European Commission Issue Paper on Ocean Energy
Industry Response
Ocean Energy Europe and TP Ocean

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Overview

- **Ocean energy is composed of five technology families all of which are of strategic importance to the EU's continental grid and in its overseas territories as a trampoline for a vast global export market.**

- **Cost reductions in ocean energy will occur through the increased deployment of devices and up-scaling of plants.**

- **The cost of energy targets proposed by the Commission are extremely aggressive and unrealistic without adequate national policy frameworks giving visibility on potential deployment volumes. These should be coupled with financial support to match ambition, alongside continued EU and national commitment to ocean energy R&I.**

- **The ocean energy sector has significant potential for cost reductions. Through deployment,**
  - **Tidal LCoE could reach €c10/kWh by 2030.**
  - **Wave LCoE could reach €c10/kWh by 2035.**
  - **Salinity Gradient LCoE could reach €c8/kWh by 2025.**
  - **Tidal Range LCoE could reach €c13/kWh by 2025.**
  - **OTEC LCoE could reach €c15 to 20/kWh by 2025.**

- **Supporting the deployment of a pipeline of demonstration projects between now and 2020 is fundamental to ensure the ocean energy sector heads down the cost reduction path. It is expected that as deployment picks up, ocean energy will follow a steep cost reduction curve.**

- **LCoE cannot be the only metric for selection of priority technologies, as it ignores the benefits that each technology brings to the electricity system as a whole. Ocean energy technologies bring added system benefits in the form of dispatchable power production, off-sync production and other grid support services. They are, thus complementarity to other renewables and second-to-none in predictability. These should be priced on the electricity market to reflect the benefits of the technology.**

This industry response has been prepared after consultation of the ocean energy sector by ***Ocean Energy Europe*** *and* ***TP Ocean****.*

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1) Issue paper Introduction – five ocean energy technologies, five opportunities

The Issue paper's introduction is, broadly, in line with the industry's vision on how the sector could develop over the coming years, as regards **wave** and **tidal stream** technologies. Ocean energy has the potential to be the "next big thing" in the European power mix meeting a large share of power demand at a competitive cost for consumers.

The Introduction also, correctly, highlights the diversity of technologies, scale and applications of ocean energy indicating, moreover, that they are at different levels of development.

It is important, therefore, to consider all the technologies and how they integrate into the power system to help the EU meet its decarbonisation and climate change objectives.

Specific comments on OTEC and Salinity Gradient

The paper comes across as somewhat dismissive of OTEC and Salinity Gradient technologies due to supposed geographical limitations outside of continental Europe.

Firstly, this is not the case for Salinity Gradient that has deployment potential in mainland Europe. Secondly, in the broader context of the global climate agreement and of developing European industrial excellence for export, European industry has an important card to play in tapping an increasingly large global market for both these technologies.

- ⇨ *Continued support for OTEC and Salinity Gradient within the EU, whether continental or peripheral, will not only provide clean power to European consumers, it will also allow European industry to grow globally.*

Specific comments on Tidal Range

Tidal Range is the most mature ocean energy technology, building on traditional hydro and benefitting from 50 years of operational experience in La Rance, France.

The scale of Tidal Range plants means it can have a significant impact on future power supply, despite deployment being geographically limited to certain Atlantic areas (particularly in Western UK and Western France). Some 20 GW of Tidal Range capacity could be deployed in the UK alone over the next decade.

Moreover, Tidal Range power plants stimulate a European supply chain, creating investment and growth opportunities for companies across the EU, including in countries that do not have a coastline.

- ⇨ *The scale of Tidal Range plants and the advanced state of the technology means that it can make a significant impact on the EU's power supply, rapidly reaching competitive costs of energy, while stimulating a pan-European industrial supply chain.*

2) LCoE targets must be linked to deployment

Short-term cost of energy targets are an important bar for the ocean energy sector to pass. However, they must be linked to deployed volumes. The proposed targets are exclusively linked to a given year, with no indication of how many devices or power plants should be deployed to achieve them.

As for all industries, significant cost reductions will come through volumes: increased deployment will allow for cost reductions through learning-by-doing and economies of scale linked to the industrialisation of manufacturing and logistic processes.

Innovation through Research and Development is required throughout an industry's lifetime and will allow step changes even as the technology matures. However, without a deployment pipeline, R&D alone will not facilitate significant cost reductions as innovations will remain un-proven and will not form part of an industrialisation process.

Ocean energy has significant scope for cost reductions. As the volumes of deployed devices increases and as power plants are scaled up it is expected that costs will fall dramatically, as has been experienced in other renewable energy industries such as solar photovoltaic or wind.

⇨ *The European ocean energy industry calls for the European Commission and Member States to define cost reduction targets alongside a commitment to bring forward a pipeline of ocean energy projects. This commitment needs to be backed by an adequate policy framework regarding consenting and grid connection, continued Research and Innovation support and appropriate power production support.*

LCoE targets for Wave and Tidal

The proposed cost of energy reduction targets for wave and tidal seem overly aggressive. Moreover, there is little information as to what cost elements were taken into account in calculating the proposed LCoE. Taking all ocean energy farm cost factors into account, including the cost of capital, environmental surveys and grid connection, the proposed targets and timeframes seem unrealistic.

The initial 2020 target of €c20/kWh (2025 for wave) would require the industry to follow a significant learning curve, meaning a high level of deployment of devices in the water. The SI Ocean Cost of Energy Report[1] suggested that such a target could be achieved through the deployment of around 350 MW globally.

Analysing the current pipeline and level of Member State ambitions in support for the industry, it is, today, not possible to suggest that the €c20/kWh target can be met by 2020.

In the longer-term, the European Ocean Energy Forum has suggested, in its Draft Roadmap[2], that the cost of energy from wave and tidal farms could tend towards €c10/kWh under the right conditions and through device deployment.

⇨ *More appropriate targets, assuming visibility over significant deployment volumes, are*
  - *Tidal Stream - LCoE of €c10/kWh in 2030;*
  - *Wave energy - LCoE of €c10/kWh in 2035.*

[1] Ocean Energy: Cost of Energy and Cost Reduction Opportunities, SI Ocean (2013) http://www.si-ocean.eu/en/upload/docs/WP3/CoE%20report%203_2%20final.pdf

[2] Draft ocean energy strategic Roadmap: Building ocean energy fro Europe. European Ocean Energy Forum, 2015, http://oceanenergy-europe.eu/images/Documents/Ocean_Energy_Forum_Roadmap.pdf

LCoE targets for Salinity Gradient
Although there is little data from online plants allowing for a precise cost of energy figure for Salinity Gradient, current experimental deployment in Europe of Reverse Electrodialysis (RED), places the cost of energy at around €c20/kWh.

- ⇨ *Adopt a 2025 SET-Plan target for Reverse Electrodialysis Salinity Gradient of €c8/kWh assuming support for the up-scaling process (1 MW plant, then 50 MW plant, then 200 MW plant).*
- ⇨ *Cost reductions will continue with continued roll-out of Salinity Gradient power plants.*

Other forms of Salinity Gradient technology, such as Pressure Retarded Osmosis (PRO) may have different cost structures and, therefore, different targets.

LCoE targets for Tidal Range
There are few technological barriers to deploying tidal range power plants. The power conversion (turbines) build on traditional hydro technologies and a 240 MW plant has been operating in France since 1966. Innovative designs for tidal range, such as in the shape of a lagoon rather than barrage, are being developed and a first 320MW plant could be online in the UK as early as 2021.

Tidal range is eminently scalable, allowing significant economies of scale. Consequently the cost of energy from Tidal Range could come down quickly if there is ambition to bring forward a pipeline of projects.

- ⇨ *Adopt a 2025 SET-Plan target for Tidal Range of €c13/kWh through the deployment of several GW size projects.*
- ⇨ *Cost reductions will continue with continued roll-out of Tidal Range projects.*

LCoE targets for Ocean Thermal Energy Conversion (OTEC)
Although there is little data from online plants allowing for a precise cost of energy figure for OTEC, after the first down-scaled prototype plant is completed, full-scale demonstrators could reduce cost of energy rapidly. This would already allow for the commercialisation of the technology in areas of the world where access to power is limited and expensive, further increasing cost reduction potentials through economies of scale and learning-from-doing.

- ⇨ *Adopt a 2025 SET-Plan target for OTEC of €c15 to 20/kWh assuming support for the up-scaling process (15 MW plant, then 100 MW plant, then 300 MW plant).*
- ⇨ *Cost reductions will continue with continued roll-out of OTEC power plants.*

3) Reliability and Survivability – factors of LCoE
The cost of energy, reliability and survivability of devices and plants are intrinsically linked. Meeting the ambitious cost of energy reduction targets proposed in this paper will, inevitably, require increasing reliability and survivability.

Setting targets allows focussing research and innovation attention on these important aspects of ocean energy development. They highlight, furthermore, the need to support deployment of demonstration devices, arrays and plants as it is through the collection of real data and "at sea" experience that improvements in the reliability and survivability in device or plant design will be possible.

- ⇨ *Short-term targets for demonstrator projects, especially for the less mature ocean energy technologies, could be set in terms of achieving an availability figure, rather than an LCoE target, which is a less relevant metric in early and first of a kind demonstration.*

4) Capacity Factor – not a target in and of itself

Tidal and wave energy project capacity factors will probably increase as the technologies progress. However, capacity factor is not a measure of performance *per se*, merely a useful ratio linking the energy produced to the size of the generator and allowing quick calculations between capacity and electricity production. Capacity factors should, therefore, not be set as targets.

A device or farm may have a low capacity factor, but be designed or deployed in such a way as to minimise manufacturing and logistic costs, in which case the cost of energy may well still be competitive.

Similarly, over-engineering an ocean energy device to reduce the need for maintenance or failure can improve the devices capacity factor by reducing down-time. However, it would also push up manufacturing costs that could offset any LCoE gains from increased production.

- ⇨ *Device manufacturers and developers are best placed to optimise the economics of their machines and projects through demonstration and deployment.*

5) Planning grids requires planning for volumes

The ocean energy sector supports the need to anticipate future deployment of ocean energy projects to inform grid planning from as early as possible. Grid extensions can take many years to build and be costly, it is important for grid operators, like ocean energy developers to have visibility on where and how big future projects might be.

- ⇨ *Planning for grid extensions requires Member States to create visibility over what volumes could be deployed over the coming years. The same visibility required by the ocean energy industry to plan device and plant manufacturing.*

6) Reducing system costs with ocean energy

In terms of grid management and optimisation, ocean energy offers numerous benefits. Wave and tidal energy have different production cycles than wind and solar photovoltaic. Therefore, the combination of these different sources of energy reduces uncertainties linked to the variability of the resources and, consequently, overall system costs.

Moreover, tides are predictable many years in advance, which allows grid operators to plan increases and decreases in tidal array output to a significant degree of certainty, facilitating grid management.

- ⇨ *Large-scale ocean energy integration into the grid can be a factor in reducing system costs if planned correctly.*

About the respondents

Ocean Energy Europe is the representative body for the ocean energy industry in Europe. It's membership is composed of over 100 organisations spanning the entire ocean energy supply chain: device manufacturers, project developers, power producers, component manufacturers, research centres, universities, regions and national industry associations committed to the development of local ocean energy supply chains.

TP Ocean is the European Technology and Innovation Platform for ocean energy, officially recognised by the European Commission. TP Ocean brings together 220 ocean energy experts from over 150 organisations spanning the entire ocean energy supply chain. TP Ocean is also responsible for the European Ocean Energy Forum's technology work stream.

The European Commission's issue paper was largely disseminated to the membership of both OEE and TP Ocean. This response, therefore, takes into account the numerous feed-back and input received from OEE and TP Ocean members. Around 70% of responses came from companies (including SMEs, large companies and multinationals) and 30% from research centres and academia.