

Energy and infrastructure

outlook 2014-15

Offshore wind



Overview

Since 2001 we have awarded leases for offshore wind farms through running six leasing rounds. The successful developers have been awarded a five-year agreement for lease, providing them the time to secure all the necessary consents, grid connection and finance to start construction. If successful, offshore wind developers will be award a full lease for operation of the site for up to 50 years.

We have a duty of care to ensure the seabed is used sustainability so we manage conflicting uses of the sea and existing land rights. At present, we have 24 operational offshore wind farm leases that we are actively managing.

In Round 3 we are co-investing up to £100 million with developers in the origination and consenting of projects. Our contributions have helped pay for site surveys, engineering studies and metmasts.

We also work in a facilitating role across the sector, with government, industry and stakeholders. As landlord of the seabed, through our leases and agreements for lease we have insights into all projects in operation and development. This allows us to identify and prioritize common issues across the sector. We work with a broad range of stakeholders to help industry overcome these concerns.

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The programme is a superb and unique idea with a significant positive impact for the UK.

BUSINESS IN THE COMMUNITY AWARD
in recognition for the UK Fisherman's
Information Mapping Project (UKFIM)
which The Crown Estate facilitated

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Working in close collaboration with The Crown Estate and other key organisations in the offshore renewables sector will enable us to speed up the delivery, commercialisation and scalability of technology innovation. This will help to meet the challenges of harnessing low-carbon power from offshore wind by driving down costs and realising significant economic, social and environmental benefits.

CHRIS HILL
ORE Catapult Innovation
Programmes Director

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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



COURTESY OF SIEMENS

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



COURTESY OF AREVA

An industry coming of age



Our decision to construct a production facility for offshore wind turbines in England is part of our global strategy: we invest in markets with reliable conditions that can ensure that factories can work to capacity.

MICHAEL SUESS
Member of the managing board of Siemens AG



3%

Offshore wind already provides more than 3% of all electricity in the UK

The offshore wind industry hit a number of major milestones in the last 12 months. This includes the opening of London Array, the world's largest offshore wind farm, and the first consent for a Round 3 offshore wind farm in the Moray Firth.

The UK now has installed over 1,100 turbines at sea and around another 350 are currently under construction. As a result of this rapid growth, the industry can now claim to be providing around 3% of total electricity in the UK.

However, it is fair to say that the industry is only now coming of age, as developers, governments and suppliers start to gain a better understanding of what

will be feasible and affordable over the coming years. This certainty has in part been possible because of the clarity provided by the passing of the Energy Act in December 2013 and the implementation of the Electricity Market Reform package.

The UK now has 3.7GW of offshore wind capacity providing clean energy for British homes and businesses, and we expect a further 1.4GW of capacity to be completed during the next 12 months, taking total operational capacity to 5GW by the end of 2015.

The last 12 months have also seen significant achievements by the sector, most notably the

long-awaited confirmation by Siemens and Associated British Ports to invest £310m in wind turbine and blade manufacturing facilities on the Humber creating more than 1,000 jobs. This demonstrates that the UK's commitment to decarbonisation is creating new employment and economic opportunities for the regions of the UK.

Dr Michael Suess, member of the managing board of Siemens AG: "Our decision to construct a production facility for offshore wind turbines in England is part of our global strategy: we invest in markets with reliable conditions that can ensure that factories can work to capacity."

Delivery

With the government now providing policy certainty through the Energy Act and Electricity Market Reform, the industry has a clearer idea of capacity to be delivered in the second half of this decade.

3.2GW of new capacity has been contracted through the government's Final Investment Decision Enabling

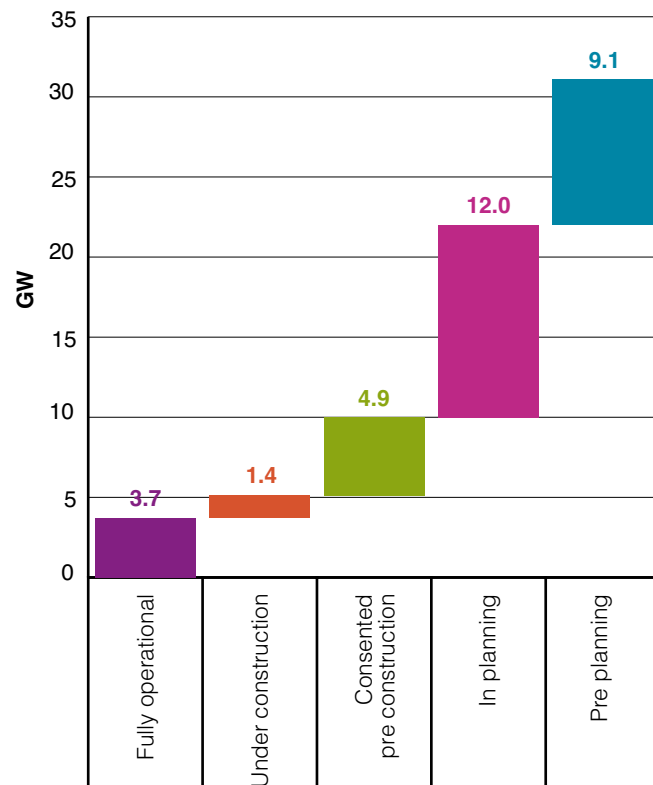
process, which is designed to drive investment in renewables ahead of the launch of the 'Contract for Difference' enduring regime in late 2014. By 2020, we expect to see in the region of 10GW of offshore wind power capacity operating in UK waters.

According to Ernst & Young, the UK remains the most attractive place to invest in offshore wind globally.

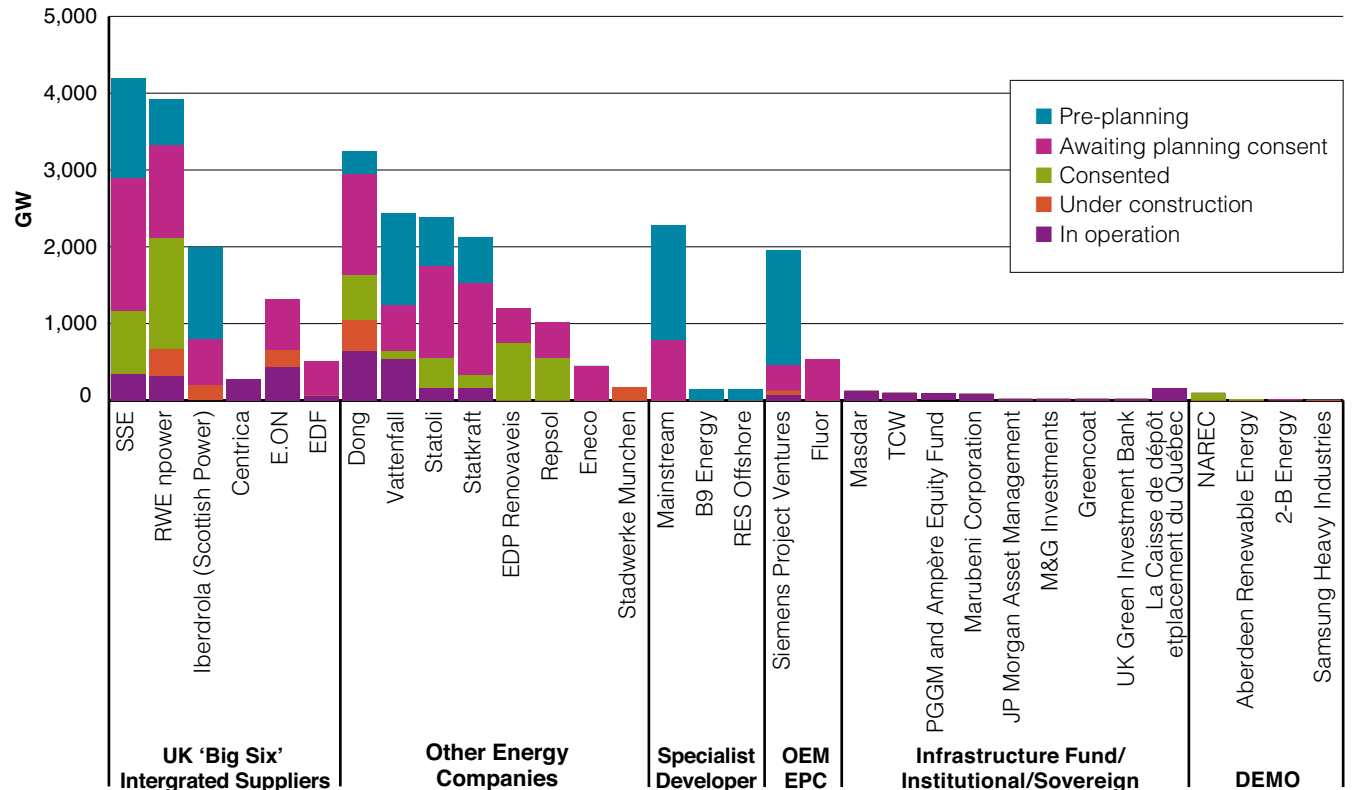
This enables developers, and consequently the supply chain, to more easily map out what the future holds for their portfolios. Over the course of 2013 and early 2014 we have seen a number of announcements from developers as they firm up their future plans.

During 2014, we fully expect to continue to see projects progress to final investment decision,

UK offshore wind project pipeline – April 2014



Project Pipeline – Developer shares in each phase – April 2014



and other projects to change hands. There will also be projects which draw to a close and speculative capacity no longer planned in larger Round 3 zones dropped. However, this should not be seen as a surprise. In every industry, some projects fail to stack up economically. With more than 21GW of project capacity either in the planning system, consented, in construction or operating, and another 5GW of projects likely to enter the planning system in the next 12 months, the programme is well placed to meet the clear policy demand out to 2020, and provide a sound basis for a sustainable industry beyond then.

Ed Davey, UK Energy and Climate Change Secretary: "It is true that not all the offshore wind farms that were planned can go ahead, that's because we can't afford every single project that's put on the table. But we are massively expanding offshore wind. We are the world leaders".

We are pleased that in early 2014, the government's Green Investment Bank made its first investment in two offshore wind farms, Westernmost Rough and Gwynt y Môr, both under construction. This investment demonstrates that the bank is now prepared to take on a greater element of risk and back this promising industry.

As manager of the UK seabed The Crown Estate is well positioned to help catalyse this fresh focus on delivering high quality projects. This is why we are bringing industry together to collectively optimise development opportunities and to take the decisions needed to bring the pipeline more in line with the Government's aspirations.



We have signed a total of 77 agreements with developers for offshore wind projects, including 29 leases

Management of seabed assets



With 3.7GW of turbines already installed offshore and a further 1.4GW due to be completed by summer 2015, we are currently managing the seabed leases of 5GW of wind power capacity in UK waters. Working with industry and government we are using our unique perspective to help maximise the yield and efficiency of these projects. We are also continuing to provide support to developers as they move through the consenting system.

In November 2013, we signed a three-year memorandum of understanding with the Offshore Renewable Energy (ORE) Catapult to collaborate on five key areas. These are: identifying enabling technologies to deliver affordable offshore renewable

energy; developing frameworks for collection of performance and reliability data from offshore wind turbines and for establishing best practice in offshore transmission issues; developing a reliability certification system for offshore wind turbines and leading the Deep Water Foundations Working Group.

During 2013 we also published new guidelines on the interaction between offshore wind industry and the fishing industry, that aim to ensure good relations between the two sectors throughout the planning, construction and operational phases of offshore wind farms. This is the latest development from the long-running Fishing Liaison with Offshore Wind and Wet Renewables Group (FLOWW).

System Performance, Availability and Reliability Trend Analysis (SPARTA)

Our first project with ORE Catapult is to provide seed funding for SPARTA, a database that allows offshore wind farm operators to compare the performance of their wind farms with each other and deliver improvements.

SPARTA, live in summer 2014, enables wind farm operators to anonymously submit the performance data relating to their wind farm. More than 50 are used including the availability of turbines and electrical systems.

The system will feed back anonymous analysis of how other wind farms are performing, allowing developers

1,465

There are 1465 offshore wind turbines in the UK that are installed or under construction



to benchmark their assets and understand which areas need improvements.

To date, we have eight voluntary participants, including Vattenfall, Scottish Power, SSE, EDF, RWE, Centrica, Statoil and Statkraft. While we have provided initial funding for the launch of SPARTA, we expect industry to appreciate the benefits of this new reporting tool and continue to finance the scheme once the pilot phase has ended.

We have also been supporting the joint industry Structural Lifecycle Industry Collaboration (SLIC) project, established by a group of ten offshore wind operators undertaking research to inform the design of future wind farms and the optimisation of existing offshore projects.

Offshore Wind Programme Board (OWPB)

The Crown Estate is an active member of the OWPB, established last year between industry and government following the recommendations in the Offshore Wind Cost Reduction Task Force report. We are using our unique perspective and portfolio insights to drive cost reduction activity across the industry.

The Crown Estate chairs the OWPB's Risk Committee and supports a number of work streams such as technology and innovation. We are currently working to develop a cost reduction monitoring framework that will track progress on reducing costs. We are also working with developers to set up a "community of practice" to promote cost reductions through sharing best practice across industry.

Offshore Renewables Joint Industry Programme (ORJIP)

Last year we launched a new joint industry programme with our partners, designed to encourage offshore wind developers to collaborate on researching the impact of their sector on birds and marine mammals.

The programme, managed by the Carbon Trust, will see £3m of public and private sector funding invested in research over the next three years, generating scientific evidence to provide greater certainty on the potential environmental impacts of offshore wind developments, in order to reduce consenting risks for developers.

The first project analysing bird collision risk with offshore turbines has been commissioned. The first



phase of the Acoustic Deterrent Devices for marine mammals has been completed.

Research

We continue to support the industry in monitoring for unexpected or incidental finds relating to the historic environment. We developed an industry protocol for the reporting of archaeological finds for the marine minerals sector, which has now been transposed to the offshore wind industry.

This has been particularly relevant, as the Forewind consortium has started to work on the Dogger Bank Round 3 zone in the North Sea. We know that the area was dry land until being submerged between 9,000 and 7,000 years ago when it was gradually flooded by rising sea levels. Forewind has found almost 200 samples of peat in the survey material from the Dogger Bank, some of which contain seeds. These



samples, initially judged to be formed between 12,000 and 8,000 years before the present time (BP) have helped to create a better picture of the environment as it was then.

Test and demonstration

In autumn 2013, we granted an agreement for lease for the UK's first floating offshore wind farm, which will be located in the Buchan Deep, off Peterhead, Aberdeenshire in Scotland. The agreement with Statoil represents the second phase of its Hywind project, comprising five floating turbines, each with a capacity of 6MW.

The Crown Estate and Statoil have been working together closely over the past two years to progress this project, which aims to bolster the UK's position as a global leader in offshore wind technology development. Statoil is now working to secure the necessary consents



The UK remains the most attractive place to invest in offshore wind globally.

ERNST & YOUNG
February 2014



from the Scottish Government with an aim to commission the project by 2017.

As a result of the interest generated from this scheme, we launched a leasing round in June 2013 with a view to showcasing the main types of floating substructures being developed by the industry.

Project developers were invited to propose new sites and we received a positive response. We are now assessing the responses to these rounds and hope to see new projects delivered between now and 2020.

We are working closely with the Scottish Government in this area, which last summer confirmed that developers of floating offshore wind pilot projects would be eligible for a new higher level of subsidy under the Scottish Renewable Obligation Certificate (ROC) scheme.



Together with Marine Scotland, DECC and the private sector we are funding a £3 million programme to better understand the environmental effects of offshore windfarms



COURTESY OF SIEMENS

Siemens 6MW: From test to manufacturing

In March 2014, Siemens confirmed plans to start manufacturing its next-generation 6MW offshore wind turbine at Green Port Hull, in a £310m deal with Associated British Ports.

This long-awaited announcement is fundamental to the future of the industry, acting as an indicator that the offshore wind sector remains healthy and evidence that the Crown Estate's leasing approach is helping to maintain the UK's position as the most attractive country for offshore wind investment.

June 2012 we awarded a lease to DONG Energy to demonstrate two Siemens 6MW wind turbines at the Gunfleet Sands offshore wind farm. Those test turbines have now been running successfully for a year and DONG Energy has chosen its Westermost Rough offshore wind farm off the coast of the Humber to be the first commercial offshore wind farm in the world to use the 6MW machines.

These new turbines are expected to help reduce costs for the industry, by offering a greater energy yield.

Health and safety

We promote the adoption of high standards of health and safety by the industry through our work with industry bodies like G9 and RenewableUK.

For the last three years The Crown Estate has sponsored the annual RenewableUK Energy Health and Safety Award. It is currently the only awards scheme of its kind for the renewable energy industry and is designed to recognise and promote the development, implementation and sharing of best practice in health and safety across the sector.

Supply chain and skills

In summer 2013, the government launched its Offshore Wind Industrial Strategy, setting out its long-term vision for the sector and promoting innovation, investment and economic growth in the UK supply chain.

We will continue to play our part in this, working with government, industry and others via the Offshore Wind Industry Council and Offshore Wind Programme Board, to support de-risking of projects, technology and the supply chain to provide a stable foundation for growth.

The Crown Estate publishes a supply chain gap analysis of the offshore wind industry in Europe and has provided a 2013 assessment, together with a high level assessment of the UK supply chain capability.

To help guide the next generation of students to the offshore renewables industry, we have also sponsored a new interactive guide on the U-Explore website to showcase various careers in the sector to secondary school option takers, older students aged 12 and above as well as parents.

139,691

139,691 new registrations since September 2013. U-Explore's Offshore Wind Wall gives an insight into potential careers in the offshore wind industry

Centrica: Generation Safe

This year, we were delighted to award the Health and Safety Award to Centrica Energy for its Generation Safe initiative, which changed the culture on offshore wind construction sites, reducing the number of incidents occurring over the course of a year but dramatically increasing quality of reporting.

Centrica launched the programme by inviting more than 1,000 people, including employees, contractors and suppliers to a one-day event that focused on the need to develop a common understanding of the need for exemplary safety standards, and to demonstrate the managements' commitment to the cause.

The company then built a centre of excellence at its renewables base in Grimsby, which provided the backdrop for cutting-edge skills building techniques, creating

realistic scenarios using themed sets, props and actors.

Centrica's new 'one team' culture was tested at Lynn and Inner Dowsing offshore wind farm in early 2013, when urgent repairs were needed on a number of monopiles that had been found to have excessive corrosion. Employees, contractors and suppliers were again invited to attend workshops where they learnt best practice in areas including transfers, radio communication and health and safety reporting.

Throughout the operations, Centrica published fortnightly bulletins, providing updates on progress and key safety messages, which helped keep health and safety and the forefront of employees' minds. Each week, one team member who made the best contribution to safety was awarded a prize.

The project saw fewer incidents, and crucially, was also completed early and under budget by £1m.

Following the completion of the project, Centrica held a day-long lessons learned workshop for all contractors, suppliers and employees, the results of which have been communicated through the entire business.

Generation Safe has been rolled out across Centrica Energy's portfolio, and has delivered a 100 per cent rise in the number of employees and contractors making safety reports and a 40 per cent increase in the number of observations.

By the third quarter of 2013, Centrica's incident rates of Lost Time Injury Frequency dropped by 20 per cent and Total Recordable Injury Frequency fell by 15 per cent.

Grid and offshore transmission



With 5GW of offshore wind capacity expected to be completed by summer 2015 and a significant pipeline likely to be maintained throughout the 2020s, it is crucial that the UK has robust grid systems in place to deliver power to land, where it can be used by homes and businesses.

To date, offshore wind farms have been connected on a radial basis. However, this may change in the future as projects become larger and are built in phases within defined Round 3 zones.

There is a general industry and government consensus that it would be more cost efficient to build large-scale transmission infrastructure that can be shared by a number of wind farms as and when they are constructed.

We will continue to participate in this nationwide dialogue – both in terms of technical and regulatory issues – to help overcome the barriers to the delivery of this crucial infrastructure.


Also, as projects get further offshore, the cost of grid infrastructure for individual projects can increase to 20 to 25 per cent of the total project, compared to around 15 per cent for those closer to land being developed currently.

Therefore, efforts to reduce costs in grid and transmission will be crucial to industry wide efforts to drastically reduce the levelised cost of offshore wind energy. We are working with industry through the Offshore Wind Programme Board to help

developers capture best practice and develop standardised designs.

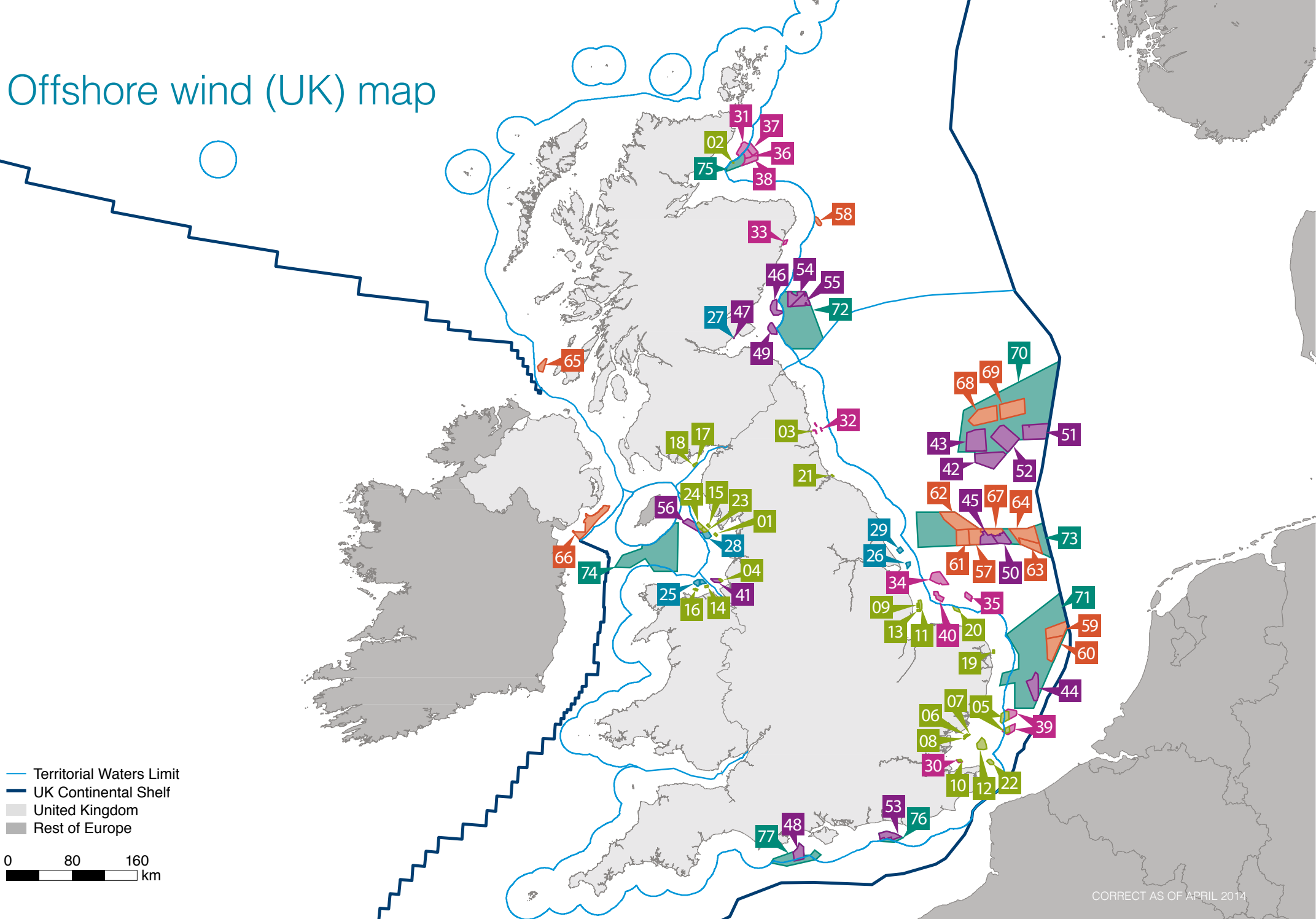
We have commissioned a study into understanding lessons learned in offshore transmission for offshore wind and how the sector can better share knowledge, building on recommendations from the Offshore Wind Cost Reduction Task Force made last year. We expect to publish this in summer 2014.

We have also developed a dedicated Transmission Infrastructure website to promote awareness and knowledge of offshore transmission, which can be accessed at <http://www.transmissioninfrastructure-offshoregen.co.uk/transmission-infrastructure/>

An aerial photograph of an offshore wind farm. In the foreground, a large white wind turbine with three blades is prominent, mounted on a yellow and white jacket. A blue and white service vessel is moving through the water in the lower-left quadrant. The background shows a long, straight line of similar wind turbines extending into the distance under a blue sky with scattered clouds.

We believe that offshore wind can become a mainstream power source, provided costs continue to come down. The market will double between now and 2020, and can double again in the years thereafter

Offshore wind (UK) map



CORRECT AS OF APRIL 2014

Operational Wind Farms

No.	Name	Up to capacity MW
01	Barrow	90
02	Beatrice Demonstrator Site	10
03	Blyth	4
04	Burbo Bank	90
05	Greater Gabbard	504
06	Gunfleet Sands I	12
07	Gunfleet Sands II	108
08	Gunfleet Sands Demonstration	65
09	Inner Dowsing	97
10	Kentish Flats 1	90
11	Lincs	270
12	London Array 1	630
13	Lynn	97
14	North Hoyle	60
15	Ormonde	150
16	Rhyl Flats	90
17	Robin Rigg East	90
18	Robin Rigg West	90
19	Scroby Sands	60
20	Sheringham Shoal	317
21	Teesside	62
22	Thanet	300
23	Walney 1	184
24	Walney 2	184
Total		3,654

Construction Wind Farms

No.	Name	Up to capacity MW
25	Gwynt y Môr	576
26	Humber Gateway	219
27	Methil Demonstration – Samsung	7
28	West of Duddon Sands	389
29	Westermost Rough	210
Total		1,401

Consented Wind Farms

No.	Name	Up to capacity MW
30	Kentish Flats 2	50
31	Beatrice	750
32	Blyth Demonstration	100
33	Aberdeen Demonstration	66
34	Triton Knoll	600-900
35	Dudgeon	402
36	Stevenson	372
37	Telford	372
38	MacColl	372
39	Galloper	340
40	Race Bank	580
Total		4,926

In planning Wind Farms

No.	Name	Up to capacity MW
41	Burbo Bank Extension	259
42	Creyke Beck A	1,200
43	Creyke Beck B	1,200
44	East Anglia ONE	1,200
45	Heron Wind	600
46	Inch Cape	905
47	Methil Demonstration – 2-B Energy	12
48	Navitus Bay	900
49	Neart na Gaoithe	450
50	Njord	600
51	Teesside A	1,200
52	Teesside B	1,200
53	Rampion	700
54	SeaGreen Alpha	525
55	SeaGreen Bravo	525
56	Walney Extension	750
Total		11,991

Pre planning Wind Farms

No.	Name	Up to capacity MW
57	Breesea	500
58	Buchan Deep Demonstrator Site	30
59	East Anglia FOUR	1,200
60	East Anglia THREE	1,200
61	Hornsea SPC 5	500
62	Hornsea SPC 6	500
63	Hornsea SPC 7	500
64	Hornsea SPC 8	500
65	Islay	690
66	NI Wind Resource Area	600
67	Optimus	500
68	Teesside C	1,200
69	Teesside D	1,200
Total		9,120

Wind Farm Areas of Search

No.	Name
70	Dogger Bank
71	East Anglia
72	Firth of Forth
73	Hornsea
74	Irish Sea
75	Moray Firth
76	Southern Array
77	West Isle of Wight

NOTE: Quoted capacity refers the property rights held with The Crown Estate and does not necessarily reflect the build out capacity permissible under current or future statutory planning permissions.

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 @TheCrownEstate

Correct as of May 2014

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.