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MARCH 2023

BRETAGNE DÉVELOPPEMENT INNOVATION

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Background information

Island and isolated communities often have abundant natural resources, including wave and tidal energy. These offer a lot of potential as secure sustainable and renewable energy sources, but the calculations to quantify the resource are not straightforward or readily accessible. The literature on the topic is also in considerable depth, but there is a lack of clarity generally on how to get from resource data to a reasonable initial estimate of the number of devices required to give sufficient community energy.

If such communities wish to access this resource, local stakeholders need reliable information about the different renewable energy sources available to them, to be able to make informed judgements about the resource, without necessarily having a background in ocean science or marine renewable energy engineering.

This deliverable therefore provides simple guidance on how to assess the marine energy resource. It is divided into two components:

1) Tidal energy resource assessment
2) Wave energy resource assessment

Each component illustrates how the energy generated from typical devices may be considered in relation to community energy usage.

The tidal and wave energy assessment tools make it possible for numerically competent islanders, stakeholders, or students of marine energy to arrive at meaningful estimates of available energy, to consider this in context of the required energy, and to calculate the number and size of the typical (current) marine energy devices required to meet this need.

SYSTEM/TECHNOLOCY SPECIFICATIONS

The tool provides the theory and demonstration calculations required to assess the tidal stream resource and the wave resource. The reports draw on the latest technological developments in both tidal and wave energy theory. The approach extracts the readily usable components of the literature and currently employed approaches to provide a working route from tide and wave data to assessing the scale (number) of devices required to meet community energy needs.

Tidal stream estimates are needed for regions with strong tidal flow. The method demonstrated here uses data from tidal diamonds on nautical charts, such as those provided by the UK Admiralty. Alternatively, data from nautical almanacs could be used. Acoustic Doppler Current Profiler (ADCP) surveys are an established method of recording tidal flow strengths. These may be used, if available, for the site of interest.

Wave energy data is required from wave buoys in the proximity of the site. There are several locations where data can be accessed, and these are signposted in the tool.

Some aspects of the tool may be enhanced using updated device specific parameters, such as newly available power matrices for wave energy devices, or the latest power coefficients for specific tidal energy devices. These parameters may be viewed as commercially sensitive, so it is necessary to use ones that are openly available (as shown here), or work with developers to use specific values.

The user needs to have numerical competency in standard spreadsheets such as Excel or simple programming languages such as Matlab to implement the calculations. The level of required expertise is that of a competent engineer. A normal personal computer or laptop is sufficient to run the calculations.

ANTICIPATED AND/OR RECORDED IMPACTS/ BENEFITS

The impact has been positive for the testers (students), who have found the tool to be useful. They have been able to carry out resource assessment of tidal sites without requiring data from expensive ADCP deployments, or the requirement to run complex numerical model. They have also been able to follow the steps in the wave energy calculations, to go from wave data at a buoy, to an estimation of the energy yield for a community. One of these students is now working for one of the wave energy developers in the South West UK. Another is working for the UK Offshore Renewable Energy Catapult in Pembrokeshire, near the Ramsey Sound tidal energy site.

The impact has also been positive for the contributing researcher in multiple ways. Working on the best practice has enabled new knowledge acquisition, put research skills into practice and has also increased scope for community engagement work.

The wave analysis approach has recently attracted attention for a local community development in Polperro. The development of the tool is giving us something tangible to offer in terms of assessing the wave resource at the site.

ANTICIPATED AND/OR RECORDED CHALLENGES

Potential challenges may be:

- locating accessible wave data from a wave buoy near the area of interest.
- Identifying sources of tidal stream strength data.

- Gaining access to potentially commercially sensitive technology data about the latest devices, such as operational thresholds and energy matrices for wave energy devices, and power curve characteristics for tidal energy devices.
- In understanding the different units of energy for the wave component.
- The mathematical expansion of the small amounts of available data to obtain tidal velocity predictions every hour for longer periods.