

# Capital Grant Scheme for the North Hoyle Offshore Wind Farm Annual Report: July 2004 – June 2005 Part 1

## EXECUTIVE SUMMARY

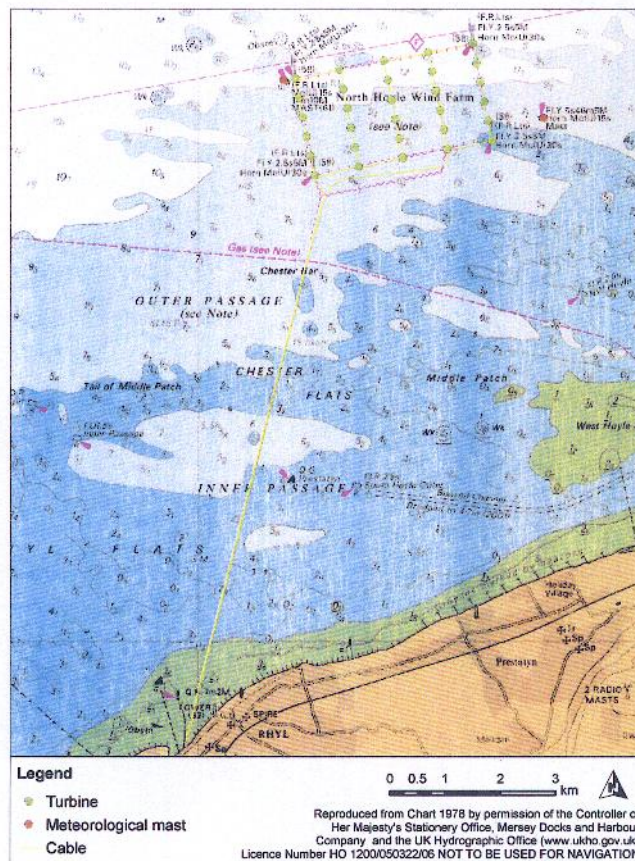
Built in 2003, North Hoyle is the UK's first major offshore wind farm and represents a major milestone in the UK's drive towards cleaner sources of power.

The project is located 4-5 miles off the North Wales coast between Rhyl and Prestatyn and comprises 30 Vestas V80 wind turbines, each rated at 2MW.

The majority of the offshore construction work at North Hoyle was carried out during 2003. The work was carried out by The North Hoyle Consortium, a consortium of two UK companies – Vestas Celtic Wind Ltd and Mayflower Energy Ltd.

Total overall final project cost totalled £81m (prior to grant) which equates to £1.35m/MW. The DTI grant for the project of £10m reduced the total cost to £1.18m/MW.

## SITE PLAN



## CONSTRUCTION

### An Overview of the Construction Programme

The approximate timeline for the different components of construction was as follows:

- Wind turbine foundations April 2003 – July 2003
- Boat landings June 2003 – August 2003
- Transition pieces July 2003 – August 2003
- Export Cables August 2003 – October 2003
- Wind turbines August 2003 – March 2004
- Offshore cable works September 2003 – December 2003
- First power generation November 2003

### Description of Construction Methods

The construction methods used at North Hoyle, together with a description of those issues which impacted on the original programme schedule, are set out below

- Construction of foundations;

30 Tubular steel piles (monopiles) were fabricated in Holland by Smulders BV and transported to Port of Mostyn by barge in groups of 4. Foundations were designed by LIC engineering and the design is certified by Germanisher Lloyd. After delivery monopiles were temporarily stored in a compound at Mostyn. Steel stoppers were then fitted to both ends of the monopiles which were then floated to site and lifted to the exact final position by the installation barge Excalibur. The pile was then installed into the sea-bed by a combined drive - drill - technique. The pile was initially driven through upper sand and clay layers, then a hole was drilled into the underlying rock layers and the pile finally driven into this hole. After the pile was installed the transition piece was landed and grouted in place from the jack up vessel the Wind. The J-tubes for protection of power cables and turbine access ladders were then installed on hangars and bolted into place from the barge Forth Guardsmen.

- Erection of towers

The towers and nacelles were delivered to Port of Mostyn by barge from the fabrication yard at Cambletown in the West of Scotland. Towers were lifted onto the transition pieces then bolted into place. The first 27 towers were installed by the MEB JB1 and Seacore Excalibur vessels, with the final three towers being installed by the Mayflower Resolution.

- Installation of nacelles

Nacelles were assembled in Cambletown and delivered to Port of Mostyn by barge and road. Final assembly and checking of the nacelle were completed in Mostyn. Nacelles were then delivered to site by barge and lifted into position by the construction jack-up vessels. Nacelles were then bolted into place on top of the

towers. Delays of varying degrees to nacelle installation were caused by ground conditions, weather conditions (preventing lifts) and also storm damage to one of the construction vessels.

- Fixing of blades to hubs

Nacelles were installed on the towers in a “bunny-ears” configuration, with two blades attached. The third blade of each machine was bolted onto the hub of the nacelle after the nacelle was in position on top of the tower. Some delays to blade installation were caused by high wind speeds preventing safe lifting.

- Power cable installation and connection.

Power cables were installed by two different methods offshore. The interarray cables were installed by a new remotely operated vessel, the LBT1. The inter-array cables were wound directly onto a drum on the LBT1 and were unrolled into a trench cut by the vessel on the seabed. Some programme delay was experienced due to the late arrival of the LBT1 from the fabrication yard in Middlesborough.

The beach to wind farm cables (the export cables) were installed by a new plough constructed in Newcastle which arrived on site on time. The plough was towed behind the vessel the Pontra Maris and the cable was dragged into the trench behind the plough.

The export cables were connected to land based cables installed into buried ducts in Rhyl, connecting through to the substation and the grid at the Manweb compound next to the technical college in Rhyl.

- Installation vessel issues

It was originally intended for the Mayflower Resolution to install all monopiles, towers and nacelles at North Hoyle and also support the installation of inter-array cables by the LBT1. This brand new and purpose-designed vessel experienced a substantial delay in delivery from the shipyard. This impacted on the North Hoyle build programme in various ways, however major delays were avoided by procuring and adapting existing construction vessels (MEB-JB1 and Seacore Excalibur) to undertake the work originally intended to be undertaken by the Resolution

## WIND FARM ANNUAL OPERATIONAL INFORMATION

### PERFORMANCE REPORTING

#### 1. Availability (%)

Wind farm availability inclusive of scheduled service and DNO downtime (%)													
WTG	Jul 04	Aug 04	Sep 04	Oct 04	Nov 04	Dec 04	Jan 05	Feb 05	Mar 05	Apr 05	May 05	Jun 05	Overall
Overall	88%	79%	72%	63%	78%	91%	81%	90%	90%	91%	94%	89%	84%

Total Budgeted Availability	90%
-----------------------------	-----

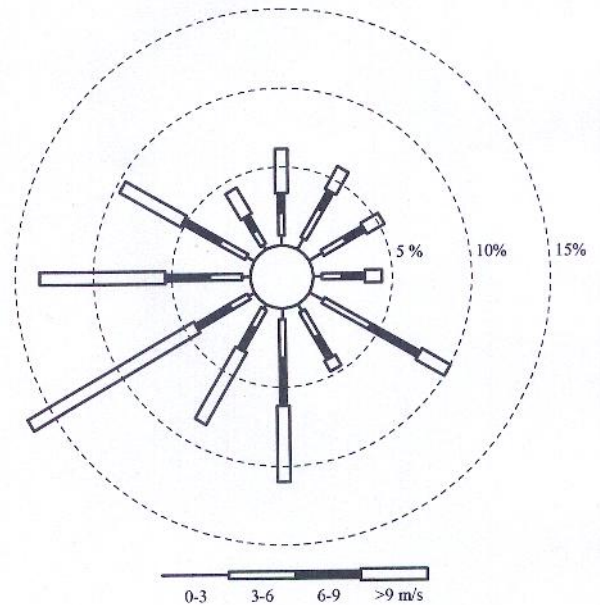
Causes of non-availability are described in the Operational Issues section and summarised statistically in the adjacent table

Downtime owing to:		%
Turbine		67%
Construction activities		12%
Scheduled maintenance		5%
Weather / Accessibility		17%

#### Wind speed (m/s) and wind rose

	Mean wind speed at 67 m <sup>1</sup> (m/s)	Gust wind speed at 67 m (m/s)
Jul-04	6.8	Insufficient data
Aug-04	6.7	Insufficient data
Sep-04	9.8	Insufficient data
Oct-04	8.7	Insufficient data
Nov-04	9.0	Insufficient data
Dec-04	9.8	Insufficient data
Jan-05	13.0	Insufficient data
Feb-05	9.5	Insufficient data
Mar-05	8.4	30.32
Apr-05	8.0	24.13
May-05	7.7	Insufficient data
Jun-05	6.4	30.93
Overall	8.7	
Budget	9.0	

<sup>1</sup> The site measured data was combined with data synthesised from Rhyl Flats to provide a complete record at 67m amsl.



## 2. Output (MWh)

Wind farm net output (MWh)													
WTG	Jul 04	Aug 04	Sep 04	Oct 04	Nov 04	Dec 04	Jan 05	Feb 05	Mar 05	Apr 05	May 05	Jun 05	Overall
Overall	13,171	11,063	17,187	11,977	15,836	19,609	22,998	18,236	17,342	16,323	16,227	10,783	190,752

Total output at the point of export	188,135
Total budgeted output	194,886*

\* net of contingency for forecast uncertainty

The difference between budget and actual output is due to the combined effect of lower availability and lower wind speeds than expected in the first twelve months of operation, as described in parts 1 and 2. Electrical losses within the wind farm are estimated to be 1.4% and are in line with original expectations.

## 3. Load factor (Capacity factor, %)

Wind farm capacity factor (%)													
WTG	Jul 04	Aug 04	Sep 04	Oct 04	Nov 04	Dec 04	Jan 05	Feb 05	Mar 05	Apr 05	May 05	Jun 05	Overall
Overall	30%	25%	40%	27%	37%	44%	52%	45%	39%	38%	36%	25%	36%

Budgeted capacity factor	37.1%*
--------------------------	--------

\* net of contingency for forecast uncertainty

The difference between budget and actual load factor is also due to the combined effect of lower availability and lower wind speeds than expected in the first twelve months of operation, as described in parts 1 and 2.

## 4. Annual input (MWh, MVA<sub>r</sub>)

Imported power (real)													
	Jul 04	Aug 04	Sep 04	Oct 04	Nov 04	Dec 04	Jan 05	Feb 05	Mar 05	Apr 05	May 05	Jun 05	Overall
MWh	36.4	45.9	19.7	31.4	9.6	15.0	7.0	9.3	14.0	14.4	23.5	36.3	262.5

No specific import power budget was established at the start of the year (this being part of the overall import electricity line item which includes import power, use of systems costs and metering costs) and reactive power statistics are not available (these are not routinely recorded and have not been invoiced by the DNO).



Proactive measures for H&S, with regular reviews and close liaison with the contractor on all H&S matters, are being pursued to reduce likelihood of incidents and accidents.

Below is a summary of Accidents, Incidents & Near Misses

Oct 04	Technician twisted his back removing spares from the service lift within the tower – Riddor reportable
Jan 05	Vestas Operations Manager twisted his ankle coming out of the office - non Lost Time Accident (LTA)
Apr 05	Technician sprained his ankle lifting a large toolbox from the boat – LTA less than three days
May 05	Celtic Wind crewman cut his head on an open window on board the boat – LTA less than three days

### **Environmental**

Environmental monitoring has taken place over the past twelve months and has focussed on the following areas:

- Ornithology
- Benthic Ecology
- Fish & Fisheries
- Marine Mammals
- Sediments
- Physical Processes

A summary of the key findings follows.

### **Ornithology**

Information on the distribution and behaviour of birds has been collected since 2001, therefore data is held for the period prior to the construction of North Hoyle, the construction period and a complete year of the operational period of the wind farm. Data has been collected through a combination of boat-based and aerial survey methods. A range of statistical analysis techniques has been used on the resulting data in order to assess possible avoidance or barrier effects of the wind farm. The results indicate that:

- Common scoter showed strong avoidance of the wind farm area during construction, moved closer to the wind farm during operation but are not currently as close to the wind farm area as they were before construction.
- Red-throated diver show little difference in distribution between the pre and post construction periods however numbers recorded at North Hoyle have always been very low.
- Gannet have been shown to come closer to the wind farm during construction and slightly further away during operation, but again numbers counted are very low.
- Guillemot show little difference in distribution following construction of the wind farm.

- Analysis of the flight heights of key species through the wind farm have indicated a low risk of collision with the turbines.

### **Benthic Ecology**

A combination of grab survey and beam trawls are used to assess any impacts on the benthos and epi-benthos. Although changes have been observed in the number of species and individuals with reductions noted at most sites, there appears to be no uniform pattern for this reduction in taxa and individuals. Rather this has occurred at sites across the entire area, including those within the wind farm and at distant controls. Sites within the wind farm continued to have the highest number of taxa, as in previous years. Overall, there is no substantial evidence to suggest that the biotopes previously identified at North Hoyle from the baseline survey of 2001 have changed.

### **Fish**

Beam trawls are used to assess fish populations within the wind farm area. The array area did not produce good fish catches before construction commenced so it is only possible to detect total avoidance or increases in numbers due to the wind farm. Overall, fish survey results in relation to the wind farm development were highly variable. It is possible at this stage to note that there has been neither a wholesale avoidance of the area or a general increase in demersal fish abundance/diversity at benthic habitats within the array area. Gadoid species (poor cod and whiting) may be less readily captured within the array area now that they appear to be congregating around monopile structures.

Contact has been maintained with the local fishing industry through the project fisheries liaison officer. In all, 30 individual fishermen or fishing organisation representatives contributed to the consultation exercise, plus three of the local fishery regulators. Results of this consultation suggest that during the latter stages of the North Hoyle construction phase (spring 2004), and possibly throughout the summer/autumn of 2004 it appears that fish distributions or behaviour were affected in some way that resulted in poor catches. Initially, this appeared to continue into 2005 but from spring 2005 the general impression is that fishing in close proximity to the North Hoyle wind farm has picked up and is not significantly different from how it was immediately before construction work began. Although formal records have not been kept, the angling charter boat skippers take a keen interest in the range of species taken by their clients as this influences subsequent bookings. They are satisfied that the variety of species and size of fish is sufficient to meet their clients' expectations and ensure further bookings.

### **Marine Mammals**

The environmental assessment identified that the only cetacean species seen with any regularity in Liverpool Bay and the local area is the harbour porpoise (*Phocoena phocoena*). Due to the fact that numbers of this species are low in Liverpool Bay, and that it was considered unlikely to be significantly affected by the construction, operation or decommissioning of the North Hoyle offshore wind farm, no specific on-site monitoring for cetaceans has been included in the environmental monitoring.

For cetaceans, liaison with the Sea Watch Foundation has been maintained to monitor cetacean sightings in Liverpool Bay and the local area through the National Cetaceans Sightings Database. Investigation of the Sea Watch Foundation cetacean sightings database suggests that there is no evidence that the construction and operation of North Hoyle offshore wind farm has had any adverse impact on populations of cetaceans, especially the most commonly occurring species, harbour porpoise, in Liverpool Bay.

### **Sediments**

The sea bed within and around the North Hoyle wind farm is considered to be composed of fine and medium sands with varying amounts of coarser material. Eastwards from the array towards the mouth of the Dee estuary sediments are sandier and coarser areas are found further offshore and to the west of the development.

An initial baseline benthic survey for the North Hoyle wind farm location and its surrounding sublittoral environment was undertaken during August 2001. The baseline survey and subsequent annual monitoring during 2003, 2004 and 2005 have covered subtidal benthic ecology and marine sediments in order to assess any impacts of the construction and operation of the wind farm.

Surveys have found the sea bed in the area of the wind farm itself to be highly variable over even quite short distances, but consisting largely of sand and sandy gravels with varying amounts of stone and minor clay/silt content, depending upon location.

There is no evidence that the distribution of drill cuttings arising from the construction process over the sea bed has acted to increase the coarseness of the sea bed sediments at the wind farm site and most of the wind farm sample sites had the same sediment classification in 2003 as in 2002 (prior to any construction activity).

### **Physical Processes**

A number of geophysical surveys have been carried out since the construction of the wind farm, including high resolution swath bathymetry surveys around each monopile and a side-scan sonar survey of the whole wind farm array area.

The results of these surveys show that there has been no overall change in sea bed levels as a result of the construction and operation of the wind farm. The high resolution swath bathymetry surveys of the area around each monopile have shown that minimal amounts of scour (well within the levels predicted in the environmental statement) have occurred since construction.

### **Summary**

The results of the monitoring programme this year show that the wind farm has not had any significant adverse effects on the environment, with all results largely as predicted in the environmental statement for the project. The monitoring programme

is due to continue until 2007 and additional data will give further reassurance that no impacts are occurring.

### **Public relations**

In November 2003, npower renewables celebrated the first official generation from North Hoyle with launch events at the Science Museum in London, with Guest of Honour, the then Energy Minister Stephen Timms, and at the Town Hall in Rhyl, hosted by local MP Chris Ruane. At both venues guests listened to a congratulatory speech from the Prime Minister Tony Blair who praised the North Hoyle project stating "...this first large-scale offshore wind farm venture is a highly significant step toward achieving Britain's renewables goal."

During construction of the North Hoyle wind farm, npower renewables, in partnership with education specialists CREATE ([www.create.org.uk](http://www.create.org.uk)) undertook an education programme with primary and secondary schools in Rhyl and Prestatyn. This involved CREATE going into schools to educate young people about climate change, energy efficiency and renewable energy, topics which are covered as part of the National Curriculum. Pupils at the junior schools were also invited to take part in an art competition to have one of the thirty wind turbines at North Hoyle named after them. The winning children, with their teachers and families attended a prize-giving ceremony at Rhyl Town Hall in March 2004.

November 2004 marked a year of clean energy production from North Hoyle, with news issued by npower renewables that public attitude surveys carried out locally before and after construction of the North Hoyle Offshore Wind Farm showed a rise in residents' support for the project from 62% to 73% now the wind farm is in place. Only 5% of residents oppose the scheme.

The results also revealed that the majority of residents (67%) believe there to be no effect on the number of visitors to the area and more people believe that there has been an increase in visitors as opposed to a decrease (11% compared to 4%). 82% of the visitors themselves believe that the wind farm has had no effect on the number of people visiting the area and none of those surveyed opposed the project.

In September 2005, North Hoyle was again making positive headlines with news of the official launch of the North Hoyle Offshore Wind Farm Community Fund. The Fund, set up by npower renewables in partnership with Denbighshire County Council and the Area Partnerships for Rhyl and Prestatyn & Meliden, will pump £60,000 (index-linked) into communities local to North Hoyle every year for the 20 year life of the wind farm to support local community projects.

The launch event also saw the official unveiling of a new support Land Rover for Rhyl RNLI Lifeboat Station, donated by npower renewables.

**This report was prepared by npower Renewables Limited.**  
For further information on the project contact Nigel McManus, Asset Manager,  
[nigel.mcmanus@npower-renewables.com](mailto:nigel.mcmanus@npower-renewables.com) or on 0118 959 2440

For further information on the Capital Grant Scheme contact Mark Thomas at  
[mark.thomas@aeat.co.uk](mailto:mark.thomas@aeat.co.uk) or on Tel 0870 190 6286.