Supergen Offshore Renewable Energy

Policy and Innovation Group

Marine Renewable Energy

Benefits and Importance of Continued and Consistent Support

The Policy Makers Tool Box

Henry Jeffrey

Annual Assembly July 2023

THE UNIVERSITY of EDINBURGH
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Analysis and Reports

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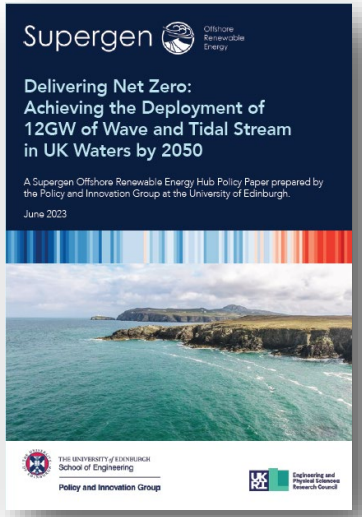
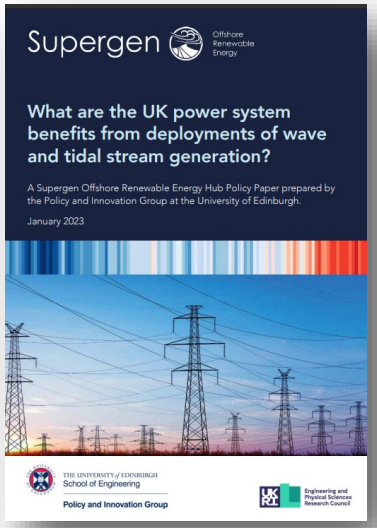
Deployment Modelling

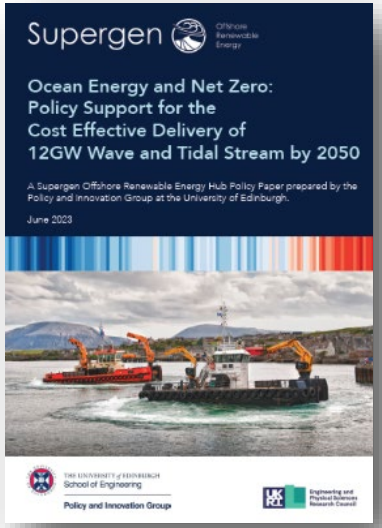


Economic Benefit (GVA)

Systems Benefit



Value of Innovation



Areas of Innovation

Deployment Modelling

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How much wave and tidal could be installed by 2050?

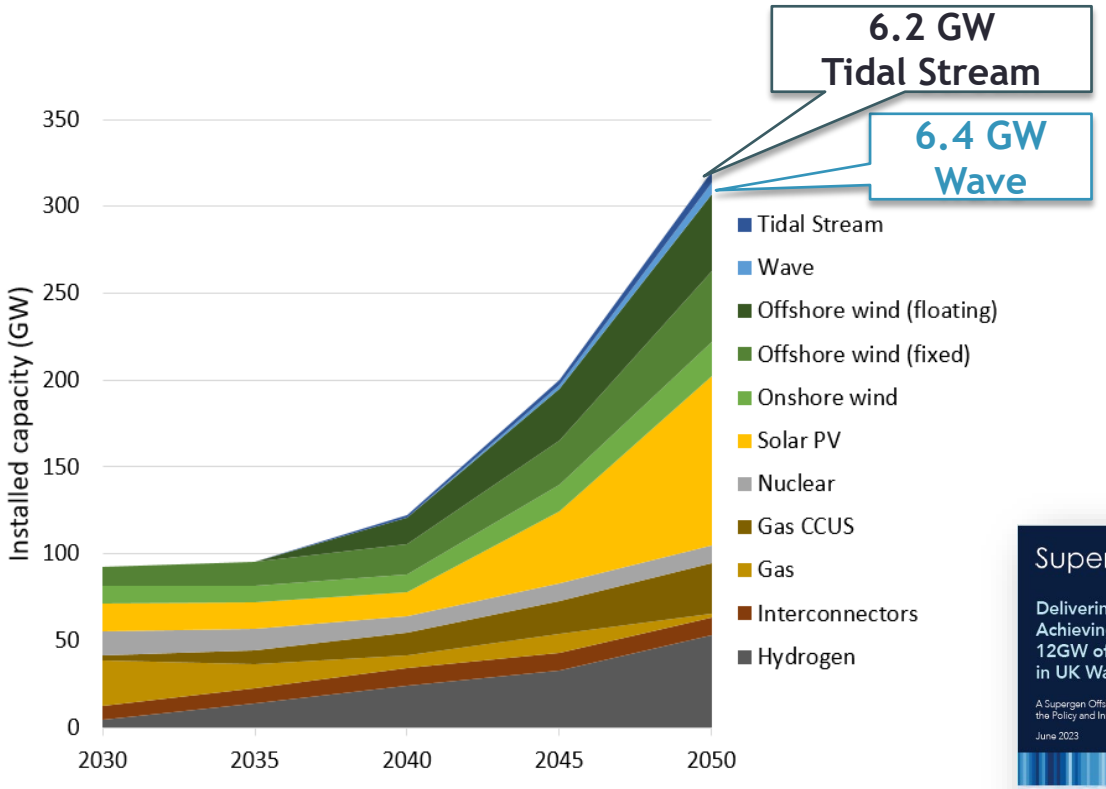
Energy planning modelling

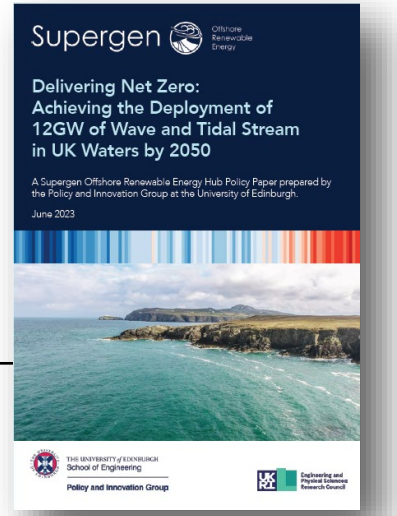
ESME Energy System Modelling Environment

CATAPULT Energy Systems

- 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





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Economic Benefit (GVA)

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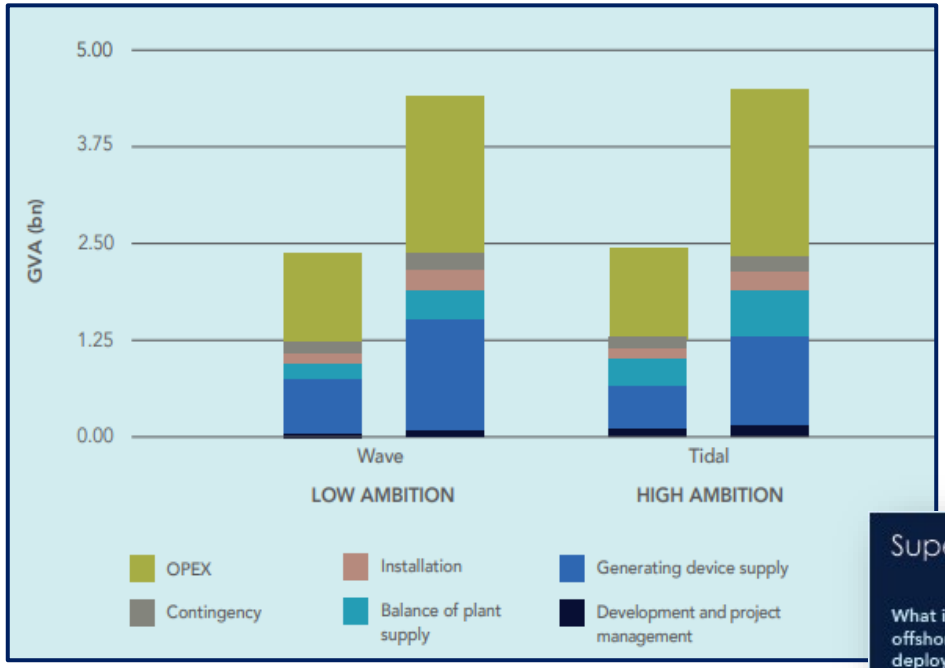
GVA Benefits:

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

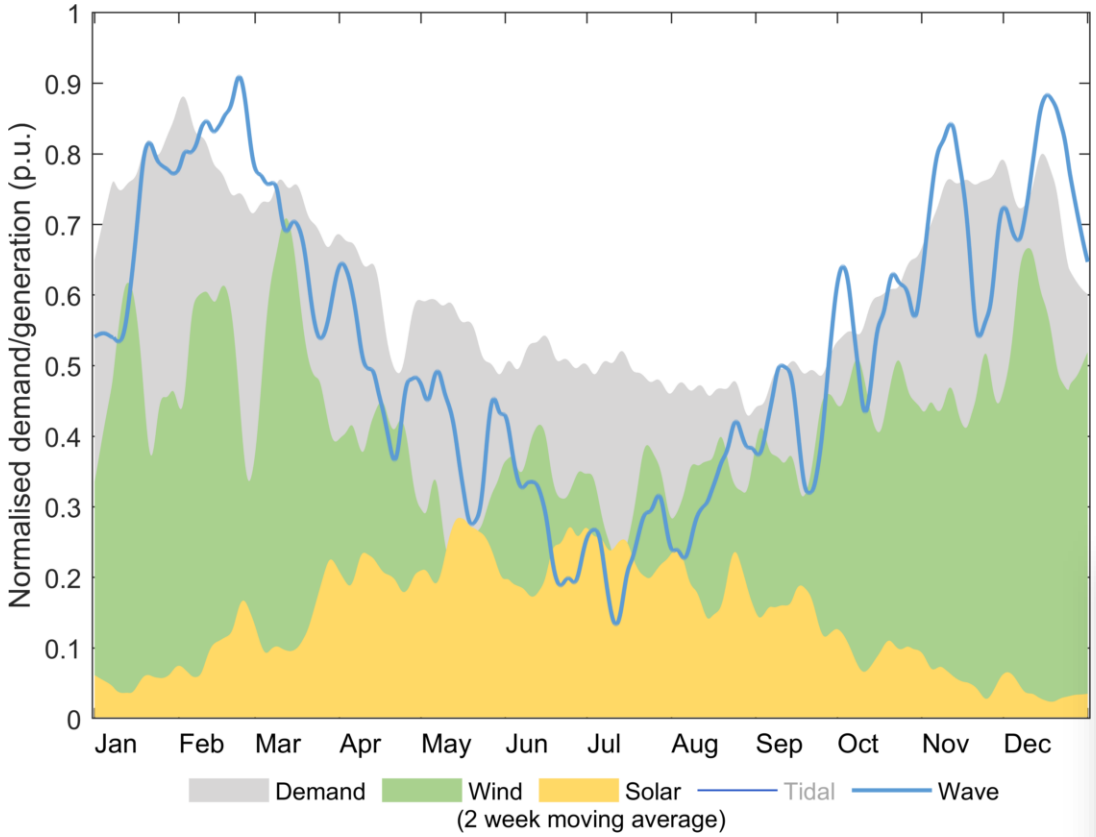


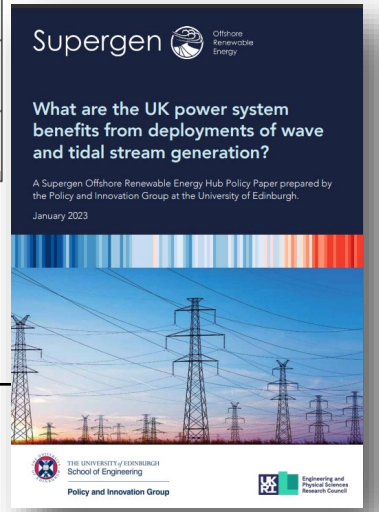
- **Great Just Transition argument !**

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

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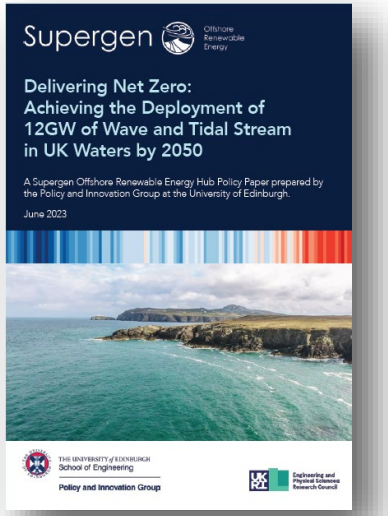
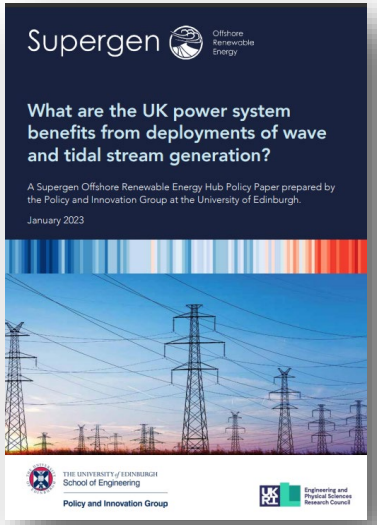
Deployment Modelling

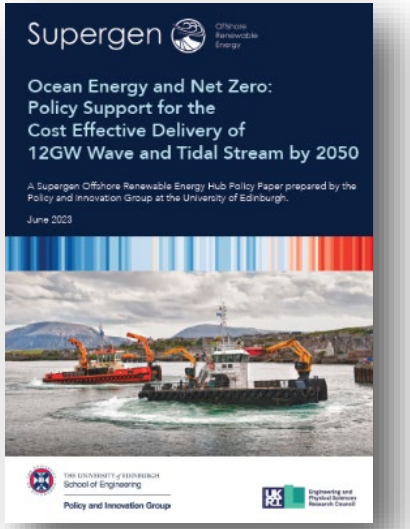


Economic Benefit (GVA)

Systems Benefit



Value of Innovation

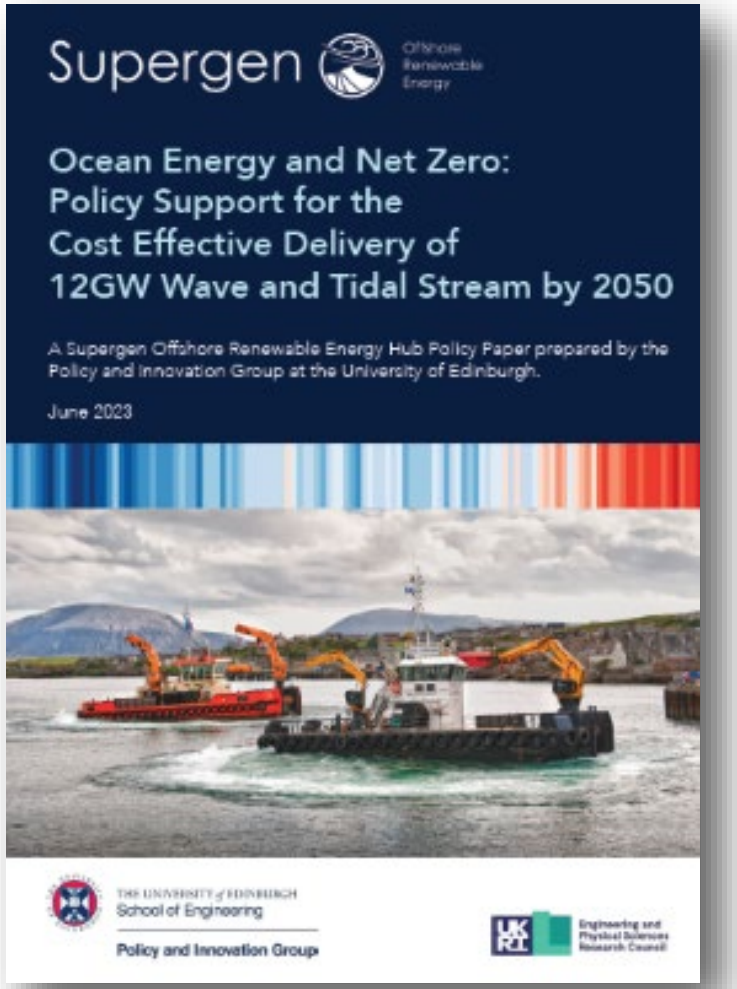


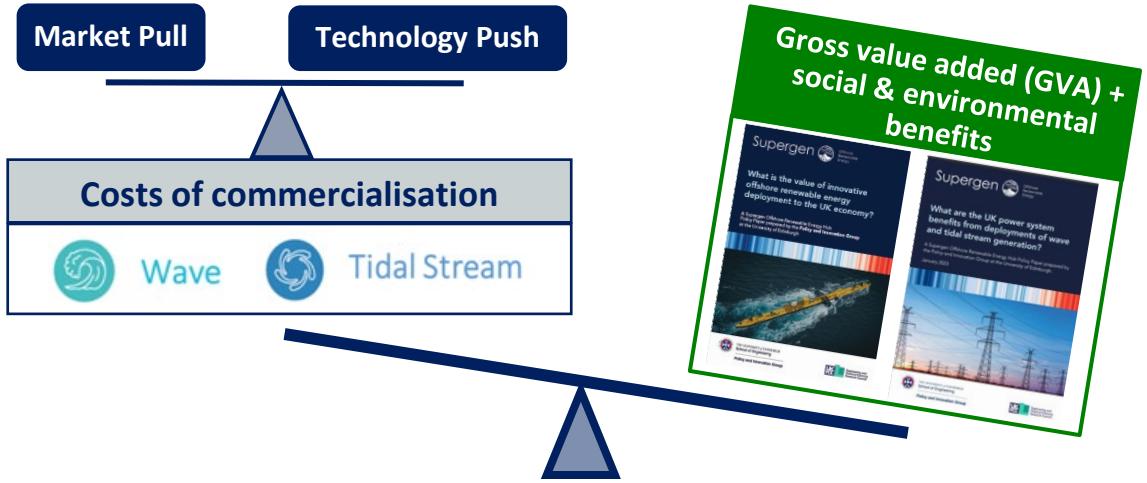
Areas of Innovation

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?

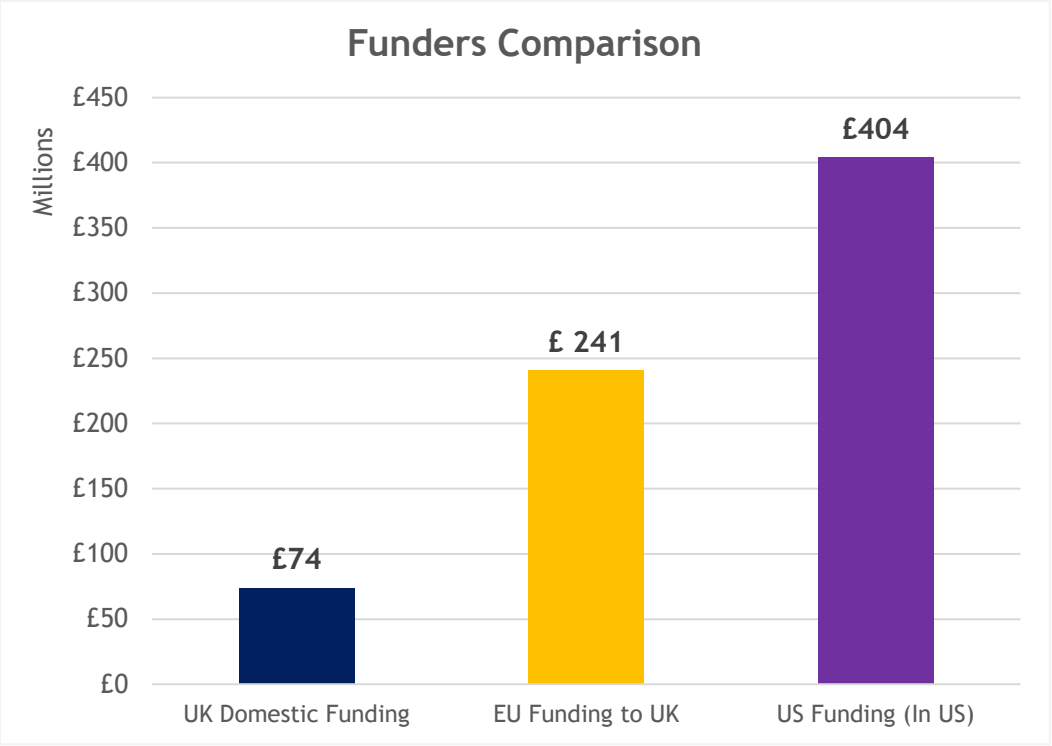
- Technology Push Funding Analysis
- Market Pull Funding Analysis

Existing Polices – 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)

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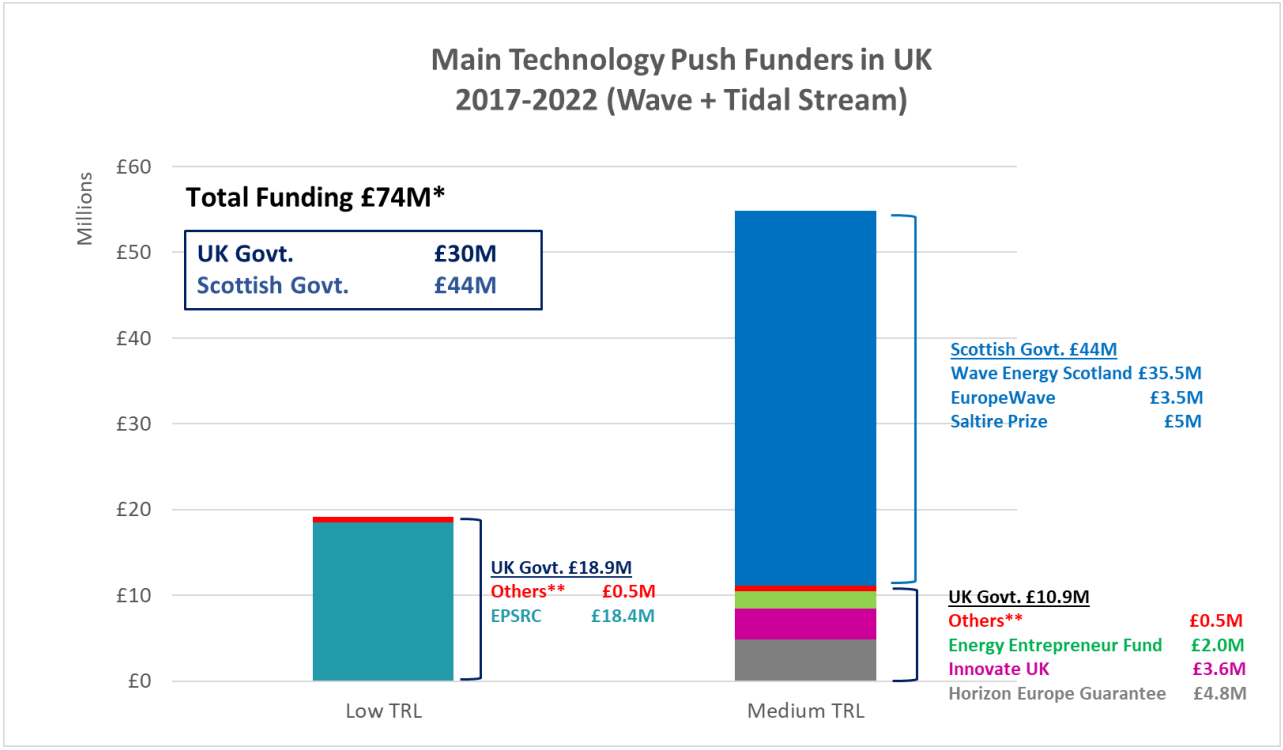
Between 2017-2022

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

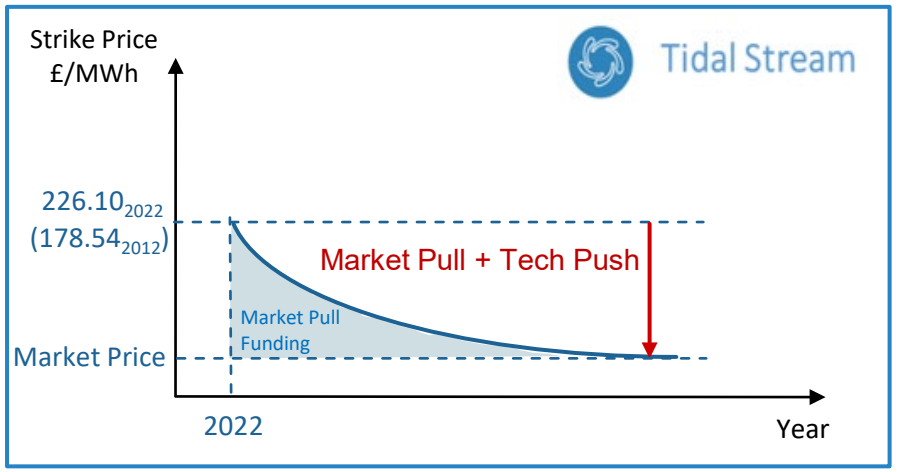


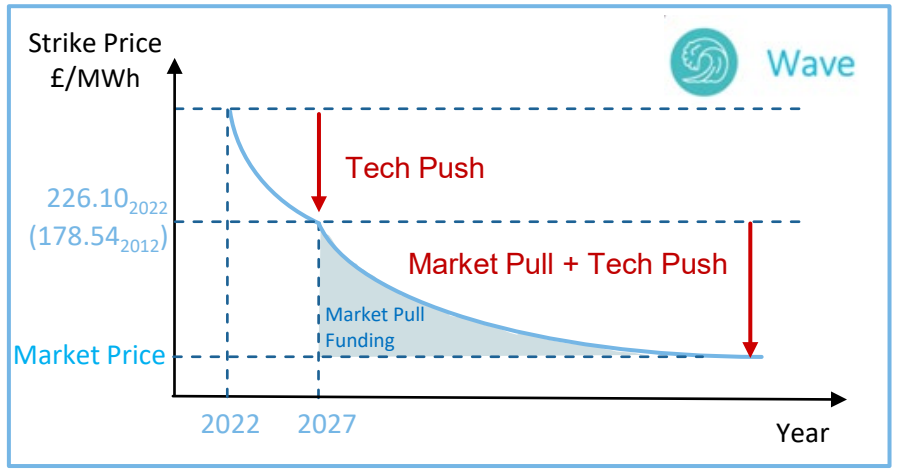
Future Scenario Analysis – Market Pull

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)

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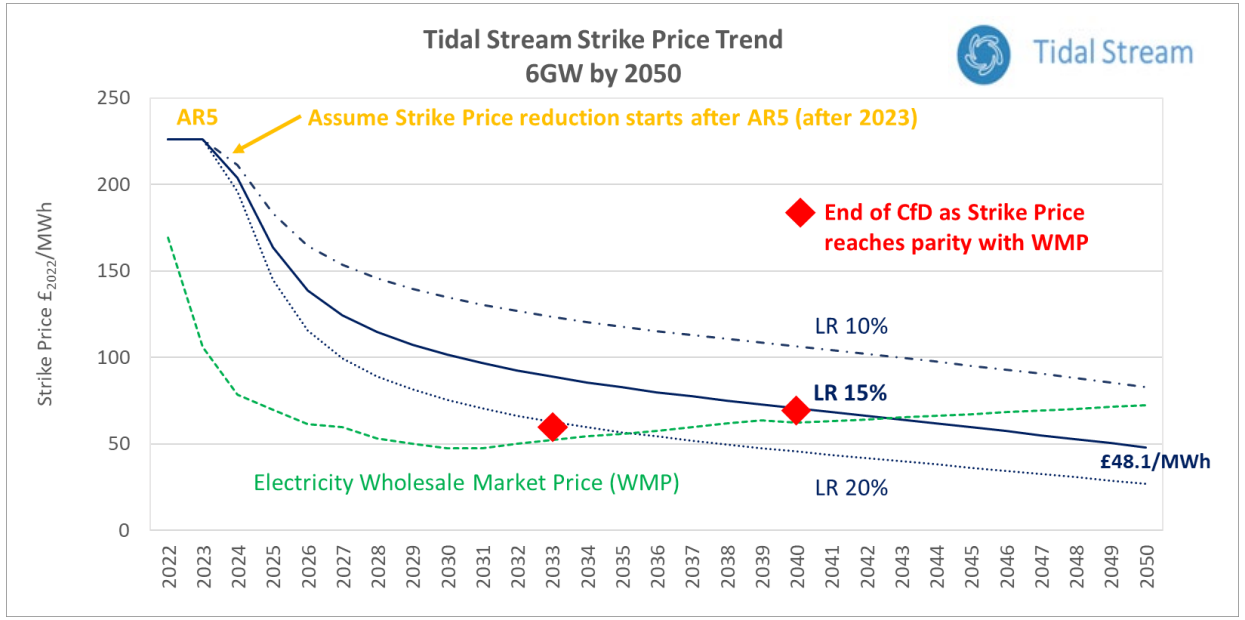
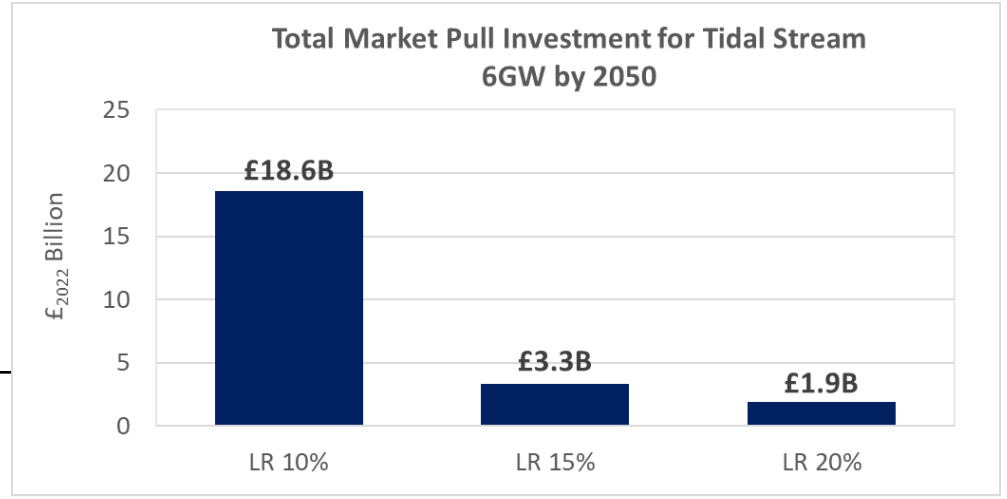
- Total Market Pull Investment
  - LR 10% - Suboptimal £18.6Bn
  - **LR 15% - Preferable £ 3.3Bn**
  - LR 20% - Ambitious £ 1.9Bn

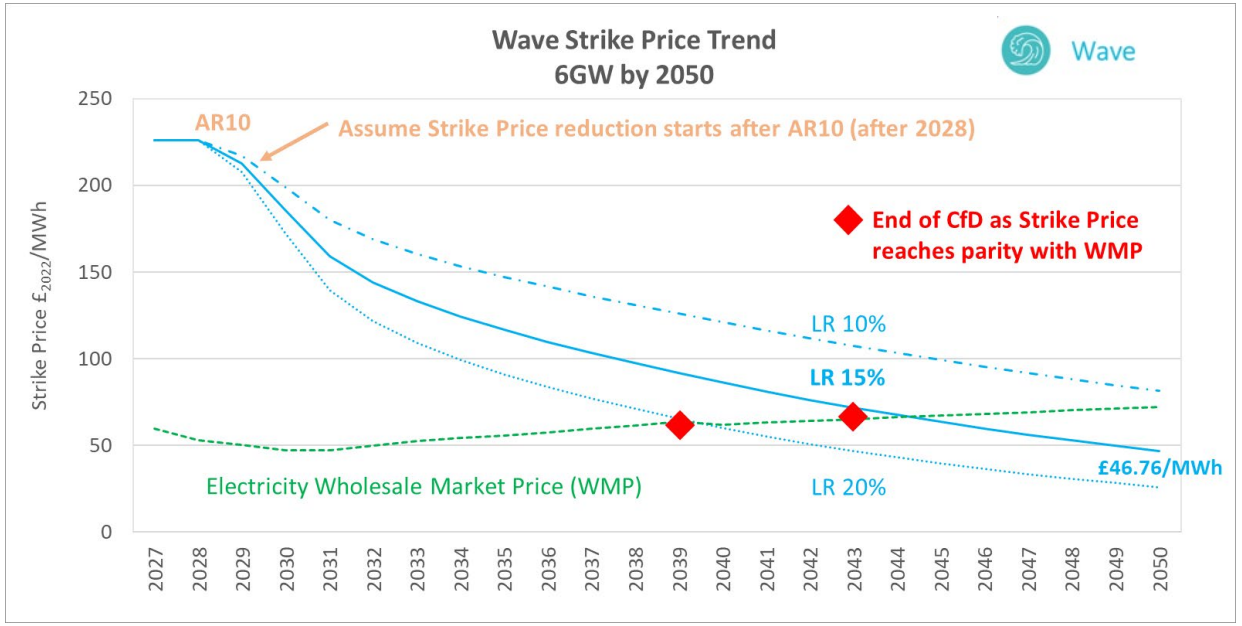


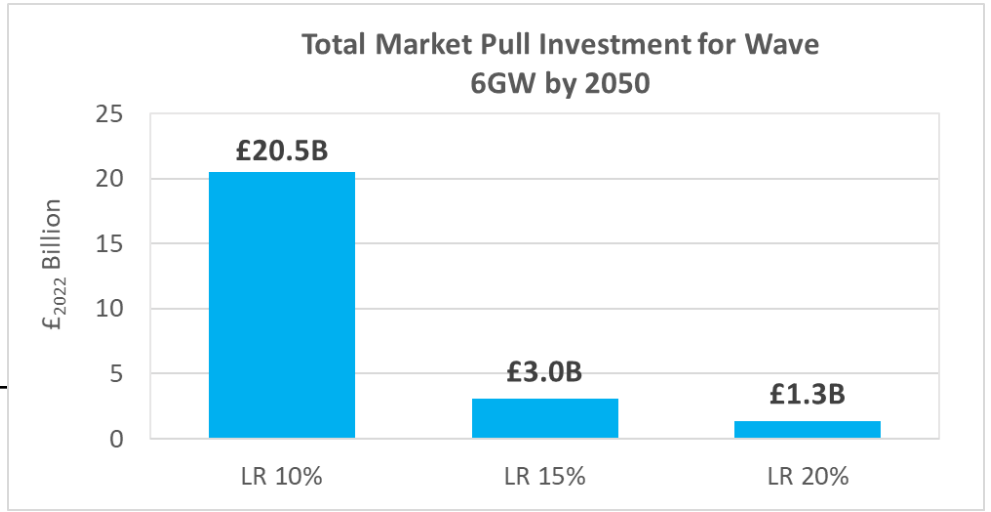
Technology Push investment greatly reduces total Market Pull investment



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

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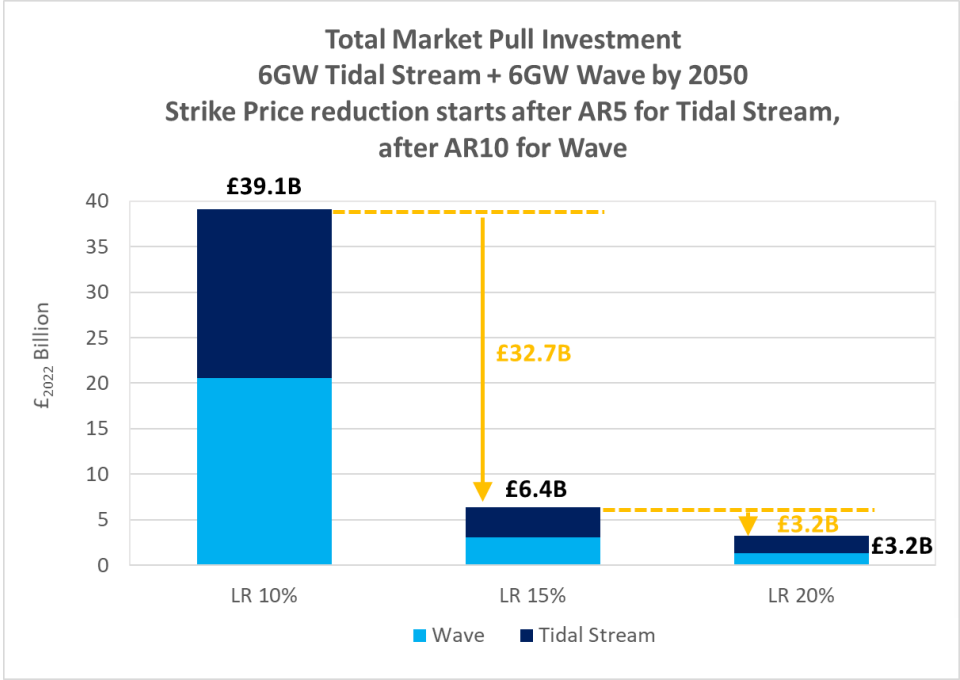
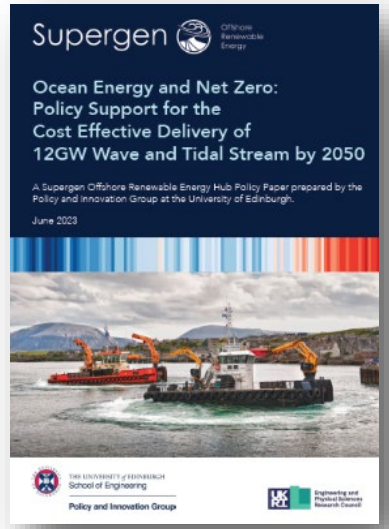
Summary

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

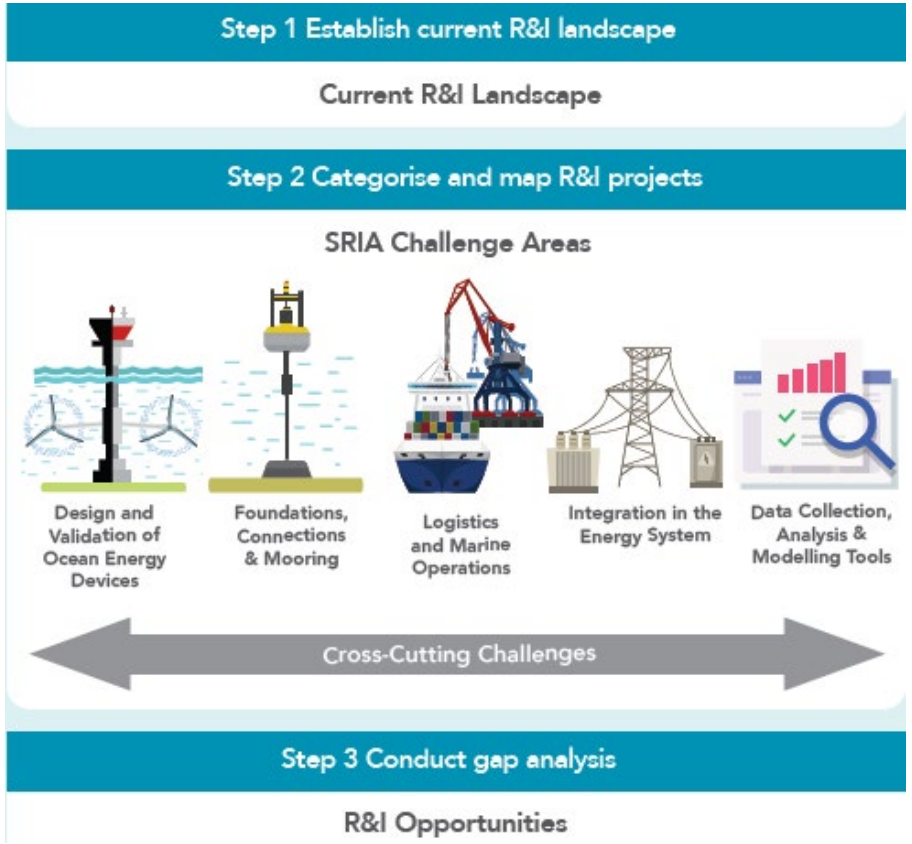




Remember High TRL UK - £3.6 million

Research and Innovation Analysis

How should UK strategise future R&I funding?



Demonstration & Innovation Analysis

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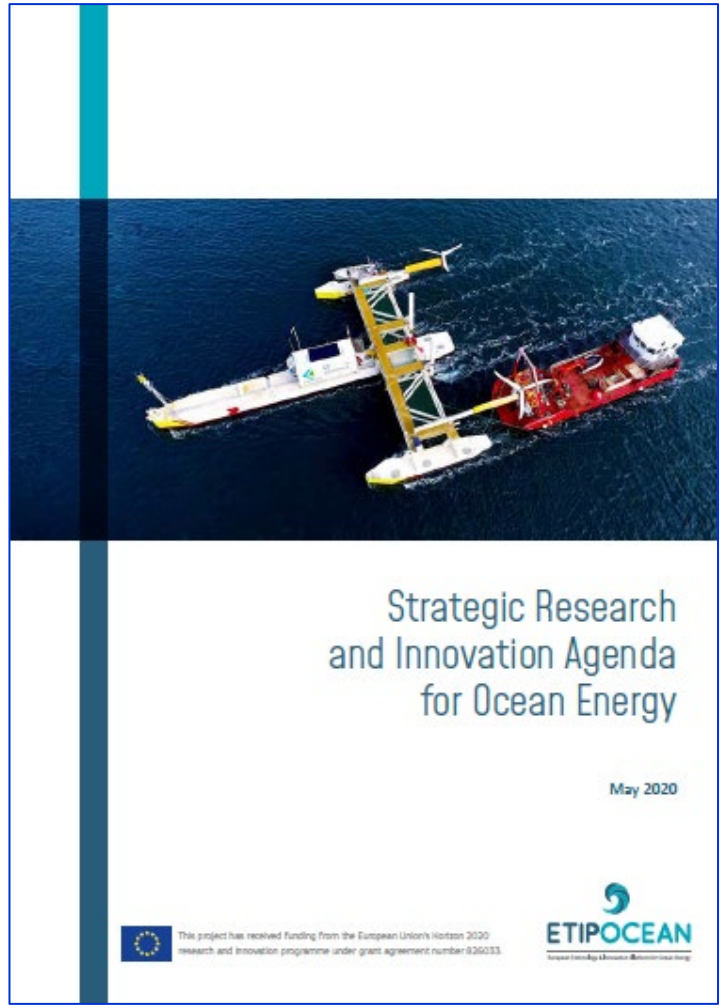
SRIA Recommendation (Baseline)

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[8]	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

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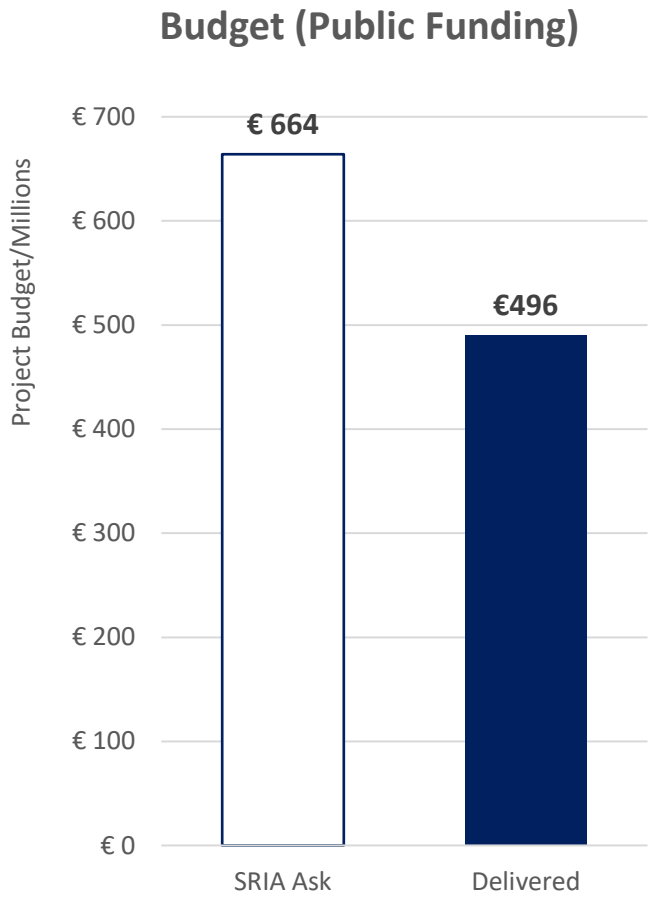
Current Status

	Budget
SRIA Ask	664€m
Delivered	496€m



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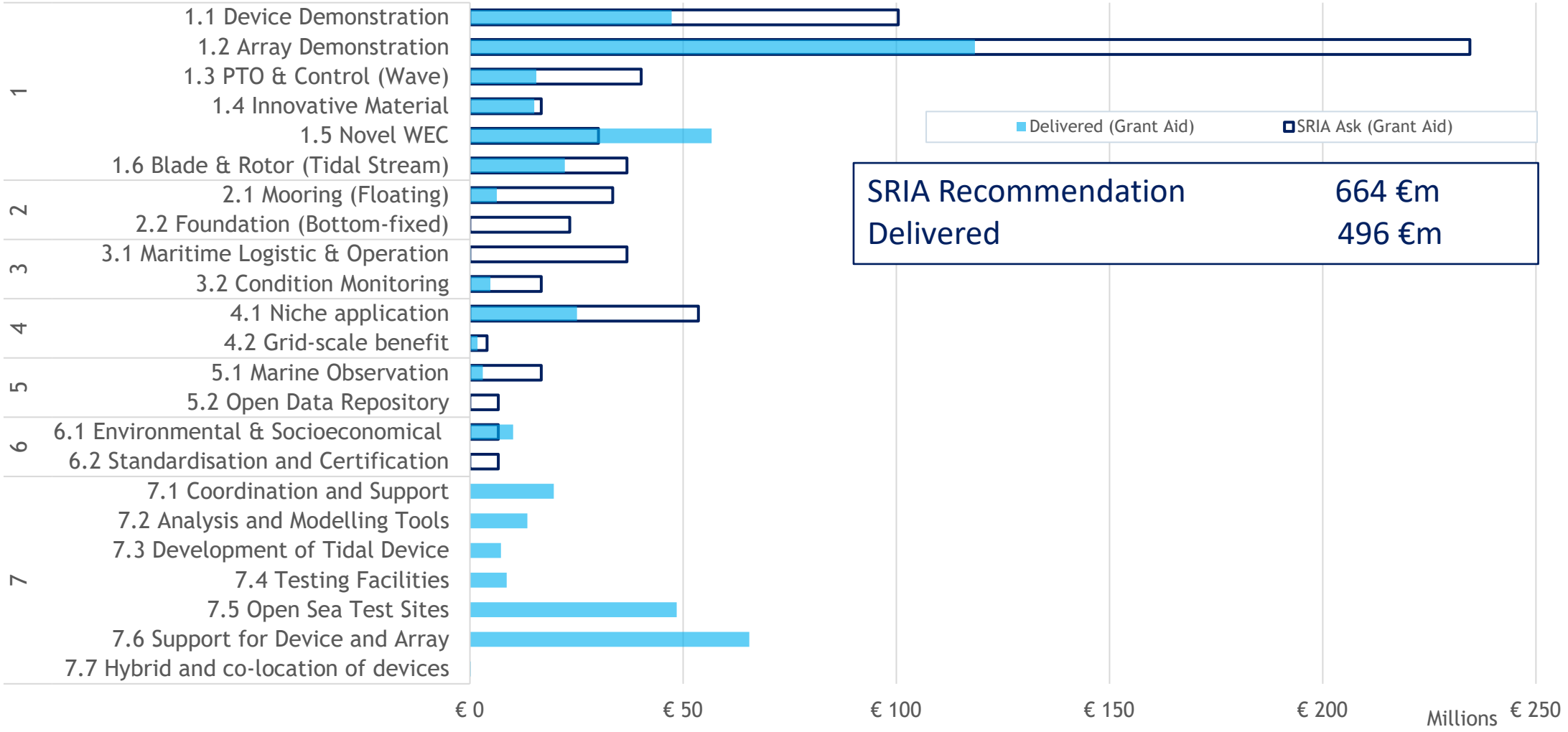
*Boundary: only includes projects/activities in wave and tidal stream we are aware of that are active within 2022-2025

Current Status – Budget



SRIA Recommendation	664 €m
Delivered	496 €m

SRIA Analysis – Challenge Area 1, Priority Topic 1

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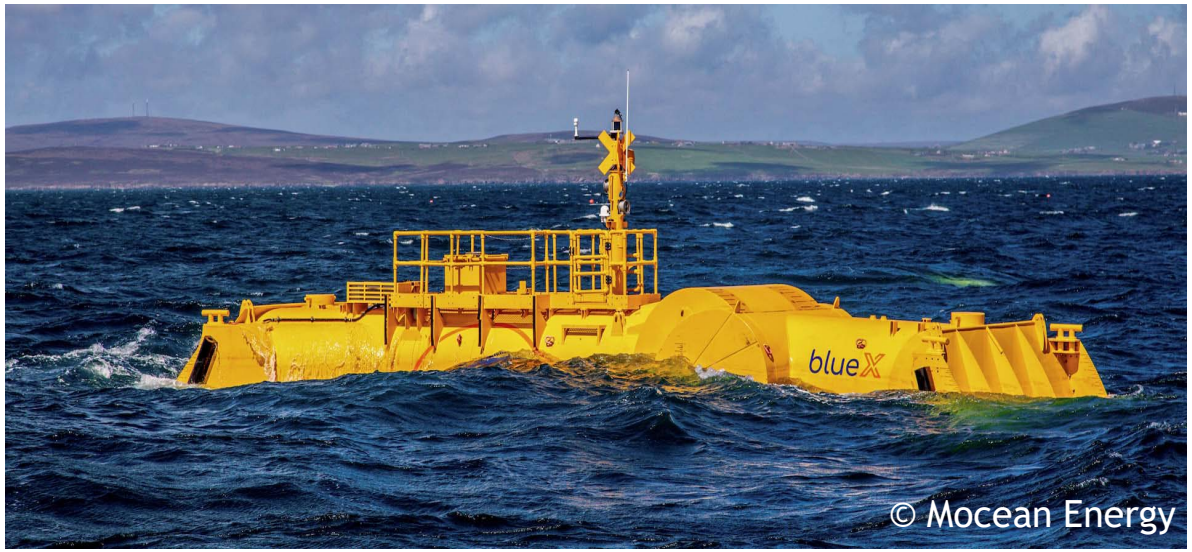
1. Design and Validation of Ocean Energy Device

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



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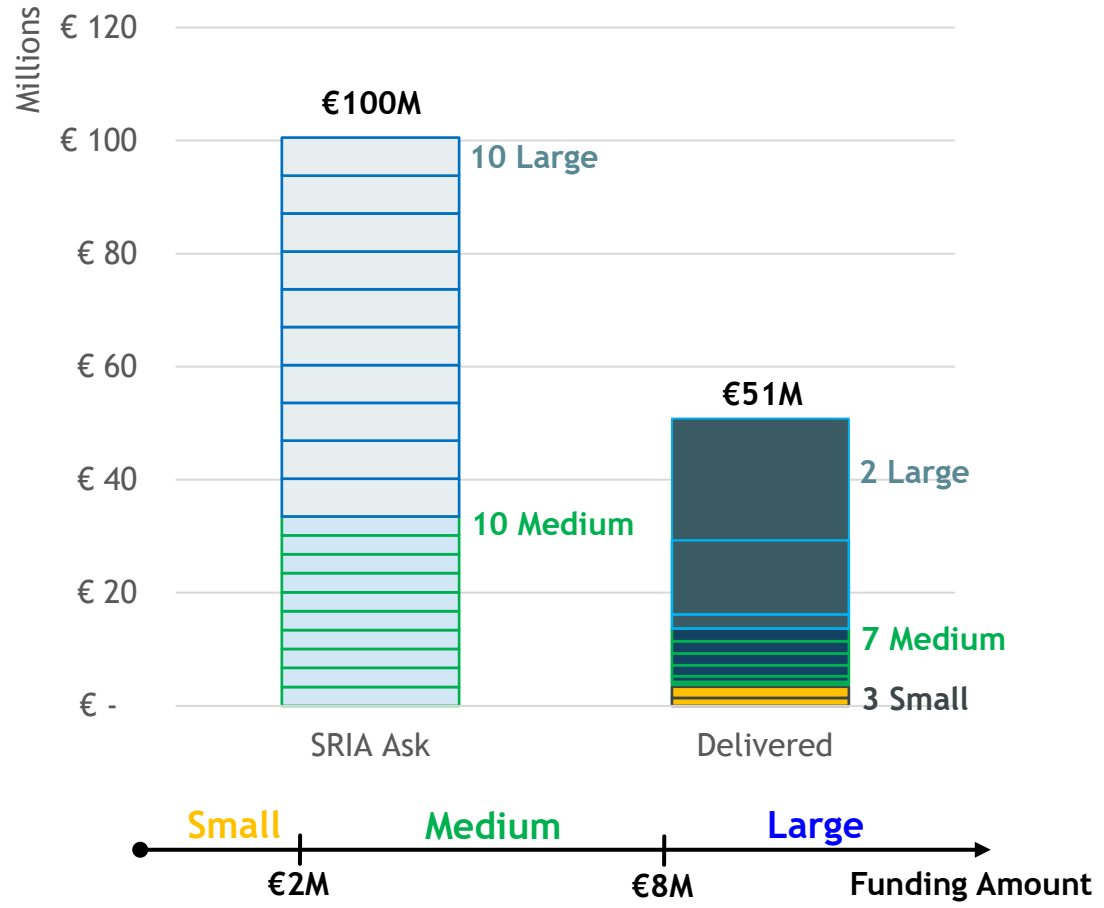
1 Design and Validation of Ocean Energy Device

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

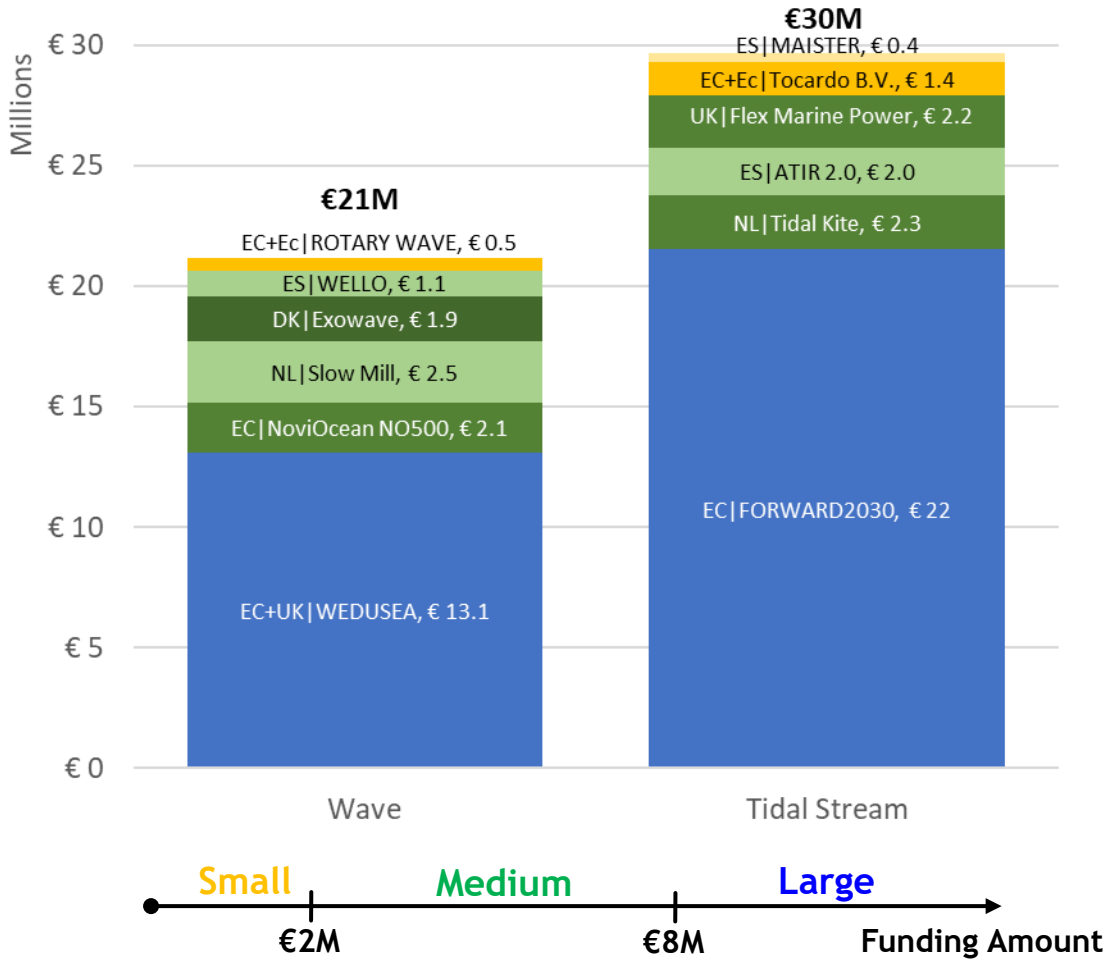
	№ Projects	Budget
SRIA Ask		
• Medium	10	
• Large	10	
Total	**20**	**100 €m**
Delivered		
• Small	3	
• Medium	7	
• Large	2	
Total	**12**	**51 €m**



1 Design and Validation of Ocean Energy Device

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

	№ Projects
SRIA Ask	**20**
Delivered	**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

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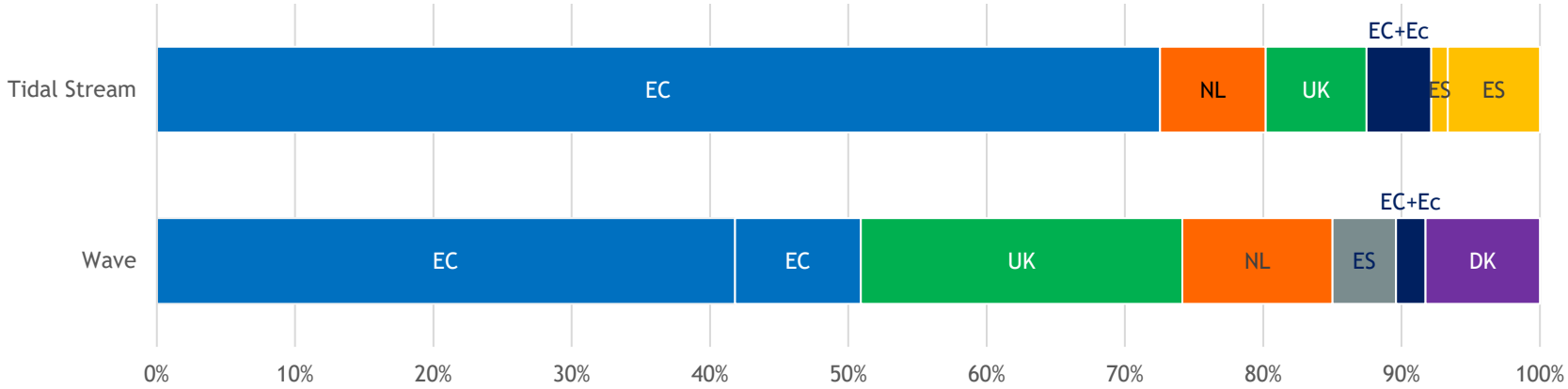
Main Funders

Tidal Stream
- **EC**

Wave
- **EC**



EC – European Commission
Ec – European countries

Summary: the policy makers tool box

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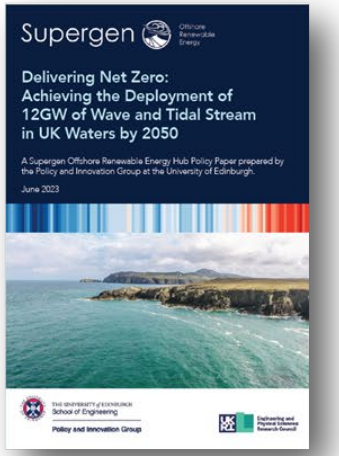
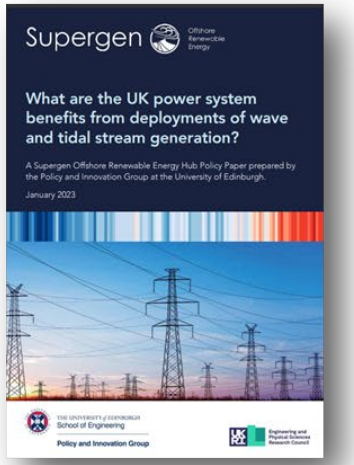
Deployment Modelling

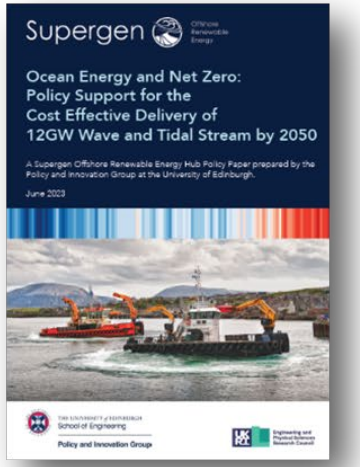


Economic Benefit (GVA)

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