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Marine renewable energy: could environmental concerns kill off an environmentally friendly industry?

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The marine energy industry has seen remarkable development since the first attempt in the UK to generate electricity from tidal stream power, by the lifelong exponent of renewable energy, Peter Fraenkel. In the 1990s, Peter successfully extracted power from a turbine mounted beneath a moored raft in Loch Linnhe, and this experiment led to the deployment in 2008 of the 1.2MW Seagen tidal turbine – the world's first marine energy power station.

Seagen continues to operate in Strangford Narrows (Northern Ireland) and to date has delivered more than 8GWh to the national grid. Several other tidal energy generators have been successfully tested at the European Marine Energy Centre (EMEC) in the Orkneys, including devices owned by OpenHydro, Alstom, Scotrenewables, Andriz Hydro Hammerfest, Atlantis Resources Corp and Voith.

Wave power has developed in parallel, with the complex nature of this energy resource leading to literally hundreds of inventions with potential to extract and exploit that energy. The UK's leading devices are arguably the 'sea snake' Pelamis, which works in deep water waves, and the flapping Oyster device (developed by the company Aquamarine Power), which is designed for shallower water. An array of three Pelamis wave energy converters was deployed in 2008 off the coast of Portugal, supplying 2.25MW to the local grid. Two Mark 2 Pelamis devices and an upgraded Oyster device are currently deployed at EMEC, together with wave energy converters by Seatricity and the Finnish company Wello.

As a result of such success stories, the UK is acknowledged as the global leader in these challenging technologies that generate electricity from indigenous, renewable energy resources with zero carbon emissions.

Renewable energy resources with zero carbon emissions? That surely must be good news for the environment – or is it? Sadly, as an emerging technology, marine energy attracts a depth of scrutiny from environmental regulators and statutory nature conservation bodies that more established marine industries such as fishing and shipping have managed to escape. Much of this scrutiny stems from European legislation, such as the Habitats Directive (92/43/EEC) and the Marine Strategy Framework Directive (MSFD).

The Habitats Directive was introduced with the praiseworthy goal of protecting vulnerable habitats and species in Europe, through establishing a network of protected marine sites: special areas of conservation (SACs) for habitats and species, special protected areas (SPAs) for birds. The Directive prohibits projects that have an adverse effect on the features of a site, unless no viable alternative is available and imperative reasons of overriding public interest (IROPI) can be demonstrated. Socioeconomic impacts of a project, such as jobs or wealth creation, may not be taken into account in the consenting process.

Natural England, in statements on marine renewable energy, has suggested that the majority of locations with an exploitable tidal stream resource lies within, or may have an impact on, protected sites or species (Natural England, 2008). Hence it is apparent that environmental considerations threaten to curtail the development of tidal energy in the UK (and indeed throughout Europe, although this depends on the interpretation of the European legislation by member states). Because the effects of electricity generating devices on habitats and species are poorly understood, regulators may take a precautionary approach and

grant conditional consents for development that restrict operations and involve punitive environmental monitoring regimes.

The Marine Current Turbine development in Strangford Lough, which is an SAC for harbour seals, provides a concrete example of disproportionate costs. The stipulated environmental monitoring programme attributes £2 million to the costs for a project with an initial budget of about £10 million. The costs of both the project and the monitoring have since risen, with the latter now standing at over £3 million. Operational restrictions for Seagen included daylight only operation, with a Marine Mammal Observer stationed on board the platform, ready to press the emergency stop button should a seal be spotted within a given distance of the turbine.

The 'receptors' for potential impacts of the tidal turbine considered within the monitoring programme are marine mammals (harbour seals), benthic ecology and tidal flow within the Lough. Marine mammal monitoring involves exercises such as strapping GPS machines to the heads of seals to follow their tracks and chartering helicopters with infrared cameras to check seal haul-out sites at night.

The marine renewable energy industry is by definition environmentally aware and embraces environmental best practice, but the costs of such environmental monitoring could potentially destroy the sector. It is worth noting that after three years of post-installation monitoring, the Seagen results showed:

- No major impacts on marine mammals were detected.
- Changes in benthic ecology appeared to be gradual and in line with natural variation.
- No evidence was found of significant change to ambient velocity or flow direction within the lough.

The importance of demonstrating negligible environmental impact and/or identifying potentially harmful impacts of marine energy devices has been recognised by industry and government, who have funded some environmental monitoring programmes associated with deployed devices. Monitoring work addressing underwater noise, impacts on marine life and pollution is being conducted at EMEC, at the Fundy Ocean Research Center for Energy (FORCE) in Canada and at Galway Bay in Ireland, the results of which will be publically available.

The Crown Estate has also initiated a number of projects to facilitate deployment of projects in the Pentland Firth and Orkney Waters. These include:

- development of a common framework for assessing cumulative impacts of several arrays of devices;
- aerial surveys to characterise sea-space usage by birds and mammals;
- the effect of arrays of devices on migratory fish; and
- operational noise.

The Crown Estate has also set up an Offshore Renewables Joint Industry Programme (ORJIP) to address the key strategic research needs of the sector; research topics include the behaviour of fish and of diving birds around operating tidal devices and assessing the potential effects of marine life displacement by wave and tidal arrays. Joint industry projects work well for large revenue-generating companies such as offshore oil and gas, but funding will be more difficult for the wave and tidal sector, where companies are still a long way from commercial viability.

Measures to protect the marine environment could place a prohibitive financial burden on developers and unduly limit the level of offshore energy resource available for exploitation. Hard decisions may have to be taken regarding the relative priority of environmental concerns on a global scale (i.e. mitigation of climate change) and the protection of local features. It is important to bear in mind that in the longer term, global warming may well destroy the beneficial effects of local conservation measures.

Reference

Natural England. (2008). Consultation on Draft Policy on Wave and Tidal Energy.