

Case study – North Hoyle offshore wind farm

The North Hoyle offshore wind-farm (OWF) consists of 30 turbines covering an area of approximately 10 km² and is located 4 miles off the North Wales coast, between the towns of Rhyl and Prestatyn.

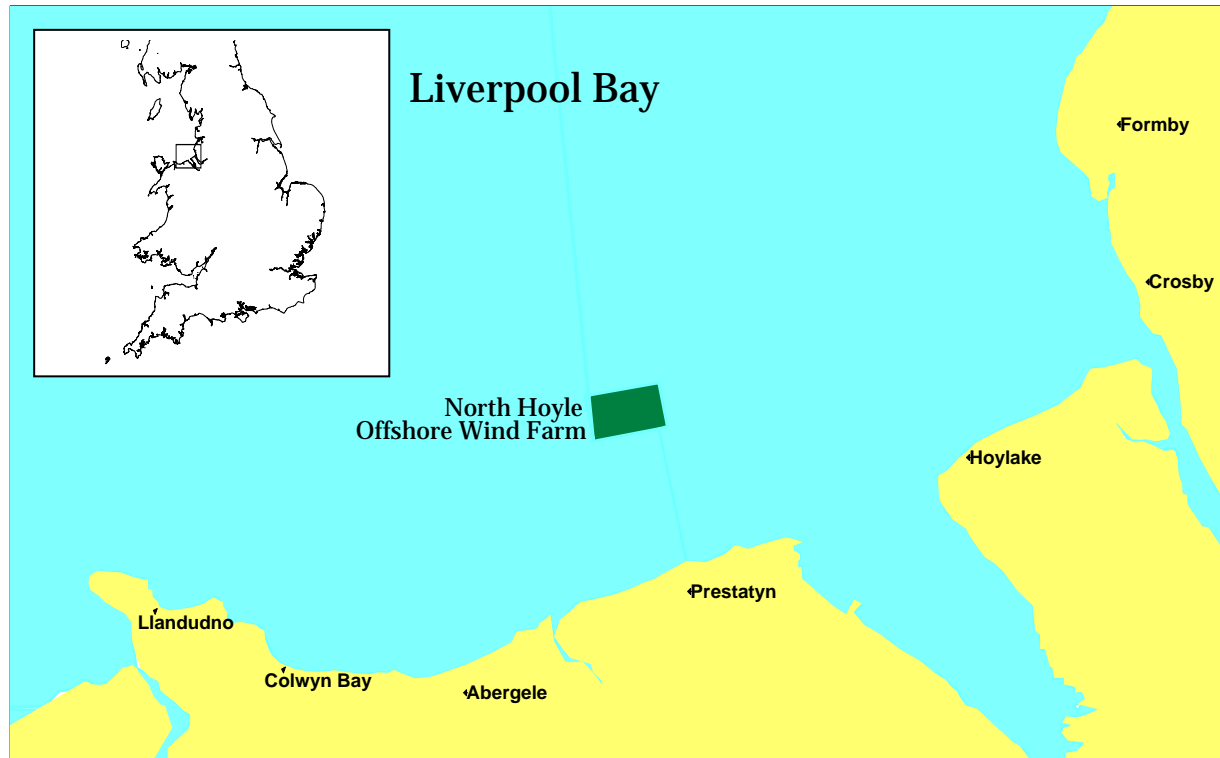


Figure 1. Location of the North Hoyle offshore wind-farm

In an initial site selection process the developer considered options to minimise any potential impacts on the physical, biological and human environments, to identify an area with an appropriate combination of relatively shallow waters, good strong winds and proximity to the national electricity network. Initial site investigations were undertaken in the summer of 1999 with options for the potential development of the North Hoyle site awarded in April 2001.

The United Kingdom has a regulatory regime in place whereby all construction works in the marine environment have to be consented by the United Kingdom's regulators. Wherever necessary an appropriate level of environmental assessment has to be undertaken to support applications to construct and operate offshore developments sufficient for the regulators to reach an informed decision on whether or not to give consent.

The developer, npower Renewables Ltd, sought formal Environmental Impact Assessment (EIA) screening and scoping opinions from the United Kingdom regulators in 2001. Based on the response from the United Kingdom regulators, a stakeholder consultation and the available guidance for the conduct of EIA at offshore wind-farms¹ an EIA was commissioned and undertaken and the developer submitted an Environmental Statement (ES) to the United Kingdom regulators along with the requisite applications for construction and operation consents in February 2002. This ES was based on a combination of historic data sourced for the proposed development area, new environmental surveys and predictive numerical models.

Following a formal consultation on the ES and a dialogue between the regulators, their statutory advisors and the developer to address uncertainties and omissions in the ES, the United Kingdom's regulators decided, that if certain conditions were applied, the potential for this development to have an adverse impact on the local environment was low, and as such they issued the consents for npower Renewables Ltd to construct and operate the North Hoyle OWF in October 2002.

Construction started in April 2003 and was completed in December 2003:

	Start	Finish
- Wind turbine foundations:	April 2003	July 2003
- Transition pieces:	July 2003	August 2003
- Export cables:	August 2003	October 2003
- Wind turbines:	August 2003	March 2004
- Intra array cabling:	September 2003	December 2003
- First power generation:	November 2003	

The consents to construct the North Hoyle OWF included a number of conditions to reduce the potential for the construction and operation of the offshore wind-farm to have an adverse environmental impact. The review of the ES by the UK regulators, their advisors and the output from the consultation also identified specific areas where environmental monitoring should be undertaken. The main premise of the environmental monitoring was to test the predictions made in the ES. All of the licence conditions and monitoring requirements are legally binding and non-compliance by the developer would result in legal action and penalties.

Licence conditions – examples of monitoring

Suspended sediments

Movement of suspended sediments through the North Hoyle site is in a south-easterly direction. Predictions in the ES were that the release of suspended sediments from the construction of the North Hoyle OWF would be at concentrations of up to 10-15 mg³ the measured background levels of suspended concentrations to the south-east of the development of 200 mg (a maximum increase of 7.5%). In order to test this prediction a condition of the licence was to the measurement of suspended sediment concentrations before, during and after construction. The results of these measurements showed comparable baseline measurements within and to the south-east of the OWF. Whilst a few measurements exceeded the typical background levels, the majority of measurements at the North Hoyle site during construction were within the tolerances identified in the ES. From these results it was concluded that there was no overall detectable increase in suspended sediment load due to construction works at the North Hoyle OWF. It was also recommended that the need and scope of any monitoring at other offshore wind-farms should be on a site-specific basis and only needs to address the construction phase (and potentially any maintenance works that could disturb seabed sediments).

Seabed morphology and scour

Predictions in the ES were that scour pits could form around the bases of monopile foundations of up to 6 m depth, with side slopes of 25-30° and scour hole diameters of 24-40 m. The available evidence suggested that changes to ambient bed conditions would occur within 6 to 10 diameters around the support structure to a depth of 1.4 diameters. As such it was predicted that there would be no interaction between the foundations as they were at a spacing of more than 40 m between foundations. The construction licence required the developer to investigate scouring via a sequence of bathymetric surveys to be undertaken around a subset of adjacent foundation pieces (minimum of 4) to assess the changes in bathymetry within the array. These surveys were undertaken at 6 monthly

intervals for 3 years after construction was completed. The need and extent for any scour protection should be assessed on the basis of the outputs from these studies. Swathe bathymetry surveys in one hundred metre square boxes were undertaken around all 30 foundations between 2004 and 2007 at the site. The results showed that due to the local sedimentary conditions at this location the maximum scour depth recorded was 0.5 m although the overall dimensions of the scour holes were unclear. Rock scour protection was placed around the exposed cables at the J-tubes between July and October 2004. To date, no long-term scour is developing at the North Hoyle Offshore Wind Farm. It is possible to conclude from these investigations that the environmental implications of the regional sediment transport regime at the North Hoyle site are negligible, as no distinct scour pits have developed. Placement of rock around the J-tubes has generally remained *in situ* with potential movement occurring at only 3 locations.

Benthic organisms

The ES predicted that loss of seabed habitat would be small at 0.02 km² (based on thirty, 4 m diameter piles each with 30 m of scour protection). As such a minor and localised impact on benthos was predicted. The faunal assemblage observed at the North Hoyle site is widespread and common throughout Liverpool Bay with the recovery of benthic communities from disturbance predicted to be rapid. Conditions attached to the construction licence required monitoring of the local seabed habitats before, during and after construction. These investigations identified a total of 13 326 individuals from 190 taxa. The surveys between 2002 and 2004 indicated a general decline in invertebrate numbers and abundance across the development area, but this trend was observed both within the array and at several control sites outside. The 2005 survey revealed an increase in invertebrate numbers, both within the wind-farm array and in the surrounding area. Invertebrate numbers were in some cases the highest recorded in the monitoring campaign. In general, it appears that the samples from 2002 (pre-development) and 2005 are actually more similar than other paired samples in many cases. Video surveys of 6 of the foundations and the meteorological mast were undertaken in 2004 and showed that pioneering / 'fouling' organisms predominated (*Jassa falcata*, barnacles, mussels).

It was concluded from these investigations that there was no evidence to suggest that the biotopes previously identified in the 2001 and subsequent surveys have changed following construction of the North Hoyle offshore wind-farm. Some reduction has been observed in the number of species and individuals but there is no uniform pattern for this reduction. The observed changes have occurred at sites across the entire area, including those within the OWF and the controls. Sites within the OWF continued to have the highest number of taxa. The absence of any identifiable trend in sediment particle size characteristics associated with construction of the offshore wind-farm suggests that North Hoyle has not, to date, affected benthic invertebrate communities through this mechanism other than at a very localised scale due to the physical presence of the monopile foundations or, potentially, very localised effects of scour or scour protection within 50 m of turbines in areas that are not routinely sampled.

Fish aggregation device

The ES included the prediction that fish tend to aggregate around objects placed in the sea, but that such attractions to 'artificial reefs' were poorly understood. Different species have different affinities to submarine structures. The ES stated that it was not possible to predict the extent to which local distribution and abundance of fish would be affected but the balance of probability was that more fish would seek shelter than would be present outside the wind-farm. To investigate this assertion the construction licence required surveys of fish abundance and distribution in the vicinity of the North Hoyle OWF. During construction (spring 2004) and into summer/autumn 2004 poor catches in the vicinity of the OWF indicated that fish distribution and behaviour were affected in some way. From

spring 2005 the general impression was that fish distribution and abundance and fishing activities were not significantly different from how it was immediately before construction work began. Data from 2005 indicated that although the catch rates of most fishes in the North Hoyle area decreased slightly from 2004 values, the data were broadly comparable to previous years for most species, and were within the range observed in preceding years.

¹ Offshore Wind-farms – Guidance note for Environmental Impact Assessment in respect of FEPA/CPA requirements, Version 2 – June 2004

Sources of information:

- North Hoyle Offshore Wind Farm - Baseline Monitoring Report (June 2003)
- North Hoyle Offshore Wind Farm - Annual FEPA Monitoring Report (June 2005)
- North Hoyle Offshore Wind Farm - Annual FEPA Monitoring Report (February 2006)
- North Hoyle Offshore Wind Farm - Annual FEPA Monitoring Report (March 2007)

↪ *Go to full QSR assessment report on the environmental impact of offshore wind farms (publication number 385/2008)*