The technologies

The two most promising technologies for early commercial development in Europe are wave and tidal power:

1. Wave power

Devices can be bottom-mounted or floating, and sited at various distances from the shore, but all derive their energy from the movements and power of waves.

2. Tidal energy

Current

Devices are placed in-stream and generate energy from the flow of water. Ideal locations are around peninsulas and through restricted channels, such as between islands and the shore.

Barrage

These systems use the rise and fall of tides in estuaries and bays to produce electricity. The technologies are well developed and work is continuing to develop strategies to minimise environmental impact.

Other technologies

These technologies are seen as potentially interesting for supplying electricity in Europe in the longer term:

Temperature

The difference in temperature between warm surface waters and cool deep waters can be harnessed by Ocean Thermal Energy Conversion (OTEC) technologies. These involve pumping cold water up from lower layers to condense warm waters that then run through a turbine.

Salinity gradient

Salinity gradient systems derive energy via osmosis, the natural flow created between seawater and fresh water being passed through a turbine.

Ocean energy in practice

Before moving on to large-scale deployment, device prototypes tend to be extensively tested and monitored on dedicated test sites. These test sites often become centres of excellence in research and development, offering a range of services to technology developers. There are a number of such facilities in Europe, including:

- European Marine Energy Centre (EMEC) in Scotland, UK
- Wave Hub in Cornwall, UK
- Galway Bay Wave Energy Test Site in Ireland
- SEM-REV in Bretagne, France
- Biscay Marine Energy Platform (BIMEP) in Lemoiz, Spain
- Nissum Bredning Wave Energy Test Site in Helligsø, Denmark.

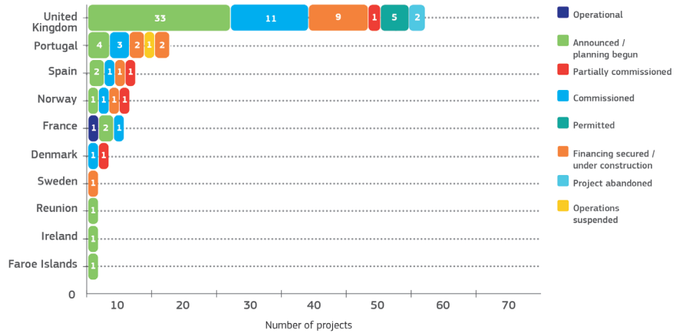

Figure 5: Number of ocean energy projects per country.

Source: Bloomberg New Energy Finance

More information

http://ec.europa.eu/dgs/maritimeaffairs_fisheries/index_en.htm

and

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European Commission

The Future of Ocean Energy

Maritime Affairs

The great untapped potential

Day and night, around the world, the force of the sea can be seen and heard, crashing onto beaches and rocky shores. The endless cycle of waves, tides and currents is driven by wind, the gravitational effects of the moon and, ultimately, the power of the sun.

Following decades of research, the ability to tap into this formidable source of energy is finally within our grasp. What it promises is seductive: a vast and dependable supply of clean energy, accessible on shore and yet largely out of sight, helping to reduce our dependence on fossil fuels and thus our footprint on planet Earth.

Tapping into the power of waves and tides to generate electricity also promises to create a vibrant new energy sector, offering new high-quality jobs (up to 40 000 by 2035) and economic growth, especially for areas suffering from the decline of traditional maritime industries such as shipbuilding and fisheries.

The UK's Carbon Trust estimated that the global wave and tidal energy market could be worth up to €535 billion between 2010 and 2050. Creating the conditions under which the sector could prosper would enable the EU to maintain its leadership in this field and capture a sizable share of the market in the future.

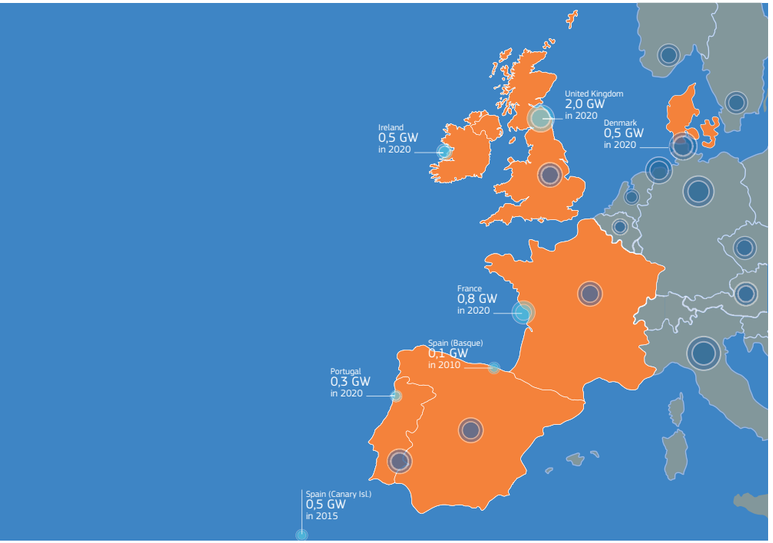

Figure 1: Manufacturing capacity supporting the ocean energy sector (dark blue circles) across Europe.

The story so far

EU funding programmes have provided over €90 million since the 1980s to support research and development into technologies that harness energy from the seas and oceans.

A variety of technologies have been tested, keeping Europe at the cutting edge of global research in the field.

Progress into full-scale production in the open sea has, however, been complicated by a number of obstacles.

There still are important technical challenges that need to be resolved to ensure that devices can produce electricity reliably.

The roll-out of arrays is, however, also being held back by difficulties in accessing finance, administrative barriers, limited knowledge about the environmental impact of ocean energy devices and a lack of grid connections, which are needed to bring the electricity onshore and to where the demand is. While this has made for slow progress and kept the unit cost of electricity generated from our seas and oceans relatively high, costs are set to decrease as the technologies advance along the learning curve.

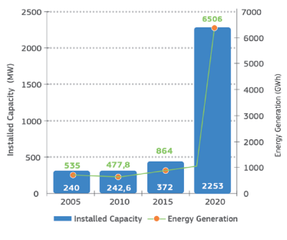

Figure 2: Wave and tidal energy installed capacity and energy generation in EU27, according to EU27 Renewable Energy Progress Reports and National Renewable Energy Action Plans.

The momentum builds

There are clear signs that the tide is turning. Some observers suggest that ocean energy could become competitive within a decade. A number of devices have proved their reliability in pilot projects and are ready to be rolled out in a large-scale deployment.

Several EU Member States have included marine energy in their Renewable Energy Action Plans. Many regions, mostly along the Atlantic coast, have identified ocean energy as one of their key priorities for regional development. Large power operators are getting involved in the sector. So, too, are major manufacturing companies and industrial groups.

Over €600 million have been invested by the private sector over the last seven years and this is set to increase further, provided that there are favourable conditions for the development of these devices.

In the wind energy sector, an EU framework brought together key actors to drive technological development, by setting common goals and creating a critical mass of activities. This helped the sector grow to maturity.

Stakeholders have led calls for a similar strategy to replicate this success in the ocean energy sector.

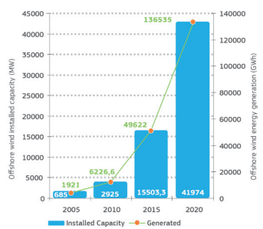

Figure 3: Offshore wind installed capacity and generated energy in EU27, according to EU27 Renewable Energy Progress Reports and National Renewable Energy Action Plans.

EU ready to act

In response to these calls, the European Commission developed a two-step action plan to support this emerging sector. In the first phase (2014 – 2016), an **Ocean Energy Forum** will be set up, which will bring together stakeholders to develop a shared understanding of the problems and to develop solutions. It will focus on building capacity and critical mass, and on fostering cooperation. The outcomes of the Forum will feed into a **Strategic Roadmap**, which will provide an agreed blueprint for action in order to help the ocean energy sector move towards industrialisation.

In the second phase (2017 – 2020), a **European Industrial Initiative** could be developed, based on the outcomes of the Ocean Energy Forum. European industrial initiatives are public-private partnerships that bring together industry, researchers, Member States and the Commission to set out and implement clear and shared objectives over a specific timeframe. They enhance the impact of innovative research and development and provide a platform for sharing investment risk.

In addition, the Commission could develop **sector-specific guidelines**, in order to ease the burden faced by public authorities and developers in licensing ocean energy projects.

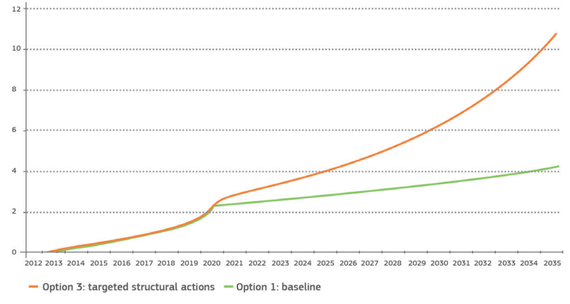

Figure 4: Expected development of ocean energy installed capacity in the EU until 2035 following targeted structural actions taken by the EU and Member States (option 3) and continuation of the current baseline scenario (option 1 – no actions).