Joint Marine Programme

Marine update 54

March 2003

Turning the Tide

Power from the sea and protection for nature in Welsh waters

AMEC BORDER WIND

Example of an offshore wind turbine

In this marine *update*, WWF and *The Wildlife Trusts summarise Turning the Tide: Power from the Sea and Protection for Nature.* This new report, written by Iwan Ball of Cardiff University, examines the potential for acquiring renewable energy from the sea, with particular reference to the Welsh marine environment. There is now an overwhelming body of scientific opinion which considers that the continued use of fossil fuels is associated with increasing levels of CO_2 and other greenhouse gases in the atmosphere, resulting in the enhancement of the "greenhouse effect" and associated climate change. Clearly, changes in energy production and use have an important part to play in reducing the threat of climate change.

The world's governments also have an obligation to reduce emissions of greenhouse gases such as CO_2. The UK government's commitment to reduce greenhouse gas emissions under the Kyoto Protocol, and the National Assembly for Wales' (NAW) commitment to sustainable development and its review of energy policy, has stimulated consideration of all options for renewable energy. The UK has a target to supply 10 per cent of electricity from renewables by 2010. Targets for Wales are being debated.

A report by the Royal Commission on Environmental Pollution, *Energy – the Changing Climate* (June 2000), supported the development of renewables and has ensured that the long-standing proposal for a 16km tidal barrage to be built across the Severn Estuary has reappeared on the agenda. However, since the last studies on the barrage were reported in 1989, renewable energy technology has progressed and other, less expensive, options have been developed that could lessen any environmental impact. These include stand-alone tidal stream turbines, constructed tidal lagoons, shore-based and offshore wave energy devices, and offshore wind turbines.

Wales has significant potential to be at the forefront of the development of a major new offshore renewable energy industry. Its coastal zone and offshore areas present a rich asset of potentially suitable sites for harnessing marine renewable energy. Offshore wind technology is already well advanced, to the extent that the industry is poised for major and rapid deployment. It is anticipated that several new marine renewable energy technologies, such as those mentioned above, may also become deployable on a commercial scale, some sooner than others. Recognising this potential, the NAW intends to develop Wales as a global showcase for clean energy production.

WWF and The Wildlife Trusts recognise that marine renewable energy generation, in common with all types of development, is likely to have some environmental impact, although this may be significantly less than other conventional forms of energy generation. Nevertheless, marine renewables are not necessarily benign. The benefits in terms of reduced emissions have to be balanced against other effects and impacts, including those on biodiversity. Some marine renewable projects have the potential for much greater implications for biodiversity than others.

The Kyoto Protocol

The Kyoto Protocol, agreed in December 1997, to set a goal for developed countries to reduce their annual emissions of the six main greenhouse gases to below 1990 levels by 2008-2012. In June 1998 the UK agreed to cut its emissions by 12.5 per cent. The government then set a more challenging domestic goal – to reduce CO_2 emissions to 20 per cent below their 1990 level by 2010. Energy generation is a significant contributor to greenhouse gas emissions. Many of the means by which emissions can be reduced have been devolved to the National Assembly for Wales, reflecting the government's aim to provide a positive strategic approach to planning for renewable energy from the regional level downwards. As part of the Assembly's obligation to contribute to the abatement of greenhouse gas emissions, there is a compelling case for increasing the proportion of energy generated by renewable sources.

The marine potential

The exploitation of three marine resources – tidal, wave and wind – are at different stages of development, and the resource potential for each varies in Wales. Some technologies, such as the tidal lagoon, are new and untested while others – wind and tidal barrage, for example – are more advanced, with a number already operating worldwide.

Tidal energy

The coast of Wales has some of the best conditions anywhere in the world for tidal power. This is because of its high tidal range – up to 15 metres on very high spring tides in the Severn Estuary. Tidal power can be harnessed either through the energy stored in tidally impounded water, or by extracting energy from the tidal movement of water (tidal stream). Impoundments are of two types: one takes advantage of natural features such as estuaries by building a barrage; the other can be constructed as a stand-alone tidal lagoon. At 8,640 MW, the Severn tidal barrage is the biggest such proposal put forward in the UK, possibly generating up to 7 per cent of England and Wales' annual electricity needs. Tidal lagoons consist of stand-alone impoundments, and are ideally located where the tidal range is high and where there are broad tidal flats at minimal depth. At the time of writing (spring 2003) there are two proposed schemes, both off the Welsh coast: Swansea Bay (30 MW) and Rhyl (432 MW).

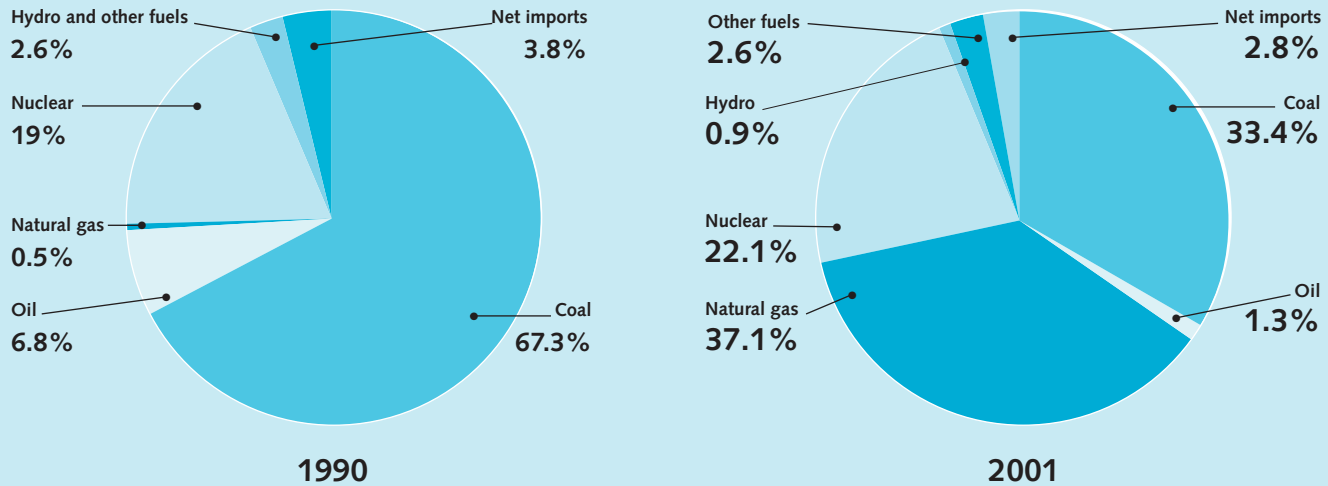

Figure 1: UK electricity generation by fuel type, 1990 and 2001

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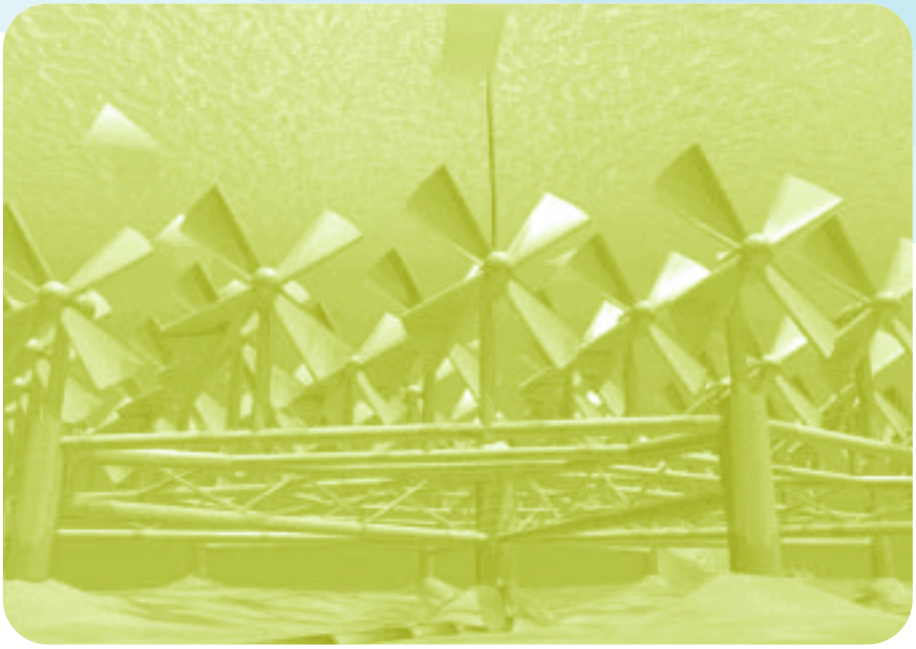
Tidal lagoons

Constructed tidal lagoons offer a potential energy source for Wales: Tidal Electric (a private electricity generating company) claims that an initial tranche of offshore tidal power installations can deliver 8,000 MW by 2010 – enough to meet the 10 per cent renewables target. Much of this potential is located in North Wales/ Liverpool Bay (1,500 MW) and the Severn Estuary (4,500 MW), together with the proposed developments in Swansea Bay (30 MW) and North Wales (432 MW). Wales could be a key player in pioneering this technology, but there are major concerns about resource needs in terms of building materials, and changes to local sediment and current regimes.



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Tidal Stream generators capture the energy of the tides without requiring barrages or impoundments. A number are being researched, the most advanced being a 300 kW full-scale tidal stream generator developed by Marine Current Turbines Ltd. This is being tested off Lynmouth in Devon.

Tidal stream generators

The only project presently being under-taken in Wales involves research and development by Tidal Hydraulic Generators Ltd into a sea-mounted tidal flow water turbine farm. This project is supported by Pembrokeshire Coast National Park through the Environment Development Fund, with additional funding from ETSU (DTI). Phase 3 of the project involves the installation of a 1 MW average (5MW) turbine in a sheltered location in Milford Haven waterway.

Wave energy

There are no plans at present for developing wave energy in Wales, but the high-energy environment of South-west Wales offers a potentially significant wave resource – especially in areas of low tidal range, where the most developed technologies work best. Three schemes are being developed in Scotland.

Wind energy

The UK's offshore wind resource has the potential to provide more than three times the country's present electricity needs. Three Welsh proposals are in the front line of offshore wind development: Rhyl Flats, off Abergele (150 MW); North Hoyle, off Prestatyn (90 MW); and Scarweather Sands, off Porthcawl (90 MW). North Hoyle was granted final consents in October 2002 for a project of up to 30 wind turbines 7.5 km offshore, and will be the first offshore development in Wales. These three developments could make Wales a key player in the emerging offshore wind industry.

Above and right: Tidal flow water turbine farm

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Strategic issues common to all marine renewables

It is acknowledged that the single most serious problem facing the successful exploitation of marine renewable energy in the UK is the difficulty of network connection. The country's electricity grid was not designed to receive energy from small, multiple sources in remote areas and transmit it to the main demand centres. Areas with the greatest potential for marine renewable energy generation are often situated near the end of the distribution network which, in many rural shoreline areas, can be weak and will need strengthening if they are to accept new generation capacity.

There are no north-south national grid links in Wales, and the infrastructure in mid-Wales is particularly weak. Potential developers may be faced with large network connection charges – a major cost centre that lies outside their control. The government is studying the possibility of developing an offshore high-voltage direct current (hvdc) network. This would connect renewable energy sources sited along the west coast of Britain, which would in turn feed into the existing transmission system nearer to the centre of UK demand. This has the potential to overcome the deficiencies of the existing grid infrastructure in serving remote coastal areas in Wales, although the environmental implications of such an ambitious scheme have yet to be satisfactorily evaluated.

No energy technology can be completely lacking in environmental impact, but marine renewables look likely to offer less negative environmental impact than most. Environmental Impact Assessments (EIAs) are already a necessary requirement of the consent routes for offshore wind-farms, and should also figure in the consent process for other marine renewables. EIAs should take into account potential impacts during site preparation, construction, operation and decommissioning stages. Public consultation with all user and interest groups is also a vital part of the process. Lessons can be learned from the off-shore oil and gas industries in addressing environmental issues, including the application of Strategic Environmental Assessment (SEA) and the cumulative impacts of developments. Furthermore, under Regulation 48 of the Habitats Regulations, it is necessary for plans and projects which may have a significant effect on a European Marine Site (SAC or SPA with subtidal or intertidal zones) to be subject to an "appropriate assessment of the implications for the site". These plans and projects do not need to be situated within the boundaries of the SAC or SPA, and might only need to be "adjacent" in order to undergo an assessment (see figure2).

The complicated consents process involves a number of statutory bodies that have an interest in the licensing arrangements for developments below the low-water mark. This is widely acknowledged to have been a significant barrier to implementing renewable energy projects, particularly for small companies developing renewables technology. As a result of the planned deployment of offshore wind-farms, the general issues of deployment of specific offshore renewable energy schemes (planning, the consents process, the role of the Crown Estates etc) are now being streamlined, to replace the previous system of sectoral controls.

This will involve the creation of a "one-stop shop" by the Department for Trade and Industry that will encompass nearly all the procedural steps. It should be noted, however, that decisions on offshore wind and water-driven generating stations larger than 1 MW in the territorial waters of England and Wales require the consent of the Secretary of State for Trade and Industry under Section 36 of the Electricity Act. This means that where they affect Wales, those decisions will be taken outside Wales.

As more development takes place within the relatively shallow waters close to shore, the potential for further deployment of large-scale renewable energy technologies may be constrained. Consideration should be given to clarifying the legal framework for developing marine renewables beyond the 12-nautical mile limit of the territorial seas (see figure 3).

Figure 2: Statutory Conservation Designations for the Welsh coast

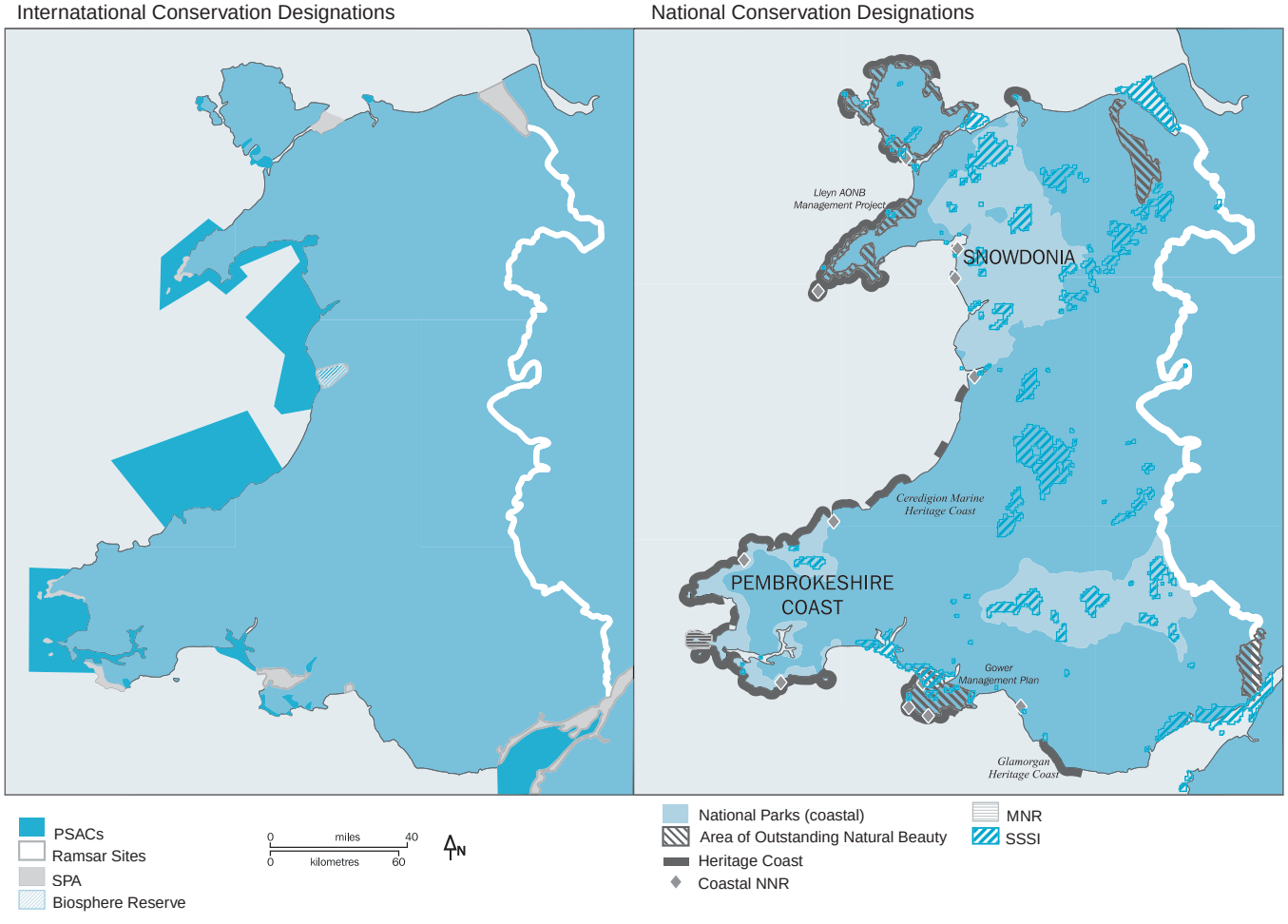

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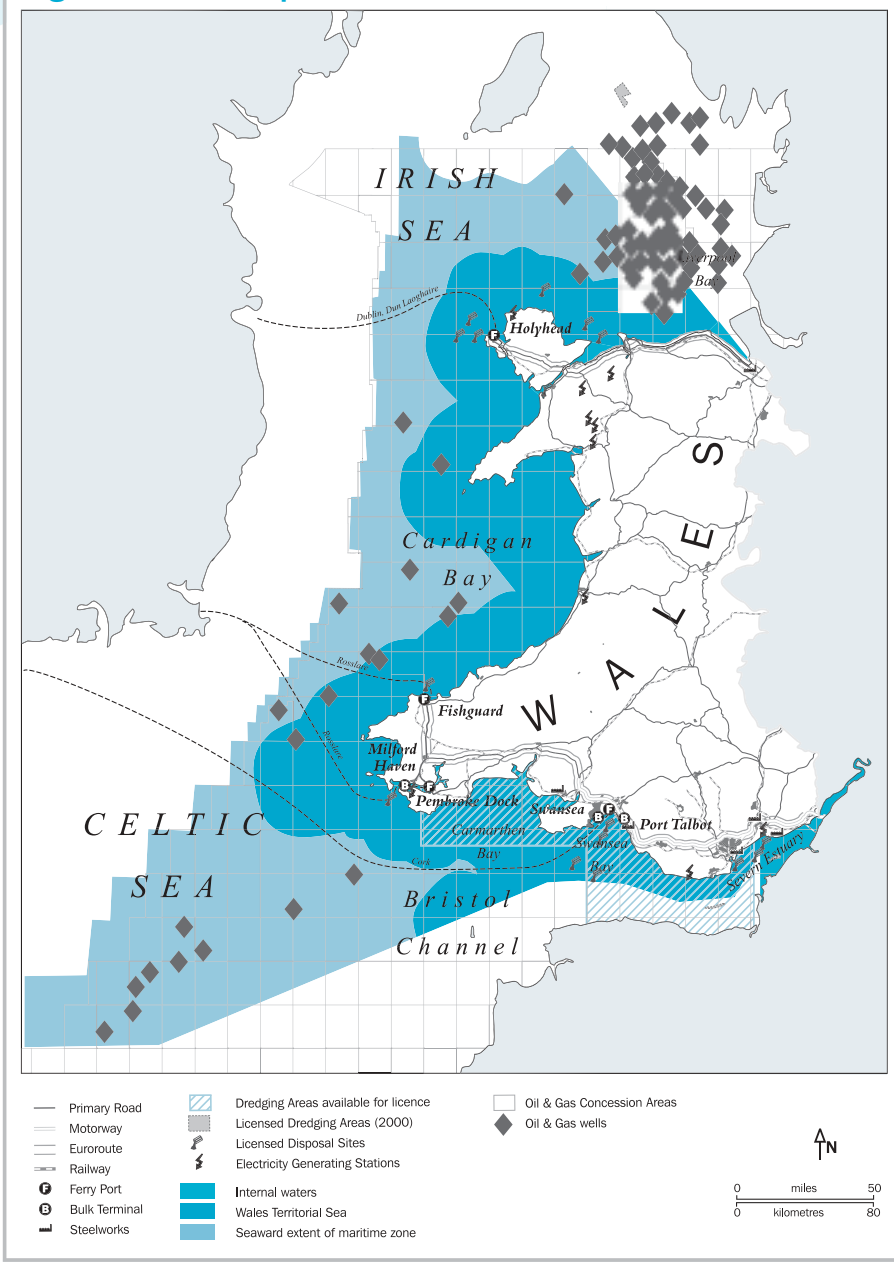
Figure 3: Development in coastal and offshore areas



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Conclusion

If we do not develop marine renewable energy resources, it can be argued that we will be unable to meet our commitments to reduce greenhouse gas emissions while still supplying future energy needs. Offshore wind is now considered to be an integral component of the UK government's strategy in order to achieve the target of providing a 10 per cent contribution from renewables. However, other marine renewables, namely tidal currents and waves, possess higher energy intensity than most, and offer a more predictable and reliable source of energy. They therefore constitute a potentially cost-effective source of future energy. To date, these technologies are less developed than others. Even so, many of the problems facing the development of new marine renewable energy technologies are generic, and progress in one area could benefit others.

The prospects for marine renewables are difficult to evaluate with any certainty beyond the short-term (i.e. 2010). Medium- (2025) and long-term (2050) prospects depend upon several factors, including government support and funding, research and development progress in overcoming existing technological difficulties, and cost reduction to enable commercial competitiveness. The market remains substantially influenced by government policy, and future decisions on other elements of energy policy are likely to significantly influence the prospects for renewables.

Recommendations

The seas around Wales, particularly the offshore marine environment, offer huge open spaces with potentially large renewable resources of wind, wave and tidal energy, where new energy technologies could be employed on a much wider scale than on land. Based on the findings of *Turning the Tide: Power from the Sea and Protection for Nature,* WWF and The Wildlife Trusts recommend that:

- Every proposal for marine renewable energy projects should be subject to full consultation and an Environmental Impact Assessment (EIA) before consent is given. The EIA should inform the design of the project and should identify measures to be adopted during the construction and operation of the project to avoid or reduce impacts where practicable. All efforts must be made to avoid the "right technology in the wrong location".
- The construction of large tidal barrages such as that across the Severn Estuary should not be undertaken in view of the disproportionately large environmental impacts.
- The National Assembly for Wales should recognise the potential marine renewable energy resource base available in Wales, and how this could contribute to future energy security and diversity needs within the principles of sustainable development. With the right approach, Wales could be at the forefront of developments in this field and reap the potential economic and environmental rewards.
- Marine renewable technologies should be advanced by academic and SME partnerships in Wales. Targeted funding should therefore be made available to encourage research

activities in these fields and to attract an increasing number of researchers. This should accelerate innovation in wave and tidal energy, and bring the technology closer to commercial competitiveness.

- The National Assembly for Wales should vigorously pursue opportunities to increase energy efficiency and promote energy efficient technologies, and establish a Sustainable Energy Agency to monitor renewable energy development and progress in energy efficiency.
- Strategic Environmental Assessment (SEA) should be implemented to ensure a more transparent planning process for marine renewables by involving the public and by integrating environmental considerations into the decision-making framework. SEA should also be integrated into a wider assessment of the social and economic effects of development proposals. This will help assess cumulative impacts of such developments on Welsh waters, and help achieve the goal of sustainable development.

HUGH CLARK/WWF-UK

Climate change is more of a threat to wildlife than appropriately sited marine renewables

Taking a wider perspective of the marine environment, Wales needs a strategy for its marine and coastal environment that takes account of all planning demands at a country level, to make sure the impacts of all possible developments are considered together. WWF and The Wildlife Trusts believe that all interested organisations should be consulted on such developments, including nature and heritage conservation agencies, voluntary organisations and local coastal communities, and users of the sea such as fishermen, commercial shipping, recreation and tourism interests.

This Marine Update was written by Sally Bailey and Iwan Ball and is based on Turning the Tide: Power from the Sea and Protection for Nature – a report for WWF and The Wildlife Trusts which gauges the potential for marine renewables in Wales. It was published in December 2002. Research was carried out between June and November 2002. Copies of the full report are downloadable from www.wwf.org.uk/filelibrary/pdf/turningthetide_full.pdf

An ecosystem-based approach

Hundreds of different laws and policies govern our seas, causing conflict and confusion coupled with delays for development and for nature conservation. WWF and The Wildlife Trusts are calling for the delivery of an ecosystem-based approach through new legislation in the form of a Marine Act. This Act should provide a UK framework that enables better management of marine resources with adequate protection for wildlife and habitats.

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