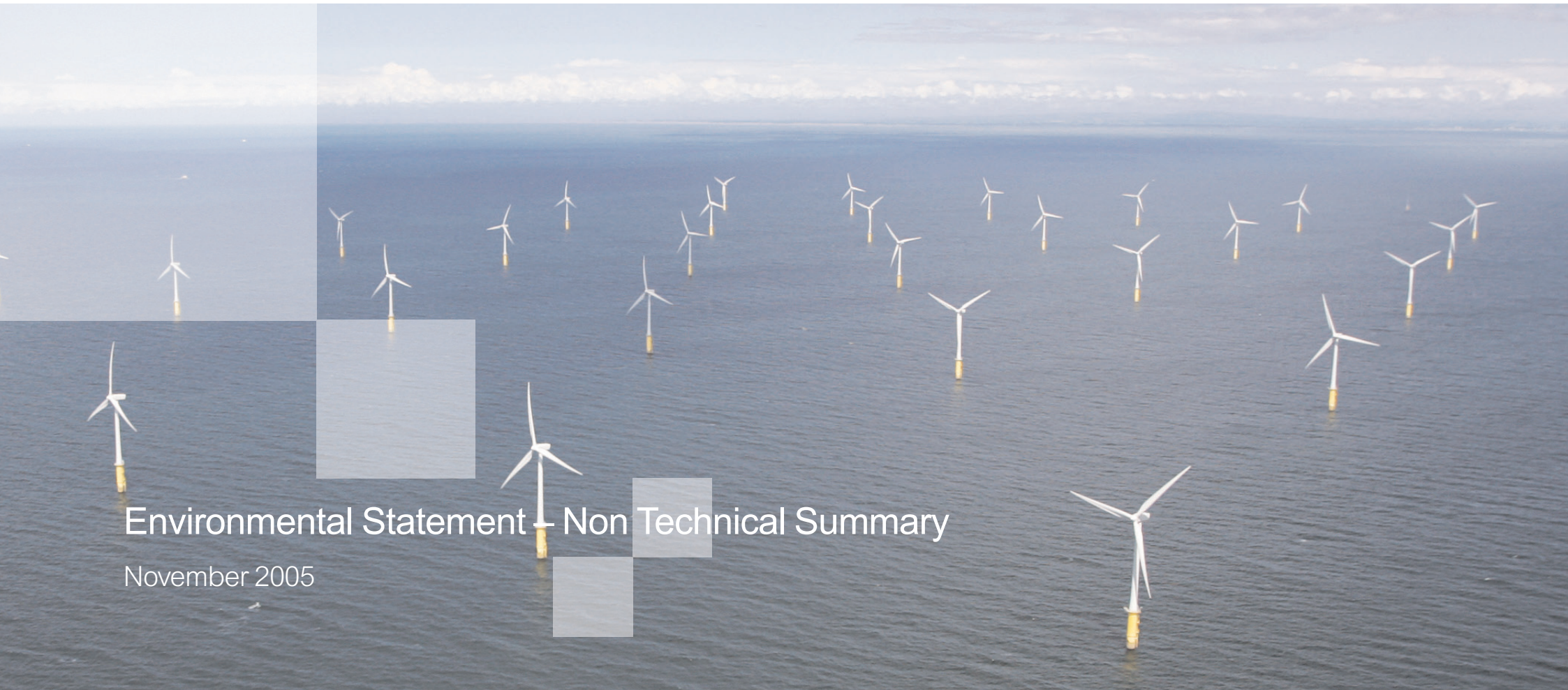


# Gwynt y Môr Offshore Wind Farm

Environmental Statement – Non Technical Summary

November 2005







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# Gwynt y Môr Offshore Wind Farm

## Introduction

Gwynt y Môr Offshore Wind Farm Limited is proposing the development of an offshore wind farm of up to 750 MW (megawatts, where 1 MW = 1,000 kW) to be known as the Gwynt y Môr Offshore Wind Farm. The wind farm would be located approximately 13 to 15 km off the coast of North Wales. Npower Renewables Limited (hereafter referred to as npower renewables) is acting as agent for the project developer, Gwynt y Môr Offshore Wind Farm Ltd. npower renewables was allocated the development rights for the Gwynt y Môr project as part of the Crown Estate's second Round of UK offshore wind farm development (Round 2).

Gwynt y Môr would provide a significant source of clean, renewable electricity, and would make a major contribution towards meeting the UK Government's targets for generating 10% of UK electricity demand from renewable sources by 2010, and 15% by 2015. It is anticipated that Gwynt y Môr could offset around 2 million tonnes of carbon dioxide emissions per year when compared with electricity that might otherwise be generated from a coal-fired power station ([www.bwea.com](http://www.bwea.com)).

## Purpose of this document

This document is the non-technical summary (NTS) of the Environmental Statement (ES) for the project. The project has been the subject of Environmental Impact Assessment in line with current regulations in order to identify and assess all significant environmental effects of the development. A description of the project proposals, together with the conclusions of the impact assessment, are set out in the ES. This non-technical summary provides a

summary of the ES for the non-specialist reader, and forms part of the ES. The full ES is available for public viewing at a number of locations and is also available to members of the public in both electronic and hard-copy form, both as set out at the end of this NTS.

The Environmental Statement provides detailed information on both the offshore and onshore elements of the project. This includes a description of the project proposals and a comprehensive description of the environment of the project area. The document covers the entire life of the project, including design, construction, operation and decommissioning. The potential positive and adverse environmental impacts are assessed in relation to the existing physical, biological and human environments and, where appropriate, mitigation measures and monitoring requirements have been set out.

## Background to the proposal

In 2002, the Department for Trade and Industry (DTI) identified three 'strategic areas' around the UK coastline within which the second round of offshore wind farms could be developed. Gwynt y Môr lies within the North West Strategic Area and is the only Round 2 project in Welsh waters.

The proposed Gwynt y Môr Offshore Wind Farm (Welsh for "Wind of the Sea"), would be located approximately 13 to 15 km off the North Wales coast. The project area extends from Penrhyn Bay in the west to Prestatyn in the east, and lies approximately 18 km from the coast of the Wirral (see Figure 1). The Gwynt y Môr project covers an area of around 124 km<sup>2</sup> with water depths of between 12 m and 34 m at low water (LAT, Lowest Astronomical Tide).



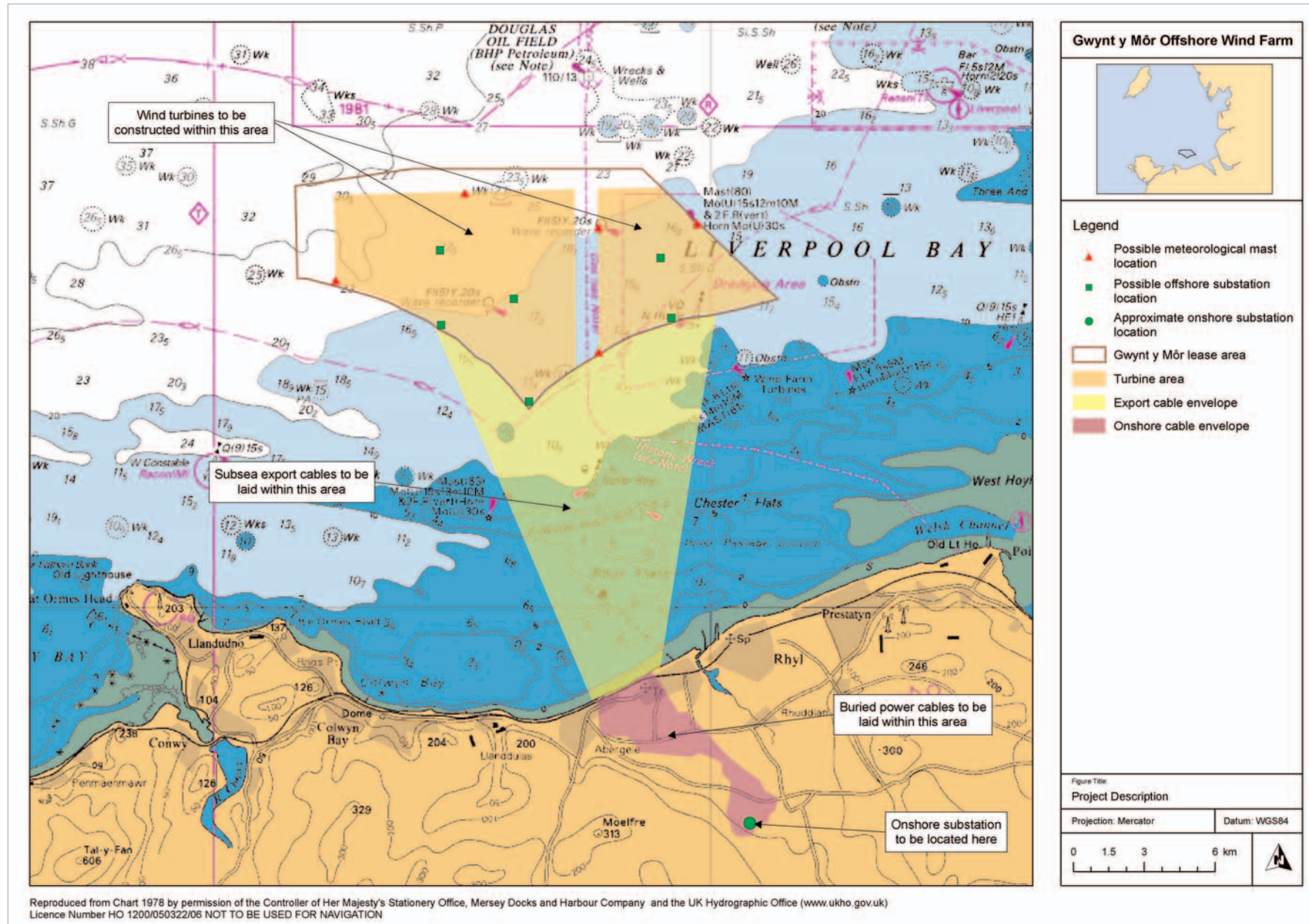


Figure 1 Project overview of Gwynt y Môr Offshore Wind Farm

The Gwynt y Môr proposal covers the installation and operation of between 150 and 250 offshore wind turbines, to a maximum capacity of 750 MWe. In addition to the wind turbines, between 2 and 4 offshore substations will be required to convert the electricity generated into a voltage suitable for transmission to shore. The proposal also includes between 3 and 5 offshore meteorological masts, which are required to monitor the meteorological and oceanographic conditions at the site (see Figure 1).

A network of undersea power cables will transmit the power between the wind turbines and the offshore substations. To transmit the power ashore, between 3 and 6 undersea power export cables will run from the offshore substations to a landfall point on the coast between Abergele and Kinmel Bay in North Wales. Buried onshore cables will then complete the link to the onshore substation, located to the south of the St Asaph Business Park.

Once completed, Gwynt y Môr could generate enough electricity to supply approximately 500,000 homes, equivalent to over 40% of all Welsh households or approximately 2% of all UK households (www.statistics.gov.uk; Digest of UK Energy Statistics, 2005).

Subject to obtaining the necessary permissions, the wind farm would be built between 2008 and 2010/2011. npower renewables has been awarded a 50 year lease for operation of the site from the owner of the seabed, The Crown Estate.

Gwynt y Môr would provide a significant source of clean, renewable electricity, and would make a major contribution towards meeting the UK Government's targets for generating 10% of UK electricity demand from renewable sources by 2010, and 15% by 2015. It is anticipated that Gwynt y Môr could offset around 2 million tonnes of carbon dioxide emissions per year when compared with electricity that might otherwise be generated from a coal-fired power station (www.bwea.com).

## The need for Gwynt y Môr

The need for renewable energy projects such as Gwynt y Môr is being driven primarily by the need to combat the effects of climate change, brought about by the effects of greenhouse gas emissions (such as carbon dioxide), which are leading to global warming.

The international community's collective response to climate change is embodied in the United Nations Framework Convention on Climate Change. Established at the 1992 UN Conference on Environment and Development, which was held in Rio, the Convention sets out an overall framework for intergovernmental efforts to tackle the challenge posed by climate change. Following on from the 1992 convention, the 'Kyoto Protocol' was adopted by the member states in 1997, and ultimately became legally binding in February 2005 following ratification by Russia. This Protocol sets targets and timetables for reducing greenhouse gas emissions from developed countries, with the initial, legally-binding commitments on reductions due by 2008–2012.

The Commitment for the European Union as a whole is to reduce emissions by 8% by 2012, and then by a further 1% per year from 2012 to 2020, with a long-term goal of a 70% reduction on 1990 levels (European Commission, 2002).

In March 2000, the UK Government launched its draft Climate Change programme. This programme is designed to meet the UK's commitments under the Kyoto Protocol to cut greenhouse gases by 12.5% by 2008–2012 with a cut in CO<sub>2</sub> of 20% by 2010, relative to the 1990 baseline levels. In seeking to achieve these targets and reverse the trends of climate change, the UK Government is committed to supplying 10% of its electricity from renewable sources by 2010, and 15% by 2015 with an aim of supplying 20% of all electricity from renewable sources by 2020.

Welsh planning policy similarly reflects the aspirations of central UK Government, with a key Welsh policy objective being:

*'to promote the generation and use of energy from renewable sources and energy efficiency, especially as a means of reducing the effects of climate change'*

On a more local level, the Denbighshire County Council Unitary Development Plan contains a policy relating specifically to meeting the UK's targets for renewable energy development.

Government policy has clearly and consistently highlighted the vital role of wind energy as a key source of renewable energy in helping to meet these targets and in particular the role that offshore wind farms are expected to play in providing the required renewable energy capacity. Diversification of the UK energy supply through the development of renewable sources, such as offshore wind farms, can bring additional benefits in terms of the security of energy supply and could provide a basis for the development of new industries.

## Outline of the Gwynt y Môr proposals

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### The project

The Round 2 process was initiated following a Strategic Environmental Assessment (SEA), carried out by the DTI in 2003. The SEA assessed the three strategic areas in terms of the biological, physical and human environments, and proposed the capacity of each area for offshore wind farm development on a strategic basis.

In 2001 npower renewables began a programme of site selection and evaluation in anticipation of the Round 2 process. A wide range of studies were undertaken to identify a suitable location for the development of a Round 2 project. Building on the knowledge and experience gained through the development and construction of North Hoyle, the area around North Wales was a key search region. This process ensured that the site was selected based on an evaluation of environmental, technical and commercial considerations.

A range of constraints were identified which had to be considered in developing the boundaries of the proposed Gwynt y Môr project area, including navigation, dredging activity, MoD interests, visual constraints, oil and gas operations, wildlife habitats and a number of other environmental factors.

Following the production of the DTI's Strategic Environmental Assessment Environment Report, a precautionary exclusion zone, extending between 8 and 13 kilometres from the coast was announced, where no offshore wind farm projects could be tendered. This exclusion zone was intended to avoid development in potentially sensitive inshore areas and to reduce the potential visual effects of Round 2 projects.

Consideration of the various constraints, supported by a programme of consultation, led to the finalisation of the Gwynt y Môr project boundary. The proposed development area was selected in order to minimise potential environmental effects, and has the following key attributes:

- good wind resource
- relatively shallow water across the wind farm area
- existing national electricity network relatively close to the coast, with available capacity
- suitable ports for construction and operation in the region
- good seabed properties for foundations and subsea cable installation.

The preliminary layouts of the wind farm were subsequently determined following consideration of the following key criteria:

- wind speed characteristics
- electrical layout
- safety of navigation
- seascape and visual issues
- dredging and MoD radar areas
- site constraints
- technical requirements for wind turbine generators.

### *Offshore cable route*

Electricity cables will be needed to link the wind turbines to the offshore substations and to bring the power to shore. A number of options for cable landfall locations have been investigated during the development process, considering both environmental and engineering requirements. These options included three sites between Rhos Point and Point of Ayr, two areas in the Dee Estuary, and one site on Anglesey. The option of routing the offshore cables along the Dee Estuary was ruled out on both environmental and engineering grounds, and engineering factors eliminated the option of a landfall point near Wylfa power station on Anglesey.

After further consideration it was determined that a landfall point on the North Wales coast between Kinmel Bay and Pensarn Beach offered the best options when considering the full range of requirements.

### *Onshore cable route and substation*

Three possible locations for connecting to the main grid transmission line were initially identified for further evaluation, with due regard to the necessary engineering requirements and environmental constraints. Potential locations for the onshore substation were then identified following both desk-based assessments of engineering and environmental parameters, and site walkovers. These alternative locations were assessed with the aim of minimising the potential environmental effects associated with the proposed works, and in particular to minimise the use of overhead lines, thereby mitigating potential visual impacts.

These studies have identified a location to the south of the St Asaph Business Park as an appropriate location for substation development for the following key reasons:

- good existing road access
- adjacent to existing development
- relatively unconstrained environmentally
- close to the existing 400 kV electricity transmission line, minimising the need for associated overhead transmission lines.

The power cables between the proposed landfall site and the proposed onshore substation will be buried. The selection of buried cabling by npower renewables thereby avoids the need for over 9 km of overhead electricity transmission lines running across the coastal plain. The selection of buried cabling is considered to substantially mitigate against potentially adverse visual impacts that might otherwise occur.

### **The Environmental Impact Assessment**

A detailed Environmental Impact Assessment (EIA) process has been completed for Gwynt y Môr. EIA for offshore wind farms is a requirement necessitated by the EIA Directive as applied to the Electricity Act.

The findings of the EIA process, presented in the main Environmental Statement and summarised in this non-technical summary, seek to present a detailed description of the likely environmental costs and benefits of the Gwynt y Môr project, thereby allowing Government and stakeholders to make an informed judgement in considering the proposed development.

The Gwynt y Môr EIA has been conducted using the turbine dimensions and layouts (shown in Figures 2 to 4), summarised in greater detail below. The use of these layouts has allowed the completion of the EIA process based on the assessment of a ‘worst realistic case’ within which the final design of the project will lie. This process defines the ‘envelope of effects’ and allows a precautionary assessment to be completed whilst maintaining the necessary flexibility for the final design and procurement process.

### **Consent requirements**

In order to carry out an offshore wind farm development such as Gwynt y Môr, a developer is required to obtain a number of licences or consents.



The consents, permissions and licences required for Gwynt y Môr are listed below.

Section 36 Consent	Section 36 of the Electricity Act 1989	Department of Trade and Industry
Section 37 Consent	Section 37 of the Electricity Act 1989 (To be progressed by NGT)	Department of Trade and Industry
FEPA licences	Food and Environment Protection Act 1985	National Assembly for Wales (administered by MCEU)
CPA Consent	Section 34 of the Coast Protection Act 1949	Marine Consents and Environment Unit
Planning Permission	Town and Country Planning Act 1990 (TCPA)	Denbighshire County Council and Conwy County Borough Council

An application will also be made for safety zones around the offshore structures of Gwynt y Môr. npower renewables also intends to apply to extinguish rights to navigation at the location of the offshore structures, as permitted under the provisions of the Energy Act 2004.

Other statutory permissions and licences that may be required for the development include:

- a licence from the Environment Agency under the Water Resources Act 1991 (Section 109)
- a licence from the Environment Agency under the Land Drainage Act 1991.

Consent for the onshore substation and the associated cable end sealing compound will be covered by applications under The Town and Country Planning Act to the relevant local authorities. These will also be submitted by npower renewables.

The short length of overhead cabling works between the onshore substation and the existing overhead line will require a Section 37 consent under the Electricity Act. National Grid Transco will be responsible for consenting these overhead lines and an application will be made by NGT in due course.

## Gwynt y Môr project details

### *Principal components*

The principal components of the Gwynt y Môr Offshore Wind Farm will include:

- up to 250 wind turbines and towers
- up to 4 offshore substations
- power cables between the turbines, between turbines and offshore substations, and from the substations to the shore
- pipeline crossings
- up to 5 meteorological masts (one is already in place)
- scour protection (where appropriate)
- onshore cabling and associated works
- onshore substation and associated works.

### *Turbine layout scenarios*

Rapid technological development in wind turbine technology means that it is difficult at this stage to determine the generating capacity of the individual turbines that will be installed at Gwynt y Môr. It is anticipated that turbines with a rated capacity in the range of 3 MW to 5 MW class will be commercially available at the time of construction. npower renewables has therefore developed three scenarios in terms of the likely minimum and maximum capacities and dimensions of turbines (see Figures 2 to 4). These layouts have allowed for an assessment of the full range of both size and number of turbines as a basis for the EIA and consenting process. These scenarios are intended to provide a realistic range within which the final project designs will fall, thereby allowing the realistic worst case EIA to be developed. The layout scenarios, although providing a realistic 'envelope' for the purpose of EIA, are unlikely to correspond precisely with the final detailed project design. For the purposes of this EIA, a 'worst case' envelope has been assessed.



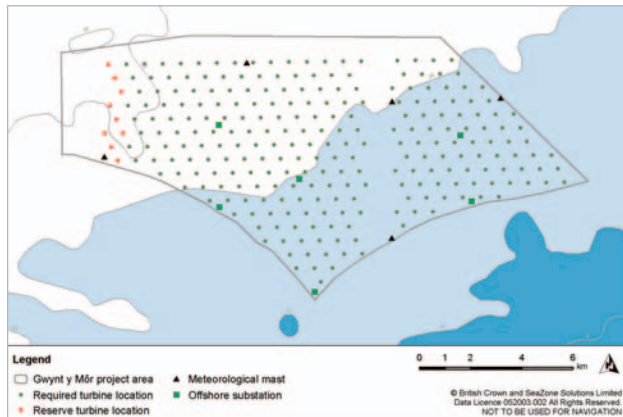


Figure 2 Gwynt y Môr turbine layout scenario 1

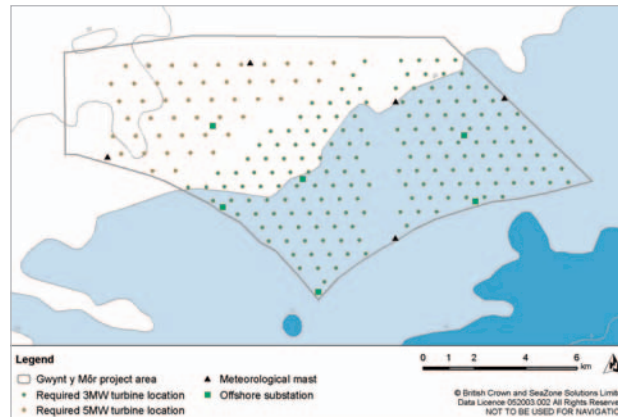


Figure 3 Gwynt y Môr turbine layout scenario 2

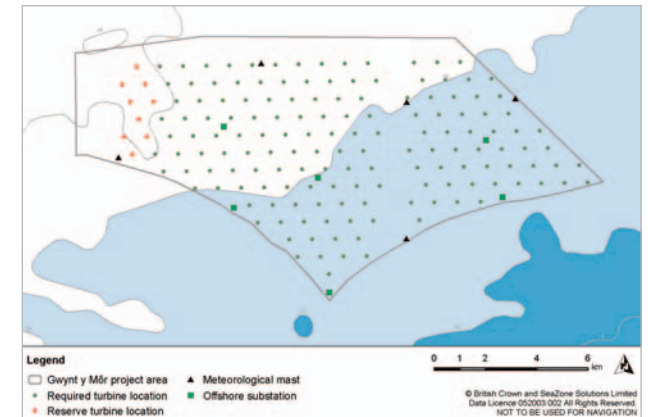


Figure 4 Gwynt y Môr turbine layout scenario 3

The three turbine scenarios used as a basis for the EIA process are summarised in the following table:

	Layout Scenario 1	Layout Scenario 2	Layout Scenario 3
MW Generation	750 MW	750 MW	750 MW
Turbine Rating	3 MW Class	Combined 3 MW and 5 MW Classes	5 MW Class
Number of turbines	250	172 and 47 (219 total)	150

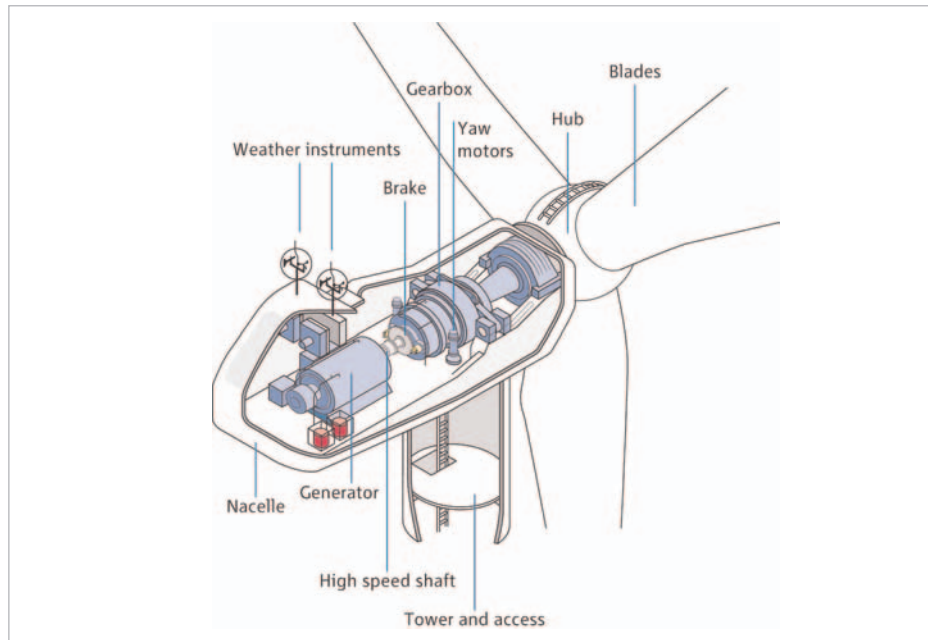
Table 1 Summary of the Gwynt y Môr turbine layout scenarios

### Foundations

The final selection and design of the foundations, upon which the turbines will be installed, will take place as part of the final project design and procurement process. Four possible types of foundation are being considered:

- monopiles - welded steel tubular sections which are driven vertically into the seabed
- multipiles – a support structure consisting of a large vertical steel tubular located centrally under the main turbine tower, supported by a three-leg frame of smaller steel tubulars
- gravity base – a large diameter steel or concrete base which sits on the seabed to support the turbine tower
- suction caisson – similar to the gravity base, but is smaller in diameter with perimeter skirts that penetrate further into the seabed.

The foundations would be pre-fabricated onshore and transported to the site. Installation would be carried out by either a purpose-designed floating vessel, or a jack-up (a ship or barge that can be stabilised by raising itself up on legs), and is expected to take up to a week per turbine.



**Figure 5** Components of a typical wind turbine

### **Turbines**

The turbine hub height will be between 75.5 m and 98 m above LAT, with a maximum blade tip height of 165 m. The minimum distance between the blade tip and sea level (at Mean High Water Springs) will be 22 metres. Turbines will be arranged in straight lines, and widely spaced to ensure that each has clear wind. The exact spacing required between turbines depends on the size of turbine selected, with larger turbines requiring more space between them. However, the minimum distance between turbines will be 350 m with an approximate maximum of 1000 m.

The wind turbines installed at Gwynt y Môr will be of a modern, quiet design. They will incorporate three rotor blades attached to a nacelle housing,

containing the generator, gearbox, and other operating equipment (see Figure 5). The nacelles will be mounted on top of tubular steel support towers. The colour of the towers will be confirmed following consultation and agreement with the regulatory authorities, but it is likely that the upper sections will be a low-visibility grey, and the lower sections yellow to aid visibility to shipping.

Following foundation installation, turbine installation would take place either from a jack-up or floating vessel. It is likely that the tower would be transported in sections and then lifted into place. This would be followed by the nacelle and rotor assembly (see Figure 6). Turbine installation is expected to take approximately 3 days per turbine.

### **Meteorological masts**

In order to monitor and control the wind farm, up to 5 meteorological masts will be constructed. These masts will collect meteorological and oceanographic information (most importantly wind data) and are required for the efficient design and control of the wind farm.

These masts will be up to 100 m tall and will have foundations similar to those described for the turbines themselves (although somewhat smaller). These foundations will be installed using a similar methodology to that used for the wind turbines. Above the foundations, the masts will consist of tall lattice towers. These are likely to be fabricated ashore, and transported to the site and installed using a floating or jack-up vessel.

### **Offshore substations**

The offshore substations will comprise a support structure and associated foundations very similar to those used for the wind turbines. This support base will carry a topside structure housing the required electrical equipment. The topside structure is likely to be assembled at the construction port facility and loaded onto a heavy-lift vessel, which will subsequently lift the topside onto the



Figure 6 Installation of turbine nacelle using a jack-up barge

support structure. Installation of each of the offshore substations is anticipated to take up to 17 days.

#### *Undersea connection cables*

A network of undersea cables is required to:

- connect groups of wind turbines together and to connect the groups of turbines to the offshore substations
- interconnect the offshore substations
- transmit the bulk power from the offshore substations to the shore landing point.

All of the offshore cables will be buried to a nominal target depth of circa 0.5 m - 1.0 m below the seabed surface where possible, although ultimately the actual burial depth will be subject to the final detailed design. Cables will be installed using an underwater cable plough or trenching tool, such as a water jetting unit.

#### *Scour protection*

The placement of structures on the seabed can lead to localised scouring (erosion) of the seabed by altering water flows. Scour protection will therefore be installed where necessary around the offshore structures and cables to minimise these effects. Scour protection may consist of rocks, grout-filled bags, frond mattresses or concrete mattresses.

#### *Pipeline crossings*

A subsea gas pipeline runs through the middle of the Gwynt y Môr project area, and as a result it will be necessary for the undersea power cables to cross this pipeline at up to two points.

The crossings will be designed and installed so as to ensure the safety and integrity of the pipeline. The crossing method will be selected through discussion with the pipeline operator.



### *Onshore connection cables*

At the cable landfall point, the offshore cables will be connected to the onshore underground cables. Between 3 and 6 buried cables will run from this connection point to the onshore substation, a distance of up to 9.3 km. Onshore cables will be buried to approximately 1 m depth. A 5 m wide temporary haul road will be installed alongside the onshore cable route to facilitate cable delivery and installation. This temporary haul road would be removed following completion of the works and the area affected subsequently re-instated.

### *Onshore substation*

The onshore substation will be constructed at a site to the south of the St Asaph Business Park. The onshore substation will require an area with a footprint of up to 220 x 190 m, including landscaping and car parking. An adjacent area of 'reactive compensation equipment' will also be required, with a footprint of approximately 95 x 85 m. The electrical equipment will either be located outside or will be fully enclosed in a building. The final design will be determined by consultation with the local authority.

Construction works will be controlled according to standard practices, with construction work normally limited to standard working hours as defined by the applicable British Standard guidance. Some road improvements may be required in the immediate vicinity of the substation site to improve access. Construction of the onshore substation will take an estimated 12 to 14 months to complete.

The substation components will include up to 6 transformers of up to 15 m in height, which will be designed to manage potential noise emissions. Ancillary equipment, a small office facility and car parking will also be required, with appropriate landscaping to minimise the visual effect of the substation.

### *Associated grid connection*

From the 132 kV onshore substation to the grid connection, the transmission

system is owned and operated by National Grid Transco (NGT); NGT will require a short length of overhead line (up to 500 metres), buried cables and a small compound to complete the connection to the existing grid. NGT will be preparing separate Section 37 consent applications for these elements.

### *Construction programme*

Assuming a continuous build of the full 750MW capacity, Gwynt y Môr will be constructed over a period of around 3 years, with onshore works anticipated to take 2 years, and offshore works 3 years. Subject to consent, the wind farm would be built between 2008 and 2010/11.

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## **Baseline environmental conditions**

A wide range of environmental issues have been investigated as part of the EIA process that has been completed for Gwynt y Môr, including but not limited to:

- physical environment: waves, tides, sediments and coastal processes
- biological environment: birds, marine mammals, species of conservation interest, fish, newts and badgers
- human environment: seascape and visual issues, shipping, recreational activity, tourism, fishing, aircraft, communications, etc..

The following sections briefly summarise the key points of interest identified during the numerous surveys and studies undertaken in order to describe the existing environment, and as a basis for the project EIA.

### **Physical environment**

The Liverpool Bay area is noted for its large tidal range – in the region of 8.5 m around Gwynt y Môr. The water depths at low tide (LAT) range from 12 to 34 m across the site. The seabed in the project area is predominantly coarse sand and gravel, and is relatively stable in nature.

### Biological environment

Two years worth of boat-based and aerial surveys have been completed in order to describe the distribution of bird species within Liverpool Bay. Key bird species include those associated with the ‘proposed’ marine SPA (special protection area) under consideration in Liverpool Bay. Figure 7 shows the distribution of common scoter and Figure 8 shows the distribution of red-throated diver; two of the key species of interest.

In addition, extensive marine mammal surveys have been undertaken and have confirmed that Liverpool Bay supports relatively small numbers of marine mammals. The most common species recorded during these surveys were harbour porpoise and grey seal.

Surveys of the seabed habitats and fish and shellfish species have confirmed that the seabed in and around the project area is similar in nature to much of that found across the eastern Irish Sea and supports a similar range of species.

### Human environment

There are a number of significant port facilities in the region, including those around Liverpool itself. Marine traffic surveys have been carried out which have shown that around 21 ships per day use the most significant route past the northern boundary of the project area. There is also shipping and helicopter traffic associated with the cluster of offshore oil and gas installations in Liverpool Bay.

A number of existing activities have also been identified within Liverpool Bay including oil and gas production, existing or proposed marine aggregate dredging areas, spoil disposal areas and pipelines and cables.

Commercial and recreational fishing is also undertaken across the Liverpool Bay area. The main fishing activity within Gwynt y Môr is undertaken by small commercial vessels based at the ports and harbours along the North Wales coast along with more occasional activity by trawlers and scallop dredgers from

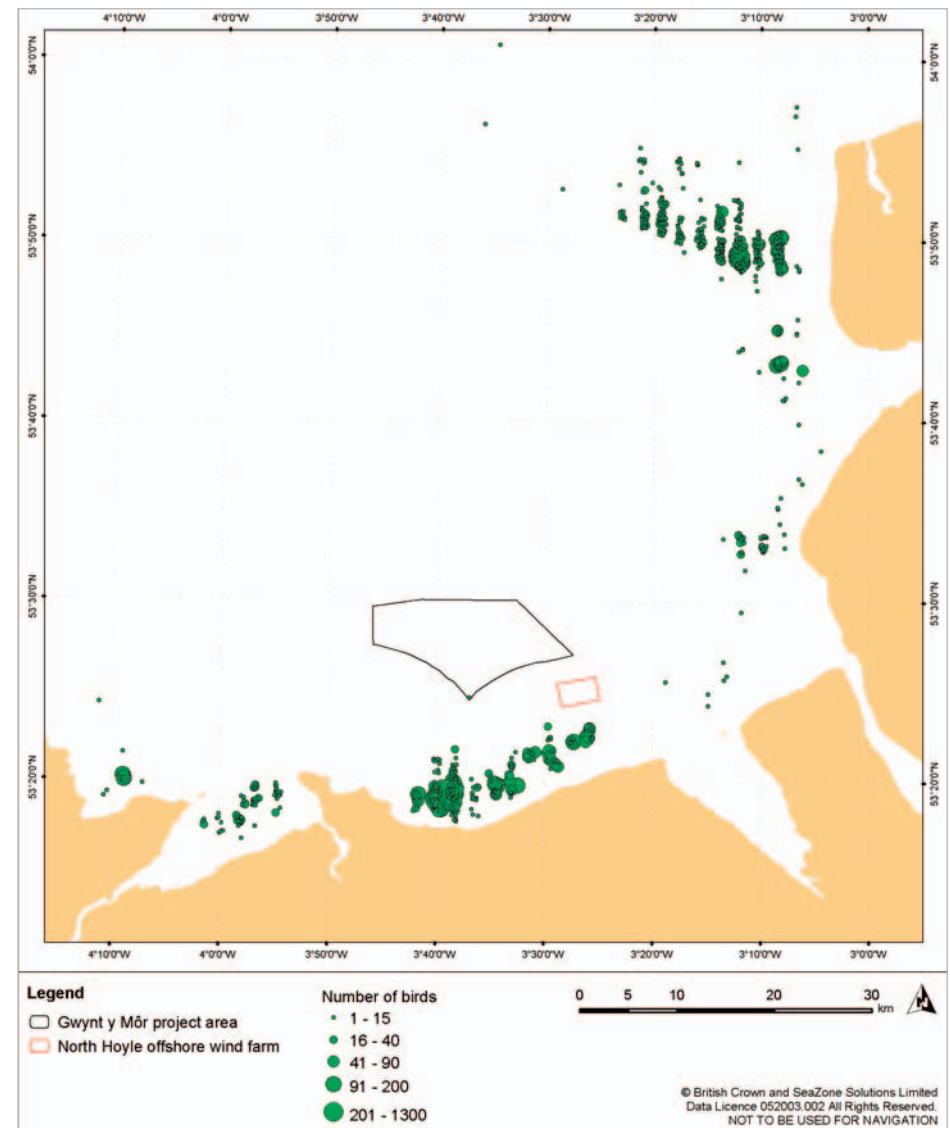


Figure 7 Distribution of common scoter (Aerial Survey February/March 2005)

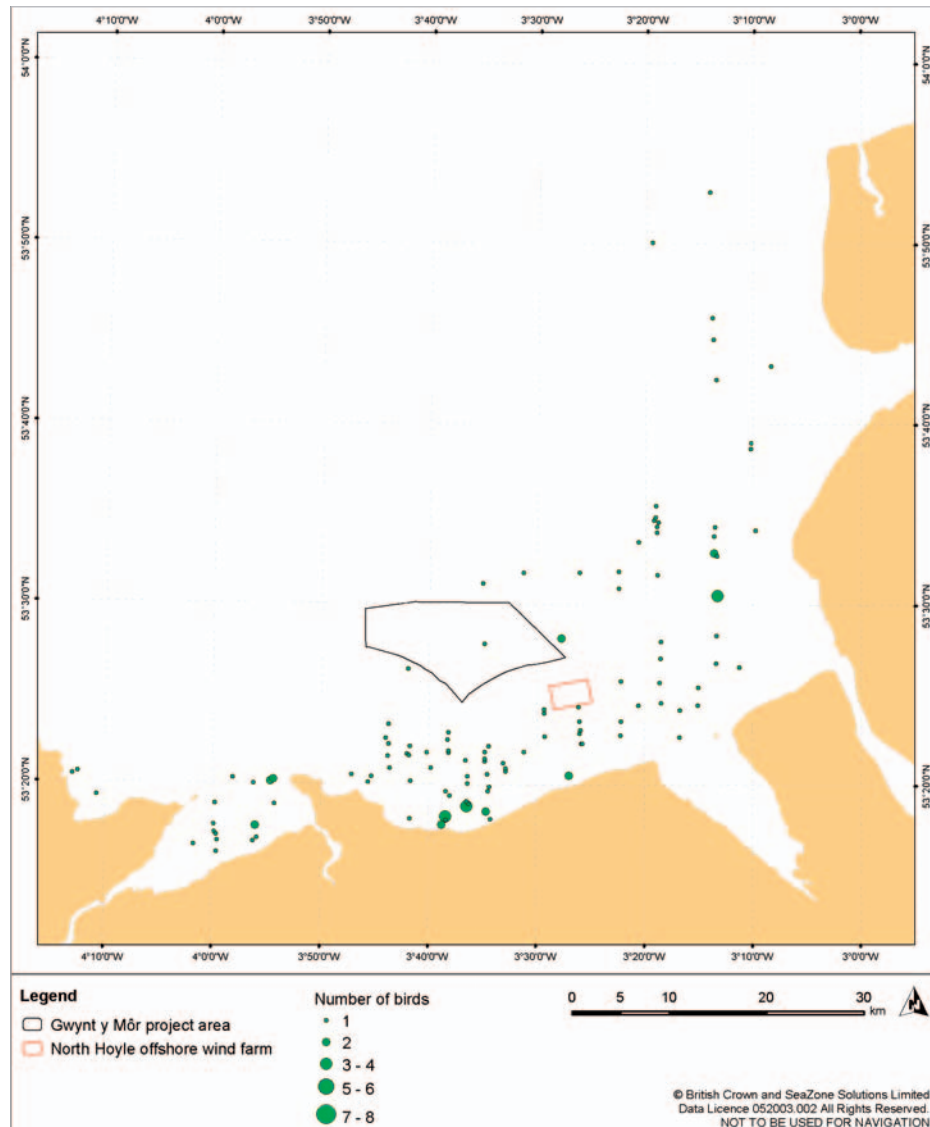


Figure 8 Distribution of red-throated diver (aerial survey February 2004)

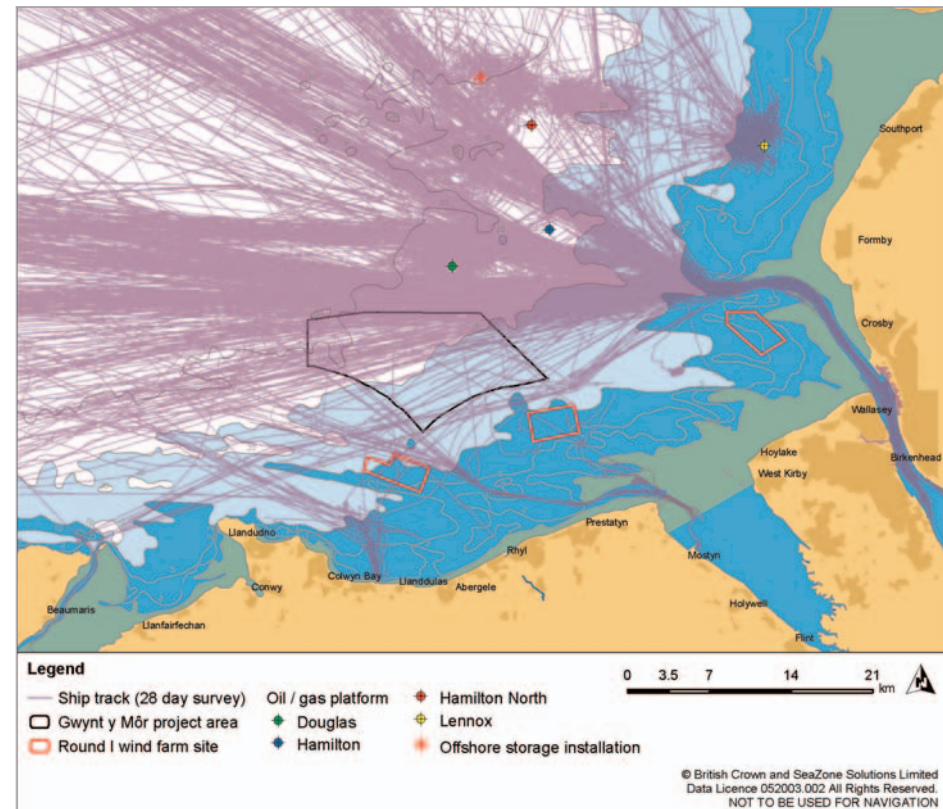


Figure 9 Shipping tracks, plus oil and gas platforms

further afield. Recreational angling is undertaken by a number of charter vessels from North Wales. Other recreational use includes scuba diving and sailing. The tourism industry and associated tourist attractions along the North Wales and Wirral coasts have also been described.

A number of known and potential sites of archaeological interest have been identified, most notably the wreck of the 'Resurgam', which lies within the area being considered for installation of the main power export cables.



Site studies have identified eleven discrete 'Regional Seascape Units' extending between the East Anglesey coast in the west and Sefton coast in the east, each of which has distinctive characteristics. There are wide ranging views out to sea throughout the study area including those from promenades and also more elevated viewpoints inland.

## Environmental Impact Assessment of the offshore components

### Physical environment

The Environmental Impact Assessment of Gwynt y Môr has included investigations into potential effects on the physical processes of the Liverpool Bay region. These investigations, which cover the construction, decommissioning and operational phases of the project, have specifically addressed:

- effects on suspended solids
- scour effects
- effects on sediment transport
- effects on waves and tides
- effects on water quality.

#### *Suspended Solids*

During construction and decommissioning, small volumes of sediment would be released during the installation of each foundation and cable. Due to the short duration of these activities, no significant effects are anticipated. Any effects would be local to the cable or foundation installation activity and small in magnitude when compared with the naturally high levels of suspended solids that have been recorded in Liverpool Bay.

#### *Scour*

Placing a structure in the marine environment will tend to lead to a change in the water movements in its immediate vicinity. These can result in scour (localised seabed erosion) around the structures.

At Gwynt y Môr, the scour that develops following construction will be dependent on the type of foundation structure installed and also the nature of the local seabed. The assessment has identified the potential for some localised scour to occur, but it will be limited in its extent even under the 'worst case' scenarios investigated. As a result, scour effects are considered to be insignificant.

A programme of monitoring has been developed to evaluate the development of scour at Gwynt y Môr over the initial post-construction phase. Mitigation in the form of scour protection around the offshore structures and/or along the cable routes would subsequently be installed where monitoring showed that significant scour had developed.

#### *Sediment transport*

The term sediment transport refers to the movement of sediments, such as sand, across the seabed or in the water column. In relation to Gwynt y Môr, detailed modelling exercises have been completed which have predicted no significant change in the prevailing pattern of sediment movement locally or regionally, including at adjacent coastlines, even when considering the 'worst case' scenarios. Nonetheless, a precautionary programme of bathymetric and sediment surveying has been set out within the Gwynt y Môr project area.

#### *Waves and tides*

The potential effects on waves and tides have also been assessed using detailed modelling exercises supported by data collected in Liverpool Bay. This modelling has shown that, generally, any changes to tides and waves will tend

to be both small and localised within the project area. When considering the extreme ‘worst case’ (the largest gravity base foundations installed at all turbine locations), some small reduction in wave heights is predicted inshore of the project area, but in all cases these changes to waves and tides are not considered to be of significance.

### *Water quality*

Significant impacts on water quality resulting from the disturbance of seabed sediments or releases of materials from vessels operating in the project area are not anticipated. This is due to the small scale and transient nature of any potential effects on water quality and the dispersive effects of the surrounding waters, as demonstrated by detailed modelling exercises.

### **The biological environment**

The assessment of Gwynt y Môr has included investigations into potential effects on the offshore ecology of Liverpool Bay and the wider eastern Irish Sea. These investigations, have considered the construction, decommissioning and operational phases of the project, and have specifically addressed:

- birds
- seabed habitats
- fish & shellfish
- marine mammals
- nature conservation.

### *Birds*

An assessment has been completed of the potential effects of Gwynt y Môr on birds. This assessment has considered the existing sites of conservation interest and their species of interest, together with the ‘proposed’ Liverpool Bay

SPA, which is being considered as a result of the presence of two species - common scoter and red-throated diver. Bird surveys at Gwynt y Môr have been carried out over a two-year period using skilled bird experts surveying the distribution and behaviour of birds from both boats and aircraft. Data generated by the monitoring of the potential effects on birds at the adjacent North Hoyle Offshore Wind Farm have also been used to predict the effects of Gwynt y Môr.

The Gwynt y Môr assessment has considered the potential for birds to be displaced by the wind farm during operation. The bird surveys have shown that the main populations of species, such as red-throated diver, common scoter, terns, shag and cormorants, are distributed in the areas inshore of Gwynt y Môr. As a result it is predicted that these species would not be significantly affected. The species that have been recorded in the Gwynt y Môr area also tend to be distributed throughout Liverpool Bay and surveys have shown a number of these species within the North Hoyle wind farm boundary. For example, gannet and auks have been recorded within the wind farm area but are also known to forage over extensive areas, with the main populations of both located away from the project area. As a result significant impacts on these species are not anticipated.

With regard to the potential for collision of birds with the operational turbines, the survey data show that relatively few birds currently use the area of Gwynt y Môr. In addition, the survey data show that the majority of those birds recorded within the project area fly below 20 m and therefore would not collide with the turbine blades. The surveys conducted to date on operational offshore wind farms have indicated that the risk of collisions with turbines is low; with only very small percentages of birds in the vicinity of the wind farms ever flying close enough to the turbines to be at risk.

It has been suggested that during storms birds could be more at risk of collision. The available evidence regarding Liverpool Bay suggests that under storm conditions, the majority of species fly close to the coast and a considerable distance to the south of the Gwynt y Môr project area.

With respect to potential impacts upon the 'proposed' Liverpool Bay SPA, impacts upon the key species, common scoter and red-throated diver, are not considered to be significant since these species are generally concentrated inshore of Gwynt y Môr. However, in order to avoid any significant impact on these inshore populations, the power export cables, which pass through the inshore area, will not be installed during the key winter months, when these species are most abundant.

### *Seabed habitats*

The placement of offshore structures and scour protection on the seabed, as well as the activity of jack-up barges, will directly affect the seabed (benthic) habitats. However, the actual proportion of the project area that would be affected is very small (less than 1% of the seabed across the project area). In addition, the habitats that have been recorded across the Gwynt y Môr project area are common throughout large parts of the central Irish Sea. The effects of this loss of seabed habitat are therefore not considered significant. Scour effects (as described above) will have only a localised impact on seabed habitats and the associated animal communities, and as such would not result in any significant effects.

Modelling of the suspended sediments that could be released during construction has confirmed that these sediments would be relatively rapidly dispersed to natural background levels. As a result of the intermittent and temporary nature of any plume effects and the natural tolerance of the animals in the area to such events, significant impacts on seabed habitats will not occur.

The installation of the undersea connection cables within Gwynt y Môr, along the main export cable route and across the intertidal (or beach) zone, will cause a temporary disturbance. However, the nature of the habitats and the associated animals that would be disturbed means that recovery of these areas is anticipated to be rapid. Combining this with the relatively small area

affected means that these effects are not considered to be significant.

In addition, the offshore structures and scour protection will represent new surfaces for colonisation by a range of animal species, such as mussels, barnacles, tubeworms, hydroids, sponges, soft corals, crabs and other invertebrates, allowing the formation of an 'artificial reef', as seen at North Hoyle. Whilst not considered as mitigation for the initial loss of seabed habitat occupied by the offshore structures and scour material, the introduction of this new habitat at Gwynt y Môr could act to increase biodiversity and habitat complexity within the area.

Monitoring of the seabed animal communities will be carried out before, during and after construction of Gwynt y Môr. Monitoring of the colonisation of the wind farm structures will also be conducted.

### *Fish and shellfish*

Since the early 1970s an ongoing annual programme of trawl surveys has been carried out by CEFAS (the Centre for Fisheries and Aquaculture Science) across the east Irish Sea, and therefore the fish in this region are well documented. Analysis of the CEFAS beam trawl data indicates that over 95% of the total catch is accounted for by twenty species, all of which are relatively commonplace in UK coastal waters. These include dab, solenette, plaice, common dragonet, and dover sole.

Species known to spawn in and around Gwynt y Môr include sole, plaice, whiting and dab, although all of these species also spawn over much of the eastern Irish Sea area. Rays may also spawn within the project area, although the key areas for their spawning activity are thought to be further inshore.

The extent of the spawning habitat within the eastern Irish Sea, combined with the limited area of habitat directly affected by the wind farm structures, means that impacts on spawning habitat are considered to be limited and will not be



significant. The installation of the subsea cables will disturb a small area of fish and shellfish habitat which, combined with the temporary nature of this disturbance, means that significant effects will not occur.

Fish nursery areas are concentrated in inshore waters and will be unaffected by the majority of the project. The power export cables will need to pass through these areas, but the limited installation time involved and the small area affected means that this will not result in significant effects.

The potential worst-case increase in suspended sediments during construction is considered to have the potential to result in some avoidance of the affected areas by fish. This is anticipated to be a small-scale and temporary effect, with no anticipated long-term impacts upon spawning or nursery habitats, or fish or shellfish behaviour, due to the rapid dilution and dispersion of this material. Similarly, it has been concluded that the short-term nature of the cable installation process and the distance of such activities from the Clwyd Estuary means that significant effects on salmon migration would not occur.

Noise, particularly from construction activities such as the pile driving of foundations (considered to be the 'worst-case' scenario), may drive fish some kilometres from the source of the noise for at least the duration of the activity. Within hours of pile driving ceasing fish will begin to move back into the area and normal fish behaviour and distribution would recover. Closer to the piling activity, within a few metres, there is the potential for physical harm. In order to mitigate this effect, the use of a 'soft-start' procedure will be used, whereby piling is started at a low intensity and gradually built up, allowing sensitive fish species to vacate the immediate area.

The Gwynt y Môr subsea cables have the potential to generate electromagnetic fields (EM-Fields), which could affect the behaviour of a variety of fish species, particularly rays. This potential effect is considered to be potentially significant for these ray species due in large part to the current lack of knowledge about the ecological consequences of any behavioural changes. A national programme



**Figure 10** Juvenile whiting browsing over a mat of common (blue) mussels settled on the sub-surface monopiles of North Hoyle Offshore Wind Farm within 12 months of construction

of research into the marine effects of EM-Fields in relation to offshore wind farms is ongoing, the results of which will be combined with further mitigation as appropriate.

The Gwynt y Môr offshore structures and scour protection may also have a positive effect on fish and shellfish populations by acting as an 'artificial reef', thereby providing new habitat for a range of species, including crustaceans such as crab and lobster (see Figure 10). Although potentially positive, this effect is not considered to be significant when considered on a regional scale.

Monitoring of the distribution of fish will be completed at Gwynt y Môr during the post-construction period.

### *Marine mammals*

Marine mammals, including porpoises, seals, dolphins and whales, are found in Liverpool Bay, the most common species being the harbour porpoise and the grey seal. The occurrence and distribution of porpoise and seals around the project area have been confirmed by site specific-studies.

In extreme cases, construction noise from piling operations has the potential to cause physical harm to marine mammals in close proximity to the noise source. This is considered to be potentially significant. As a result, where piling is the chosen foundation installation method, marine mammal acoustic deterrents and a soft-start procedure will be employed which will avoid any significant effects on marine mammals.

Further afield, piling noise may result in changes to marine mammal behaviour. Evidence from the monitoring of other offshore wind farms has shown that, whilst avoidance of affected areas occurs as a result of piling operations, normal behaviour quickly resumes following the cessation of the noisy activities. This fact, combined with the relatively low importance of Liverpool Bay for marine mammals, means that significant long-term effects on their behaviour are not anticipated.

Similarly, the increased vessel traffic movements during construction and operation would result in only small-scale avoidance, which would also tend to minimise the likelihood of any collisions between marine mammals and vessels. The intermittent and small-scale nature of any such disturbance will ensure that any impacts upon marine mammals are not significant.

Significant effects during the operational phase of Gwynt y Môr on marine mammal species are not anticipated. Evidence from other, existing offshore wind farms has shown that marine mammals occur within operational sites

and have been seen foraging for prey.

A programme of monitoring of marine mammals during the construction and immediate post-construction phases of the project will be completed.

### *Nature conservation*

The Gwynt y Môr project area coincides with a 'proposed' marine Special Protection Area (SPA) currently being considered in Liverpool Bay. The SPA is being considered for its populations of common scoter and red-throated diver. The assessment of the potential impacts on these birds and their habitats has shown that there will not be any significant effects, given the mitigation proposed in relation to the timing of the installation of the main power export cables.

Although not directly affected by the proposed wind farm, a number of other sites designated as a result of the populations of birds that they support, occur around the Welsh and English coastlines of Liverpool Bay. The potential impact of Gwynt y Môr on these sites has been assessed with respect to their ornithological interest with no significant effects anticipated.

As part of the assessment, indirect effects on other areas of nature conservation interest have been investigated. These could conceivably occur, for example, if changes to tidal currents or waves altered coastal processes along adjacent coastlines. The assessment of physical processes concluded that significant effects on coastal areas will not occur and therefore associated effects on coastal sites within Liverpool Bay will similarly not occur.

In the Liverpool Bay area a range of seabed habitats, fish species and marine mammals are also considered to be of conservation interest, such as porpoise and seals. The assessment of potential effects has concluded that, with the mitigation detailed in the preceding sections, impacts on the conservation status of these species and habitats will not be significant. Indeed, anecdotal evidence from the adjacent North Hoyle Offshore Wind Farm has reported harbour porpoise and seals actively foraging within the wind turbine array. Fish species such as whiting

have also been recorded around the North Hoyle turbine structures, indicating that the positive effects of the turbines acting as ‘artificial reef’ structures may be of some benefit to certain species of conservation interest.

## The human environment

### Seascape and visual environment

It is important to note that the project area has been located at least 13km offshore and outside of the precautionary exclusion zone, announced by the DTI following the strategic assessment programme in 2003. The DTI exclusion zone is in place specifically to reduce the potential impacts that might otherwise arise from offshore wind farms in shallow, nearshore waters. In addition, npower renewables have restricted development at the western extent of the project area specifically to reduce potential visual effects in areas perceived to be particularly sensitive.

A comprehensive seascape and visual impact assessment has been carried out using best practice guidelines, and incorporating the experience gained from earlier wind farm developments, such as North Hoyle. The seascape assessment has been based around the concept of ‘Regional Seascape Units’ (dividing up the coastal region into sections, see Figure 11). For each of these units an assessment has been made of their ‘sensitivity’ to offshore wind farm development. The ‘magnitude of impact’ of Gwynt y Môr has also been assessed for each of these units and this has been considered in conjunction with the sensitivity to arrive at an assessment of the significance of the predicted effects. The assessment has taken account of planning designations in the region such as the Snowdonia National Park and the Anglesey and Clwydian Range Areas of Outstanding Natural Beauty (AONB).

The results of the seascape assessment are shown in Table 2. In this case, effects that are ranked as Moderate or Moderate/Substantial significance are considered

to represent potentially significant changes to the existing seascape environment.

Seascape unit	Sensitivity of impact	Magnitude of effects	Significance of
East Anglesey	High	Negligible	Slight
North-east Menai	Moderate/High	Small	Slight/Moderate
Conwy Bay	Moderate/High	Small	Slight/Moderate
Llandudno Bay	Moderate/High	Medium	Moderate/Substantial
Colwyn Bay	Low/Moderate	Medium/Large	Moderate
Vale of Clwyd	Low	Medium/Large	Slight/Moderate
Clwydian Hills	Low	Medium	Slight
Western Dee	Low	Small	Insignificant
Eastern Dee	Moderate	Small	Slight
North Wirral	Low	Small	Insignificant
Sefton Coast	Low/Moderate	Small	Insignificant

**Table 2** Gwynt y Môr seascape assessment summary

The visual impact assessment has considered the wide range of views around Liverpool Bay. The assessment has also addressed visual impacts during the construction phase, at night and upon people at sea (on board ferries for example).

Thirty six key viewpoints around the coast have been selected and agreed through consultation with local authorities, CCW and in response to comments received during public exhibitions held around the coast.

The key characteristics of these views have been described, and for each viewpoint, photomontages have been produced (panoramic photographs of the view, with and without the proposed wind farm). These have helped determine the likely magnitude of the impact of the wind farm development which, combined with an assessment of the sensitivity of people at each viewpoint, enables the significance of the predicted effects to be assessed. The impact assessment has assumed clear weather and good visibility but it is important to



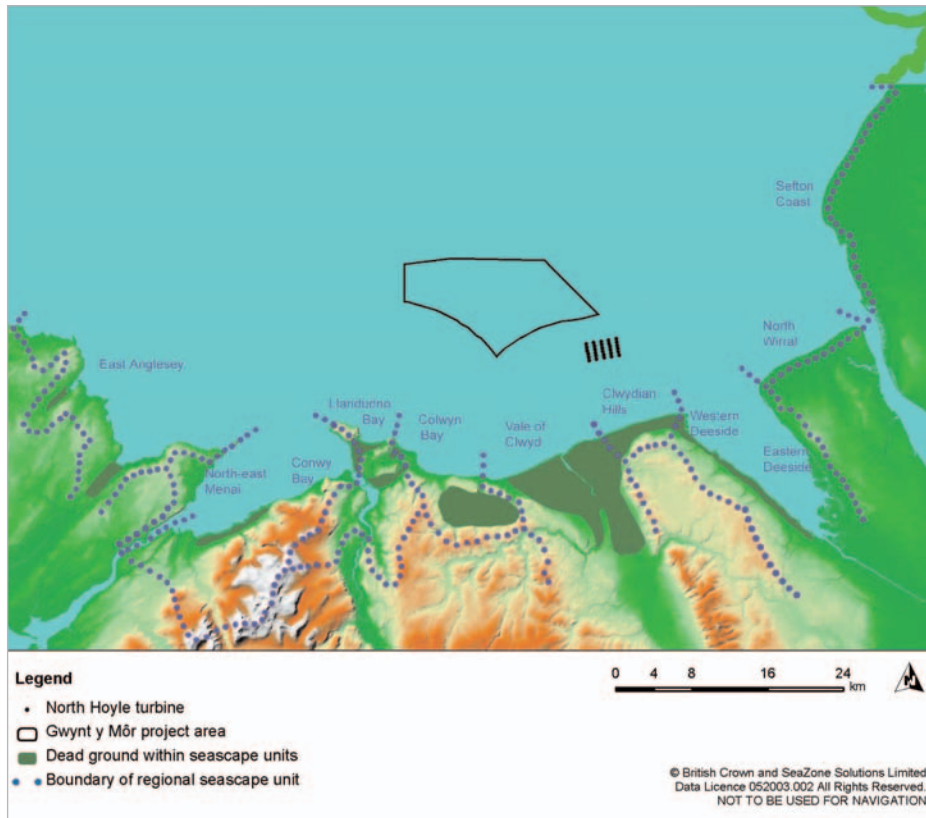


Figure 11 Seascape units surrounding Gwynt y Môr

note that, being located at least 13 km off the coast, the turbines would not always be visible from land.

Four of these photomontages, at Llandudno promenade (by the monument), Abergele Pensarn Station, Prestatyn Hillside Gwaenysgor and Hilbre Point are included in this NTS (see Figures 16 to 19) to provide a representation of the types of views available within the study area. These photomontages illustrate the

location and scale of Gwynt y Môr (layout scenario 3, 5 MW class turbines) and the consented, but as yet not built, Rhyl Flats and Burbo Bank offshore wind farms in relation to other features in the view, including with the operating North Hoyle wind farm. If standing at the viewpoint, features in the photomontage could be aligned with the actual view by curving the larger picture through an arc of radius 290 mm and viewing it with one eye from that distance.

The inset map included on each photomontage shows the location of the viewpoint, the 180° angle of view of the upper panorama and the 55° angle of the larger view, with a scale of 1:100,000.

Other visual impacts arising from the effects of the navigational lighting on the offshore structures or from the offshore construction or decommissioning activities are not considered significant. Visual impacts on those at sea, such as people on ferries, yachts or in fishing boats, would occur and would be dependent on the distance from the wind farm. It may be that some would regard the windfarm as a feature of interest – it is noted that small boat operators currently offer trips for tourists to the operational North Hoyle site, indicating the interest that such a feature can represent.

### Shipping and navigation

There are a number of significant ports in the vicinity of Gwynt y Môr. The River Mersey provides access to several facilities, including the Port of Liverpool and the Manchester Ship Canal and Port of Manchester. Also, lying on the Welsh coast of the Dee Estuary is the port of Mostyn Docks. A significant proportion of the shipping that uses these port facilities passes close to the Gwynt y Môr project area.

Marine traffic surveys have been carried out to establish the types and numbers of vessels navigating in the area and the routes they follow (see Figure 12). This data, together with the outcomes from computer simulations and a comprehensive consultation with local professional mariners, were used as inputs into a detailed assessment of navigation and shipping.

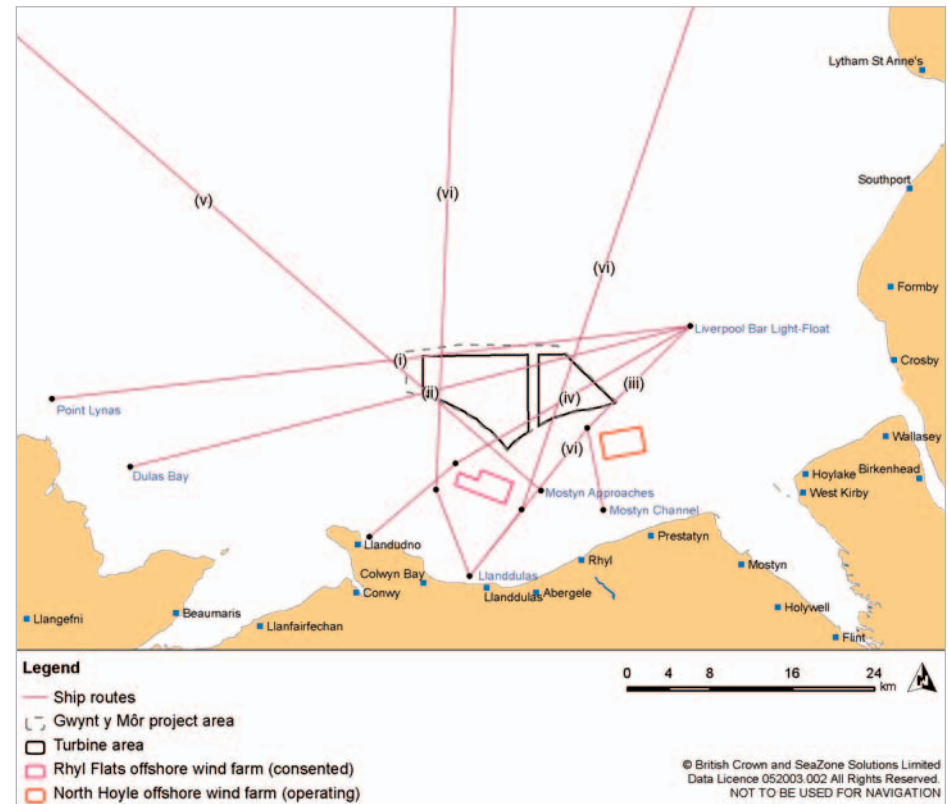
The assessment, taking into account the normal lighting and marking of the wind farm, has concluded that:

- shipping would need to make a deviation from their present routes, in order to pass safely around Gwynt y Môr. The extra distances involved in the deviation are not considered significant (see figures 12 and 13)
- the emergence of craft from the northern boundary of the wind farm could create a hazard for ships navigating along the northern boundary
- navigation in the vicinity of the wind farm's boundaries will be affected by the reduction in available sea room
- the position of the wind farm with respect to levels of vessel movement means that the sea area will be reduced south of the Douglas platform.

Consideration has therefore been given to the extent to which additional controls are required to address navigation within the project area and the sea areas adjacent to the project area. This consideration has included a review of the anticipated levels of traffic during the construction, operation and the decommissioning of the project. Mitigation will be further discussed and refined through consultation with the MCA and other navigation stakeholders. In particular, a routing measure is being considered since there would be a distance of approximately 2.6 nautical miles between the northern part of the proposed wind farm and the Douglas oil field platform. Whether separately or in association with a routing measure, cautionary notes may also be helpful mitigation tools.

In addition, the following mitigation measures will be applied for under provisions of the Energy Act 2004:

- the establishment of temporary safety zones during the construction phase
- the introduction of small safety zones around each of the operational offshore structures to protect any small craft that may be navigating in the wind farm
- the extinguishment of the public rights of navigation at the location of each offshore structure.



**Figure 12** Present vessel traffic routes before construction of Gwynt y Môr

An investigation has also been carried out into the effects of Gwynt y Môr upon communication and navigational equipment (such as radio and radar systems), the results of which have also been considered as part of the navigational risk assessment. This study concluded that:

- there would be virtually no impacts upon VHF, GPS or mobile phones
- AIS (Automatic Identification Systems) might be affected, but only when at short ranges and blocked behind a turbine

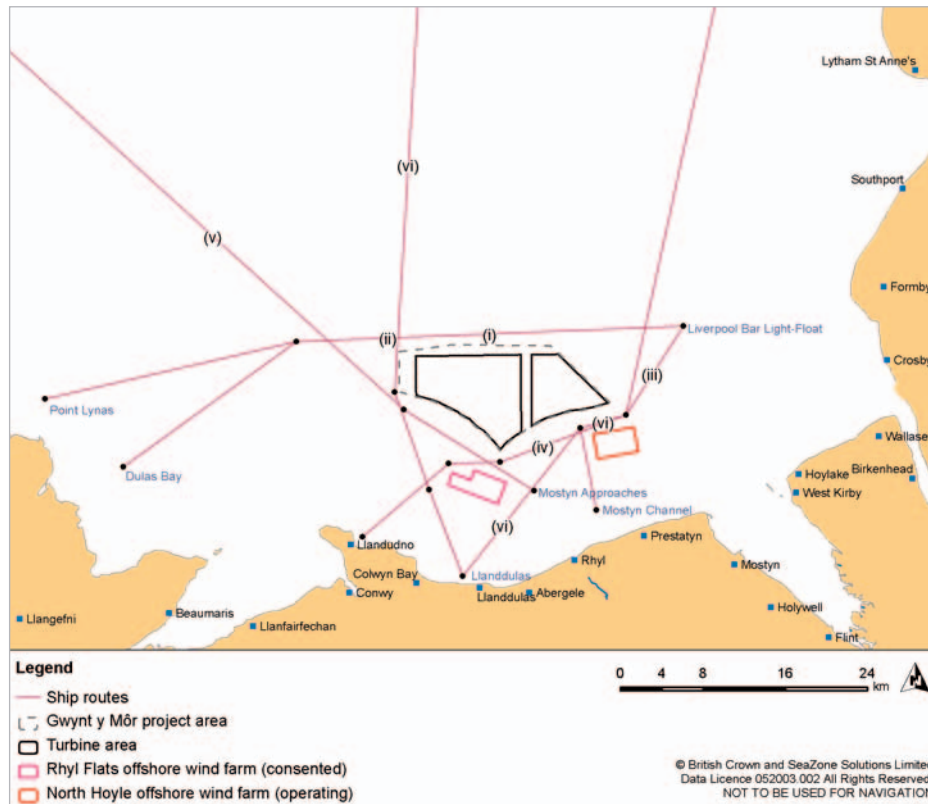


Figure 13 Vessel traffic routes expected post construction of Gwynt y Môr

- radar systems may be affected, these affects are generally most pronounced at close range to the turbines (close to and within the wind farm).

These effects have been incorporated into the discussion and conclusions of the navigational risk assessment, and in developing the navigational mitigation previously described.

### Oil and gas

Oil and gas production activity occurs to the north of Gwynt y Môr in Liverpool Bay and is undertaken by BHP Billiton. The closest oil and gas facility is the Douglas platform to the north of the project area, whilst a gas pipeline runs through the Gwynt y Môr project area.

A number of potential effects on BHP Billiton’s operations have been identified and investigated. These include changes to the patterns and safety of navigation of shipping (including effects on navigational radar systems), effects on helicopter access to the offshore installations, effects on the integrity of the gas pipeline and effects on the platform’s safety case or oil pollution response plan.

Each of these potential issues has been considered as part of the Gwynt y Môr assessment process. In the case of potential effects on the integrity of the gas pipeline, mitigation measures have been set out and will be agreed with BHP Billiton and the relevant authorities. Consideration is being given to additional mitigation measures, in particular a routeing measure to address the potential effects on navigation (and radar). npower renewables will continue to consult with BHP Billiton, CHC-Scotia and the Civil Aviation Authority to resolve potential effects on helicopter access.

### Pipelines and cables

The gas pipeline running between the BHP Douglas platform and the Point of Ayr gas processing plant, passes through the middle of the Gwynt y Môr project area. A 500 metre buffer zone either side of this pipeline has been proposed by npower renewables. Inside this buffer zone no structures will be built, (with the exception of some limited cable-laying, discussed below), to ensure there is no effect on the integrity of the pipeline and to ensure suitable access for pipeline maintenance.

A limited number of the Gwynt y Môr undersea power cables will need to be laid across this pipeline. Where this is required BHP Billiton will be fully consulted



and involved in the process, and recognised construction methods will be employed to avoid any damage to the pipeline or cables.

#### *Tourism and recreation*

During the construction phase of the development there may be some disruption to offshore recreational activities, such as angling, sailing and diving, in the vicinity of Gwynt y Môr. Vessels will be restricted from entering a proposed safety zone of 75 m radius around each structure once operational. However, no significant, long-term effects on offshore recreational activity are anticipated.

The installation of cables may also disrupt recreational use of the beach and surrounding coastal areas while work is being carried out. The short duration of this work, and the small areas affected, mean that significant, long-term effects will not occur.

However, given the importance of this recreation and tourism to the local area, a programme of mitigation has been developed to ensure that potential effects on recreation are minimised. This will include minimisation of the active offshore construction area as much as possible, minimisation of the area of beach used for cable installation and a system to ensure effective liaison with the relevant authorities and user groups.

Concerns have also been raised during consultation about the potential for the wind farm to affect the tourism industry along the coasts of North Wales and the Wirral. An independent survey of tourists' opinions was carried out at 8 locations along the North Wales and Wirral coastlines in the summer of 2004. The survey sought to determine the response of visitors to the existing North Hoyle Offshore Wind Farm and their views on the proposed Gwynt y Môr project.

The results of the survey showed that 48% of tourists surveyed support the Gwynt y Môr project, while 18% had no opinion, 12% wanted more information and 22% opposed the project. Only 4% of the tourists surveyed felt that the presence of Gwynt y Môr would make them less likely to return to the area.

These positive results are supported by the response of tourists to the existing North Hoyle wind farm, with 66% of tourists surveyed stating their support for North Hoyle and only 7% opposing it. In addition, 96% of tourists expressing an opinion on the effect of North Hoyle on visitor numbers to the area said there was "no effect".

Offshore wind farms can in fact prove to be a tourist attraction in their own right. The Scroby Sands Offshore Wind Farm, for example, located off the coast of Great Yarmouth in Norfolk, has its own seafront visitor centre, which has welcomed some 30,000 people through its doors in its first 6 months of operation.

#### *Dredging and disposal areas*

The eastern portion of the Gwynt y Môr project area was previously licensed to United Marine Dredging Ltd and Norwest Sand and Ballast Company, for the extraction of sand and gravel. The licensed area has now been amended and is adjacent to the eastern boundary of Gwynt y Môr.

There are no current proposals for dredging or disposal licences within the project area.

#### *Archaeology*

The Gwynt y Môr project area and proposed corridor of the export cable contain a number of sites of archaeological interest. Studies and surveys have confirmed the wrecks of the Penstone, Dublin, Ocean Monarch, Calcium, Four Brothers and Guardian Angel, as well as the locations of two crashed military aircraft within the project area or the area that may be affected by the power export cables.

The Resurgam, a protected wreck of national importance, is also located within the power export cable route corridor. There is also the potential for as yet undiscovered submerged prehistoric landscapes within the area.



Figure 14 npower Juice windsurfers

A detailed mitigation programme has been developed, which will be based around avoiding all known features of interest. This should ensure that no known remains are affected by the development works, thereby avoiding any significant effects. In addition, the data generated by the Gwynt y Môr development process, for example from geological investigations, is considered to have the potential to enhance the current understanding of submerged archaeology in the Liverpool Bay region.

### *Commercial fishing*

Around the Liverpool Bay area, Fleetwood is the only recognised fishing port (i.e. a port with a registered fish market) but there are many other places where small fishing craft are based including Hoylake, Chester, Mersey Estuary, Mostyn, Rhyl, Connah's Quay, and Conwy.

During the construction and decommissioning phases of the project, navigational safety zones will be established around the offshore structure locations to ensure the safety of other sea users. These safety zones will exclude all vessels other than those involved with the wind farm or emergency vessels.

Very few fishing vessels based outside the North Wales coast fish in the Gwynt y Môr area on a regular basis. It has been concluded, therefore, that the loss of access due to the safety zones will not be significant for itinerant fishing vessels (generally trawlers and scallop dredgers) since it will constitute only a small part of their total fishing grounds and one used on only an occasional basis. For locally-based 'set-net' vessels which fish across Gwynt y Môr on a seasonal basis, the effect is considered to be more significant since they are more restricted in their area of operation. Similarly, the increased intensity of vessel traffic during the construction and decommissioning periods could also have some seasonal effect on set-netting vessels that fish in the area.

During the operational phase of Gwynt y Môr, safety zones will be limited to a small area around each offshore structure (with a radius of 75 metres) so some fishing activity could continue within the wind farm area.

It is considered likely that the wind farm could act to effectively exclude some types of fishing, notably set netting, where the fishermen may choose not to fish between the turbines. There are no effects anticipated on potting or angling vessels during the operation of Gwynt y Môr. It must be noted that the actual fishing activities that will be able to take place during the operation of the wind farm are subject to some uncertainty and are the subject of an ongoing national research programme.

If it is shown that set netting cannot continue during the operational phase, this could have a significant effect on locally-based set-net fishermen. Effects on the more occasional trawling or scallop dredging activity are not considered to be significant.

A programme of mitigation and monitoring has been developed to minimise the possible effects on commercial fishing. This will include effective liaison and communication with the relevant fishing fleets before, during and after construction, including the continued presence of a Fisheries Liaison Officer for Gwynt y Môr. A seabed survey of the project area and export cable corridor will be conducted after construction to ensure that there is no debris left on the seabed that might endanger fishing vessels or damage fishing gear.

#### *Military activity*

Following a thorough consultation with the MoD (Ministry of Defence), MoD Defence Estates has confirmed that it holds no objections to Gwynt y Môr. This included specific assessments of MoD radar, communications and training activities.

#### *Munitions*

The proximity of Gwynt y Môr to Liverpool and the associated activity of the Second World War means that unexploded ordnance could be encountered during the construction of the project. This subject has been assessed and the available information indicates that the threat is likely to be limited to air-dropped munitions (bombs and mines), including items that have migrated into the area.

There is considered to be a low risk of any significant incidents. Nonetheless, further detailed risk assessments will be carried out under the construction contract, and any appropriate risk mitigation measures will be applied.

#### *Aviation*

A concern has latterly been raised by the National Air Traffic Services (NATS) with regard to the potential effects of Gwynt y Môr on the radar systems at St Anne's airport. Discussions between NATS and npower renewables are underway in an attempt to resolve these concerns.

In addition, Gwynt y Môr could interfere with helicopter access to the Douglas oil and gas platform in poor visibility and may have the potential to restrict the ability of helicopters to climb clear of the turbines under one engine inoperative situations in certain wind conditions. npower renewables will continue to consult with BHP Billiton, CHC-Scotia and the Civil Aviation Authority to resolve these potential effects.

#### *Television, mobile phone and fixed communication links*

An assessment of the existing television transmission around Liverpool Bay has concluded that Gwynt y Môr will not cause any adverse effects and thus there will be no impact on television reception around the Liverpool Bay coastline.

There are two BHP Billiton communication links that operate in the vicinity of Gwynt y Môr, transmitting data between the offshore installations and onshore radar sites. Based on the layouts used for assessment, there is currently the potential to affect one of these links. A number of options to mitigate this effect have been identified, primarily positioning the individual wind turbines to ensure a clear line of sight for the link, re-positioning the onshore transmitting station, or placing a repeater station on the northern boundary of the wind farm to ensure uninterrupted data transmission.

A technical assessment has also been carried out to assess the likely effects of the Gwynt y Môr project on mobile phones. It has been concluded that mobile phones would only be affected if they were immediately adjacent to a turbine, and directly to the north (i.e. completely shielded from the land).



### *Socio-economic*

Based on evidence from previous offshore wind farm construction projects, it is currently anticipated that 66% of the total Gwynt y Môr contract value could be spent in the UK. It has been further estimated that 9% of the total contract could be sourced locally, for example within the North Wales, Merseyside and Cheshire regions.

This would represent a significant positive contribution to the regional economy. It is predicted that the project could directly support around 1,330 permanent full-time equivalent jobs during the construction phase.

Experience elsewhere, including from the existing North Hoyle wind farm, has demonstrated that there is the potential to source many of the construction and operation related labour inputs locally. As such, in the UK and local areas, indirect and induced effects have been assessed to provide additional employment on top of direct employment. Direct and induced effects could support 1180 jobs in the UK, including around 140 in the local regions.

Although the detailed management and operational arrangements for Gwynt y Môr have not yet been finalised, it is currently thought that a total of around 90 full-time permanent workers would be employed locally in the operation and maintenance of the project. This will include maintenance technicians, offshore supervisory/engineering staff, offshore technical staff, shore-based managerial and clerical staff and crew for the maintenance vessels (see Figure 15). In addition, further indirect employment will be generated during the operational phase so that, in total, it is estimated that around 124 full-time equivalent jobs could be supported in the UK during the operational phase, with a significant number located in the local regions.

### *Noise*

The offshore construction activities associated with the proposed development will generate noise and vibration. Most of this noise, from construction



**Figure 15** Maintenance vessel operating at North Hoyle

equipment and vessel activity, will be localised and inaudible at the adjacent coastline, and will not cause a significant effect.

The worst-case construction noise would occur if piling is used to install the foundations of all the offshore structures. The assessment of piling noise has concluded that, at a number of locations along the North Wales coastline closest to the project area, during certain weather conditions (onshore winds) the sound may be just audible. The assessment also shows that the piling noise at the coast would remain below the relevant guideline levels of acceptability and therefore this is not considered to be significant. However, in view of the potential sensitivity of the coastal receptors to such noise, offshore piling operations will be restricted during periods of onshore winds at these locations until monitoring at the closest receptors has confirmed that no significant effects are occurring.

The assessment of the operational noise from the Gwynt y Môr turbines has considered the potential effects on all of the adjacent Welsh and English coastline, as well as the cumulative noise of all the consented and operational wind farms in Liverpool Bay. The predicted operational noise was compared with the existing noise levels at locations along the adjacent coastlines and assessed for significance.

The operational noise assessment concluded that at all of the locations around the coast, the impact of the total cumulative noise from all of the wind farm sites in Liverpool Bay would be below guideline levels and as such would not cause a significant impact.

At a few locations, slightly inland, the worst-case conservative assessment indicated that during the quietest periods of the night and under downwind conditions, the turbine noise could be audible. It is clear, however, that the noise would remain below all relevant guideline levels and this is therefore considered to be insignificant. It should be noted that this would be an occasional effect and that at these same locations in other weather conditions and at other times of the day, the noise would not be audible.

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## Environmental Impact Assessment of the onshore components

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### *Cultural heritage*

The onshore construction works (such as cabling or the development of the onshore substation) have the potential to disturb archaeological remains. A detailed archaeological mitigation programme has been developed for Gwynt y Môr which will avoid or significantly reduce the potential effects on the onshore archaeological resource. This mitigation and monitoring programme will be agreed through discussion with Cadw and other relevant archaeology consultees.

### *Landscape*

The onshore buried cables will be installed to connect the chosen landfall point (between Abergele and Kinmel Bay in North Wales) and the onshore substation (south of the St Asaph Business Park). The decision to lay these cables underground, rather than use overhead lines with pylons, has been taken to avoid long term impacts on the coastal plain and ensure that visual impacts are temporary and limited to the construction stage.

The onshore substation and associated equipment will be located immediately to the south of the St Asaph business park, which is a modern development, containing mainly 2 and 3 storey buildings. The area to the south is a mixture of open farmed land, divided by hedgerows, with scattered copses and woodland. Close to this point is the overhead Deeside-Pentir 400 kV transmission line, and associated pylons.

In order to mitigate the potential impacts of the various onshore structures, any hedgerows that are breached as part of the works will be reinstated, and the buildings will be sited and designed to minimise any potential intrusion. Landscaping, including tree-planting and hedgerow reinforcement around the sites will also be employed where necessary in order to provide additional screening.

A landscape and visual impact assessment has been completed in order to assess the possible effects of these onshore elements. The assessment has concluded that subject to appropriate mitigation as described above, and taking into account the presence of existing features such as the business park and existing pylons, the visual impact of these onshore developments would not be significant.

### *Traffic*

Disruption to the local road network and increases in local traffic as a result of the installation of the onshore cable will be intermittent and temporary with appropriate measures in place to minimise the generation of construction traffic. Once the final onshore cable route has been determined, further consultation with the Highways Agency, Local Authorities and other interested parties will be carried out.

The onshore substation site is located to the south of the St Asaph Business Park. Road access from the adjacent A55 is good, although some road development around the business park is likely to be required to ensure adequate access to the substation during both construction and operation. During construction, HGV movements, including the delivery of large components such as the transformers, and personnel movements, will lead to only intermittent and temporary increases in traffic around the local area. Appropriate mitigation and management will ensure the traffic movements are kept to a minimum and main routes, such as that to Bodelwyddan Hospital, will not be affected.

Traffic movements to and from the onshore substation, once operational, will be occasional and no significant effects on the surrounding road network would occur.

### *Ecology and nature conservation*

Construction of the onshore components will result in the permanent loss of onshore habitat as a result of the onshore substation site, the additional

overhead electricity pylons, the cable end sealing compound and any additional access roads to the onshore substation.

The majority of the habitat, which will be permanently affected, is agricultural land comprising improved grassland and arable fields. These habitats are of low local nature conservation interest but do provide some foraging habitat for birds and badgers.

The construction of the substation could also result in the loss of two ponds and two ditches. The effects on these habitats will ultimately depend on the final site design. It is, however, anticipated that careful siting of the substation will minimise any significant effect on these habitats. If it is not possible to avoid permanent impacts, consideration will be given to providing compensatory habitat in consultation with The Countryside Council for Wales.

Species of note identified during the cable route surveys include bats, water voles, otters, badgers, and great crested newts. There is the potential for effects on a number of these species as a result of habitat loss or through disturbance. This is considered to be most significant with respect to great crested newts, which are a protected and sensitive species. Careful siting of the onshore works together with further monitoring and mitigation measures will be adopted to reduce the potential effects on these species to an acceptable level.

### *Birds*

Summer and winter bird surveys have recorded a variety of species within the onshore development areas, including both common and rarer species. Notable species recorded during winter included grey partridge, lapwing, curlew, skylark and song thrush. These were also observed during the breeding bird season along with quail, starling, house sparrow, linnet, bullfinch and reed bunting.

The habitats affected by cable installation would be reinstated following completion of the works so that no significant, permanent impacts are anticipated on bird



species. The area of land required for the onshore substation and associated developments is considered to be relatively small. Within the wider area there is an abundance of suitable foraging and nesting habitat for these species, so that effects on birds are not expected to be significant.

During construction there may be some disturbance to birds due to the noise and dust created by machinery and construction vehicles, the floodlighting of the construction compounds and the human presence on the site. Whilst the disturbance will occur over an 18 month period, it will be short-lived in any one area as the work will progress along the cable route, only affecting a small area at a time. Significant longer term effects on birds will not occur.

#### *Coastal defence, flood risk, water quality and drainage*

The area of coast around Towyn, in common with much of the North Wales coast has been subject to historic flooding. The power export cables will be landed at one of four locations between Abergele and Towyn and could necessitate the breaching of the existing coastal defence. In order to avoid flood risk, any such breach would be conducted using directional drilling which would avoid significant disruption of the coastal defence works. Further to the south, across the coastal flood plain, cable installation would also temporarily disturb the existing drainage systems, including drainage ditches and sub-surface drainage networks. Such disturbance would be temporary, however, and all such systems would be fully re-instated following installation in discussion with the Environment Agency and the local authority. Significant effects on flood risk will not occur.

Construction works, such as the installation of the cabling or at the onshore substation site, would necessitate the management of surface water in order to avoid pollution events on adjacent watercourses such as the River Gele. A range of mitigation and management has been set out, and would be agreed with the Environment Agency. Significant effects on surface water quality will not, therefore, occur.

#### *Noise*

Noise would be generated during the onshore construction works including cable installation and associated developments. Where cable installation occurs within 200 metres of dwellings located in quiet rural setting, or within 50 metres of dwellings in more urban areas, significant noise impacts could occur. These impacts would, however, be temporary, intermittent and transient. Mitigation has been developed which will act to control noise emissions and reduce the significance of these noise effects to an acceptable level.

The construction of the onshore substation, including transportation of the new transformers to the site, will also result in noise. The effect of such noise is considered to be potentially significant for any dwellings in quiet rural settings that are within 200 m of the onshore substation site. Such effects would be temporary and intermittent, and mitigation has been developed which will act to reduce noise to an insignificant level.

Any road improvement operations required during the onshore works may result in increased noise levels for any particularly noise-sensitive sites in rural locations within 100 m of the works. Traffic levels will increase during the construction period but it is considered unlikely that the increase in noise levels would impact greatly upon noise sensitive locations.

#### *Cumulative effects*

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The cumulative effects of Gwynt y Môr have been considered in-combination with a range of other existing activities and developments in Liverpool Bay including:

- other offshore wind farms within Liverpool Bay (North Hoyle, Burbo Bank and Rhyl Flats)
- commercial fishing activity
- shipping
- aggregate extraction
- maintenance dredging and dredge spoil disposal

- oil and gas operations
- cables
- other onshore development.

The cumulative impacts assessment has concluded that in most cases significant cumulative effects will not occur. This is generally as a result of either the low level significance of the individual effects at Gwynt y Môr or the distance that separates Gwynt y Môr from other projects within Liverpool Bay or the wider eastern Irish Sea region. For example, no significant cumulative effects are anticipated in relation to bird populations, marine mammal species or sites of nature conservation interest (including those designated under European wildlife legislation).

The cumulative assessment has identified a small number of issues where some significant in-combination effects could potentially occur. For example, the project could act in-combination with oil and gas operations, aggregate dredging and other offshore wind farms to affect some commercial fishing activity. Similarly, cumulative effects with shipping could affect recreational activity, particularly sailing, during the construction phase. In both cases mitigation has been set out which would act to reduce or manage the significance of these potential cumulative effects.

Guidance produced for visual assessments of offshore wind farms in the UK, suggests that where offshore wind farms already exist these contribute to seascape character, thus reducing the sensitivity of these seascape units to the introduction of more turbines. Similarly, it is implied that people will become less sensitive to new wind farms in locations where they have already become used to seeing turbines offshore. Based on this Guidance it is predicted that the presence of Rhyl Flats and Burbo Bank will act to reduce the sensitivity of seascape units to Gwynt y Môr, and also the sensitivity of people at most of the key viewpoints. Consequently, the presence of Rhyl Flats is predicted, for example, to reduce the significance of effect of Gwynt y Môr on, the Colwyn Bay seascape unit and on people at Llandudno.

Positive cumulative benefits of the project have also been identified by the assessment process. For example, cumulative socio-economic benefits arising from the multiple offshore wind farm developments in the Liverpool Bay region could lead to significant benefits for the North Wales and North West regions in terms of investment and employment opportunities.

Perhaps of greatest significance in terms of cumulative impacts are the benefits that will arise from these offshore wind farms acting in-combination to offset potential CO<sub>2</sub> emissions that might otherwise be generated by the burning of fossil fuels, thereby acting in-combination to reduce the effects of climate change and helping to fulfil the aspirations of Government and society.

### Concluding statement

The reality of global climate change is becoming increasingly apparent and is now a recognised issue requiring an unprecedented response by the international community. Efforts have begun around the world to respond to this threat. The UK is leading the way in its response through its efforts to harness the power of offshore renewables to produce clean and truly sustainable energy. The Gwynt y Môr project represents an important step in realising those efforts.

The electricity produced by Gwynt y Môr could be sufficient to supply over 40% of the households in Wales and could prevent the release of around 2 million tonnes of CO<sub>2</sub> per year ([www.bwea.com](http://www.bwea.com)).

Gwynt y Môr would provide a significant source of clean, renewable electricity, and would make a major contribution towards meeting the UK Government's targets for generating 10% of UK electricity demand from renewable sources by 2010, and 15% by 2015.

The project has been assessed through a comprehensive Environmental Impact Assessment process in accordance with statutory requirements. This has been informed by an extensive and ongoing process of consultation with

statutory and non-statutory stakeholders and the public. The EIA process has been conducted through the consideration of the project scenarios that would have the greatest potential environmental impacts. This approach has provided a precautionary assessment. This approach allows the flexibility required by the developer in finalising the project design whilst ensuring that the regulatory bodies can come to a judgement on the project with the confidence that the final environmental impacts will be no greater than those described by the EIA and may in fact be considerably less than those presented.

The EIA process has identified the potential for some significant effects on the Llandudno Bay and Colwyn Bay seascapes. Significant visual effects are also predicted for people at Llandudno and at Graig Fawr in the Clwydian Hills. At all other viewpoints around Liverpool Bay, from Anglesey in the west to Sefton in the east, visual impacts are not considered significant. When considered cumulatively with other consented wind farms in Liverpool Bay, the sensitivity of seascapes to the addition of Gwynt y Môr is generally considered to be reduced. This would also apply to the sensitivity of people at looking out to sea.

Some potentially significant impacts on a small number of set-net fishermen from North Wales may also occur.

For the remainder of the issues considered, the EIA process has, in the majority of cases, identified no significant impacts.

In those cases where potentially significant effects have been identified, npower renewables has progressed appropriate mitigation or management arrangements designed to reduced the effect. For example, impact of noise effects on marine mammals during construction activities will be reduced by implementing acoustic deterrent devices where necessary. In addition, a range of monitoring has been developed in order to monitor the effectiveness of the mitigation and to add to the knowledge of the surrounding environment and the influence of offshore wind farms in relation to specific sensitivities.

## Further information

If you have any questions on the project, or would like any further information, please contact:

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Website: [www.npower-renewables.com/gwyntymor](http://www.npower-renewables.com/gwyntymor)

During the consultation period for the Gwynt y Môr application, copies of the complete Environmental Statement will be available for the public to view at the following locations:

- Denbighshire County Council Offices, County Hall, Wynnstay Road, Ruthin, LL15 1YN
- Isle of Anglesey County Council, Council Offices, Llangefni, Anglesey, LL77 7TW
- Conwy County Borough Council, Bodlondeb, Conwy, North Wales, LL32 8DU
- Wirral MBC, Town Hall, Brighton Street, Wallasey, Wirral, CH44 8ED
- Sefton MBC, Balliel House, Balliel Road, Bootle, L20 3NJ
- Llandudno Tourist Information Centre, 1-2 Chapel Street, Llandudno, Gwynedd, LL30 2YU
- Colwyn Bay Tourist Information Centre, Imperial Buildings, Princes Drive, Colwyn Bay, Conwy, LL29 8LF
- Rhyl Tourist Information Centre, Rhyl Childrens Village, West Parade, Rhyl, Denbighshire, LL18 1HF.



To comment on the application, please write to:

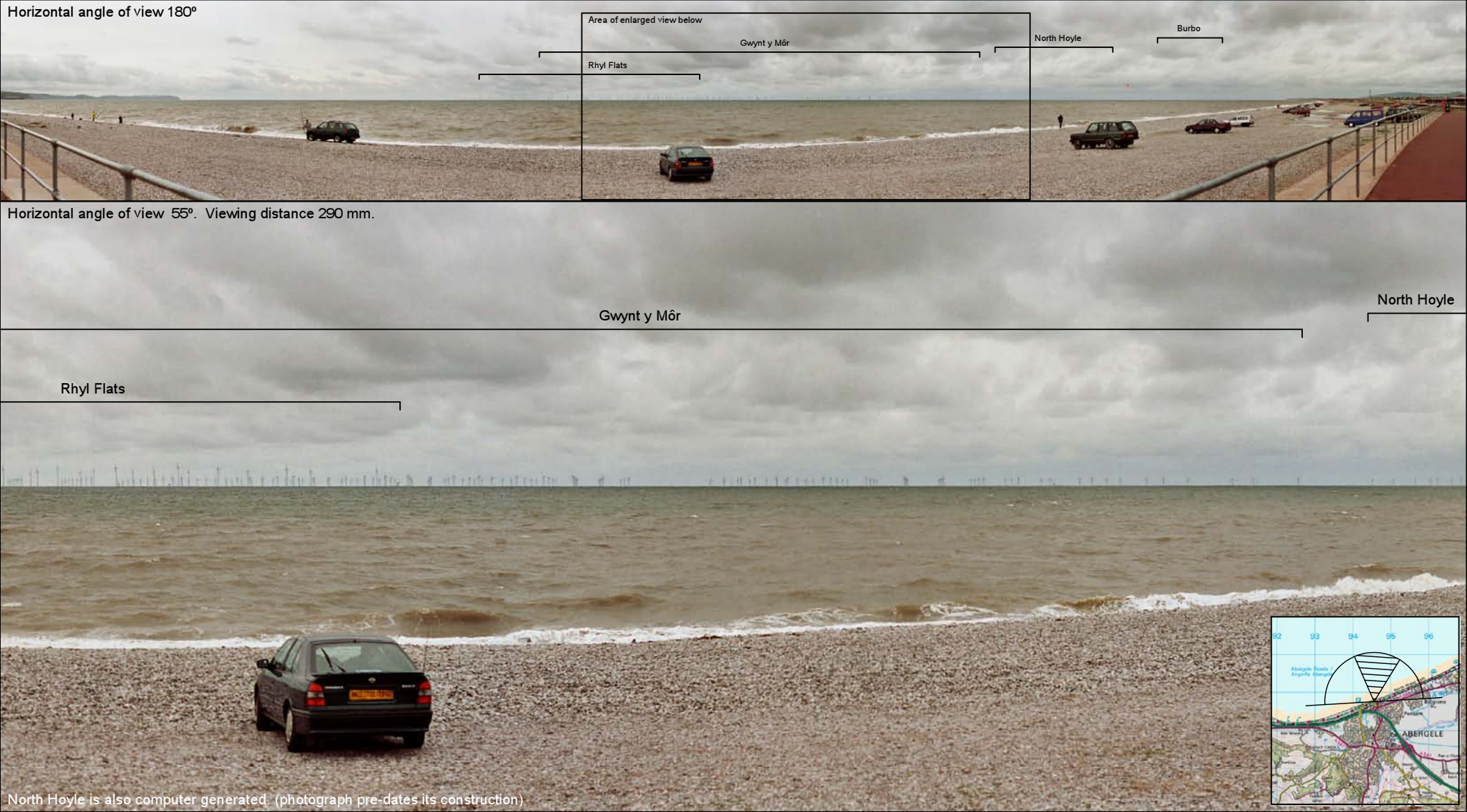
Offshore Renewables Consent Unit  
Department for Trade and Industry  
Bay 2121  
1 Victoria Street  
London, SW1H 0ET



**Figure 16** Predicted view from Llandudno promenade (by the monument).  
 Distance from viewpoint to nearest wind turbine at Gwynt y Môr (proposed) 16.2 km; North Hoyle (operating) 25.7 km  
 Rhyl Flats (consented) 11.1 km

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**Figure 17** Predicted view from Abergele Station.  
 Distance from viewpoint to nearest wind turbine at Gwynt y Môr (proposed) 13.9 km; North Hoyle (operating) 14.6 km  
 Rhyl Flats (consented) 8.1 km; Burbo Bank (consented) 32.7km

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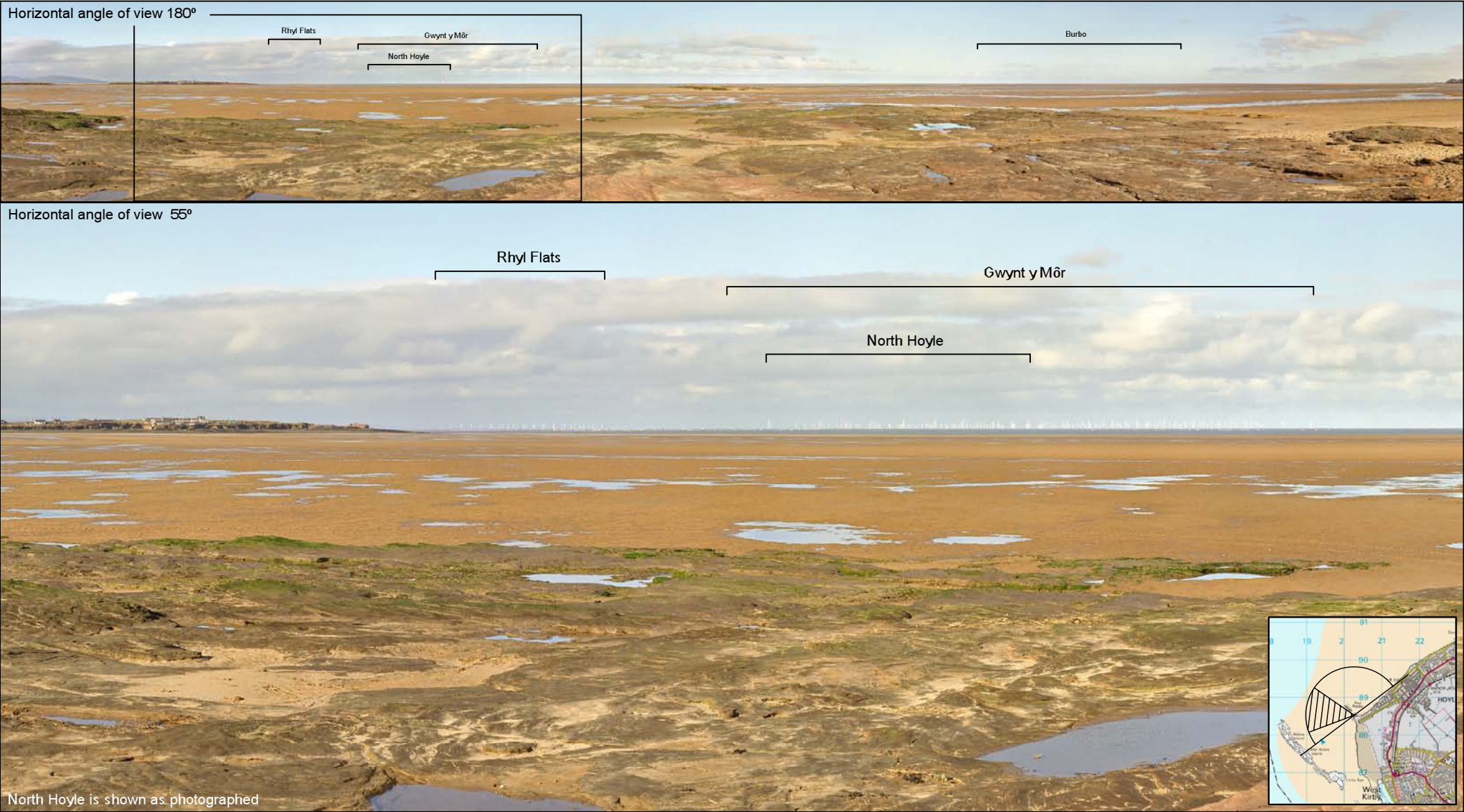




**Figure 18** Predicted view from Prestatyn Hillside Gwaenysgor. Distance from viewpoint to nearest wind turbine at Gwynt y Môr (proposed) 14.9 km; North Hoyle (operating) 10 km Rhyl Flats (consented) 15.9 km; Burbo Bank (consented) 21.5 km

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**Figure 19** Predicted view from Hilbre Point.  
Distance from viewpoint to nearest wind turbine at Gwynt y Môr (proposed) 19.1 km; North Hoyle (operating) 15.1 km  
Rhyl Flats (consented) 27.3 km; Burbo Bank (consented) 9.8 km

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