

# The Path to Power

Delivering confidence in Britain's  
wave and tidal stream industry

June 2006

THE BRITISH  
WIND ENERGY  
ASSOCIATION

npower juice

# npower juice fund



## Supporting marine wave and tidal technology

npower juice was the first domestic, non-premium green energy tariff and was developed through a unique partnership between npower and Greenpeace. Greenpeace is working to show industry and the Government that there is wide spread consumer demand for clean, renewable energy.

npower has made a commitment to Greenpeace to estimate every unit of electricity juice customers use throughout the year and feed the same amount of renewable electricity from renewable sources into the electricity network.

npower and Greenpeace also created the juice fund in 2003 to assist the development of new renewable energy technologies. This is funded by npower who make an annual contribution of £10 to the juice fund for ever customer who stays with juice throughout the year.

This gives juice customers the satisfaction that not only are they receiving 100% renewable energy but also that the money they spend on their energy bills is helping develop new renewable energy technologies.

The juice fund has decided to concentrate on wave and tidal technologies as they have the ability to supply a significant proportion of the UK power market.

Projects funded by the juice fund to date include:

- Wave Hub data collection
- The Path to Power project
- The Pulse Stream Generation Concept
- The Edinburgh Designs Tidal Turbine

For more information on the juice fund together with the criteria required for an application go to [www.npower.com/juicefund](http://www.npower.com/juicefund)

## BWEA



With over 300 company members the British Wind Energy Association (BWEA) is the UK's leading renewable energy trade association championing the wind, wave and tidal stream energy sectors. BWEA supports marine renewables by representing the industry in discussions with Government, stakeholders and the media.

The BWEA Marine Focus Group consists of 117 companies interested and involved in this emerging industry, making it the largest wave and tidal energy group in the world. These companies include, amongst others, technology and project developers, utilities, financiers, legal advisors and environmental consultants.

BWEA is helping to ensure that the knowledge gained through the development of offshore wind energy is transferred into the emerging marine renewables. The Association also brings its experience in high level policy discussions, communications, conferences and membership services into this sector with the aim of ensuring as smooth a path as possible can be created for the development of wave and tidal stream energy around the UK.

For more information go to [www.bwea.com/marine](http://www.bwea.com/marine)

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## Further Work and Consultation

BWEA will be soliciting views from its members and a range of organisations on the ideas and recommendations in this report. We have already fed conclusions into the Energy Review team and will be putting the reports formal proposals to the Energy Minister. If you have any views on this work then please contact:

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BWEA would like to thank the npower juice fund for sponsoring this work and the external members of the Steering Group for giving their time and for providing valuable insights throughout the study.

# Preface

This project has been managed by BWEA and fully funded by the npower juice fund for wave and tidal energy.

It has been compiled in response to the growing need for Government to commit its support to the UK's wave and tidal stream industry. For the first time the various strands of support required to ensure this country maximises the economic and environmental opportunities available have been brought together into one document, resulting in the creation of a number of key recommendations for action.

Over 100 interviews have been conducted on the issues of consenting, grid access and financial support requirements, making it the largest ever study of its kind for this sector. These have been carried out and reported upon by leading experts in their respective fields (see inside back cover).

Three technical documents have been completed following these interviews. These documents, together with a significant number of further interviews and analysis, form the basis on which this final report has been compiled. These are available at [www.bwea.com/pathtopower](http://www.bwea.com/pathtopower).

A steering group was also formed to review and critique the work at the completion of each stage. This group comprised:

- Alan Moore, Board Member with responsibility for Marine, BWEA and Co-Chair of DTI Renewables Advisory Board
- Michael Hay, Marine Renewables Development Manager, BWEA
- Jon Boston, Marine Renewables Development Manager, npower renewables
- Carolyn Heeps, Head of Offshore and Environment, The Crown Estate
- Nick Mabey, Chief Executive, E3G
- Graham Sinden, Environmental Change Institute, University of Oxford
- Sue Barr, Senior Consultant, Entec UK
- John Callaghan, Technology Strategy Manager, the Carbon Trust

As well as the three technical documents, this study has drawn on the work of the Carbon Trusts Marine Energy Challenge, (published January 2006) and various Government policy documents on the development of wave and tidal stream energy around the UK.

# Introduction

Wave and tidal energy (also known as marine renewable energy) is electricity generated from the movement of waves and tidal flows. It has the potential to deliver a substantial, secure and renewable source of power for the UK and offers the UK the chance to create a world-class domestic industry developing, manufacturing and installing devices for the emerging global market.

The wave and tidal energy industry is now at a critical stage of development. It faces a number of hurdles that must be overcome for its potential to be realised. In response, BWEA initiated a project, funded by npower Juice, to identify the hurdles faced by the industry and to map out a Path to Power. The project comprises three completed studies on key issues for the wave and tidal industry:

- Stage 1: Legal and Regulatory Requirements, prepared by Bond Pearce LLP
- Stage 2: Marine Stakeholder / Statutory Bodies views on Deployment, prepared by ABPmer Ltd
- Stage 3: Grid Evolution Scenarios and GB Network Access, prepared by Econnect Ltd.

These studies are available from BWEA's website at [www.bwea.com/pathtopower](http://www.bwea.com/pathtopower).

This final report, prepared by Climate Change Capital (CCC), summarises the potential for the industry, outlines the hurdles the industry faces and sets out recommendations for Government and others on how the industry can achieve its long-term potential.

The report uses a number of standard definitions. Bond Pearce's report (Stage 1) identified four stages of marine renewable deployment in the UK that are followed here. The capacity definitions for these stages of deployment are:

- Prototype device – single pre-commercial devices up to 1 megawatt (MW) in size
- Small array – small arrays of devices up to 5 MW in total export capacity
- Large array – large arrays of devices up to 30 MW in total export capacity
- Significant projects – large commercial projects in excess of 30 MW.

Together, prototype devices and small arrays are referred to as "demonstration-scale" installations. Tidal energy in this report refers to tidal stream (or tidal current) and does not include barrages, dams or tidal lagoons.

# Executive summary

The wave and tidal stream industry is poised to become a significant provider of clean renewable energy for the UK. In the long term marine renewables could meet 15 to 20% of current UK electricity demand, with 3% to 5% coming from tidal stream and the remainder from wave energy. The Carbon Trust's Marine Energy Challenge (MEC) estimates that 3 gigawatts (GW) of wave and tidal stream capacity could be installed by 2020 which represents 2.1% of electricity supply in that year, as shown in Figure 1.

Although the industry is at an early stage, all indications suggest that it can deliver its potential. Such confidence stems from the UK's outstanding wave and tidal resource and its world leading base of marine renewable technology together with the

increasing interest from the private sector and the UK's strong existing offshore skills.

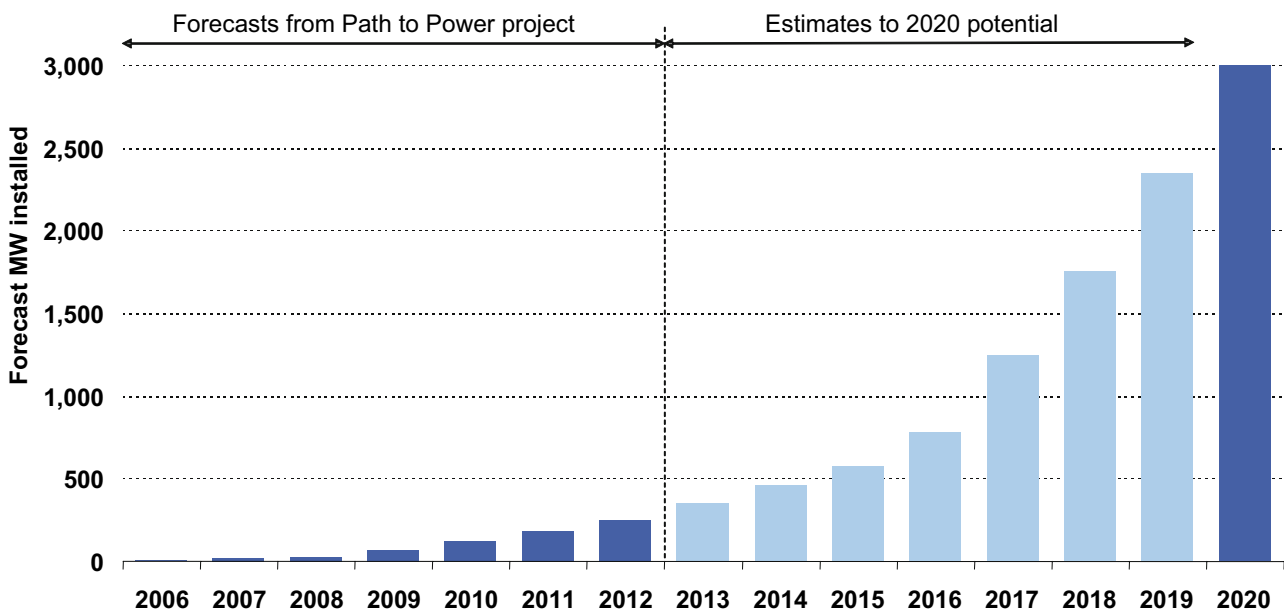
There are, however, a number of hurdles that will require addressing before these strengths can be brought together towards the creation of a new clean power sector and potentially significant new industry.

## Hurdles

Interviews with industry stakeholders identified three distinct categories of hurdle with a clear hierarchy of importance: financing, grid access, and planning and permitting.

Figure 1: Deployment scenario for wave and tidal energy in the UK to 2020

BWEA (2006) Energy Review submission; Bond Pearce (2005) Path to Power: Stage 1 report; CCC



## Financing

In interviews, all stakeholders highlighted the urgent need for clarity on the existence and form of a support mechanism that will enable deployment of large-scale arrays and significant projects. Such a mechanism is needed to bridge the gap between support for demonstration-stage technologies, mainly through the recently introduced Department of Trade and Industry (DTI) Marine Renewables Development Fund (MRDF), and that offered by the Renewables Obligation (RO) and Climate Change Levy (CCL) to more mature renewable technologies. Without such a mechanism, it is highly unlikely that any installations above demonstration scale will be put in place in the UK.

## Grid access

Device and project developers consistently ranked grid access as one of the two major hurdles to the development of the industry. A substantial proportion of the UK's wave and tidal resource is located off the north and west coasts of Scotland, where grid capacity is extremely limited today and is likely to remain so until beyond 2020. Although the picture in the other major areas of resource – South Wales and South and South West England – is more positive, this implies that large-scale deployment of wave and tidal will be constrained by an inability to tap the best resources unless the issue is resolved.

## Planning and permitting

In the course of CCC's interviews, industry stakeholders identified a number of specific planning and permitting hurdles to the development of the industry. Most related to the need to ensure that a longer-term planning and permitting framework is in place in time so that the industry's development is not delayed. Many of their concerns centred on the requirement for a Strategic Environmental Assessment (SEA) in areas of resource in England and Wales, and related issues of guidance in site selection and Environmental Impact Assessment (EIA) requirements for commercial deployment.

## Recommendations

In response to the hurdles identified during all stages of the Path to Power project, a number of recommendations have been developed to help the industry achieve its potential. Some require urgent action, others require action now to prevent a hiatus at a later stage and still others need acting on only in future. Figure 2 provides a summary of the major recommendations, their timing and their relation to the installation of wave and tidal generation in the UK.

### **Recommendation: Publish a strategy for the wave and tidal industry**

*Recommendation on: UK Government, led by DTI  
Timing: As soon as practicable*

A consistent theme in conversations with industry stakeholders was the need for Government to demonstrate a longer term commitment to the wave and tidal industry across the whole of the UK. To this end, this report recommends that statements on many of the recommendations outlined below could be drawn together in a single strategy document, setting out the Government's belief in the industry's potential and the actions being and to be taken to help the industry realise that potential.

Such a strategy document would provide a strong signal to the industry and its current and potential future backers that the Government recognises the potential contribution the wave and tidal industry can make, and is committed to working with the industry to achieve that potential.

### **Recommendation: Introduce a financial support mechanism to bridge the funding gap**

*Recommendation on: DTI  
Timing: Announce intention and begin work as soon as practicable, leading to introduction in 2008*

The introduction of a support mechanism to bridge the funding gap to the RO is both critical and urgent. Interviews with stakeholders highlighted two key requirements for a support mechanism to bridge the funding gap:

- A preference for revenue rather than capital support
- The support should be set at an appropriate level to create a market pull, overcoming the risks of an early-stage industry and recognising that, perhaps out to 2015, the industry is likely to be prevented from

tapping the best resources at any significant scale by grid constraints.

The Path to Power has not analysed the best form a further support mechanism might take, but two studies analysing the options are underway:

- A Carbon Trust study identifying and assessing the potential options to change the current renewables policy framework
- A Scottish Executive consultation looking at the level of financial support required by marine technology developers and assessing how this level of support may be delivered through the banding of the Renewables Obligation (Scotland) (ROS).

Given the industry’s request for early clarity, the UK Government should announce a programme of work as soon as practicable to identify a support mechanism to bridge the funding gap for wave and tidal. This programme could include a study commissioned to analyse promising options, building on the results of the two studies now in progress. These options could be costed, with a view to earmarking a sum within the 2007 Comprehensive Spending Review

(should there be any taxpayer funded requirements) and consulted on with a view to introducing the new mechanism in 2008. Throughout this process DTI and Scottish Executive should note that industry’s preference is for a single UK-wide mechanism.

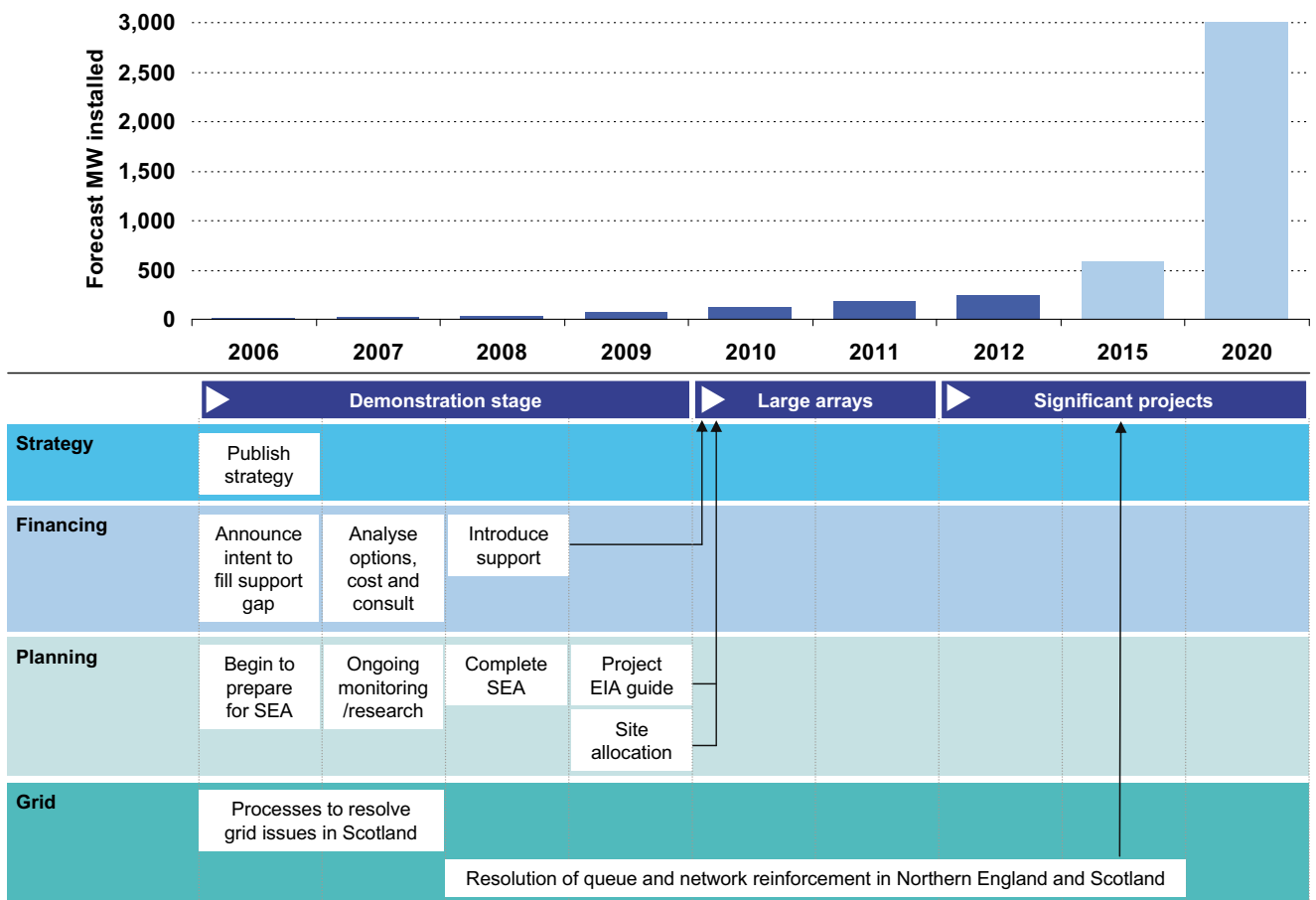
**Recommendation:  
Participate in existing processes to resolve grid issues**

*Recommendation on: Industry  
Timing: Current and ongoing*

The grid-related hurdles to the development of a wave and tidal industry are shared, at a larger scale, by the on- and offshore wind industries. As a result, much effort is already being made to resolve the connection and charging problems. In particular, four processes are of major importance, in which the wave and tidal industry should participate actively to ensure that its interests are reflected in the outcomes:

- Ofgem’s third consultation on the transmission price control review 2007-2012

Figure 2: Recommendations summary



- A related National Grid consultation process on managing access to the GB transmission systems
- Ofgem’s programme of work on the regulation of offshore electricity transmission
- A DTI consultation on capping Transmission Network Use of System (TNUoS) charges for wind generators in remote locations in Scotland to help enable the UK Government to meet its renewables targets.

**Recommendation:  
Begin preparations for an SEA**

*Recommendation on: DTI and other relevant government departments and bodies*

*Timing: As soon as practicable, leading to SEA in 2008.*

Relevant Government departments should formally begin preparations for an SEA as soon as practicable in order to be able to complete an SEA in 2008. This will help the identification of sites for large-scale projects and allow the completion of work that depends on the SEA and that will be required in order for large arrays to be installed.

Beginning the SEA process would involve scoping an SEA’s requirements, initiating generic studies and providing guidance for the monitoring requirements

of installed devices. Overall this may take up to three years. In addition, the Government should set out the regions that will be covered by marine renewables SEAs.

The Scottish Executive is already preparing a wave and tidal SEA, which is examining the Western seaboard including the Inner Isles, Western Isles and Argyll and Bute, the Solway Firth and the Northern Isles (Orkney and Shetland). This SEA is expected to be completed towards the end of 2006.

The remaining areas with the greatest wave and tidal potential that still require an SEA therefore appear to be in South West England and South Wales. Once preparatory work has been conducted, completion of an SEA is expected to take around one year. Once an SEA is complete, the Government should publish guidance on the EIA requirements for large arrays and significant projects and work with The Crown Estate to identify potential sites for development and develop an approach to site allocation. In addition, the SEA can feed into any process of marine spatial planning that may emerge from the current Marine Bill consultation.

# 1. Potential of wave and tidal industry

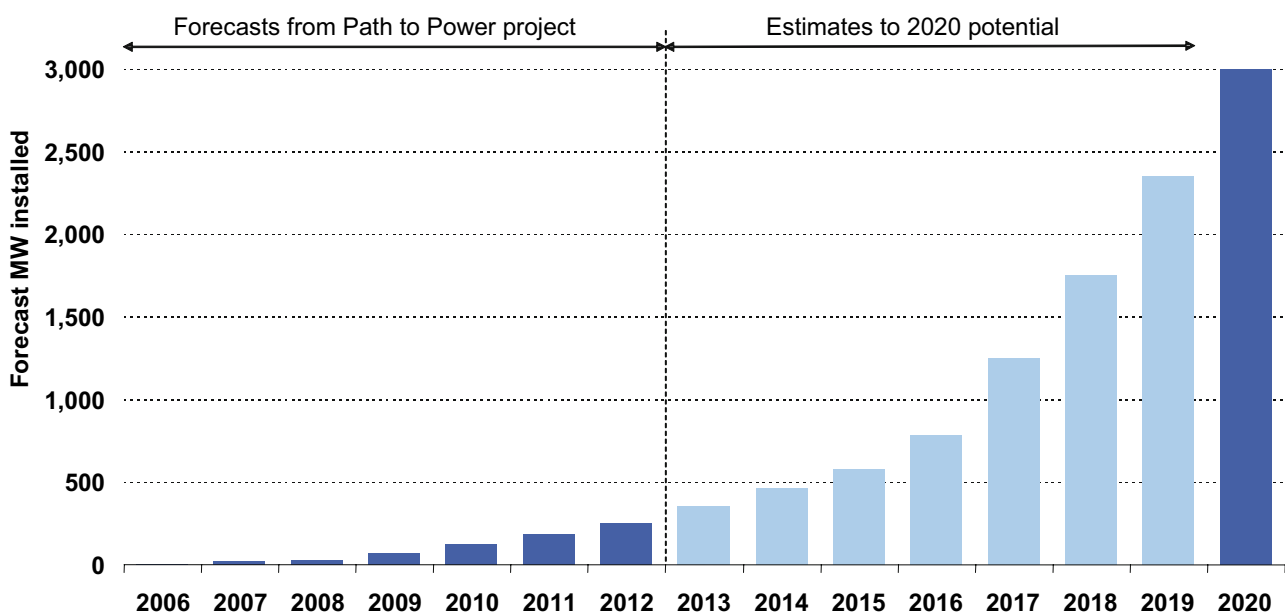
The UK possesses some 35% of Europe's wave resource and 50% of its tidal resource. BWEA, using data from the Carbon Trust's Marine Energy Challenge (MEC), estimates that 3 GW of wave and tidal capacity could be installed in the UK by 2020, as shown in Figure 3. This capacity could generate approximately 8 TWh of electricity a year, equivalent to 2.1% of UK electricity supply in that year. The MEC suggests that this capacity would constitute a substantial proportion of between 1.0 GW and 2.5 GW each of wave and tidal energy expected to be installed across Europe<sup>1</sup>.

In the long term, marine renewable energy could meet 15% to 20% of current UK electricity demand, with 3% to 5% coming from tidal stream<sup>2</sup> and the remainder from wave energy.

The potential for this level of deployment gives wave and tidal energy a strategic importance in preserving multiple options to meet the UK's aspiration of supplying 20% of electricity from renewable sources by 2020 and intention to reduce carbon emissions by 60% in 2050. These targets necessitate options beyond those available today.

*"Wave and tidal stream technologies will only make a small contribution towards the 2010 renewables target but, if they can be successfully developed on a commercial scale, they could make a significant contribution towards achieving the 2020 aspiration and beyond." UK Climate Change Programme 2006<sup>3</sup>*

**Figure 3: Deployment scenario for wave and tidal energy in the UK to 2020**  
BWEA (2006) Energy Review submission; Bond Pearce (2005) Path to power: Stage 1 report; CCC



<sup>1</sup> Carbon Trust (2006) Future Marine Energy, as cited in BWEA (2006), Energy Review Submission, Appendix C

<sup>2</sup> Black and Veatch (2005) The UK Tidal Stream Resource and Tidal Stream Technology, report prepared for the Carbon Trust Marine Energy Challenge

<sup>3</sup> HM Government (2006) The UK Climate Change Programme 2006, Pg 37

In addition, because the industry is at an early stage, it offers the opportunity to create a new manufacturing industry serving the domestic and export market. According to the Carbon Trust, "UK plc has the opportunity and potential to create competitive positions in all areas of design, manufacture, installation and operations of marine renewables"<sup>4</sup>. Acknowledging uncertainties, they estimate that the value of worldwide electricity revenues from wave and tidal projects could ultimately be between £60 billion and £190 billion annually<sup>5</sup>.

All indications suggest that the industry has the potential to deliver this goal. Along with the UK's outstanding wave and tidal resource, such confidence stems from:

- The UK's existing world-leading base of marine renewables technology
- Increasing private sector interest in the industry
- Research demonstrating the potential for cost reductions in the technologies
- The UK's strong existing offshore skills.

### Base of marine renewables technology

The UK has established itself as an early market leader with over 30 technology developers headquartered in the UK, compared to approximately 15 developers in the rest of Europe and around 20 developers in the rest of the world. In addition, the UK has pioneered the establishment of shared facilities for testing of wave and tidal devices such as the European Marine Energy Centre (EMEC) in Scotland and the Wavehub project in southwest England.

### Increasing private sector interest in the industry

Initial investments in the industry were restricted to device developers' own equity and to limited venture capital financing. However, in the last three years the industry has seen the initial involvement of major utilities in both technology provision – for example Scottish and Southern Energy's role in developing Neptune, a tidal energy device – and in project development, illustrated by the relationship between Ocean Prospect and Ocean Power Delivery to develop a demonstration project in the southwest of England<sup>6</sup>. A number of relationships are also in place between device developers and major industrial manufacturers. A good example is the acquisition of Wavegen, a wave energy systems company,

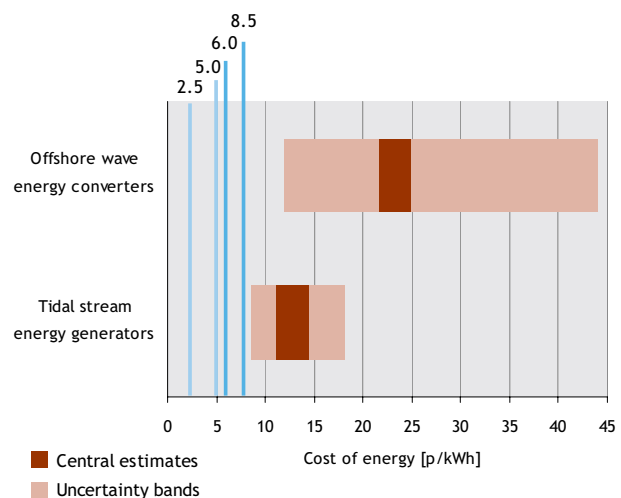
by Voith Siemens. Venture capital interest in the sector has risen substantially, although it remains constrained. However, the industry has had some success in raising finance from the public markets, with the listing of Ocean Power Technologies on the London Stock Exchange's Alternative Investment Market in 2003<sup>7</sup>.

### Potential for cost reductions

The UK's technology providers are at varying stages of development. Although a few devices have been tested in sea conditions, and at least two companies are now planning to install large arrays, there are no significant wave and tidal projects completed to date. While there are some clear market leaders, in terms of proximity to multiple device project development, the market has not selected the winners as yet.

This lack of operating devices creates considerable uncertainty over the potential future viability of the industry, especially as costs are currently high compared with more mature renewable generation technologies. The current cost and potential for cost reductions has been studied independently by the Carbon Trust's Marine Energy Challenge. This study states that central estimates for current costs of offshore wave energy projects are in the range 22-25 pence per kilowatt hour (p/kWh) and for tidal projects from 12-15 p/kWh, as shown in Figure 4<sup>8</sup>. However, some device developers believe that the cost ranges for offshore wave technologies do not reflect the position of the more advanced technologies in the industry and as a result are too high. The large majority of tidal technologies, on the other hand, are beginning to consolidate around the horizontal axis

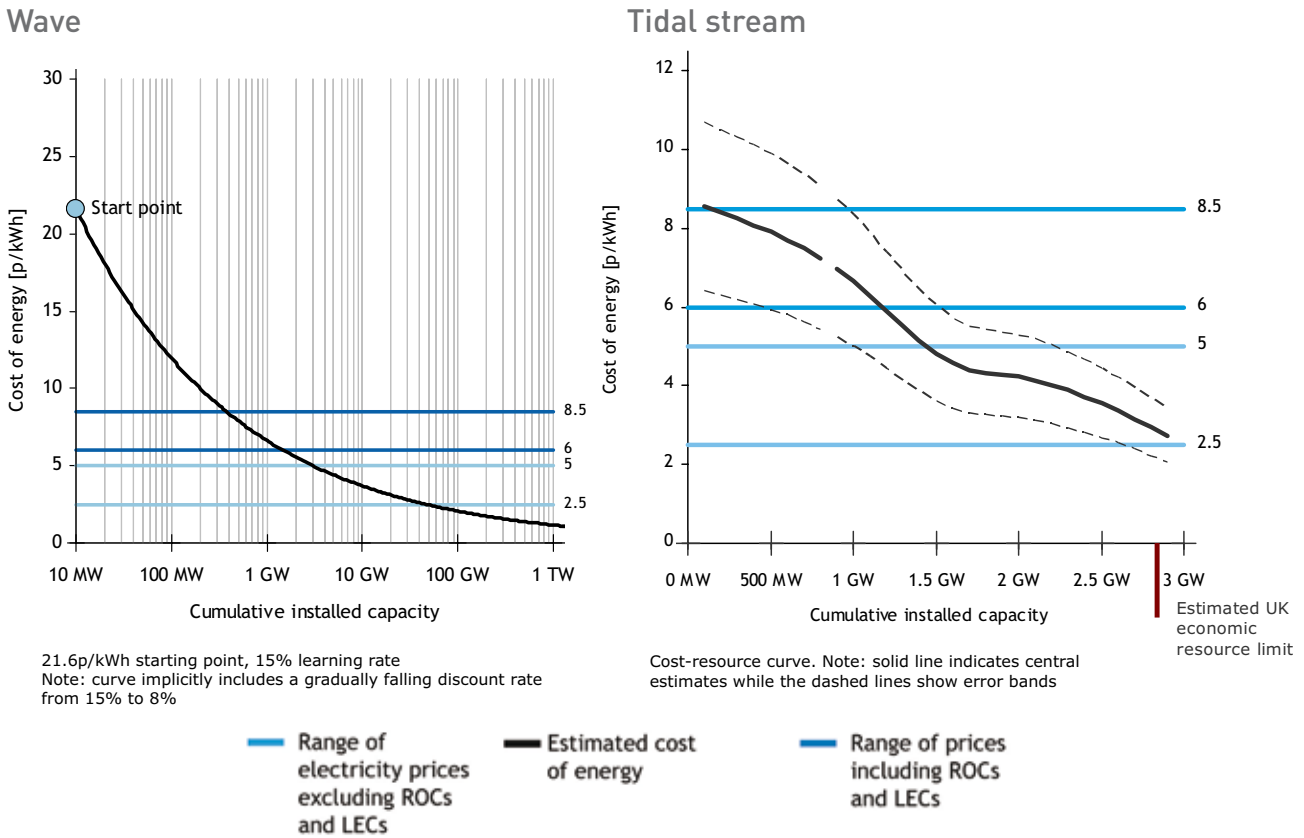
Figure 4: Estimated costs of energy today  
Carbon Trust (2006) Future Marine Energy, Pg 14



4 Carbon Trust (2003) Building Options for Renewable Energy, Pg 15  
5 Carbon Trust (2006) Future Marine Energy, Pg 7  
6 Ocean Power Delivery website, [www.oceanpd.com](http://www.oceanpd.com)

7 Ocean Power Technologies website, [www.oceanpowertechnologies.com](http://www.oceanpowertechnologies.com)  
8 Carbon Trust (2006) Future Marine Energy, Pg 15

Figure 5: Cost reduction scenarios for offshore wave and tidal stream energy  
Carbon Trust (2006) Future Marine Energy, Pg 19 and 22



turbine. This results in greater clustering of current cost potentials around the central estimates.

The MEC provides a central scenario for cost reductions in offshore wave and for tidal energy keeping in mind the estimated UK economic tidal resource potential, given in Figure 5. The MEC concludes that based on these scenarios, "there is potential for marine renewable energy to become competitive with other generation forms in the future"<sup>9</sup>, particularly considering this deployment will be on a global level. This is not dissimilar to the development of the wind industry, which has seen a reduction in costs with increasing installed capacity, as seen in Box 1. Although tidal energy is likely to be cost effective sooner offshore wave energy has the most potential in the UK due to the significantly higher economic resource potential.

### Existing offshore skills

The wave and tidal industry should be able to benefit from the UK's wider base of experience in the marine environment particularly that gained in the oil and gas, and offshore wind industries. This experience includes:

- Offshore engineering and fabrication
- Offshore technology deployment and maintenance
- Understanding the impact of fixed structures on the marine environment.

#### Box 1: Development of wind energy and potential for cost reduction

Carbon Trust (2006) Future Marine Energy, Pg 31

The installed capacity of wind energy worldwide increased from a few megawatts in 1980 to around 50 GW in 2004. In line with this increase, the cost of wind energy during this period fell from 20 €¢/kWh to under 5 €¢/kWh, implying a learning rate of 18%.

<sup>9</sup> Carbon Trust (2006) Future Marine Energy, Pg 19 & 22

## 2. Hurdles to achievement of potential

Although there have been a number of positive developments for the wave and tidal industry recently, it still faces a number of hurdles if it is to achieve its potential.

The interviews with industry stakeholders identified three distinct categories of hurdles with a clear hierarchy of importance. In order of importance these were:

- Financing
- Grid access
- Planning and permitting.

### Financing

The lack of adequate financial support for the industry was stressed by almost all industry stakeholders interviewed as the most important hurdle to the development of the industry and one that needed to be addressed in the near term. At present Government provides support to the

industry through two main mechanisms:

- The DTI New and Renewable Energy R&D Programme (now the Technology Programme)
- The Marine Renewables Deployment Fund, a new fund specifically to support the wave and tidal industry. The key aspects of the MRDF are highlighted in Box 2.

The MRDF is a strong positive signal of early stage project support for technology developers that qualify for the funds. A majority of industry stakeholders favoured the combination of capital and revenue support and were of the opinion that the mix of these two was broadly correct in order to reduce project risks while rewarding performance. However some felt that the qualifying criteria were too restrictive. In particular, several respondents commented that the funding cap on projects excluded support to technologies with large unit

#### Box 2: Key aspects of the MRDF

DTI (2005) Marine Renewables – Wave and Tidal Stream Energy Demonstration Scheme, Pg 3-4

The primary objective of the MRDF is to encourage the accumulation of manufacturing and operating experience necessary for the continued evolution of marine renewable technologies towards commercial viability. Key features of the scheme are:

- A total amount of £50 million allocated with £42 million for project support, £2 million for monitoring the impact of deployment on the marine environment and the remainder for support in other areas that can help to develop the industry, such as infrastructure projects and general environmental studies to complement project specific EIAs
- A combination of capital grants and revenue support for grid-connected devices
- Capital grant support to projects up to 25% of eligible costs, and limited to a maximum of £5 million
- Revenue support payment of £100/megawatt hour (MWh), in addition to the market value of electricity the Renewables Obligation Certificates that they generate
- Support for a period of up to two years for commissioning and a maximum of seven years for operation
- Cap of £9 million per project

sizes, thereby creating a bias towards smaller-scale devices. Developers also found that the level of support is not sufficient to allow the installation of arrays of a scale (greater than around 5 MW) attractive to project developers.

Most technology providers and developers agreed that while the MRDF could be made to work for demonstration-scale arrays, the industry requires urgent clarity on the existence and form of a support mechanism that will enable deployment of large-scale arrays and significant projects with backing from project developers. Such a mechanism would help bridge the gap between funding the demonstration-scale technologies that the MRDF was designed to support and the support offered by the Renewables Obligation and Climate Change Levy to more mature renewable technologies.

The urgency of such a mechanism stems from two primary factors:

- The leaders in the industry are looking to deploy arrays larger than those the MRDF was designed to support. As a result, they face a direct and current funding gap in the UK that is preventing developers from bringing forward projects
- Many more technology providers, especially those who are sufficiently advanced to potentially benefit from the MRDF are finding it difficult to raise capital from private sources without clarity on a support mechanism beyond the MRDF. This problem is especially acute for those seeking venture capital funding, where investors have less strategic interest in the sector and shorter time horizons. Without greater clarity on future support, this substantial pool of funds will remain largely closed to the industry.

Without such a mechanism, it is highly unlikely that any installations above demonstration-scale will be put in place in the UK. A number of device developers exploring options in international markets, were of the opinion that if the right support mechanism is not put in place in the UK, the industry could shift operations to markets where support is available. A strong home market is seen as a fundamental requirement for the development of the industry in the UK.

## Grid access

In the course of conversations with industry stakeholders, device and project developers consistently ranked grid issues alongside finance as one of the two major hurdles to the development of the industry. This concern prompted BWEA to

commission a study from Econnect on network access as part of the Path to Power project. The issues identified below draw from both CCC's conversations and from the Econnect study.

Almost all of the hurdles faced by the industry in relation to network capacity stem from the mismatch between the location of the UK's highest wave, tidal and wind resource and its centres of demand. This creates two main issues. The first is the ability of projects to secure connection to the electricity network, with many potential projects seeking to connect to a weak network already near capacity. The second is the cost of a connection and network charges.

## Resource distribution and transmission capacity

The maps in Figure 6<sup>10</sup> overleaf show that for offshore wave power, a substantial proportion of the best resource is located off the west coast of Scotland, where grid capacity is extremely limited at present. This is similarly true of the UK's highest tidal stream resource area in the Pentland Firth, off North Eastern Scotland. The picture in the other major areas of resource – South Wales and South and South West England – is more positive. Transmission network capacity in South Wales is high, although the distribution network is weak. In the South West, both the transmission and distribution networks have spare capacity.

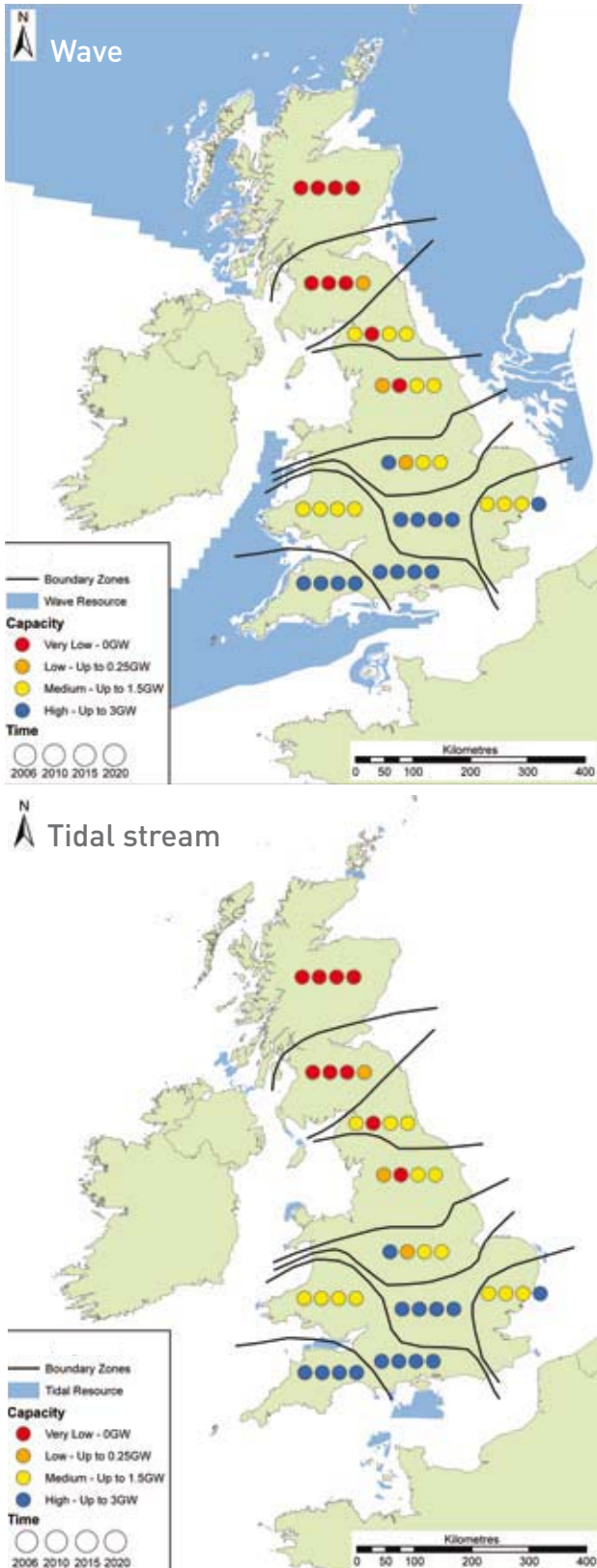
In general, network availability in Scotland and Wales is limited to 2020 by the large volumes of wind power expected to be built, despite the expected decommissioning of a number of nuclear and thermal plant and planned or forecast upgrades to the grid. The scale of the problem in Scotland caused by wind farms seeking connection is indicated by the British Electricity Trading and Transmission Arrangements (BETTA) queue - a list of all wind farms that have applied for grid connections in the region in application date order. Some 13.5 GW of potential wind capacity is currently awaiting connection, with expected connection dates stretching to 2015 and beyond.

The only factors likely to mitigate this outlook are if more thermal plant than expected shuts down and if the expected volumes of wind generation fail to materialise, although the Econnect study already applies a 40% probability of completion to the current queue of wind projects, based on historical data.

These grid constraints apply only indirectly to projects connected to the distribution network

<sup>10</sup> The maps have been prepared by ABPmer based on resource information contained in its study for the Path to Power and on Econnect's study of the likely development of transmission network transfer capacity. Details of Econnect's methodology can be found in their report.

Figure 6: Wave and tidal resource and grid accessibility in GB (2006 to 2020)



Note: The wave resource includes both deep water (depth >50 metres) and shallow water (depth 25 – 40 m) with an annual mean wave power > 10 kW/m of wave crest. The tidal resource includes both deep water (depth > 30 m) and shallow water (depth 20-30 m) with a mean peak spring tidal current speed > 2 metres per second. [ABPmer, (2006) Path to Power: Stage 3 report].

below a certain size threshold defined in the Grid Code. At present, this threshold is set at 5 MW in northern Scotland and 30 MW in southern Scotland. Below these thresholds, potential generators must negotiate access with the local Distribution Network Operator (DNO). Anecdotal evidence suggests that although this creates pockets of opportunity for connection, in general the problem remains acute for generators of any scale.

If this problem is not resolved, the UK will be unable to access its best wave and tidal resources at any scale, which is likely to cap deployment levels well below the industry’s potential.

### Cost

The weak grid in many areas of large wave and tidal resource and the distance between the resource and the centres of demand mean that any marine renewable generator connecting in these areas will face high charges. Generators must:

- Pay for own connection to the network
  - Costs of connections to the distribution network must be paid partly up-front and partly through Generator Distribution Use of System (GDUoS) charges according to a formula
  - Costs of connections to the transmission network look set to be spread over time, rather than paid up front, as set out in the Government’s recent response to the DTI/Ofgem consultation on regulation of offshore electricity transmission<sup>11</sup>
- Pay for their use of the network through GDUoS if they are connected to the distribution network and TNUoS charges if they are connected to the Transmission Network. TNUoS charges are locational and highest in regions such as Scotland where generation is furthest from the centres of demand. In the South West, in contrast, TNUoS charges are negative
- Provide security, known as Final Sums Liability (FSL) to cover the cost of any upgrades required to the transmission network as a result of their connection. Although these costs are ultimately socialised, albeit locationally, through TNUoS, FSLs can present a significant hurdle to generators looking to connect, especially if the developer does not have the required credit rating.

Together, these charges can have a substantial effect on the financial viability of projects, particularly where these are transmission-connected.

<sup>11</sup> DTI (2006) Regulation of Offshore Electricity Transmission: Government Response to the joint DTI/Ofgem Public Consultation

## Planning and permitting

In the course of the interviews, industry stakeholders identified a number of specific planning and permitting hurdles to the development of the wave and tidal industry. Their concerns and others are well covered in ABPmer's Stage 2 report as part of the Path to Power project. However, the overriding theme was that, in order for large-scale deployment of wave and tidal technologies to occur the industry will require clarity over the planning and permitting process for large arrays and significant projects and that this will take time and resources to achieve.

*"The picture on permitting is confused. The Scottish Executive is pressing ahead on SEA. The DTI have no such timetable. Defra are pushing marine spatial planning. There doesn't seem to be a coherent strategy. We need a clear transparent timetable what happens after the demonstration stage." A technology developer<sup>12</sup>*

### Current arrangements

At present, the planning and permitting arrangements for demonstration-scale projects are governed by the DTI's recently-published guidance on consenting arrangements<sup>13</sup>. This has been well received by industry for providing clarity and adopting a pragmatic approach appropriate for an early-stage industry. However, the guidance currently applies only in England and Wales. The Scottish Executive plan to consult on similar consenting arrangements for offshore renewables in late 2006.

### Future requirements

Most of the hurdles identified in the course of the discussions with industry stakeholders focused on the need to ensure that a longer-term planning and permitting framework is in place in time so that the industry's development is not delayed. Many of their concerns centred on the requirement for a Strategic Environmental Assessment (SEA) in areas of resource in England and Wales. As highlighted the Scottish Executive is already conducting a desk-based SEA on a strategic level for Scotland.

### Strategic Environmental Assessment

An SEA is required for all offshore commercial projects, as defined by the EU Directive 2001/42/EC. The DTI views the start of the SEA process for England and Wales to be some distance away, as not enough is known about key issues surrounding wave and tidal energy that would require more

understanding before the process of an SEA can be initiated<sup>14</sup>.

Many respondents were concerned about the length of time an SEA is likely to take and therefore about the need to start the process of an SEA (scoping, generic studies, identifying the requirements for device monitoring etc.) early in order to be ready for the deployment of large arrays and to enable a marine renewables SEA to feed into any process of marine spatial planning. It was also felt that formally beginning the SEA process now would have a positive signalling effect for the industry and help bring a range of stakeholders together in preparation for larger-scale deployment of the industry.

### Environmental Impact Assessment

The requirements of an Environmental Impact Assessment (EIA) are linked to the process of SEA, as the SEA helps to define the issues and the level of detail that an EIA would need to consider for project-level proposals. In essence, an SEA could help to reduce the requirements of an EIA and restrict them to site- and technology-specific issues. As the issue of an EIA is inextricably linked to the SEA process, an SEA would need to be in place before further guidance on the EIA requirements for significant projects could be provided.

### Monitoring

Monitoring is of vital importance at all stages of deployment, but even more so at the initial demonstration stage where it can be most expensive. It will help to provide an understanding of the impacts of wave and tidal energy generation on the marine environment that can help inform SEAs and EIAs and allow actual effects to be tested against those predicted in an SEA.

Consultations with many marine stakeholders highlighted a high level of uncertainty that arose from a perceived lack of understanding of the actual impacts likely to arise from developments. This was related to gaps in data for marine activities and systems linked with the uncertainty engendered by the multitude of potential technology designs for devices.

### Marine spatial planning

Marine spatial planning is a process by which the sustainable use of marine resources can be planned and managed. It is envisaged that SEA will be incorporated into any marine spatial plan (MSP) to understand the impacts of marine renewables alongside other users of the sea.

<sup>12</sup> Bond Pearce (2005) Path to power: Stage 1 report, Pg 5

<sup>13</sup> DTI (2005) Guidance on consenting arrangements in England and Wales for a pre-commercial demonstration phase for wave and tidal stream energy devices (marine renewables)

<sup>14</sup> DTI (2005) Guidance on consenting arrangements in England and Wales for a pre-commercial demonstration phase for wave and tidal stream energy devices (marine renewables), Pg 8

A plan to develop an MSP is a likely outcome of the Marine Bill, currently under consultation, with a draft Marine Bill expected in November 2006. While industry is positive about an MSP as it could provide greater certainty over where specific activities can occur, it is worried that the process will be overly prescriptive and rigid in the identification of potential areas for deployment, which would be detrimental to an early stage industry. In addition, there are concerns that the gap between preparation of an SEA and an MSP should not lead to a hiatus in the installation of wave and tidal projects.

### Stakeholder buy-in

While stakeholder buy-in was not viewed as a hurdle by the industry stakeholders, the importance of ensuring that all stakeholders are engaged from the project design stage was mentioned by both the industry and other marine stakeholders. This would be important to ensure that projects were not delayed once consent had been granted and construction activities had been initiated.

### Site selection and leasing

At present, The Crown Estate grants leases to demonstration-scale wave and tidal projects on the basis of a business plan. In order for large-scale arrays and significant projects to be installed, a more systematic approach with longer-term leases and a structured approach to site expansion will be required. This will need to be balanced against risks to The Crown Estate of site sterilisation, decommissioning costs and adverse environmental impacts.

# 3. Recommendations

In response to the hurdles identified during the course of the Path to Power, outlined below is a list of recommendations that CCC believes have the support of a broad range of industry stakeholders, are pragmatic and, together, if implemented, would create a path to power for the industry. Some of them require urgent action, others require action now to prevent a hiatus at a later stage and still others need to be acted on only in future.

## Strategy for the wave and tidal industry

A consistent theme in conversations with stakeholders was the need for the Government to demonstrate its commitment to the wave and tidal industry. To this end, CCC recommends that statements on many of the recommendations outlined below could be drawn together in a single strategy document, setting out the Government's belief in the industry's potential and the actions being and to be taken to help the industry realise that potential.

Such a strategy document would provide a strong signal to the industry and its current and potential future backers that the Government recognises the potential contribution that the wave and tidal industry can make, has identified hurdles on the industry's path and is committed to working with the industry to overcome them.

## Financing

The recommendations on financing include reviewing the details of the MRDF and providing follow-on support to avoid the creation of a funding gap between demonstration scale projects and large arrays.

### Review the details of the MRDF

Applications for the first round of the MRDF were due on 8 May 2006. Once the DTI has assessed the level and quality of the tenders, it should review the

details of the MRDF, particularly in light of the issues raised by industry stakeholders and set out earlier in this report.

### Announce a support mechanism to bridge the funding gap

The introduction of a support mechanism to bridge the funding gap to the RO is both critical and urgent. Conversations with stakeholders highlighted two key requirements for a follow-on support mechanism:

- **A preference for revenue rather than capital support.** In general, respondents felt that revenue support was a more appropriate way to incentivise larger-scale installations
- **The support should be set at an appropriate level.** Such a level would need to be sufficient to create a market pull, overcoming the risks of an early-stage industry and recognising that, perhaps out to 2015, the industry is likely to be prevented from tapping the best resources at any significant scale by grid constraints.

The Path to Power has not analysed the best form a further support mechanism might take, but a broad range of options for changes to the RO to take account of the varying requirements of different technologies have been proposed recently and at least two studies of these and other potential options are in progress at the moment:

- A study commissioned by the Carbon Trust examining the different policy frameworks for mass generation renewables technologies in the UK. This includes the identification and assessment of the potential options to change the framework to address the barriers to deliver the 2010 target and 2020 aspiration. The study also tests the implications of the different policy frameworks on a small number of technologies, including wave and tidal

- A Scottish Executive consultation study examining the level of financial support that is required by marine technology developers in order to operate on a commercial basis and assessing how this level of support may be achieved. This study has been commissioned in the context of a consultation on banding of the Renewables Obligation (Scotland).

Discussion is consistently focused on two generic types of potential mechanisms:

- Multiple Renewables Obligation Certificates (ROCs) and technology banding
- A feed-in tariff.

### Multiple ROCs and technology banding

There are currently a number of proposals in circulation for ways to amend the RO to provide different levels of support to different technologies. One way of doing this would be to establish 'technology bands' and offer multiple ROCs within them in order to reduce the bias in the system towards generation options that are currently low cost such as onshore wind. Additional ROCs for marine renewables could offer an option for getting marine energy generation closer to commercial viability at current costs.

Feedback from the industry was divided on this and other ROC-based options, but considered it to have a greater chance of speedier implementation than a feed-in tariff, and possibly greater certainty as it would be built within the RO, which is currently in place until 2027. Whilst industry feedback suggests that this option would not significantly alter the RO as the installed capacity eligible for support would be a small percentage of the total RO, this option has secured little support from the wider renewables industry. In particular, interviews with utilities, who increasingly are getting involved as project developers and therefore the potential drivers of the industry, suggest that this is not a favoured option.

### Feed-in tariff

Feed-in tariffs are characterised by a specific price, normally set for a period of several years, paid to generators. These schemes have the advantage of investment security, the possibility of fine-tuning without affecting prior investments, and can be set at different levels for different technologies. In addition, while a number of industry stakeholders identified this as a preferred option, there was recognition it could take longer to introduce than an amendment to the RO.

Whatever support mechanism is implemented, it should be judged on:

- Its speed of implementation
- The certainty of the cash flows it provides
- Its stability over the long-term
- Its level
- Its efficiency in terms of costs to consumers/taxpayers and administrative simplicity.

In addition, almost all respondents stated a preference for a consistent mechanism across the UK and the consequent need for the Scottish Executive and DTI to work together on the implementation of the mechanism.

Although none of the participants in the Path to Power has analysed the economics of wave and tidal energy, it is instructive to look at the level of support offered in other countries to see the type of level that might be sufficient to bring forward investment in the UK. Portugal, for example, has put in place a feed-in tariff of €230/MWh for wave installations. The cost to the consumer/taxpayer is limited by establishing a cap of 50 MW on the total installed capacity that would be eligible for support.

Section 2 outlined the need for a further support mechanism to be put in place as soon as practicable. However, the timing for the introduction of a mechanism requires careful co-ordination.

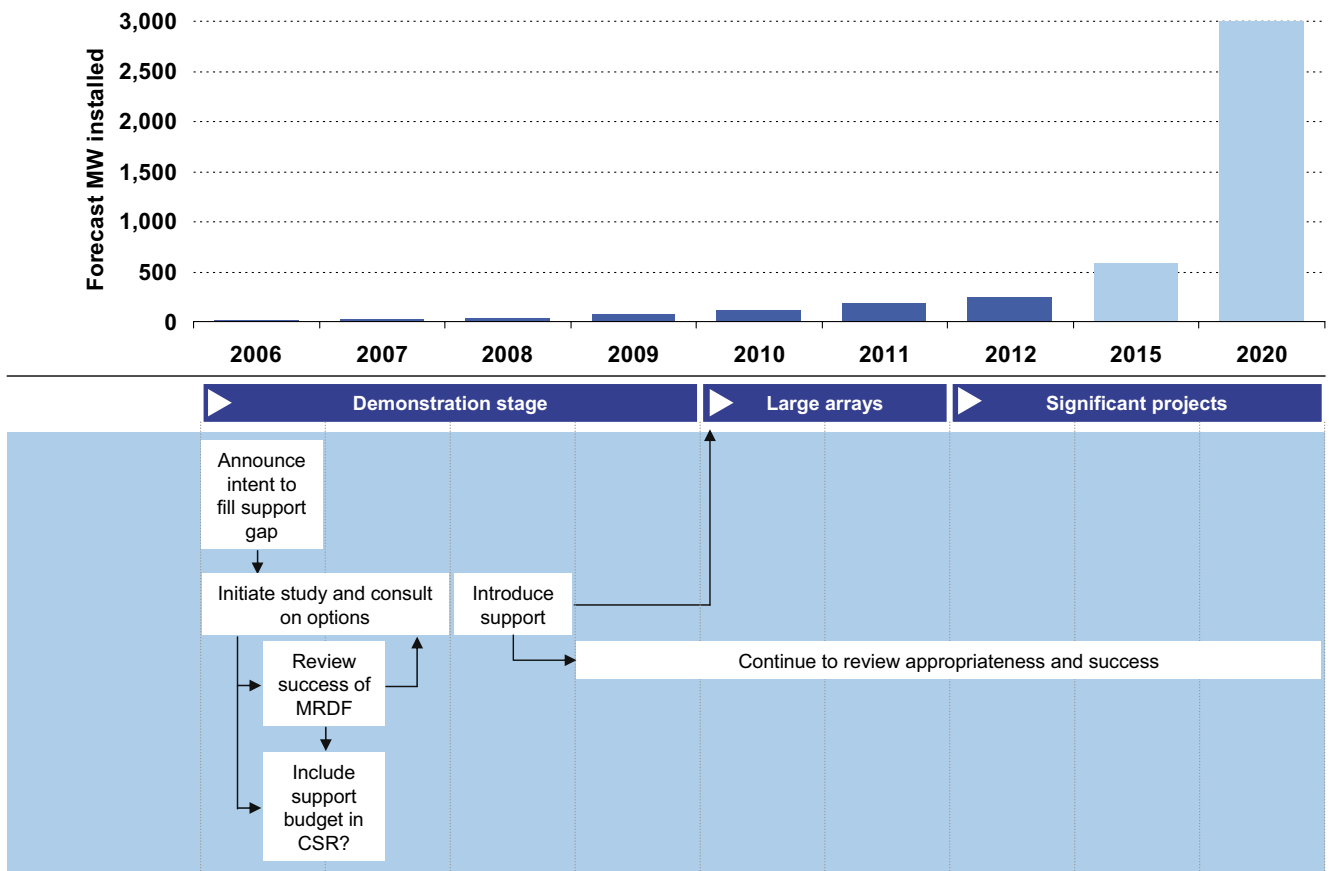
The options for a further mechanism will need to be analysed in the light of other proposals, in particular for amendments to the RO. It therefore seems prudent to await the results of the two existing studies and using their results to narrow down the options for further analysis. Both studies are due to be published by late summer 2006.

It will be important for the Government to review the response to the MRDF before putting in place a further support mechanism. Given that the second round of the MRDF closes in May 2007 and some time will be required to review the submissions, the Government is unlikely to be able to form a view based on two rounds of submissions before the end of 2007.

However, submissions to the Treasury's 2007 Comprehensive Spending Review (CSR) are due in late 2006. Dependent on the mechanism chosen, it may be important for the DTI to be able to earmark a sum for support by this date and this, in turn, may be dependent on the response to the MRDF, suggesting that the MRDF may need to be subject to a preliminary review based on the first round of submissions.

These factors suggest that the Government

Figure 7: Timetable to put in place a financial support mechanism



should announce a programme of work as soon as practicable to identify a further support mechanism to bridge the funding gap for wave and tidal. This programme could include a study commissioned to analyse promising options, building on the results of the two studies now in progress. The results of this study could lead to proposals put out for consultation and, depending on the results of the MRDF, lead to a number earmarked for wave and tidal power in the CSR. The exact form of the mechanism could then be refined through 2007, with a view to its introduction in 2008. Beyond this, the mechanism should be subject to review for its appropriateness and success. This potential timetable is shown in Figure 7 above.

- Ofgem’s third consultation on the transmission price control review 2007-2012<sup>15</sup>
- A related National Grid consultation process on managing access to the GB transmission system<sup>16</sup>
- Ofgem’s programme of work on the regulation of offshore electricity transmission<sup>17</sup>
- A DTI consultation on capping TNUoS charges for wind generators in remote locations in Scotland to help enable the UK Government to meet its renewables targets<sup>18</sup>.

## Grid access

The grid-related hurdles to the development of the wave and tidal industry are all shared, at a larger scale, by the on- and offshore wind industries. As a result, much effort is already being made to resolve the connection and charging problems. In particular, four processes are of major importance:

The wave and tidal industry should participate actively in these processes to ensure that their interests are reflected in the outcomes.

If these processes are successful in resolving the queue issues and result in the network reinforcement

<sup>15</sup> Ofgem, March 2006, Transmission Price Control 2007-2012: Third Consultation

<sup>16</sup> National Grid (April 2006) Managing Access to the GB Transmission System

<sup>17</sup> Ofgem (2006) Offshore Electricity Transmission – Scoping Document

<sup>18</sup> DTI (2005) Adjusting Transmission Charges for Renewable Generators in the North of Scotland

required, it should allow developers to access the best resources – primarily in Scotland – at scale from the middle of the next decade, as shown in Figure 8.

### **Ofgem 2007-2012 price control review**

The price control review proposes to institute locational revenue drivers to allow Transmission Owners (TOs) to recover the unanticipated costs of connecting new generation in Scotland. This would substantially increase the flexibility and speed with which TOs could respond to network upgrade needs.

In addition, in connection with the review, Ofgem has established the Access Reform Options Development Group (ARODG) to facilitate industry discussion of how to better manage the BETTA queue to ensure that more robust projects are able to secure a network connection faster, although this might mean changing the structure of the FSL requirement.

Both of these developments should be positive for wave and tidal energy, allowing a more flexible response to demands on the grid, although Ofgem needs to consider the effect that changes to the structure of FSL payments will have on wave and tidal developments at any scale. The industry should seek to play an active role in the ARODG.

### **National Grid consultation**

The National Grid consultation (which closed on 12th May 2006) is designed to address some of the same issues as the Ofgem price control review. However, National Grid's consultation also covers related proposals on:

- How the method for reallocating capacity rights between generators in the queue could be improved beyond the current first-come, first-served method
- How it may be possible to connect generators before the upgrades necessary to provide them with full firm access have been completed.

The wave and tidal industry should support both of these proposals and should work with National Grid, through BWEA, to respond to the consultation to ensure that the most favourable proposals are implemented. The latter proposal, in particular, offers considerable potential to allow generators in remote locations quicker access to the network.

### **Ofgem work programme on regulation of offshore electricity transmission**

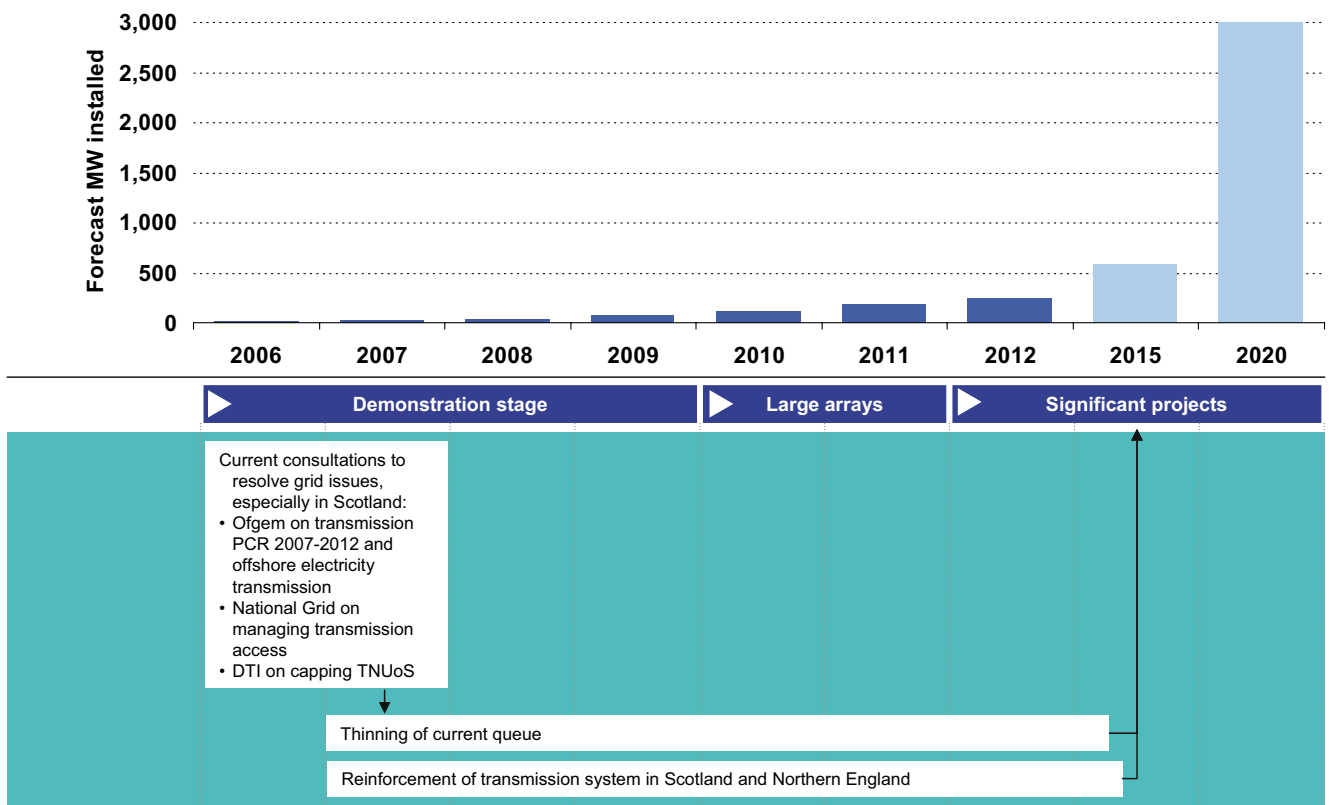
Although Ofgem's programme to develop the regulation of offshore electricity transmission is at an early stage, it is clearly of relevance for the wave and tidal industry and some potential outcomes will be more favourable than others. In particular, it may be appropriate to reflect some of the changes being proposed to onshore transmission charging, discussed above, in offshore charging. The industry should follow this programme of work and respond as appropriate to any consultations.

### **Consultation on capping TNUoS charges**

This consultation, which closed in November 2005, proposes that TNUoS charges for wind, wave and tidal generators should be capped at a certain level – perhaps the level of the current highest TNUoS charge – in order to prevent very high charges preventing exploitation of Scotland's renewable resources. The proposal could apply for the Western Isles, Orkney and Shetland or for all of the Scottish Highlands and Islands, although CCC understands that the former is more likely. If implemented, under current legislation the transmission charges could be capped only until 2014, although a bill currently before Parliament is seeking to extend this to 2024.

Again, this proposal would clearly be favourable for wave and tidal. BWEA has already submitted a response to this consultation and recommended that the power to cap charges be used after careful consideration and with an extension of the time limit to 2024.

Figure 8: Timetable to resolve grid issues



## Planning and permitting

The hurdles relating to planning and permitting suggest that the Government should formally begin preparations for an SEA, or more likely, SEAs, as soon as practicable in order to be able to complete an SEA, and allow completion of work that depends on the SEA, in time to meet the needs of the industry. Beginning preparations for an SEA would involve scoping an SEA’s requirements, initiating generic studies and providing guidance for the monitoring requirements of installed devices. ABPmer’s estimates suggest that this process of information gathering may take up to three years.

In addition, the Government should set out the regions that will be covered by marine renewables SEAs. Given that the Scottish Executive is already preparing an SEA, which is examining the Western seaboard including the Inner Isles, Western Isles and Argyll and Bute, the Solway Firth and the Northern Isles (Orkney and Shetland), the remaining areas with the greatest wave and tidal potential that still require an SEA therefore appear to be South West England and South Wales.

Once preparatory work has been conducted, completion of an SEA itself is expected to take around one year. Once an SEA is complete, the Government

should publish guidance on the EIA requirements for large arrays and above and work with The Crown Estate to identify potential sites for development and develop an approach to site allocation. In addition, the SEA could feed into the process of marine spatial planning, but this should not cause a hiatus in the development of the industry.

The Marine Bill is likely to become law in 2008 with a marine spatial planning element, which the SEA will inform, expected to take three years to complete thereafter. Although the timing of some of the elements in this programme are dependent on the present consultation, enough is known to propose a timetable shown in Figure 9. The detailed recommendations behind this timetable are given below.

### Begin preparations for an SEA now

The report concludes that Government should begin preparations for an SEA of the most promising areas of resource as soon as practicable. Announcing that preparations for an SEA were in place would send a strong signal to the industry. Beginning background work towards an SEA should ensure that SEAs do not become a hurdle for the development of the industry, that guidance on project-level EIA is clear and focused on site and device-specific issues, and

that SEAs are in place for marine renewables to feed into any process of marine spatial planning.

The steps towards an SEA that could be initiated today include:

- Initial scoping, data gathering and generic research
- Introduction of monitoring guidelines
- Consultation with stakeholders.

**Begin scoping, data gathering and generic research for an SEA**

Scoping an SEA now would help guide the process of data gathering, research and monitoring towards an SEA, providing the industry with greater clarity on requirements and potentially saving wasted effort.

Once the scoping is complete, a process could begin of gathering existing data, from work for offshore wind, for example, and of identifying areas of generic research required to fill any broader gaps.

**Establish guidelines for device monitoring**

Monitoring will inform the process of completing an SEA (recognised by the DTI in the guidance note:

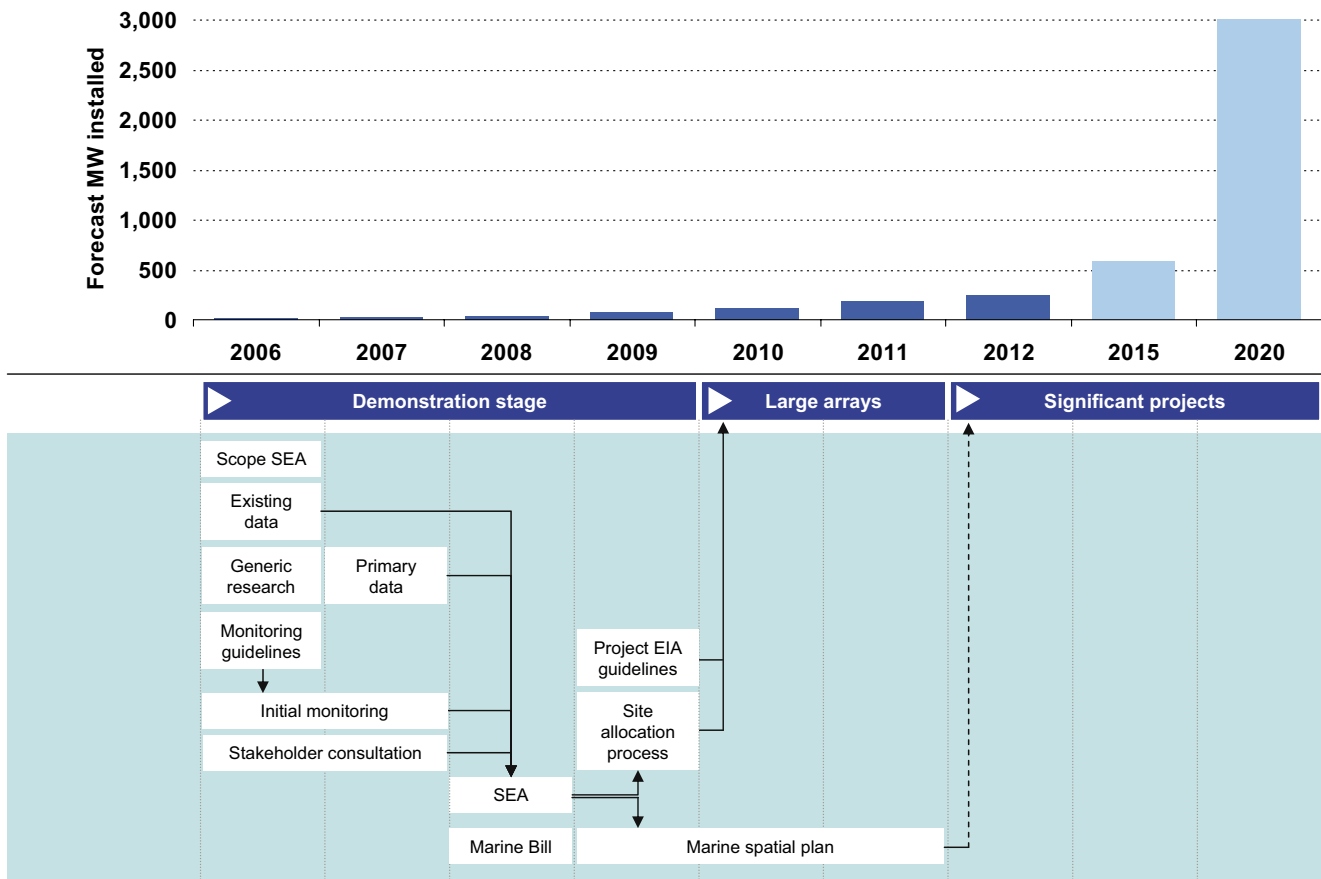
"...sufficient knowledge of marine renewables needs to be acquired in order to design a suitable SEA...") and have wider importance to the development of the industry, particularly in its early stages.

In order to feed into the SEA and to provide the industry with clarity, the Government should as soon as practicable:

- **Begin a gap analysis.** Research priorities should focus on gaps in understanding of impacts, which need to be highlighted through a detailed gap analysis.
- **Establish a monitoring regime for demonstration projects.** A rigorous monitoring regime will have to be put in place for demonstration projects to maximise the usefulness of initial project deployment; this could be done through requiring consent conditions to stipulate that the results of monitoring studies are fed back into an ongoing assessment process for a given project.

Such monitoring will require adequate funding; in the short term, the funds earmarked in the MRDF may

Figure 9: Timetable for reducing planning and permitting uncertainties



be sufficient. In the longer term, an arrangement similar to the COWRIE<sup>19</sup> fund for offshore wind could be phased into any Government funded programme of monitoring.

### **Begin the stakeholder consultation process**

The early involvement of all stakeholders will be crucial to ensure that potential impacts and plans for mitigation are identified at early stages of project design, which will ultimately warrant against future project delays. For this, the industry will need to develop a process by which all stakeholders are consulted.

In addition, an independent process for undertaking research that is widely acceptable to all parties needs to be put in place. The Research Advisory Group (RAG) research programme will be instrumental in achieving this.

### **Use the SEA to clarify requirements for project EIAs**

An SEA will help to clarify a number of issues with respect to individual projects EIAs. Specific recommendations with respect to EIAs are:

- **Issue guidance for next stage of deployment.** Once the SEA is prepared, the Government will need to issue guidance for the next stage of deployment to cater to the needs of the leaders in the market.
- **Minimise EIA requirements.** By completing an SEA, the Government should require EIAs to look primarily at site-specific issues, which would reduce the detail required from individual EIAs.

## **Marine spatial planning**

The implementation of marine spatial planning should not delay the development of the marine renewables industry, nor does it remove the need for an SEA on the timeline set out earlier.

BWEA has put forth recommendations in its response to the Marine Bill, which CCC believes would allow for a flexible approach to planning within the remit of sustainable development<sup>20</sup>.

## **Site identification and leasing**

In light of the results of the SEA and the development of the Marine Spatial Plan, the Government and Crown Estate will need to develop a strategy for site allocation appropriate for the large-scale deployment of wave and tidal devices that adequately enables development while recognising the risks of site sterilisation, decommissioning costs and negative environmental impacts.

At present, the industry should look to participate in the DTI's consultation on offshore decommissioning to ensure that its views are adequately represented. This consultation was launched in June 2006 with a view to producing proposals before the end of the year.

<sup>19</sup> Collaborative Offshore Wind Research into the Environment  
[www.offshorewindfarms.co.uk](http://www.offshorewindfarms.co.uk)

<sup>20</sup> BWEA (2006) The Marine Bill – Offshore Renewables Perspective, available at [www.bwea.com/pdf/Marine-Bill.pdf](http://www.bwea.com/pdf/Marine-Bill.pdf)

# Glossary

ABPMer	Association of British Ports Marine Environmental Research
ARODG	Access Reform Options Development Group
BETTA	British Electricity Trading and Transmission Arrangements
BWEA	British Wind Energy Association
CCC	Climate Change Capital
CCL	Climate Change Levy
COWRIE	Collaborative Offshore Wind Research into the Environment
CSR	Comprehensive Spending Review
Defra	Department for Environment, Food and Rural Affairs
DNO	Distribution Network Operator
DTI	Department of Trade and Industry
EC	European Community
EIA	Environmental Impact Assessment
EMEC	European Marine Energy Centre
EU	European Union
FSL	Final Sums Liability
GDUoS	Generator Distribution Use of System
GW	Gigawatt
kWh	Kilowatt hour
LEC	Levy Exemption Certificate
MEC	Marine Energy Challenge
MRDF	Marine Renewables Deployment Fund
MSP	Marine Spatial Planning
MW	Megawatt
MWh	Megawatt hour
Ofgem	Office of Gas and Electricity Markets
RAG	Research Advisory Group
RO	Renewables Obligation
ROC	Renewables Obligation Certificate
ROS	Renewables Obligation (Scotland)
SEA	Strategic Environmental Assessment
TNUoS	Transmission Network Use of System
TO	Transmission Operator
TWh	Terawatt hour

**The following companies were responsible for producing the four stages of work that make up the Path to Power. All documents are available at [www.bwea.com/pathpower](http://www.bwea.com/pathpower).**

**Stage 1: Bond Pearce LLP**  
**Legal and Regulatory Requirements**



Bond Pearce LLP is a leading UK commercial law firm of 68 partners, 276 fee earners and 668 staff working from offices in Bristol, Exeter, London, Plymouth and Southampton. The firm delivers cost effective, solutions oriented advice and works closely with clients to assist in achieving their business goals. The firm is widely recognised as a leader among law firms in the renewable energy sector with 15 years' experience advising on more than 200 renewable energy projects, including on and offshore wind, tidal and wave power, biomass and energy from waste in the UK and Europe.

**[www.bondpearce.com](http://www.bondpearce.com)**

**Stage 2: ABPmer**  
**Marine Stakeholder/Statutory Bodies Views on Deployment**



ABPmer is a specialist consultancy with over 50 years of proven experience offering bespoke scientific support and technical solutions to Government and industry sector clients. We have developed a leading position in supporting marine renewable projects through strategic research, coastal process investigations and metocean studies for developments including offshore wind farms, tidal barrages, low head turbines, tidal current turbines and WEC devices. In addition to the Path to Power project, ABPmer has successfully delivered the Atlas of Marine Renewable Energy Resource (DTI); a review of nature conservation and landscape impacts of marine renewable energy development (CCW); and research on minimising the impact of developing marine technologies (CCW and The Crown Estate). Our technical standing is highly regarded by project developers, regulators and marine stakeholders and reflected by our invited contributions to the Offshore Renewable Energy Environmental Forum (OREEF).

**[www.abpmer.co.uk](http://www.abpmer.co.uk)**

**Stage 3: Econnect Ltd**  
**Grid Evolution Scenarios and GB Network Access**



Econnect are leading international consultants specialising in the grid integration of renewable energy projects and have now been involved in over 20 GW of developments. Established in 1995, Econnect has since built an enviable reputation worldwide for providing innovative solutions for the connection of all renewables technologies. In 2005 Econnect established Econnect Construction which has successfully built the electrical infrastructure of a 73 MW wind project in Ireland and since then has been actively involved in 8 projects representing over 100 MW of wind and landfill gas projects from both an electrical and civil construction perspective. Econnect Group can therefore offer the complete service from initial feasibility to energisation and are pleased to offer assistance on the Path to Power project with the assessment of future connection issues for marine renewables.

**[www.econnect.com](http://www.econnect.com)**

**Stage 4: Climate Change Capital**  
**Final Report: The Path to Power – Delivering Confidence in Britain's Wave and Tidal Stream Industry**



Climate Change Capital (CCC) is a specialist merchant-banking group focused on companies and financial institutions affected by the policy and capital market responses to climate change. CCC is the leading financial institution in the climate change arena, employing some 75 experts from a wide range of backgrounds including international lawyers, commodity traders, corporate financiers, international policy experts, carbon finance experts, risk finance specialists, investment advisors and fund managers. As all energy markets are influenced by policy, part of the CCC value proposition is that a superior understanding of policy in turn leads to superior investment decisions. CCC's distinct ability lies in its ability to blend a level of policy insight generally not seen in the financial sector with a level of financial insight not seen in the policy arena. Founded in 2003, CCC is structured into three distinct, but complementary teams, Advisory, Asset Management and Carbon Markets. Through these teams CCC provides corporate finance, M&A and financial advisory services; develops and manages funds that facilitate the transition to a low carbon economy; and invests in projects and companies that generate carbon emission credits under the Kyoto Protocol. CCC has offices in London, Paris and Madrid.

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