# Locating Wind Farms

## Oil and Gas experience provides wind farm location expertise using established ranking analytical criteria.

In June 2009, the Climate Change Secretary, Ed Miliband opened the Little Cheyne Court wind farm on Romney Marsh. This sparsely populated wetland area of Kent is now home to 26 windmills, each standing nearly 400 feet high and spread over a four kilometre square area. It is estimated that the farm will provide energy for 33,000 local homes. At the opening ceremony the Minister said; "The expansion of wind energy, alongside other renewables... is vital for the UK's low carbon energy mix and brings with it massive opportunity in terms of jobs and economic growth". Add this sentiment to his recent announcement that opposing wind farm development should be as socially unacceptable as "not wearing your seatbelt or driving past a zebra crossing" and you can see the desire to develop more and more possible wind farm sites around the UK.

But what criteria should be used to decide the best locations? The Crown Estate's Round 3 Programme will see that organisation working with its partners to identify suitable offshore wind farm sites within each of their pre-defined zones. This work will surely be followed by more studies to determine suitable sites; both on and offshore.

It doesn't take a huge leap to see that GIS will be a key tool in making the location decisions – the Government's own Strategic Environmental Assessment relating to the offshore developments lists wind speed, water depth, proximity to areas of high electricity demand and onshore transmission connection points as key location-based criteria. One tool that is being used to provide rankings of the suitability of possible developments sites comes, slightly surprisingly, from the Oil & Gas industry.

Exprodat is a company rich in Oil & Gas expertise and experience. Formed in 1997, the company has provided information management and GIS solutions to the world's biggest energy suppliers. Harnessing this knowledge and developing with ESRI GIS software, Exprodat has created a suite of products that address specific requirements for Oil & Gas exploration and production management. One of these tools is Team-GIS Acreage Analyst.

In exactly the same way that potential sites for wind farms are ranked according to their performance against a list of criteria, so are the blocks that make up an exploration and production site for Oil & Gas companies. In this industry data inputs are geologic, environmental, economic, engineering-based etc. but the principle is exactly the same – create a ranking of the possible development sites based upon the inputs and weighting applied to each one. Exprodat realised that the Team-GIS Acreage Analyst software could be a perfect tool in grading possible wind farm sites and recently set about testing this idea.

To develop as real-world an example as possible, the Exprodat development team decided to focus on the Holderness Round 3 region from the Crown Estate's Programme. Data for this area is widely available and additional data sources included the Joint Nature Conservation Committee (JNCC), the Department of Energy & Climate Change (DECC) and English Heritage. A fascinating source of data was the Atlas of UK Marine Renewable Energy Resources, a project commissioned by the Department for Business Enterprise and Regulatory Reform in 2007. The charts in the Atlas indicate the distribution of potential resource for the future deployment of renewable energy technologies. The wind maps in the Atlas allowing users to view areas depending upon their annual mean wind speed and power can be downloaded from the site in a number of formats (www.renwables-atlas.info ).

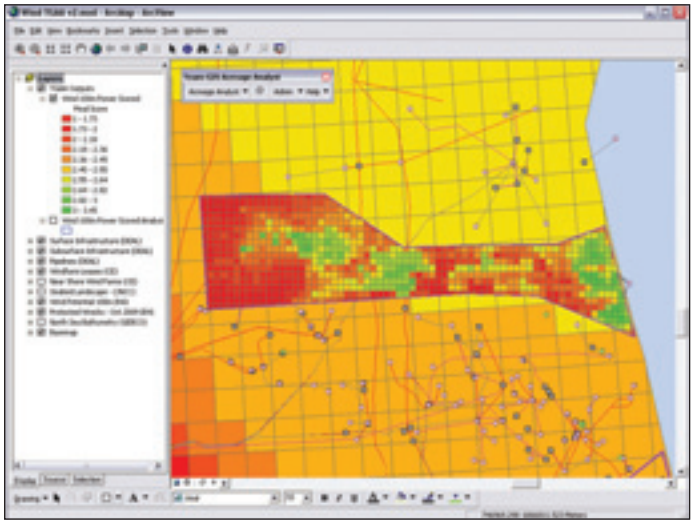

Fig.1 - Seabed Landscape data analysis mapping output

With the information assembled the Exprodat team collated their input datasets for their test and decided upon the analysis type that would be applied to each one. The term analysis was defined as how to determine the relationship between the base layer (i.e. the layer that included the locations that were to be ranked) and the specific input dataset. This could take the form of overlap analysis, distance analysis and summarising numeric attributes amongst others techniques. Additionally, the Team-GIS Acreage Analyst tool allows the user to sub-divide the base layer polygons into an equally spaced grid so that analysis can be carried out on each of the resulting cells. In this test, the Holderness Round 3 area covers approximately 160 km by 40km which was sub-divided into 845 equal 2.5km by 2.5km gird cells.

The location ranking schema used in the analysis was based on general assumptions that the optimal locations were close to existing infrastructure (pipelines, platforms, etc.), did not contain protected wrecks, had specific sea-bed geology types and had high potential wind energy values. Additional data that was not considered in this test but maybe required in further work include; proximity to shipping lanes and / or cable networks, water depth, impact on fishing areas and other economic factors.

Each input layer was then spatially analysed with respect to each grid cell in the base layer (the Round 3 Holderness region), and scored based upon the results.

The 'Wind Potential 100m (RA)' layer (power at 100m, calculated per square metre of rotor swept area) was given a weighting of 2 as it was perceived as the most important in the analysis, and then scored using the classification shown in Table1.

The Seabed Landscape data was analysed by assessing percentage overlap of suitable geology type with each grid cell, while proximity analyses were applied to the Wrecks and Infrastructure layers. Scoring schemas for these layers were then applied in accordance with the assumptions of the analysis.

The processing took only a matter of minutes and the results are shown on a map as in Fig. 1.

Using the Team-GIS Acreage Analyst tool it was a very simple process to apply different weightings and 'show-stopper' criteria, include other data (likely some of the previously suggested information) and tweak the model based on previous iterations. Quickly and simply a ranking system was built up using an 'off-the-shelf' tool and without the user having to build a bespoke geo-processing model.

Whilst there were a number of specific conclusions from this project, overall it highlighted the good sense in applying technology and experience from an established industry to a fledgling application. To aid the planning of the new renewable energy sites there is no need to re-invent the wheel. Planners should recognise that many tools already exist to improve the understanding of risk attached to making these decisions. The Team-GIS Acreage Analyst tool has shown that the industries already has the tools to analyses and present these complex datasets and their interactions in a standardised and simple to understand form.

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| Mean Wind Potential Value in Base Layer Grid Cell | Point Scored |
|---|---|
| 0-968 | 0 |
| 968-996 | 1 |
| 996-1020 | 2 |
| 1020-1039 | 3 |
| 1039-1053 | 4 |
| >1053 | 5 |