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## **Identification of good examples of wind energy projects that have successfully mitigated potential negative environmental impacts**

### **1<sup>st</sup> case: Egmond aan Zee offshore wind farm (The Netherlands)**

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*The Egmond aan Zee wind farm represents a good example of how to resolve potential conflicts between localised environmental impacts and the exploitation of the vast offshore wind resource. It is an example of how potential environmental impacts can be overcome, and how the active involvement of stakeholders in the project is essential for its success.*

#### **1. Project characteristics:**

Location:	Egmond aan Zee, The Netherlands
Project developer:	Shell and Nuon, working together under the name of NoordzeeWind
Installed capacity:	108 MW
Turbines:	36 x Vestas 3 MW V90
Foundation:	Monopile
Water depth:	16 to 20 metres
Distance from shore:	10.5 km (nearest turbines) to 18 km (furthest turbines)
Electricity supply equivalent:	About 100,000 households
Capital cost:	> €200 million
Compensation plan cost:	€500,000
Estimated costs related to the implementation of environmental requirements:	three to four % of overall costs
Date of operation:	January 2007

The history of the Egmond aan Zee wind farm, the Netherlands' first offshore wind park, goes back to 1997 when the Dutch government decided, as part of its renewable energy policy, to develop a "demonstration" wind offshore project. Through a competitive bidding process, Shell and the power utility Nuon were chosen in 2002 as the successful developers, working together under the name NoordzeeWind. The final EPC (Engineering, Procurement and Construction) contract was signed in 2005, after an Environmental Impact Assessment (EIA) and environmental and construction permits were issued.

#### **2. Description of the main environmental concerns and potential impacts**

Following an initial environmental assessment carried out by the government (1998-2001), the developers were required to undertake their own more detailed EIA before they could apply for both an environmental and a construction permit (2002-2005). Three particular issues were identified: the potential effect of the wind farm on **sea birds**, its impact on **marine life** and its **visibility** from the coast.

#### **3. Identification of the measures/actions carried out to mitigate these potential impacts**

In order to answer these concerns the developers carried out two main types of measures:

- A “monitoring and evaluation programme” comprising extensive ecological monitoring of the site during the construction (2006) and operation phases (2007-2008 and 2011);
- And a “compensation plan.”

### *3.1) Ecological monitoring*

The ecological monitoring addresses the wind farm impact on a large variety of animal species. It includes birds, fish and marine mammals, as well as benthos, i.e. marine life in the sea bed. These studies are transparently carried out by independent scientific institutions.

3.1.1) To assess the wind farm effects on **bird populations**, studies taking into consideration North Sea bird migration routes and feeding sites around the wind farm’s area are being carried out. The preliminary monitoring results of the wind farm’s first operation year suggest the Egmond aan Zee plant has a very low impact on birds.

3.1.2) As regards **marine life**, the main question dealt with was whether sea mammals have been affected by the wind farm. During its construction phase, there were some concerns about the impact on porpoises of the noise of driving foundation piles. As a response, developers have taken two initiatives. Firstly, they installed a device (a so-called “pinger”) hung over the side of the construction vessels that sent out an underwater “scram” signal before the pile driving started. The aim was to keep porpoises away from the area. Secondly, they collected dead porpoises and kept them in cold storage for post-mortem examination to see whether their ear drums had been affected. The results of this study are not yet available. Monitoring of porpoise and seal movements is continuing but preliminary results suggest impacts caused by the wind farm, if any, are low.

The fact that the entire area became an exclusion zone for any other marine activity, such as fishing and shipping circulation, is expected to be beneficial for the marine biology, e.g. improved fish stocks and increased biodiversity. The wind farm foundations have been rapidly colonised, and in that sense are acting as a natural reef.

3.1.3) **Visibility** has been another question raised by public consultations and opinion surveys carried out both by the Dutch government and developers. The solution to reduce the visual impact of the wind farm from the coast was to place the rows of turbines further back into the 40km<sup>2</sup> area allocated by the government. The first turbines start more than 10km from the shore, instead of the 8km distance allowed under the government concession agreement. A related issue involved visibility of the turbines at night, when they have to be identified by lights as a warning to passing ships and aircraft. The developers’ solution has been to keep the brightness of the lighting down to the minimum level acceptable for safety reasons. From the shore, the effect generally is very low visibility, if at all.

As visibility concerns are highly related to an appreciation of the need for the wind farm, the developers have created a public information centre in the village of Egmond aan Zee. This centre operates in close collaboration with the local tourism office and attracted more than 60.000 visitors between April and December 2007. Visitors appreciated the information and frequently offered balanced comments in the guest book. Public opinion polls were held in 2005, 2006, 2007 and will be held in 2008. They show an increasing public acceptance of the wind farm.

### *3.2) Compensation plan*

As part of compliance with environmental legislation, the NoordzeeWind developers were required to develop and carry out a plan to compensate for the project’s potential negative impact on the local environment, specifically focused on birds and visibility. Among the six measures undertaken by Shell and Nuon are the conservation works in the dunes area, making it more attractive as a place both for wildlife and people.

Developers have acquired some fallow agricultural land adjacent to the dunes area and converted it into wetland for stimulating bird feeding. In addition, despite an initial proposal to locate the wind farm's transformer sub-station on the site of an old radio station among the coastal sand dunes, the developers demolished the existing station and moved the sub-station about 200m to a new site. The old site was converted into habitat for the sand lizard protected species, thus strengthening the dunes natural habitat.

Another interesting measure involves supporting what is called the "fishing for litter" project. Through the international organisation KIMO, this initiative enables local fishing boats to separate and collect rubbish which gets caught up in fishing nets – and then ensure it is recycled or safely disposed. NoordzeeWind is sponsoring a number of fishing boats from the port of IJmuiden taking part in the scheme. This means providing large collection bags on the boats and then dealing with processing of the waste once it's back on shore. Before the project started up, rubbish such as plastic would invariably be tipped straight back into the sea, damaging both the landscape and birds, which often inadvertently eat it and die from hunger with a stomach full of plastic.

#### ***4) Stakeholders' involvement***

The general position of most environmental stakeholders has been cautiously positive from the beginning. Although there were concerns about unknown environmental effects (birds and visibility), the need for large-scale wind power was well appreciated. As a result, an extensive environmental monitoring programme has been defined, the scope of which has been prepared in consultation with the public and stakeholder groups.

A "stakeholder reference group" was set up in 2002, comprising environmental and fisheries organisations as well as regional government representatives. The group has an independent chair person, and meets every six months to review project progress including results of the ongoing ecological investigation work. This forum has proven very beneficial as a sounding board throughout the project and has helped to identify priority areas.

The concerns of key stakeholders, such as navigation and fisheries interests, were addressed by the government during the site selection phase. Agreed to measures, such as support radar on one of the turbines, were subsequently included as permit conditions.

The local information centre in Egmond aan Zee has not only proven very useful as a facility to reach out to the local public, but especially to the large number of tourists who visit this popular bathing resort every year.

In the developers' view, a key success factor has been the lead role of the government in the site selection phase, as only governments have the authority to set priorities in relation to other uses for the sea. This applies not only to environmental stakeholders, but also to fisheries and navigation interests.

## **2<sup>nd</sup> case: Black Law onshore wind farm, Scotland (United Kingdom)**

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*The Black Law wind farm is a good example of how a major contribution to pollution reduction can be combined with improvements to the local environment. One of the largest operating onshore wind projects in the United Kingdom, it has also succeeded in enhancing and restoring blanket bog and turning an abandoned cast coal mine into a habitat management scheme worthy of approval by both conservation and wildlife organisations.*

### **1) Project characteristics:**

Location:	South Lanarkshire, Scotland, United Kingdom
Project developer:	ScottishPower
Installed capacity:	124.2 MW
Turbines:	54 x Bonus (Siemens) 2.3 MW
Turbine height:	70 m (110m to tip)
Electricity supply equivalent:	85,000 households
Capital cost:	€139 million
Estimated costs related to the implementation of environmental requirements:	Opencast mine restoration: €6m Forestry clearance and restoration: €1.5m Annual management: €70k
Date of operation:	July 2005

Black Law is the largest operating onshore wind farm operating in the United Kingdom. The proposal for the development of a wind farm at Black Law was granted planning approval in February 2004. This approval was preceded by an Environmental Impact Assessment (EIA) on the potential local impacts of the wind farm development. Works on site started the following May and were carried out in two phases. The first project phase consisted of the installation of 42 wind turbines and was completed in July 2005. Further 27.6 MW were installed in a second project phase, which was concluded in September 2006.

### **2) Description of the main environmental concerns and potential impacts**

As part of the site selection and the EIA process, extensive ornithological and ecological studies were conducted. There are no local, national or European environmental designations on or adjacent to the project site, which has demonstrated having a very low natural and wildlife value. This was because post Second World War development had left a mix of poorly restored and abandoned opencast coal mines, commercial conifer plantation, degraded blanket bog and improved grassland.

The preliminary ecological studies have, however, indicated the main adverse environmental impacts involved the potential effect on blanket bog and the disturbance to various bird species, such as Long-eared Owls and Waders.

### **3) Identification of the measures/actions carried out to mitigate these potential impacts**

In order to mitigate these potential impacts, ScottishPower has developed a **Habitat Management Plan (HMP)**, which has as its main goal to implement positive land management for the benefit of landscape and wildlife conservation. It covers 1,440 ha of the 1,850 ha-site and was developed in consultation with conservation organisations, such as the Royal Society for the Protection of Birds and Scottish Natural Heritage. Both associations are represented in the Habitat Management Group and have offered encouragement and advice.

The HMP is ongoing and will operate for the lifetime of the wind farm. It is an iterative process with objectives and management prescriptions liable to change, as new information becomes available. The HMP is updated as required to reflect these developments.

### ***Blanket Bog Management***

Central to the HMP has been ScottishPower blanket bog management of an area over 900 ha. This includes enhancing 450 ha of existing blanket bog habitat and restoring 458 ha of blanket bog by removing commercial conifer plantation.

The main management measures include grazing management and the development of a drain management plan. This involves identifying the core areas where dams are actively draining the blanket bog and implementing a plan for damming these areas to aid the rewetting of the bog.

### ***Restoration of 150 ha opencast coal mines***

ScottishPower has also carried out a series of measures to tidy up the mess left by the abandoned coal workings. As part of the habitat creation scheme, the Climpy mine, with a capacity of 1.5 million cubic metres, has been filled in with material from a mass of spoil heaps and developed as wet grassland for breeding birds. Stones from the quarry space were used for the road surfaces, making it a good example of local recycling. Altogether, a total of four million tonnes of material had to be moved.

### ***Plantation programme***

A programme of planting trees, hedges and pockets of crops to improve conditions for farmland birds was also developed. In consultation with Lanarkshire Farmland and Wildlife Advisory Group (FWAG), three areas totaling 2.59 acres have been planted with a blend of grains and seeds. These were left unharvested to provide feeding for finches and buntings over the winter.

It is hoped that planting deciduous woodland and scrub encourages Black Grouse - a UK Biodiversity Action Plan species - back to the area for the first time in 10 years. Meanwhile, sensitive planting within six metres of the banks of the Abbey Burn, 300 metres of which were reinstated to their original course as part of the Climpy restoration, is aimed at encouraging Water Voles and Otters. Nest boxes were also provided around the Habitat Management Area as homes for a range of bird species, such as Kestrels, Barn Owls and small birds such as Blue Tits and Spotted Flycatcher.

### ***Observed results***

The Black Law wind farm demonstrates that wind farms can deliver significant biodiversity gains for a range of threatened habitats and species. Vegetation monitoring has shown very encouraging signs of regeneration by typical upland vegetation such as Cotton Grass, Heather, Blaeberry and Bog Cranberry. Meanwhile, an increase of a range of bird species has been observed - notably, breeding waders, Black Grouse, Short-eared Owl, Curlew and Snipe.

### 3<sup>rd</sup> case: Cortijo Linera onshore wind farm, Malaga (Spain)

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The Cortijo Linera wind project demonstrates how it is possible to build a wind power plant during birds' breeding period without damaging birdlife. The project developer, in collaboration with the regional environmental authorities, a consulting company and scientific experts, found and carried out different solutions to mitigate the potential environmental impact on bird populations.

#### 1) Project characteristics:

Location:	Teba, Campillos, Andalusia, Spain
Project developer:	Gamesa
Installed capacity:	28 MW
Turbines:	14 x Gamesa G-90 2.2 MW
Turbine height:	78 m
Capital cost:	> € 32 million
Estimated costs related to the implementation of environmental requirements:	€ 1,500 for the environmental compatibility plan € 1,050 per visit for the environmental vigilance plan
Scheduled completion:	December 2008 – February 2009

The process to obtain the administrative authorisation and the necessary environmental and construction permits for the onshore Cortijo Linera project goes back to December 1999, when the project developer submitted a preliminary project plan and an Environmental Impact Assessment. In the spring of 2003, Gamesa had obtained both the Environmental Impact Statement and the administrative authorisation from the Andalusia government. Following a request for tenders launched in September 2002, the project developer also fulfilled the necessary conditions for carrying out the project and was invited to submit a detailed project implementation proposal which was approved in July 2006. Since then Gamesa has been involved in obtaining other different permits, such as cultural and road construction permits. Due to long and complex administrative constraints, construction on the project only started in March 2008. By the end of 2008, at least two wind turbines are scheduled to begin operating.

#### 2) Description of the main environmental concerns and potential impacts

One of the main questions the developer needed to answer was the **potential impact of the wind farm construction phase on bird populations**. The Cortijo Linera project was proposed to be built in a grassland area which has proven attractive for *Tetrax tetrax* birds breeding. Furthermore, a *Falco naumanni* nest of seven birds was found in the surroundings of the wind farm. These concerns were further emphasised by the fact that the project developer was required to start constructing the wind farm during the spring of 2008 – the most important season for birds and animal breeding – because otherwise the Environmental Impact Statement and the administrative authorisation would be outdated.

#### 3) Identification of the measures/actions carried out to mitigate these potential impacts

In order to ensure the construction of the wind farm project without damaging birds' breeding, Gamesa participated in a joint meeting with the regional environmental authorities. A common agreement was reached by both parties on:

- a. Developing a compatibility plan;
  - And carrying out an environmental monitoring plan.

##### 3.1) The compatibility plan

Following the suggestion of a consulting company specialising in environmental studies, and in agreement with the environmental authority, Gamesa decided to remove the grassland area surrounding the wind farm (83m<sup>2</sup>). The initiative has proven very successful since birds, and especially *Tetrax tetrax* birds, are no longer attracted by the wind farm grassland area for breeding purposes. Furthermore, and after careful assessment, this solution proved to have no

impact on customs and habitats of bird populations. As the region is very rich in grassland, birds avoid the Cortijo Linera wind plant area and go directly to other attractive breeding sites.

In order to address the potential risks to the *Falco naumanni* species reproduction, the project developer created an exclusion zone of 400m around the existing *Falco naumanni* nests. No activity – including circulation or construction activities - is allowed in this exclusion zone.

### **3.2) The environmental monitoring plan**

As part of the environmental monitoring plan, an extensive study has been carried out to analyse the wind farm impact on different concerned bird species during both the construction and operation phases. To assess these potential impacts, Gamesa has subcontracted the services of an ornithologist, who has been visiting the wind farm site since the beginning of its construction phase. During the most relevant months coinciding with birds' breeding periods, these field visits are done on a weekly basis. The regular twice-a-month visits during the construction phase will be replaced by one visit a month when the wind plant starts operating.

The first preliminary results of the monitoring have revealed the presence of one *Tetrax tetrax* bird flying around the area of a future wind farm road. Consequently, the project developer has decided to postpone the land-clearing works in this specific area until the moment the breeding season is over. The local environmental authority has been informed of these developments.

#### 4<sup>th</sup> case: Monte Arca onshore wind farm, Pontevedra (Spain)

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*The Monte Arca project shows how it is possible to develop wind energy power in a special wolf population area. It provides relevant experiences on how wind power plants are compatible with the preservation of local cultural heritage and can contribute to the promotion of rural tourism activities.*

##### 1) Project characteristics:

Location:	Monte Arca, Pontevedra, Galicia, Spain
Project developer:	Gamesa
Installed capacity:	42 MW
Turbines:	21 x Gamesa G-90 2.2 MW
Turbine height:	78 m
Capital cost:	> € 5 million (project first phase)
Estimated costs related to the implementation of environmental requirements:	€ 36,000 for the <i>Canis lupus</i> study € 37,150 for the trekking route
Scheduled completion:	December 2008 (project first phase)

Design of the onshore project Monte Arca started in 2003. From 2004 on, the project developer carried out an Environmental Impact Assessment (EIA) and all other required initiatives to obtain the environmental and construction permits for the three-wind-turbines-project first phase. Construction was expected to begin on the first stage of the wind farm in July 2008, and the first three wind turbines should be connected to the grid by the end of the year.

##### 2) Description of the main environmental concerns and potential impacts

The main question raised by the EIA was the potential impact of the wind farm on the ***Canis lupus* wolf population**. As the project Monte Arca is situated in a rural tourism area, some concerns were also raised about its **landscape impacts** and its potential effects on the local economy.

##### 3) Identification of the measures/actions carried out to mitigate these potential impacts

To tackle these concerns, Gamesa signed with the regional authority (Dirección Xeral de Conservación da Natureza de la Consellería de Medio Ambiente) an agreement to carry out two types of measures:

- a. Monitoring of the wind farm impact on wolf populations during the project pre-construction, construction and operation phases;
- b. And the development of a compensation plan.

##### 3.1) Monitoring of the wind farm impact on wolf populations

In order to monitor the potential wind farm impact on wolves, Gamesa sub-contracted the services of a company specialising in wolf habitat studies. The company is responsible for analysing whether the construction and operation phases of the Monte Arca project are compatible with the conservation of the *Canis lupus* wolf species. This extensive study is focused on the main variables that may affect the wolves, such as food supply and survival rates. Among other issues, the company assesses the wind energy plant's effect on wolves caused by increasing human activity and forest fire risks. When available, the monitoring analysis results will be directly communicated by scientific experts to the responsible regional authority. So far, preliminary results show there is no substantial impact on the wolf population.

It is important to underline that the project developer is also involved in the monitoring of other wildlife species identified by the EIA, such as birds and chiropters. A more extensive monitoring is carried out for birds of prey identified by the national list of endangered species. According to the Environmental Impact Statement, an exclusion zone of 500m should be respected in case bird of prey nests are found in the area.



### **3.2) Development of a compensation plan**

In agreement with the regional administration, Gamesa has developed a compensatory plan to mitigate the potential disruptive wind farm impacts on landscape and on rural tourism activities. The main element of the compensatory plan is the development of a trekking route and the placement of different informative posters. The trekking route includes not only the wind farm site, but all the relevant archaeological sites in the surroundings. An archaeological management company was sub-contracted to design and develop the project proposal, which was approved by the *Estrada* and *Cuntis* local authorities. The Cuntis village council has expressed such a high interest in the project that it has become directly involved in the improvement and enhancement of the proposal, adapting it to its specific requirements. The council has publicly recognised the trekking route initiative as a very positive measure to promote local tourism activities and to protect the regional cultural heritage.