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Task 1.2 – Identify priority technology development areas for updated Strategic Research and Innovation Agenda (SRIA)

Co-funded by the European Union

ETIP Ocean brings the sector together

- Promotes ocean energy development
- Knowledge-sharing webinars & workshops
- Reports based on research & consultation
- 'Knowledge Hub' at www.etipocean.eu

OceanSET helps implement the SET Plan

- Secretariat to the SET Plan IWG for Ocean Energy
- Monitors the sector's progress in technology development, policy and funding
- Annual reports at www.oceanset.eu

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SUSTAINABLE ENERGY AUTHORITY OF IRELAND

Direção-Geral de Energia e Geologia

ENEA

Funded by the European Union

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B-1040 Brussels
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www.etipocean.eu

Task 1.2. Identify priority technology development areas
Agenda for meeting

Outline

- What is the Strategic Research and Innovation Agenda (SRIA)?
- What has it achieved?
- Approach for updating the SRIA
- Showcase analysis
- Next steps

What we need from you

- Experience, expertise, enthusiasm…

What you get from this

- Influence topics for future European Commission & Member States funding calls

Outline and purpose of this work

- Strategic Research and Innovation Agenda (SRIA) is important to inspire future funding calls
- Updating to ensure focus on topics with greatest impact
  - **You** have the opportunity to **influence R&D priorities** for ocean energy
- Quantitative analysis of projects funded to date
  - Differences in funding amounts, number of projects, topic areas…
- Asking for qualitative feedback to assess the progress to date by topic
  - Challenge solved, no longer a priority, are there new priorities?
- Feedback collected through (online) breakout sessions, simple questionnaires, and optional written inputs

What is the Strategic Research and Innovation Agenda (SRIA)?

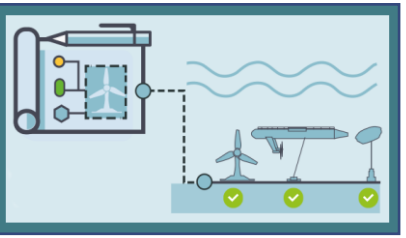
What is the Strategic Research & Innovation Agenda (SRIA)

- The SRIA identified main 'Challenge Areas'
  - Expected to deliver the greatest cost reductions
- For each Challenge Area, 'Priority Topics' identified
  - For research, technology development, and innovation
- Defines specific objectives and actions to carve the path towards Ocean Energy commercialisation
- Audience: the whole ocean energy sector in general,
  - specifically **public funding organisations** (EC, member states, and regional agencies)
  - with the aim of inspiring research calls.

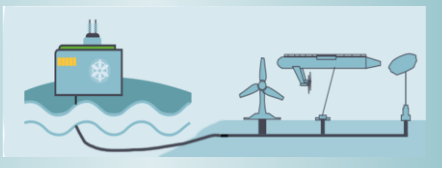
SRIA Challenge Areas

Design and Validation of Ocean Energy Devices

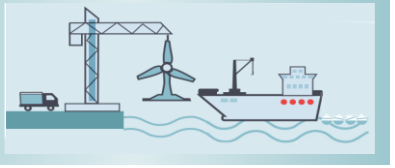
- Most urgent & crucial area of focus
- Important step towards private finance replacing public support



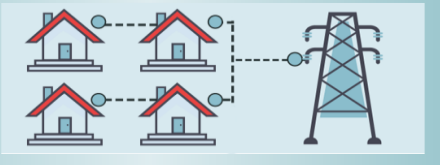
Foundations, Connections and Mooring



Logistics & Marine Operations



Integration in the Energy System



Data Collection & Analysis and Modelling Tools

Cross-cutting Challenges: Environmental and socio-economics

Priority Topics within SRIA Challenge Areas

1. Design and validation of ocean energy devices

1. Demonstration of devices to increase experience in real sea conditions
2. Demonstration of ocean energy technology at array scale (>1 device)
3. Improvement and demonstration of (wave) PTO and control systems
4. Application of innovative materials from other sectors
5. Development of novel wave energy devices
6. Improvement of tidal blades and rotor
7. Development of other ocean energy technologies (OTEC, SWAC, Salinity gradient, Tidal range)

2. Foundations, connections and mooring

1. Advanced mooring and connection systems for floating OE devices
2. Improvement and demonstration of foundations and connection systems for bottom-fixed OE devices

3. Logistics and marine operations

1. Optimisation of maritime logistics and operations
2. Instrumentation for condition monitoring and predictive maintenance

4. Integration in the Energy System

1. Developing and demonstrating near commercial application of ocean energy in niche markets
2. Quantifying and demonstrating grid scale benefits of ocean energy

5. Data collection & analysis and modelling tools

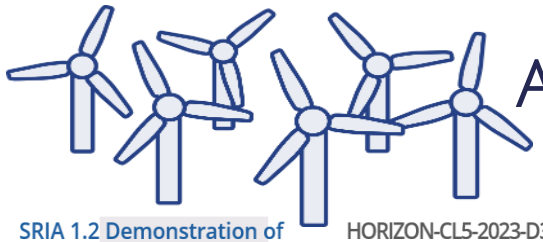
1. Marine observation modelling and forecasting to optimise design and operation of ocean energy devices
2. Open-data repository for ocean energy

6. Cross-cutting Challenges

1. Improvement of the environmental and socioeconomic impacts of ocean energy
2. Standardisation and certification

What has the SRIA achieved…

- Clear influence of Horizon Europe work programme in 21-22 & 23-24
  - Both call topics and wording



Arrays

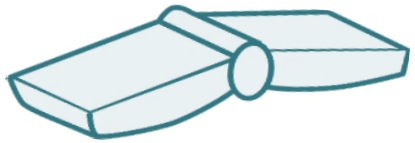
SRIA 1.2 Demonstration of ocean energy pilot farms

- Deployment of ocean energy pilot farms in full operational conditions for long periods of time is essential to advance this sector.
- It is the only way to achieve high TRLs while reducing costs, reducing risks and attracting investors for future commercial projects.
- To focus on the technologies with the greatest chances of success, ocean energy devices should have been satisfactorily demonstrated at full scale before this action.
- The innovation component should mainly lie on the pilot farm subsystems and activities that enable a cost-effective pilot farm.

Etc. …

HORIZON-CL5-2023-D3-01-08: Demonstration of sustainable tidal energy farms

- Demonstration of sustainable tidal energy pilot farms … in full operational conditions for long periods of time is essential to advance this sector.
- It is the way to bridge the gap from technology development to market development while reducing costs, reducing risks and attracting investors for future commercial projects.
- To focus on the technologies with the greatest chances of success, the single tidal device to be used in the array deployment is expected to be satisfactorily demonstrated at full scale before, with limited changes…
- The innovation component should mainly lie on the pilot farm systems and supporting industrial manufacturing activities that enable a cost-effective and high-performance pilot farm.



Devices

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

- Demonstration of ocean energy devices in real sea conditions for long periods of time provides Invaluable learnings
- Demonstrate improved performance, reliability, availability, maintainability and survivability
- Contribute to LCOE reduction approaching SET Plan targets (actions should clearly state estimated LCOE at project start and end).
- Reinforce the industrial supply chain.

Etc. …

HORIZON-CL5-2021-D3-02-01: Demonstration of wave energy devices to increase experience in real sea condition

- Demonstrate wave energy devices in real sea conditions for long periods of time (12-24 months) providing invaluable learnings regarding performance, reliability, availability, maintainability, survivability and environmental impact.
- Reduction of the LCOE in line with the SET Plan targets (actions should clearly justify estimated LCOE at project start and end, using a recognised calculation methodology).
- Reinforced industrial supply chain in Europe.

Subsystems

SRIA 1.6 Improvement of tidal blades and rotor

- There are different blade solutions under development in terms of shape and material.
- Blade edges can erode rapidly, facilitating water ingress, accelerating fatigue and the risk of failure.
- Failure in a blade can create long downtimes, which reduces annual energy production and increases operating costs.
- Improving the seaworthiness of blades will reduce the likelihood of this type of failure.

HORIZON-CL5-2022-D3-01-07: Demonstration of innovative rotor, blades and control systems for tidal energy devices

- There is a need for further technology investigation and demonstration for improved reliability and efficiency of tidal turbine rotor and blades, including control and condition monitoring systems.
- Failure in a blade can create long downtimes, for instance blade edges can erode rapidly, facilitating water ingress, accelerating fatigue and the risk of failure.
- There are different blade solutions under development in terms of shape and material.
- Improving the seaworthiness of rotor and blades will reduce the likelihood of failure, reduced annual energy production and increases in operating costs.

- Discussions ongoing regarding upcoming 25-27 work programme

Updating the SRIA
& review of projects funded to date

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Why are we updating the Strategic Research and Innovation Agenda?

What are we doing?

- Reviewing + updating SRIA
  - Developed in 2019, published May 2020

Why are we doing this?

- Ensure investment & funding is focused on Research & Innovation with greatest impact

What will it influence?

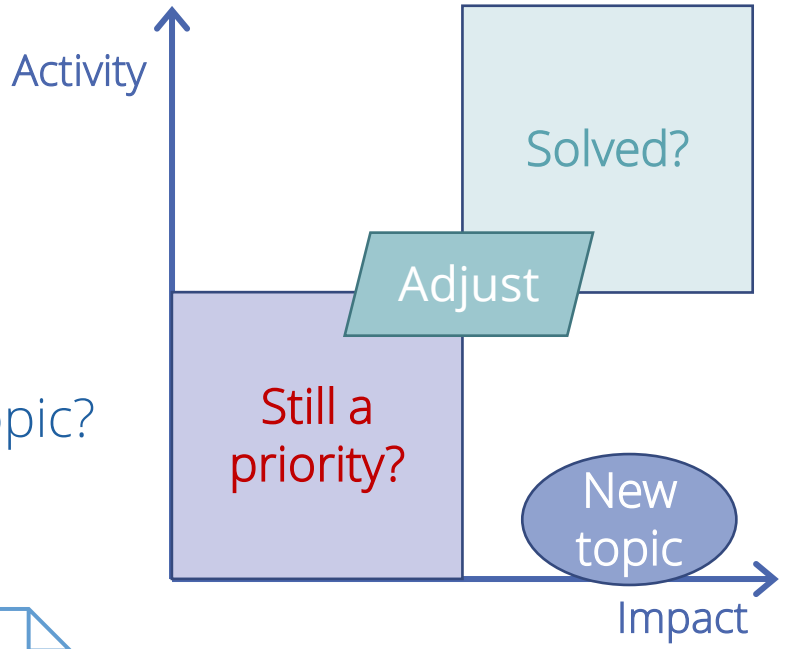
- Horizon Europe 2025-2027 work programme
- Other national & international funding calls

2024 update

Strategic Research and Innovation Agenda for Ocean Energy

How are we updating SRIA?

1. Review of everything that's happened
   - Projects funded by Commission & MS/Countries
   - Compared to SRIA Priority Topics
2. Assessment of progress to date in each topic
   - Have project outputs addressed the challenges of the topic?
   - Are topics solved/no longer a priority, need adjusting?
3. Identification of other challenges
   - Through findings of projects
   - Previously non-priority topics
4. Produce updated SRIA document



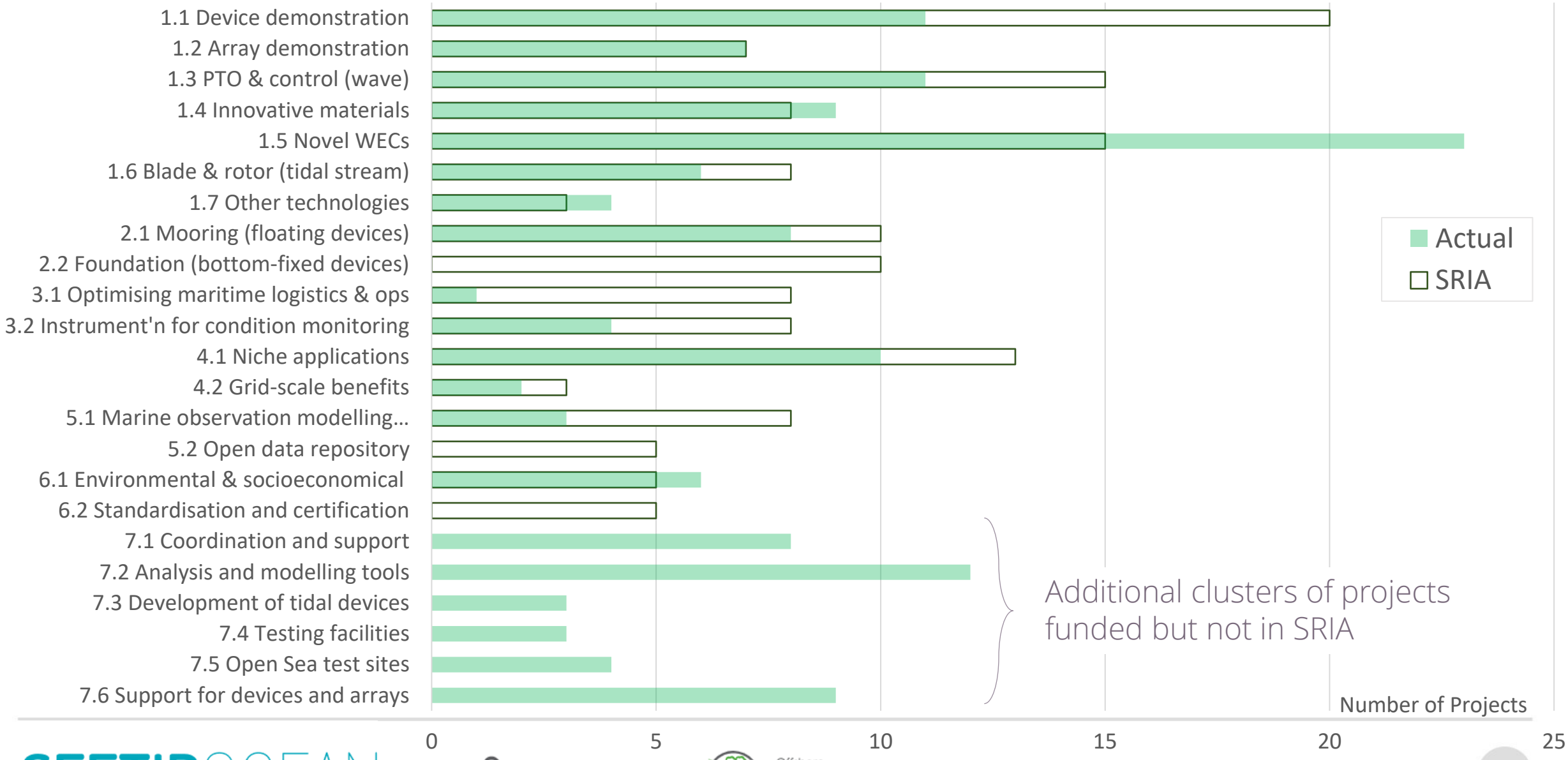
Review of projects funded to date

Supergen Offshore Renewable Energy

- Considered projects within Europe
  - Includes EU, ERANET, MS & country funding, etc
- Active within period 2022 – 2025
  - Excludes projects largely completed prior to the SRIA
- Projects were aligned to SRIA topics – plus additional clusters
  - Using available information, subject to refinement
- For each topic, consider
  - Actual № projects, size & total funding – compared to SRIA
  - Split between wave & tidal stream. Main funders and countries
- Overview of results on next 5 slides

DRAFT

Current status – Number of projects



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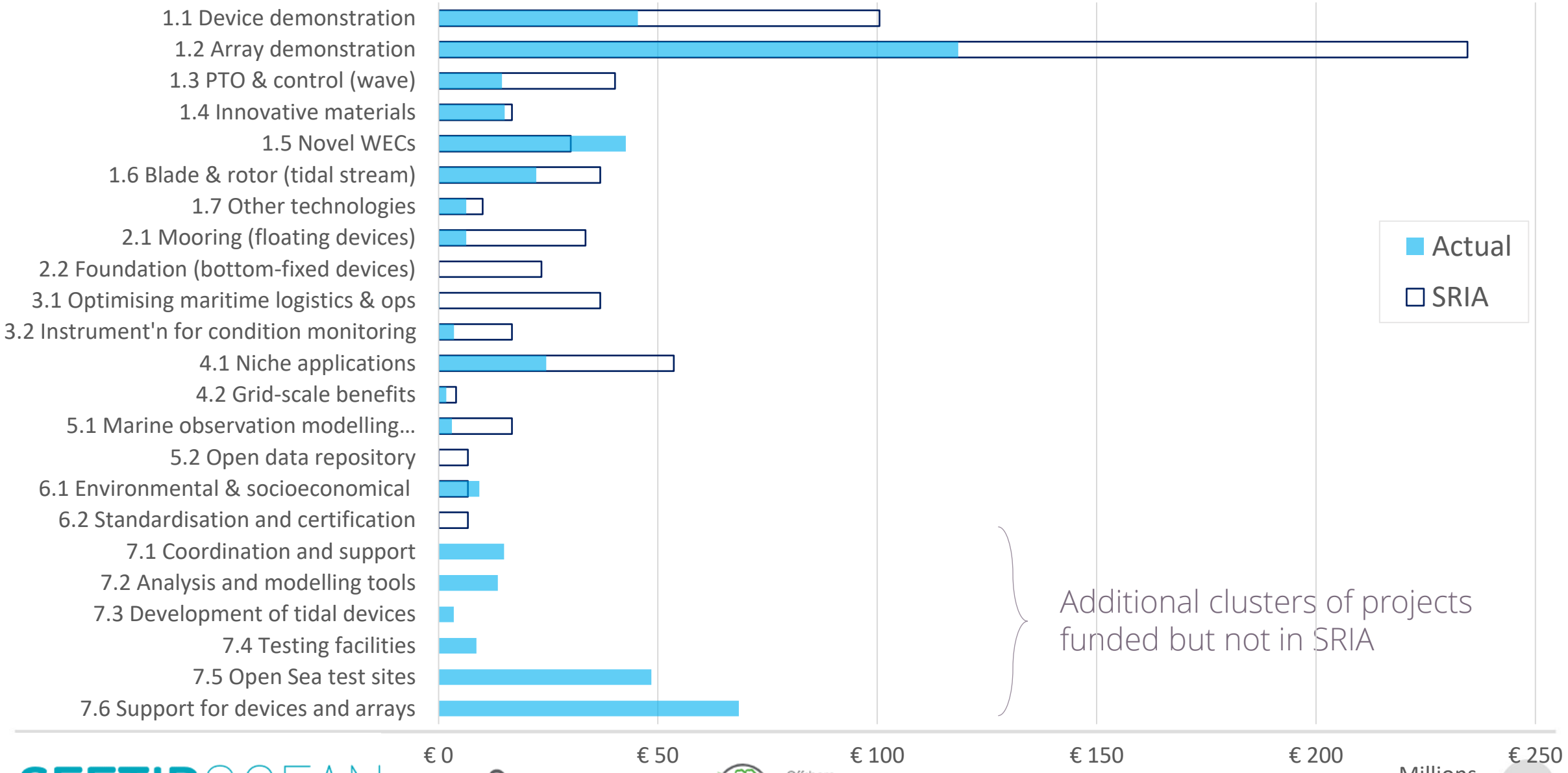
Supergen Offshore Renewable Energy

Boundary/scope: projects/activities we are aware of that are active within 2022-2025

Current status – Grant funding allocated

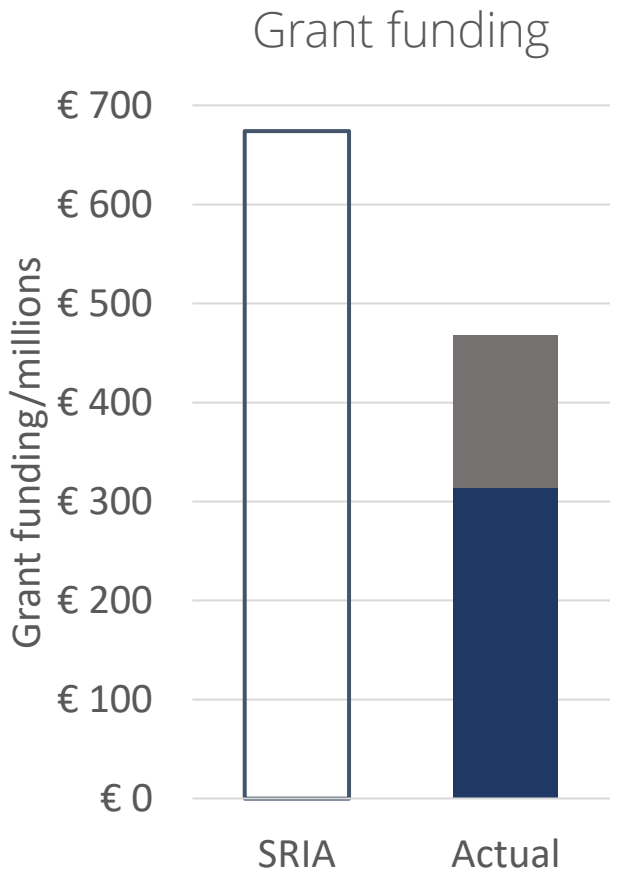


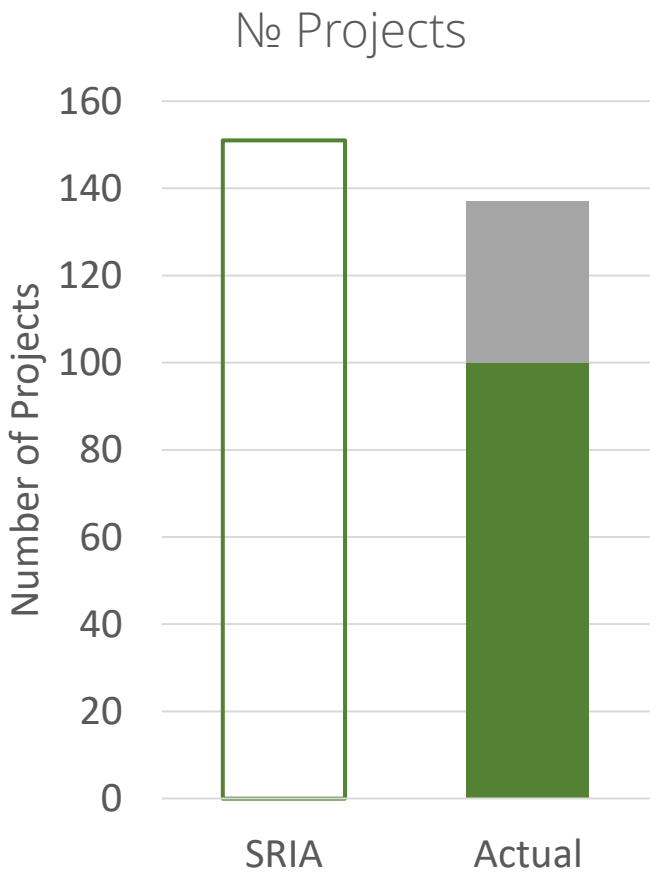
Boundary/scope: projects/activities we are aware of that are active within 2022-2025

Current status – summary

	Budget	№ Projects
SRIA ask	671 €m	151
Delivered	467 €m	137
SRIA Topics	313 €m	100
Non-SRIA	154 €m	37

- More smaller projects delivered than proposed in the SRIA
- Projects funded on other topics





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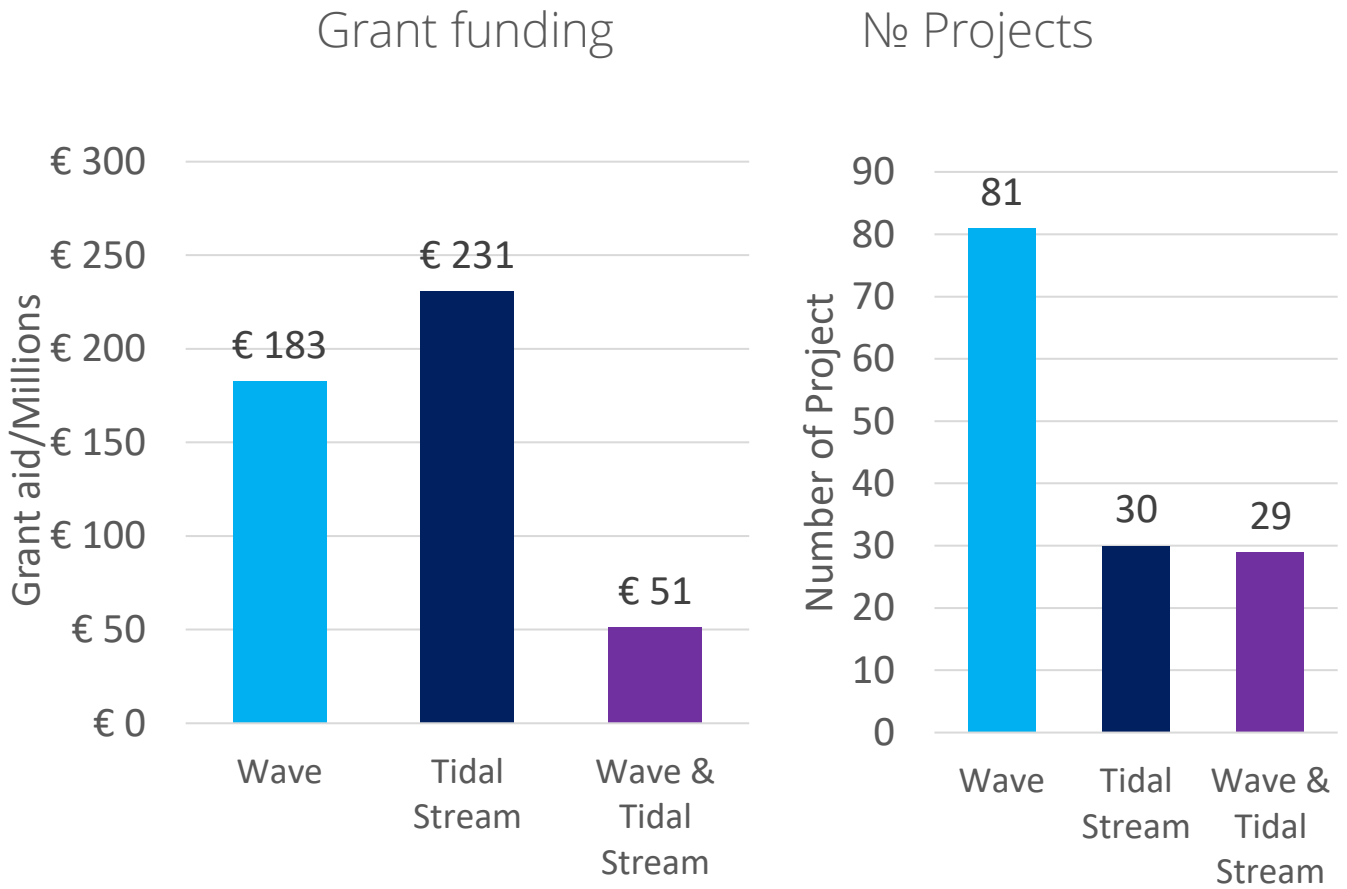
Supergen Offshore Renewable Energy

Boundary/scope: projects/activities we are aware of that are active within 2022-2025

Current status – Sectoral breakdown

- Tidal stream
  - Highest funding amount
- Wave
  - Largest number of projects
- Excluding other technologies (OTEC/Salinity/etc) on this slide

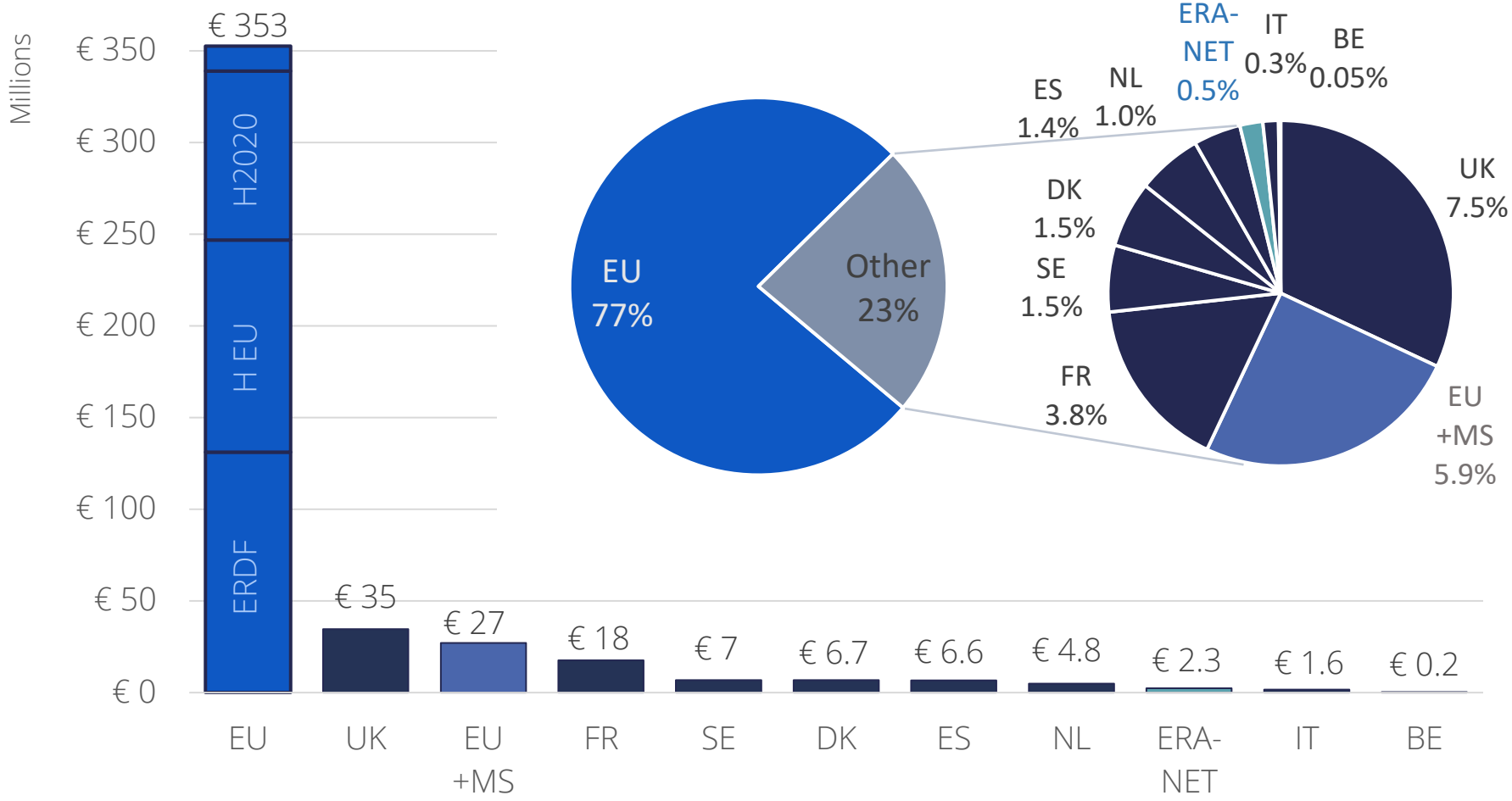


Boundary/scope: projects/activities we are aware of that are active within 2022-2025

Current status – Funding breakdown (grant aid)

Main funders

- EU 353 €m
- UK 35 €m
- EU+MS 27 €m
- FR 18 €m



Boundary/scope: projects/activities we are aware of that are active within 2022-2025

Topics where projects have been funded not in SRIA

1. Coordination and support actions and other knowledge sharing activities
2. Analysis and Modelling tools
3. Development and testing of tidal devices
4. Testing facilities & infrastructure
5. Open sea test sites
6. Support for demonstration of devices and arrays
    - Others?

- **Are these a priority?**
- Should they be incorporated into an existing SRIA challenge or topic?

Next steps to update the SRIA

Review of projects & progress by topic → Next steps

- Too much information for today's call
- Discuss progress by topic on follow-up calls/breakout groups
  - Grouped by themes, e.g. technology development, demonstration…
  - Please fill in the survey with:
    1. Topics you are interested in
    2. Dates you are available
- Also accepting written feedback
- Workshop at OEE2023

		TRL	Projects
1	**Design and Validation of Ocean Energy Devices** [All shapes, tank to sea. Considering one or several subsystems. Reliability key]		
1.1	**Demonstration of ocean energy devices to increase experience in real sea conditions** [Real sea, for long periods. Comprehensive onshore/dry-testing beforehand (separately/within project). Any common issues identified & addressed in further R&I]	5 → 7+	10 med. 10 large
1.2	**Demonstration of ocean energy technology at array scale** [Pilot farms, >1 device, long periods of time. Technology previously demonstrated at full scale. Innovations should focus on farm aspects. Shared mooring/electrical infrastructure. Optimise installation/O&M. Contribute to LCOE reduction]	7 → 8-9	7 array
1.3	**Improvement and demonstration of PTO and control systems** [Wave energy only. Onshore/lab testing + demonstration in realistic environments. Gearbox, generator & power-electronics. Control an integral part]	3 → 6 4-5 → 7-8	5 small 10 med.
1.4	**Application of innovative materials from other sectors** [Testing/characterising/demonstrating materials (structural, mooring, foundation, antifouling coatings, manufacturing processes). Long durability, survivability in seawater. Applicability to multiple OE devices]	5 → 7+	5 small 3 med.
1.5	**Development of novel wave energy devices** [& subsystems. Radical improvements, step-change in performance. Staged approach, numerical modelling, experimental validation, demonstration…]	3 → 6	10 small 5 med.
1.6	**Improvement of tidal blades and rotor** [Characterisation/use of novel materials. Coatings & anti-fouling. Control (pitch and yaw systems). Increase reliability (fatigue resilience), efficiency and lifespan of blades. Modelling turbulence. Improved manufacturing processes. Demonstrate blades & control in real sea]	4+ → 6+	5 small 3 large
1.7	**Development of other ocean energy technologies** [i.e. OTEC, SWAC, Salinity gradient, Tidal range]	→ 6	3 med.
2	**Foundations, Connections and Mooring** [For floating & fixed devices. Similarity/differences to established tech (monopiles, current). Consider with demo & LMO, not alone]	TRL	Projects
2.1	**Advanced mooring and connection systems for floating ocean energy devices** [Bespoke & challenging requirements of ocean energy. Combined mooring & power/shared anchors. Advanced simulation to reduce uncertainties. Quick connection systems. ↔1.3 materials]	3-4 → 6	10 med.
2.2	**Improvement and demonstration of foundations and connection systems for bottom-fixed ocean energy devices** [Simplify electrical connections. Improve/optimise/validate installation methods & tools. Robust/optimised foundations for conditions at tidal sites]	Any 4+ → 6+	5 small 5 med.
3	**Logistics and Marine Operations** [Development & demonstration of marine ops. for installation, operation, maintenance & decommissioning of OE devices & arrays]	TRL	Projects
3.1	**Optimisation of maritime logistics and operations** [Potential for dramatic/early cost reductions. Selectively adapting good practices. Identify novel requirements, develop bespoke ops & tools. ↔1]	4+ → 6+	5 med.
3.2	**Instrumentation for condition monitoring and predictive maintenance** [to improve availability, survivability, and reduce OPEX. Take advantage of advances in sensor/comms. technology. Big data/machine learning.]	4+ → 6+	5 small 3 med.
4	**Integration in the Energy System** [Offers between national grids/smaller island grids. Evaluate system balancing benefits]	TRL	Projects
4.1	**Developing and demonstrating near commercial application of ocean energy in niche markets** [Identify best-fit applications. Advance tailored solutions. Deploy & demonstrate, where most competitive, for sufficient time to de-risk. Also consider manufacturing readiness level]	7 → 8-9	10 med. 3 large
4.2	**Quantifying and demonstrating grid scale benefits of ocean energy** [Phase/correlation with wind/solar. Cost-benefit of including OE, considering predictability, intermittency, etc. Quantify lower requirements for transmission infrastructure, demand-response & storage. Engage with utilities/regulators]	7 → 8-9	3 small
5	**Data Collection & Analysis and Modelling Tools** [Generation of information & tools critical for other Challenge Areas. Sharing through standardised data management & storage]	TRL	Projects
5.1	**Marine observation modelling and forecasting to optimise design and operation of ocean energy devices** [Forecasts for real-time/predictive control. Observe/model/forecast intra-site variability in waves/currents. Develop instruments to measure W/C. Impacts on power performance of device induced changes in W/C]	L → M/H	5 small 3 med.
5.2	**Open-data repository for ocean energy.** [Develop tools to facilitate identification, access and reuse of data. Coordinate with existing repositories (e.g. Wave and Tidal Knowledge Network, WES knowledge library)]	CSA?	5 small
6	**Cross-cutting Challenges**	TRL	Projects
6.1	**Improvement of the environmental and socioeconomic impacts of ocean energy** [Within other projects? LCA of OE vs other renewables. Assess/monitor impacts of ocean energy projects. Quantify benefits/jobs]	Env. High S-E. M/H	5 small
6.2	**Standardisation and certification** [Lack of consensus beyond power performance. Gather best-practice from lab to final validation. Develop & improve internationally recognised standards, with other bodies. Involve investors, utilities, insurance, regulators so that certification reduces cost of capital.]	CSA?	5 small
7	**Other clusters of funded projects** [Not linked to priority topics in SRIA]	TRL	Projects in cluster
7.1	**Coordination and support actions & knowledge sharing activities** *E.g. SEETIP Ocean, WECANet, OceanSET, OPIN, MEA, ELBE Plus, Selkie, MEECE*	CSA	8
7.2	**Analysis and Modelling tools** [For design/optimisation of arrays, devices & subsystems.] *E.g. InWAS, SURVIWEC, INTERACT, WavE-Suite, Co-Tide, FASTWATER*	Any	12
7.3	**Development and testing of tidal devices** [Technology development rather than demonstration. Not 1.1] *E.g. ENCORE: Water2Energy & EEL Energy*	→ 6	3
7.4	**Testing facilities & infrastructures** [Components/scale model testing. Building facilities. Supporting access to] *E.g. IMPACT, VALID , InfinityWEC PTO HWIL testing*	3 → 7	3
7.5	**Open sea test sites** [Consenting and building of facilities. Supporting access to] *E.g. HarshLab , OceanDEMO, Morlais Infrastructure, META*	5 → 8	4
7.6	**Support for demonstration of devices and arrays** [Project consenting or other preparatory work. Not 1.1/1.2] *E.g. TIGER, Deep Green Ph2, Enlli, Pembrokeshire Demo Zone, Crosswing, Exowave, SCELPHY, Waveform*	5+→7-9	9

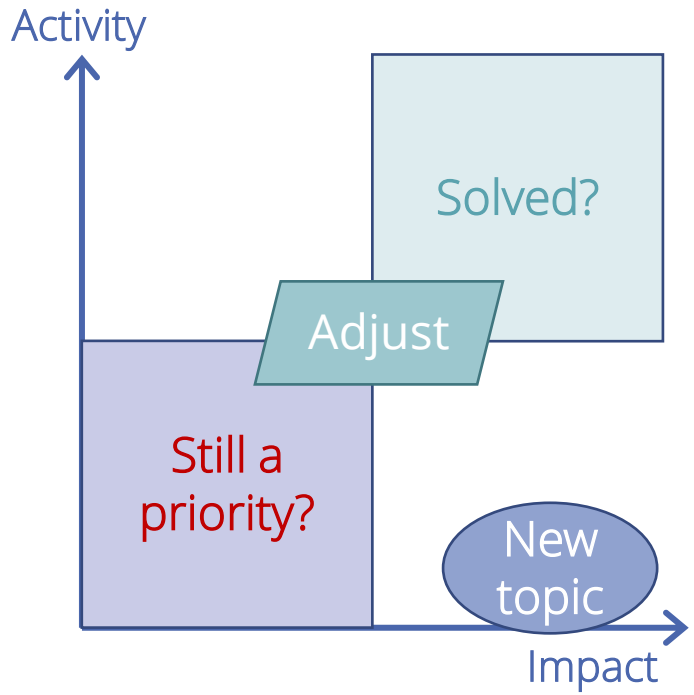
Review of projects & progress by topic → Next steps

For each topic, in breakout groups:

a) Review the projects funded to date
   - Example of detailed analysis for one topic on next 4 slides

b) Discuss if/how well the topic has been addressed
   - Not at all → fully (or unknown)

c) Areas/items to add/adjust/remove
   - Refine the topics to meet future sector priorities



Example analysis of projects funded to date

1 Design and Validation of Ocean Energy Device

1.2 Demonstration of ocean energy at array scale

Key phrases from SRIA – Actions & impact

- Pilot farms >1 device, long periods of time
- Technology previously demonstrated at full scale
- Innovations should focus on farm aspects
- Shared mooring/electrical infrastructure
- Optimise installation/O&M
- Contribute to LCOE reduction

- TRL 7 → 8-9

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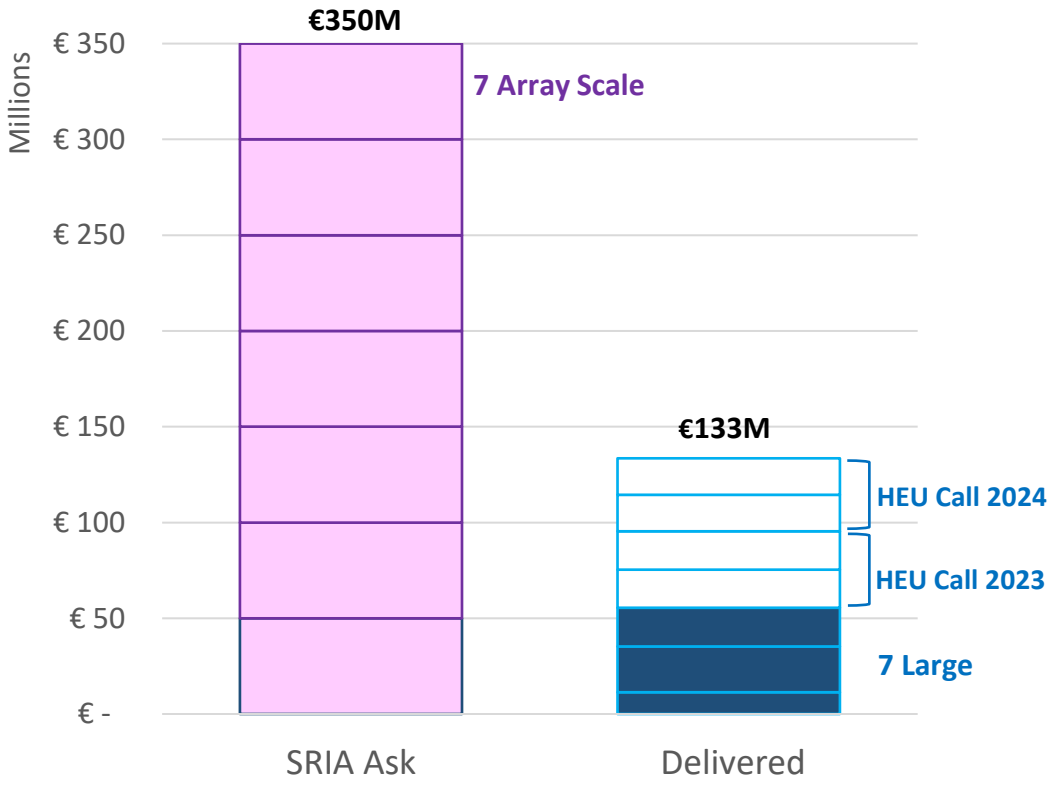
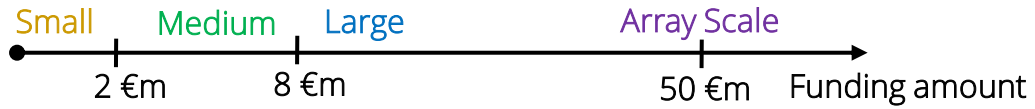
Example analysis of projects funded to date

1 Design and Validation of Ocean Energy Device

1.2 Demonstration of ocean energy at array scale

	№ Projects	Budget
SRIA Ask		
• Array scale	7	350 €m
Delivered		
• Large	3	55.4 €m
Pipeline		
• Large	4	77.5 €m





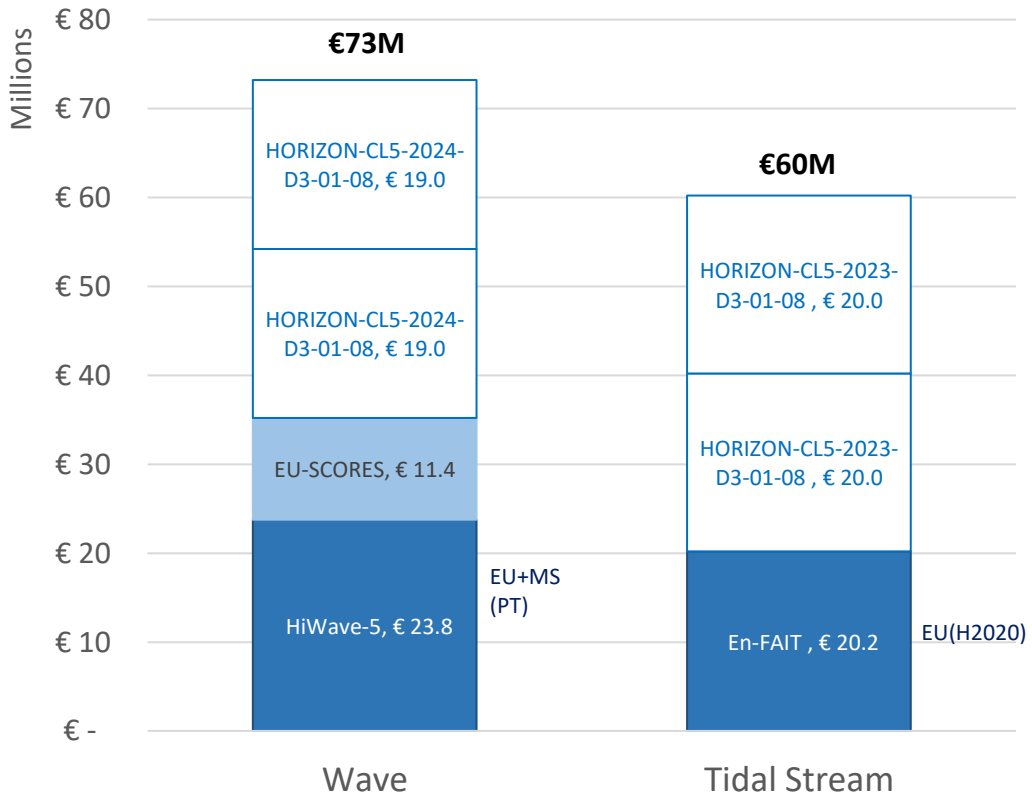
Example analysis of projects funded to date

1 Design and Validation of Ocean Energy Device

1.2 Demonstration of ocean energy at array scale

Sector breakdown & project details

		№ Projects
SRIA Ask	• Array scale	7
Delivered	• Wave – large	2
	• Tidal – large	1
	• **Total**	**3**
Pipeline	• Wave – large	2
	• Tidal – large	2
	• **Total**	**4**



Next steps…

1. Information pack sent out to TWG members (today)
   - Meeting slides & background information

2. TWG members complete survey of topics/dates (by 12 June)

3. Next meetings to review topics in breakout groups (dates tbc…)

   a) Review the projects funded to date
   b) Discuss if/how well the topic has been addressed
   c) Any areas to add/adjust/remove in these topics

4. Updated SRIA due to be published next summer

Any questions?

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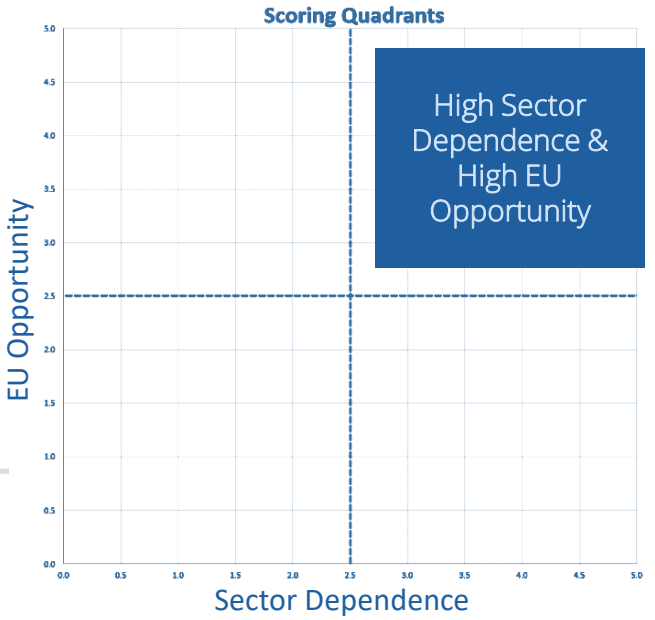
Appendix of details not presented

How was the SRIA developed?

- Review of previous studies, visions & landscapes
- Identified ~58 challenges

- **Scored and prioritised**:
  1. Sector dependence on overcoming challenge
  2. European opportunity to play significant role

- Reviewed and validated by a Technology Working Group & project Steering Committee



Other points from the SRIA

- Challenge Areas should not be addressed in isolation
  - Knowledge exchange between the Challenge Areas is specifically identified
    - Needs a balance between open data and confidentiality
  - Opportunity to link subsystem/other development to ocean demo. projects
- Most topics apply to both wave & tidal stream
  - Some only applicable to one technology
  - One topic for other technologies
- Indicative number & size of projects proposed

Small	Medium	Large	Array
<2 €m	2-8 €m	>8 €m	~50 €m

- Total project cost
- With 1/3 private funding

Challenge Areas		SRIA Priority Topics	Tech.	Small <2 €m	Medium 2-8 €m	Large >8 €m	Budget €m
Design and Validation of Ocean Energy Devices	1.1	Demonstration of ocean energy devices in real sea conditions	W&T	—	10	10	150
	1.2	Demonstration of ocean energy technology at array scale	W&T	7 Array Scale (~50 €m)			350
	1.3	Improvement and demonstration of PTO and control systems	W	5	10	—	60
	1.4	Application of innovative materials from other sectors	W&T	5	A few (3)	—	25
	1.5	Development of novel wave energy devices	W	10	5	—	45
	1.6	Improvements of tidal blades and rotor	T	—	5	A few (3)	55
	1.7	Development of other ocean energy technologies	Other	—	A few (3)	—	15
Foundations, Connections and Mooring	2.1	Advanced mooring and connection systems for floating ocean energy devices	W&T	—	10	—	50
	2.2	Foundations and connection systems for bottom-fixed ocean energy devices	W&T	5	5	—	35
Logistics and Marine Ops	3.1	Optimisation of maritime logistics and operations	W&T	-	5	A few (3)	55
	3.2	Instrumentation for condition monitoring and predictive maintenance	W&T	5	A few (3)	-	25
Integration in Energy System	4.1	Developing and demonstrating near commercial ocean energy in niche markets	W&T	—	Several (10)	A few (3)	80
	4.2	Quantifying and demonstrating grid scale benefits of ocean energy	W&T	A few (3)	—	—	6
Data Collection & Analysis and Modelling Tools	5.1	Marine observation, modelling and forecasting to optimise design and operation of ocean energy devices	W&T	5	A few (3)	—	25
	5.2	Open-data repository for ocean energy	W&T	5	—	—	10
Cross-cutting Challenges	6.1	Improvement of environmental and socioeconomic impacts of ocean energy	W&T	5	—	—	10
	6.2	Standardisation and certification	W&T	5	—	—	10
Others clusters	7.1	Coordination and support actions including knowledge sharing					
	7.2	Analysis and Modelling tools					
	7.3	Development and testing of prototype scale tidal devices					
	7.4	Testing facilities & infrastructures (Includes building, and access to)					
	7.5	Open sea test sites (includes consenting, building, and access to)					
	7.6	Support for demonstration or consenting of devices and arrays					
					151 projects		**1006 €m**

Projects funded, but topic not in SRIA

Previous SRIA Challenge Areas and Priority Topics [1/4]

1	**Design and Validation of Ocean Energy Devices** [All stages, tank to sea. Considering one or several subsystems. Reliability key]	TRL	Projects
1.1	Demonstration of ocean energy devices to increase experience in real sea conditions [Real sea, for long periods. Comprehensive onshore/dry-testing beforehand (separately/within project). Any common issues identified & addressed in further R&I]	5 → 7+	10 med. 10 large
1.2	Demonstration of ocean energy technology at array scale [Pilot farms, >1 device, long periods of time. Technology previously demonstrated at full scale. Innovations should focus on farm aspects. Shared mooring/electrical infrastructure. Optimise installation/O&M. Contribute to LCOE reduction]	7 → 8-9	7 array
1.3	Improvement and demonstration of PTO and control systems [Wave energy only. Onshore/lab testing + demonstration in realistic environments. Gearbox, generator & power-electronics. Control an integral part]	3 → 6 4-5 → 7-8	5 small 10 med.
1.4	Application of innovative materials from other sectors [Testing/characterising/demonstrating materials (structural, mooring, foundation, antifouling coatings, manufacturing processes). Long durability, survivability in seawater. Applicability to multiple OE devices]	5 → 7+	5 small 3 med.
1.5	Development of novel wave energy devices [& subsystems. Radical improvements, step-change in performance. Staged approach, numerical modelling, experimental validation, demonstration…]	-3 → 6	10 small 5 med.

Previous SRIA Challenge Areas and Priority Topics [2/4]

1	**Design and Validation of Ocean Energy Devices** (cont.) [All stages, tank to sea. Considering one or several subsystems. Reliability key]	TRL	Projects
1.6	Improvement of tidal blades and rotor [Characterisation/use of novel materials. Coatings & anti-fouling. Control (pitch and yaw systems). Increase reliability (fatigue resilience), efficiency and lifespan of blades. Modelling turbulence. Improved manufacturing processes. Demonstrate blades & control in real sea]	4+ → 6+	5 small 3 large
1.7	Development of other ocean energy technologies [i.e. OTEC, SWAC, Salinity gradient, Tidal range]	→ 6	3 med.
2	**Foundations, Connections and Mooring** [For floating & fixed devices. Similarity/differences to established tech (motion/currents). Consider with demo & LMO, not alone]	TRL	Projects
2.1	Advanced mooring and connection systems for floating ocean energy devices [Bespoke & challenging requirements of ocean energy. Combined mooring & power/shared anchors. Advanced simulation to reduce uncertainties. Quick connection systems. ↔1.3 materials]	3-4 → 6	10 med.
2.2	Improvement and demonstration of foundations and connection systems for bottom-fixed ocean energy devices [Simplify electrical connections. Improve/optimise/validate installation methods & tools. Robust/optimised foundations for conditions at tidal sites]	Any 4+ → 6+	5 small 5 med.

Previous SRIA Challenge Areas and Priority Topics [3/4]

3	**Logistics and Marine Operations** [Development & demonstration of marine ops. for installation, operation, maintenance & decommissioning of OE devices & arrays]	TRL	Projects
3.1	Optimisation of maritime logistics and operations [Potential for dramatic/early cost reductions. Selectively adapting good practices. Identify novel requirements, develop bespoke ops & tools. ↔1]	4+ → 6+	5 med.
3.2	Instrumentation for condition monitoring and predictive maintenance [to improve availability, survivability, and reduce OPEX. Take advantage of advances in sensor/comms. technology. Big data/machine learning.]	4+ → 6+	5 small 3 med.
4	**Integration in the Energy System** [Differs between national grids/smaller island grids. Evaluate system balancing benefits]	TRL	Projects
4.1	Developing and demonstrating near commercial application of ocean energy in niche markets [Identify best-fit applications. Advance tailored solutions. Deploy & demonstrate, where most competitive, for sufficient time to de-risk. Also consider manufacturing readiness level]	7 → 8-9	10 med. 3 large
4.2	Quantifying and demonstrating grid scale benefits of ocean energy [Phase/corelation with wind/solar. Cost-benefit of including OE, considering predictability, intermittency, etc. Quantify lower requirements for transmission infrastructure, demand-response & storage. Engage with utilities/regulators]	7 → 8-9	3 small

Previous SRIA Challenge Areas and Priority Topics [4/4]

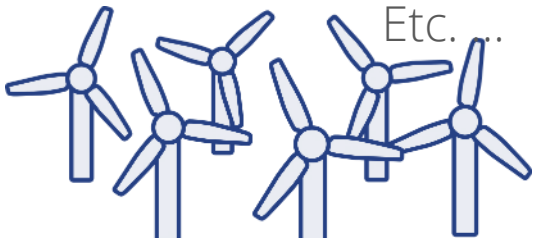
5	**Data Collection & Analysis and Modelling Tools** [Generation of information & tools critical for other Challenge Areas. Sharing through standardised data management & storage]	TRL	Projects
5.1	Marine observation modelling and forecasting to optimise design and operation of ocean energy devices [Forecasts for real-time/predictive control. Observe/model/forecast intra-site variability in waves/currents. Develop instruments to measure W/C. Impacts on power performance of device induced changes in W/C]	L → M/H	5 small 3 med.
5.2	Open-data repository for ocean energy. [Develop tools to facilitate identification, access and reuse of data. Coordinate with existing repositories (e.g. Wave and Tidal Knowledge Network, WES knowledge library)]	CSA?	5 small
6	**Cross-cutting Challenges**	TRL	Projects
6.1	Improvement of the environmental and socioeconomic impacts of ocean energy [Within other projects? LCA of OE vs other renewables. Assess/monitor impacts of ocean energy projects. Quantify benefits/Jobs]	Env. High S-E. M/H	5 small
6.2	Standardisation and certification [Lack of consensus beyond power performance. Gather best-practice from lab to final validation. Develop & improve internationally recognised standards, with other bodies. Involve investors, utilities, insurance, regulators so that certification reduces cost of capital.]	CSA?	5 small

Other topics where projects have been funded

7	**Other clusters of funded projects** [Not linked to priority topics in SRIA]	TRL	Projects in cluster
7.1	Coordination and support actions & knowledge sharing activities *E.g. SEETIP Ocean, WECANet, OceanSET, OPIN, MEA, ELBE Plus, Selkie, MEECE*	CSA	8
7.2	Analysis and Modelling tools [For design/optimisation of arrays, devices & subsystems.] *E.g. InWAS, SURVIWEC, INTERACT, WavE-Suite, Co-Tide, FASTWATER*	Any	12
7.3	Development and testing of tidal devices [Technology development rather than demonstration. Not 1.1] *E.g. ENCORE: Water2Energy & EEL Energy*	→ 6	3
7.4	Testing facilities & infrastructures [Components/scale model testing. Building facilities. Supporting access to] *E.g. IMPACT, VALID , InfinityWEC PTO HWIL testing*	3 → 7	3
7.5	Open sea test sites [Consenting and building of facilities. Supporting access to] *E.g. HarshLab , OceanDEMO, Morlais Infrastructure, META*	5 → 8	4
7.6	Support for demonstration of devices and arrays [Project consenting or other preparatory work. Not 1.1/1.2] *E.g. TIGER, Deep Green Ph2, Enlli, Pembrokeshire Demo Zone, Crestwing, Exowave, SCELPHY, Wavefarm*	5+→7-9	9

SRIA 1.2 Demonstration of ocean energy pilot farms

- Deployment of ocean energy pilot farms in full operational conditions for long periods of time is essential to advance this sector.
- It is the only way to achieve high TRLs while reducing costs, reducing risks and attracting investors for future commercial projects.
- To focus on the technologies with the greatest chances of success, ocean energy devices should have been satisfactorily demonstrated at full scale before this action.
- The innovation component should mainly lie on the pilot farm subsystems and activities that enable a cost-effective pilot farm.



HORIZON-CL5-2023-D3-01-08: Demonstration of sustainable tidal energy farms

- Demonstration of sustainable tidal energy pilot farms ... in full operational conditions for long periods of time is essential to advance this sector.
- It is the way to bridge the gap from technology development to market development while reducing costs, reducing risks and attracting investors for future commercial projects.
- To focus on the technologies with the greatest chances of success, the single tidal device to be used in the array deployment is expected to be satisfactorily demonstrated at full scale before, with limited changes...
- The innovation component should mainly lie on the pilot farm systems and supporting industrial manufacturing activities that enable a cost-effective and high-performance pilot farm.

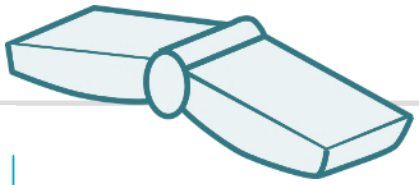
SRIA 1.1 Demonstration of ocean energy devices to increase experience in real sea conditions

- Demonstration of ocean energy devices in real sea conditions for long periods of time provides Invaluable learnings
- Demonstrate improved performance, reliability, availability, maintainability and survivability
- Contribute to LCOE reduction approaching SET Plan targets (actions should clearly state estimated LCOE at project start and end).
- Reinforce the industrial supply chain.

HORIZON-CL5-2021-D3-02-01: Demonstration of wave energy devices to increase experience in real sea condition

- Demonstrate wave energy devices in real sea conditions for long periods of time (12-24 months) providing invaluable learnings regarding performance, reliability, availability, maintainability, survivability and environmental impact.
- Reduction of the LCOE in line with the SET Plan targets (actions should clearly justify estimated LCOE at project start and end, using a recognised calculation methodology).
- Reinforced industrial supply chain in Europe.

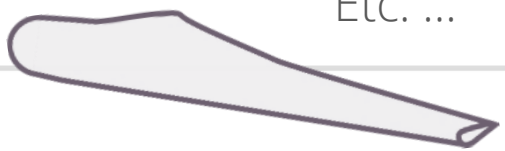
Etc. ...



SRIA 1.6 Improvement of tidal blades and rotor

- There are **different blade solutions** under development in terms of shape and material.
- **Blade edges can erode rapidly**, facilitating water ingress, **accelerating fatigue** and the **risk of failure**.
- **Failure** in a blade can **create long downtimes**, which reduces annual energy production and increases operating costs.
- **Improving the seaworthiness** of blades will **reduce the likelihood** of this type **of failure**.

Etc. ...



HORIZON-CL5-2022-D3-01-07: Demonstration of innovative rotor, blades and control systems for tidal energy devices

- There is a need for further technology investigation and demonstration for improved reliability and efficiency of tidal turbine rotor and blades, including control and condition monitoring systems.
- **Failure** in a blade can **create long downtimes**, for instance **blade edges can erode rapidly**, facilitating water ingress, **accelerating fatigue** and the **risk of failure**.
- There are **different blade solutions** under development in terms of shape and material.
- **Improving the seaworthiness** of rotor and blades will **reduce the likelihood of failure**, reduced annual energy production and increases in operating costs.