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Title:

'Optimising Network Integration of Wave Energy using Geographical Information System (GIS) and Power Flow Techniques'

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Synopsis:

The UK government is promoting marine energy as means to help meet its renewable energy targets. A variety of wave energy and tidal stream devices are being developed within the UK and around the world, and within the next few years the first devices will become commercially available. The UK has a vast wave energy resource, with the most favourable sites located off the west coast of Scotland. However, this is the region of the UK with the weakest electricity network infrastructure as customers are supplied via long 11kV and 33kV radial circuits. This presents the challenge of how to deliver the energy produced from the remote offshore, resource-rich locations, to the onshore consumer.

A Geographical Information System (GIS) is a software tool used to solve problems where data is dependent on a geographical position. A GIS model has been created that encapsulates a wide variety of extensive data for the marine environment. Spatial analysis techniques within the GIS allow suitable sites for wave energy converters to be identified which fulfil prescribed resource, bathymetric and environmental criteria. Calculating the optimal route for a submarine cable from the device to shore identifies a landfall site for bringing the new connection on shore.

Power system analysis software enables electricity networks to be modelled and the effects of varying generation and load to be determined. Power flow analysis techniques allow the available network capacity at network connection points on the west coast of Scotland to be calculated. As such, the amount of new wave generation that could be connected to the network can be determined. Combining the results from the GIS and power flow analysis identifies the location and extent of the most favourable resource, which can be delivered to the consumer via a submarine cable and a network connection point.

A novel integrated GIS/power flow model is described that is used to identify areas of suitable wave energy resource in closest proximity to available network capacity to accommodate the new generation. This will allow sites that have the optimal recoverable energy to be identified allowing developers to choose sites that have greatest economic viability.

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