July 2009 Horizon Scanning SR021

HSE Horizon Scanning Short Report

Marine renewable energy

Status:
Active
Monitoring

Issue

The health and safety implications of the growth of marine renewable energy in the UK.

Background

Marine renewable energy can be described as the conversion of the energy of waves, tides or currents into electricity. The following categories exist:

Wave Devices
Devices that capture the energy in the motion of waves and convert it to electricity, using a variety of techniques. These can be sited on the shoreline, near-shore and far-shore and consist of 3 main types:
Buoys: these move with waves, connected to an anchored structure below the surface;[1]
Segmented devices: these are snake-like connected segments that move in the waves;[2]
Oscillating water columns: wave movement pushes air through a column to power a turbine.[3,4]

Tidal Devices
Technology that converts the energy in the tides to electricity; there are two types:
Range type: these use the change in height of water due to tides and
Current type: which use the flow of water due to tides.
Tidal lagoons that store water at high tide, which can be released later to drive electricity generation, also exist.

Ocean Devices
Current type: these generate electricity from the flow of water in ocean currents[5]
Thermal type: known as Ocean Thermal Energy Conversion (OTEC), this generates electricity from the temperature difference between shallow and deep water (which would be largest in the tropics).[6]

The Atlantic edge of the British Isles has some of the strongest waves and tidal currents in the world.[7] Theoretically the UK has marine renewable resources of 65 megawatts (MW) for shoreline, 2600 MW near-shore and 16000 MW far-shore. However, this theoretical potential has to be considered in terms of existing technical resource, external constraints (shipping lanes and environmental sensitivities) and economic resources,[8] so the exploitable resource will be lower than this. But it is estimated that marine renewable energy could provide up to 20% of UK electricity.[3] A number of climate change and energy policy goals, including the UK's Climate Change Act impose a legal obligation on future governments to cut carbon dioxide production by 80% or more by 2050.[9] Marine renewable energy has an important role to play in meeting these targets.

The UK Energy Research Centre (UKERC)[10] Marine Renewable Energy Technology Roadmap has a target of achieving 2 gigawatts (GW) of installed capacity in the UK by 2020, taking into account assumptions such as an attractive market being in place; it also aims for marine energy to be competitive with other sources of energy by this time.[11]

Existing operating devices include:

Wavegen Limpet[12] (wave shoreline technology) on Islay, rated 250 kW.
Pelamis (wave far-shore) 3 lengths of articulated cylinder devices in Portugal, rated 3x750 kW.
SeaFlow[13] (tidal current) turbine, tested for 3 years in the Bristol Channel, rated 300 kW.
SeaGen[14] (tidal current) a twin propeller recently installed on Strangford Lough, rated 1200 kW.

Planned marine renewable devices include:

Severn Estuary tidal power scheme: 5 projects short listed, including Severn barrage plan 8GW or 5% of UK energy needs by 2023, a decision on the choice of technology is due by 2010.[15]
SeaGen: a marine turbine farm is planned off the Anglesey coast, initially rated 10.5MW by 2011, but could eventually be up to 350MW.[16]
Pelamis: 4 segmented devices to be placed off the Orkney coast in 2009 and 7 off the North Cornwall coast in 2010, each rated 750kW.[17]

Improved tidal turbines are also in development, such as the *Thawt* rotor device, which could be in use as multiple unit farms in 2013.[18]

Factors that may slow the introduction or growth of marine renewables in the UK include: high initial costs, lack of investment (exacerbated by the current recession), environmental and public opposition and that some technologies may not scale-up or prove robust in the open sea.

The majority of marine renewable energy technology is being developed in the UK and Ireland by the following companies: Marine Current Turbines (MCT) and Pelamis Wave Power (PWP), SeaGen and Open Hydro (Ireland). The infrastructure includes the Engineering and Physical Sciences Research Council's (EPSRC) SuperGen Marine Energy Research Consortium, UKERC and the Carbon Trust's Marine Energy Accelerator to advance the commercialisation and reduce the high costs of marine energy.[19]

Health and Safety Implications and Discussion

Given the UK and EU climate change and energy policy targets, we can expect marine energy to play a significant role in meeting these. This could potentially mean a large rollout of marine renewable units around the UK coastline over the next 10-15 years once these technologies have been proven. Already the Severn Estuary scheme, which is the UK's largest renewable energy project, is underway. The UKERC's Marine Renewable Energy Technology Roadmap states that to meet a target of 2 GW by 2020, then by 2012

the sector must be building 1 unit a week, jumping up to approximately four units a week by 2015.

Health and safety (H&S) considerations include risks during construction and installation of marine energy devices in the sea, using specialised boats. There are additional risks involved with other activities associated with marine energy such as diving, large equipment and laying of cables to connect to the electricity grid. There will also be H&S risks during maintenance of these units and potentially during their manufacture, a large amount of which will take place in the UK. Potential external risks to marine energy operations could come from boats and shipping.

Recommendations

HSE needs to consider the resource implications of inspecting and regulating for an expansion in marine renewable energy over the next 10 years, given that offshore division will also be dealing with oil, gas and offshore wind power.

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[1] http://www.bwea.com/marine/devices.html
[2] http://www.pelamiswave.com/
[3] http://www.parliament.uk/documents/upload/postpn324.pdf
[4] http://www.wavegen.co.uk/what_we_offer_nearshore_owc_tech_info.htm
[5] http://www.telegraph.co.uk/earth/energy/renewableenergy/3535012/Ocean-currents-can-power-the-world-say-scientists.html
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