wave energy SCOTLAND

Title: A Techno-Economic GIS for Ocean Energy

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INTRO

There are many GIS and TE tools geared for renewable energy applications. However:

- Few are suitable for wave and tidal energy applications
- Those available either adopt a GIS or a TE approach, not a combination
- They are limited by lack of up-to-date, high-resolution information on specific sites
- Full TE functionality is not open-access

For WP4 of the Selkie Project, I have designed and developed a fully open-access GIS Techno-Economic (GIS-TE) tool, suitable for wave and tidal energy project developers, academia and government. The tool can:

- Propose sites and produce techno-economic recommendations for wave and tidal energy technologies in Irish and UK waters.
  - The GIS aspect allows for identification of potential sites
  - The TE element facilitates assessment of project feasibility at these sites

METHODS

1. The web-interface was developed in HTML, CSS and JavaScript with the help of Esri Developer's JavaScript API.
2. The GIS data was gathered from a range of open access sources across Ireland and the UK to depict all relevant constraints, restrictions and opportunities.
3. The wave and tidal resource data also came from open access sources and is of an unprecedented spatial resolution for any tool of its kind (~1.5km both for wave and tidal). Using MATLAB code, wave data was tested against in-situ data for accuracy, but this was not possible for tidal data due to lack of validation sources.
4. Default techno-economic inputs in the tool are either geospatially determined by where the user clicks on the map (i.e. distance inputs) or are derived from the available literature (i.e. cost inputs). Annual Energy Production (AEP) was calculated by applying the resource data to power matrices/curves in MATLAB.

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LCOE is inherently spatial in nature, thus the location of a project has a resounding effect on the output. Combining GIS with Techno-Economics can address this.

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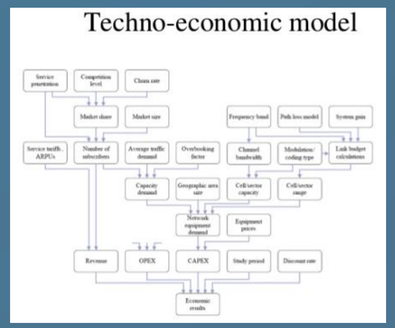

= LCOE

HOST INSTITUTION
UCC University College Cork, Ireland Coláiste na hOllscoile Corcaigh

PARTNER INSTITUTIONS
CIT Cork Institute of Technology · DCU · DIAS Dublin Institute for Advanced Studies · Dundalk Institute of Technology · ESRI Economic & Social Research Institute · Maynooth University · NUI Galway Ollscoil na Gaillimhe · Trinity College Dublin · DIT Dublin Institute of Technology · Tyndall · UCD University College Dublin An Coláiste Ollscoile, Baile Átha Cliath · University of Limerick Ollscoil Luimnigh

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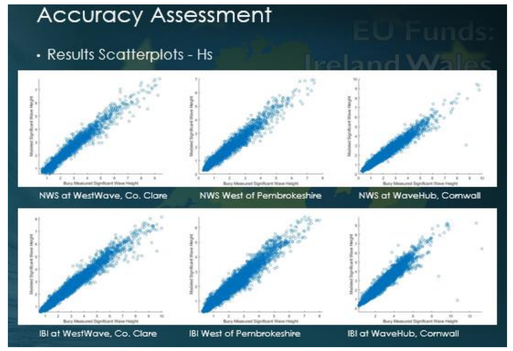
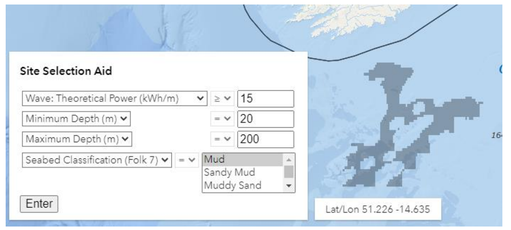
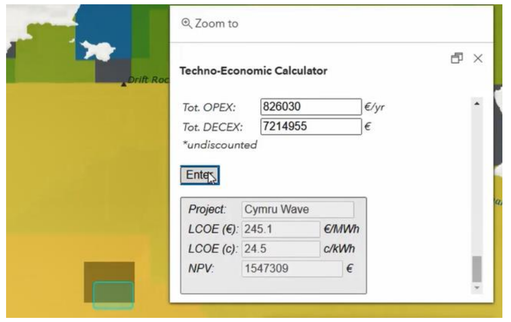


RESULTS

- Good correlation between model data and in-situ validation data for wave height and period (above).
- Using real case study scenarios based on industry survey responses, the Site-Selection Aid (within the tool) reveals several locations meeting desired criteria to show suitable sites (below).



- Running the Techno-Economic model on some of these sites to assess project feasibility KPIs reveals LCOE returns of as low as 24.5 c/kWh (below). However, these results vary drastically depending on the site location (i.e. where the map is clicked).



Conclusion

- Open-source GIS data from across the web can be integrated to decision making tools such as this to enable effective site suitability assessment for wave and tidal energy farm deployments.
- Open-access oceanographic models with a high spatial resolution that have recently become available online perform well when assessed for accuracy against in-situ validation points and can be used to get the AEP of ocean energy devices when applied to the device technical data.
- KPIs such as LCOE are inherently spatial in nature, and thus the location of a project has a resounding impact on said.