European Commission

European MSP Platform

Sector Fiche:

Tidal and Wave

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1 Basic Facts

Gross Value added	State of the sector	Presence across sea basins
N/A	Emerging but varies per technology.	Predominantly Atlantic, North Sea and East Mediterranean due to available resources.

Land-sea interaction	Temporal aspect	Lifetime of installations
Transmission infrastructure, maintenance traffic.	No seasonal variation. Once installed, present until decommissioned.	According to country-specific licensing process, usually 20-30 years.

Interaction with other uses
Potential for positive and negative interactions, depending on the location. Likely exclusion of fishing and shipping around wave and tidal arrays.

2 Composition of the tidal and wave sector

Development of tidal and wave energy technologies is advancing in Europe and globally, and both sectors are expected to expand significantly in the next decade. Wave energy is dependent on wave height, speed, length and the density of the water, whereas tidal energy is generated by the difference in surface height in a dammed estuary, a bay or a lagoon (tidal range) and the kinetic energy in the currents caused by the tides (tidal stream)[1].

Tidal energy technology is at a more advanced stage due to convergence of technology and involvement of large industrial players and utility companies, with commercial-scale devices currently being tested (notably in Scotland and France)[2]. Wave energy conversion technologies remain at an early prototype phase, with 10 experimental-scale devices of 100 kW or larger deployed at sea between 2013-16, with a total capacity of almost 5 MW[3].

3 Relationship between tidal and wave and MSP

3.1 What are present spatial needs of the tidal and wave sector?

Wave and tidal projects are placement-driven and depend on the resource potential in a given location. While areas with high potential for tidal energy projects have been identified, wave energy conversion includes a broader range of technology types which are adapted to different wave conditions and assessing likely use of future areas therefore remains uncertain given the potential for technological development. Unlike wave energy, tidal resources are not widely distributed and are found in specific areas, limiting the geographical expansion of the tidal energy sector.

The primary locations of tidal stream resource in Europe include areas around Scotland and the Orkney Islands, off the coast of Northern Ireland, off the coast of Normandy and Brittany, between the Greek islands Korfu and Paxi and the Greek mainland, Spain, the Netherlands and Denmark[4]. Key locations for wave energy resources are the Atlantic Ocean (United Kingdom, Ireland, Spain, Portugal and France) and the North Sea (Denmark)[5].

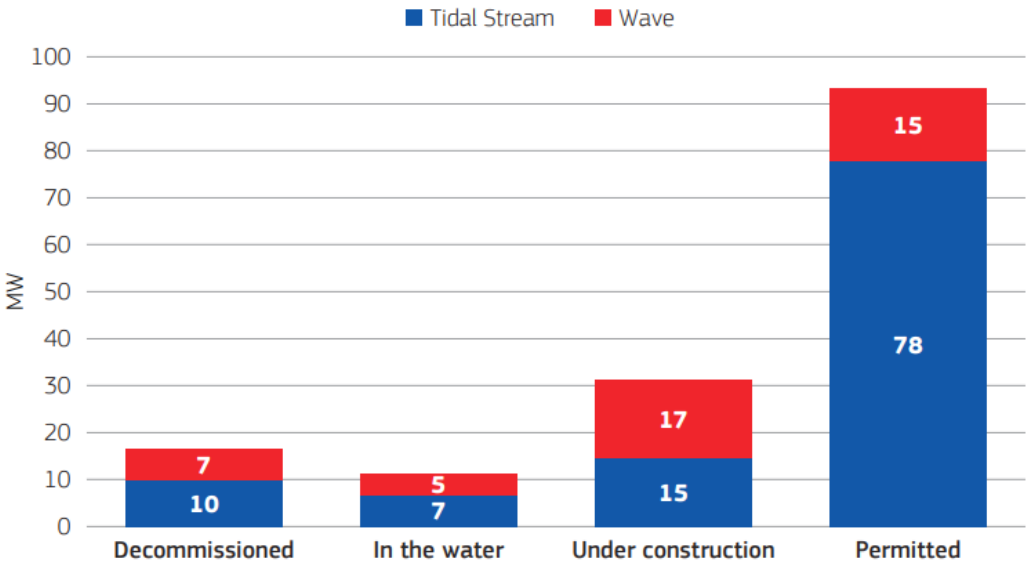

Figure 1. Deployed tidal stream and wave capacity, capacity under construction and permitted capacity (MW) in Europe in June 2016.

Source: Ocean Energy Forum, Ocean Energy Strategic Roadmap Building Ocean Energy for Europe, 2016, p. 17

[1] DGMARE (2015).
[2] European Commission (2013).
[3] Ocean Energy Europe (2017).
[4] Ecorys (2017).
[5] Ibid (2017).

3.2 Which anticipated future developments of the industry are relevant to MSP?

Increased demand for space	Commercialisation
The ocean energy sector as a whole foresees larger-scale projects of up to 50MW by 2020 in preparation for full commercialisation from 2025[6]. The ambition of the sector is to install wave and tidal energy capacity over the next 35 years at such a scale that it could address up to 10% of the European Union's energy demand[7]. While a number of barriers to the growth of the sector exist, it is anticipated that the demand for space from wave and tidal projects will increase in the coming decade.	Commercialisation of wave energy conversion technology could result in major spatial implications in areas where wave resource is present, both in terms of individual devices and commercial arrays. Demand for space for wave energy projects is expected to be modest in the short-to medium-term, but could drastically change in the longer term, if technological advancements enable upscaling and cost reduction in a way similar to offshore wind[8].

4 Interaction with other sectors

Shipping and ports	Tourism and recreation
• Potential for negative interaction between shipping and wave or tidal energy arrays, if the location of suitable resources overlap with established shipping activity. This depends on the height of the technology in the water column and whether surface-piercing infrastrucuture is required. • Port facilities required for construction of devices, equipment preparation and maintenance, with associated vessel traffic for attending project locations. • Potential for competition for port facilities with other sectors, although synergies may also be possible.	• Potential for concerns regarding visual impacts at areas of scenic value, and for interaction with recreation such as kayaking and diving. • Potential increase in visitors at project locations.

Oil and gas	Pipelines and cables
• Some potential for use of supply chain and infrastructure in the development of wave and tidal energy projects. • Potential competition in demand for space development, although only where the resources are suitable for both types of development	• Ocean energy development will require the development of the submarine cables sector as means to deliver the obtained energy to energy grids.

Fishing	Marine aquaculture
• Potential for displacement of fishing activity from areas of project development, including along the cable routes, and particularly during installation due to vessel presence.	• Potential competition in demand for space development, although only where the resources are suitable for both types of development. • Where suitable and technological and regulatory hurdles can be addressed, co-location of wave energy devices with aquaculture facilities may be possible[9].

[6] Ocean Energy Assocation (2013).
[7] Ocean Energy Europe (2017).
[8] Ocean Energy Forum (2016).
[9] MARIBE (2016).

Offshore wind and marine renewables	Conservation
• Potential competition in demand for space development, although only where the resources are suitable for both types of development, which is not often the case. • Synergies may take place in terms of supply chain services, grid connection and R&D efforts. Conceptual studies indicate potential for co-location of wave energy devices with offshore wind turbines (although this remains to be tested commercially[10].	• Potential for ecological interactions, particularly between tidal turbines and bird / marine mammal species of conservation importance[11].

5 Recommendations for MSP processes in support of the sector

In supporting Blue Growth, MSP can support the development of wave and tidal energy projects, alongside other sectors and interests. However, MSP processes are highly context-specific, and the emphasis placed on ocean energy will be in accordance with policy set out at Member State level. General recommendations for MSP are set out below.

Accurate resource mapping MSP should be informed by accurate resource mapping to identify areas of interest for ocean energy development. This should be continually refined based on improved understanding of wave and tidal resources, and in response to continual technological advancement. The location of onshore transmission infrastructure is also important, as a key factor in the feasibility of offshore wave and tidal energy project development.	**Differentiate** Wave and tidal energy needs to be considered separately given the different stages of development and sector requirements. There is considerable technological diversity among wave energy converters, and tidal stream / range, which have different spatial demands.	**MSP as information base** In addressing environmental and social constraints, MSP provides an information base, reducing uncertainty around impacts and can reduce risk in consenting. MSP mechanisms can also be used to facilitate data gathering in relation to environmental impacts, including monitoring the effects of devices and arrays, and particularly on mobile species such as fish, marine mammals and birds[12].
Promoting synergies MSP provides a framework for managing conflict and promoting synergies between sectors, e.g. co-location with wave energy and/or aquaculture. It can also facilitate dealing with issues around social acceptance, by engaging stakeholders locally in considering multi-sector development scenarios and at an early stage in the planning process.	**Strategic electricity planning** Given the cross-border aspect of MSP including internationally, and across the land-sea interface, MSP can support planning strategic electricity transmission. This includes promoting transnational initiatives, such as the North Sea Supergrid, and setting policies for effective use of submarine cabling and onshore transmission between projects, and with other technologies such as offshore wind.	**Co-operation between authorities** Co-operation between authorities responsible for MSP and offshore energy developments is essential to ensure that the changing spatial demands for wave and tidal energy are considered from the outset of planning processes.

[10] Perez Collazo et al. (2014).
[11] ICES (2016).
[12] Ocean Energy Forum (2016).

6 Resources[13]

6.1 Actors

Name	Link	Short explanation
Ocean Energy Europe	www.oceanenergy-europe.eu	EU industry association, representing a members network of 115 organisations and ocean energy professionals, including utilities, industry and research institutes.
Ices Working Group on Marine Renewable Energy	http://www.ices.dk/community/groups/Pages/WGMRE.aspx	ICES Working Group on Marine Renewable Energy (WGMRE) coordinates the flow of science between topic-based science working groups on seabirds, benthic ecology, fish ecology and its application in planning, consenting and regulatory processes in relation to tidal (both in-stream and barrage), wave and offshore wind energy. ICES provides applied scientific knowledge relating to management of this increasingly important and rapidly developing set of activities.

6.2 Initiatives

Name	Link	Short explanation
Ocean Energy Europe	www.oceanenergy-europe.eu	EU industry association, representing a members network of 115 organisations and ocean energy professionals, including utilities, industry and research institutes.
Ocean Energy Forum (no longer active)	https://www.oceanenergy-europe.eu/en/policies/ocean-energy-forum	Stakeholder platform established in 2014 by DG MARE to promote dialogue between all stakeholders (industry, Member States/regions, EC) and make recommendations on how to support growth of the sector.
European Technology and Innovation (ETIP) Platform Oceans	https://www.etipocean.eu	ETIP Ocean is a recognised advisory body to the European Commission, part of the EU's main Research and Innovation policy the Strategic Energy Technology Plan (SET-Plan). ETIP Ocean brings together around 250 experts from 150 organisations covering the entire European ocean energy sector
SEANERGY 2020	http://www.seanergy2020.eu/	Seanergy was an EU funded which ran from May 2010 to April 2012, co-ordinated by the European Wind Energy Association. The project provided an in-depth analysis of the national and international Maritime Spatial Planning (MSP) practices, policy recommendations for developing existing and potentially new MSP for the development of offshore renewable power generation, including from wind, wave and tidal energy.

[13] The information provided under this section is non-exhaustive. The intention is to provide the reader with basic information on the sector.

6.3 Selected literature

Author	Title	Link	Short explanation
DGMARE	Energy sectors and the implementation of the Maritime Spatial Planning Directive	https://ec.europa.eu/maritimeaffairs/sites/maritimeaffairs/files/docs/publications/energy-sectors-msp_en.pdf	This report summarises conclusions drawn from the conferences on "Maritime Spatial Planning (MSP) and energy" in Dublin, Ireland (14 June 2013) and "Regional cooperation on energy and Maritime Spatial Planning in the North Sea"(29 January 2015). It informs relevant industries, national authorities and NGOs about the specific characteristics, challenges and benefits of the implementation of the new MSP Directive for the energy sector.
Ocean Energy Forum	Ocean Energy Strategic Roadmap: Building Ocean Energy for Europe	https://webgate.ec.europa.eu/maritimeforum/sites/maritimeforum/files/OceanEnergyForum_Roadmap_Online_Version_08Nov2016.pdf	This Strategic Roadmap was commissioned by DGMARE and produced in collaboration with the Ocean Energy Forum. The Ocean Energy Forum was set up to bring together stakeholders to develop a shared understanding of the problems faced by the Ocean Energy sector and to collectively devise workable solutions. The strategic roadmap sets out the vision for the sector, with recommendations across three topic areas: Environment & Consenting, Finance and Technology.

7 List of references

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