6. HUMAN ENVIRONMENT

6.1 RECEIVING ENVIRONMENT

6.1.1 Population

The population of Ireland was almost 4.6 million in 2011 and it has been increasing at ever growing rates. Nonetheless, population densities are still low from a European perspective and the overall population still remains below that of the island in the early-19th century. The population of the area comprising the Republic of Ireland was more than 6.5 million as measured by the 1841 Census of Population.

Population structure and change in Ireland is strongly influenced by migration and emigration rates, rather than birth and death rates. Over the last 10 - 15 years, population trends in Ireland have changed dramatically. Historically, these trends were largely determined by labour market conditions in Ireland and in the countries to which Irish people migrated. Population growth peaked at 81,000 per annum during the period 2002-2006. The most recent inter-censal period (2006-2011) shows the highest natural increase at 45,000 persons per annum, with 73,000 births and 28,000 deaths.

While the natural increase of Ireland's population has in general been positive over the past 50 years, the large swings in net migration have had a strong effect on overall population growth. Net outward migration has varied considerably over the past 50 years. Outward migration during the 1950s led to a population low of 2.8 million being recorded in the 1961 Census with net migration remaining negative throughout the 1960s.

Net inward migration was recorded briefly for the first time in the 1970s, but this quickly reverted to net outward migration again throughout the 1980. The turnaround began in the 1991-1996 inter-censal period, with small positive inflows leading up to the peak net inward migration period of 2002-2006. It has now fallen back again.

The CSO population and emigration estimates April 2014 indicated as follows:

The combined effect of natural increase and negative net migration resulted in an overall increase in the population of 16,500 bringing the population estimate for the state to 4.61 million in April 2014.

The wind farm site is within the townlands shown in Figure 6.1, which are predominantly in the District Electoral Divisions (DEDs) of Glanlee and Glanlough in the Kenmare Rural District of Co. Kerry. The populations of each from Census of Ireland data produced by the Central Statistics Office are shown in Table 6.1. The most populous DED in the area is Kilgarvan.

Table 6.1: Population Trends

Area	1996	2002	2006	2011	Change (96-11)
State	3,621,035	3,917,336	4,239,848	4,581,269	+ 17.1 %
Co. Kerry	126,130	132,527	139,616	145,502	+15.4 %
Kenmare Rural	6,425	7,198	6,987	7,449	+15.9 %
Glanlee DED	214	203	214	195	- 8.9 %
Glanlough DED	133	142	158	164	+ 23.3 %

The population of the State increased significantly in the period 1996 – 2011 and Co. Kerry experienced a broadly comparable increase. As would be expected, growth that was recorded was not uniform throughout the county. Substantial growth occurred in rural areas around the main towns, with relatively static numbers in urban areas and rural depopulation. Population growth is usually employment led and is reliant on the availability of services and infrastructure.

The average population per household in Ireland continues to reduce, being partly attributable to a significant growth in the number of one person households. However, by international standards the average household size in Ireland remains high. It is expected that average household size in Ireland will continue to decline and in the longer term will normalise towards the EU-wide average of 2.63 persons per household.

Static population numbers or declines are reflective of a number of processes at work, particularly in rural Ireland. These influences include the decrease in the number of farmers and the consequent increase in farm sizes, lack of locally based employment opportunities, lack of access to services and the movement of population, particularly the young, towards the larger urban centres.

Co. Kerry has a significant Gaeltacht area and the Irish language is intrinsically linked its heritage and culture. The Grousemount site doesn’t fall within the Gaeltacht area.

6.1.2 Kilgarvan

The village of Kilgarvan is the nearest recognised settlement and it has a range of basic services that serve a large farming hinterland. There are shops, petrol stations, a post office, several pubs, a village grill, a Church, a National School, a Garda Station, a community centre, a childcare facility, a funeral home and a hairdresser. The Rock Mount Centre (Heatherview Day Centre) provides services for the elderly. There is also a GAA pitch located outside the village on the Kenmare road.

The Michael J Quill Centre is also located outside the village on the road to Kenmare in what was formerly St. Peter's Church of Ireland and is now a training centre for the disabled, with a gift shop and café.

The village is lacking in formal amenity areas and, while it is in relative close proximity to the tourist towns of Kenmare and Killarney, it has not benefited hugely from tourism.

6.1.3 Socio-economics

The unprecedented growth in the national economy in recent years was mirrored in Co. Kerry. The occupation by industry for Co. Kerry in the years 2006 and 2011[15] is shown in Table 6.2.

Table 6.2: County Kerry Labour Force by Sector 2006 – 2011

Sector	2006		2011	
Agriculture	5,040	8.3 %	5,621	10.1 %
Mining, quarrying / turf production	247	0.4 %	121	0.2 %
Manufacturing	6,660	11.0 %	5,327	9.4 %
Electricity / gas / water	401	0.7 %	425	0.8 %
Construction	8,216	13.5 %	3,338	6.0 %

15 Kerry County Development Plan 2015- 2021

Sector	2006		2011	
Wholesale / retail	8,087	13.3 %	8,300	14.9 %
Hotels / restaurants	5,581	9.2 %	5,483	9.8 %
Transport / storage / communications	2,428	4.0 %	2,042	3.7 %
Banking / financial	1,547	2.5 %	1,752	3.1 %
Real estate / business	3,355	5.5 %	3,471	6.2 %
Public administration & defence	2,448	4.0 %	2,945	5.3 %
Education	3,917	6.4 %	4,804	8.6 %
Health & social work	6,110	10.1 %	6,439	11.6 %
Other service activities	2,223	3.7 %	2,345	4.2 %
Unstated	4,550	7.5 %	3,444	6.2 %
Total	60,810		55,767	

Indications of future patterns of employment are difficult given the current economic environment, the changing nature of the employment market and the availability of data. It is unlikely that the construction industry will return to 2006 levels and other sectors with the potential for growth such as information technology, tourism, small indigenous industries and the agri-sector will need to expand to provide the jobs lost in traditional employment sectors.

Co. Kerry has a strong tourism industry and it is one of the sectors most likely to drive economic growth in the short to medium term. With its unspoilt natural features and friendly communities, Co. Kerry is a favoured destination for many travellers, Irish and foreign alike. The importance of the tourism sector is evident in approximately 10% of employment occurring in the hotels and restaurants sector, compared with about 5% nationally. However, unlike other parts of Co. Kerry, the area immediately surrounding the site does not have a tradition of tourism, even though it has important natural and built heritage features.

Although the model of rural land use, dominated by traditional agriculture, has been changing to include more varied patterns of rural land use, the agricultural economy remains crucial to rural parts of Ireland. While there are declining prospects for agricultural employment, employment data on agriculture understates the sector’s importance to the region, in relation both to the food manufacturing sector and the services sector, which are both interrelated and partly dependent on agricultural activity.

6.1.4 Health and Safety

Safety is a core value in ESB and its subsidiary companies. Its management and continual improvement are an integral part of company activities.

The basic technology to be employed in the project is well understood and there have been significant technical advances in the recent past. The development of the technology is reflected in its growing application in many successful projects both nationally and internationally.

Electromagnetic Fields

Electric and magnetic fields (electromagnetic fields (EMF)) around wind farms can originate from wind turbine generators, electrical transformers, underground network cables and grid connection lines. Both electric and magnetic fields also occur naturally. The Earth's magnetic field, which is due mainly to currents circulating in the outer layer of the Earth's core, varies between about 30 μT (microtesla, 1000 μT = 1 mT, millitesla) at the Equator and about 60 μT at the poles. This field may be distorted locally by ferrous minerals or by steelwork such as in buildings.

At the Earth's surface there is also a natural electric field, created by electric charges high up in the ionosphere, and varying between 100 Volts per metre (V/m) and 150 V/m in fine weather. Below a storm cloud containing large quantities of electric charge for example, the field may reach intensities up to 20 kV/m over flat surfaces, while above hillocks or other irregularities or near the tops of objects such as trees, the field strength can be considerably higher. In mountains, for instance, the presence of these fields produces electrical discharges and crackling noises on sharp ridges and on the ends of ice peaks.

Ice shedding

Similar to other structures there is some potential for ice to form on wind turbines under certain atmospheric conditions, typically with ambient temperatures near freezing (0 °C) combined with high relative humidity, freezing rain, or sleet. Weather conditions, the force of gravity and turbine blade rotation may cause this ice to be shed, giving rise to safety concerns. In certain circumstances changing temperatures and climatic conditions may cause ice fragments to loosen and fall. Rotating turbine blades may also propel ice fragments up to several hundred metres from the turbine depending on conditions. The immediate risk area will be directly beneath the turbine blades and within several hundred metres from the wind turbine itself.

Two types of ice can form on the blades of wind turbines. Smooth glaze ice, which is transparent and highly adhesive, can form when moisture contacts surfaces colder than 0 °C, e.g. ice storms at low elevation. It normally falls straight down shortly after formation. Granular and opaque rime ice, which is formed from super-cooled droplets which trap air giving the ice a white appearance, can form at colder temperatures and is less adhesive. It is sometimes thrown from moving turbines, but often breaks into smaller pieces. Falling ice may cause damage to structures and vehicles, and injury to site personnel and the general public, unless adequate measures are put in place for protection. Ice shedding from stationary turbines could place service personnel within the wind farm at risk.

6.1.5 Noise

Noise may have various effects on human beings exposed to it ranging from discomfort and annoyance to various psychological and pathological conditions. The susceptibility of people to noise and the level of annoyance they experience varies widely. Indeed, the degree of annoyance is dependent on the quality of the sound and the receptor's attitude towards it. Measurable psychological and pathological effects have been shown to be attributable to noise. They include effects on health, sleep, communications, working efficiently, industrial accidents and mental stress.

An increase in background noise will occur during the construction and operational phases of the development. Construction noise will be typical of that associated with any large construction site and will be temporary in nature. An increase in background noise will occur when the wind farm is operational and generating electricity. The levels of noise attributable to the proposed development are such that significant health effects outside the site boundary (such as occupational deafness, etc.) can be ruled out. However, impacts such as annoyance are examined as part of this study. A full assessment of the construction and operational noise is presented in Chapter 7 of this EIS.

6.1.6 Shadow Flicker

Wind turbines, as with trees or any other tall structure, can cast long shadows when the sun is shining and is low in the sky. A phenomenon, known as shadow flicker, which could be considered a nuisance even though the effect would be very short-lived, could occur under certain conditions. This is where the blades of a wind turbine cast a shadow over a window in a nearby house. The rotation of the blades might cause a shadow to be cast about once per second or two in the room whose window is affected. The potential for shadow flicker at distances greater than 10 rotor diameters (a maximum of 1,120 m in the case of Grousemount, based on the largest size of rotor blade envisaged) is very low. Where unacceptable impacts in terms of level of shadow flicker are predicted the relevant contributing turbines can be curtailed in operation for the brief critical periods. An assessment of the potential for shadow flicker from wind turbines within Grousemount Wind Farm on houses in the broader area is presented in Chapter 8 of this EIS.

6.2 IMPACT OF THE DEVELOPMENT

6.2.1 Population, Employment and Socio-economics

Local Level

As the proposed development contains no residential component, it is unlikely to have any significant direct impact on the composition of the population in the immediate area. There is no evidence from Ireland or elsewhere that the presence of a wind energy development in an area has an effect on population numbers.

During construction there may be some limited impacts on the residential amenity of the population living in the locality of the development. These would be short-term impacts relating primarily to construction traffic. These impacts are quantified and described in detail elsewhere herein.

As in many capital intensive industries, renewable energy development tends to be characterised by substantial short-term employment creation during the construction phase and relatively modest long-term employment thereafter. It is expected that at peak employment approximately 50 - 80 jobs will be created during construction.

Employment in the wind energy sector is closely related to the rated capacity planned, constructed and installed and as such jobs supported by the wind industry are located largely where generating capacity is installed. Therefore, the jobs created will be widely displaced around the island of Ireland, including Co. Kerry.

During the construction phase, which will last approximately 18 months, there will be significant expenditure on the provision of site facilities including the construction of the civil and electrical infrastructure. These can benefit local companies, contractors and their employees. There will also be indirect employment in the manufacture of building materials and equipment used in construction. Experience at ESB's other wind farm developments indicates that up to 40 separate sub-contractors may be employed in the course of project construction.

The anticipated total capital cost of the project is of the order of €180M. In addition to impacts on the national economy, this expenditure will result in economic benefit to the local economy. Up to approximately 25% of expenditure will be on the supply of construction material, non-turbine equipment and services.

A requirement for some temporary or medium-term accommodation may arise during project construction.

The wind farm will not impact negatively on other employment in the area. In terms of land use the area occupied by the wind turbines, access tracks and the Substation will be small relative to the extent of lands overall at the site and existing or alternative future land uses will not be compromised.

The project will generate annual Local Authority Rates for Kerry County Council that will provide indirect long-term benefit for the broader community. In 2013 local authorities benefited to the tune of almost €12M, demonstrating the wind industry's benefit to local authorities.

A wind farm development is unique in its ability to contribute to agricultural diversification in the following manner:

- The wind farm development will provide a source of income through land leasing arrangements.
- The project will give lands a commercial value that they didn't previously have, without significantly compromising existing uses.
- Existing land uses will be largely unaffected and the proposed development will not compromise alternative future land uses.

National Level

Based on the estimates of the capacity to be installed to reach national targets for renewable energy generation, a report in 2009 by Deloitte[16] indicated that the construction and development of wind energy projects across Ireland to 2020 will involve c. €14.75 billion of investment, c. €5.1 billion of which will be retained in the local Irish economy to 2020. Typical investment costs by category are shown in Figure 6.2.

The Deloitte report suggested that the wind energy sector to 2020 in Ireland is capable of supporting more than 10,760 jobs through direct and indirect involvement in the sector. Regarding potential employment in the renewables sector, as in many capital intensive industries, renewable energy development tends to be characterised by substantial construction jobs. These include civil engineering, electrical engineering, labouring, project management, health and safety, turbine transport and crane, and further environmental analysis required to satisfy planning conditions.

The above is a substantial contribution, particularly given the decline in traditional industries including agriculture and across a number of areas of manufacturing. In addition many of the jobs created in the renewables sector would be private sector employment, thereby contributing to the necessary balance between the enterprise and public sectors. The estimates take no account of turbine installation, as international suppliers tend to predominantly deploy in-house teams rather than sub-contracting all activities. Projected employment in the wind industry is shown in Figure 6.3.

The outcome of the analysis undertaken regarding employment is comparable with the results found in studies elsewhere.

6.2.2 Community Benefit

Community benefit schemes, which are over and above the local direct project investment, are a well-established component of wind energy developments in Ireland. The wind sector already delivers long lasting community benefits to communities across Ireland.

16 Jobs and Investment in Irish Wind Energy Powering Ireland's Economy

The Irish Wind Energy Association (IWEA) recognises and stresses that increasing community acceptance of wind energy is central to the efficient deployment and expansion of wind energy in Ireland with the consequent positive economic development resulting in greater security of our energy supply, job creation, lower energy prices and a reduction of greenhouse gas emissions.

Often seen as a goodwill contribution, community benefit schemes are a commitment by developers to ensure that a proportion of the benefits delivered by wind energy projects are realised within the communities that live near them. Community benefit is also recognition of local communities' accommodation of wind farms in their area.

Contributions made by the developer are used to support the local community, through funding of projects and services over and above those required to be provided by the local authority.

IWEA has reinforced its commitment to local communities through publication of its community engagement and commitment guidelines[17], the principles of which will be followed by ESB Wind Development Limited.

6.2.3 Health and Safety

The DoEHLG's Windfarm Planning Guidelines (Section 5.7) note as follows regarding safety aspects:

> *There are no specific safety considerations in relation to the operation of wind turbines.*

Access to the site and to the turbines within it is safe for people and animals under normal conditions

Fire

As with any structure, fires in wind turbines are not totally unknown. A wind turbine caught fire in hurricane-force winds at Ardrossan, North Ayrshire, Scotland, during severe weather in 2011. While rare wind turbine fires are dramatic visually, they are immaterial in context of more than 200,000 working, productive wind turbines world wide.

Structural Integrity

In Ireland a wind turbine collapsed in the Maas area of Ardara, Co. Donegal in 2013 and an equivalent event occurred in Co. Tyrone in 2015. A turbine at Tursillagh Wind Farm near Tralee, Co. Kerry lost a blade in early-2015. In none of these isolated cases did personal injuries or damage to third party property arise.

In the past, some poorly designed wind turbines have experienced blade failures during storms. This has applied particularly to two-bladed machines. In documented cases of wind turbine blade failure, the maximum reported throw distance is 150 m for an entire blade, and 500 m for a blade fragment.

The type of wind turbine proposed will be a three-bladed machine with Class One Certification for Structural Integrity issued by Germanischer Lloyd. The machines will be designed to withstand gusts of up to 70 m/s, which is well above the wind speed applicable to the design of conventional structures in this part of Ireland. The maximum gust recorded at Valentia between 1981 and 2010 was 88 knots (45 m/s).[18] The extreme

[17] Irish Wind Energy Association , Good Neighbour, IWEA Best Practice Principles in Community Engagement and Community Commitment, 2013

[18] http/www.met.ie/climate-ireland/1981-2010/Valentia.html

conditions represented by the design wind speed are very rare and, if they did occur, would cause widespread destruction to dwellings and infrastructure. Because of the distance to the nearest dwellings, it is extremely unlikely that even under these conditions the wind turbines would cause additional damage or risk to persons.

The DoEHLG Windfarm Planning Guidelines refer to the possibility of injury to people or animals from a damaged blade as being very remote. The Guidelines explain why this is the case, as follows:

> *Most blades are composite structures with no bolts or separate components and the danger is minimised as a result.*

Electromagnetic Radiation

In common with all electrical equipment, the turbines and other equipment associated with a wind farm produce both electric and magnetic fields, collectively termed electromagnetic fields or EMF. Such emissions for the type of machine proposed would be very low in the immediate vicinity of the machine and almost non-existent at any distance from it. There is no evidence that such emissions, which are common at higher levels in all built-up areas, are injurious to human health.

Domestic electrical appliances and tools, for example, can generate much higher electromagnetic fields in their close proximity compared to transmission lines at a nominal 50 m distance away.

It is accepted internationally that wind turbine generators and underground electricity cables do not give rise to potential EMF impacts with human beings. Turbine generators are located inside the turbine’s central housing, which will be situated up to 80 m above ground, and will result in little or no EMF at ground level. In addition, all wind turbines are at least 500 m from the nearest dwelling house outside the site. All electrical that connections from the turbines to the Substation will be by underground cables, which effectively generate no EMF at the surface because of the close placement of phase conductors, that is placing the cables with small separation distances, to minimise the EMF field generation and screening of the cables.

Transformers located in the Substation are the main EMF generation focal points within Grousemount Wind Farm. However, in the case of Grousemount the nearest dwellings are in excess of 2 km from the Substation and there will be no impact from EMF.

Hazard from Falling Ice

In cold climates or at high altitude ice can potentially build up on the blades or other parts of a wind turbine. This does not arise when a turbine is in operation but rather where it has been stopped, following a grid failure for example, and the ambient temperature is very low, allowing ice to build up. Any ice formation during operation would be likely to cause a dynamic imbalance on the rotating blades that would automatically result in a shut-down of the wind turbine.

Falling ice could cause damage to structures and vehicles, and injury to site personnel and the general public, unless adequate measures are put in place for protection.

To minimise the potential risk from falling ice the design of the wind farm has ensured that turbines are located a safe distance from potential receptors. For example, Wind Energy

Production in Cold Climate[19], recommended by Germanischer Lloyd and the Deutsches Windenergie Institut (DEWI) provides the following formula for calculating a safe distance: 1.5 x (hub height + rotor diameter)

In the case of Grousemount for turbines having a maximum overall dimension of 126 m, the various combinations of tub height and rotor diameter generate a maximum safe distance requirement of 273 m (1.5 x (70 + 112)). All potential receptors at Grousemount are located well in excess of this calculated safe distance from all turbines.

The DoEHLG Windfarm Planning Guidelines refer to the possibility of injury to people or animals from flying fragments of ice. The Guidelines explain why this is the case, as follows:

> *The build up of ice on turbine blades is unlikely to present problems. Most wind turbines are fitted with anti-vibration sensors, which will detect any imbalance caused by the icing of the blades. The sensors will cause the turbine to wait until the blades have been de-iced prior to beginning operation.*

Wind turbines installed in such environments may incorporate an automatic ice warning system and some components in the wind turbine require a certain time for preheating prior to turbine restart. This does not generally arise in Irish conditions and there is no single known recorded incidence of flying fragments of ice occurring at a wind farm in Ireland in almost 20 years of commercial operation.

Summary

The minimum desirable distance between wind turbines and occupied buildings, established on the basis of protection of residential amenities including visual impact and expected noise levels, will always be greater than that necessary to meet safety requirements. Extensive operational experience has shown that the health and safety record of wind turbines is exceptionally high, being better in most instances than other forms of electricity production.

Some health or safety related topics are covered by separate and more specific legislation and so do not form part of this environmental assessment. Examples include worker health and safety, and construction safety.

6.2.4 Other Issues

Other concerns for human beings will be audibility, shadow flicker, visibility and traffic. These issues are dealt with in the Sections 7, 8, 12 & 16, which deal with Noise, Shadow Flicker, Landscape, and Roads & Traffic.

6.3 MITIGATION

6.3.1 General

Mitigation of impacts on human beings has been considered in the context of mitigation of other aspects of this development in the relevant Sections of the EIS.

6.3.2 Health & Safety

The emphasis in ESB and its subsidiary companies on safety will be applied to all aspects of the construction and operation of Grousemount Wind Farm. Its management and continual improvement are an integral part of the company's activities.

[19] Wind Energy Production in Cold Climate, Tammelin, Cavaliere, Holttinen, Hannele, Morgan, Seifert & Säntti, 1997

Access to electrical equipment will be restricted to authorised persons who will operate under specific safety rules.

Health and safety provisions will be in accordance with recognised best practice in the wind energy industry. General health and safety procedures will include but will not be limited to the following:

- Site access will be restricted to authorised construction personnel only.
- Clear signage will be provided indicating site restricted area
- All appropriate safety regulation signage will be displayed at the site entrance and elsewhere as appropriate.
- All construction works will be to codes of practice and certified standards set by the various construction trades, such as electricians, excavators, transportation, etc.

It is ESB Wind Development's intention that the project will be built, operated and maintained to the highest standards of safety. All relevant legislation will be fully adhered to during all stages of development. Any risks that might be associated with this project will be minimised by the use of recognised best practice and technology.

Modern wind turbines incorporate sophisticated control systems that continually monitor the operational status and safe working of key components of each wind turbine and allow an operator to remotely manage the turbines. Under fault conditions, affected turbines shut down automatically and transmit an alarm to the control centre. For safety-critical faults, turbines do not restart until a maintenance engineer has diagnosed and rectified the problem.

Specific actions in relation to safety will include the following:

- The turbines will be equipped with lightning protection to effectively and safely discharge a lightning strike to earth.
- All electrical systems will comply with the relevant national and international standards.
- Access to electrical equipment will be restricted to authorised persons who will operate under specific safety rules.

In response to its requirement that was outlined in the course of consultation regarding potential interference with telecommunications networks (Section 16.4), Kerry Fire Brigade will be provided with generic advice on how first responders should respond to a fire in a wind turbine.

6.4 CONCLUSIONS

In summary, the proposed development will not result in significant adverse impacts on human beings.

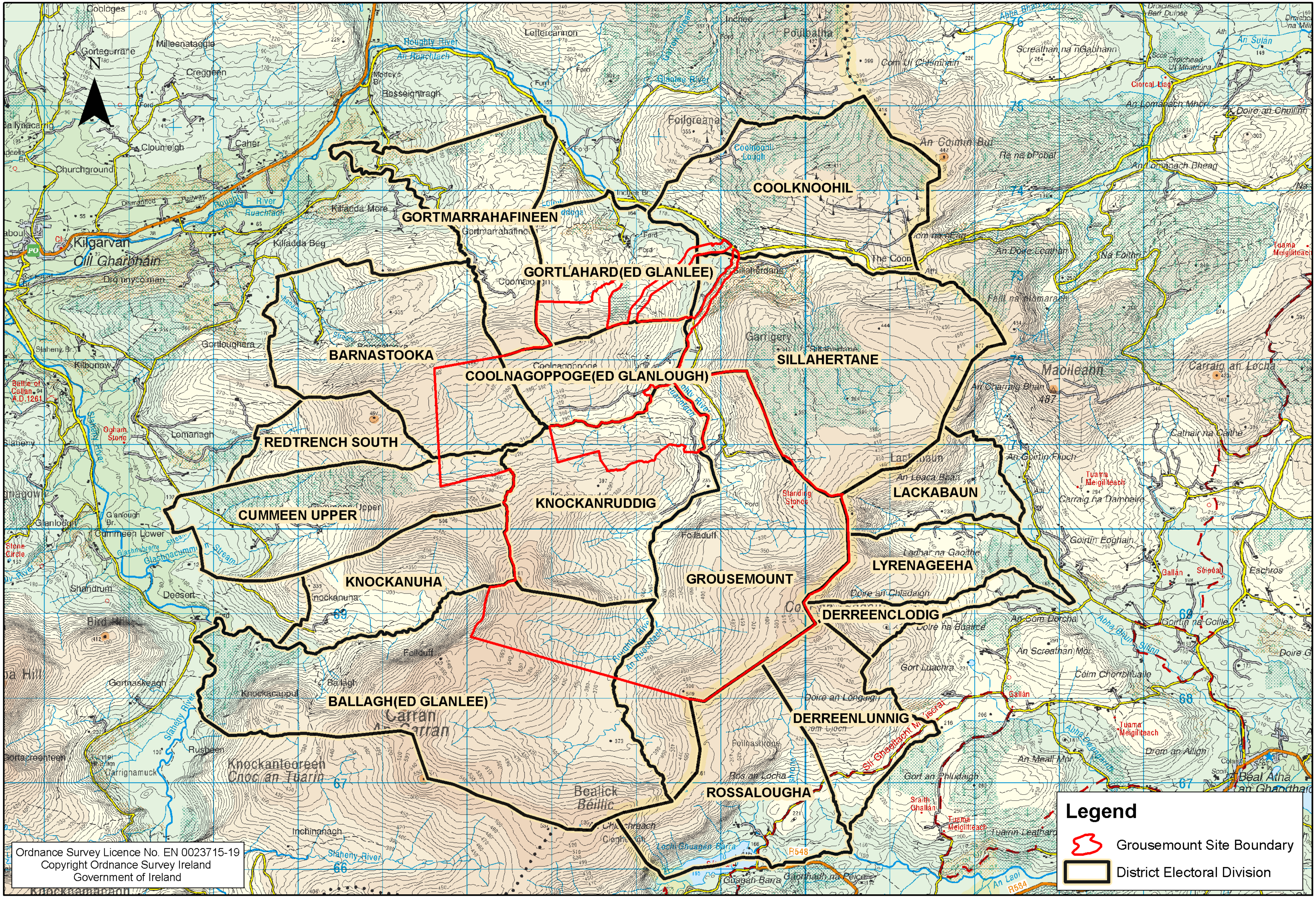

Figure 6.1 - Townlands at Wind Farm Site

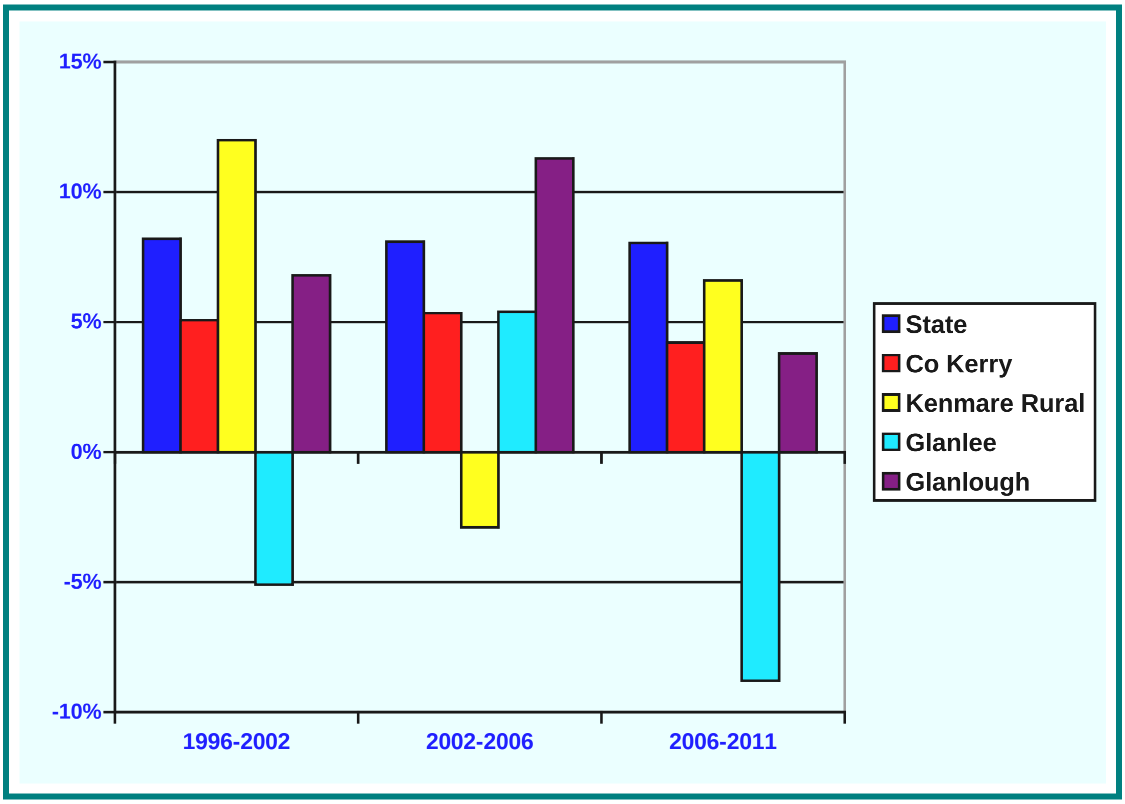

Figure 6.2: National & Local Trends in Population Growth

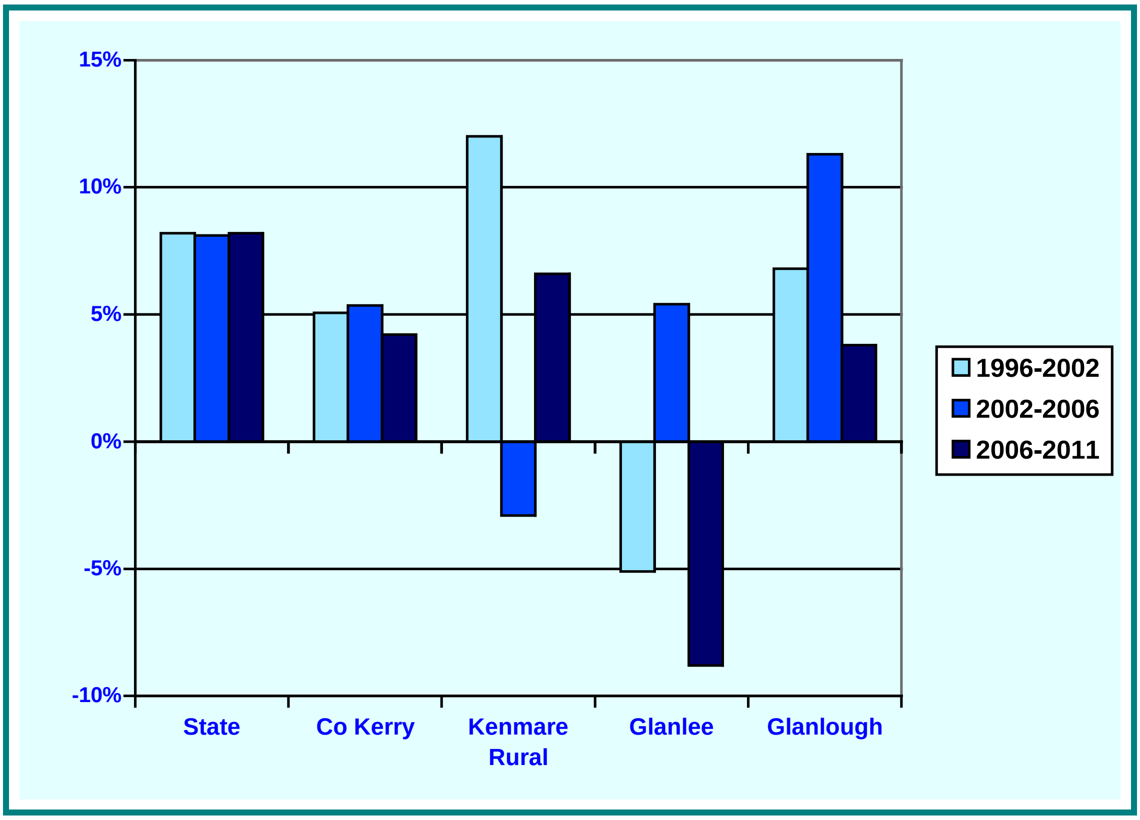

Figure 6.3: Historical Trends in Population Growth

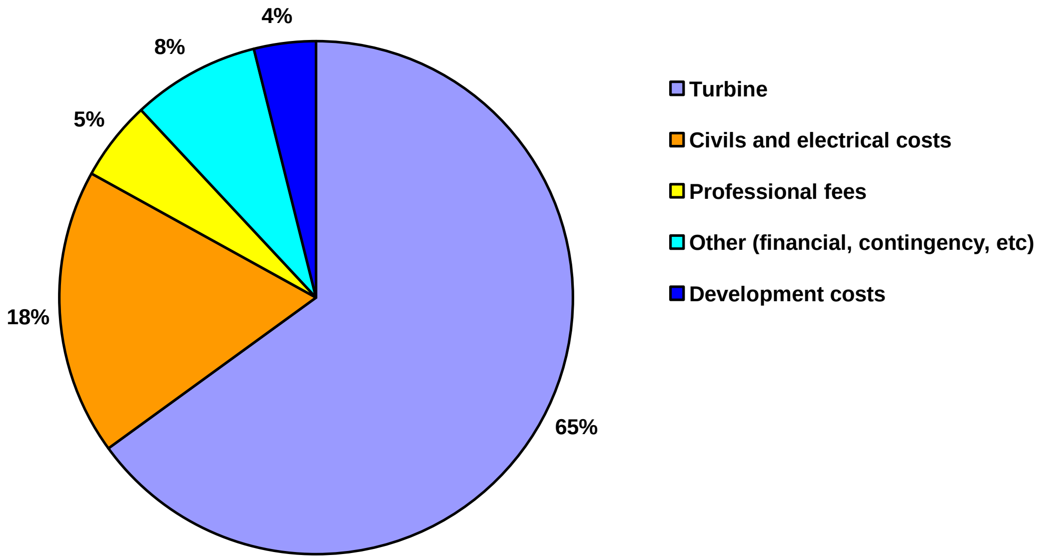

Figure 6.4: Wind Industry Investment Costs by Category

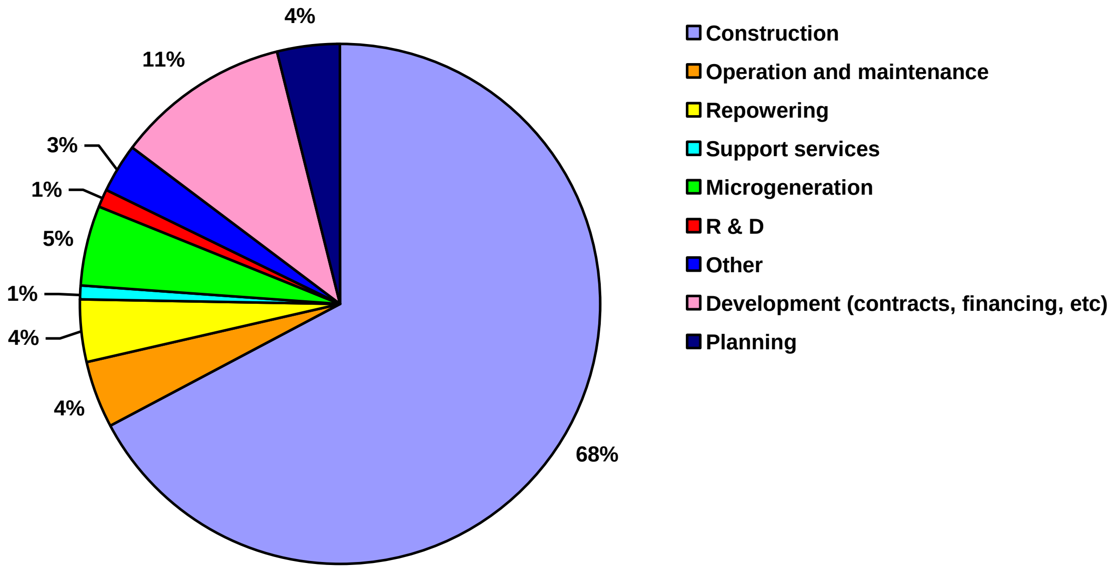

Figure 6.5: Irish Wind Jobs by Category