Renewable energy by harnessing tides, Strangford Lough,   Northern Ireland - UK

1. Policy Objective & Theme

- ADAPTATION TO RISK: Integrating coherent strategies covering the risk-dimension (prevention to response) into planning and investment
- SUSTAINABLE USE OF RESOURCES: Sound use of resources and promotion of less resource intensive processes/products
- SUSTAINABLE ECONOMIC GROWTH: Balancing economic, social, cultural development whilst enhancing environment

2. Key Approaches

- Ecosystems based approach
- Technical

3. Experiences that can be exchanged

In order to meet EU targets of reduced carbon emissions, tidal energy may need to be harnessed to generate electricity. This case shows the advances being made in this field.

4. Overview of the case

The UK is leading the way in tidal generator technologies which harvest the energy of streaming sea tides. In 2008, an underwater turbine was fed into the National Grid. The Government has recently published a strategy to meet its required renewable energy targets.

5. Context and Objectives

a) Context

In 2007, the European Commission made proposals for a new Energy Policy for Europe. These included a Renewable Energy Roadmap proposing a binding 20% target for the overall share of renewable energy in 2020 for the EU. An Action Plan on offshore and coastal water wind energy is being prepared which “may also be relevant for tidal energy”.

On July 15th, 2009, the UK published its renewable energy strategy showing how the national goal of 15% of energy from renewables by 2020 can be reached. It will require producing enough energy from renewable sources by 2020 to supply the equivalent of nearly all 26 million homes in the UK with their current electricity needs, and 4 million homes with their current heating needs; reducing overall fossil fuel demand by around 10% and gas imports by 20–30% against what they would have been in 2020. To reduce the UK’s emissions of CO_2 by over 750 million tonnes between now and 2030 will require more than 30% of the electricity being generated from renewables, up from about 5.5% today. Much of this will be from wind power, on and offshore, but tidal energy will also play an important role. A Strategic Action Plan for tidal stream and wave energy has been developed and is the subject of a Strategic Environmental Assessment which will be completed by early 2010.

Given its geography, there is a great potential for the UK to harness the power of tides around its coastline in order to generate electricity. Tidal streams are fast sea currents that flow as tides move in and out. Tidal streamtechnologies are similar in concept to wind turbines and generate in areas where tidal currents are concentrated. The turbines work like submerged windmills, turned by water currents rather than air currents. As the turbine turns, electricity is generated and taken to shore by cables. Tidal energy is renewable, it will never run out, it produces no pollution or greenhouse gases, it is completely predictable, it does not depend on the weather and probably has little environmental impact.

b) Objectives

To improve the competitiveness and the technology of tidal stream generators so that it can become a meaningful contributor to renewable energy supplies.

6. Implementation of the ICZM Approach (i.e. management, tools, resources)

a) Management

SeaGen was designed and built by the Bristol-based tidal energy company Marine Current Turbines (MCT), which also installed the device at Strangford. The Department for Trade and Industry is responsible for the permitting.

b) ICZM tools

On the 17 July, 2008 an underwater turbine that generates electricity from tidal streams was plugged into the UK's national grid. It marked the first time a commercial-scale underwater turbine has fed power into the network and the start of a new source of renewable energy for the UK. The first tidal turbine (10kW) was produced only in 1994-5 and tested on Loch Linnhe in Scotland by Marine Current Turbines Ltd. (MCT). In 2003, Seaflow, a 300kW experimental test rig was installed in the Bristol Channel. The trial at Strangford Lough, a Natura 2000 site in Northern Ireland, used a device called SeaGen and generates power at 1200kW enough for about 1,000 homes. Some key features are that the 2 x 600kW carbon/glass epoxy composite,16m diameter rotors and the nacelles are raised above sea level for maintenance and are installed on a steel pile. The transformer and electrical connection to the grid are in visible and accessible housing on top of the pile. The water depth is 25 ± 2m and the mean max current is 7.8 knots. All installations require a government permit and there is continuous environmental monitoring.

The cost per kW energy produced is becoming more competitive as the turbines capacity is increased viz. Seaflow cost £4340/kW in 2003 whilst Seagen cost £2830/kW in 2007. It is predicted that up-scaling to 10WM capacity will cost £1900/kW in 2009. In order to be commercially successful and economic, the turbines need to be 1MW or more; access needs to be safe, affordable and reliable for servicing; the turbines must be reliable to minimise costly intervention and they must have a life-time of several decades. Predictions indicate that a 30 MW turbine would produce electricity costing £0.052/kWh at the end of its life.

MCT is now planning to build a farm of turbines before 2011 off the coast of Anglesey, North Wales. The initial farm is to be about 10.5MW although the potential is for 350MW. The Pentland Firth in Scotland, the Channel Islands off the coast of France and the Severn estuary in west England are also potential hotspots for tidal energy.

7. Cost and resources

The Department for Business, Enterprise and Regulatory Reform supported Seagen with a £5.2m grant. The cost of installing the marine turbines is £3m for every megawatt they eventually generate, which compares to £2.3m per megawatt for offshore wind. The costs will drop if the technology is more widely adopted. In its Strategy, the government has pledged to invest up to £60 million to help accelerate development and deployment in wave and tidal generation.

8. Effectiveness (i.e. were the foreseen goals/objectives of the work reached?)

The Government is working with the sector to develop a Marine Action Plan by the end of 2009 to consider the prospects and environmental implications of wave and tidal technology, including any planning and other barriers to development, along with the nature of support needed to facilitate effective deployment. It will provide a basis for considering the framework of support for the deployment of wave and tidal stream technologies going forward. Marine energy – wave and tidal stream energy sources – has the potential to make a significant contribution to the UK's longer-term (2020-2050) energy and climate change goals by providing up to 20% of electricity needs, with negligible emissions. It has been estimated that a practically exploitable tidal stream resource of around 18 TWh/y could be produced in the period 2020-2050.

9. Success and Fail factors

The government will invest up to £60 million in UK marine energy infrastructure and technology, including wave and tidal energy testing centres. It will provide up to £10 million to support the South West's potential for wave and tidal energy deployment, research, demonstration and engineering. The Government will also launch a Marine Renewables Proving Fund which will provide up to £22 million of grant funding for the testing and demonstration of pre-commercial wave and tidal stream devices. This is being done to accelerate wave and tidal technologies' move towards commercial demonstration and assist the development of successful projects up to the period 2011–2014. Furthermore, Scottish Ministers launched a £10 million worldwide innovation prize designed to accelerate the commercial deployment of wave and tidal energy which has attracted over 100 registrations of interest from over 23 countries. However, tidal stream turbine technology is still under development. The technology has met with no opposition, especially from environmental organisations.

10. Unforeseen outcomes

MCT has already started to work on a 10MW Seagen Array project. Already their innovation is looking at bridges with each support strut bearing a turbine which can be scaled up or down according to circumstances from 110kW (8m rotor) to 1,350kW (24m rotor). In fact, the rotor size is not the problem, but the strength of the structures to hold them – Seaflow weighs 130 t. and Seagen 390 t. The next generation turbines could weigh 1100t. The long term environmental impacts are unknown.

11. Prepared by

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12. Verified by

It has not been possible to verify this case.

13. Sources

- Marine Current Turbines: an update (2007) P. Fraenkel, MCT Ltd
- Marine Current Turbines: Pioneering Tidal Stream Technology (2008) P. Fraenkel, MCT Ltd
- Planning And Consents For Marine Renewables: Guidance On Consenting Arrangements In England And Wales For A Pre-Commercial Demonstration Phase For Wave And Tidal Stream Energy Devices (Marine Renewables) (2005) Department Of Trade And Industry.
- The UK Renewable Energy Strategy (2009) Presented to Parliament by the Secretary of State for Energy and Climate Change by command of Her Majesty. Crown copyright.
- www.marineturbines.com
- www.newenergyfocus.co.uk
- www.seageneration.co.uk
- www.tidalenergy.eu

MCT - Pioneering Tidal Stream Technology (2.02 MB)

MCT - an update (2.66 MB)

Planning and Consents for marine renewables (232.72 KB)

The UK Renewable Energy Strategy 2009 (3.82 MB)