Energy and infrastructure outlook 2014-15

Wave and tidal

THE CROWN ESTATE

Introduction

The UK's wave and tidal energy resources have potential for many gigawatts of power generation, which could be harnessed through a range of technologies, including wave farms, tidal current farms and tidal range projects. Collectively, these could make a significant contribution to the country's utility-scale electricity demand, providing low carbon power for decades to come.

Previous work on wave and tidal energy has mainly focused on researching generation technologies and developing conceptual project designs. Today, as the technologies continue to make material progress the first projects containing multiple devices are closer to being realised. The potential over the coming years is to construct increasingly large generation assets and grow an industry on the same scale as offshore wind.

Taking a strategic view of this potential as manager of the UK seabed, The Crown Estate is focused on helping the emerging wave and tidal industry grow. Through the ways we lease sites and work with project developers on an ongoing basis, our objectives are to help the industry attract significant investment, encourage major players to commit to projects and work with the industry to ensure the sustainable development of the seabed.

“

The United Kingdom is seen as the destination for wave and tidal energy and we want to keep it that way… Working together, all of us – government at every level, supply chain, developers and investors – must take this sector forward through to successful deployment of the first large-scale arrays… Let’s work together to unlock this untapped potential.

GREG BARKER MP
Minister of State for Climate Change

”

“

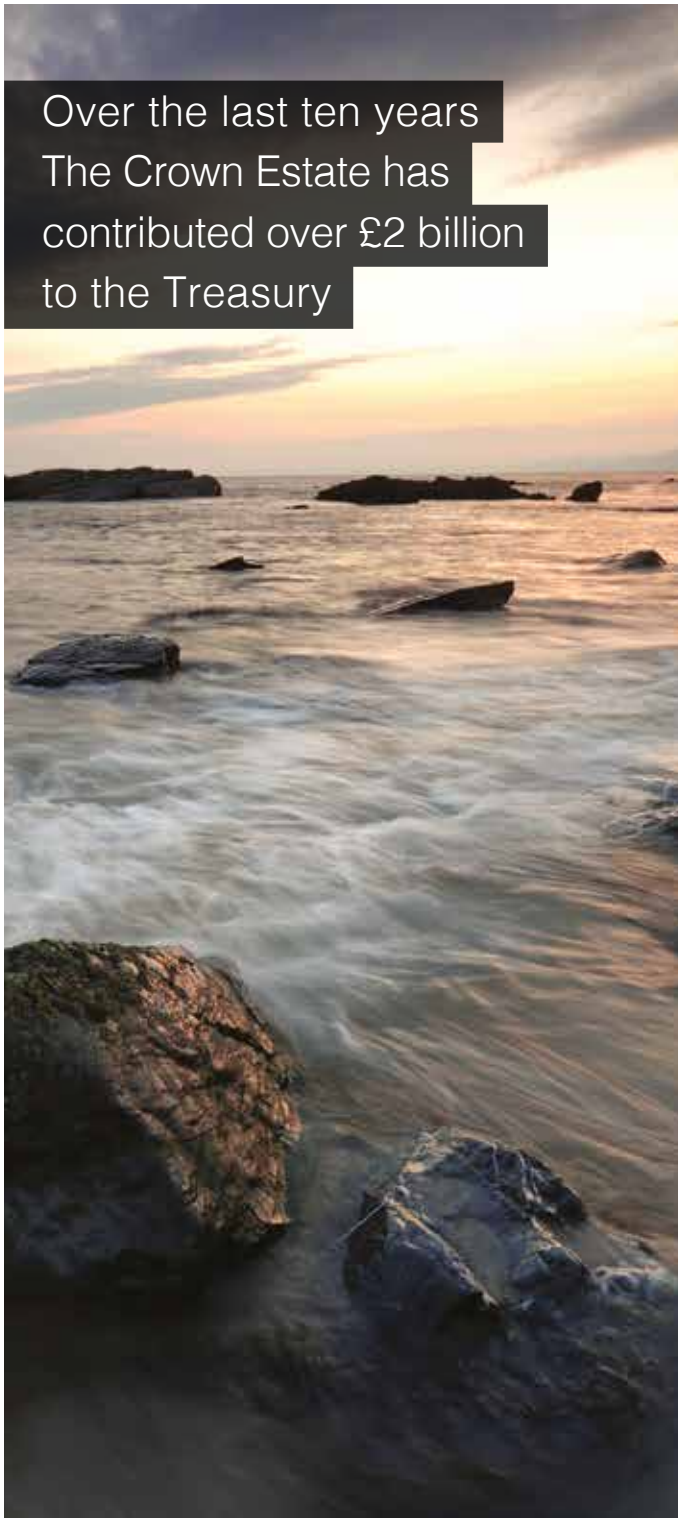
…Scotland’s commitment to ocean energy is absolute and unwavering. We’re in this for the long term. And we will use our research expertise, our inventiveness, our engineering capacity and our natural resources; to develop the clean technologies which will power Scotland and the wider world in the future.

ALEX SALMOND
First Minister of Scotland

”

The Crown Estate's energy and infrastructure portfolio is part of a diverse £8 billion UK property portfolio

The portfolio includes the rights for renewable energy generation on the UK Continental Shelf



Over the last ten years The Crown Estate has contributed over £2 billion to the Treasury

Wave and tidal current site leasing

We provide wave and tidal developers with exclusive rights to explore areas of the seabed through agreements for lease which can lead to the award of full leases for construction and operation.

To date, we have leased around 40 wave and tidal projects in the UK with a total potential capacity of 2GW. These sites are currently being developed by a range of organisations.

In October 2013, we commenced the latest leasing process for new wave and tidal current sites. The purpose of this process is to accelerate technology testing and development and the process includes two new features.

- Demonstration Zones: To help the industry focus on the best seabed locations, we have created new zones for test and demonstration activities. Utilising our specialist knowledge of the UK seabed and working in partnership with statutory marine planning organisations, we have defined zones that offer appropriate wave and tidal energy resources and access to necessary infrastructure.
- Third party management of zones: Subsequently we have invited third party organisations to manage the zones and sublet areas within them for test and demonstration activities. To ensure the zones are managed sustainably, we have included in the selection criteria a requirement that interested parties demonstrate a strong understanding of local interests.

The response to the leasing process has been positive and we expect to announce the outcome in summer 2014.

> We welcome the approach taken by The Crown Estate in seeking early engagement with all stakeholders. We consider this early contact to be particularly important given the benefits of gathering collective views on what is a novel and emerging technology that poses a number of new challenges, particularly in regard to its interactions with the natural marine environment.
>
> **RSPB**

First array wave and tidal current investments

First array projects represent a crucial stepping-stone between single prototypes and large commercial arrays.

Last year, we announced that we were considering co-investing up to £20m in the UK's first wave and tidal stream arrays and invited expressions of interest from developers about such investments.

We received a positive response to the invitation and following preliminary due diligence work we are now undertaking more detailed due diligence on a small number of candidate projects.

We anticipate completing this work and negotiating commercial terms with developers as part of their capital investment decision processes later in 2014. Should we decide to invest, we expect to make a further announcement in conjunction with other relevant project co-investors.

Support for wave and tidal stream project development

As well as providing leases for projects, we actively support the project development process. This includes helping developers to overcome barriers to obtaining consents for their schemes and in other ways pertinent to preparing the projects for construction. We call this work 'Enabling Actions'.

Since 2010, we have spent £3m on Enabling Actions across a range of topic areas, including health and safety, environmental assessment, planning and consents, grid infrastructure and supply chain development. Such work is generally at a strategic level and intended to help multiple projects rather than any single scheme. The work has saved project developers significant time and costs as they progress their individual projects. It is defined and steered through a Developers Forum, chaired by The Crown Estate and comprising staff from the project developers.

Examples of our wave and tidal Enabling Actions work includes:

- Work to develop a common approach to assessing the cumulative impacts of projects, in order to ensure consistency in preparation of consents submissions. This is helpful to both individual project developers and planning authorities.
- Development of a methodology by which developers can assess the socio-economic impacts of development. This is of interest not only to the project developers and regulators but also other stakeholders in the local community, who may stand to benefit from business opportunities associated with the projects.

Wave and tidal energy in the Pentland Firth and Orkney waters: Delivering the first phases of projects

Some of the wave and tidal current projects currently under development are in the Pentland Firth and Orkney waters area, which is around Caithness and the Orkney Isles in North Scotland.

In September 2013, we published a key report about progress of these projects which identified issues affecting their delivery and recommended ways these issues could be addressed.

The report identified four key risk areas: market confidence, readiness of technologies, creation of grid infrastructure, and certainty of environmental impacts and consents. The report recommended that, with a concerted effort by industry and government, all of the key risk areas and make timely delivery of the projects much more likely.

Key recommendations included:

- For government to provide a signal that it supports the creation of the wave and tidal industry beyond existing short-term policy mechanisms
- For industry to be more open about project costs and provide evidence for the case about the projects' wider economic benefits.

> "This Crown Estate report provides a thorough and accurate description of the challenges and a good basis for taking coordinated action."
>
> **DP ENERGY**

Tidal lagoon leasing

COURTESY OF MAREMBERT BENOIT

Tidal Range represents an untapped renewable energy resource, and could contribute to the UK's low carbon future.

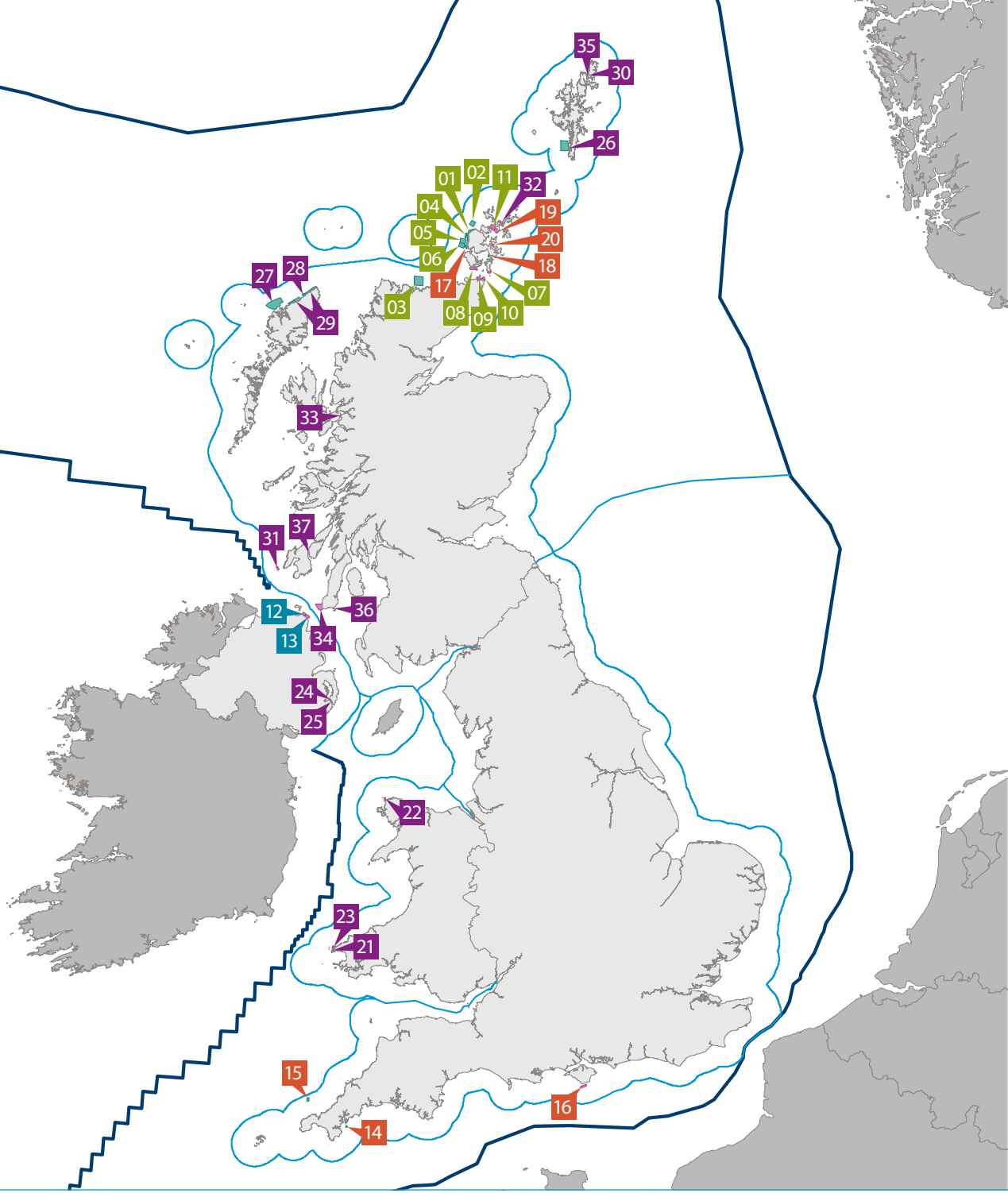
Tidal lagoons exploit the "head" of water which is created by impounding a volume of water within a large artificial sea wall. The potential energy stored in this head of seawater is converted when it is released through hydro-electric turbines which have been installed in the impoundment wall. This happens when the tide has ebbed sufficiently to create a height difference between the water held in the lagoon and the height of the surrounding sea.

Having received a number of enquiries from potential developers of tidal range projects around the UK in recent years, at the end of 2013 we invited interested parties to respond to an engagement process and share their views about possible approaches to leasing tidal range projects.

This invitation received considerable interest in developing tidal range projects in the UK in the coming years, though there were very few proposals at an advanced stage of development. The Crown Estate is therefore currently reviewing its position (including stakeholder and government inputs), looking to assess resource interactions and aligning a leasing process to best meet the stakeholder feedback and The Crown Estates' objectives during the 2014-2015 financial year.

In 2012, we published the results of a study mapping the UK's potential wave and tidal power resources. It found that tidal lagoon schemes could provide up to 25 terawatt hours per year, equal to 14GW of new capacity.

Wave and tidal projects



Pentland Firth and Orkney waters

Scotland	**Wave**	
	01	Brough Head
	02	Costa Head
	03	Farr Point
	04	Marwick Head
	05	West Orkney Middle South
	06	West Orkney South
	Tidal stream	
	07	Brough Ness
	08	Brims Tidal Array
	09	Inner Sound
	10	Ness of Duncansby
	11	Westray South

Rathlin Island and Torr Head

N Ireland	**Tidal stream**	
	12	Fair Head
	13	Torr Head

Managed test/ demonstration facilities

England	**Wave**	
	14	FaB Test
	15	Wave Hub
	Tidal stream	
	16	Solent Ocean Energy Centre
Scotland	**Wave**	
	17	Billa Croo
	18	Scapa Flow
	Tidal stream	
	19	Fall of Warness
	20	Shapinsay Sound

Other UK sites

Wales	**Tidal stream**	
	21	Ramsey Sound
	22	Skerries
	23	St David's Head
N Ireland	**Tidal stream**	
	24	Strangford Lough
	25	SeaGen Strangford Lough
Scotland	**Wave**	
	26	Aegir
	27	Bernera
	28	Galson
	29	North West Lewis
	Tidal stream	
	30	Bluemull Sound
	31	Isle of Islay
	32	Lashy Sound
	33	Kyle Rhea
	34	Mull of Kintyre
	35	Ness of Cullivoe
	36	Sanda Sound
	37	Sound of Islay

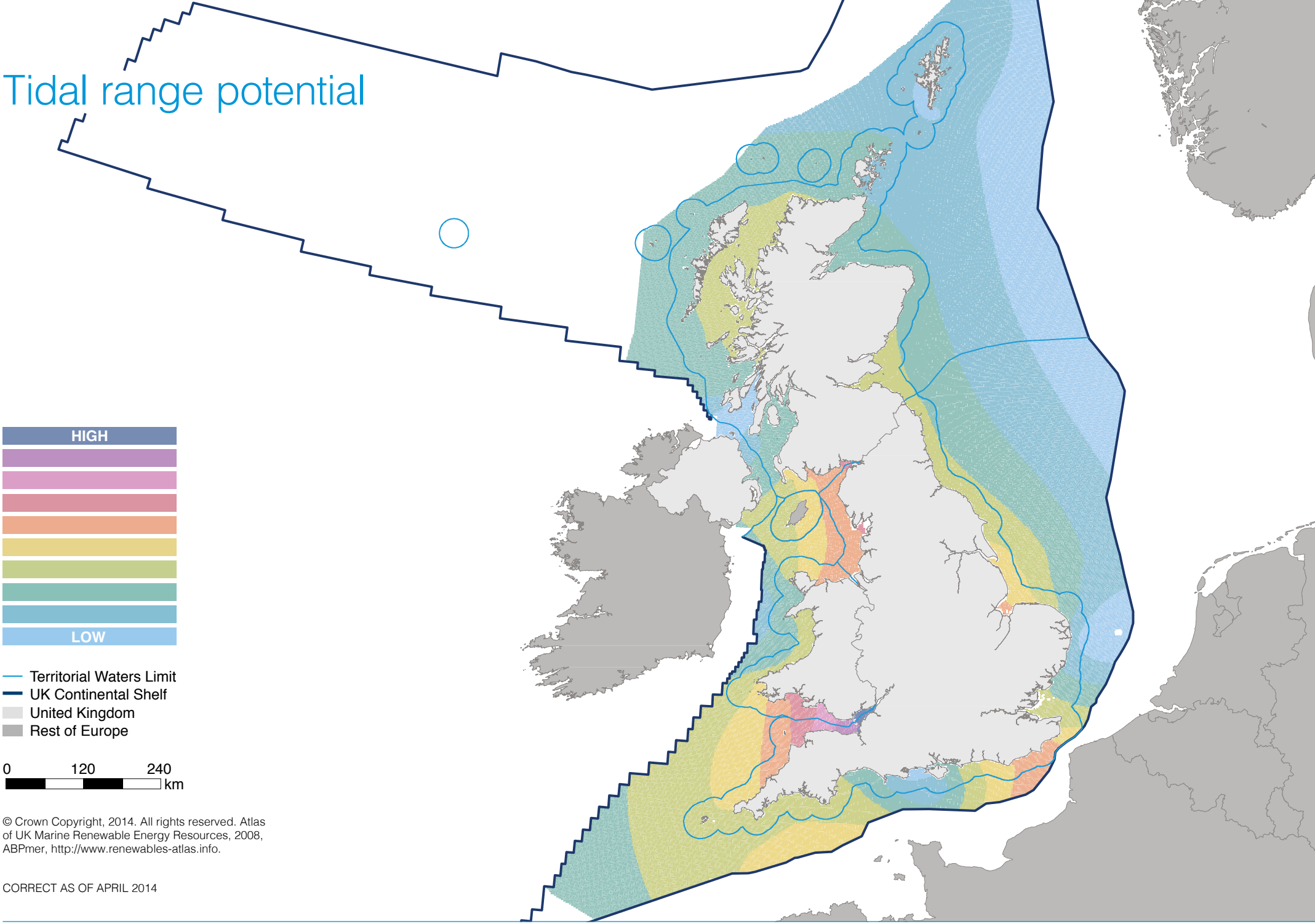
Wave site
Tidal site

Territorial Waters Limit
UK Continental Shelf
United Kingdom
Rest of Europe

0 100 200 km

CORRECT AS OF APRIL 2014

Tidal range potential



CORRECT AS OF APRIL 2014

THE CROWN ESTATE

London
The Crown Estate
16 New Burlington Place
London
W1S 2HX
T 020 7851 5000

Edinburgh
The Crown Estate
6 Bell's Brae
Edinburgh
EH4 3BJ
T 0131 260 6070

www.thecrownestate.co.uk/energy-infrastructure
@TheCrownEstate

Correct as of May 2014

COVER IMAGES COURTESY OF MAREMBERT BENOIT; ANDRITZ HYDRO HAMMERFEST TIDAL TURBINE TECHNOLOGY; AQUAMARINE POWER

At The Crown Estate, we are landlords of the UK's seabed, managing it effectively and sustainably, balancing different interests and delivering the best value over the long-term.

This gives us a unique role to play in developing and helping sustain the UK's energy supply and infrastructure, by working in partnership with a wide range of organisations that have interests in the seabed.

These include wind, wave and tidal power, carbon capture and storage, gas storage, marine aggregates and minerals, cables and pipelines.

We are active asset managers, applying our experience, skills and understanding to deliver optimum returns, create opportunities for ourselves and our partners, and provide a quality service to our customers.

Aware of our monopoly position and the impact of our activities, we are careful to comply with competition laws, co-exist with the wider marine community, and be open and transparent in our dealings.

Because of who we are, we are able to see the bigger picture, making best use of the seabed, and supporting and investing in sustainable development for the long-term benefit of the whole of the UK, now and in the future.