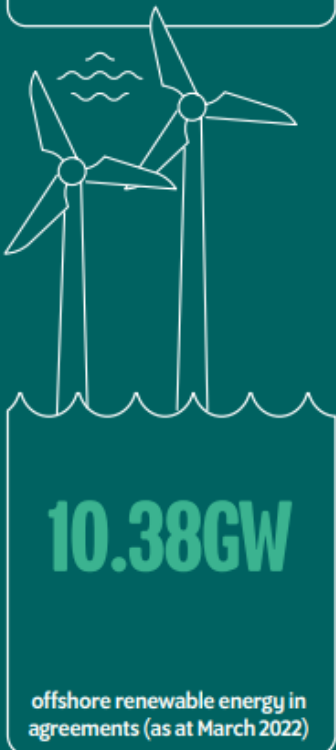
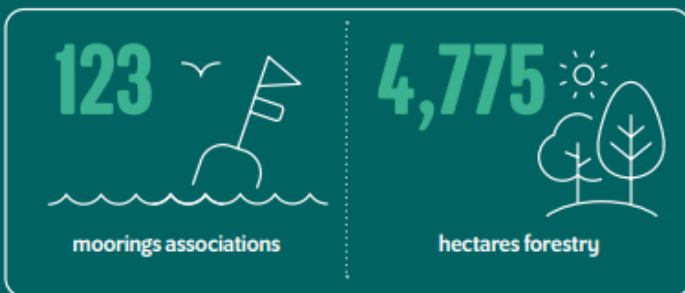
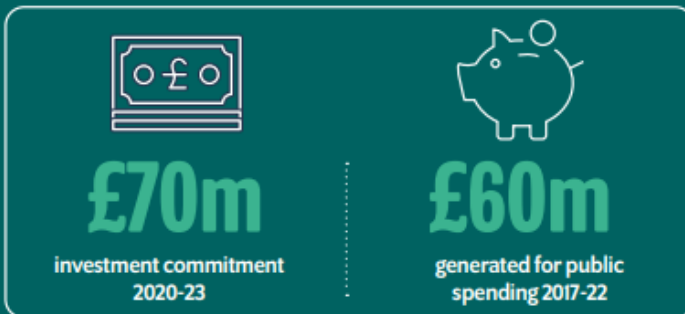
Keynote Speakers

Caitlin Byers - Development Manager
(Integration & Transition) - Crown Estate
Scotland

Henry Jeffrey - Co-Director of the Supergen
ORE Hub and Head of Policy Unit, University of
Edinburgh

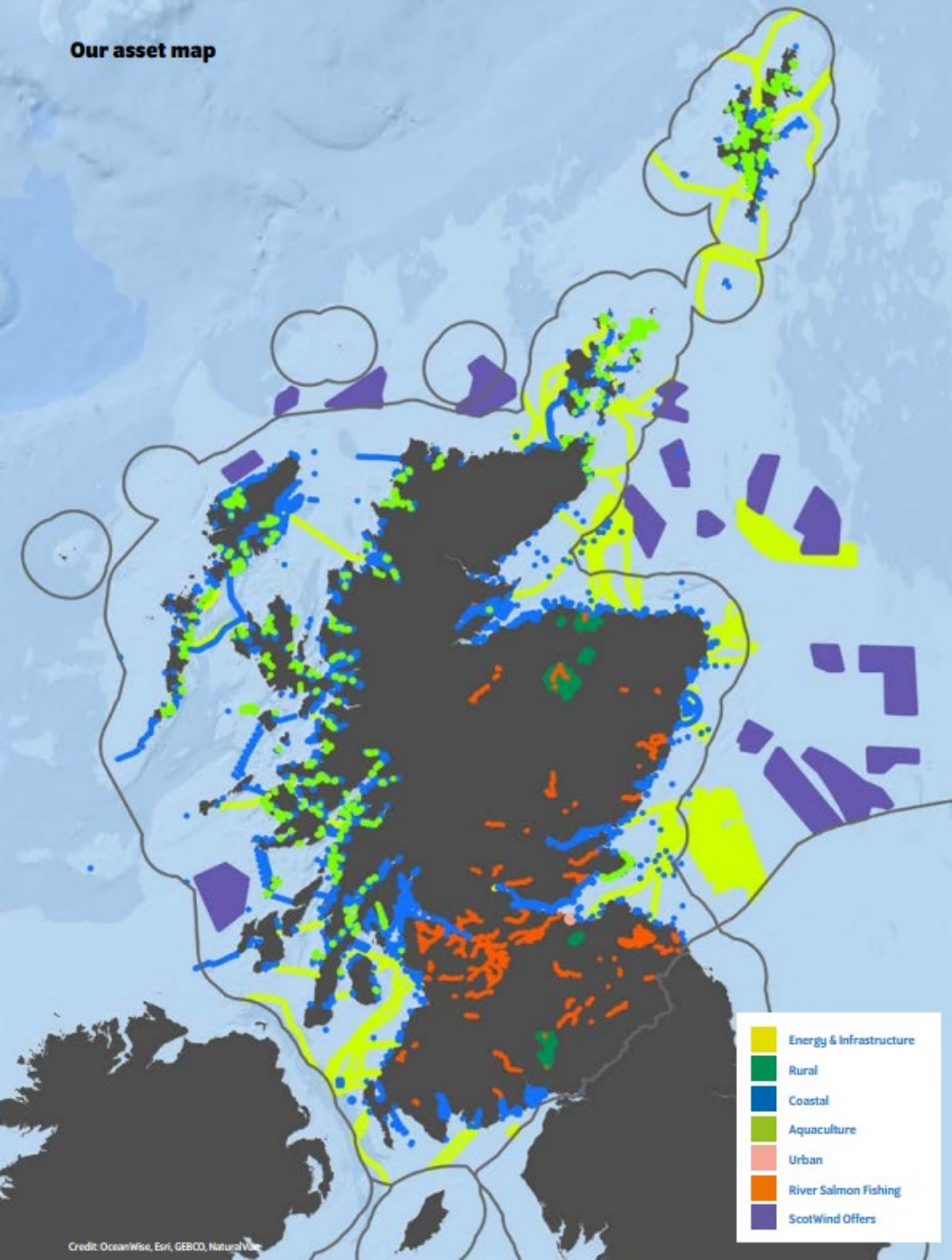


Achieving targets and unlocking lasting
value for Scotland



Who are we? What do we do?

- We manage property including buildings, land, coastline and seabed on behalf of the people of Scotland.
- Our purpose is to invest in property, natural resources and people to generate lasting value for Scotland.



Our Portfolio



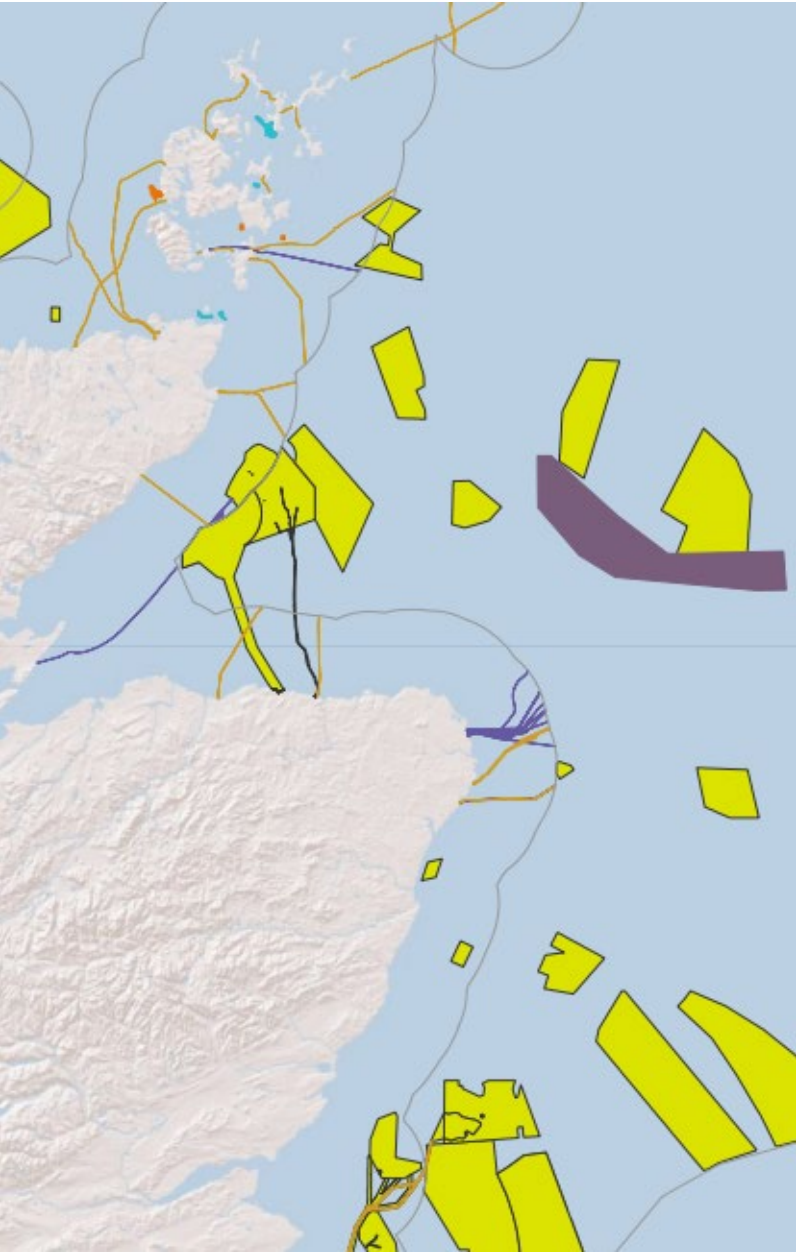
**Crown Estate
Scotland**
Oighreachd a' Chrùin Alba

Building the blue economy



- Offshore renewables
- Ports & harbours
- Local energy systems
- Transmission
- Carbon capture & storage
- Telecommunications
- Marine tourism
- Sustainable aquaculture

Our key role in offshore renewables

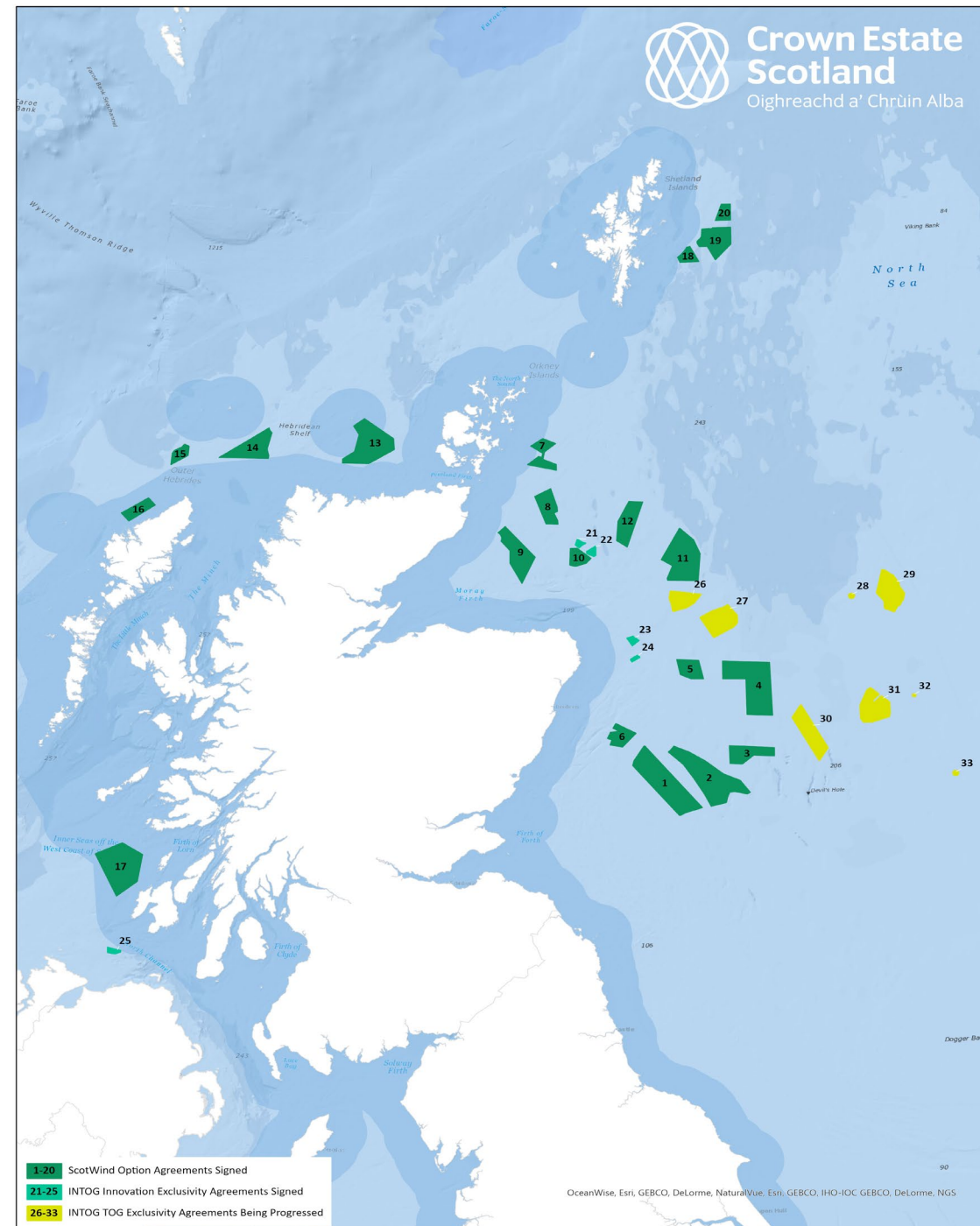
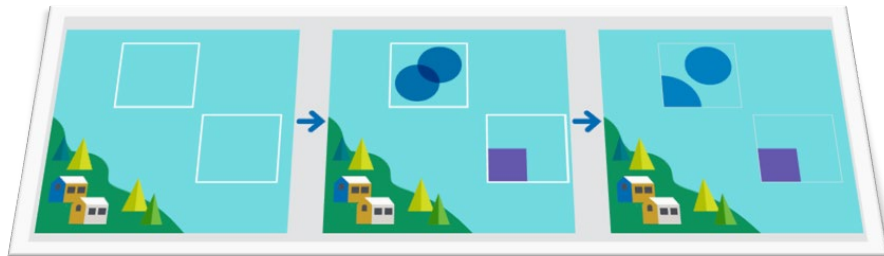


Our responsibilities include:

- Leasing of the seabed out to 12 nautical miles (cables and pipelines, aquaculture)
- The rights to offshore renewable energy and gas and carbon storage out to 200 nautical miles
- **Marine Directorate** (previously Marine Scotland) are responsible for strategic marine planning and grant consents for projects.
- Crown Estate Scotland award Option Agreements or Agreements for Lease which secure the right to investigate the site.
- Crown Estate Scotland only grants a Lease once necessary consents and permissions are in place.

ScotWind

- Plan led process - Marine Scotland's Sectoral Marine Plan (SMP) for Offshore Wind
- **20** ScotWind projects with **8000km²** of seabed secured (from 74 bids)
- £755m Option Fees for Scottish Public spending
- £1.4bn average Scottish supply chain commitment per project
- Builds on existing pipeline of 8 projects in construction and development
- Over 40GW of potential offshore capacity now visible in Scotland



INTOG Results

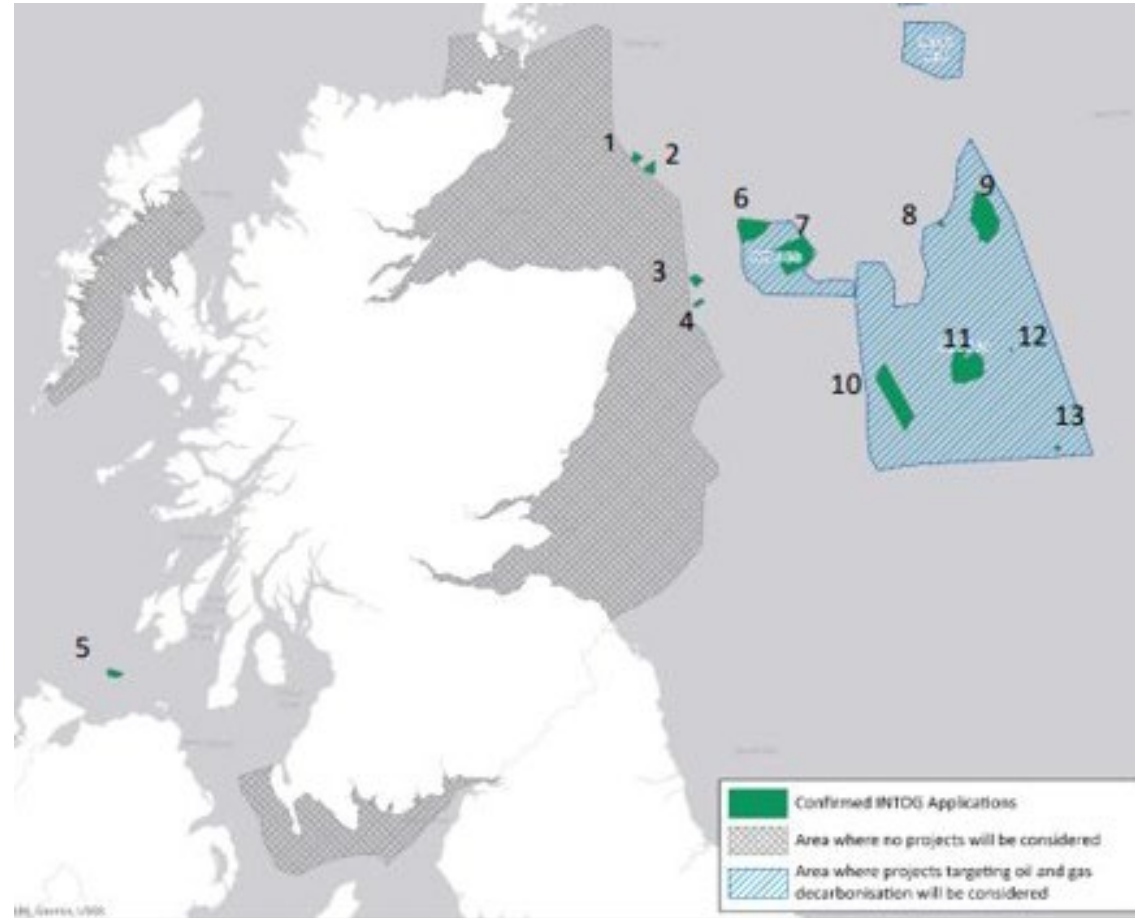
13 Projects offered
Exclusivity Agreements:

5 Innovation Projects

- 449MW awarded
- Area of seabed – 139km²

8 TOG Projects

- 4.96GW awarded
- Area of seabed – 1535km²



Wave and tidal

- Over 480 MW of wave and tidal energy sites with seabed agreements
- **Currently operating an open ad-hoc leasing process:**
 - Up to 3MW for test and demonstration
 - 3 - 30MW where there is sufficient evidence of energy yield from selected technology
- Our role also extends to:
 - Funding research and technical studies to enable sector growth
 - Investing in ground breaking projects
- Market engagement survey due to commence shortly

Wave & tidal

Wave

- ▨ Agreement / Option for Lease
- Lease

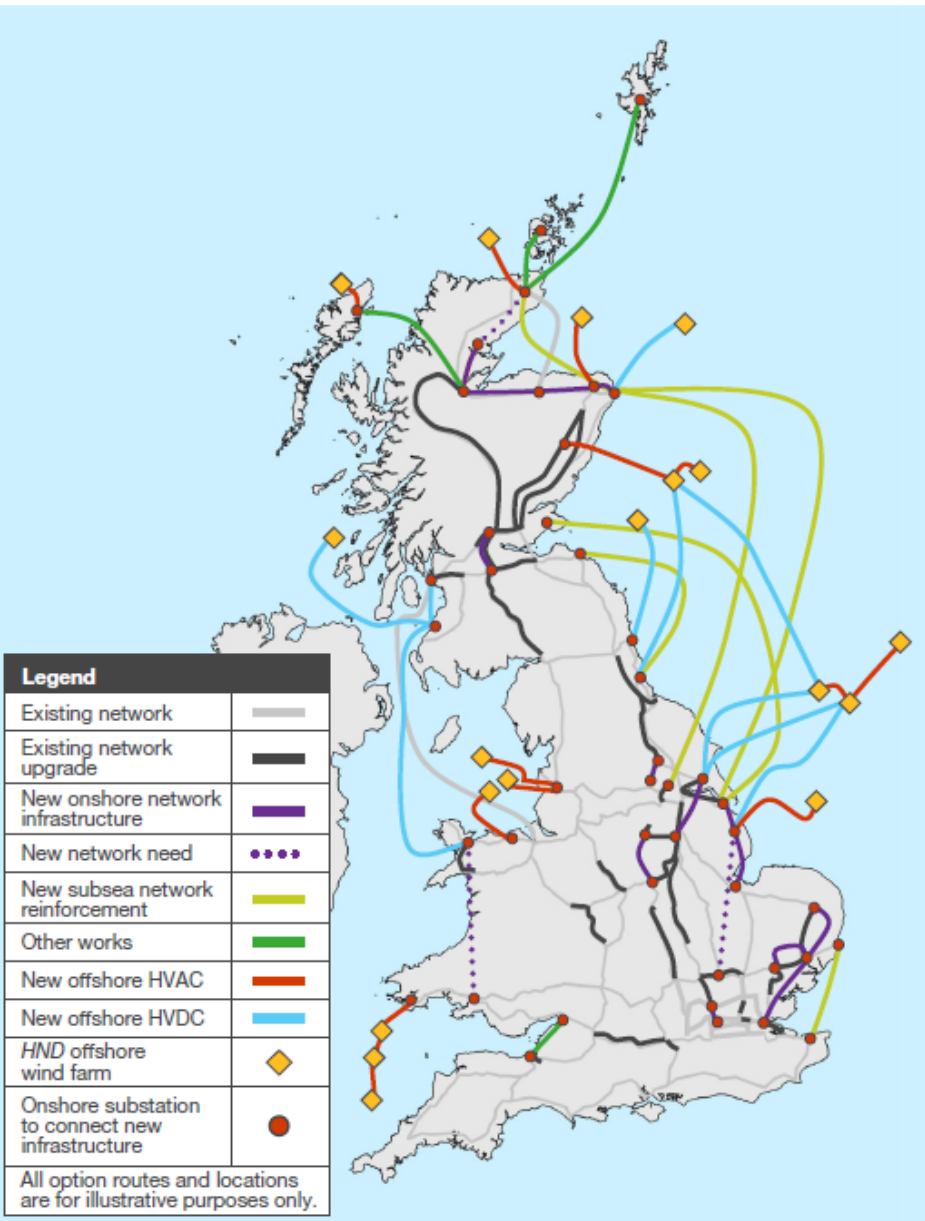
Tidal

- ▨ Agreement / Option for Lease
- Lease



Opportunities and challenges ahead

- Three key areas – due to scale:
 - Grid (HND & HND FUE)
 - Consenting
 - Building supply chain
- Collaboration is a buzzword but we need to translate this into practical early engagement and successful combined project development and delivery
- Cross-sector working essential on innovating market design, progressing significant technical and skills challenges



Collaboration, cooperation and colocation

- Growth and demand
 - Meeting Net Zero targets
 - Pace and timing
 - Increasing seabed demands
 - Marine protection
 - Natural capital
 - Economic activity
- Collaboration and cooperation
 - Understanding other sectors and their needs
 - Communication on shared space and willingness to work together
 - Innovation to create colocation opportunities



Thank you

www.crownestatescotland.com

Marine Renewable Energy

Benefits and Importance of Continued and Consistent Support

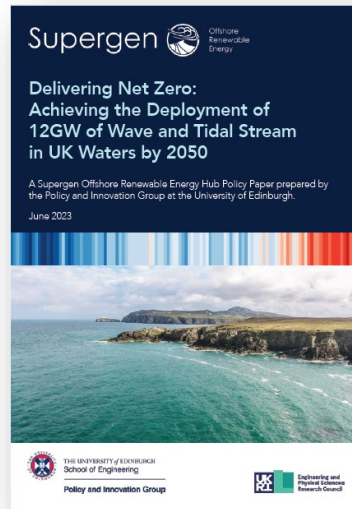
The Policy Makers Tool Box

Henry Jeffrey
Annual Assembly July 2023



Analysis and Reports

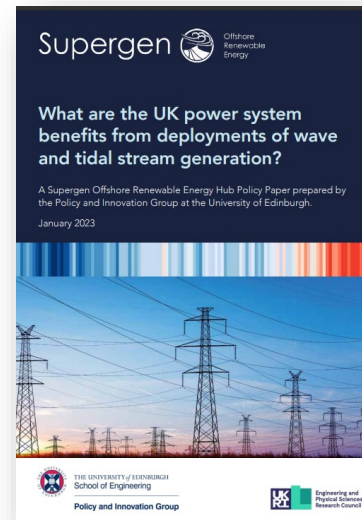
Deployment Modelling



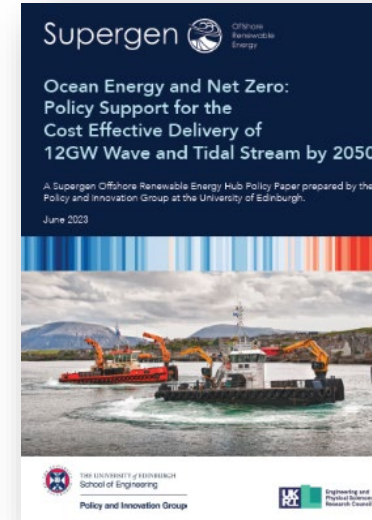
Economic Benefit (GVA)



Systems Benefit



Value of Innovation



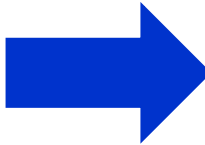
Areas of Innovation



Deployment Modelling

How much wave and tidal could be installed by 2050?

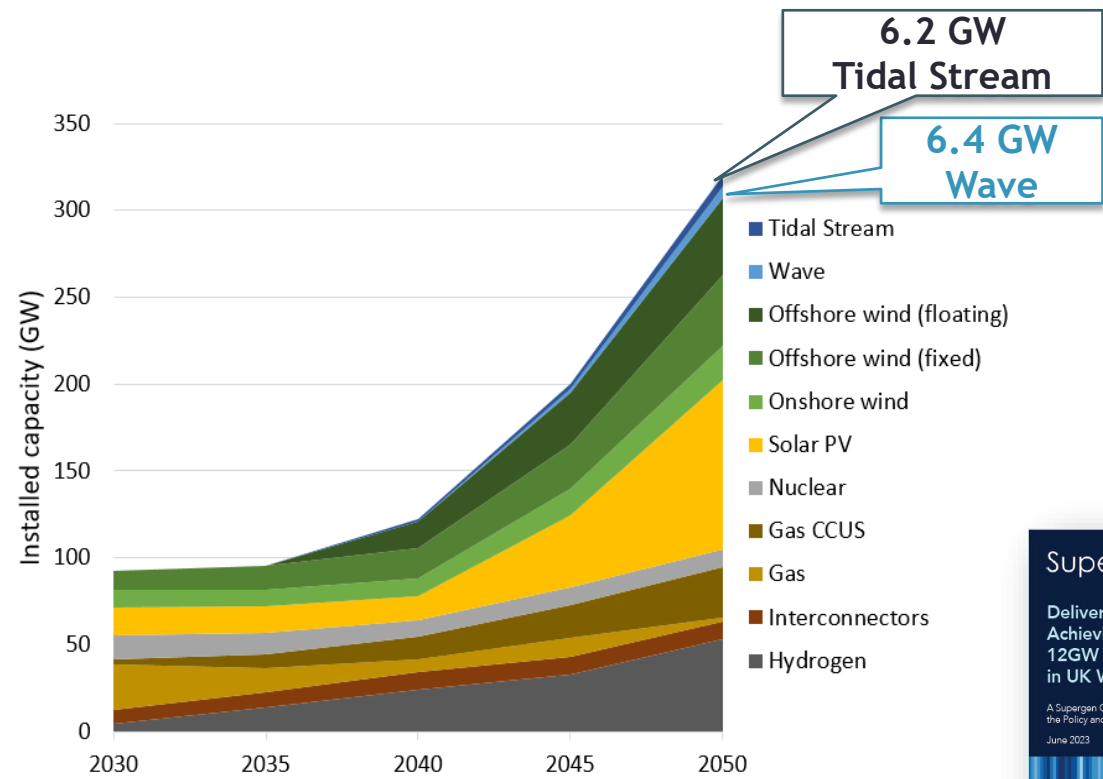
Energy planning modelling



- ▶ GB deployment modelling to 2050
- ▶ ESME model run by ESC
- ▶ Future Ambition Scenario
- ▶ Cost assumptions:



Technology	2030 target LCOE
Tidal stream	€100/MWh
Wave	€150/MWh



Supergen Offshore Renewable Energy

Delivering Net Zero: Achieving the Deployment of 12GW of Wave and Tidal Stream in UK Waters by 2050

A Supergen Offshore Renewable Energy Hub Policy Paper prepared by the Policy and Innovation Group at the University of Edinburgh.
June 2023

THE UNIVERSITY OF EDINBURGH School of Engineering
Policy and Innovation Group

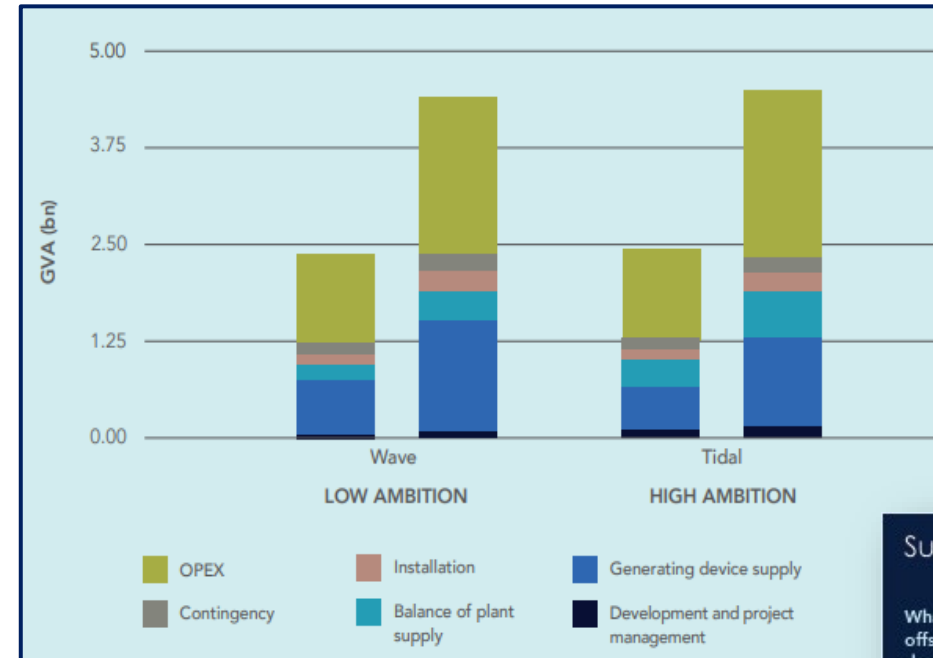
UK Research and Innovation Engineering and Physical Sciences Research Council

Economic Benefit (GVA)

GVA Benefits:

- £4.9B - £8.9B from UK deployments
- £6.4B - £32.1B from International deployments

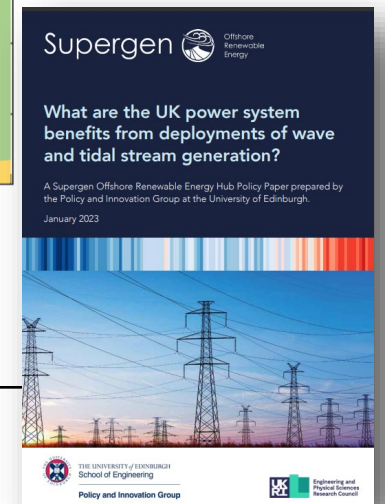
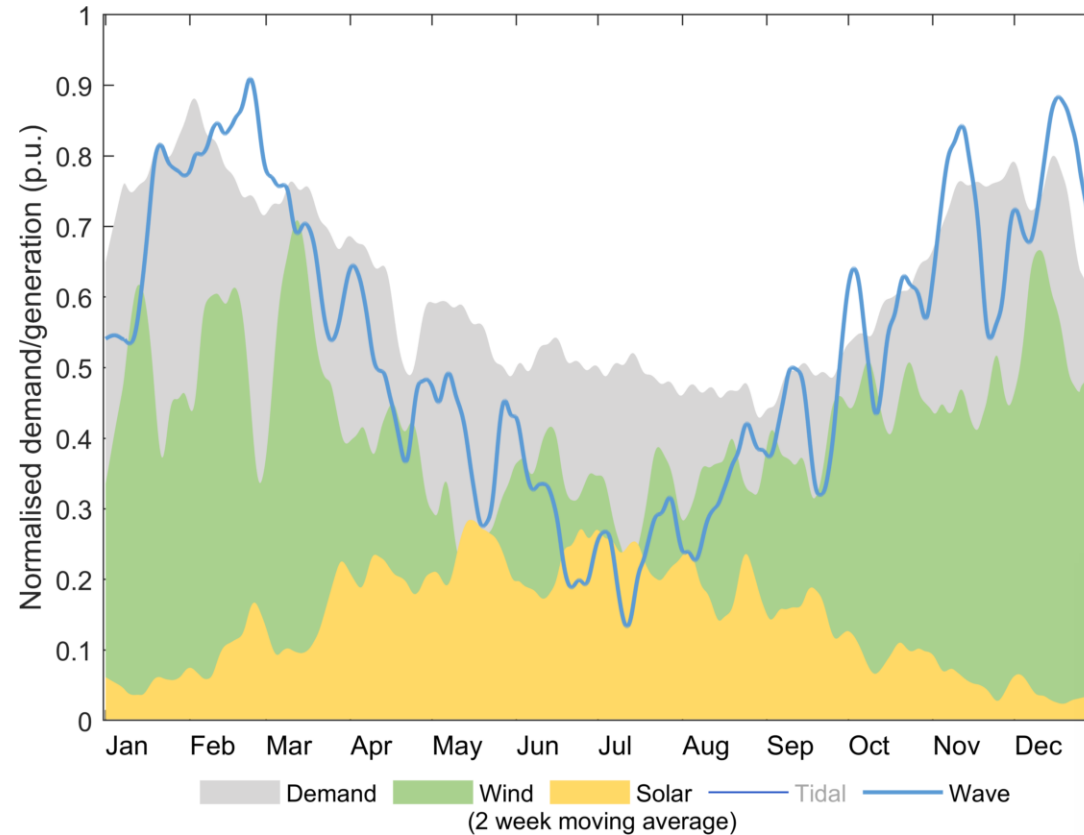
- **Great Just Transition argument !**



System Benefit

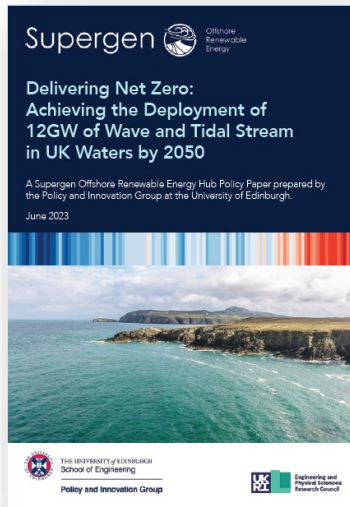
System benefits in 2050:

- £1.03B annual reduction in cost of dispatch
- 300 GWh reduction in fossil fuel dispatch
- An enabler of offshore wind !



Five reports

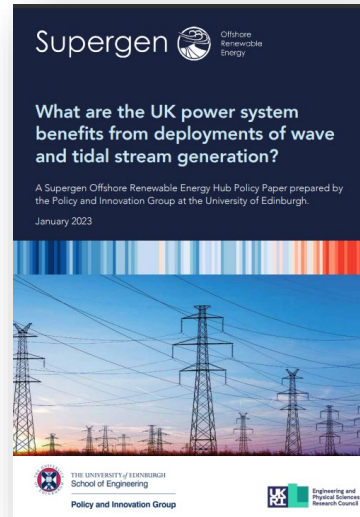
Deployment Modelling



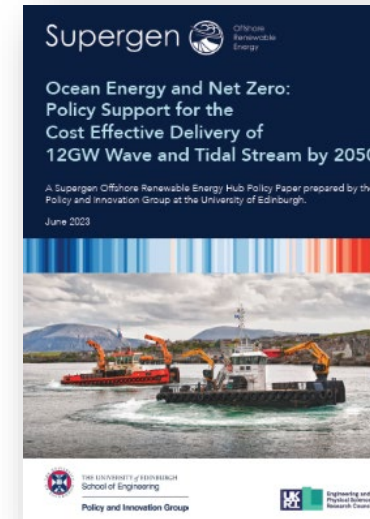
Economic Benefit (GVA)



Systems Benefit



Value of Innovation



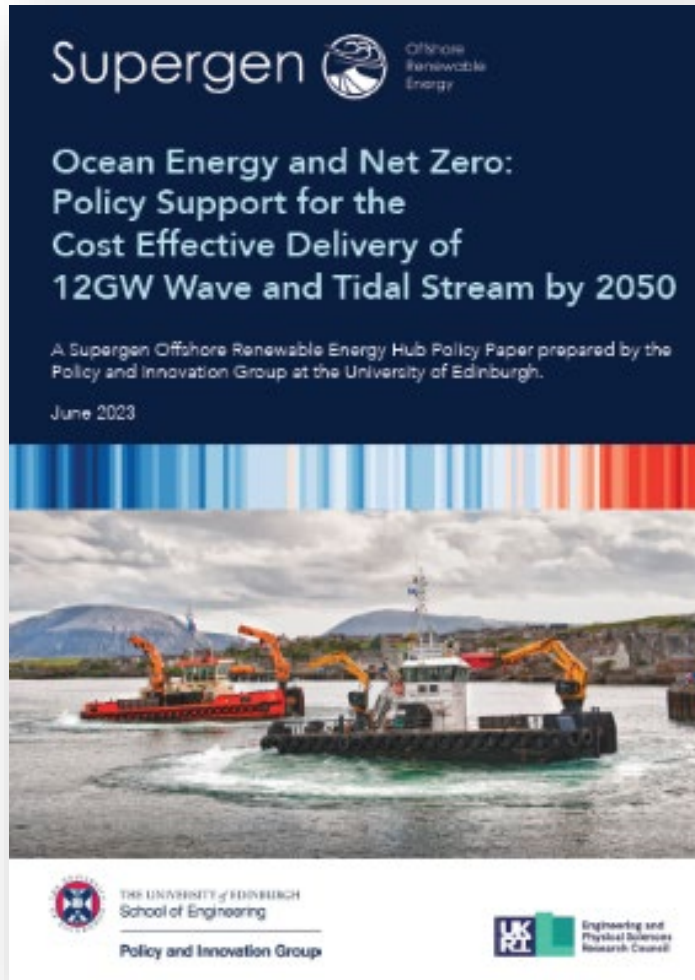
Areas of Innovation



Existing Underpinning

Launched Today

Market Pull and Tech Push Policy Analysis



What is the least cost option to deliver 6GW of wave + 6GW of tidal stream by 2050?

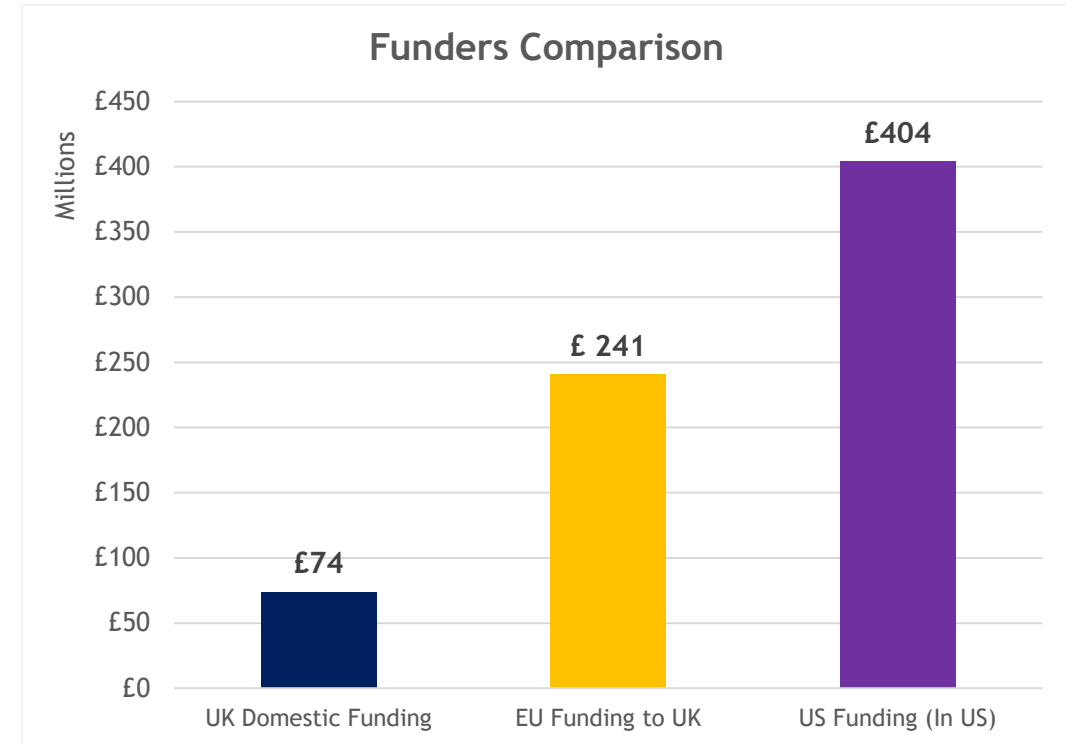
- Technology Push Funding Analysis
- Market Pull Funding Analysis

Existing Policies – Technology Push (Wave & Tidal Stream)

Between 2017-2022

Total funding in UK: **£315 Million**

- Total Funding from EU: **£241 Million**
 - Total Funding from UK: **£74 Million**

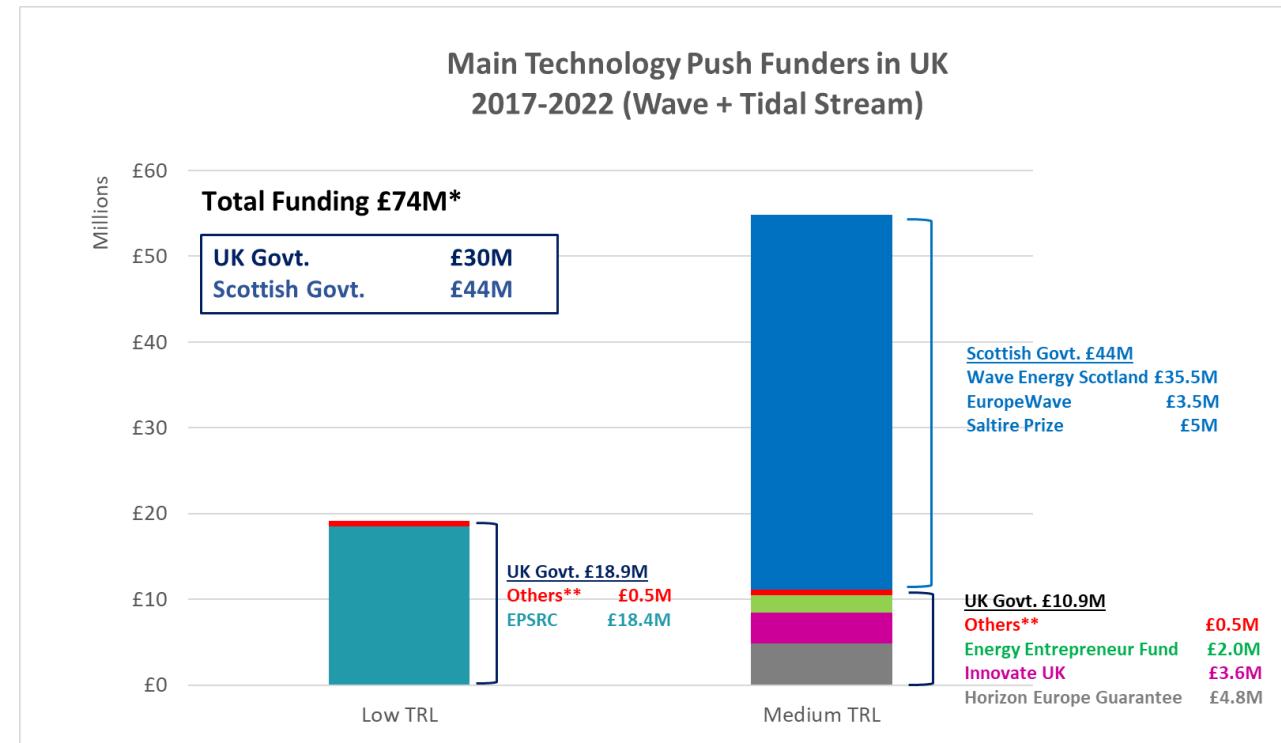


Existing Polices – Technology Push (Wave & Tidal Stream)

Between 2017-2022

Total Domestic Funding: **£74M**

- Total Funding from Scottish Govt.: **£44M**
 - Total Funding for H.E. Guarantee: **£4.8M**
 - Total Funding from UK Govt.: **£25.2M**
 - EPSRC: **£18.4M**
 - Innovate UK: **£3.6M**
 - Energy Entrepreneurs Fund: **£2M**
 - Others: **£1M**

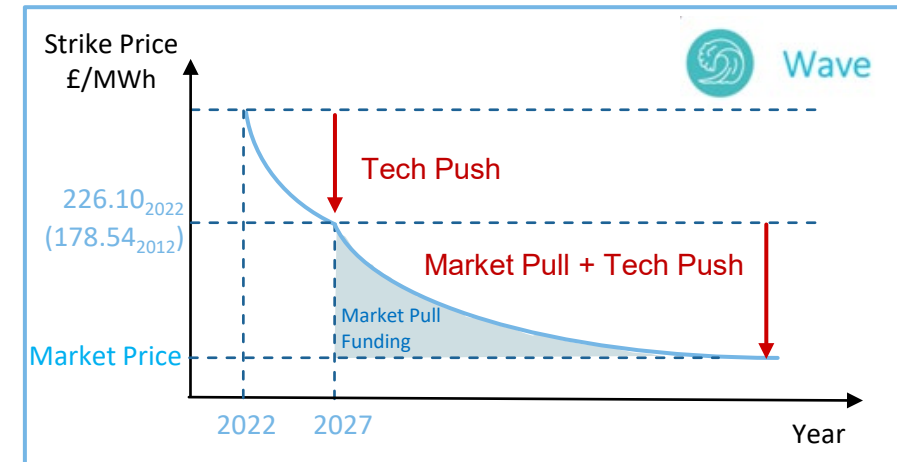
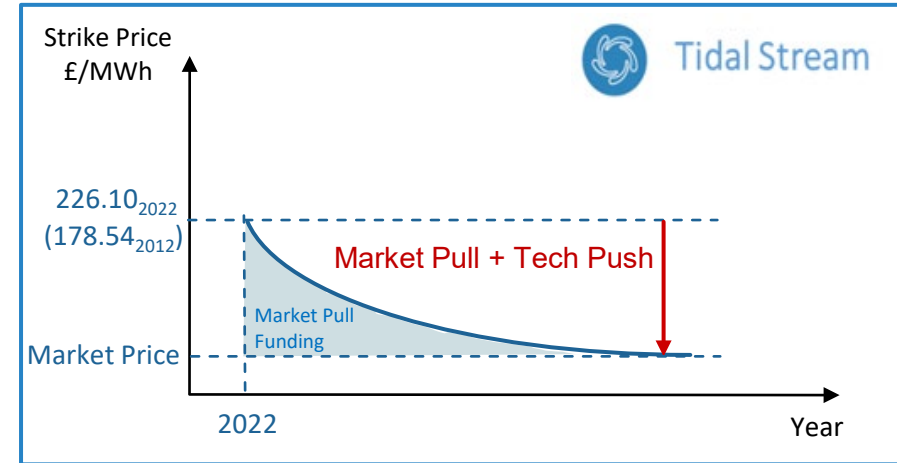


Future Scenario Analysis – Market Pull

CfD mechanism

- Tidal Stream
 - ❖ From 2022 (CfD4 - Strike Price **£178.54/MWh**)

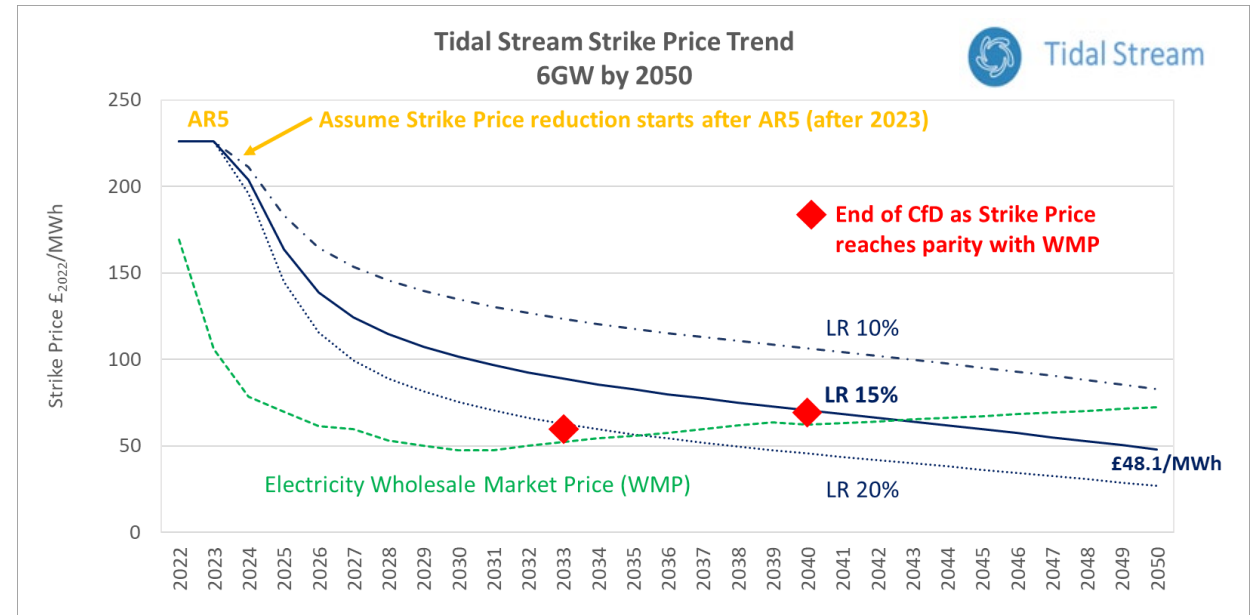
- Wave (Assumption)
 - ❖ From 2027 (CfD9 - Strike Price **£178.54/MWh**)



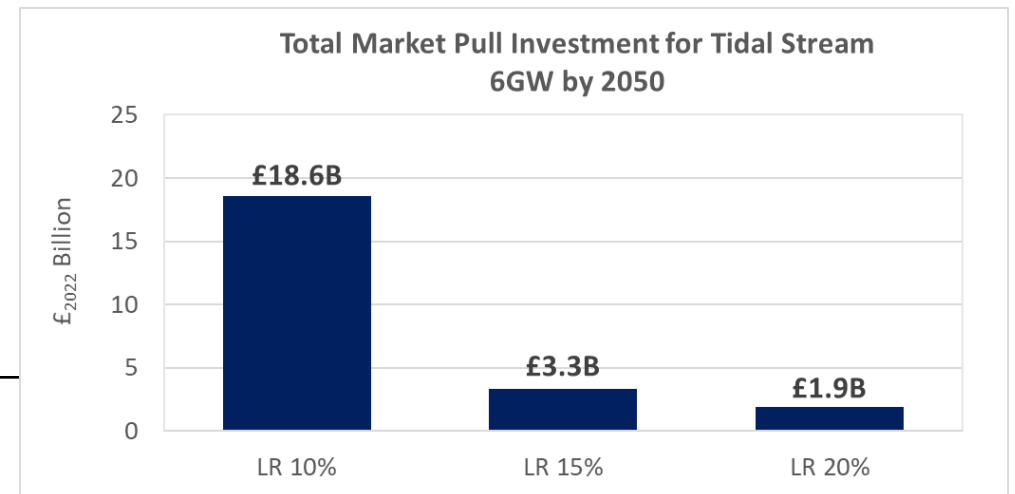
Market Pull – Future Scenario Analysis (Tidal Stream)

□ Total Market Pull Investment

- LR 10% - Suboptimal £18.6Bn
- **LR 15% - Preferable** **£ 3.3Bn**
- LR 20% - Ambitious £ 1.9Bn



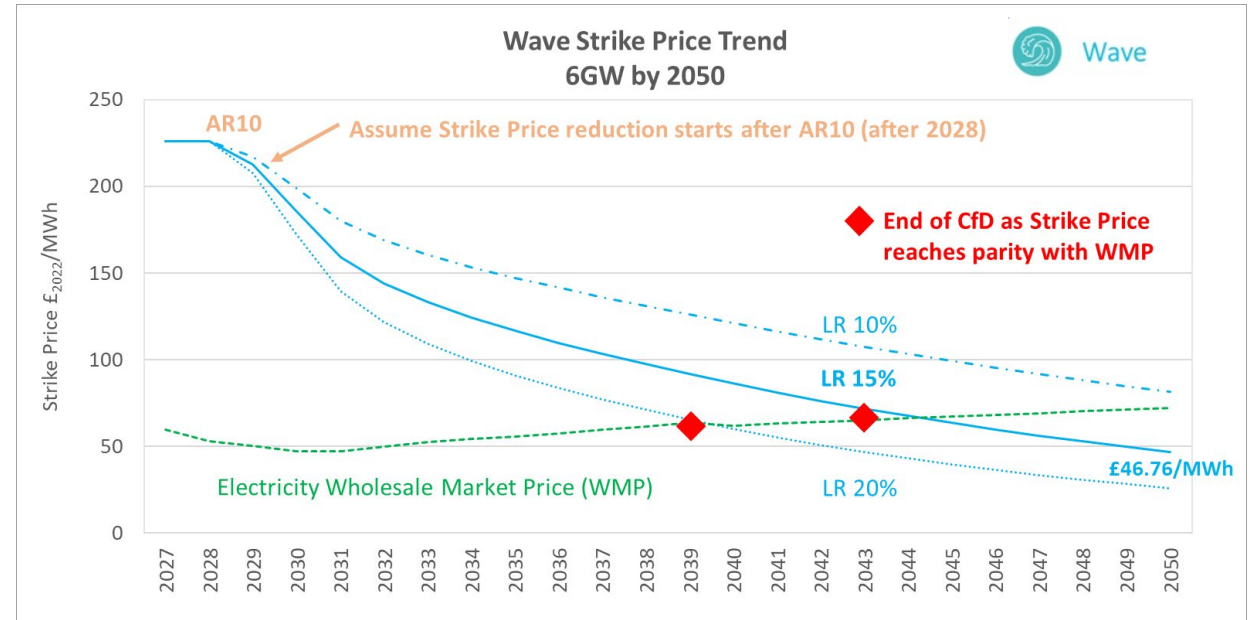
Technology Push investment greatly reduces total Market Pull investment



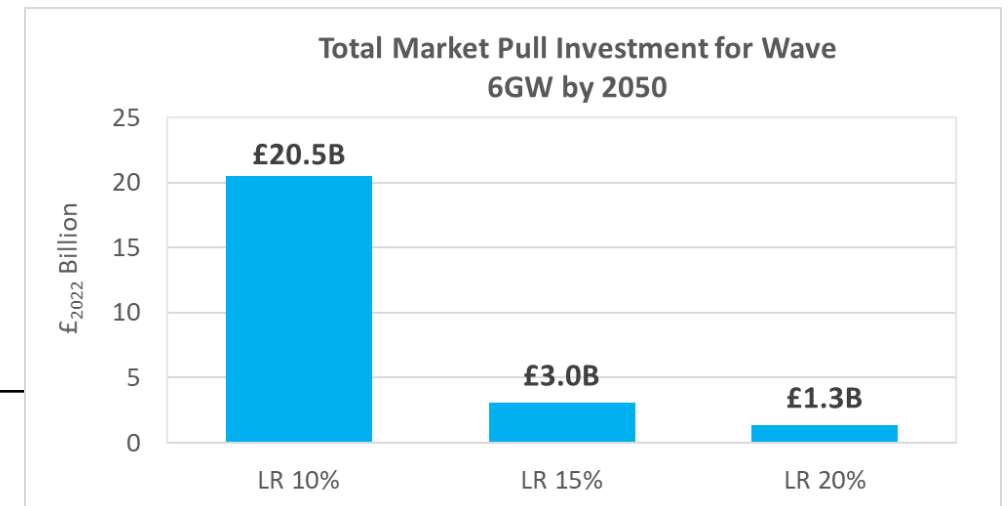
Market Pull – Future Scenario Analysis (Wave)

□ Total Market Pull Investment

- LR 10% - Suboptimal £20.5Bn
- **LR 15% - Preferable £ 3.0Bn**
- LR 20% - Ambitious £ 1.3Bn



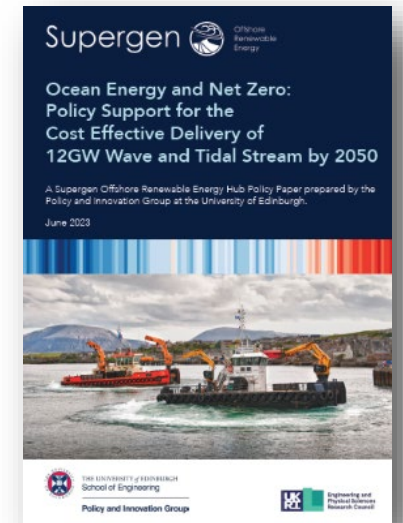
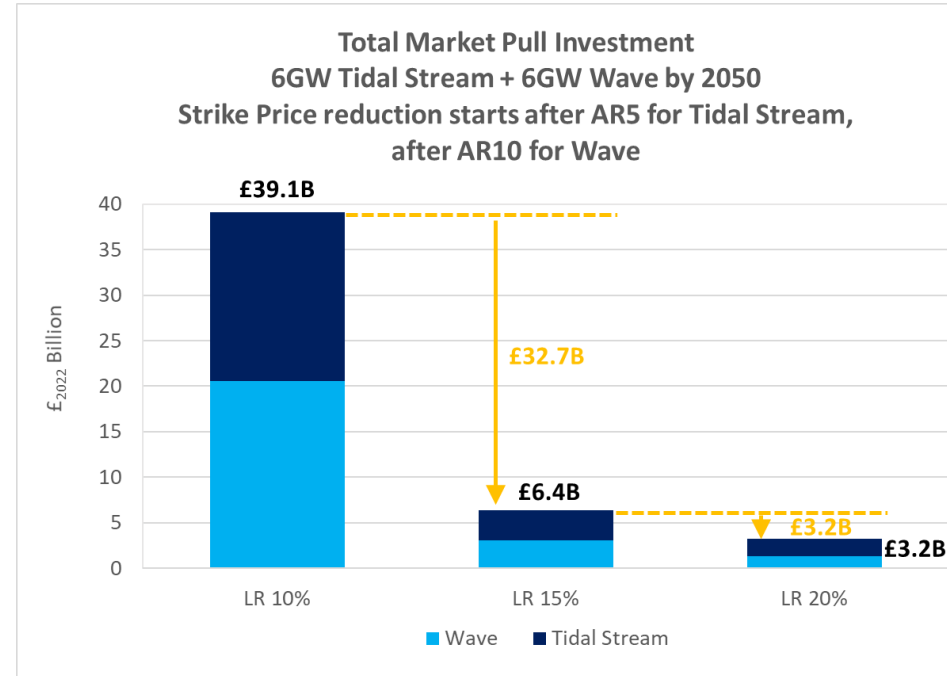
Technology Push investment greatly reduces total Market Pull investment



Market Pull – Future Scenario Analysis

Summary

- ❑ Total Market Pull investment is greatly affected by the rate of cost reduction
- ❑ Rate of cost reduction is greatly affected by Technology Push Investment



Remember High TRL UK - £3.6 million

Research and Innovation Analysis

Supergen Offshore Renewable Energy

Research and Innovation for Wave and Tidal Stream in the UK and EU

A 2023 Summary

A Supergen Offshore Renewable Energy Hub Policy Paper prepared by the Policy and Innovation Group at the University of Edinburgh
 July 2023

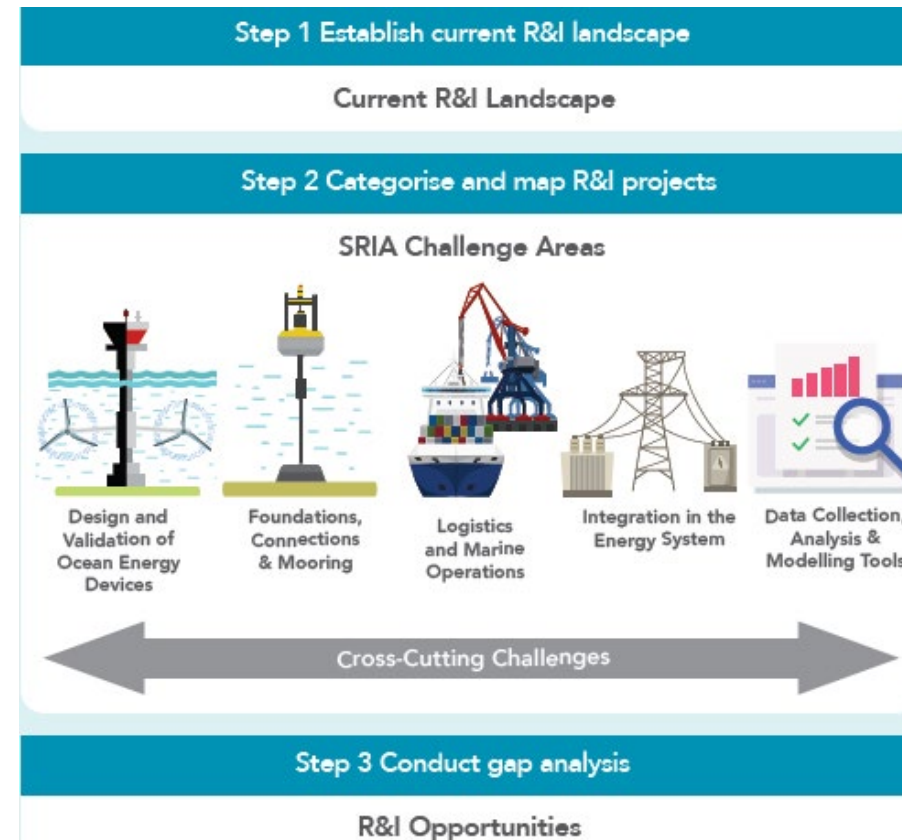


 THE UNIVERSITY of EDINBURGH School of Engineering
 Policy and Innovation Group

 EERA
 OceanSET

 UK EPSRC
 Engineering and Physical Sciences Research Council

How should UK strategise future R&I funding?



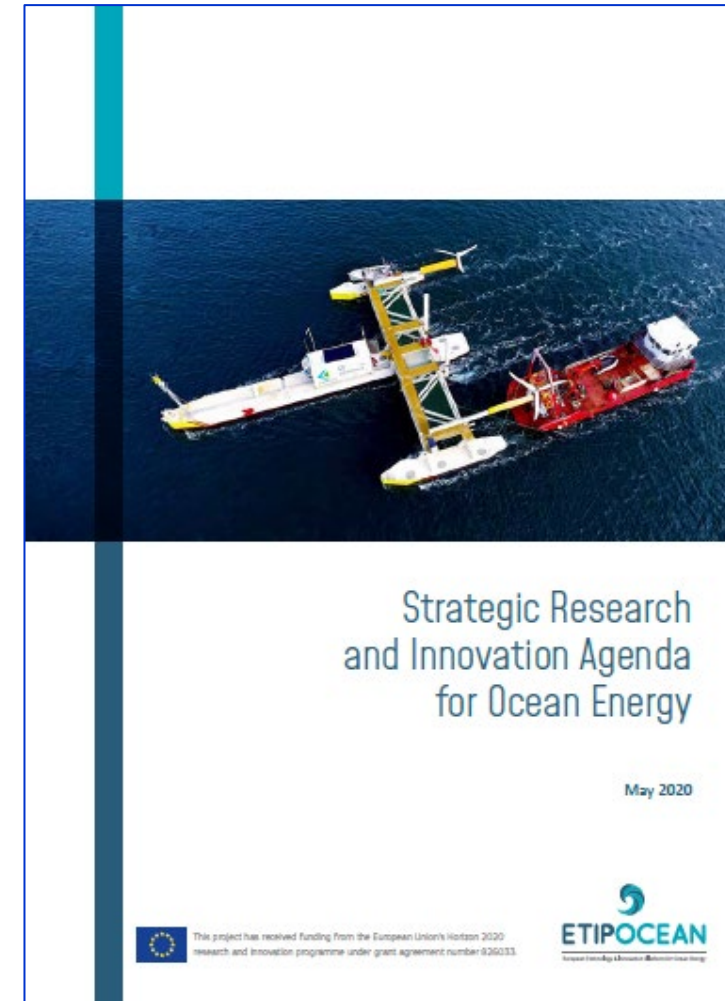
Demonstration & Innovation Analysis

SRIA Recommendation (Baseline)

Period	2021-2025
Recommended Budget	664 €m*
Suggested Number of Projects	148*

6 Challenge Areas

- ❑ Design and validation of ocean energy devices
- ❑ Foundations, Connections and Mooring
- ❑ Logistics and Marine Operations
- ❑ Integration in the Energy System
- ❑ Data Collection & Analysis and Modelling Tools
- ❑ Cross-cutting Challenges



Research & Innovation Analysis

6 Challenge Areas - 17 Priority Topics

For each priority topic, the SRIA defines:

- Scope
- Applicability (wave, tidal, others)
- Expected impact
- TRL (entry/exit)
- **Budget Required (number and size of projects)**

Challenge Areas	Priority Topics	Number and Size of actions ^a	Budget Required (million €)	
Design and Validation of Ocean Energy Devices	Demonstration of ocean energy devices to increase experience in real sea conditions	Around 10 large and 10 medium	150	700
	Demonstration of ocean energy technology at array scale	7 Projects at array scale	350	
	Improvement and demonstration of PTO and control systems	Around 10 medium and 5 small	60	
	Application of innovative materials from other sectors	A few medium and around 5 small	25	
	Development of novel wave energy devices	Around 10 small and 5 medium	45	
	Improvement of tidal blades and rotor	Around 5 medium and a few large	55	
	Development of other ocean energy technologies	A few medium	15	
Foundations, Connections and Mooring	Advanced mooring and connection systems for floating ocean energy devices	Around 10 medium	50	85
	Improvement and demonstration of foundations and connection systems for bottom-fixed ocean energy devices	Around 5 medium and around 5 small	35	
Logistics and Marine Operations	Optimisation of maritime logistics and operations	Around 5 medium and a few large	55	80
	Instrumentation for condition monitoring and predictive maintenance	A few medium and around 5 small	25	
Integration in the Energy System	Developing and demonstrating near-commercial application of ocean energy in niche markets	Several medium and a few large	80	86
	Quantifying and demonstrating grid-scale benefits of ocean energy	A few small	6	
Data Collection & Analysis and Modelling Tools	Marine observation modelling and forecasting to optimise design and operation of ocean energy devices	A few medium and around 5 small	25	35
	Open-data repository for ocean energy	Around 5 small	10	
Cross-cutting Challenges	Improvement of the environmental and socioeconomic impacts of ocean energy	Around 5 small	10	20
	Standardisation and certification	Around 5 small	10	
			TOTAL	1,006

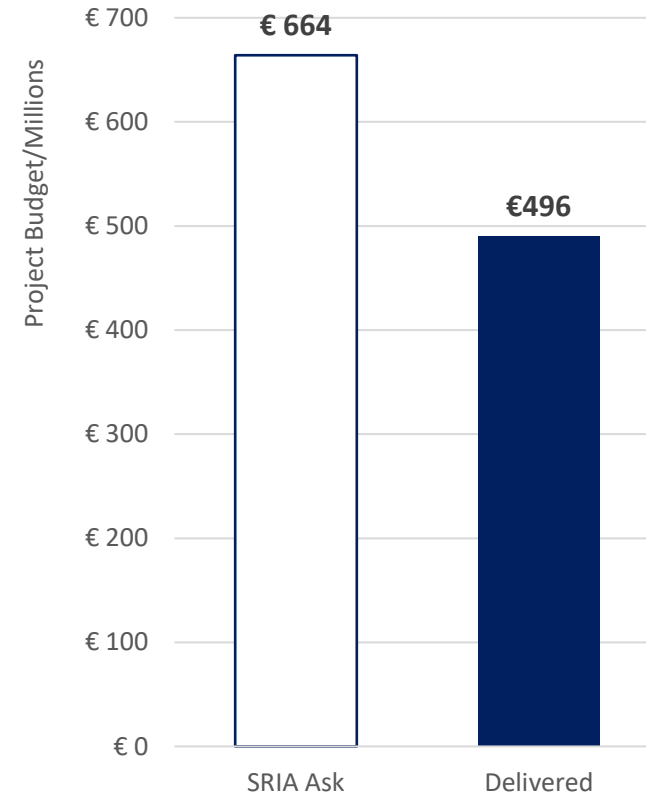


Research & Innovation Analysis

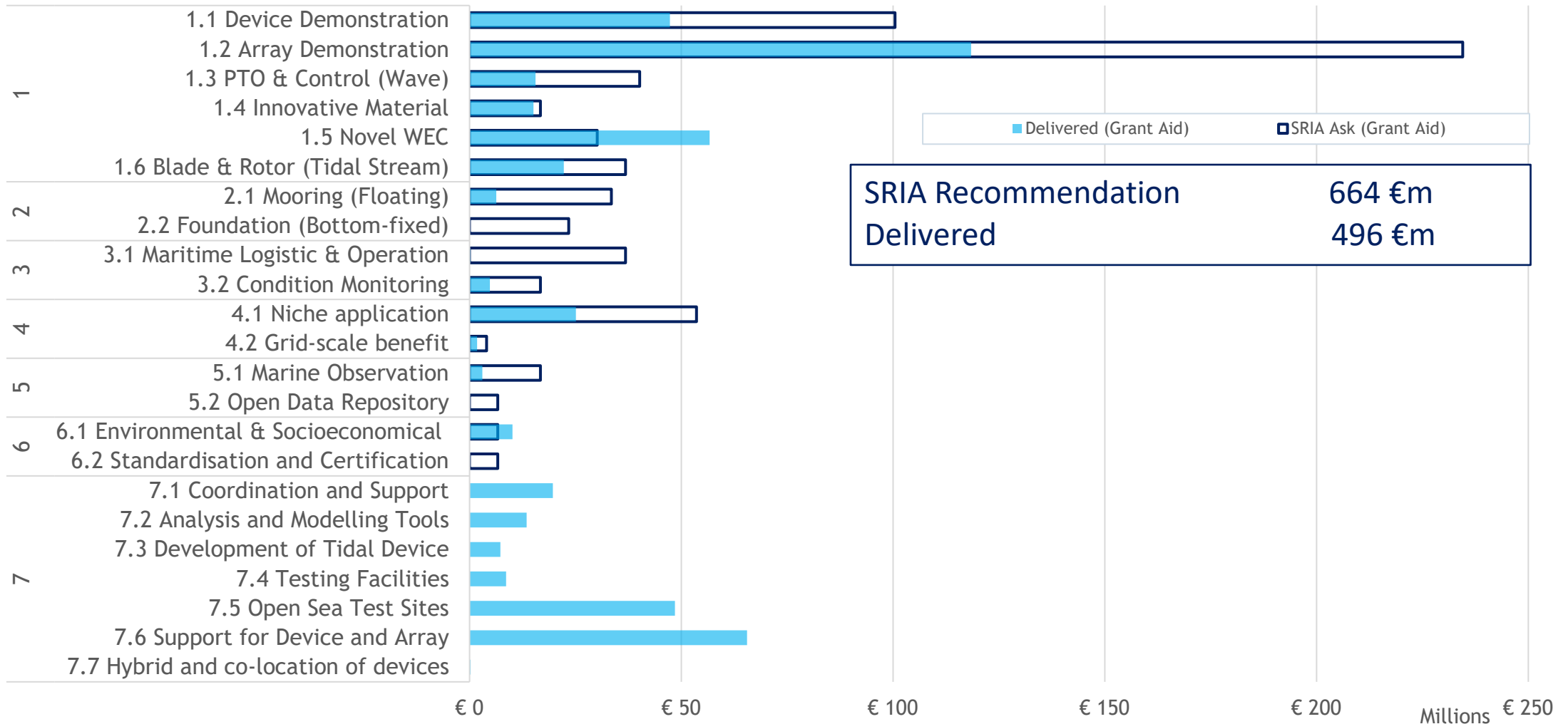
Current Status

	<u>Budget</u>
SRIA Ask	664€m
Delivered	496€m

Budget (Public Funding)



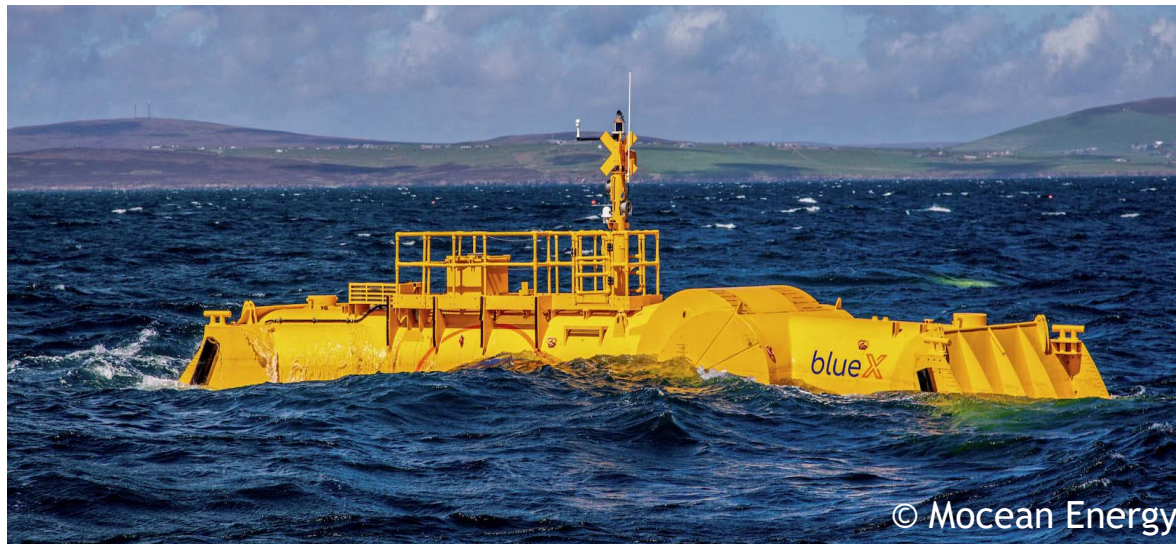
Current Status – Budget



SRIA Analysis – Challenge Area 1, Priority Topic 1

1. Design and Validation of Ocean Energy Device

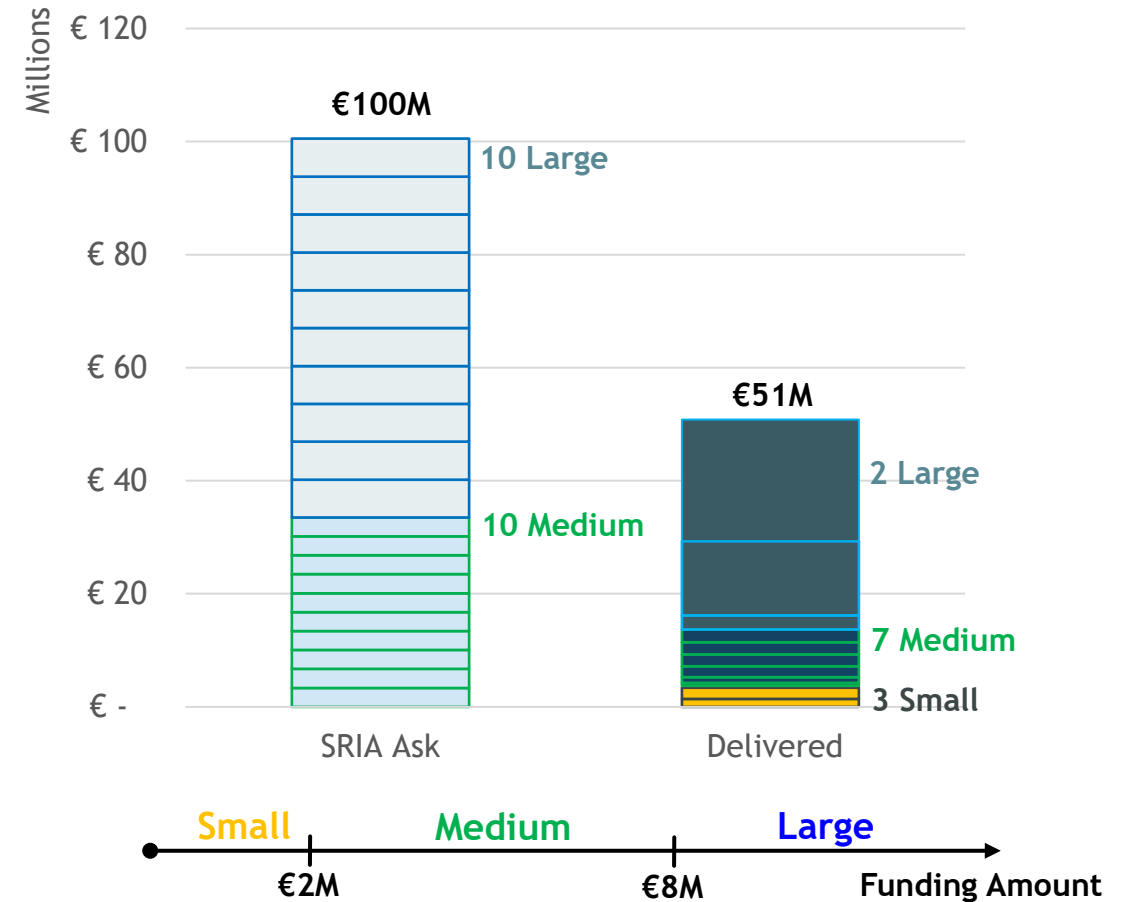
1.1 Demonstration of ocean energy devices to increase experience in real sea conditions



1 Design and Validation of Ocean Energy Device

1.1 Demonstration of ocean energy devices to increase experience in real sea conditions

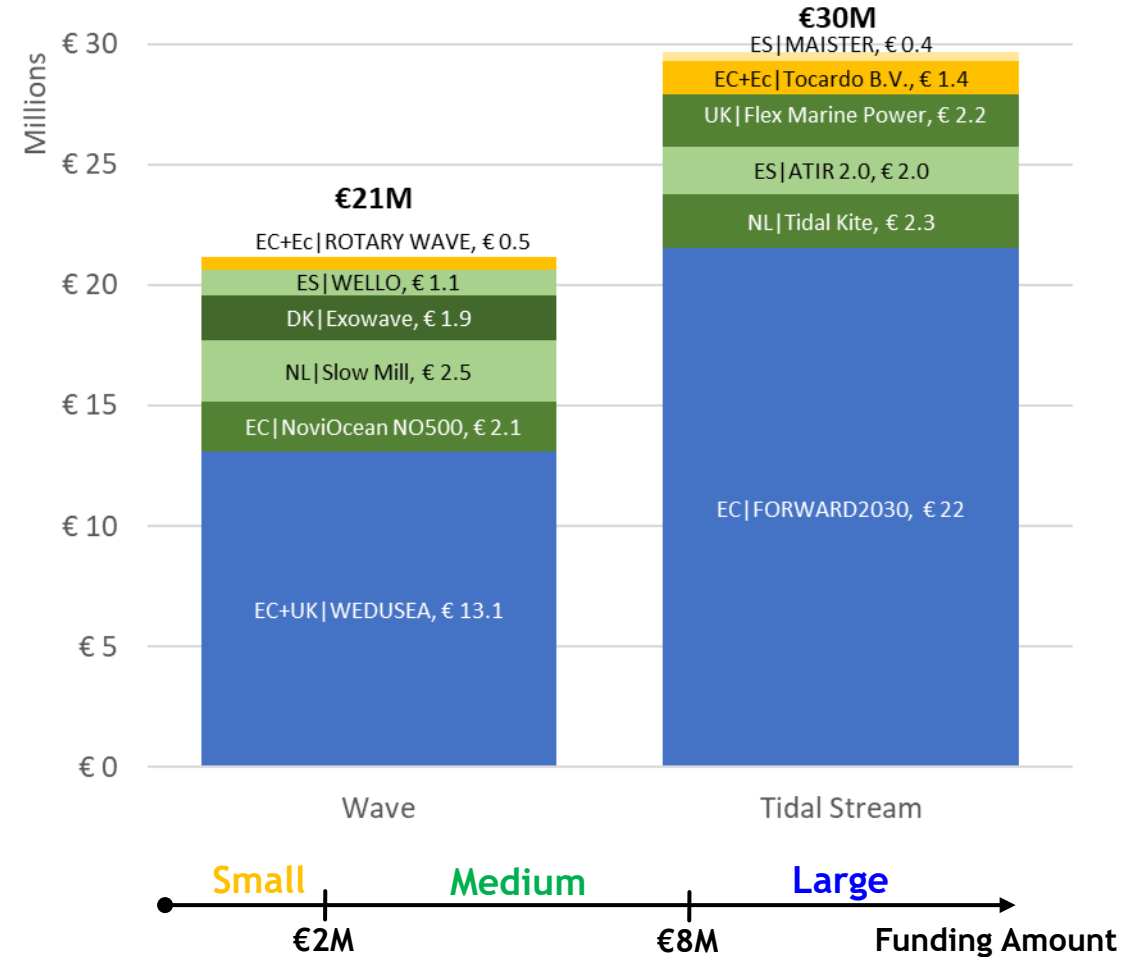
	<u>No Projects</u>	<u>Budget</u>
<u>SRIA Ask</u>		
• Medium	10	
• Large	10	
Total	20	100 €m
<u>Delivered</u>		
• Small	3	
• Medium	7	
• Large	2	
Total	12	51 €m



1 Design and Validation of Ocean Energy Device

1.1 Demonstration of ocean energy devices to increase experience in real sea conditions

	<u>No Projects</u>
<u>SRIA Ask</u>	20
<u>Delivered</u>	12
• Wave	6
• Tidal Stream	6



1 Design and Validation of Ocean Energy Device

1.1 Demonstration of ocean energy devices to increase experience in real sea conditions

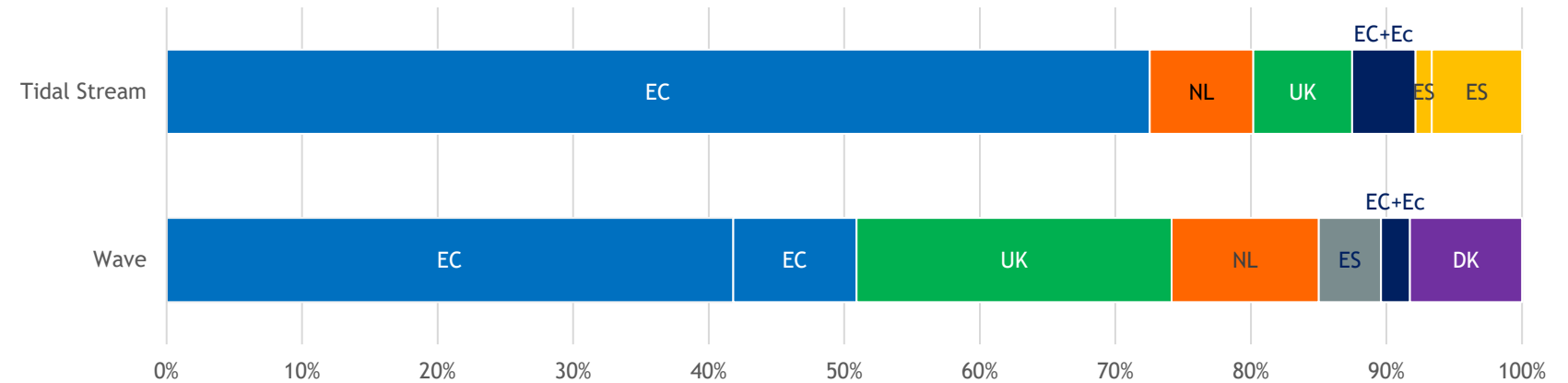
Main Funders

Tidal Stream

- EC

Wave

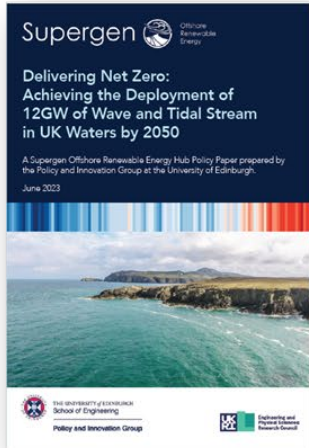
- EC



EC - European Commission
Ec - European countries

Summary: the policy makers tool box

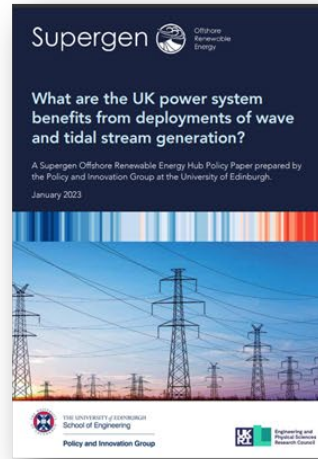
Deployment Modelling



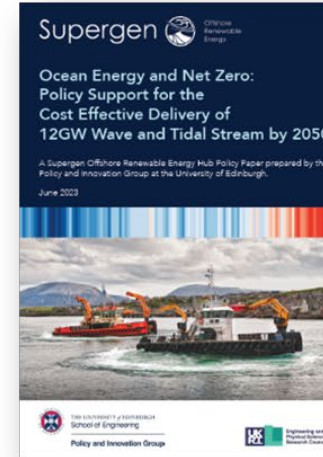
Economic Benefit (GVA)



Systems Benefit



Value of Innovation



Areas of Innovation



- **6GW Wave + 6GW Tidal Stream – Net Zero**
- **Socioeconomic benefit – Just Transition**
- **System Benefit - Enabler of offshore wind**
- **Consistent Demonstration and Innovation is essential**



Panel session 1

Unlocking growth targets

What changes are needed within policy and practice to enable targets for 2030 and beyond to be achieved within the context of ORE? And what is the role of the Supergen ORE Hub

Policy interventions to deliver regional green growth in FLOW projects in the Celtic Sea region

Dr Michael Warner, Director
Centre for Local Content Innovation

BEIS - CfD, OWMIS, CCUS, Hydrogen Council
DIT - Prosperity Fund, NSO, HSCGS
TCE - FLOW Celtic Sea
US - offshore wind regulation
Canada- offshore energy regulation
BG Group - Local Content and Supply Chain Sustainability Manager
Imperial College - PhD - Strategic EIA

Celtic Sea FLOW Summit 2023
June 7th, Exeter



Photo Credit: Aker Offshore Wind

Example from Trinidad: Local Platform Fabrication



91.3% of fabrication contract value as Local Content

- Fabrication and structural labour (100% Local Content)
- Construction management (55%)
- Marine supply and tow vessels (100%)
- Electrical and instrumentation labour (59%)
- 99% of labour was national, of which 27% from region



BG GROUP

Anchor developer
(contracting strategy)

FLUOR

Anchor EPCm
(risk liabilities)

Int/Local JV
(QA/QC)



Policy interventions to deliver AMBITIOUS Case 62%

68% > 95% of sub-structures:
regional EPCm/EPCI (absorb liability of liquidated damages), steel floater fabrication, steel plate production

38% > 87% of electrical infrastructure: offshore substation fabrication and installation; export cables manufacture under OEM license

0% > 40% turbines: blade and tower/TP manufacture under OEM license

35% > 50% O&M: steel plate supply; larger fabrication works; contractor hub

- **New FLOWMIS for component manufacturing** (blades, towers, nacelle) - £500m+ to cover Scotland and Celtic Sea, able to attract OEM component manufacturers. Apply 'rank applicants + reapply for Phase 2'
- **FLOW infrastructure tax incentives** aligned with freeport benefits, but without need for freeport status: Capital Allowance, Structures and Build Allowance
- **Regional anchor EPCm/ECPI - international contractors able to absorb liquidated damages risk;** prime service contractors ('Mooring as a Service')
- **Model EPCI contract tenders:** 'K' factor Supply Chain Plans aligned with five '*inherent local advantages*'
- **Incentivise corporate and private wire PPAs** to generate forward demand

Policy interventions to

Dr Michael Warner, Director
ation

CELTIC SEA POWER NEXT STEPS:

'COORDINATED POLICY PLANNING ACTION'

CORNWALL FLOW COMMISSION

Council
, HSCGS
Celtic Sea
regulation
regulation
Manager
egic EIA

Celtic Sea FLOW Summit 2023
June 7th, Exeter

Photo Credit: Aker Offshore Wind



Who We Are



Renewable Risk Advisers is a specialist insurance broker and risk management / insurance claims consultancy with an unparalleled depth of experience of risk mitigation in the renewable energy sector.

We work with clients developing and operating projects and for new technologies in the following sectors:

- floating wind
- fixed offshore wind
- onshore wind
- wave
- tidal
- floating solar
- onshore commercial solar
- hydro
- geothermal
- ocean-thermal
- Hydrogen and alternative fuels
- waste-to-energy
- biomass
- biofuels
- energy storage

“Our goal is to be seen as trusted advisers and a valuable part of our clients’ broader project team.”



What We Do

Alternative Risk Strategies

Our original thinking led to EU/UK funded research into the cascading effect of insurability on bankability, to enhance investment through the leveraging effect of risk averse debt on equity. We are actively encouraging the establishment of alternative insurance mechanisms for clients experiencing difficulties in the insurance market.

Strategic Risk/Insurance Advisory

Our offering as strategic risk/insurance advisers supports projects from origination to financial close, through construction and throughout the life of an operational asset. When required by clients we support market placements and the preparation of necessary documentation, including bespoke policy wordings.

Post-Loss Advisory

Our post-loss advisory services seek to frame the structure and pace of a claim, through effective agenda-setting and corporate diplomacy. Familiarity with the two-tier 'Steering Committee' and 'Task Force' approach helps align objectives between Employer, Contractor, and Lead Insurers before settling on fair and equitable terms.



Thought Leadership Workstreams


SBRI Government challenges. Ideas from business. Innovative solutions.

UKRI Innovate UK

Renewable Risk Advisers

PROSPECT LAW


CATAPULT Offshore Renewable Energy



**The Insurance-Debt Nexus:
How risk policy keeps renewable energy bankable**

Project Number: 10031487

**Feasibility Study on an OFTO Mutual
Post Phase 2 Bid Revision**



FLOATING OFFSHORE WIND CENTRE OF EXCELLENCE | Delivered by **CATAPULT** Offshore Renewable Energy

FLOATING OFFSHORE WIND CENTRE OF EXCELLENCE

FLOATING OFFSHORE WIND – PROJECT INSURANCE




Photo courtesy of Principle Power. Artist: DOCK90

Author: Renewable Risk Advisers, Miller
Date: 29/11/2022
Reference: PN000476-RPT-002
Status: Private (Client use only)

In partnership with:
Renewable Risk Advisers **Miller**

TIGER TIDAL STREAM INDUSTRY ENERGISER

EUROPEAN UNION European Regional Development Fund


CATAPULT Offshore Renewable Energy

Renewable Risk Advisers

Ocean Energy Europe **Miller** **PROSPECT LAW**

The Ocean Energy Accelerator


V0.4
October 2022

Interreg 
France (Channel) England
European Regional Development Fund





Orbital's 02: winner of two AR4 contract, EMEC, Orkney, Scotland



Magallanes Renovables

Magallanes: winner of an AR4 contract, Morlais, Anglesey, Wales

Simec Atlantis: winner of an AR 4 contract, MeyGen, Scotland





Nova Innovation: Bluemull Sound, Shetland, Scotland



Minesto kites

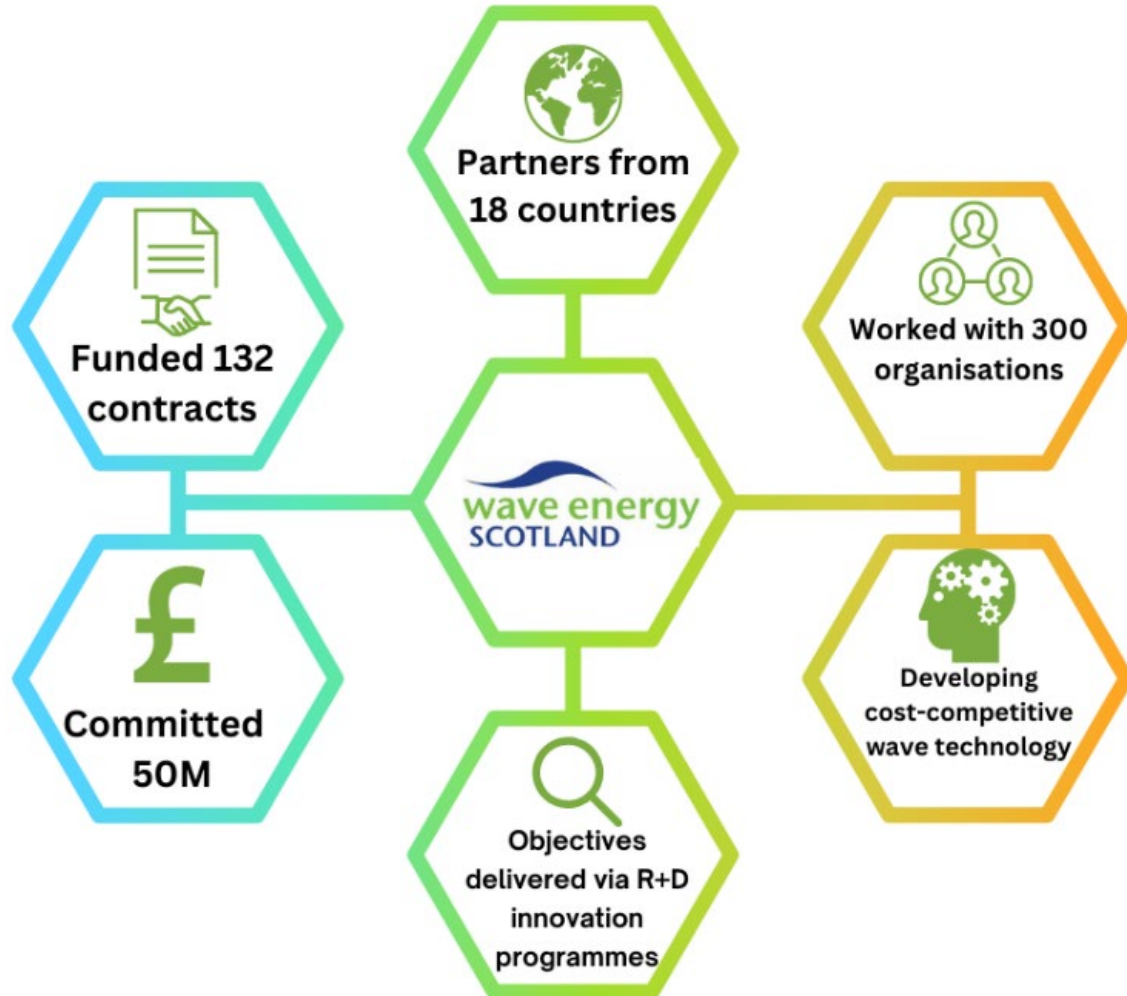
Mocean: Blue X



CorPower Ocean



Wave Energy Scotland - Introduction



- Established in November 2014 as a subsidiary of Highlands and Islands Enterprise



- Funded by the Scottish Government



Funded 5 competitive programmes:

- Power Take-Offs
- Wave Devices
- Advanced Control Systems
- Structural Materials
- Quick Connection Mooring Systems

Technology Development & Innovation



Concept development



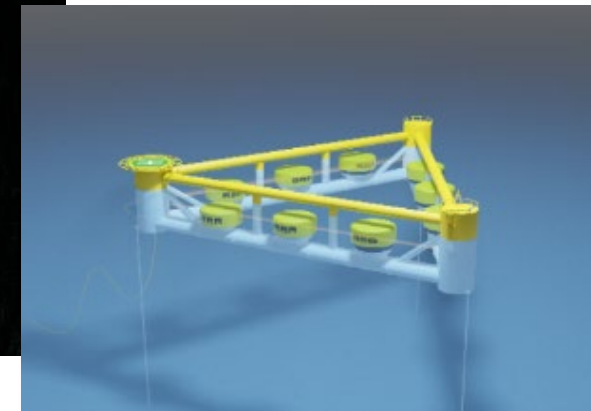
Large-scale demonstration



Proof-of-concept testing



Commercialisation

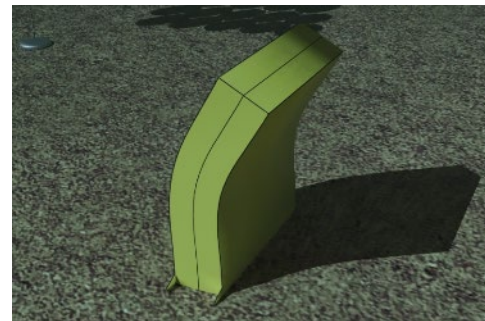
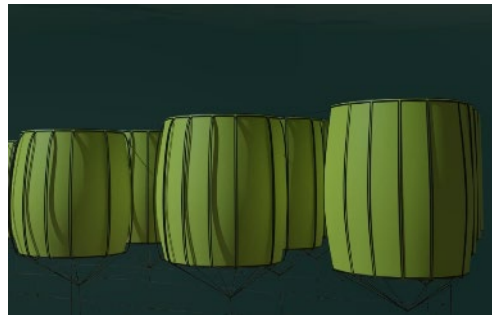


Enabling and supporting technologies



Next Generation Technologies

- Direct, distributed, flexible generation
- Electrostatic generation technologies
 - Variable capacitance metamaterials
 - Flexible properties of polymers, elastomers, and dielectric fluids
 - Dielectric Elastomer Generators (DEG) and Dielectric Fluid Generators (DFG)
- Waves → stretching, twisting, bending → electrical energy
 - A new class of wave energy converters



Panel session 1

Unlocking growth targets Q&A

What changes are needed within policy and practice to enable targets for 2030 and beyond to be achieved within the context of ORE? And what is the role of the Supergen ORE Hub