AN UPDATE ON THE EXTENT OF MARINE RENEWABLE ENERGY DEVELOPMENTS IN THE NORTHEAST ATLANTIC

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ABSTRACT

There has been a rapid expansion of Marine Renewable Energy Developments (MREDs) – predominantly windfarms - in Northern Europe. Concerns have been raised that their potential impacts are not being adequately taken into account. This paper provides further information about the extent of MREDs in the region, revealing that there are at least 50 existing, under construction or planned windfarms.

KEYWORDS: Marine Renewable Energy, noise, UK, Europe

INTRODUCTION

Whilst renewable energy sources have been widely welcomed, concerns have been expressed about the swiftness of their development in the marine environment and potential impacts on cetaceans and other marine wildlife (for example, Dolman *et al.,* 2007; Evans, 2008). The IWC Scientific Committee in 2003 commented that it 'regarded the rapid development of marine windfarms to be of potential concern' and it recommended 'that full independent and publicly-accessible environmental impact assessments are conducted wherever they are planned' (International Whaling Commission, 2004). The Convention for Migratory Species at its last Meeting of Parties passed resolution 7.5 'Wind Turbines and Migratory Species' which spoke to the need for parties to the convention to address wind turbines including those offshore and their effects on migratory birds and mammals. Similarly, the Parties to the Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS) at their 5th Meeting (2006) called for further research to be conducted on the effects of windfarms on small cetaceans.

Dolman *et al*. (2007) provided an overview of the potential issues for cetaceans relating to Marine Renewable Energy Developments (MREDs) and suggested that the concerns for cetaceans included the intense noise generated during construction (especially with respect to pile-driving); associated increased vessel noise and disturbance; operational noise and vibrations from the turbines; and physical changes to the local environment. Noise source levels from impact pile driving can be in the order of 218-227 dB re 1µPa @1m, comprising short (100-200 ms) but intense impulses with maximum overall energy <1 kHz, but some components from ramming impulses up to 100 kHz (Evans, 2008) and each pile may take two hours to complete. Noise levels will vary from development to development with factors such as the size of the turbines and the local substrate being important.

This short paper is intended as an addendum to Dolman et al. (2007) and seeks to provide an up-to-date illustration of the current extent of operational and planned MREDs in the North East Atlantic area.

A recent symposium was dedicated to considering impacts from windfarms on marine mammals (Evans, 2008). Evans (2008) commented that 'offshore renewable energy represents perhaps the fastest moving industrial development facing the coastal zone of Europe' and noted the extensive developments 'in shallow waters across

Northern Europe, particularly in a wide band from the Irish Sea eastwards across the southern North Sea to the Baltic.' He also made recommendations about the research that should be conducted before, during and after MRED developments to better understand their impacts.

METHODS

An investigation was made of web-based and other literature to try to determine the current scale of windfarm development in the Northeast Atlantic. The results are provided here as two figures and four tables. The tables (1-4) provide information about those windfarms that are operational, those under construction, those for which proposals have been submitted, and those approved for development.

'Operational windfarms' are those that have been completed and are providing electricity. The information in Table 1 includes the year the windfarm started operation and the energy produced annually (where the information is available). 'Windfarms under construction' have been approved and construction has started. The year given in Table 2 is when construction was started. 'Submitted windfarms' are at the first stage of development, plans have been completed and reports are submitted. At this stage they may be approved or rejected. Table 3 includes information on the year the plans were submitted for consideration and the estimated annual energy production (where the information is available). 'Approved windfarms' are those for which the submitted plans have been consented to but construction has not yet started. Table 4 includes the year that approval was given.

The locations of these wind farms are plotted for the British Isles and continental Europe (Figures 1 and 2). This exercise has not currently extended further south as the relevant information has been difficult to obtain.

DISCUSSION

The widespread and expanding nature of MREDs has been confirmed by this exercise. There are at least 22 operating MREDS in this region, at least eight more are under construction and we are aware of six more that are being planned. In addition, a further 14 windfarms have already been approved for development.

Evans (2008) has highlighted the fact that the region of windfarm development is now extending northwards to eastern Scotland and southwards to France and the Iberian Peninsula, with plans for ever larger turbines and operations in deeper waters. Whilst the shallow water developments to date mainly overlap with the habitats of harbour porpoises, *Phocoena phocoena,* these newer ones will inevitably pose new challenges, including potential concerns for other marine mammal species whose ranges fall within those areas of development. It will not be adequate to extrapolate potential impacts from smaller inshore developments. We agree with Evans that to date the industry has moved faster than proper procedures to enable adequate surveys of affected populations, or monitor impacts. This situation urgently needs to be rectified.

Finally, we note the launch of a new generation of MREDs that extract wave or tidal energy, and which range from underwater turbines to floating structures, is imminent with unknown consequences for marine mammals and other wildlife. However, some idea of the potential consequence of a commercial underwater turbine development can be gained from a modelling exercise that showed for the coast of western Scotland, 10.7% of the harbour porpoise population (some 1300 individuals) would encounter a rotating blade in the space of one year (Wilson *et al*., 2007). The authors conclude that "the introduction of these new energy generation technologies may pose a significant new threat to European cetacean populations", and emphasise the urgent need to better understand this matter.

It was relatively difficult to obtain information outside of the UK and we regard these figures as works in progress and would be pleased to be provided with additions or corrections.

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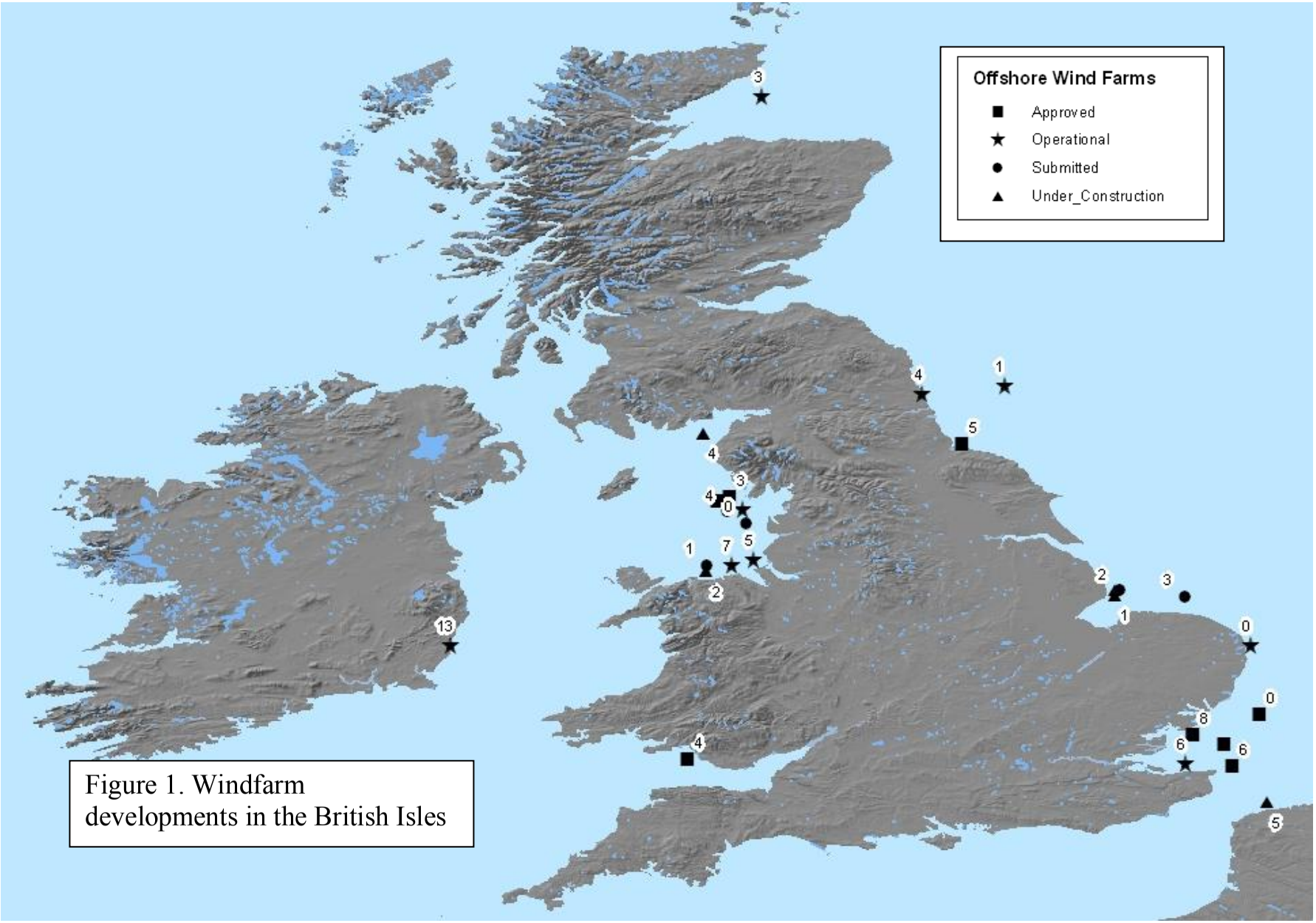

Figure 1. Windfarm developments in the British Isles

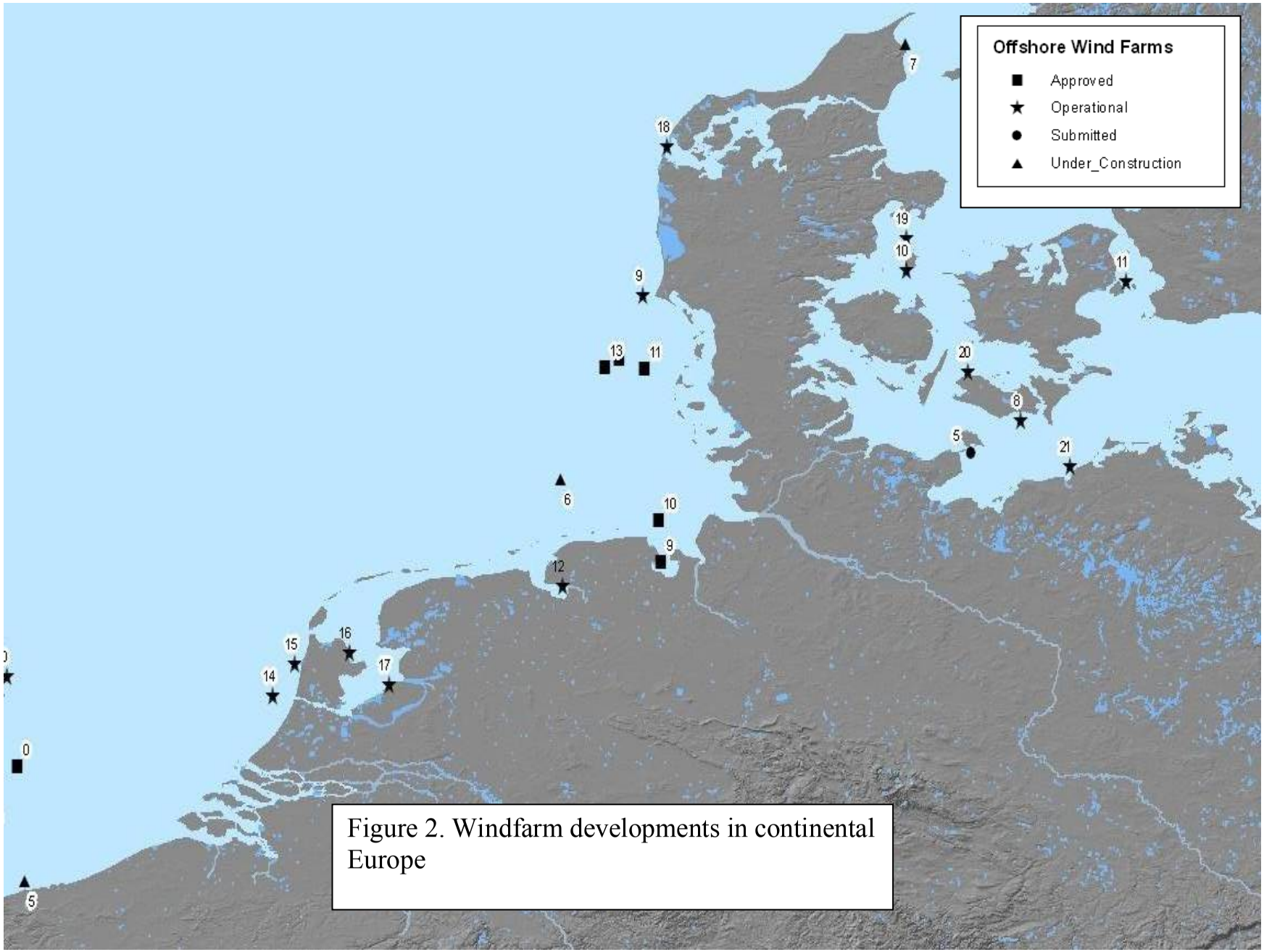

Figure 2. Windfarm developments in continental Europe

Table 1. Operational Wind Farms in the Northeast Atlantic in 2008

Id	Name	Location	Region	Turbines	Power MW	MW Capacity	Developer	Lat Long	Country	Year	Info source
0	Scroby Sands	3km NE Great Yarmouth	Norfolk	30	2	60	E.ON UK Renewables	52 38 00N 01 47 00E	England	2004	BWEA website www.bwea.com/ukwed/operational.asp
1	Wether Hill	-	Dumfries & Galloway	14	1.3	18.2	Scottish Power	55 13 20N 04 02 30W	Scotland	2007	BWEA website www.bwea.com/ukwed/operational.asp
2	Barrow	7km Walney Island	North West/ Cumbria	30	3	90	DONG Energy/ Centrica Renewable Energy	53 59 00N 03 17 00W	England	2006	BWEA website www.bwwa.com/ukwed/operational.asp
3	Beatrice	Beatrice Oilfield, Moray Firth	Scotland	2	5	10	Scottish and Southern	58 06 20N 03 05 35W	Scotland	2007	BWEA website www.bwea.com/ukwed/operational.asp
4	Blyth Offshore	1km Blyth Harbour	North East/ Northumberland	2	2	3.8	E.ON UK Renewables	55 08 09N 01 29 25W	England	2000	BWEA website www.bwea.com/ukwed/operational.asp
5	Burbo Bank	5.2km Crosby	North West/ Merseyside	25	3.6	90	DONG Energy	53 29 00N 03 11 00W	England	2007	BWEA website www.bwea.com/ukwed/operational.asp
6	Kentish Flats	8.5km offshore from Whitstable	South East/ Kent	30	3	90	Vattenfall	51 27 00N 01 08 10E	England	2005	BWEA website www.bwea.com/ukwed/operational.asp
7	North Hoyle	7.5km Prestatyn and Rhyl	North Wales/ Denbighshire	30	2	60	Npower renewables	53 26 00N 03 24 00W	Wales	2004	BWEA website www.bwea.com/ukwed/operational.asp
8	Nysted	10km south of Nysted on Lolland	Rodsand/ Lolland	72	-	-	DONG Energy		Denmark	2003	Offshore-wind.de website www.offshore-wind.de
9	Horns Rev	14-20km offshore from Jutland	Blavandhuk	80	-	160	DONG Energy		Denmark	2001	Offshore-wind.de website www.offshore-wind.de
10	Samso	3.5km south of the island Samso	Island of Samso	10	2.3	23	Locally owned		Denmark	2003	Offshore-wind.de website www.offshore-wind.de
11	Middelgrunden	2km offshore from Copenhagen	Port of Copenhagen	20	-	-	DONG Energy		Denmark	2003	Offshore-wind.de website www.offshore-wind.de
12	Ems-Emden	40m offshore		1	4.5	4.5	Enova		Germany	2004	Offshore-wind.de website

										www.offshore-wind.de
13	Arklow Bank	10km Arklow	County Wicklow/East Ireland	7	25.2		Airtricity	Ireland	2007	Offshore Wind Energy www.offshorewindenergy.org
14	Q7-WP	23km Ijuiden		60	2	120	Econcern, Energy Investments Holding, ENECO Energy	Netherlands	2008	Offshore Wind Energy www.offshorewindenergy.org
15	Egmond aan Zee	10km offshore from Egmond aan Zee		36	3	108	NoordzeeWind (Shell/NUON)	Netherlands	2007	Offshore Wind Energy www.offshorewindenergy.org
16	Lely	750m offshore		4	500 KW	2		Netherlands	1994	Offshore Wind Energy www.offshorewindenergy.org
17	Irene Vorrink	20m offshore	Dronten - Ijsselmeer	28	600 KW	16.8		Netherlands	1996	Offshore Wind Energy www.offshorewindenergy.org
18	Ronland	Lim fjord	NW Jutland	8	2.3	17.2		Denmark	2003	Offshore Wind Energy www.offshorewindenergy.org
19	Tuno Knob	Inland Sea 6km from shore		10	500 KW	5		Denmark	1995	Offshore Wind Energy www.offshorewindenergy.org
20	Vindeby	1.5km from shore		11	450KW	4.95		Denmark	1991	Offshore Wind Energy www.offshorewindenergy.org
21	Brietling	500m offshore	Nr Rostock	1	2.5	2.3	Wind-projekt GmbH	Germany	2006	Offshore Wind Energy www.offshorewindenergy.org

Table 2. Windfarms under construction in the Northeast Atlantic during 2008

Id	Name	Location	Region	Turbines	Power (MW)	MW Capacity	Developer	Lat Long	Country	Year	Info source
0	Inner Dowsing	5.2km Ingoldmells	East Midlands/ Lincolnshire	27	3.6	90	Centrica Renewable Energy Ltd	53 11 00N 00 26 00E	England	2006	BWEA website www.bwea.com/ukwed/construction.asp
1	Lynn	5.2km Skegness	East Midlands/ Lincolnshire	30	3	97	Centrica Renewable Energy Ltd	53 07 39N 00 26 10E	England	2006	BWEA website www.bwea.com/ukwed/construction.asp
2	Rhyl Flats	8km Abergele	North Wales/ Conwy	25	3.6	90	npower renewables	53 22 00N 03 39 00W	Wales	2007	BWEA website www.bwea.com/ukwed/construction
3	Solway Firth/ Robin Rigg B	9.5km Maryport/ 8.5km off Rock Cliffe	Scotland/ Dumfries and Galloway	30	3	90	E.ON UK Renewables	54 45 00N 03 41 00W	Scotland	2006	BWEA website www.bwea.com/ukwed/construction.asp
4	Solway Firth/ Robin Rigg A	9.5km Maryport/ 8.5km off Rock Cliffe	Scotland/ Dumfries and Galloway	30	3	90	E.ON UK Renewables	54 45 00N 03 41 00W	Scotland	2006	BWEA website www.bwea.com/ukwed/construction.asp
5	Breedt/Mardyck Bench			0		8	Nord-Pas-de-Calais/Shell/TFE/Jeumont		France	2003	Offshore Wind Energy www.offshorewindenergy.org
6	Alpha Ventus	45km north of Borkum		12	5	60	E.ON Energy, EWE, Vattenval		Germany	2008	Offshore wind.de website www.offshore-wind.de
7	Frederikshavn			4		10.6	Elsam essential energy		Denmark	2003	Offshore Wind Energy www.offshorewindenergy.org

Table 3. Wind farms for which proposals have been submitted for consideration in the Northeast Atlantic

Id	Name	Location	Region	Turbines	Power MW	MW Capacity	Developer	Lat_Long	Country	Year	Info source
0	Cirrus Array (Shell Flats)	7km Cleveleys	North West/ Lancashire	90	0	270	Celt Power/ DONG Energy/ Shell Wind Energy	53 31 00N 03 15 00W	England	2003	BWEA website www.bwea.com/ukwed/planning.asp
1	Gwynt y Mor	Liverpool Bay (13-15km offshore)	North West	200	0	750	npower renewables	53 26 00N 03 38 00W	England	2005	BWEA website www.bwea.com/ukwed/planning.asp
2	Lincs	8km off Skegness	Greater Wash	0	0	250	Centrica Renewable Energy Ltd	53 11 00N 00 29 00E	England	2007	BWEA website www.bwea.com/ukwed/planning.asp
3	Sheringham Shoal	Sheringham, Greater Wash	East of England/ Norfolk	0	0	315	Scira Offshore Energy Ltd	53 07 00N 01 08 00E	England	2006	BWEA website www.bwea.com/ukwed/planning.asp
4	West of Duddon Sands	N. Irish Sea	North West	0	0	500	DONG Energy/ E.ON UK/ Eurus	53 58 00N 03 26 00W	England	2006	BWEA website www.bwea.com/ukwed/planning.asp
5	Sky 2000			50		175	GEO		Germany	2004	Offshore Wind.de www.offshore-wind.de

Table 4. Windfarms that have been approved in the Northeast Atlantic

Id	Name	Location	Region	Turbines	Power Mw	Mw Capacity	Developer	Lat Long	Country	Year	Info source
0	Greater Gabbard	26km off Orford	Norfolk, Thames Estuary	0	0	500	Airtricity	51 56 00N 01 53 00E	England	2007	BWEA website www.bwea.com/ukwed/conseted.asp
1	Gunfleet Sands (September) TWA	7km Clacton-on-Sea	East of England/ Essex	30	3.6	108	DONG Energy	51 43 50N 01 12 50E	England	2003	BWEA website www.bwea.com/ukwed/conseted.asp
2	London Array	24km off Clacton-on-Sea	Thames Estuary	271	0	1000	DONG Energy/ Shell Wind Energy/ E.On Renewables	51 38 00N 01 32 00E	England	2006	BWEA website www.bwea.com/ukwed/conseted.asp
3	Ormonde	off Walney Island	North West/ Cumbria	30	5	150	Eclipse Energy	54 06 00N 03 25 00W	England	2007	BWEA website www.bwea.com/ukwed/conseted.asp
4	Scarweather Sands	5.5km Sker Point (nrPorthcawl)	South Wales/ Bridgend	30	3.6	108	DONG Energy/ E.ON UK	51 28 50N 03 50 50W	Wales	2004	BWEA website www.bwea.com/ukwed/conseted.asp
5	Teeside/Redcar	1.5km NE Teesmouth	Yorkshire & Humber/ North Yorkshire	30	0	90	EdF	54 38 00N 01 05 00W	England	2007	BWEA website www.bwea.com/ukwed/conseted.asp
6	Thanet	11-13km Foreness Point, Margate	Thames Estuary	0	0	300	Warwick Energy	51 25 00N 01 32 00E	England	2006	BWEA website www.bwea.com/ukwed/conseted.asp
7	Walney Island	14km Walney Island	North West	0	3.6	450	DONG Energy	54 04 00N 03 32 00W	England	2007	BWEA website www.bwea.com/ukwed/conseted.asp
8	Gunfleet Sands II		East of England/ Essex	18	0	64	DONG Energy	54 43 00N 01 12 50E	England	2008	BWEA website www.bwea.com/ukwed/conseted.asp
9	Jade	550m offshore Wilhelmshaven		1	4.5	4.5	Winkra-Energie GmbH		Germany	2003	Offshore wind.de website www.offshore-wind.de
10	Offshore Windpark Nordergrunde			25	25	125	Energie-kontor AG		Germany		Offshore wind.de website

						www.offshore-wind.de
11	Offshore-Burger-Windpark Butendiek	80	240	Gmbh & Co. KG Husum	Germany	Offshore wind.de website www.offshore-wind.de
12	Dan Tysk	80	400	Gesellschaft fur Energi und Okologie mbH	Germany	Offshore wind.de website www.offshore-wind.de
13	Nordlicher Grund	80	400	GEO mbH, renergys GmbH	Germany	Offshore wind.de website www.offshore-wind.de