ENERGY

DHI CASE STORY

DEVELOPING A DATA PORTAL FOR THE WAVE AND TIDAL ENERGY INDUSTRY

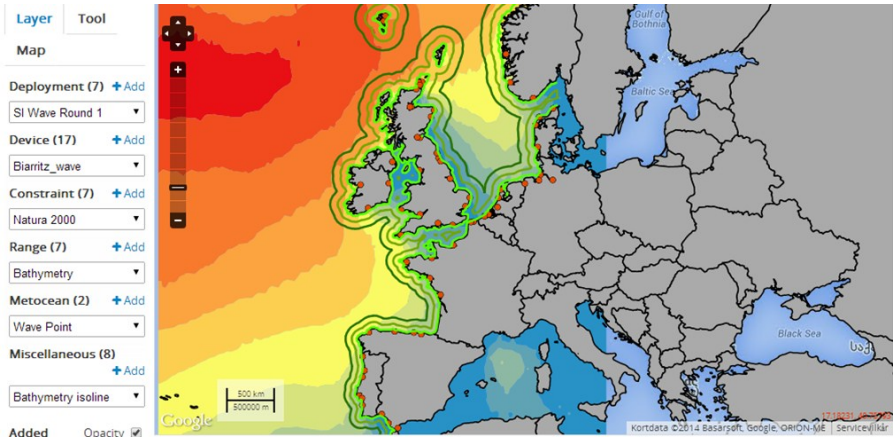
Encouraging ocean energy extraction in Europe using resource mapping

The European Union (EU)'s Intelligent Energy Europe programme aims to improve energy sustainability in Europe. To do this, they funded the Strategic Initiatives for Ocean Energy (SI OCEAN), which is paving the way for the identification of current barriers to the deployment and commercialisation of wave and tidal energy technology. Proper resource mapping is vital to achieve this. To assist with this, we worked with several partners to develop the SI OCEAN Data Portal – a GIS-based web client that uses our MIKE CUSTOMISED platform. It enables the European ocean renewable industry to better evaluate the potential of wave and tidal energy production.

DEVELOPING A WAVE AND TIDAL ENERGY DATA PORTAL

Most people think the ocean is vast with plenty of space for wave and tidal energy devices. However, there is little space not already claimed (by shipping routes, fishing grounds, offshore activities and so forth) that is also suitable for present wave and tidal energy extraction technologies.

An important building block in identifying where energy is available close to the coast with no or few constraints is resource mapping. In collaboration with several partners, we developed a GIS-based web client – the Strategic Initiatives for Ocean Energy (SI OCEAN) Data Portal – to aid in this.



A screenshot from SI Ocean (http://si-ocean.dhigroup.com/map) showing service ports, wave power and distance to the coastline.

SUMMARY

CLIENT

The European Union's Intelligent Energy Europe, in collaboration with:

- Ocean Energy Europe
- Wavec
- Carbon Trust
- RenewableUK
- The University of Edinburgh
- European Commission Joint Research Centre

CHALLENGE

- Identifying technological, resource-based, policy and market barriers for the wave and tidal energy industry in Europe
- Mapping wave and tidal energy resources and energy production in Europe

SOLUTION

Resource mapping based on our MIKE CUSTOMISED technology platform

VALUE

- Enables the development of a Strategic Technology Agenda and Market Deployment Strategy with stakeholder buy-in from ocean renewable energy developers
- Provides a sound starting point for the further development of ocean renewable energy technology
- Enables anyone to browse and make use of freely available data in the free GIS-based resource mapping tool and open data portal

LOCATION / COUNTRY

North Atlantic Ocean, Europe

The SI OCEAN Data Portal allows anyone to view a collection of data in order to determine suitable locations for arrays of devices, such as wave energy converters. The available GIS-data layers include:

- Constraints: telecom cables, Natura 2000 (an EU-wide network of nature protection areas), offshore installations, wind farms and shipping lanes
- Placement criteria: water depth, distance to the shore, grid power stations and service ports
- Wave and tidal energy criteria: wave power, extreme wave height (for survivability assessment), tidal maximum current speed and tidal range
- Metocean data: wave data (scatter tables) and tidal current speed data (scatter tables)

The data currently covers Europe's North Atlantic Ocean, including Denmark, France, Ireland, Portugal, Spain, and the United Kingdom. However, the flexibility of the portal allows additional and enhanced data sources to be added by users.

WAVE ENERGY IN EUROPE

Wave and tidal energy will always be a relatively small but valuable contributor to the renewable energy mix in Europe. The EU's wind energy capacity currently covers 7.6% of EU's electricity needs (Source: EUROSTAT Electricity Statistics 2013). By comparison, deploying 500,000 wave energy devices in Europe would produce up to 45 GW of energy per year (Source: SI Ocean Resource Mapping Methodology and key projections Report). This would cover 12% of Europe's current electricity consumption.

TOOLS FOR ANALYSING DATA

The data portal has several tools – available to users with a login and password – for data evaluation, including:

- New Area Layer – facilitates the process of marking areas unoccupied by constraints, resulting in a new polygon layer identifying suitable areas
- New Device Layer – can be used to place devices (array of devices, individually or by importing points layers from a shape file) once suitable areas for wave or tidal devices have been identified
- Device Layer Tool – can be used to delete any devices outside of the defined polygons
- Shadowing Tool – can be used to assess and attribute each device with a reduction factor
- Energy Yield Calculation – calculates the average annual energy production by multiplying the power production characteristic of the device with the Metocean table for the occurrence of various sea states and current velocities

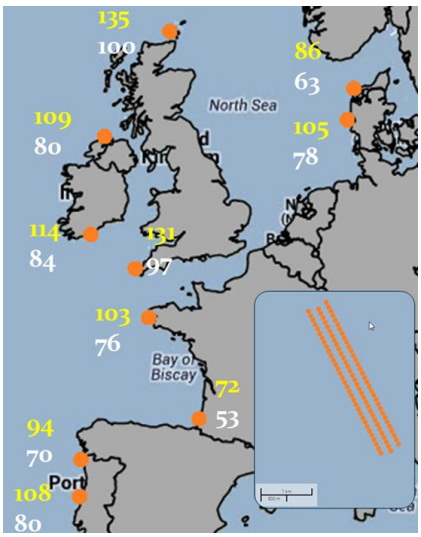
A power matrix of additional devices can easily be added to the system back office.

COMPARISON OF ARRAYS OF WAVE ENERGY CONVERTERS

Ten sites were selected based on some of the existing test sites, constraints, wave energy level variations and the severity of extreme waves. Orkney, Scotland – the site with the highest energy yield – was indexed with the number 100. By comparison, the same wave array placed near Biarritz, France in the Bay of Biscay will produce 53% of the energy produced at Orkney. This does not mean that the Bay of Biscay is a less attractive site.

An equally good or potentially better levelized cost of energy (LCOE) can be obtained at low energy level sites. This is the case if, for example, mooring costs are lower and the energy device is optimally designed and configured for site conditions.

Selecting another type of device and placing the arrays in other locations can significantly change the results. The optimal spot for an array of devices depends on a large range of criteria. The SI Ocean Data Portal can help you pinpoint that spot.



Wave array production examples. Each array consists of 99 devices in three rows, as indicated. The yellow numbers show the energy production in Gigawatt hours per year (GWhr/year). The white numbers are a percentage index in relation to the site with the most energy (in Scotland).

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