

Support to the realisation of the Ocean Energy Implementation Plan for the EU SET-Plan

10th March 2022

Gianmaria Sannino* (Chair IWG OceanEnergy)

* **ENER** - Italian National Agency for New Technologies, Energy and Sustainable Economic Development

OceanSET Annual Report on the status of Ocean Energy in Europe

- 1. Review of the results of the third annual Member States survey, by **Rachel Power** from <u>SEAI</u>
- Update on the third annual technology developers survey, by Ana Andrade from <u>DGEG</u>
- 3. Q&A session



SET PLAN ACCELERATING THE TRANSFORMATION OF EUROPE'S ENERGY SYSTEM

The European Strategic Energy Technology Plan (SET Plan) is the technology pillar of the EU's energy and climate policy since 2008. It is a key stepping-stone to boost the transition towards a climate neutral energy system through the development of lowcarbon technologies in a fast and cost-competitive way.



13 implementation working groups



EU Objectives for the Ocean Energy sector

In 2018 invited stakeholders and SET Plan countries reached an agreement on common objectives specifically for the ocean energy sector.

These are:

- to bring ocean energy to commercial deployment,
- to drive down the levelised cost of energy (LCOE),
- to maintain and grow Europe's leading position in ocean energy
- to strengthen the European industrial technology base, thereby creating economic growth and jobs in Europe and allowing Europe to compete on a global stage.



EU Objectives for the Ocean Energy sector

These common objectives are supported with two sets of quantitative targets for tidal stream and wave energy:

- Deployment targets aligned with those in the EU Offshore Renewable Energy Strategy (Nov. 2020):
 - **100MW** of deployed wave & tidal capacity in EU waters by 2025
 - Around **1GW** of deployed wave & tidal capacity in EU waters by 2030
- LCOE targets, maintained from the 2018 Implementation Plan:
 - The LCOE for tidal stream energy should be reduced to €0.10/kWh in 2030.
 - The LCOE for wave energy should be reduced to €0.10/kWh in 2035.





Implementation Working Group – Ocean Energy



The Implementation Working Group is composed of representatives from the European Commission, Member States, regions and other stakeholders.





Directorate-General for Research and Innovation (DG RTD)

12 Member States (BE, CY, DE, DK, ES, FI, FR, IR, IT, ND, PT, SE) + NO & UK



The new Implementation PLAN – Ocean Energy

The actions listed within the Implementation Plan are primarily based upon two key sources:

THE EU STRATEGY ON OFFSHORE RENEWABLE ENERGY

The EU 'Offshore Strategy' was released in November 2020 by the European Commission. It sets out the EU's potential and ambitions in the field of offshore wind and ocean energy.



THE EU TECHNOLOGY AND INNOVATION PLATFORM FOR OCEAN ENERGY (ETIP-Ocean)



Ocean Energy - Implementation Plan – Revised version

This plan outlines three high level actions:

- Co-ordination between Member States (MS) and Regions to share and track critical information annually that will demonstrate the clear development of the ocean energy technologies.
- Collaboration between MS, Regions and the European Commission to ensure the effective use and appropriate blending, if possible, of funds to drive large scale deployment.
- The need for annual monitoring of progress with a progress review carried out at the end of each phase to determine Go/NoGo to the next phase.







SET Plan Ocean Energy

How it works



The SET Plan is the technology pillar of the EU's • energy and climate policy



An Implementation Plan was developed for ocean energy actions in the SET Plan (2018)



OceanSET

The Implementation Working Group will deliver actions

From 2019 the H2020 OceanSET project assists the IWG to deliver on the

targets and actions set in the Implementation Plan.

OceanSET

Overview of OceanSET

OceanSET aims to obtain a solid understanding of **evolution in the European ocean energy sector** in order to **optimally tailor future funding** for member states, regions and the European Commission.



Number of OE projects over the three years (2018-2020)





Support to the realisation of the ocean energy implementation plan of the SET-Plan

Thank you for your attention!

- 1. Review of the results of the third annual Member States survey, by Rachel Power from <u>SEAI</u>
- 2. Update on the third annual technology developers survey, by **Ana Andrade** from <u>DGEG</u>
- 3. Q&A session



OceanSET has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°840651



oceanset.eu



Sceon SET

C Hans / Pixabay



OceanSET is focusing on assessing the **progress of the Ocean Energy sector** and monitoring funded projects in delivering successful supports.

| Work Package | Code | Leader |
|--|-------|-------------------------------|
| Ethics requirements | WP1 | SEAI |
| Mapping & Analysis | WP2 | SEAI |
| Finance | WP3 | WES |
| Pre-Commercial Procurement | WP4 | WES |
| Programme Development | | |
| Monitoring & Review | WP5 | DGEG |
| Communication & Dissemination | WP6 | FEM |
| Management | WP7 | SEAI |
| Seal SUSTAINABLE ENERGY AUTHORITY OF IRELAND | nergy | FRANCE ENERGIES MARINES |
| C Direção-Geral de Energia e Geologia | | European Ocean Energy |
| THE UNIVERSITY of EDINBURGH | | PLOCAN |

Mapping using a survey: what information?



4 types of information

aligned with the requirements of the Implementation Plan











Annual report key findings – 2020



16 responses received (from 14 Member States) Ref year 2020.





Annual report key findings – 2020



Member States report 34 projects over TRL 7 active in 2020. Developers reported target values from a selection of projects.

> Mainly horizontal axis turbine and tidal kite

For 0,25 – 2 MW rated capacities:

- > 78% average annual availability for tidal prototypes
- > 3.4 €/W average capital expenditure
- > 0.5 €/W/year average operational expenditure

5 17 wave projects

12 tidal projects

Technologies included point absorber, attenuator and oscillating water column

For 0.2 – 1.5 MW rated capacities:

- > 78% average annual availability for wave prototypes
- > 6.4 €/W average capital expenditure
- > 0.5 €/W/year average operational expenditure





Project grant aid, funding and cost - 2020



141 projects

| Total agreed grant aid (€M) | Applicant/private funding contribution (€M) | Total project cost (€M) |
|--------------------------------|---|-------------------------|
| €334M | €162M | €507M |

| | Average project duration (yrs) | Stage prior to the project (mode) | Stage at the end of the project (mode) | Uplift |
|------------|--------------------------------------|---|--|--------|
| Wave (82) | 2.5 | 2 | 3 | 1 |
| Tidal (28) | 3.2 | 3 | 4 | 1 |
| All (141) | 2.6 | 2 | 3 | 1 |

Task 12 IEA OES: Performance Metrics International Framework for Ocean Energy

https://www.ocean-energy-systems.org/oes-projects/performance-metrics-international-framework-for-ocean-energy/





Data for MS for 2020 - value of projects funded

| Budget (€M) | Spend (€M) |
|-------------|------------|
| €28.66M | €30.91M |



| | TRL 1-6 | TRL 7+ | Unknown | Total |
|-------|------------|-----------|---------|-------|
| Wave | 40 | 17 | 25 | 82 |
| Tidal | 8 | 12 | 8 | 28 |
| Ocean | 9 | 5 | 17 | 31 |
| Total | 57 | 34 | 50 | 141 |



System Demonstration and Deployment TRL 7-9 Oceo









Funding Supports for national/regional programmes to support ocean energy:

- Yes: 10
- No: 3

Policy Mechanisms

• No major changes compared to 2019 (when 2 MS reported having a dedicated ocean energy policy; and 7 MS reported having a general renewable policy that includes ocean energy)





Test Infrastructure:

- **5** MS reported changes to testing facilities in 2020
- In 2019 **80%** of MS believe there is sufficient test infrastructure
- 95% MS believe testing facilities are sufficient to support the sector development

Steps taken in 2020 to speed up Consenting:

- 1* MS inside a test site
- **1** MS outside test sites





No change to 2019 results:

Port facilities

• 80% of MS identified port facilities for OE as 'Good' or 'Adequate/requires some upgrades'

Grid Access

 90% of MS identified grid access as 'Good' or 'Adequate/requires some upgrades'

Supply Chain

- 90% identified Supply chain as 'part of a supply chain which is partially or well complemented by suppliers from other sectors'
- One response identified 'dedicated/self-sufficient supply chain'



SRIA PRIORITY AREAS



Demonstration of OE devices to increase experience in real sea conditions Demonstration of OE technology at array scale Improvement and demonstration of PTO and control systems Application of innovative materials from other sectors Development of novel wave energy devices Improvement of tidal blades and rotor Development of other OE technologies Advanced mooring and connection systems for floating OE devices Improvement and demonstration of foundations and connection systems... Optimisation of maritime logistics and operations Instrumentation for condition monitoring and predictive maintenance Developing and demonstrating near commercial application of OE in niche... Quantifying and demonstrating grid scale benefits of OE Marine observation modelling and forecasting to optimise design and... Open-data repository for OE Improvement of the environmental and socioeconomic impacts of OE Standardisation and certification none C



Strategic Research and Innovation Agenda (SRIA) for Ocean Energy, ETIP Ocean

Key metrics – MS Survey (2018, 2019, 2020)



| Policy/Deployment | 2018 | 2019 | 2020 |
|---|-------|----------|----------|
| number of MS answering the survey | 11 | 10 | 13 |
| Number of MS with an OE policy | 6 | 9 | 8 |
| Number of MS with an assigned Ministry/Department | 0 | 0 | 0 |
| owner at governmental level for OE | 9 | 9 | 0 |
| Number of MS with consistent environmental impact | | | |
| assessment for OE at Governmental level (outside test | 9 | 8/6 | 8/6 |
| site/inside test site) | | | |
| Number of MS with test site facilities | 10 | 10 | 11 |
| Estimated total budget for OE (wave, tidal) (€M) | 23* | 42.7 | 28.7 |
| Total amount spent on OE (€M) | 26.3 | 44.8 | 30.9 |
| Number of MS with revenue support for wave energy | 6 | 5 | 6 |
| Number of MS with revenue support for tidal energy | 5 | 4 | 5 |
| Estimated average consenting time (years) (outside test | 4 25* | | 27/12 |
| site/inside test site) | 4.25 | 2.7/ 1.3 | 2.7/ 1.3 |
| Number of MS with self-sufficient/well complemented | 7 | 7 | 10 |
| supply chain for OE | / | / | |
| Number of MS who funded TRL 7+ projects | 7 | 9 | 11 |

*Metrics have been estimated because data was collected in terms of ranges. The methodology followed consisted in assigning a value by averaging the maximum value and the minimum value in the selected range; in the lowest range, the midpoint is considered; in the highest range the minimum of the range is considered.





- Overall sector continued to be well supported in 2020
- Identifying annual funding remains the main challenge (MS sometimes reporting total funding for multi-annual projects)
- Cumulative MS budget (€28.7m) and spend (€30.9m) for OE in 2020 likely to be an underestimate of the true total value of MS support
- Marine Spatial Plans in all but one Member State (All but two MSPs include zones for ocean energy development)
- No evidence yet of progress towards the creation of a collaborative investment fund, combining EU and Member State funds, dedicated to supporting initial deployments of ocean energy technology.





Support to the realisation of the ocean energy implementation plan of the SET-Plan

Thank you for your attention!

Rachel.Power@seai.ie



OceanSET has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°840651







Sceanser (

© Hans / Pixabay

Sector distribution





Sector distribution





Whole-system project: device development project

Page 3 **Sub-system** project: project contributing for a device development project

* * * * * * *

Funding model











Consortia composition







Consortia composition









Technology transfer











Delivery sectors

On/offshore wind Composites Aerospace Industrial automation Oil and gas



Development areas



- Demonstration of ocean energy devices to increase experience in real sea...
 - Demonstration of ocean energy pilot farms Improvement and demonstration of PTO and control systems
 - , Application of innovative materials from other sectors
 - Development of novel wave energy devices
 - Improvement of tidal blades and rotor
- Advanced mooring and connection systems for floating ocean energy devices Improvement and demonstration of foundations and connection systems for... Optimisation of maritime logistics and operations
 - Instrumentation for condition monitoring and predictive maintenance
- Developing and demonstrating near-commercial application of ocean energy...
 - Quantifying and demonstrating grid-scale benefits of ocean energy
- Marine observation and modelling to optimise design and operation of ocean... Open-data repository for ocean energy
 - Improvement of the environmental and socioeconomic impacts of ocean... Standardisation and certification







Device and installation technologies





Technology performance metrics



Smaller scale devices (< 0,1 MW)

Larger scale devices (> 0,1 MW)

Technology hybrids

• Estimated metrics:

• Data asked in terms of:

- given ranges
- target and achieved performance

Individual values assigned by averaging the maximum and the minimum in the range

- in the lowest range, averaging between zero and its higher value

- in the highest range, the minimum is considered instead of an average

Metrics obtained by averaging individual values

- **n.a.** data considered insufficient when:
 - o **not available at all**
 - the few data available would lead to a possible identification of the project(s) involved





| (target performance) | Rated power (MW) | CAPEX (€/W) | OPEX (€/W) | Energy/year (MWh) | Availability (%) | LCOE (€/MWh) |
|---|---------------------|----------------|---------------|----------------------|---------------------|-----------------|
| WAVE large scale | 0.8 (0.2 to 1.5) | 6.4 | 0.5 | 2207 | 78 | 272 |
| TIDAL large scale | 1.2 (0.25 to 2) | 3.4 | 0.5 | 2933 | 78 | 200 |
| WAVE/TIDAL small scale (< 0.1 MW) | 0.02 | 10.2 | 1.2 | 175 | 90 | n.a. |
| WAVE/TIDAL technology hybrid (Wave/Tidal + Wind/Solar/Off-grid app.) | 2.5 | 7 | 0.3 | 5250 | 92.5 | 362 |





Technology performance metrics



Larger scale devices

| Active TRL 7+ / Stage 4-5 projects – Target technology performance data | 2018 | 2019 | 2020 |
|--|-------|-------|-------------|
| Number of projects addressing environmental impact assessment (EIA) methodologies and tools | 0 | 1 | 3 |
| Number of projects addressing enforcement of stage progression standards through scale testing | 1 | 4 | 6 |
| Total installed capacity (MW) – wave | 0.6 | 4.4 | 4,6 |
| Total installed capacity (MW) – tidal | 4 | 5,25 | 3.5 |
| Average installed capacity per project (MW) – wave | 0.08 | 0.73 | 0,8 |
| Average installed capacity per project (MW) – tidal | 0.8 | 1,31 | 1,2 |
| Total annual electricity production (MWh/year) – wave | n/a | 1825 | 2207 |
| Total annual electricity production (MWh/year) – tidal | 11500 | 13250 | 2933 |
| Average annual electricity production per installed capacity (MWh/MW) – wave | n/a | 1468 | 6826 |
| Average annual electricity production per installed capacity (MWh/MW) – tidal | 1762 | 2550 | 1830 |
| Average annual availability (%) – wave | 88 | 67 | 78 |
| Average annual availability (%) – tidal | 74 | 67 | 78 |
| Average CAPEX (€/W) – wave and tidal | 9.5 | 5,65 | 5.5 |
| Average CAPEX (€/W) – wave | 12.7 | 2.01 | 6.4 |
| Average CAPEX (€/W) – tidal | 7.9 | 8.38 | 3.4 |
| Average OPEX (€/W/year) – wave and tidal | 0.4 | 0.76 | 0,5 |
| Average OPEX (€/W/year) – wave | 0.7 | 0.32 | 0.5 |
| Average OPEX (€/W/year) – tidal | 0.1 | 1.08 | 0.5 |
| Min./max. technical lifetime (years) – wave | 3/25 | 5/20 | 20/30 |
| Min./max. technical lifetime (years) – tidal | 5/25 | 15/25 | 20/25 |
| Average LCOE (€/MWh) – wave | n/a | 207 | 272 |
| Average LCOE (€/MWh) – tidal | 217 | 375 | 200 |



Technical standards



| How do you carry out the of your device? | he performance | certificatio | 1 | | -ii-d S | |
|---|---|---|----------------------------|--------------------------------|------------------------------|----|
| 3rd party application of 2nd party application 1st party application of | of relevant standar of relevant standar of relevant standar | ds (accredited ds (client/inve ds (developer) | certification and te stor) | st bodies) | | |
| | Tidal Whole-system , | | Wave Sub-system, 3 | Wave Whole- system, 1 | Wave Sub- system, 1 | 20 |
| Wave Whole-system, 7 | 3 Tidal Sub-system, 1 | Wave Whole- system, 3 | Tidal Whole-system , 2 | Tidal Su system, | b- 1 | |



Technical standards



Technical specifications (*e.g.* on design, resource characterization, acoustic characterization, moorings, power performance assessment) for ocean energy technology are in development.

• Do you feel technical specifications benefit the sector in its current state of development?



• As a technology developer, are you engaged with the process of creating these specifications?







Environment standards



 In terms of reducing risks, do you feel project development would benefit from European-level harmonization of Environmental standards (*e.g.* rules implemented for the treatment, maintenance and protection of the environment)?



 Would you be willing to share environmental impact data you have collected to help develop a harmonized European environmental monitoring strategy?



 Was environmental information for your zone made available to your project from regulators, stakeholders, researchers and/or other developers?

Yes

TIDAL, WAVE

Whole-system Sub-system

2019





Suggestions for EC action

- Additional support from funding providers?
- Topics to upcoming R&I funding calls?
- Other actions from the European Commission?









Suggestions for EC action



Technology push mechanisms - TIDAL STREAM

- Continued European funding
 - Continuing initiatives like the "Innovation Fund"
 - High priority for diversification of the renewable energy systems in the upcoming "Research and Innovation" (for generating economic growth and increasing energy security)
- Simplified approval process for short term trials of devices

- Ongoing funding to support multiple technical challenges of unit scaling (onshore testing of drivetrain/blades, load control optimisation, mooring/anchoring, launch and recovery)
- More devices in the water namely a tidal energy blades project involving multiple partners
- Novel methods for reducing CAPEX and OPEX innovative technologies and solutions to widen the deployment potential of tidal technologies (a large deployment potential is important to reach scale that will drive cost reductions)
- Funding for environmental monitoring for first arrays developing a robust, low-cost environmental monitoring system
- Support for **hybrid projects**: floating wind and tidal





Technology push mechanisms - WAVE

- Insurance, warranties and guarantees for future projects
- Shortened consenting lead times (easier administrative procedures; understanding among countries on starting offshore energy projects)

 Region directed actions (*e.g.* Mediterranean)

- When funding 'demonstration Projects' its is key to map 'side Projects', to be leveraged and validated
- Commitment to longer term support until higher TRL levels
- Further support for **small wave arrays** (*e.g.* 3 devices)
- Support applications for smaller scale wave energy
- Support hybrid projects: wave & wind; wave & power-to-X (*e.g.* requiring new energy sources like wave to be integrated in large offshore energy farms)



Suggestions for EC action

Market pull mechanisms

- WAVE

- Support for Feed in Tariffs
- Introductions to energy and utilities companies
- Support on entering the market (*i.e.* reducing the risk for the customer)
- Electricity production regulations promoting renewables with the capacity to balance supply-demand (instead of just looking after the amount of capacity installed and energy produced)



 Network/contacts of future customers







ana.andrade@dgeg.gov.pt

Support to the realisation of the ocean energy implementation plan of the SET-Plan

Thank you for your attention!



OceanSET has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°840651

