# Environmental risk for offshore wind farm developers: lessons from other industries

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**SYNOPSIS**

A lack of understanding of the environmental risks, and how they inter-relate, led to some costly and embarrassing situations in the offshore industries in the 70s and 80s. It is important that the offshore wind industry does not try and 're-invent the wheel' and find itself in a similar position. This paper looks at some of the lessons learned in the oil & gas, water, telecommunication, and aggregate industries, which may benefit offshore wind farm developers.

## 1 INTRODUCTION?

*Offshore Risks*

Developers, moving offshore for the first time, will want to minimise their financial, environmental, and safety risk. Although many of the risks that they will face are similar to those on land, they will vary in both magnitude and diversity. There are also some that will be entirely new to them.
Offshore, the environmental risks become an increasingly important issue; manage them wrongly and considerable costs and time delays can be incurred.

*Types of Environmental Risk*

Essentially, there are two types of environmental risk:

a) Impacts by the environment on a development

   Seabed conditions, geohazards, oceanography, meteorology, human activities

b) Impacts on the environment by a development

   Fisheries, marine/coastal ecology, geomorphology, human activities, visual impact

The environmental risks in (a) have played an integral part in man's endeavours from the beginning of time. By the fact that he is 'part of his environment', his developments have evolved by intuition and instinct. However, through the rapid growth in marine science and technology over the last 100 years, developers have presumed to try and 'manage the environment'. Even now, they are only partially successful, as evidenced by failure of their developments, from time-to-time, in various parts of the world. What they should actually be learning to do is 'manage the environmental risks': balancing the costs and time delays against the potential impacts and consequences.

In contrast, the environmental risks in (b) have come onto the offshore scene much later in time – from about 20 years ago. They have arisen because man began to realise that his

activities offshore can have a deleterious effect on his environment. In consequence, he has introduced legislation and regulation to safeguard it – albeit in a piecemeal and uncoordinated way. Developers must now learn to manage another set of environmental risks: balancing potential impacts and time delays against the costs of mitigation.

## 2 IMPACTS BY THE ENVIRONMENT

*Other Industries*

Without a doubt, the main industry that has driven the development of offshore science and technology over the last 30 years has been oil & gas. What it has achieved in offshore engineering terms has been nothing short of incredible. Spinning off from the many developments in the North Sea and elsewhere has been a range of equipment, skills and services, specifically to manage the environmental risks associated with seabed geology, currents, waves, tides, and winds. The proof of the pudding is in the eating. On the UK Continental Shelf alone, there are over 200 fixed or floating structures and over 25 pipelines carrying the oil or gas to the shore.

The lessons in the early days were many and hard but they were learnt well: 'blowouts' due to shallow gas pockets; unstable jack-up rigs due to poor ground conditions; broken risers and wellheads due to very strong currents; inadequate deck heights due to poor design criteria; excessive down-time due to long periods of high winds and waves;…and so on. Now, no development or activity offshore proceeds without a detailed appraisal of the environmental risks. This appraisal will include desk studies, site investigations, hindcast studies and statistical analyses – some of them requiring approval from various certifying bodies.

Likewise, in the water and telecommunication industries, inadequate site investigations and appraisals of the environmental risks at an early stage in a development's history have led to losses of many millions of pounds during construction (due to unforeseen conditions) or many months of delay (due to design faults). These industries, like oil & gas, are realising that 3-4% of the development's costs, spent up-front, can save much more at a later stage. In fact, this early expenditure could well ensure that the whole development is not compromised.

*Offshore Wind Farm Industry*

Most developers (as consortia or otherwise), understandably, are loath to spend significant sums of money up-front, before the development has been 'sanctioned' and becomes a live project. However, the mechanism through which the British government is expecting to conduct the first round of licence awards will put pressure on the developer to understand clearly the environmental risks he faces on his selected site, prior to award of a contract by government to develop that site. He needs to consider the key environmental issues, which will either affect the development or incur him in extra expenditure in design and construction.

At the pre-qualification stage, he should begin to appraise his environmental risk – if he has not already done so. Drawing on a variety of databases, existing reports and, possibly, some proprietary data, he can evaluate the wave and current climates (assuming that in his resource studies he has obtained a good knowledge of the wind climate), tidal and surge conditions, human activities, operational constraints, and last, but far from least, the ground conditions and topography. Likely as not the data and information will be patchy but it will provide the basis upon which any future site investigations and measurements can be made.

Following the pre-qualification submission, the government will register sites to successful developers, who will then need to convince themselves and government that they fully understand their risks and are prepared to manage them. Within the period of a few months a developer will need to pull together a variety of data and information on the environment, to enable the risks to be evaluated and development costs finalised.

Preliminary surveys of the bathymetry, surface geohazards, sedimentary processes, rock distribution, and soil and rock strengths will be

an essential component of his risk management. A knowledge of the waves, currents, and tides can be built up from known data, some site specific measurements, and simulation through mathematical modelling; the sedimentary processes through physical and mathematical modelling and -- dare it be said -- experience and judgement. Other environmental risks can be evaluated through desk studies and extreme value analyses.

*Site Investigations*

It is important that the developer uses good, professional contractors for the geophysical, geotechnical, and oceanographic surveys. Because of the specialist nature of some of the work, there are few companies that can do all of the work well. There may be the need for 1, 2, or 3 companies to be integrated into the studies. There are up to a dozen companies in UK and Europe that will provide a good, professional service – given good contracts, tight specifications, and sound scopes of work. They all have had substantial experience of working offshore for the oil and gas and cable industries. Their equipment and data presentations are state-of-the-art. Equally important, they have access to a variety of survey vessels – some of them their own. Indeed, one of the issues facing the offshore wind farm industry may be the availability and suitability of survey resources – although the recent cutback in oil and gas exploration could help in this matter. It is also important to remember that trying to do survey work in the winter months can be very expensive.

The types of contract selected for this work are important. They need to be adapted to marine conditions. The issues of location control, data quality, downtime due to poor weather, maritime safety, notices to mariners, etc. become important.

*Conceptual Design*

Throughout the data gathering and collation processes the developer's environmental risk managers should be working iteratively with his design engineers. Once the ground conditions have been assessed and design and operating criteria calculated, he should be able to see where his major risks lie and his engineers develop conceptual designs that remove or minimise these risks.

Key issues for the offshore wind farm industry will be:

- Foundation design for the turbine structure
- Response of the turbine structure to joint forces, operating at different frequencies -- such as those due to winds, waves, currents, and rotor movements
- Impacts of extreme events in currents, tides, winds, and waves (including breaking waves)
- Sediment scour and accretion through and around the farm site
- Cable routing – hazards, burial depths, land/sea interfaces
- Shipping and aviation risks, including collision
- Operating conditions for maintenance and repair

## 3 IMPACTS ON THE ENVIRONMENT

*Planning Processes Offshore*

For a variety of reasons, the government, and many of the pressure groups in the marine environment, as well as the developers, want offshore wind farms to be a success. The industry starts with goodwill in many areas of our society. It is important that it does not destroy this through poor management of its risks – particularly the impacts by its developments on the environment.

In the 80's, this type of environmental risk was at a nascent stage. Offshore, both developers and regulators were feeling their way forward without the benefit of any over-arching control, as provided onshore by the Town & Country Planning Act. They had to grapple with new ideas and disparate standards, arising through EU Directives and reactive government legislation. Industries were, and still are, controlled sectorally and by different

government departments. Because of this lack of a unified approach, progress offshore in the areas of Environment Impact Assessment (EIA), consents and planning processes, and associated political and public relations work has lagged behind that on the land. The legislation controlling development offshore remains inadequate and, as we are seeing, is poorly adapted to cope with the demands of new industries as they arise.

In the early years there was a view prevailing in some industries that this type of environmental risk could be satisfied by a cursory 'tick-in-the-box' approach. The Brent Spar saga, which has had a major impact on the management of environmental risk in the oil and gas industry, arose because the operator essentially saw the disposal problem as an engineering issue and not also a business/communications issue. Conversely, the government's final response to decommissioning – by banning deepwater disposal altogether -- is indicative of a regulator 'on the back foot' and also not participating in a meaningful dialogue.

However, these uncertainties are disappearing. As regulators have become better informed, and pressure groups have realised that they can influence events, the need for better identification of the environmental risks – and design of appropriate mitigation measures – has become increasingly important for the developer. Now, failure to address these environmental risks at the early stages can delay the necessary permits and consents. What's more, if not handled effectively with the many consultees, the development can be slowed or stopped.

It is appreciated that the wind farm industry already knows a good deal about the interfaces between planning, politics, and the environment. Indeed, the move offshore is partly driven by this. It is worth noting, however, that offshore industries have their own problems in promoting marine projects. The issues may be different but the politics can be equally challenging.

*Future Developments*

Most of the environmental issues which will be raised in marine EIAs, and how to tackle them, are now understood by regulators such as MAFF, DTI, DETR. The exception is visual impact, which is a very new issue in the marine environment, and one which existing legislation cannot deal with adequately.

The key issues are likely to be:

- Physical issues: sedimentary processes, wave climate, coastal erosion
- Biological issues: benthos, fish/shellfish, spawning and nursery areas, marine mammals, birds
- Human issues: visual impact, fishing, navigation, aviation, local economic benefits.

The potential impacts of a development are both positive and negative and the best EIAs stress the environmental benefits of the development as well as the negative effects. It is perfectly legitimate to stress the 'global' environmental benefits of wind power in an EIA, and not simply to dwell upon relatively small-scale local inputs.

However, unbalanced or biased EIAs will be spotted a mile off. There is nothing to be gained from putting PR material into an EIA, or drawing tendentious conclusions on impacts, which are not supported by proper scientific assessments. This is always a bad idea, and it could damage the reputation of the entire industry as well as throwing doubt on the independence of the assessment. Offshore EIAs are reviewed by government departments and agencies, which have built up many years of relevant experience. They are staffed by leading scientists in the various specialist disciplines covered in the EIA, including experts in the identification of Clupea harengus rufus.

*Cumulative Impacts*

Because of the mobility of the marine environment, there will definitely be pressure for cumulative environmental impacts of

offshore wind farms to be studied especially where individual sites are close together. The environmental assessment of individual wind farms may not be seen as sufficient in the medium-term as more and more sites are proposed in the most attractive areas. Similar issues have arisen in the marine aggregates industry where MAFF/DETR will not recommend any more licences in some areas until detailed regional studies of cumulative impacts have been completed. Funding these studies, which may require detailed baseline research, can be a source of friction in that industry and has led to very long delays in the determination of applications. In marine aggregates, the major cumulative impacts studied are effects on fisheries and sedimentary processes. In offshore wind, cumulative visual impacts, noise effects on mammals, and impacts on navigation may be of equal or greater importance.

*Industry Differences*

Offshore wind farms can learn from environmental work in other marine industries, but the differences are just as important as the similarities. Offshore wind is itself environmentally benign; it generates no routine emissions or has the potential to generate significant emissions under emergency conditions; it disturbs the seabed to a very limited extent, although the cable routes will cause greater disturbance; and, with careful planning and consultation, it should be able to co-exist with fishing and navigation interests. On the other hand, it has greater potential for visual impact than any existing marine industry, though this will depend on distance offshore and the characteristics (topographical, visual quality and land use) of the coastal environment.

## 4 LESSONS TO BE LEARNED

There are many lessons that can be learned from other industries:

a) Start investigating all of your environmental risk at the beginning of the development. Six months into the conceptual design could be too late.

b) Use skills and resources, wherever possible, that are experienced in the offshore industries, particularly oil and gas.

c) Start a dialogue with the regulator and consultees as soon as possible – all parties will benefit.

d) Ensure independence in your EIA and related work

e) Plan the data collation and gathering programmes carefully. Significant sums of money and time can be saved through good scopes of work, contractor selection, project programmes planned to take advantage of good weather conditions, and good quality control. Co-ordination of surveys with other developers may also result in considerable savings.

f) Involve the engineering certifying authorities at an early stage of your deliberations on design and design criteria.

g) Consider Joint Industry Projects (JIPs) for certain research topics that do not compromise the commercial objectives of any individual developer. Examples that spring to mind are sedimentary processes, cumulative visual impacts, risks of bird strike, environmental design criteria, etc. It is valuable if government is a member of any JIP.

h) Do not undertake more work than you need to in the mitigation of any of your risks. Beware of the demand for ‘danegeld’, whether from government institutions, pressure groups, or fishermen. If you have to do something, do not ‘go it alone’. Work through a JIP or the BWEA.

i) Ensure that your environmental risk management is in accordance with the latest practice and that all parties – including the regulator and other government agencies, buy into your proposals for ‘cradle to grave’ management.

j) Promote and support a regulatory system in which the consent processes are fully

co-ordinated -- subject to time limitations -- and are under the direction of one appropriate government department.