# Specific country information for the UK




**Aquatic Renewable Energy Technologies (Aqua-RET)**
is an aquatic renewable energy e-learning tool funded by the EU Leonardo Da Vinci Programme.

Education and Culture
Leonardo da Vinci

Revision 0.1 - December 2008

## 1. Country resource

The wet renewable resources of the United Kingdom are widely distributed.

The following link takes the user to the Atlas of UK Marine Renewable Energy Resources.

http://www.renewables-atlas.info/

This Atlas has information on wave, tidal stream, and offshore wind resources.

The best tidal stream resource is found in areas such as: the Pentland Firth, Orkney, west of Argyll and Bute, around Anglesey, the Severn Estuary, close to the Isle of Wight, around Norfolk and around the Humber. Generally speaking, the best wave resources are to be found in areas such as: the West of Scotland's Hebrides, Shetland and Orkney Islands, and west of Cornwall.

Existing offshore wind farm developments have clustered around resource areas off Lancashire and Cumbria, east of the Thames Estuary, north of Norfolk, and east of Lincolnshire, as well as the Moray Firth in Scotland. The next phases of offshore wind development will be concentrated in the new areas of seabed to be leased by The Crown Estate. These are indicated in Figure 1 as pink areas.

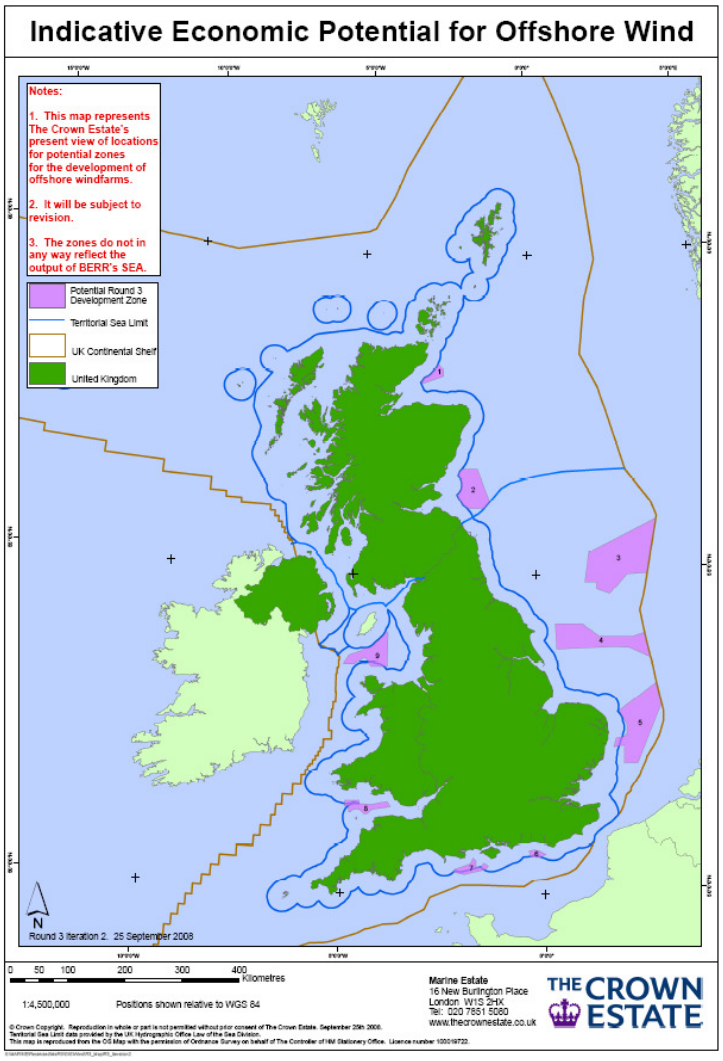


*Figure 1 – Map of Round 3 areas for Offshore Wind, copyright The Crown Estate*

The Sustainable Development Commission has reported on the tidal range resources in the UK, noting the top UK sites for tidal range resource being the Duddon, Mersey, Wyre, Conway and Severn Estuaries.

Table 1: Top UK sites for tidal power

| Tidal range sites | | Tidal stream sites | | |
|---|---|---|---|---|
| Site name | Resource (TWh/year) | Site name | Area | Resource (TWh/year) |
| Severn | 17 | Pentland Skerries | Pentland Firth | 3.9 |
| Mersey | 1.4 | Strøma | Pentland Firth | 2.8 |
| Duddon | 0.212 | Duncansby Head | Pentland Firth | 2.0 |
| Wyre | 0.131 | Casquets | Alderney | 1.7 |
| Conwy | 0.06 | South Ronaldsay | Pentland Firth | 1.5 |
| | | Hoy | Pentland Firth | 1.4 |
| | | Race of Alderney | Alderney | 1.4 |
| | | South Ronaldsay | Pentland Firth | 1.1 |
| | | Rathlin Island | North Channel | 0.9 |
| | | Mull of Galloway | North Channel | 0.8 |

*Figure 2 – Table 1 – "Turning the Tide" Sustainable Development Commission, copyright Sustainable Development Commission*

Some of the best run-of-river resource in the UK is located in North West Scotland. The Forum for Renewable Energy Development in Scotland (FREDS) group will shortly publish a report on Scotland's hydro resources, which will be available here: http://www.scotland.gov.uk/Topics/Business-Industry/Energy/19185/17613

# 2. Development and testing

## 2.1. Research and development institutions and facilities

The UK has a strong R&D base for wave and tidal stream technologies. Research has been carried out by universities across the country, and several universities have developed their own devices (e.g. the Salter Duck developed at Edinburgh University in the 80s). The SUPERGEN Marine consortium is a key research programme, funded by the UK Government's Engineering and Physical Sciences Research Council (EPSRC), which has had two phases. The second, now active, aims to "increase knowledge…of device-sea interactions… from model-scale… to full size," and involves Edinburgh University, Heriot Watt University, Lancaster University, University of Strathclyde, and Queen's University Belfast. A "landscape" of UK R&D into marine renewables is available from the UK Energy Research Centre (http://ukerc.rl.ac.uk/Landscapes/Marine.pdf).

There have been a number of offshore wind R&D programmes in the UK. One notable programme is the SUPERGEN Wind consortium, also funded by EPSRC, and founded in 2006. The aim of SUPERGEN Wind is to "undertake research to improve the cost-effective reliability and availability of existing and future large-scale wind turbine systems in the UK". A programme of research has been undertaken by the UK Government's Marine Renewable Energy Research Advisory Group, to investigate impacts of offshore wind. Research through this programme has focused on environmental and navigation impacts, and details can be found on http://www.berr.gov.uk/energy/sources/renewables/policy/offshore/research-advisory/page22590.html The COWRIE (Collaborative Offshore Wind Research Into the Environment) is a charity which directs research into the environmental impacts of offshore wind. Details of COWRIE projects can be found on http://www.offshorewindfarms.co.uk/Pages/Projects/.

## 2.2. Technology and design testing facilities

There are a number of facilities available in the UK at which aquatic technology can be tested.

The European Marine Energy Centre (EMEC) is based in the Orkney Islands in Scotland. Founded on the basis of a 2001 recommendation of the House of Commons Science and Technology Committee, EMEC has been funded by a number of public organisations. EMEC aims to help marine energy technologies progress from the prototype stage to commercial readiness. This is primarily through the provision of grid-connected berths in which developers can assess device performance, in line with internationally recognised standards. The Centre offers a wave device test site with four berths, and a tidal stream site with five berths. Research into the environmental impacts of devices is also possible at EMEC. For more information on the services offered by EMEC, please see the organisation's website: www.emec.org.uk.

NaREC, the New and Renewable Energy Centre, is another key UK testing facility for aquatic renewable technology. It is based in Blyth, Northumberland, and was established in 2002 with funding from UK and EU public sources as a Centre of Excellence for the design, deployment and commercialisation of sustainable energy forms. NaREC is involved in the development of electricity networks which have capacity for new renewable generation. The services provided by NaREC include: wind turbine blade and materials testing; wave and tidal energy prototype development; marine energy resource and market assessment; and high voltage system design. NaREC also offers a controlled saltwater testing facility for testing of subsea equipment and the "EnergyLINK lab"

for testing the impacts of micro- and medium-scale generation on electricity networks. For more information on NaREC's services, please see the organisation's website: http://www.narec.co.uk/.

The UK hosts a number of marine tanks and wind tunnels for equipment testing, operated by Universities as well as commercial companies. The UK Energy Research Centre's Marine Energy Landscape is a useful document outlining these types of facilities. Please see the: http://ukerc.rl.ac.uk/Landscapes/Marine.pdf.

## 2.3. Pilot zones and trial projects

Deployment of early-stage aquatic renewable technologies has been directed towards certain geographic areas of the UK, although the UK Government has not designated any "pilot zones" per se.

The European Marine Energy Centre (EMEC) offers testing berths for full-scale prototype wave and tidal stream devices. These berths are located in the Orkney Islands in Scotland. The wave test berths are located off Billia Croo on the Orkney mainland. The tidal stream site is at the Fall of Warness, west of the island of Eday. These berths are fully grid-connected, though basic environmental and planning consents must be attained for the connection of individual devices to the berths.

In 2007, the UK Government gave planning consent for the 'Wave Hub' project. The project aims to provide a grid connection point for wave energy devices 16km off the coast of Hayle, Cornwall in South West England. The hub caters for the testing of devices prior to commercial deployment, and will be located in water roughly 50m deep. Wave Hub is expected to have four power connection points, and four developers have already contracted to use these berths. The project aims to ensure that berths are subject to simplified consenting requirements. Installation of the Wave Hub connection point is expected in Spring 2010. For more information about the project, please see the Wave Hub website: http://www.wavehub.co.uk/.

While the location of emerging technology projects may be determined initially by testing and pre-commercial deployment facilities, the geographical location of more mature energy projects in the UK may be influenced by proposals from The Crown Estate. The Crown Estate is a UK property institution which has historically managed the property of the Crown (royal family), and owns the majority of the UK seabed. The Crown Estate has suggested "zones" for the development of offshore wind farms in the UK. For more information on these zones, please see: http://www.thecrownestate.co.uk/offshore_wind_energy.

There are no designated "pilot zones" for the development of tidal barrage or run of river technologies in the UK, though there is a feasibility study being conducted into the concept of a tidal barrage in the Severn Estuary.

# 3. Power use and transmission

## 3.1. Power use options

Energy from aquatic renewable sources in the UK is likely to be used in the form of electricity, on a large-scale, with projects feeding in to the local distribution and national transmission networks. There are a number of hurdles to be overcome in connecting offshore projects to the Grid network.

Run of river schemes may be used at the micro-generation scale, generating electricity for the personal consumption of householders or communities. Examples of a number of micro hydropower schemes which have been installed in Scotland are available on the following website: http://www.energysavingtrust.org.uk/schri/community/projects.cfm

There is increasing interest in the UK in medium scale hydro developments of 100 kW – 1MW capacity. The Forum for Renewable Energy Development in Scotland (FREDS) is currently carrying out a study into the potential hydropower resource in Scotland, including run of river schemes. This is due to be published in 2008, and will be available on the FREDS website. Offshore wind, wave, tidal stream and tidal barrage resources are less likely to be utilised at the microgeneration scale, for distributed or personal use.

The use of offshore wind, wave, tidal or run-of-river schemes to generate electricity, which would then be converted to heat, is a possibility. This option may be attractive in the future to island or remote communities where access to the gas network, or to a steady supply of biomass, is constrained. More novel forms of aquatic renewables may be used to generate heat directly. One good example of this, which is being investigated in the UK, is the use of macro-algae (or seaweed) as a fuel for anaerobic digestion. Anaerobic digestion would convert the seaweed into biogas, which could then be combusted to provide heat. In the UK, the Scottish Association for Marine Science (SAMS) is currently conducting research into this area. See their website at http://www.sams.ac.uk/.

## 3.2. Grid network

The UK national electricity network is called the National Grid. It is composed of the 'transmission network', which is a national network carrying high voltage electricity, and the 'distribution networks', which are regional networks carrying medium- and low-voltage electricity from the transmission network to consumers.

There are certain hurdles to be overcome on grid issues in order for the UK to fully maximise the potential of its aquatic renewable resources. These difficulties relate to grid infrastructure and capacity. The UK electricity grid was built for a system which relied on large-scale, centralised generation units. There have been delays in investing and approving new upgrades which would help the system cope with the often decentralised and remote nature of renewable generation.

The UK's National Grid website shows a simplified map of the UK transmission network[1]. There are large parts of the UK with a lack of significant grid coverage. Significantly for aquatic renewables, this includes the North and West Coast and Islands of Scotland, and the west coast of Wales. Due to infrastructural constraints and regulatory changes, there is more than 10GW of predominantly onshore renewables in Scotland awaiting connection.

Fortunately, there has recently been discussion on possible solutions to these difficulties. This includes thinking on the potential for large scale subsea cables, which would allow for the connection of remote aquatic renewable generation to centres of demand in the UK and abroad. The Crown Estates have conducted a feasibility study[2] for such a cable. Considerable effort is now being taken to reinforce existing networks, including the upgrade of the Beauly-Denny transmission line, for instance.

[1] http://www.nationalgrid.com/annualreports/2006/05_opfinrev/ukelecgastransmission.html

[2] http://www.thecrownestate.co.uk/east_coast_transmission_network_technical_feasibility_study.pdf

## 3.3. Grid connections for aquatic renewables

The UK national electricity network is called the National Grid. It is composed of the 'transmission network', which is a national network carrying high voltage electricity, and the 'distribution networks', which are regional networks carrying medium- and low-voltage electricity from the transmission network to consumers.

In England, the transmission network is owned, operated and developed by the National Grid in England. In Scotland, the transmission network is operated and owned by subsidiaries of Scottish and Southern Energy and ScottishPower subsidiaries in Scotland. In Northern Ireland the transmission system is operated by the System Operator for Northern Ireland (SONI). National Grid also acts as the System Operator, setting the "rule book", within which transmission operators must work.

The distribution networks are operated by a variety of different companies, depending on geographic location – this map[3] shows the different distribution network operators across the UK.

The National Grid website offers advice on the necessary requirements to connect to the distribution or transmission systems here[4].

If a generator wants to connect an aquatic renewable project to the high voltage transmission system, they must contact National Grid. To get connected, they must enter into a "Bilateral Connection Agreement" with the National Grid. This agreement will ensure that the generator complies with a number of codes. The generator must also pay a number of charges, including:

- the Transmission Use of System Charge;
- the Balancing Services Use of System Charge; and,
- the Connection Charges.

For more information on the above codes, charges and on how to apply, please see the National Grid website[5].

If a generator wants to connect an aquatic renewable project to the lower voltage distribution system, they should in the first instance contact their District Network Operator (see this map for the relevant company). However, if the generator would also like to export electricity from the distribution system to the transmission system, they must then contact National Grid. In either case, the generator will most likely enter into a Bilateral Embedded Generation Agreement. In Scotland, another form of agreement is open for generation projects with larger capacity. For more information on the agreements and associated charges, please see the National Grid website[6].

[3] http://www.nationalgrid.com/uk/Electricity/AboutElectricity/DistributionCompanies/

[4] http://www.nationalgrid.com/uk/Electricity/GettingConnected/

[5] http://www.nationalgrid.com/uk/Electricity/GettingConnected/TransmissionConnected/

[6] http://www.nationalgrid.com/uk/Electricity/GettingConnected/dnoConnected/

# 4. Industry and skills

## 4.1. Manufacturing capacity

In recent decades, the UK's economic strategy has focused on growing a 'knowledge economy', based on the service sector. This has been in the context of competition with emerging economies leading to a decline in heavy industry.

However, though the number of UK jobs in manufacturing has fallen over the past decade, there is evidence of a shift to a smaller manufacturing industry fabricating higher-value products. Additionally, the number of jobs in construction has risen over the last decade, and government economic development agencies now recognise that demand for renewable energy devices and infrastructure offers growth opportunities for the manufacturing sector. For more information on regional manufacturing capacity, the following websites may be of use:

- Futureskills Scotland
    - (http://www.scotland.gov.uk/Topics/Economy/labour-market)
- England's RDAs (Regional Development Agencies)
    - (http://www.englandsrdas.com/)
- Welsh Development Agency
    - (http://new.wales.gov.uk/topics/businessandeconomy/?lang=en)
- Invest Northern Ireland
    - (http://www.investni.com/)

There are several facilities across the UK capable of manufacturing renewable device components. This includes: the Vestas Celtic facility for wind turbine blade manufacture on the Isle of Wight and wind turbine tower manufacture at Campbeltown; the Fife Energy Park with facilities for marine and wind renewables fabrication; and the Camcal facilities for renewables device manufacture on the Isle of Lewis.

The UK has offshore engineering expertise due to its North Sea oil and gas industry. The skills from this industry will be, in many cases, transferable to the offshore aquatic renewables industry. For more information on these firms, please see the database maintained by the International Marine Contractors Association[7].

[7] http://www.imca-int.com/members/europeafrica/

## 4.2. Support facilities and vessels

The UK generally has quality infrastructure to support the development of aquatic renewable energy projects.

The national transport infrastructure is strong. There are 30 main airports operating domestically and internationally. The road and rail networks across the UK are of a good quality and coverage. For a detailed map of the UK rail network, also showing links to airports and ferry ports, please see the Network Rail website[8].

The UK has a good quality ports infrastructure, with the largest ports industry in Europe. For a map of the major ports in the UK, please see the UK Major Ports Group website[9].

One challenge for the UK aquatic renewable energy industry is difficulty in obtaining access to service and installation vessels. Anecdotal evidence suggests that vessel availability is limited due to high demand and the challenge of operating in the most energetic environments, and that vessel hire prices can be preclusive for pre-commercial projects.

## 4.3. Workforce

The UK has a skilled workforce, which could support the development of a large aquatic renewable energy industry. The following sections give more detail on the availability of specific skill sectors within the UK.

### Manufacturing

The UK's economic strategy focuses on developing a 'knowledge economy', based on the service and innovation sectors. This has been in the context of competition with emerging economies leading to a decline in heavy industry. As such, there has been a shift in skills-training away from manufacturing industry. However, although the number of UK jobs in manufacturing has fallen over the past decade, there is evidence of a shift to a smaller manufacturing industry fabricating higher-value products.

### Science and engineering

The number of jobs in construction has risen over the last decade, and government economic development agencies now recognise that demand for renewable energy devices and infrastructure offers growth opportunities for the manufacturing and construction sectors.

Skilled scientists and engineers have traditionally made up a high percentage of the UK's workforce. This is set to continue, with Government policy dictating that Britain should become "the most attractive location in the world for science and innovation." However, research[10] published through the Office for National Statistics suggests that though there has been recent growth in the numbers of science and technology graduates in the UK, this has masked a decrease in the number of engineering graduates.

[8] http://www.nationalrail.co.uk/tocs_maps/maps/NationalRailSchematicMapLarge.pdf

[9] http://www.ukmajorports.org.uk/

[10] http://www.statistics.gov.uk/CCI/article.asp?ID=1474&Pos=5&ColRank=2&Rank=288

**Regulation**

In terms of the UK's regulatory skill set, recent research[11] by the UK Parliament's 'Communities and Local Government Committee' highlights a 'drastic shortage in planning officers' as well as a shortage of expertise on renewable energy within the whole planning system. This shortage may not affect offshore wind, wave, tidal stream and tidal barrage projects to a great extent, because these types of projects are consented by central government, rather than local planning officers. The shortages of planning officers generally and planners with experience of renewables more specifically, may, however, affect run-of-river projects.

## 4.4. Educational institutes

The UK has a wealth of educational institutes at which people may train for a career in the aquatic renewable industry.

**Aquatic Renewable Energy - Science and Engineering**

The UK Energy Research Centre produces a series of "Energy Research Landscapes" which outline the main research facilities and activities in the UK relating to energy. This includes an outline of educational facilities, and highlights their research interests and capabilities.

Wave and tidal energy – The Marine Energy Research Landscape was produced in 2007[12].

Wind energy – The Wind Energy Research Landscape was produced in 2008 [13].

Hydropower (run-of-river) – Unfortunately, there are no plans to publish a hydropower research landscape. Some of the institutions which may offer training on, and conduct research into, hydropower-related subjects include:

- The Hydraulics Research Group, Queen's University, Belfast
- Environmental Fluids and Coastal Engineering, University College London
- The Maritime Environmental and Water Systems Group, University of Liverpool

[11] http://www.publications.parliament.uk/pa/cm200708/cmselect/cmcomloc/517/517i.pdf

[12] http://ukerc.rl.ac.uk/Landscapes/Marine.pdf

[13] http://ukerc.rl.ac.uk/Landscapes/Wind.pdf

**Manufacturing & Technical**

The UK Government runs a programme of 'Modern Apprenticeships', through which employees are recruited with a participating employer, and are then offered on-the-job training while working towards National Vocational Qualifications. There are a number of Modern Apprenticeships in disciplines which would be of use for a career in the aquatic renewable energy industry, including: the Electricity Industry Apprenticeship; the Manufacturing Apprenticeship; the Electrotechnical Apprenticeship; Steel and Metals Industry Apprenticeship; and the Engineering Apprenticeship. For more information on Modern Apprenticeships, please see here[14].

**Planning & Consenting**

Recent research by the UK Parliament's Communities and Local Government Committee highlighted that although there had been a fall in the number of planning schools and planning students during the 1980s and the 1990s in the UK, there has been an increase in both since 2000. There are a number of planning courses available in the UK, graduates from which go on to work in public sector consenting, or in private sector planning consultancy. The Royal Town Planning Institute accredits planning courses in the UK, Ireland and Hong Kong. A list of these courses is available here[15].

**Other**

A large aquatic renewable energy industry will require not just engineers, manufacturers and regulators, but skilled people from a range of other professions such as project management, marketing, law and finance. The UK's universities rank among the best in the world for both arts and sciences degrees.

[14] http://www.apprenticeships.org.uk/

[15] http://www.rtpi.org.uk/item/178/23/5/3

# 5. Regulation

## 5.1. Leasing

In order to develop an aquatic renewables project in the UK, a developer must obtain rights to the land, sea-bed or river-bed sought.

**Seabed**

In the UK, the majority of the seabed out to 12 nautical miles from the coast is owned by an organisation called The Crown Estate. The Crown Estate is a UK property institution which has historically managed the property of the Crown (royal family) on behalf of the UK Government. The Crown Estate currently has the right to license renewable energy generation on the sea-bed from 12 nautical miles to the seaward extent of the UK Renewable Energy Zone out to 200 nautical miles from the shore. Additionally, the Crown Estate owns approximately half of the UK's estuary beds.

Most offshore wind, wave, tidal stream and tidal barrage projects will need to obtain a lease from the Crown Estate for the sea- or estuary-bed required for their developments. In some cases, such as for offshore wind, The Crown Estate will designate certain areas of the sea specifically for development purposes. Where this is not the case, developers will need to enter into individual discussions with The Crown Estate.

For more information on The Crown Estate and leasing arrangements, please see the organisation's website[16].

**Land**

Developers of aquatic renewables projects will often need to obtain rights to land in order to progress their projects – this could be for the laying of cables on the shore, or for the siting of a substation, for instance. Project developers must enter into discussions with the current landowner to obtain the necessary rights, whether through complete purchase of the land, or through leasing arrangements. The landowner may be a private individual, company or public organisation.

**River-bed**

Developers of run-of-river or tidal barrage projects will need to obtain rights in order to progress their projects. The Crown Estate own approximately half of the tidal river beds in the UK, while the other half will be owned by private individuals, private companies or public organisations.

[16] http://www.thecrownestate.co.uk/marine

## 5.2. Consenting

In the UK, planning laws mean that anyone who wishes to 'develop' land must obtain permission before doing so, even if they own the land they wish to develop.

A developer of a renewable energy project must usually obtain this permission, or planning consent, for their project before undertaking development activities. For aquatic renewable energy installations, these will be controlled primarily through the Electricity Act 1989.

Section 36 of this Act states that applications for planning permission for offshore renewables projects (including wind farms, wave and tidal stream farms) or water-powered generation projects (including hydroelectric plants) with greater than 1 MW capacity will be dealt with by central government, rather than local planning officials. Planning permission granted through this Act is often referred to as "s36 consent".

Onshore aquatic renewable energy projects (e.g. hydropower) smaller than 1 MW is dealt with by local planning officials. An application for planning permission would have to be made in this case to the local planning authority. The Planning Portal website[17] will direct you to the relevant local authority.

The consenting arrangements for the offshore environment are currently under review by both the UK and Scottish Governments. The UK and the Scottish Marine Bills, and the Planning Reform Bill, are likely to amend the consenting process, meaning that planning permission for offshore wind, wave, tidal stream and tidal barrage projects may be granted under different conditions, by a different branch of government. For large offshore wind projects in England, for example, it is likely that a new 'Infrastructure Planning Commission' will handle consents.

[17] http://www.planningportal.gov.uk/wps/portal/genpub_DevelopmentPlans?scope=202

## 5.3. Environment

In order to develop an aquatic renewables project in the UK, in addition to a site lease and planning permission, there are two other licences a developer must obtain. These are a licence under the Food and Environment Protection Act 1985 and a licence under the Coastal Protection Act 1949. At the time of writing, these licences are awarded by branches of central government. Detailed information on the authorities with responsibility for these licences, as well as other extra requirements for the consenting of an aquatic renewables project, are available on the websites of the Department for Business, Enterprise and Regulatory Reform (wave and tidal stream[18]), and the Scottish Government[19].

The consenting arrangements for the offshore environment are now under review by both the UK and Scottish Governments. The UK and the Scottish Marine Bills, and the Planning Reform Bill, are likely to amend the consenting process, meaning that planning permission for offshore wind, wave, tidal stream and tidal barrage projects may be granted under different conditions, by a different branch of Government. One proposal, for instance in the Scottish Marine Bill, is that individual projects will not have to apply separately for planning permission and the two other licences, but will be assessed as a whole and given one licence per project. Please visit the relevant websites for detail on the progress of the UK Marine Bill[20], Scottish Marine Bill[21] and Planning Reform Bills[22].

## 5.4. Health and Safety

The Maritime and Coastguard Agency is the UK government agency responsible for implementing maritime safety policy. They have drawn up guidance for safety of navigation around offshore renewable energy installations, which is available here[23].

[18] http://www.berr.gov.uk/files/file15470.pdf

[19] http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Energy-Consents

[20] http://www.defra.gov.uk/marine/legislation/index.htm

[21] http://www.scotland.gov.uk/Topics/Environment/Water/16440/marine-bill-consultation

[22] http://www.leaderofthehouseofcommons.gov.uk/OutPut/Page2036.asp

[23] http://www.mcga.gov.uk/c4mca/mcga07-home/shipsandcargoes/mcga-shipsregsandguidance/mcga-windfarms.htm

# 6. Drivers of industry

## 6.1. Political drivers

The UK Government, and the devolved authorities (Scottish Government, Welsh Assembly, Northern Irish Executive), have each expressed a willingness to see the growth of the renewable energy sector in the UK. The growth of the sector is perceived as holding benefits in terms of reducing greenhouse gas emissions, reducing the UK's dependence on imported energy, and creating job opportunities.

The UK was instrumental in pushing forward a European commitment to oblige the European Union to produce 20% of its energy (electricity, heat and transport fuels) from renewables by 2020. This commitment will be formalised in the EU Renewable Energy Directive, and the UK expects its own obligation to amount to 15% of energy from renewables by 2020.

Achieving the 15% will be a monumental task, as it now stands at just over 2% of primary consumption met by renewable energy in the UK. The aquatic renewable energy industry has been identified as key to enable the UK to meet its energy targets.

There sector is mentioned favourably in the UK Government's important Renewable Energy Strategy. As well as this, in late 2007, the UK Government announced plans to have 33GW of offshore wind energy around the UK, and is now conducting a Strategic Environmental Assessment (SEA)[24] into further 'rounds' of offshore wind licensing.

The Scottish Government has been particularly interested in the development of the wave and tidal stream sectors. It has helped to fund the European Marine Energy Centre[25] (EMEC, the first test centre for pre-commercial wave and tidal stream prototype device), and has pledged to support the deployment of 10MW wave and tidal energy by 2010.

## 6.2. Financial drivers

There is a range of public financial support mechanisms in place in the UK for the aquatic renewable energies.

**Revenue**

Revenue support for the renewable energy industry in the UK comes largely from the Renewables Obligation mechanism. This mechanism obliges electricity suppliers to provide a certain proportion of their supply from renewables, or else to pay a penalty. To prove their compliance, they must show the regulator Renewables Obligation Certificates (ROCs). These are purchased from generators of renewable electricity at a market price, with a generator able to sell 1 ROC for every MW-hour of renewable generation. The money from suppliers who pay a penalty ("buy-out price") is put into a communal fund (the "buy-out fund") and redistributed to those suppliers who did provide ROCs. The market price of a ROC is determined by a number of factors, including the 'brown' price of electricity, and the level of buy-out price.

[24] http://www.offshore-sea.org.uk/site/index.php

[25] http://www.emec.org.uk/

At the time of writing, the UK and Scottish Governments are preparing to "band" the Renewables Obligation mechanism, so that generators of renewable electricity from emerging technologies will receive greater support than those who generate renewable electricity from mature technologies. In England & Wales it is proposed that generators of wave and tidal stream electricity will be able to sell 2 ROCs for every MWh of electricity they produce, while generators of onshore wind electricity will be able to sell only 1 ROC for every MWh. Under these same proposals, offshore wind would receive 1.5 ROCs per MWh while tidal barrage would receive 2 ROCs per MWh. Hydroelectric (including run-of-river) would receive 1 ROC per MWh for installations over 50kW capacity and 2 ROCs for installations over 50kW capacity.

At the time of writing, there is also an additional revenue support mechanism in Scotland called the 'Marine Supply Obligation' (MSO). This was put in place prior to discussions on banding the Renewables Obligation, and was developed in order to support the wave and tidal stream sectors. It is likely that the MSO will be removed, and wave and tidal stream sectors encouraged instead by a greater number of ROCs.

**Other sources of funding**

There are a number of grant support mechanisms in place for aquatic renewable technologies. These are largely in place for the more emerging technologies, such as wave and tidal stream energy. For more details on the most notable additional finance schemes please click on the following:

- Energy Technologies Institute – Offshore Wind Programme[26]
- Energy Technologies Institute – Marine Energy Programme[27]
- Environment Transformation Fund: Marine Renewables Deployment Fund[28]
- The Carbon Trust – Marine Energy Accelerator[29]
- The Saltire Prize[30]

[26] http://www.energytechnologies.co.uk/technology-programmes/current-programmes/offshore-wind/

[27] http://www.energytechnologies.co.uk/technology-programmes/current-programmes/marine-wave-and-tidal/

[28] http://www.berr.gov.uk/energy/environment/etf/marine/page19419.html

[29] http://www.carbontrust.co.uk/technology/technologyaccelerator/mea

[30] http://www.scotland.gov.uk/Topics/Business-Industry/Energy/saltire-prize