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ECONOMIC CONSULTANTS

# Socioeconomic Appraisal of the Proposed Clogher Head Offshore Wind Farm

**Report**

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## Executive Summary

1. This report provides an assessment of the socioeconomic impact of constructing a 250MW offshore windfarm off the coast of Co. Louth. Currently, wind generation capacity in Ireland amounts to about 592MW, but the only offshore facility is the 25MW currently operating at Arklow Banks. This is well short of projections.

2. The investment will proceed in 5 phases of approximately 50MW each. The projected start date for construction of Phase 1 is mid-2008 with subsequent phases annually thereafter. Total construction costs are estimated at €375 million. Technical and planning work is ongoing and is projected to be completed during 2007 and consultations have been undertaken. Total projected annual output is 788GWh for the full 250MW installation and production is forecast to begin in early 2009.

3. The underlying drivers for the development of wind generated electricity are concerns regarding the future sustainability of the supply of fossil fuels and the impact of this on prices, the environmental impact of maintaining the current use levels of fossil fuels and risks regarding the security of supply for a country such as Ireland that imports 90% of its energy requirements. With the appropriate infrastructure, Ireland would be a very competitive location for wind power generation.

4. The Stern Report on Climate Change provides a comprehensive review of the economic costs of global warming and the policies that are required to address this issue. Despite the extent of the problem that is faced, the review is ultimately optimistic. It concludes that there will be large costs for economies if the current trend is allowed to persist but that it is not too late to address the problem at much lower cost provided action is taken in the next decade or so. The worst impacts of global warming can be avoided if $CO_2$ equivalent emissions can be cut by 25% from current levels by 2050. The costs of stabilising $CO_2$ levels in the atmosphere would be only 1% of GDP each year, or lower, if action is undertaken in the short term, but if concerted action is not undertaken then the cost of climate change will be up to 20% of GDP.

5. Onshore wind power is now approaching competitiveness with other fuel sources. However, this is not the case with offshore. While Ireland is potentially very competitive in terms of its natural resource, the prospect that technological improvements and economies of scale may reduce turbine costs in the longer term has resulted in a cautious approach to supporting the development of the sector. However, because of the costs discussed in the Stern Report and the rising cost of fossil fuels, increased demand for equipment is likely to lead to increased costs for last adopters. In this situation, the benefits will shift towards countries with advantages in the production of equipment rather than those with competitive natural resources.

6. Ireland has recently moved towards a feed-in tariff support system. However, effective participation in the SEM, which will ultimately be the criterion for the long term development of the electricity generation industry, will require that Ireland has adequate interconnection. The role of policy is likely to move increasingly towards facilitating the development of the industry through supportive regulation rather than the price supports that existed in the past.

7. Although Louth is a largely rural county, the local economy is dominated by Dundalk and its environs and the population is mostly urban. Manufacturing remains particularly important and there is some evidence that knowledge industries are not as important as for the economy as a whole. Manual occupations are relatively more important and educational attainment levels are somewhat weak. This type of economy would benefit from demand for manufacturing and construction associated with the proposed investment.

8. Tourism in the area is concentrated on historic and cultural attractions and the research indicates that no detrimental effects from the development of the windfarm are expected. Ongoing consultations in relation to activities such as sailing and fishing are required and are planned.

9. An analysis of the socioeconomic impact of the project was done over 20 years. The electricity price was based on the published CER BNE price for 2007. Other values are based on variables and sources described in the text. The results are shown in Table A. All values are discounted at a real rate of 5% per annum to the base year before construction begins i.e. 2007 on current plans.

Table A: Economic Impact of the Proposed Windfarm (€ million)

| | |
|---|---|
| Incomes from Direct Employment | 69.66 |
| Income Taxes & VAT | 37.46 |
| Electricity Value | 808.22 |
| Green Credit Value | 97.91 |
| Income from Supported Employment | 22.85 |
| Tax from Supported Employment | 5.71 |
| DCMNR lease | 15.31 |
| Security of supply | 12.76 |
| R&D/Signaling | 34.03 |
| Total | 1,103.91 |

10. Sensitivity analysis was undertaken in respect of using a 4% discount rate, a lower value for green credits and a higher electricity price arising from ongoing fuel price increases. The results are contained in Section 5 of the text. In addition, a number of other potential impacts are identified for which it is not possible to identify monetary values.

11. Questions have been raised regarding the costs that would be imposed on the economy due to the intermittency of wind as its penetration level increases. However, there are opportunities to develop flexible demand variations to match this intermittency and studies suggest that system costs of unpredictable intermittency are low in comparison to generating costs. Research in the UK indicates that the impact on consumers would be about 0.1p per kWh i.e. electricity would be 1% more expensive to produce while studies that incorporate the risks associated with over dependence on a single fuel source conclude that total system costs fall when wind is added to the generating mix to foreseeable penetration levels.

# 1. Introduction

This report provides an assessment of the socioeconomic impact of constructing the proposed 250MW offshore windfarm off the coast of Co. Louth. Despite the existence of good wind resources, rising prices for hydrocarbon fuels, intensifying concerns regarding the security of supply, and the need to reduce emissions of greenhouse gasses under the Kyoto protocol, the wind energy sector has developed much more slowly than expected in Ireland. Currently, wind generation capacity amounts to about 592MW, but the only offshore facility is the 25MW currently operating at Arklow Banks. This is well short of projections and planned facilities.

Section 2 of the report summarises the current stage of development of the wind energy industry in Ireland with specific reference to the major factors driving its development. Among these, the competitive resource available in Ireland, the emergence of trading in Green Credits and the imminent Single Electricity Market in Europe will prove to be particularly important in the future. In effect, these mean that the role of policy is likely to move increasingly towards facilitating the development of the industry through supportive regulation rather than the price supports that existed in the past.

Section 3 provides information on the project and the nature of the investment that is proposed. Section 4 provides an overview of the regional economy in the vicinity of the infrastructure and discusses the potential economic impact of the investment through industrial linkages. A detailed evaluation of the potential impact of the project on the economy, including direct and indirect effects, is contained in Section 5.

## 2. Current Stage of Development of the Sector

The underlying drivers for the development of wind generated electricity are concerns regarding the future sustainability of the supply of fossil fuels and the impact of this on prices, the environmental impact of maintaining the current use levels of fossil fuels and risks regarding the security of supply for a country such as Ireland that imports 90% of its energy requirements. Against this, the pace of development of alternative sources of energy is driven by technological progress, the economics and commercial realities of generating electricity using renewable sources and the role of policy in promoting the change to renewables. For two of these criteria – technology and costs – wind power is the obvious alternative to fossil fuels in Ireland; in terms of policy the picture has been less clear.

### *2.1 Capacity and Progress*

Ireland's national target for electricity from renewable sources was to add 500MW of capacity to the grid in the period 2000-05[1]. Prior to 2000, capacity stood at about 350MW. This had risen to about 665MW of which 400MW was wind energy at end 2005. Thus, only about 300MW or 60% of the target was attained. The most recent figures indicate a total of 592MW connected with a further 649MW contracted[2]. The target under the EU RES-E Directive is to obtain 13.2% of total electricity consumed from renewable sources by 2010. The forecast rate of growth of consumption means that this will equate to 4,780GWh in 2010. Allowing for generating capacity from other renewable sources, this would require 1,200MW of wind energy in 2010 i.e. approximately 800MW above the level at end 2005[3]. Furthermore, the European Renewable Energy Council has recommended a target that 20% of electricity be generated from renewable sources by 2020. At forecast consumption growth levels, this would require 7,400MW of capacity of which 6,400MW would be wind energy[4]. This would still be low on a per capita basis compared to leading EU countries.

While this equates to a very big increase in capacity it is small when compared to the wind resource that is available in Ireland. The accessible resource has been estimated at 12TW meaning that the installed capacity would amount to only .05% of the available

[1] Department of Public Enterprise (1999) *Green Paper on Sustainable Energy*

[2] ESBNG (May 2006) *Irish Electricity System: Summary of All Wind Farms Figures*. Further pipeline applications amount to 3,126MW but experience to date suggests that only a minority of this capacity is likely to be developed.

[3] Based on figures contained in IWEA (2005) *Renewable Energy in 2020: A response to the Consultation Document from the DCMNR 'All-Ireland Energy Market: Renewable Electricity – A 2020 Vision'*. This paper estimated that there are about an additional 2,400MW of wind capacity in the pipeline awaiting grid connection agreements.

[4] IWEA (2005). This paper identified a target of 2,000MW off-shore capacity for the island as appropriate.

resource[5]. Clearly the constraints on achieving the targets arise not from this source but from the types of issues discussed in the next section: commercial requirements, social acceptability, and grid capabilities.

### *2.3 Growth Determinants and Challenges*

*Economic Impact of Climate Change*

The recently published *Stern Review of the Economics of Climate Change* is considered to be one of the most comprehensive reviews of the economic impact of global warming and the policies that are required to address this issue. The review is clear that there will be large costs for economies if the current trend is allowed to persist but that it is not too late to address the problem at much lower cost. However, urgent action is required with a window of opportunity expiring in around 20 years after which the changes would likely be irreversible.

The research estimates that the concentration of greenhouse gases in the atmosphere will reach double its pre-industrial level by about 2035 if no action is taken with a likely increase in global temperatures of 2 to 5°C. Even if the effect is more moderate there would still be a considerable impact on the environment with the initial effects already unavoidable. The research indicates that the worst impacts can be avoided if the levels of greenhouse gases in the atmosphere can be stabilised at just above current levels. This will require that $CO_2$ equivalent emissions are at least 25% below current levels by 2050 and by perhaps 80% in the longer term.

The work estimated that the economic impact of climate change will be between 5 and 20% of GDP depending on the risk assessment and the impacts included if concerted action is not undertaken. However, while the required changes are considerable, the costs of reducing greenhouse gas emissions using a range of approaches would be around 1% of GDP each year if action is undertaken in the short term. In fact, the costs may be much lower if the calculation includes the potential benefits from the growth of new markets in environmentally beneficial processes and products.

The research indicates that the costs of climate change has considerably higher than in previous work for three main reasons. First, the direct impacts on the environment and on health reduces global per-capita consumption by 5 to 11%. Second, revised model, based on recent scientific evidence that include feed-back responses to initial increases in greenhouse gases indicate that the total effect of a change in concentrations is higher than previously thought. Third, because the impact will fall disproportionately on poorer countries that can least afford these costs the overall impact on the global economy is about 25% higher than previously estimated. Together these effects lead to the conclusion that climate change will reduce consumption by 5 to 20% with the likelihood

[5] ESBI (2004) *Renewable Energy Resources in Ireland for 2010 and 2020*. Report to SEI

being that it will be towards the upper end of this range. While stabilisation will require that emissions are reduced to 25% of current levels this can be achieved if they peak in the next 10 to 20 years and then fall by 1 to 3% per year. This would equate to a reduction in GDP of about 1% per annum by 2050.

The review identifies a range of policy measures aimed at increasing energy efficiency, changing the pattern of demand, and promoting the adoption of clean energy technologies. The power sector is specifically targeted as it accounted for 24% of emissions in 2000, the single biggest category identified. If stabilisation is to be achieved it will need to be 60% clean energy by 2050. Even then, global co-operation for the development of carbon trading, cleaner technologies and reduced deforestation will still be required to help to alleviate the impact of the remaining carbon producing activities.

Despite the extent of the problem that is faced, the review is ultimately optimistic. The optimism arises due to the existence of an opportunity to address the problem at relatively little cost compared to the alternative of passive acceptance. However, the need of urgent action cannot be ignored as the next two decades will see this opportunity disappear. This is required at all levels from the individual to national governments and global co-operation. The economic consequences of non-action, similar to the environmental impacts, would be enormous and irreversible.

*Competitiveness*

There is a general acceptance that with the appropriate infrastructure, Ireland would be a very competitive location for wind power generation. The move to a feed-in tariff system, the development of the SEM – and an interconnector for Ireland – and a market for green credits will boost this development. A key development is also the reduced real cost per MW of the infrastructure. Research indicates that these costs should fall to between 65 and 75% of their 2001 level by 2010, and to under 60% for offshore by 2020[6]. If these projections prove to be accurate then a considerable review of the arguments that have been put forward for specific supports to the wind sector would be justified, particularly given the rise in fossil fuel prices. In other words, it is likely that wind generation will be commercially competitive by early in the next decade.

Currently, the large pipeline relative to the amount installed suggests that the competitiveness and commercial viability issues that have dominated discussion of progress in the sector over the past decade are receding in importance and that the required returns are available or will be in the foreseeable future. For the future, ensuring acceptability and obtaining connection are the bottlenecks. However, uncertainties regarding commercial viability remain in the shorter term. This situation has engendered something akin to a 'wait and see' approach that concludes that while Ireland has a natural advantage it should adopt a cautious approach to developing the sector as

[6] Research review in Millborough, D. (2002) *Wind Energy: The Way Forward for Ireland* as reported in IWEA (2005)

technological improvements and economies of scale will reduce costs, specifically the cost of turbines, in the longer term. However, this conclusion is problematic since the imperative towards development that is building as a result of the challenges discussed in the Stern Report and the rising cost of fossil fuels means that demand for equipment and skills will rise. This is likely to lead to rapidly increasing costs in this sector as last adopters endeavour to avoid the costs identified by Stern. In this situation, the benefits will shift towards countries with advantages in the production of equipment rather than those with competitive natural resources.

*Acceptability*

Research generally indicates very high support for renewable energy sources in general but more qualified support initially when specific infrastructure is being considered. Public acceptance of wind energy in general is very high, but this tends to fall when a proposal to develop wind farms is put forward in the vicinity of the respondents' homes. However, before/after installation surveys show that high levels of public acceptance return in the local area after the installation of the wind turbines. Clearly there are education, information and consultation issues to be considered. Research on public attitudes to wind generation in countries with significant industries, such as Britain, USA, Canada, Sweden, Germany, the Netherlands, and Denmark, indicate that there is a high degree of support[7] with the public strongly in favour of the development of wind as a renewable energy. The picture in relation to specific installations is a bit less clear-cut, particularly when the project is first proposed in the vicinity of the respondent's residence. However, once installed any opposition tends to modify towards a neutral or favourable stance.

Research by the SEI indicates that support for renewable energy in Ireland is high and that, to most people, this means wind generation[8]. In fact, the level of support was highest in areas of existing or planned wind farms possibly indicating a more informed population in these areas. There was very little evidence of opposition to wind farms being built in the general area of respondents' homes. A particularly notable finding of this work was a clear acceptance that incentives are required and the survey discovered that 73% of people supported the idea of incentives for the wind power sector. However, most people are unaware of the low penetration of renewables in the overall generating fuel mix. The work concluded that 'the overall attitude to wind farms is almost entirely positive.' These issues are further discussed below with respect to the potential impact on tourism in the area of the proposed development.

In general, offshore could be expected to have fewer potential issues regarding acceptability so that the key issues are connection to the grid/interconnection and commercial returns.

[7] Damborg S. & S. Krohn, *Public Attitudes Towards Wind Power*, Danish Wind Industry Association
[8] SEI (2003) *Attitudes Towards the Development of Wind Farms in Ireland*

*Intermittency and Associated Costs*

Questions have been raised regarding the costs that would be imposed on the economy due to the intermittency of wind as its penetration level increases. However, the situation is not simple and there are many issues to be considered. First, it must be stated that any problems that might be encountered do not arise from the total resource available as any foreseeable level of penetration would only access a tiny proportion of this. Therefore, any remaining problems relate to technical and economic issues. There can be no doubt that the technical issue can be addressed, provided the will to do so is present. The potential solutions can be divided between solutions that address supply issues and demand issues. In the case of the latter, attention has focussed on grid capacity and particularly on calculations of additional operating capacity required as wind penetration increases[9]. Clearly, this would be an additional cost factor to be allocated to wind energy and has been used as a reason to constrain the penetration of wind energy. However, a range of other approaches are possible such as optimal siting of capacity, new developments in energy storage and, probably most importantly, inter-connection and integration into the electricity SEM. Much less attention has focussed on the demand side. Approached from this side, the interconnector remains important but national solutions such as investment in off-peak energy intensive activities would provide a greater balance.

These potential solutions aside, the system costs of unpredictable intermittency are disputed, but studies suggest they are low in comparison to generating costs. These costs vary according to the proportion of total demand that is met from wind power. Research undertaken for the UK government suggested that costs are negligible at low levels and relatively small amounts of intermittent generation cannot be detected by the system operator[10]. This work estimated that at a level of 10% of electricity from wind, costs are less than 0.1c per kWh rising to about 0.2c per kWh for 20% of electricity from wind. The analysis indicated that at a high level of penetration (45% or more of peak demand) costs could rise to 0.3c per kWh. More recent work has concluded that intermittency is not a significant issue that should constrain the development of renewables[11]. In a review of over 200 studies of the impact of wind energy on transmission systems, no evidence was found of any reduction in the reliability of supply In fact, it is increasingly claimed that the inclusion of risk factors indicate that it is fossil fuels that may be unreliable in supply.[12] The work found that the output of fossil fuel plants would need to be adjusted more frequently with higher wind penetration but that this did not imply significant costs. However, it estimated that if the penetration of wind power were to increase to 20% of Britain's electricity demand, intermittency costs would rise. The impact on consumers

[9] Ireland has much lower reserve capacity than the EU norm and thus investment in capacity is required to meet forecast demand, let alone reserve capacity to cater for renewables.
[10] See 'A Programme for a Low Carbon Future' in *The Energy Review*. Report by the Performance and Innovation Unit to the Cabinet Office, February 2002. London: HMSO
[11] UKERC (2006) *The Costs and Impacts of Intermittency: An Assessment of the Evidence on the costs and impacts of Intermittent Generation on the British Electricity Network*. UK Energy research Centre
[12] Lovins, A. (2002) *Small Is Profitable: The Hidden Economic Benefits of Making Electrical Resources the Right Size*. Rocky Mountain Institute

would be about 0.1p per kWh i.e. electricity would be 1% more expensive to produce. This is in line with other independent studies[13].

Recent work also indicates that a wider approach to analysing the economics of wind energy also indicates that the net cost may have been over-stated in the past. This approach emphasis the risks associated with over-reliance on a single source of energy such as is the case in Ireland. Current forecasts indicate that by 2020 71% of the generation fuel mix will be supplied by gas powered plants. Traditionally, the supply risk argument has found favour and the indigenous fuel source identified to reduce the risk was turf. Thus, an important part of the rationale provided for the relatively expensive – and environmentally damaging – use of turf as an energy source was that it was domestically available and thus reduced the risks associated with energy supply. Recent work has indicated that such thinking is still relevant for Ireland. Using a portfolio theory approach, this work concluded that risk-adjusted estimates of the cost of gas-fired generation is at least 50% higher than market prices suggest and found that wind penetration in Scotland could be increased to 31% without increasing costs or risks[14]. If a genuinely long-term planning stance is adopted then the focus changes from the usual emphasis on fitting wind into an existing system to seeing how the system needs to be re-engineered to accommodate a variety of needs including the integration of wind.

Work undertaken in Ireland has concluded that the growth in wind generating capacity will require additional operating reserve but that this will not be substantial[15]. The impact of the operating reserve on total generating costs depends on the planning and forecasting approaches that are adopted and it is possible with an optimal approach that the cost may actually be lower with different fuel types including wind and adequate operating reserve than in a situation where there is no wind in the system. In other words, there may be system benefits up to penetration of 10%. The work found that the additional cost of operating reserve in a typical case is likely to be small and below €0.20 per MWh (i.e. 0.02c per kWh) in 2010 if there is 1,300MW of wind i.e. above the amount required to comply with the EU RES-E Directive, and €0.50 per MWh with 1,950 MW capacity.

The usefulness of adopting a portfolio approach to planning has also been supported by recent work undertaken on behalf of SEI[16]. This work looked at the risk associated with different projected generating mixes in 2020 and the role of renewables in reducing the long term supply security risks. It found that renewables can reduce the costs and risks associated with existing projections and quantified these as a potential reduction of 43%

[13] Dale, L., D. Milborrow, R. Slark and G. Strbae (2004) 'Total Cost Estimates for Large-Scale Wind Scenarios in the UK' in *Energy Policy*, Vol. 32 (17). This also found that the cost of integrating wind into the existing system would be of the order of 0.5p per kWh.

[14] Awerbuch, S. (2005) *The Role of Wind Generation in Enhancing Scotland's Energy Diversity and Security*. Report to Airtricity. The 31% penetration limit was based on on-shore generation. If off-shore is included then the total accounted for by off-shore should not exceed 10% to total electricity needs.

[15] SEI (2004) *Operating Reserve Requirements as Wind Power Penetration Increases in the Irish Electricity System*. Report prepared by Ilex Energy Consulting, UCD, QUB and University of Manchester

[16] McLoughlin, E. and M. Brazilian (2006) *Application of Portfolio Analysis to the Irish Generating Mix in 2020*. SEI Working Paper

in the associated risk and a 12% reduction in costs. While this approach is still being developed and the results remain sensitive to underlying assumptions in relation to the cost of fossil fuels and Green Credits, it is clearly an advance over the static cost models that have been used and that generally failed to include variables to reflect risks.

### *2.2 Policy Developments*

The role for policy arises from three issues:

- Market failures such that many of the costs of fossils fuels are not incorporated into the prices[17] e.g. the costs of environmental damage and the risks associated with relying to such a higher degree of imported energy;
- Risks associated with investing in new technologies that are viable in the longer term but do not provide an adequate commercial return currently;
- The need to overcome inertia in the supply system e.g. the interest of generators in continuing to use existing generating plant with familiar technologies and failure to invest in the transmission system to accommodate the slightly different requirements of renewable technologies.

In summary, the role of policy is to provide the mechanisms to address these issues through ensuring that the full costs of fossil fuels are as transparent as is possible – this is best done by allowing the avoidance of these costs to be valued and ensuring that this value accrues to generators i.e. through a process such as tradable green credits – by ensuring an adequate guaranteed revenue stream to address commercial issues and by ensuring that bottlenecks in the system are removed so that the available resources and capacity can be exploited efficiently.

In general, Irish policy with respect to the development of renewable energy has been driven by the EU and other international forces such the Kyoto Treaty. However, Irish policy has had no more than intermittent successes in addressing the requirements above. The principal support mechanism to date has been fixed term power purchasing agreements (PPAs) under AERI to AERVI. The outcomes fell far short of targets and expectations. This possibility has been clear for a considerable time. For example, an EU study concluded that

> Empirical studies show that countries with feed-in tariffs, such as Germany and Spain, have been able to achieve far higher percentages of renewable energy sources than countries with tendering systems, under which only the lowest bidders receive fixed-term electricity contract, in the UK, Ireland and France, for example[18].

[17] Perversely, EU Member State subsidies to fossil fuels continue to be much greater than the subsidies offered to renewable energies. In Ireland, the ratio exceeds 9:1 for the subsidies to fossil and renewables fuels. See Oosterhuis, F. (2001) *Energy Subsidies in the European Union*. Report to European Parliament.

[18] European Parliament (2000) *Electricity from Renewable Sources and the Internal Electricity Market*.

Despite this evidence, policy continued until recently to favour the contract auction progress. Over 4 years after the EU report the CER still argued that policy should concentrate on lowering short term prices:

> A competitive tender support system would deliver the target at a relatively lower cost to the consumer than a fixed feed-in-tariff due to the inherent competitive bidding process;
>
> A fixed feed-in-tariff system should not be pursued unless the level of support is set at a considerable discount on the exiting AER VI reserve price[19].

In summary it was argued that the support mechanism for the sector should be designed with the single goal of keeping consumer prices low although it was clear that the process to date had failed to deliver the development of the industry and that keeping prices low merely defers the cost of high emissions both in terms of the credits to be obtained and the environmental costs of the pollution.

Only recently has there been a move towards putting in place a feed-in tariff system and an interconnector to allow the industry to develop. The Renewable Energy Feed In Tariff (REFIT) programme has an initial target of 400MW of capacity and to double renewable generation to 13.2% of consumption, amounting to 1,450MW by 2010. Reference prices for calculating compensation i.e. price supports were included with 5.7c for large scale wind. This is not sufficient to make off-shore wind viable and is well below the BNE price published by the CER for CCGT in 2007 (see section 5 below). It remains to be seen if this approach stimulates the industry to reach the targets identified.

Effective participation in the SEM, which will ultimately be the criterion for the long term development of the electricity generation industry, will require that Ireland has adequate interconnection. Recent decisions mean that an East-West interconnector is likely by 2012 with 500MW initially and the prospect of a further 500MW thereafter. Even with upgrading of the North South interconnector this would be inadequate in terms of the efficient working of a single electricity market (SEM) in Europe.

[19] Letter from Chairman of CER to Minster for Communications, Marine and Natural Resources, 23rd December 2004

# 3. Description of the Proposed Investment

## *3.1 Production Capacity and Costs*

The proposed project involves the construction of a 250MW offshore windfarm off the coast of Co. Louth to the North East of Clogher Head. The project will proceed in 5 phases of approximately 50MW each. The projected start date for construction of Phase 1 is mid-2008 with subsequent phases proceeding annually thereafter. Technical and planning work is ongoing and is projected to be completed during 2007. Capacity utilisation is projected at 36% giving a total projected annual output of 158 GWh for the initial 50MW capacity and 788GWh for the full 250MW installation. Production is forecast to begin in early 2009.

The project will incur a total investment of €375 million in 5 phases. The investment in Phase 1 is projected at €85 million including connection to handle up to 80MW. Preliminary cost estimates have been prepared and form the basis for part of the analysis in Section 5 of this report. While more detailed financial projections will be prepared closer to the time that construction is scheduled to begin, these are consistent with the projections prepared for the Arklow project and also provide employment estimates in line with international experience with offshore wind projects as discussed in Section 5 below. A summary of the main costs during construction is shown in Table 3.1.

**Table 3.1: Breakdown of Costs for Clogher Head Wind Farm**

| | % of total | Labour % | € millions | | |
|---|---|---|---|---|---|
| | | | Materials | Labour | Total |
| Connection | 1.25 | 25 | 3.6 | 1.2 | 4.8 |
| Turbine, Transformer & Cables | 20 | 0 | 75 | 0 | 75 |
| Construction | 75 | 20 | 225 | 56 | 281 |
| Design, Engineering & Management | 3.75 | 100 | 0 | 14.2 | 14.2 |
| Total | 100 | 19 | 303.6 | 71.4 | 375 |

Costs will also arise during the operational phase and these are discussed further in Section 5 below. The initial 50MW installation in Phase 1 will incur slightly higher costs per MW than in later phases due to the need for excess connection capacity – connection capacity of around 80 MW will be installed at this stage – and the opportunities for economies of scale to arise at later stages.

It is projected that the gravity foundations will have a lifespan of about 50 years but the turbines will require replacement after 20 years. This puts an effective time constraint for production on the initial investment as discussed below.

The need to minimise environmental impacts and ensure public acceptability has been recognised. A consultation process has been undertaken with sailing interests that does not indicate that any problem will be encountered and, indeed, given the experience at Arklow there is considerable opportunity to enhance facilities for sailing due to the injection of economic activity into the area. However, unlike Arklow, the seabed is not sterile in the vicinity of the proposed infrastructure. A consultation process is ongoing with environmental and fishing interests in the area and an outcome that identifies a neutral to positive impact – given the potential for the foundations to provide suitable environment for fish – is currently foreseen.

### *3.2 Socioeconomic Parametres*

With an investment such as is proposed, a comparison of the estimated monetary costs of a project or strategy with the corresponding estimated returns, while useful, is really not sufficient to allow an estimation of the total costs and benefits that can accrue to the economy. Many of the benefits will not accrue to investors and are therefore not included in a commercial appraisal. As a result, a wider socioeconomic appraisal is required. This includes all costs and benefits even where these are not the intended or direct result of the action. Defining estimates for these costs and benefits is often problematic and non-market values are often assumed. Even so, it is not unusual to identify costs or benefits for which no quantification is possible. In some cases a proxy value may be available, but it is often the case that these items are noted but cannot be included in the actual calculation.

*Lifespan of the Project and Discounting*

Calculating the socioeconomic impact requires estimates of benefits and costs that will arise in future years. It is necessary, before these estimates can be aggregated, to derive an appropriate discount rate for translating future benefits and costs back to today's value[20]. In Ireland, it has become commonplace to adopt a real social discount rate of 5% per annum as has been recommended by the Department of Finance since the early 1990s[21]. This has approximated the rate paid on public debt in Ireland in the past, repayment of which is assumed to represent the alternative use, and thus the opportunity cost, of public funds. However, interest rates have been much lower in recent years and there are strong theoretical grounds for arguing that the social discount rate should remain below the commercial rate.

An important point for consideration relates to the discounting of revenue that will accrue in the long term. It has been claimed over the years that required public investments have indicated poor returns since many of the benefits arise in the distant future and

[20] The actual year for which the values are derived is not important provided appropriate time profiles are used and are constant throughout. The calculation assumes 2008 as the base year. Construction is projected to be carried out during 2008 with 2009 being the first year of operation.

[21] Department of Finance (1994) *Guidelines for the Appraisal and Management of Capital Expenditure Proposals in the Public Sector*

discounting even at low rates over periods in excess of 30 years soon reduces the values to very low levels. This is particularly the case in relation to expenditure on environmental projects where the benefits may be very long-term. One possible solution is to allow the risk free discount rate to decline with time[22]. This view has influenced thinking in the UK Treasury and the current recommendation is that a discount rate of 3.5% should be used for the first 30 years into the future and reduced thereafter[23]. As a result of these considerations, the calculation uses the 5% rate but the valuation is redone in the sensitivity analysis using a 4% rate.

It is also necessary to identify a time period over which the costs and benefits that arise will be compared. The period for the evaluation should be a sufficient period for the benefits to accrue fully but needs to be limited to a period over which the discounted values remain meaningful. The Department of Finance have recommended 20 years for investment in infrastructure projects.[24] This is too short for this infrastructure as the foundations will continue to have an inherent value for 50 years at least. However, the turbines will only operate for a period of 20 years after which replacement will be required. Eventually, the foundations will have to be decommissioned. No cost is included for decommissioning as it is assumed that the value inherent in the foundations after 20 years is sufficient to cover these future costs[25].

[22] Spackman, M. (2002) *Observations on Discounting and the Very Long Term*. UK Treasury Paper

[23] HM Treasury (2003) *The Green Book: Appraisal and Evaluation in Central Government*. London: HM Treasury. The 3.5% rate excludes risk. Including this would increase the recommended rate somewhat.

[24] CSF Evaluation Unit (1999) *Proposed Working Rules for Cost Benefit Analysis*

[25] Given that decommissioning will not be required for 50 years, the present value of the costs that would be incurred at that time would be very small and within what might be considered to be appropriate error intervals using the recommended discount rate.

# 4. Regional Impact

## *4.1 Socio-economic Profile of the Region*

Despite the outstanding performance of the Irish economy over the past decade or more, there is a general acceptance that there is still a relative scarcity of high productivity, innovative, indigenous industries[26]. This is seen as an ongoing weakness and it is accepted that sustainable development in the long run will require a renewed emphasis on local employment creation in wealth generating activities with an emphasis on investment in innovation and knowledge creation[27]. This has resulted in an area-based approach to economic development as emphasised in the National Spatial Strategy that seeks to retain the strengths of the leading sectors and regions but to build from this towards greater regional strengths and the emergence of new sectors and centres.

The economic effects of the development of wind energy arrive at the national level – the contribution to reducing pollution and stimulating new industries – and at local level in promoting regional growth and the development of indigenous businesses. One implication of the current economic structure is that indicators of capacity based on national metrics may not be relevant at local level when adequate skills are available.

The purpose of this section is to provide a socio-economic overview of the region that will be impacted by the investment. The main data source is the CSO Census of Population 2002. The study area for this section of the report has been identified as district electoral divisions (DEDs) in the hinterland of Clogher Head i.e. costal areas from North of Drogheda to Dundalk and including most of the Greenore peninsula.

*Population*

Table 4.1 shows the population of the study area in 2002. It shows that for the most part this is a rural area with a low population density of well below 1 person per hectare in most DEDs. However, the area is dominated by Dundalk and its environs, an area that accounts for 70% of the population (Dundalk Urban, Dundalk Rural and Haggardstown DEDs). This area also accounted for 70% of the population growth in the period 1996-2002. Clearly, the economic performance of the area will be greatly determined by the performance of Dundalk. This is reflected in its identification as a Gateway town in the NSS. One result of this uneven distribution is that while this is predominately a rural area, the population is mostly urban and relies heavily on urban-centred employment.

[26] Forfás (2004) *Ahead of the Curve: Ireland's Place in the Global Economy*. Enterprise Strategy Group Report

[27] Forfás (2006) *Small Business is Big Business*. Report of the Small Business Forum.

**Table 4.1: Population of Study Area (1996-2002)**

| | Persons | | Change 1996-2002 | | Area | Persons |
|---|---|---|---|---|---|---|
| | 1996 | 2002 | Actual | % | (hectares) | per ha |
| Clogher | 1,548 | 1,814 | 266 | 17.2 | 2,544 | 0.7 |
| Dysart | 548 | 649 | 101 | 18.4 | 2,422 | 0.3 |
| Drumcar | 1,404 | 1,372 | -32 | -2.3 | 2,744 | 0.5 |
| Castlebellingham | 1,391 | 1,338 | -53 | -3.8 | 1,898 | 0.7 |
| Dromiskin | 1,561 | 1,956 | 395 | 25.3 | 2,167 | 0.9 |
| Haggardstown | 4,347 | 4,894 | 547 | 12.6 | 2,144 | 2.3 |
| Dundalk Rural | 14,188 | 14,715 | 527 | 3.6 | 2,260 | 6.5 |
| Dundalk Urban | 10,583 | 11,511 | 928 | 8.8 | 520 | 22.1 |
| Ballymascanlan | 1,927 | 2,088 | 161 | 8.4 | 2,506 | 0.8 |
| Jenkinstown | 870 | 831 | -39 | -4.5 | 2,233 | 0.4 |
| Rathcor | 1,105 | 1,163 | 58 | 5.2 | 2,581 | 0.5 |
| Greenore | 905 | 898 | -7 | -0.8 | 1,497 | 0.6 |
| Carlingford | 1,282 | 1,334 | 52 | 4.1 | 1,673 | 0.8 |
| Total | 41,659 | 44,563 | 2,904 | 7.0 | 27,189 | 1.6 |

*Industry, Employment and Socio-economic Status*

The census provides information on the economic structure of the population indicating their economic status – employed, unemployed, student, etc. – and the sector of employment for those who are working. It also provides summary information on the socio-economic groups in the population as determined by these variables. Table 4.2 compares Louth with Dublin and with the economy in total. While the actual values are somewhat dated given the economic changes that have occurred, the data show that Louth has tended to have higher unemployment and lower employment rates than the economy as a whole and lags Dublin in this regard. There was a particular concentration of unemployment in Dundalk where the level was 10.4%. The overall participation rate at 60.1% was also below the national average of 61.3. Furthermore, there is a low participation in education among over 15s in this area that could have important consequences in terms of future economic development of the region. Allowing for the fact that time has passed since the Census, these data suggest that labour would be more readily available in this area than in the economy in general.

**Table 4.2: Economic Status of Population Aged 15+ (2002, % of total)**

| | Employed | Unemployed | Student | Home Duties | Retired | Other | Total |
|---|---|---|---|---|---|---|---|
| Louth | 50.5 | 7.7 | 10.3 | 14.7 | 10.5 | 6.3 | 100.0 |
| Dublin | 56.0 | 5.2 | 11.6 | 12.2 | 10.2 | 4.8 | 100.0 |
| State | 53.1 | 5.2 | 11.4 | 14.2 | 10.8 | 5.3 | 100.0 |

Table 4.3 shows the main sectors of employment of the population in Louth in 2002 compared to the economy in total. While most sectors approximate the averages for the whole economy, manufacturing is a relatively more important sector accounting for

19.4% of the total compared to 14.9% in general. Reflecting this, the business service sector – banking, financial services, real estate, etc. – is relatively under-developed accounting for 10.7% of employment compared to 13.5% in the economy.

**Table 4.3: Sectors of Employment (%)**

| | Louth | Ireland |
|---|---|---|
| Agriculture | 4.2 | 6.3 |
| Manufacturing | 19.4 | 14.9 |
| Construction | 9.6 | 9.1 |
| Utilities | 0.6 | 0.7 |
| Transport | 6.4 | 5.9 |
| Health & Education | 15.9 | 15.4 |
| Public Admin | 5.1 | 5.8 |
| Business Services | 10.7 | 13.5 |
| Other services | 23.5 | 22.2 |
| Not stated | 4.6 | 6.2 |

This means that the area's economic structure is more heavily dependent on sectors that can be expected to grow more slowing than the average in the future but also indicates that there is a relatively strong industrial base. This is particularly clear in Dundalk where 20% of employment is in manufacturing compared to 15.9% in all towns in the country with populations over 10,000.

The Census data assign persons to socio-economic groups (SEGs) depending on a number of factors, primarily occupation[28]. This is a useful summary of the economic situation of residents and is widely used as an indication of the standard of living of a population in an area in terms of spending power. The Census also provides information on the social class[29] of residents of the study area. This classification is ordinal in the sense that Class 1 is deemed to be the highest social class.

Table 4.4 shows that the population is concentrated in manual sectors (SEGs D, E, F and G) with the higher income ABC groups accounting for only 27.7% of people. This is low compared to Dublin (36.2%) and the economy as a whole (30.5%) and reflects the high proportion of manufacturing employment in older sectors. Similarly, the ordinal scale of

[28] The SEGs are defined as follows:

A = Employers and Managers
B = Higher Professional
C = Lower Professional
D = Non-manual
E = Manual skilled
F = Semi-skilled
G = Unskilled
H = Own account workers
I = Farmers
J = Agricultural workers
Z = All others gainfully occupied and unknown

[29] The social class of persons aged 15+ is determined by occupation and their employment status. The class of family dependants is determined according to the social class of the parent having the highest social class. The classifications are:

1. Professional
2. Managerial and technical
3. Non-manual
4. Skilled manual
5. Semi-skilled
6. Unskilled
7. All others gainfully employed

classes 1 to 7 shows the population is concentrated towards manual workers. Only 43.7% of the population falls into classes 1, 2 & 3, compared to 48.1% for the whole country and 52.8% for Dublin. Again this is indicative of an area of older industry.

**Table 4.4: Socio-economic Group and Class (% of population classified according to head of household)**

| SEG | | Class | |
|---|---|---|---|
| A | 14.5 | 1 | 4.7 |
| B | 4.0 | 2 | 22.7 |
| C | 9.2 | 3 | 16.3 |
| D | 17.9 | 4 | 19.3 |
| E | 12.2 | 5 | 13.3 |
| F | 10.6 | 6 | 6.7 |
| G | 6.0 | 7 | 17.0 |
| H | 4.8 | | |
| I | 2.9 | | |
| J | 0.8 | | |
| Z | 17.0 | | |

The picture that is emerging therefore is of an industrial structure in Louth that has lagged the economy in moving towards modern knowledge intensive industries and retains an important manufacturing base. Research indicates that in a knowledge economy with high value added employment the returns to education are emphasised and that the level of education is an increasingly important determinant of earning power and living standards. The CSO *Household Budget Survey* 2001 showed that the difference between high and low income households and between urban and rural incomes had widened since the mis-1990s, although incomes had risen strongly in general. Similarly, the *National Employment Survey* 2003 showed that the average income of graduates was twice that of early school leavers. The relatively low level of educational attainment in the Louth area suggests that despite its strategic location on the Dublin-Belfast corridor there are inherent weaknesses in the socioeconomic base.

*Regional Incomes*

Information on incomes is not directly available from the Census but the CSO use the Census data on sectors of employment along with other sources to compile estimates of county incomes[30]. These estimates include wages and salaries, income from self-employment and transfer payments to residents. The estimates show average disposable income per person for the state of €16,625 in 2002 with the S&E region at €17,116 per person 12% above the figure for the BMW region. The Border region, which includes Louth, was lowest at €14,935 on average. However, at €15,900, Louth had the highest disposable income within the region. This places Louth above most counties with only the Greater Dublin Area, the Mid-West and Cork having higher disposable incomes.

[30] CSO (2005) *County Incomes and Regional GDP 2002*

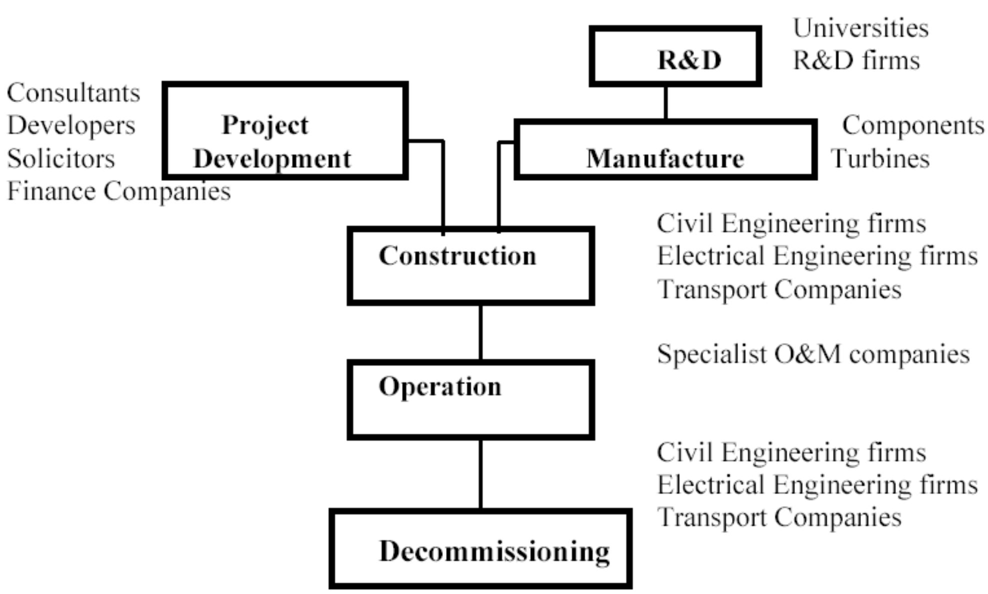
This likely reflects the relatively high urban percentage in the county and the existence of a strong industrial base.

The CSO *Census of Industrial Production* provides an indication of industrial activity and also incomes for Louth[31]. However, care must be taken when interpreting the results. Average firm size is close to the national average – 40 compared to 45 – but other averages are significantly different. The data show that net output from industry in Louth is considerably above the national average (by over 54%). However, wages are below the average at €29,128 (in 2003), compared to a national average of €31,675 for industrial workers. As a result, wages were only 7.6% of net output in Louth compared to an average of 12.8%. The reason for the very high productivity figures for the county but low returns to workers is the presence of a small number of multinational firms in the food additives sector that have a distorting impact on the figures. As a result, few conclusions can be drawn regarding industry in the county, although the lower than average wages supports the conclusions of the Census data that older manufacturing industry retains a greater presence than is typical of the economy as a whole.

### *4.2 Industrial Linkages of the Wind Energy Sector*

The demand for construction inputs and other services that is created by the offshore wind energy sector will have knock-on effects on the economy. The economic impact of this demand will depend on the ability of the economy to supply the products and services required. Figure 4.1 illustrates the main industrial linkages of the sector.

**Figure 4.1: Industrial Linkages of the Wind Energy Sector**




**Source: EWEA/Altener '*Wind Energy…The Facts*'**

[31] CSO (2005) *Census of Industrial Production 2003*

The following list identifies the types of goods and services required and the industries that could supply these[32].

Mechanical engineering systems:
- Infrastructure specification design, fabrication, testing
- Corrosion proofing and protection
- Structural steelwork and fabrication, non-metallic fabrication
- Valves, gear box systems and hydraulic systems
- Turbines, rotating machinery and other mechanical systems
- General assembly, test, commissioning
- Code compliance, quality assurance, manuals, support services

Electrical systems
- Generator manufacture, testing, commissioning
- Generator control systems
- Power conditioning electronics design and supply
- Switchgear, metering
- Wiring and Cabling
- Instrumentation/data acquisition and logging, SCADA
- Electrical protection and control systems, fault management
- General electrical contracting services
- Code compliance, quality assurance, manuals, support services
- Communications

Civil Engineering Systems
- Site development, laydown, drains, fencing, erosion management
- Access and buildings
- Dredging, drilling, blasting, excavation, spoil management
- Mooring elements
- Cable trenching
- Structural foundations and heavy fixed structures

Marine
- Submarine cable installation, protection
- Towage and tug boat services
- Work boat and safety services
- Marine installation and salvage contracting
- Mooring design

Fixed Base Facilities
- Dry dock/yard/construction or service facility
- Fabrication, assembly, test sheltered areas
- Haulage and crane services

[32] This material is based on information contained in Peter Bacon & Associates and ESBI (2004) *Analysis of the Potential Economic Benefits of Developing Ocean Energy in Ireland*. Report to Marine Institute and Sustainable Energy Ireland

- Laydown and storage, warehousing
- Work boat, barge, tug berthage
- Accommodation and catering
- Waste Management
- Power input
- Communications
- Water Supply
- Rentals

Professional Services and Facilities

- Aerodynamics (Engineers, Analysts, Draughtsmen)
- Mechanical Engineers (Engineers, Designers, Draughtsmen, Technicians, Fitters, Welders, Helpers)
- Electrical (Power) Engineering (Engineers, Electrical Fitters, Electricians, Draughtsmen
- Electrical (Electronic/software) Engineering (Measurement Control, Software Engineers, Technicians)
- Civil/Structural Engineering (Engineers, Draughtsmen, Technicians, Construction Trades)
- Marine/Insurance Surveying (Vessel Survey and Classification Personnel)
- Naval Architectural services (Naval Architects, Draughtsmen, Analysts)
- Hydrodynamics, Dynamic Analysis
- Computing Services
- Planning, Permitting, Environmental Services (Planners, Management, Environmentalists)
- Accounting, Financial and legal services, (Accountants, Clerical/Admin. Staff, Purchasing, Legal, Secretarial)
- Marketing services, Public Relations (Market Development Personnel, Media)
- Corresponding Technical and other support services
- Licencing of Systems
- Sale of energy
- Financial Management

These sources of demand will create a supply chain in the economy and further afield where the skills and technology are not available in Ireland. The largest element in this importing will be the turbines although the growth of the industry in Ireland could over time lead to the emergence of indigenous supply.

*Construction & Installation Phase*

Site developer

- Overall project definition, site selection, device selection, project management, procurement, planning applications, raising finance

Goods & services bought by site developer

- Devices (from device supplier).
- Installation work (mixture of suppliers including civil engineering contractors, offshore handling contractors, seabed drilling (if necessary), cable laying)
- Advice (technical, legal, financial, public relations etc)
- Environmental surveys and Environmental impact assessments
- Auditing (financial health & safety, environmental, due diligence)

Goods & services bought by suppliers and contractors

- Testing & accreditation
- Software (off the shelf and bespoke)
- Electronic equipment (plc controllers, SCADA systems etc)
- Advice (technical & scientific)
- Off the shelf hardware (motors, pumps, hydraulic cylinders, generators etc)
- Bespoke hardware (metalwork, other materials (e.g. GRP))
- Transport to site
- Fabrication services
- Machine tools
- Materials
- Hire of ships/tugs/barges etc

*Operational Phase*

Site operator

- Management of the site and sales of electricity to consumers via the grid

Goods & services bought by site operator

- Spare parts (from device supplier)
- Maintenance services
- Testing and inspection (acceptance, routine monitoring)
- Advice (technical, legal, financial, public relations etc)
- Auditing (financial, health & safety, environmental, due diligence)

Goods & services bought by suppliers, inspections & testing contractors

- Materials
- Inspection & testing equipment
- Software
- Vehicles

Given the local economy indicated by this analysis, there is considerable potential for industry to add value to this area thorough employment and secondary impacts such as purchasing materials. The impact on the economy will depend on the availability of suppliers for these products and services. The research undertaken for the Bacon & ESBI report referenced above identified about 30 different potential suppliers that could meet most of the requirements. The big exception remains the turbines.

### *4.3 Potential Impact on Tourism*

The area is included in the East Coast & Midlands region, formerly Midlands East, for tourism purposes. Tourism is an important industry with strong cultural and heritage attractions and marine facilities, and proximity to the Dublin-Belfast transport corridor providing excellent access. It is mostly based on rural sightseeing and activities with the historical Boyne Valley and sailing the main attractions. The main onshore attraction to the area, Bru na Boinne in the Boyne valley, is among the top 10 fee charging attractions in the country with around 220,000 visitors per annum. In line with most of the Irish industry, supporting infrastructure and the quality of accommodation in the area have greatly improved.

In the period 1990-2002, overseas and domestic tourism revenue in the Midlands East region grew by 85% in real terms in line with the national average[33]. Although this was well behind the experience of Dublin where a rise of 151% was experienced, the region retained its 10% of tourism revenue in Ireland. Table 4.5 provides data on recent tourist numbers to the area. This shows that while there was growth in the number of overseas visitors, revenue fell in the period 2002-05 even before inflation. Applying an average inflation rate of 2.5% to these revenue figures for this period indicates a real fall in the region of 11.5%. The picture with regard to domestic visitors is different with a considerable rise in numbers and a real increase in revenue of 32%. These data suggest an industry that has experienced difficulty in attracting high value visitors whose expenditure per person has fallen. In turn it has reacted by concentrating on the domestic market, probably through discounts and specials, to increase capacity utilisation and has managed to increase expenditure by this market segment.

**Table 4.5: Tourism in the East Coast & Midlands Region**

| | 2002 | 2005 | Growth (%) |
|---|---|---|---|
| Overseas Visitors (000s) | 759 | 843 | 11.1 |
| Revenue (€m) | 309 | 295 | -4.5 |
| Domestic Visitors (000s) | 792 | 935 | 18.1 |
| Revenue (€m) | 85 | 121 | 42.4 |

**Source:** Fáilte Ireland

In 2004, 87,000 overseas tourists visited Louth representing 11.2% of visitors to the region. Revenue amounted to €24 million, giving an average of €276 per person. This was just over 50% of the average for the country of €507 per person. Visitors stayed an average of 4.6 nights in the region meaning that average expenditure per diem amounted to €60, ahead of the average for the country of €45. This indicates that although the number and total revenue from overseas visitors has declined, the area continues to attract relatively high value visitors.

The development strategy for the area gives a high priority to further strengthening the domestic market while growing overseas tourism. A key issue is seen as increasing the

[33] Department of Arts, Sport & Tourism (2003) *New Horizons for Irish Tourism: An Agenda for Action.* Report of the Tourism Policy Review Group

number coming to the region through access points other than the main route through Dublin[34]. The emphasis is on revenue rather than numbers and a move towards catering for special interest rather than general market tourism. This is in line with the overall stance of Irish tourism to move upmarket while continuing to develop short break and off-peak tourism.

This analysis suggests that while there are strong attractions in the area, there are some fragilities and the future of the sector will depend on attracting niche markets rather than developing as a general interest destination. While these are potentially high value tourists, this market is also vulnerable to any fall in standards with a particular threat from any form of environmental degradation or undermining of the integrity of the historical heritage.

*Research on Tourism's Experience with Wind Farms*

Research on public perceptions of wind farms has tended to concentrate on the concerns of local residents but there has been some analysis of the tourism impact. The UK has many examples of using small-scale renewable energy installations in association with tourism activities such as, hostels, visitor centres, eco-tourism sites and alternative energy centres. Research on the impact of a wind farm on tourism in Pembrokeshire involved a comprehensive survey of tourism operators in Cumbria, Cornwall and Anglesey to establish the impact on the tourism industry[35]. In brief, the conclusion of the study was that wind turbines have, at worst, a neutral impact on tourism. However, the report highlighted a lack of definitive information on the impact of wind farms on tourism, either positive or negative.

In a survey in a tourist area of Scotland, 75% of respondents could not think of any drawback to wind farms from the point of view of the tourism industry and 62% of operators replied that the wind farm had no effect on the number of visitors to the area.[36] In a similar exercise in Wales where a wind farm had been operating for over four years, 68% of respondents replied that there had been no effect on visitor numbers as a result of the wind farm while 15% relied that numbers had increased.[37] A survey of tourists in north Cornwall also found that 95% said the presence of the wind farm would not prevent them from visiting area again. As a result of its research, the DTI in the UK reached a positive conclusion regarding the impact of wind farms on tourism[38]. A number of communities have used their wind plants to stimulate 'green' tourism and tourism has also benefited at locations in Europe, Canada and the U.S.

[34] Fáilte Ireland (2006) *Developing Regional Tourism*. Marine tourism is not mentioned in the marketing strategy with the emphasis being placed on golf and other onshore activities.
[35] *Wind Information Needs for Planners.* Report prepared for the UK Department of Trade and Industry by Land Use Consultants (2001).
[36] *Novar (Scotland) Residents Survey*, Robertson Bell Associates, July 1998
[37] *Taff Ely (Wales) Residents Survey* Robertson Bell Associates, December 1997
[38] *New & Renewable Energy: Prospects for 21st Century*, Department of Trade and Industry, January 2000

The SEI survey of attitudes in Ireland towards wind farms also provided some information on views in relation to tourism[39]. While 43% of respondents felt that wind farms in general should not be located in areas of scenic beauty where tourism is important, only 4% of respondents felt that an existing wind farm had damaged tourism in their area. The degree of acceptance once the infrastructure is in place is demonstrated by the fact that 90% felt that exiting windfarms had not damaged tourism in any way. This is in keeping with the before and after perceptions noted above and indicates that adequate consultation processes in advance and sensitivity to obvious potential impacts can virtually eliminate all possible negative impacts on tourism.

Research into the potential impact of the Arklow Banks project on tourism in Wicklow and North Wexford was undertaken at the planning stage before construction[40]. That assessment was based on the subjective views of people closely connected with the tourism industry in the area, analysis of the local industry and a review of experience with existing wind farms in other locations. It found that tourism operators' views of the development ranged from neutral to mild support with some expressions of stronger support. Given the expected risk aversion of locals to major development, this could be interpreted as general support. Most believed that the wind farm was in keeping with the image that the area wished to provide to tourists, but had not always managed to do in the past. Many did not expect that there would be any impact, but some identified proximity to the wind farm as a potential marketing strength. Irrespective, there was universal support for the development of wind electricity and all believed that development at sea was preferable to development on mountains or at intrusive locations on level ground.

*Local Views*

Among tourism operators, there appears to be a general perception that while there has been growth in recent years, the Louth region has not fulfilled its tourism potential. One cause may be that proximity to Dublin means that it is swamped by the range of choice that is available in the capital indicting a need to continue to distance the area from the general market towards niche segments. Although developments such as Bru na Boinne and marina berths improve the ability of the area to handle large numbers of visitors, the tourism product in Co. Louth has a low carrying capacity so the industry is aiming towards higher value tourism to continue to grow. A failure to develop along these lines would pose the greatest threat to the industry. In general, the inland and off-shore elements in the tourism package for the area are not integrated and there are only weak linkages between them. Most tourism in the area is only tenuously connected with the coast and the foundations of future growth are on-shore and inland where the attractions are located. Among these, heritage attractions and activities are the main strengths.

[39] SEI (2003) *Attitudes Towards the Development of Wind Farms in Ireland*

[40] *Assessment of Impact of the Proposed Arklow Bank Wind Farm on Tourism*. Report prepared for Sure Partners Ltd by KHSK Economic Consultants, November 2001

Interviews were conducted with tourism interests in the Louth area. The respondent at the Bru na Boinne site said that no negative impact could be envisaged as regards the impact of the wind farm on the heritage of the area and believed that any impact, although likely to be very limited, would be positive in terms of the overall image of the area.

Dundalk Tourist Information Office reported that there did not seem to be a great awareness of the proposed windfarm but that, in advance of details, the general views were likely to be quite positive. In general, the existing windmill in Dundalk IT drew positive comments. No obvious reason to expect a detrimental impact on tourism from an offshore windfarm was foreseen, but details in relation to the extent of the windfarm and its visibility would be welcome. In advance of the details a positive reaction is likely. A similarly positive reaction was found from commercial interests contacted. Again, the windmill at Dundalk IT was viewed positively with a certain amount of pride and as something of a symbol of opportunity for the area.

The fact that the proposed windfarm is off-shore is a considerable benefit and an alternative placing on-shore could pose a much greater issue in relation to the core attractiveness of the region as a heritage destination. The area is in a strong position to develop eco-tourism and the location of the wind farm offshore would contribute to this by indicating the availability of green electricity. Experience elsewhere also suggests that the wind farm may have some potential as a tourism attraction through its novelty value, although this option remains speculative.

# 5. Socioeconomic Impact of Proposed Windfarm

## *5.1 Assessment of Economic Impact*

*Employment in Construction*

Construction will take place in 5 phases of approximately 50MW each year from 2008. Although construction costs in phase 1 are higher than in other phases the calculation assumes that the costs are spread evenly over the full period at €75 million per annum. Discounted to the base year (2007) this amounts to €325 million.

It is estimated that labour costs in construction and connection will amount to €57.2 million over the 5 years of construction i.e. €11.44 million per annum giving a discounted value of €49.5 million for gross incomes from construction. Average earnings in construction in March 2006 were €38,734[41]. Allowing for an annual increase of 5%, this would rise to an average of €47,000 during the construction period. This would mean that 243 full time jobs (FTEs) would be created during the construction period.

Professional incomes will also arise in the construction period. These will average €2.84 million per annum in current values giving a present value of €12.3 million. No comprehensive data are published for professional incomes but the CSO provide data on earning of managers in industry. These indicate annual earnings of €53,600 in 2006. Again applying an annual index of 5% growth, this indicates an average of just over 65,000 per annum during the construction period. As a result, construction would result in the creation of 44 professional and managerial FTEs for the 5 years.

Gross income will be split between income tax (including PRSI and other levies) and net income. The estimate of the amount of revenue accruing to the government will depend on the effective income tax rate that is applied. This can be assessed from national data. Total income from wages in salaries in Ireland in 2004, the latest year for which figures are currently available, was €54.7 billion.[42] The total PAYE tax take from wages and salaries in 2004 was €8.1 billion.[43] This gives an effective PAYE take of 14.8%% on wages and salaries. PRSI and other levies amounted to €6.8 billion of which just over €4 billion was paid by employers. This would mean that just over 5% of gross wages were paid as PRSI. Therefore, the effective tax rate on income was approximately 20%.

Applying the effective tax rate to the incomes earned in construction means that net incomes after tax amount to €49.5 million when discounted to the base year with income tax valued at €12.4 million.

[41] CSO (2006) *Earnings and Hours Worked in Construction*, June. This average is based on a number of job types in construction including skilled and non-skilled operatives, and clerical support but not professional input such as design and management.
[42] CSO (2005) *National Income and Expenditure 2004*
[43] Revenue Commissioners (2006) *Annual Report 2005*

*Employment in Operations & Maintenance*

Employment will be created during the operations and maintenance (O&M) phase. Data from Denmark on experience with offshore wind farms indicate that operations and maintenance provides 0.32 FTEs per MW installed.[44] Estimates prepared for the Arklow Banks project indicated that the then proposed initial construction of a 60MW facility would give rise to 23 FTEs in operations and maintenance i.e. 0.38 FTEs per MW, with economies of scale possible in subsequent phases. This would suggest that the Danish ratio is applicable and that, assuming constant returns to scale, in the region of 16 FTEs would be created by the initial 50MW at Clogher Head starting in 2009 and each subsequent investment in 50MW per annum. Subsequent investment in the total 250 MW count be expected to increase this to 40 FTEs for the lifetime of the project.

The average industrial wage in March 2006 was €30,576 per annum.[45] Indexed at 5% per annum would give an average industrial wage in 2009 when production starts of €35,400. However, the impact on the economy is likely to be reduced by warranties on new turbines. To allow for this, it is assumed that 50% of the expenditure on O&M in the first 5 years of life of each turbine does not generate any income in Ireland. On this basis, expenditure on wages and salaries in operation would provide total gross incomes of €25.25 million from operations when discounted to the base year. This would provide €5.1 in income related taxes and levies and €20.2 million in after tax incomes.

Other taxes will also be paid during construction, particularly VAT. Excluding the turbines which will be imported, it is assumed that 75% of the materials used in construction will be sourced in Ireland and subject to Irish VAT. A flat rate of 13.5% is applied to this expenditure on Irish construction materials giving rise to tax revenue with a present value of €20 million.

The present value in 2007 of the income and tax revenue produced by this project is summarised in able 4.1.

**Table 4.1: Incomes and Tax Revenue Arising from the Project (2007 Values)**

| | € millions |
|---|---|
| Net incomes during construction | 49.5 |
| Net O&M Incomes | 20.2 |
| Income taxes during construction | 12.4 |
| Income taxes during O&M | 5.1 |
| Other construction taxes | 20.0 |
| Totals | 107.2 |

It is assumed that production will begin in the year following construction for each phase i.e. 50MW in 2009 with all 250MW in production from 2013. The analysis assumes a productive life of 20 years for turbines. Therefore production will continue up to end 2032 but shows a decline after 2028. At this stage, replacement of turbines will be

[44] European Commission (2001), *Concerted Action for Offshore Wind Energy in Europe*

[45] CSO (2006) *Industrial Earning and Hours Worked*, June

required although the foundations will have a considerable residual value given their projected lifespan up to 50 years. However, the analysis is restricted to the lifetime of the 1st installation of turbines and the residual value of the foundations is assumed to cover decommissioning costs that would arise after 50 years.

A 36% load factor is assumed, somewhat below earlier projections of load factors for off-shore production. This means that each 50MW installed will provide almost 158GWh of electricity per annum and 788GWh at full production.

The electricity price is based on the most recent estimate from the CER of the BNE price for electricity[46]. This is electricity produced by CCGT i.e. the alternative to wind energy. This paper indicates a price of €86.40 per MWh. The 2007 BNE estimate is an increase from €66.10 per MWh in 2006 i.e. a rise of €20.30 per MWh or 31% in a year. Clearly this in many times the rate of forecast inflation and is a rate that is unlikely to be maintained for any prolonged period. Two variables are of particular importance in determining this price. The first is the price of gas. There has been considerable volatility, within a sharply rising trend, in fuel prices over the past year and further considerable price rises cannot be ruled out. At a minimum, it is likely that the price of gas will rise at least at the rate of inflation and probably above. The second issue relates to the weighted average cost of capital (WACC) assumed by the CER. In determining the 2007 price, it was included that the German Bund – i.e. interest rates – had risen by 75 basis points since the calculation of the 2006 BNE. However, it is clear that interest rates are on an upward trend and that the rise will not be limited to 75 basis points. This resulted in a rise in the WACC used in the 2007 calculation to 7.38% from 7.03% in 2006. Thus, the WACC assumed in the calculations will likely prove to be low for 2007 and subsequent years. Taken together, these mean that the next couple of years could see rises in electricity prices ahead of general inflation.

Based on these considerations, it would seem prudent to allow electricity prices to rise by 10% up to 2009 when production begins. Thereafter, it is assumed that the real price remains constant. This would give a starting price of €95 in 2009. These parameters would provide annual revenue of just under €75 million at full production of 788GWh per annum before allowance for any additional inflation in electricity prices after 2010. This would have a discounted present value of €808 million in the base year.

Wind energy produces no emissions once installation is in place. To allow for emissions during construction, it is assumed that the first year of production provides no reduction over what would be achieved using CCGT. Thereafter, there are net gains of emissions saved per MWh produced. These are estimated at 375 kg $CO_2$ and 0.3 kg $NO_x$ per MWh[47]. These estimates result in emissions saved with a value of €9.6 million in a full year of production and with a present value of €98 million for the project.

[46] CER (2006) *Best New Entrant Price 2007: Decision and Response Paper*
[47] Note that the comparison is with CCGT which is assumed to provide the alternative form of generation. If the comparison was done with the average generating mix for Ireland than much higher savings would be implied. However, given the need for additional generating capacity in Ireland in the future the appropriate comparison is with the likely fuel for new capacity.

The CER BNE paper places the current price of $CO_2$ at €15.50 per tonne. However, this price has been volatile in recent years and has ranged up to almost €30 per tonne in recent years. Furthermore, these prices exist in advance of the reference period from 2008 to 2012 when trading will greatly increase. Recent government policy in Ireland has been based on the calculation that at prices in the range of €15 per tonne Ireland is better off buying credits rather than introducing fiscal incentives to reduce emissions that might risk distorting growth. This was the rationale for not introducing the proposed green taxes during 2005. Similar calculations in other economies would be likely to provide similar conclusions. This has two important implications. First, demand for credits would rise following 2008 as countries attempted to meet their obligations under Kyoto thereby pushing up the price. Second, the likely follow-on to the Kyoto Treaty following 2012 would conclude that the ability to 'buy' the required credits rather than reduce emissions means that the limits set under Kyoto were too lenient and more stringent measures would be imposed. Again, this would place upwards pressures on prices. Clearly, the precise impact on the price of $CO_2$ is difficult to determine beyond the current period but there are good arguments that it will rise in advance of inflation. In line with recent work[48], this report places a price of €30 per tonne on $CO_2$ during and after the Kyoto reference period starting in 2008. A value of €3,000 per tonne is used for $NO_x$ emissions[49].

These values would provide an estimate of €9.6 million per annum for the value of emissions saved by the wind electricity produced when in full production with 250MW. Discounted to the base year, this amounts to a value of €97.9 million.

These estimates of the direct impact of the proposed investment in discounted values in the base year are summarised in Table 4.2[50].

**Table 4.2: Direct Economic Impact of the Investment (€ millions)**

| | |
|---|---:|
| Cost of Construction | 324.71 |
| Net Incomes | 69.66 |
| Taxes | 37.46 |
| Electricity Value | 808.20 |
| Green Credit Value | 97.91 |
| Total | 1,013.23 |

[48] IWEA (2005) *Renewable Energy in 2020: Response to Consultation Document from the DCMNR*
[49] Duggan, G. (2004) *Developing Wind Power in Ireland as a Mainstream Electricity Generator: Blowing Away the Myths*. Report to IWEA
[50] It is important to note that this is not an indication of the private profits or margins. No allowance is made for the private cost of capital and some of these values do not accrue to operators e.g. taxes and externalities. In addition, while incomes are listed here as a benefit to the economy, they are clearly a cost to operators.

*Indirect Impacts*

Indirect or secondary impacts on the economy will also arise as discussed in Section 4 above. The geographical features of the location for the turbines mean that it will be possible to construct the infrastructure using gravity foundations. These are suitable for local manufacture. In addition, local ports will gain from activity during the construction phase and as operational servicing continues.

The Danish Turbine Manufacturers Association estimates that indirect employment in the industry in 1995 accounted for over 80 per cent of jobs supported. This would give an employment multiplier of 4.23 even before induced effects are included. This is very high and shows the strong export orientation of the sector: it is estimated that about half the wind turbines installed around the world have been built by Danish manufacturers. The current stage of development of the sector in Ireland means that the impact would be much less as the turbines must be imported, but this provides an indication of the long term potential of this industry. The UK Dept. of Trade and Industry (2004) in a preliminary assessment provided an approximation of employment created per MW of renewable generating capacity installed under different conditions[51]. Applying the Treasury multiplier for induced jobs sustained, this work estimated a weighted average of 10 jobs, including both direct and indirect employment, per MW installed in renewable energy. The BWEA also estimates that about 40 per cent of the employment supported by the industry in the UK is in associated sectors i.e. indirect employment is about 67% of direct giving an employment multiplier of 1.67.

The estimates above for direct employment indicated that approximately 5 construction jobs and 1 professional position was created during the construction phase per MW – 5.75 FTEs for one year per MW – and that 0.32 FTEs per MW would be created in O&M. Applying the UK estimate for supported employment would give a total of 10.1 jobs supported by every MW installed. This indicates that the estimates are within the expected range on the basis of published research.

However, imports to Ireland would be likely to be somewhat above the equivalent for the UK given the relative openness of the economy. To allow for this, it is assumed that indirect jobs amount to approximately 30% of total employment supported giving an employment multiplier in the region of 1.4.

Thus, if this project were to provide a stimulus to associated industries in the supply chain along the lines discussed then, on this basis, the estimates for direct employment suggest that a further 100 FTEs would be created in the economy during the construction phase of each 50MW of capacity. Using the same wage and salary assumptions as above, this would produce after-tax incomes with a present value of €22.9 million and income taxes amounting to €5.71 million.

[51] UK Department of Trade and Industry (2004) *Renewable Supply Chain Gap Analysis* London: HMSO; European Commission (2001)

*Additional Economic Impacts*

Additional economic benefits arise from a number of further impacts of the wind farm. These will relate to effects such as the payment of fees to the DCMNR and dynamic impacts due to the contribution of this wind farm to the overall development of the sector and Ireland's energy requirements. In this, the two most important are its potential in helping of reduce the risks that surround Ireland's energy supplies and the impact on knowledge of this sector that can be used again and the signalling benefit of a successful investment. Clearly, while there is potential in relation to these issues it is impossible to assess whether or not this will be realised.

Estimates of these values are available from work undertaken in Ireland in recent years[52]. This work estimated the value of the DCMNR lease at €1.80 per MWh of energy produced from off-shore capacity. This would amount to €15.3 million in discounted values for this investment. The benefit of indigenous energy in reducing risk associated with security of supply was estimated at €1.50 per MWh. This would amount to €12.8 million in discounted values for this investment.

The research estimated that there are considerable potential benefits in terms of learning and reducing the risks associated with subsequent investments from major investments in off-shore wind energy. Based in part on previous research, it estimated the benefits in this respect to be €16 per MWh. However, estimating the benefits of R&D is notoriously difficult and a notable feature of the proposed windfarm is that is uses well known technology in relation to the construction required, in particular the gravity foundations. While this increases the potential impact on the local economy, it reduces the potential for learning. However, it is not eliminated and the signalling effects remain. It would be prudent therefore to include some value here but less that what has been estimated for the typical wind farm. If it is assumed that the potential is 25% of the usual, then this value would amount to €34 million in discounted values for this investment. These values are summarised in Table 4.3.

**Table 4.3: Economic Benefits of the Proposed Windfarm**

| | |
|---|---|
| Incomes from Direct Employment | 69.66 |
| Income Taxes & VAT | 37.46 |
| Electricity Value | 808.22 |
| Green Credit Value | 97.91 |
| Income from Supported Employment | 22.85 |
| Tax from Supported Employment | 5.71 |
| DCMNR lease | 15.31 |
| Security of supply | 12.76 |
| R&D/Signaling | 34.03 |
| Total | 1,103.91 |

[52] Peter Bacon & Associates (2003) *Review of Alternative Models for Calculating the Optimal Price for Wind Energy*. Report to IWEA

### *5.2 Sensitivity Analysis*

Sensitivity analysis on these estimates has been done in relation to 3 variables: the discount rate, the price of electricity and the value of emissions avoided.

The earlier discussion indicted that there are arguments that a real discount rate of 4% might be appropriate when dealing with projects with a long payback period from the point of view of society. Using this rate results in the revised estimates shown in Table 4.4 for the variables discussed.

**Table 4.4: Table 4.3: Economic Benefits using a 4% Discount Rate**

| | |
|---|---|
| Incomes from Direct Employment | 73.78 |
| Income Taxes & VAT | 39.05 |
| Electricity Value | 906.29 |
| Green Credit Value | 110.76 |
| Income from Supported Employment | 22.85 |
| Tax from Supported Employment | 5.71 |
| DCMNR lease | 17.17 |
| Security of supply | 14.31 |
| R&D/Signaling | 38.16 |
| Total | 1,228.08 |

Using a 4% rate increases the present value of the construction costs to €334 million. However, the major impact is on the present value of the electricity produced which increases to €0.9 billion. Overall, the present value of benefits is increased by just over €124 million.

The second sensitivity relates to the price of electricity. The CER's BNE estimate has risen rapidly in recent years but only limited rises were included above for the years after 2007 and the rise was limited to the rate of inflation i.e. held constant in real terms at €95 per MWh from 2009. However, with rising energy prices and interest rates pushing up the WACC, there are good arguments that further increases are possible. The valuation was redone assuming that prices continue to rise in the years 2009-2012 by 2.5% per annum ahead of the CPI to level off in real terms at €102.35 per MWh in 2012. The impact of this is considerable and increases the value of the electricity produced to €867 million – an increase of 7.3% – when discounted at 5% per annum.

The final area for sensitivity is in relation to the value of emissions avoided. The central valuation assumed a steady price of €30 per tonne of $CO_2$. However, the CER uses a current value of €15.5 per tonne. It is certainly foreseeable that this will increase during the reference period up to 2012 but the situation beyond this remains unclear. The calculation was redone assuming a gradual increase to €20 per tonne up to 2012 and a steady price at this level beyond this. The impact of this valuation is to reduce the discounted value of emissions by 34% to €64.75 million when discounted at 5% per annum.

### *5.3 Other Non-valued Impacts*

A number of other economic impacts may arise but it is not possible to place a value on these. These would include:

- Skills obtained in developing and operating this project are transferable and a competency would be developed that could be used elsewhere in the economy. This would greatly increase the value added potential of the National Renewable Energy Centre at Dundalk IT for example.

- There is potential for other sectors such as tourism and fishing to benefit from proximity to the windfarm. The indications to date are that any negative impacts will be minor and opportunities exist.

- The investment would contribute to policy aims such as developing the Dublin-Belfast corridor, regional economic development and sustainable energy thereby underpinning the credibility of policy making.

These impacts will clearly increase the benefits to the economy but since it is not possible to derive estimates of their values they are noted but are not included in the results of the appraisal.