



SeaPower Funding the Marine Energy Industry 2011–2015

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RenewableUK is the trade and professional body for the UK wind and marine renewables industries. Formed in 1978, and with 650 corporate members, RenewableUK is the leading renewable energy trade association in the UK. Wind is the world's fastest growing renewable energy source, and this trend is expected to continue with falling costs of wind energy and the urgent international need to tackle CO2 emissions to prevent climate change.

In 2004, RenewableUK expanded its mission to champion wave and tidal energy and use the Association's experience to guide these technologies along the same path to commercialisation.

Our primary purpose is to promote the use of wind, wave and tidal power in and around the UK. We act as a central point for information for our membership and as a lobbying group to promote wind energy and marine renewables to government, industry, the media and the public. We research and find solutions to current issues and generally act as the forum for the UK wind, wave and tidal industry, and have an annual turnover in excess of four million pounds.

Introduction

The funding model proposed in this paper aims to provide a coordinated and coherent support framework for the UK's marine energy industry for the period 2011–2015 ensuring that the UK is in the best possible position to secure its leading role in the development of the global marine energy industry. This will maximise return on investment to date and create a new industrial sector making a significant contribution to delivering the UK's green industry revolution.

Acting upon the recommendations within this paper will provide the UK Government an opportunity to fulfil their commitment to become the greenest government ever.

The suggested spend profile outlined in this paper is based on the 'medium development' scenario in *Channelling the Energy,* a report published by RenewableUK in 2010, and would fulfil close to 100% of the developer appetite during 2011–2015, as outlined in the current RenewableUK wave and tidal *State of the Industry* report.

Key deliverables

By securing a global lead, the UK's marine energy industry could:

- Produce 20% of the UK's electricity consumption;
- Create 10,000 direct jobs by 2020 and nearly 20,000 by 2035;
- Generate annual revenues of £3.7bn by 2020 and £6.1bn by 2035;
- Save up to £1 billion in grid balancing costs.

Over the period 2011–2015 the UK could:

- Have up to 60 megawatts (MW) of marine energy projects installed or in advanced stages of fabrication;
- Strengthen its lead in marine energy;
- Attract significant additional inward investment.

Key recommendations

RenewableUK believes the UK Government can consolidate and accelerate the growth of this nascent industry by delivering the following actions:

- The Department of Energy and Climate Change (DECC) must allocate £70 million of the remaining £140 million in the low-carbon innovation fund to support marine energy development via the creation of a Marine Energy Delivery Fund (MEDF), to be made available from 2011.
- The Green Investment Bank (GIB) must allocate at least £60 million for the creation of a Marine Investment Fund (MIF), to be made available from 2012.
- DECC, the Scottish Government and the Department of Enterprise, Trade and Investment (DETI) must put in place revenue support of 5 ROCs or equivalent, for wave and tidal energy across the UK.
- The Department for Business Innovation & Skills (BIS) must support capital expenditure for the manufacture of marine energy devices.
- The Treasury must consider other supportive actions that could leverage private investment into marine energy, including tax breaks.
- The key funding partners (Carbon Trust, Technology Strategy Board, Energy Technology Institute and Regional Development Agencies) must support the industry via the continuation of their successful R&D funding programmes, with a total sum in the region of approximately £55 million.

Sector potential

The UK is currently leading the world in the rapidly developing marine (wave and tidal) energy industry, with 3.4MW of devices installed, a world-leading testing infrastructure to support deployment and more project leases awarded (1.6 gigawatts [GW]) than the rest of the world combined. A recent review of investment made in nine marine energy technology developers revealed that £42 million of public investment had leveraged £230 million of private capital, a ratio of more than 1:5 public to private funding.¹ Developing this nascent industry could produce 20% of the UK's electricity consumption and help balance the UK grid, de-risking the exposure to variability risk, whilst also creating an industrial base that is projected to provide 10,000 jobs by 2020 and nearly 20,000 by 2035.²

Despite the clear socioeconomic opportunities the industry has to offer, the Government has announced that the UK's existing £42 million ring-fenced capital funding programme for the wave and tidal sector, the Marine Renewables Deployment Fund (MRDF), is to be phased out in March 2011. This will jeopardise the delivery of the 1.6GW in the Pentland Firth and Orkney Waters areas and potentially withhold the benefits of approximately £300 million of private and public investment, by failing to secure long-term sustainable economic growth. For a review of the MRDF, see Annex 1.

Key funding requirements

The funding required to establish a successful UK wave and tidal industry during the time period covered by the Comprehensive Spending Review, which runs from March 2011 to March 2015, is detailed in the RenewableUK report *Channelling the Energy*, issued in October 2010.³ This is broken down into three key stages of industry development (Figure 1) and associated support. In summary these are:

Stage 1 Requirement	First and next-generation prototypes, and continued component and subsystems testing of Technology Readiness Levels (TRLs) 1–7, up to 1MW, covering three distinct technology development stages. Continuation of current funding from existing delivery agencies (Technology Strategy Board, Carbon Trust, Energy Technology
	Institute).
Stage 2	The deployment of the first wave and tidal farms of 2–10MW, building on existing prototype devices, many of which have already been deployed.
Requirement	£130 million in combination with revenue support of 5 ROCs or equivalent.
Stage 3	The deployment of the first commercial-scale wave and tidal projects. At this stage it is envisaged that capital support for projects will not be required and revenue support requirements will taper off to the levels offered for more mature renewable technologies.
Requirement	Revenue support starting at 5 ROCs or equivalent. This could be capped, for example to the first 500MW of production at which point a review would be triggered, to ensure that excess cost is not passed on to the consumer.

For a comprehensive summary of the industrial stages of technology development, please see Annex 2.



Proposed funding priorities

Compared to current and historical funding mechanisms, we suggest that new models and mechanisms need to achieve better coordination across funding streams, concentrating the available funding on priority areas, by funding a small number of larger projects with a commitment over a period of several years.

Stage 1 – Prototype development, technology innovation and infrastructure

The funding provided to technology developers, infrastructure and higher education institutes has been instrumental in delivering the world-class industry that the UK has established to date.⁴ It is essential to continue to deliver a pipeline of technology development. However, as there are already a number of full-scale prototypes deployed to date, RenewableUK believes the focus of the funding in stage 1 should be on technology development, to include, for example, the deployment of scale prototypes, de-risking technology development onshore, reinforcing existing infrastructure (including test facilities) and the development of generic solutions (e.g. balance of plant).

The experience of the successful MRPF programme indicates that increased consolidation of funds into a small number of well-funded programmes will deliver the greatest return in accelerating industry progress. RenewableUK would encourage the funding partners (the Energy Technology Institute, the Technology Strategy Board, the Carbon Trust, Scottish Enterprise, Highlands and Islands Enterprise, the Engineering and Physical Science Research Council and the Natural Environment Research Council) to continue to coordinate their R&D funding programmes with the testing facilities (NaREC, EMEC and WaveHub) to develop a coherent technology development pathway. Table 1 (page 8) outlines a scenario with a total public spending requirement of £55 million for 43 projects in stage 1. Based on past experience and state aid rulings, this would generate between £120 million and £300 million of private investment.

Stage 2 – First wave and tidal farms: 2-10MW

The industry has already deployed full scale prototypes, or is in the advanced stages of fabrication and deployment of full scale prototypes. The next stage of industry development is the deployment of the world's first marine energy arrays. There is a paramount need to provide funding to encourage and support these projects. RenewableUK believes that this should be provided as a balance of revenue and capital, which could be provided as follows.

Revenue Support

To leverage maximum private investment into the sector and ensure equitable returns for any private or public co-financing of projects, DECC, the Scottish Government and DETI must provide revenue support at 5 ROCs or equivalent. This could be capped, for example at 500MW, before an automatic review would be initiated. RenewableUK members believe that further work between industry and government will be required, to undertake a more rigorous evaluation of the likely rate of project deployment and establish a technology specific cap.

The Marine Energy Delivery Fund

RenewableUK believes the Government must implement a programme for the world's first pre-commercial (2–10MW) marine energy projects, a Marine Energy Delivery Fund (MEDF). The proposed MEDF would need to total £70 million and would be designed to bridge the gap between the first full-scale devices (such as those supported by the MRPF) and the first commercial arrays. It is estimated that this fund could stimulate in excess of a quarter of a billion pounds of private investment by 2015.

The fund could be established by DECC with £70m, from the remaining £140 million within the low-carbon innovation fund, and be administered by the Carbon Trust or another suitable organisation with experience of running marine energy funding calls.

Objectives and Deliverables

The key objective of the fund is to provide the essential financial stepping-stone to the commercial-scale deployment of marine energy within the UK.

By accessing the fund and completing a number of successful 2–10MW projects, the marine energy industry will demonstrate:

- the ability to scale up manufacturing, installation and management of specific technologies, balance of plant and other generic industry solutions;
- how cost reduction is linked to increased volume in the manufacturing and performance of specific technologies, balance of plant and other generic solutions;
- technology and business readiness, through the provision of credible guarantees on performance and warranties for marine energy technology;
- improved understanding of the environmental impacts caused by marine energy projects, providing regulators and statutory consultees with as much confidence as possible, to consent commercial-scale marine energy projects;
- significantly de-risked installation and operation and maintenance activity, in line with best practice in Health & Safety.

Provision of the above will prove that marine energy technology can be deployed, operated and maintained to the satisfaction of future owner/operators, placing the UK industry in a position where it can attract private finance with revenue support alone.

Application Criteria

The fund should be open to projects that meet the following criteria:

- 2MW+
- Developer has already commissioned one full-scale device
- Crown Estate or appropriate lease in place (e.g. EMEC/Wave Hub)
- Proof of ability to attract match funding.

Allocation

The fund should assume a project expenditure of $\pounds 4 - \pounds 10$ million per MW installed, with 60% maximum grant funding per project, on a sliding scale relating to state aid.

The eligible costs for the fund should include the following activities:

- Engineering design
- Manufacturing, construction and installation
- Initial operation and reporting of performance
- Follow-on supporting R&D, support tools and learning
- Other project expenditure.

Timeline

It is suggested that the following timeline be initiated to continue the rapid pace of development that has been witnessed over the past 18 months:

- Fund to open in 2011
- 24-month spending window use it or lose it
- First call to close in 2011
- Second call to close in 2012
- Third call to close in 2013
- Any funds not utilised by 2015 to be returned to the fund.

The Marine Investment Fund

The Green Investment Bank must be encouraged to provide support, in combination with grant funding or unaccompanied, through the creation of bespoke financial products supporting marine energy. A Marine Investment Fund (MIF) could take equity on a project-by-project basis, or invest in low-risk infrastructure to support project development (e.g. subsea grid infrastructure and balance of plant).

Application Criteria

The investment should be open to projects that meet the following criteria:

- Provide equitable return
- 5MW+
- Developer has already commissioned one full-scale device
- Crown Estate or appropriate lease in place (e.g. EMEC/Wave Hub)
- Proof of ability to attract match funding.

Allocation

The investment should assume a project expenditure of $\pounds 4 - \pounds 10$ million per MW installed, with a maximum allocation of one third of total project cost per project, in line with state aid.

The MIF should be used to develop the first multi-device marine energy arrays. However, due to the high levels of technology risk associated with these projects, the GIB may determine the allocation of funds to low-risk activities, such as subsea connection or balance of plant, to be more appropriate.

Time Line

- Fund to open in early 2012
- 24-month spending window use it or lose it
- First call to close in 2012
- Second call to close in 2013
- Third call to close in 2014
- Any funds not utilised by 2016 to be returned to the GIB.

Stage 3 - Second farms and beyond

After completing stages 1 and 2, successful companies will be developing the first stage of what will become commercial arrays or building out existing projects. Funding for follow-on projects and continued build-out could come through alternative sources, for example GIB, European Investment Bank (EIB), Scottish Investment Bank (SIB) or NER 300.

As outlined above, revenue support of 5 ROCs or equivalent will be required for the first commercial projects and could be capped at a set number of megawatts, to ensure that excess cost is not passed on to the consumer. Once this deployment milestone is reached, an automatic review could be instigated, if this has not already happened via an existing statutory review process.

Table 1: Stage 1 Marine Energy Funding Scenario – 2011 to 2015 ⁵				
	Stage 1A	Stage 1B	Stage 1C	
Technology and Project Delivery	Concept development / tank testing / scale prototype	Greater scale prototype	Full-scale grid-connected prototype	
Cost per Project	£800,000	£6,500,000	£22,300,000	
No. of Projects	6	4	2	
Total Cost	£4,800,000	£26,000,000	£44,600,000	
Percentage of possible support	65%	50%	40%	
Total Public Funding	£3,120,000	£13,000,000	£17,840,000	
Total Private Funding	£1,680,000	£13,000,000	£26,760,000	
Suggested Source: Carbon Trust, Technology Strategy Board, Energy Technology Institute, Regional Growth Fund				
Components and Subsystems	MEA Strand B - Scale component development lab testing		MEA Strand B & C / ETI support tools / TSB knowledge transfer and innovation projects	
Cost per Project	£400,000		£1,500,000	
No. of Projects	16		8	
Total Cost	£6,400,000		£12,000,000	
Percentage of possible support	65%		40%	
Total Public Funding	£4,160,000		£4,800,000	
Total Private Funding	£2,240,000		£7,200,000	
Suggested Source: Carbon Trust,	Technology Strategy Board, Energy Tech	nology Institute, Regional Growth F	und	
Onshore Testing Subsystems			Redesign and de-risking full- scale prototypes before array installation	
Cost per Project			3,000,000	
No. of Projects			6	
Total Cost			£18,000,000	
Percentage of possible support			40%	
Total Public Funding			£7,200,000	
Total Private Funding			£10,800,000	
Suggested Source: Carbon Trust, Technology Strategy Board, Energy Technology Institute, Regional Growth Fund				
Academic Research	Higher education institutes (e.g. Super- Gen marine)			
Cost per Project	£5,000,000			
No. of Projects	1			
Total Cost	£5,000,000			
Percentage of possible support	100%			
Total Public Funding	£5,000,000			
Total Private Funding	£0			
Suggested Source: Engineering and Physical Science Research Council, Natural Environment Research Council				
Total Cost	£16,200,000	£26,000,000	£74,600,000	
Total Public	£12,280,000	£13,000,000	£29,840,000	
Total Private	£3,920,000	£13,000,000	£44,760,000	

Annex 1 – The Marine Renewables Deployment Fund (MRDF)

Why was the MRDF not spent?

The Marine Renewables Deployment Fund (MRDF) was established by the UK Government in 2004 to support the first arrays of devices operating at sea. Due to the stage of technology development that the industry was at in 2004, it was difficult for all involved to properly quantify the true cost of the first demonstration arrays.

The MRDF was positioned in exactly the right space, allowing marine energy technology to develop from full-scale prototypes to pre-commercial arrays. However, the wide perception developed by the industry that the technology was at a more advanced stage of development, compounded with the lack of private finance as a result of the global economic downturn, resulted in MRDF being created prematurely. This could have been rectified by restructuring the fund to support different activities, but industry and government both recognised the need for funding of these projects.

In reality, interim funding was needed to assist the deployment of pre-commercial test units. This is why the Marine Renewables Proving Fund, allocated via the Renewable Energy Strategy,⁶ was so successful.

Taking funding forward: lessons learnt

The industry believes that any replacement of the MRDF structure needs to take into account the lessons learnt:

- The MRDF was limited to a £9 million cap per application, of which a maximum of £5 million could apply as a capital grant (based on 25% of eligible capital costs) with the remainder being able to be applied as a revenue top-up over seven years of operation. As a result, from the project owners' perspective, to obtain the maximum revenue support a project would need to be no more than 2–3MW in scale; however, to achieve maximum capital support the project would need to cost more than £30m.
- In practice, since these requirements are mutually exclusive, the actual level of support given to a project over the seven years of MRDF support would be much lower than the £9 million cap.
- Channelling the Energy provides a comprehensive up-to-date review of project costs, and it is evident that the industry is now at a stage where more than the maximum of £9 million support from the MRDF is required to stimulate the deployment of the first arrays into the water between 2011 and 2015.

Annex 2 – Industrial Stages and Technology Phases of Development



Stage 1. First and next-generation prototypes: TRL 1–7 up to 1MW

Capital support is vital to the industry today and devices require continued support through the research and development (R&D) stage. The primary gap today exists when devices are ready or open ocean deployment; at this point capital needs rise rapidly. Device developers are generally small and medium enterprises (SMEs) that often do not have the financial resources to fund such projects, and the initial risk exposure is too high for utilities to commit investment or for any manufacturer to underwrite performance. Hence, capital support from government is required to derisk investment in technology development and stimulate the private sector backing.

RenewableUK believes that stage 1 of industry development can be split into three specific phases of technology development, which can be related to the NASA TRLs as follows:

- Stage 1A Concept development and tank testing (TRL 1–3)
- Stage 1B Greater-scale prototype (TRL 4–5)
- Stage 1C Full-scale grid-connected prototype (TRL 6–7)

Stage 2. First wave and tidal farms: TRL 8-9 from 2-10MW

When marine energy devices become ready for deployment in small arrays, revenue incentives play an important part in making the projects economically viable. However, electricity production from the first wave and tidal farms will need time to stabilise, making revenue incentives alone insufficient. For these first steps, upfront capital grants are also required to reduce the amount of capital at risk. Under this scenario, a marine energy project starts to become attractive to utilities. However, to secure investment from utilities, device offerings have to be on a par with alternative options. In particular, device manufacturers have to be able to offer potential utility investors (a) sufficient operating experience to offer guarantees in performance and reliability, and (b) involvement of major manufacturers able to underpin these guarantees both technically and financially.

Stage 3. Second farms and beyond: TRL 8-9 from 10MW+

Following these initial small-scale projects, and with sufficient revenue support, it is likely that marine energy projects could start to move towards attracting debt finance, one of the key requirements in facilitating rapid deployment at larger scales. In turn, this will deliver associated cost reductions that would reduce the level of revenue support required.



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