ESB International

Oweninny Wind Farm

Oweninny Power Ltd.

Environmental Impact Statement

Chapter 12

Air and Climate

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BORD NA MÓNA

ESB Wind Development

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12. AIR QUALITY & CLIMATE

12. 1 RECEIVING ENVIRONMENT

This chapter presents an assessment of impacts on air quality and climate arising from the proposed development. The assessment predicts the potential impacts on the surrounding environment arising from the construction and operation of the proposed development and specifies mitigation measures to reduce potential impacts where appropriate.

12.1.1 Air Quality

12.1.1.1. Legislative Context

In order to protect human health, vegetation and ecosystems, EU Directives have been adopted which set down air quality standards for a wide variety of pollutants. The current standards are contained in the Clean Air for Europe (CAFE) Directive (EP & CEU, 2008) and the 4th Daughter Directive (EP & CEU, 2004). These Directives also include rules on how Member States should monitor, assess and manage ambient air quality.

EU Directive 2008/50/EC on ambient air quality and cleaner air for Europe was adopted in 2008. This Directive (known as the CAFÉ Directive) merges earlier Directives on limit values for a range of air quality parameters and one Council Decision into a single Directive on air quality.

The CAFÉ Directive was transposed into Irish legislation by the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011). It replaces the Air Quality Standards Regulations 2002 (S.I. No. 271 of 2002), the Ozone in Ambient Air Regulations 2004 (S.I. No. 53 of 2004) and S.I. No. 33 of 1999. The 4th Daughter Directive was transposed by the Arsenic, Cadmium, Mercury, Nickel and Polycyclic Aromatic Hydrocarbons in Ambient Air Regulations 2009 (S.I. no. 58 of 2009).

EU legislation on air quality requires that member states divide their territory into zones for the assessment and management of air quality. Ireland is divided into four such zones [See Figure 12-1]. Zone A is the Dublin conurbation, Zone B is the Cork conurbation, Zone C comprises large towns in Ireland with a population >15,000 and Zone D, principally rural, is the remaining area of Ireland. The proposed development site is located within Zone D.

In conjunction with individual local authorities, the EPA undertakes ambient air quality monitoring at specific locations throughout the country in the urban and rural environment (see Figure 12-2). It prepares an air quality report[1] based on data from 29 monitoring stations and a number of mobile air quality monitoring units. The EPA as the National Reference Laboratory for Air coordinate and manage the monitoring network. Monitoring stations are located across the country, with new stations added in 2011 in Shannon Town, Co. Clare and Claremorris, Co. Mayo. The EPA have also published air quality summary bulletins for PM10[2], Ozone[3] and Nitrogen Dioxide[4] in 2012 and also provide

[1] Air Quality in Ireland (2011) – Key Indicators of Ambient Air Quality; Environmental protection Agency

[2] http://www.epa.ie/whatwedo/monitoring/air/reports/pm2011/

[3] http://www.epa.ie/whatwedo/monitoring/air/reports/ozone2011/

real time air quality data on their website.

12.1.1.2. Baseline Air Quality

Air quality in Zone D areas is generally very good with low concentrations of pollutants such as Nitrogen Dioxide (NO_2), Sulphur Dioxide (SO_2) Particulate Matter 10 microns in size (PM_{10}), and Carbon Monoxide (CO). This is due mainly to the prevailing clean westerly air-flow from the Atlantic and the relative absence of large cities and heavy industry. Concentrations of ozone are higher in rural areas than is urban areas due to the absence of the nitrogen oxide in rural areas as an ozone scavenger. Ozone is also a transboundary pollutant, with locations on the west coast having the highest concentrations in Ireland.

The most recent EPA report published in 2011 indicates that overall, air quality in Ireland continues to be of good quality and remains the best in Europe. Measured values in Zone D for NO_2, SO2, CO, Ozone, PM_{10}, $PM_{2.5}$. A summary of air quality parameters and air quality assessment for Zone D taken from the EPA Annual Report 2011 is provided in Table 12-1

Table 12-1: Summary of air quality assessment in Zone D

Parameter	Lower Assessment Threshold	Limit Value	Number of national Monitoring Locations	Number of Zone D Monitoring Locations	Zone D result
NO_2 and NOx	26ug/m^3	200ug/m^3 one hour -, Calendar year 40ug/m^3	13	4	Below the annual limit value and the lower assessment threshold
SO_2	50 ug/m^3	125 ug/m^3/d one day human beings/ / 20ug/m^3 calendar year vegetation	10	3	Below the daily limit value for human beings and vegetation and the lower assessment threshold
CO	5 mg/m^3	8 hour - 10 mg/m^3 (human beings	5	1	Below the annual limit value and the lower assessment threshold
Ozone	Daily maximum 8 hour mean - 120 ug/m^3 over 25 days per year/Long term objective 120 ug/m^3	Daily maximum 8 hour mean - 120 ug/m^3 human beings/18,000 ug/m^3/h for vegetation. Information to be supplied at 180 ug/m^3	12	6	Below the annual target value and above long term objective on one day
Particulate Matter (PM_{10}, and Black Smoke)	25 ug/m^3 (one day)/20 ug/m^3 (calendar year)	One day 50 ug/m^3, Calendar year 40ug/m^3	17	4	Below the annual limit values and above the lower assessment threshold

[4] http://www.epa.ie/whatwedo/monitoring/air/reports/no22011/

Particulate Matter $PM_{2.5}$ ug/m^3	12 ug/m^3 averaged over a calendar year	25ug/m^3 average over a calendar year	7	2	Below both the annual limit value and the lower assessment threshold.

Heavy metals, benzene and polycyclic aromatic hydrocarbons (PAH) were all below the annual limit values in Zone D also. The report noted however, that domestic fuel burning emissions in rural areas was the main source of particulate matter and poly-aromatic hydrocarbons (PAH). Levels of particulate matter in some smaller towns for example are similar or higher than those in cities, where bituminous coal is banned.

More recent air quality data for air monitoring stations at Castlebar and Claremorris in county Mayo based on the EPA's published bulletins for 2012 is presented in Table 12-2.

Table 12-2: EPA 2012 Air Quality Bulletin for monitoring stations in County Mayo

Parameter	Station	Assessment	Number of times limit exceeded
NO_2	Castlebar	Number of values greater than 200 ug/m^3	0
Ozone	Castlebar	Number of values greater than 180 ug/m^3	0
PM_{10}	Castlebar	Number of values greater than 50 ug/m^3	1
PM_{10}	Claremorris	Number of values greater than 50 ug/m^3	0

In general air quality is good with one exceedence recorded for PM_{10} in Castlebar reflecting the impact of the likely use of bituminous coal in this location.

Overall air quality in Zone D where the site is located is generally good and it would be expected to be high at the Oweninny site itself due to the rural nature of the area with low density of rural housing.

12.1.2 Atmospheric Emissions

12.1.2.1. Legislative Context

Increased atmospheric levels of greenhouse gases enhance the natural greenhouse effect and are widely recognised as the leading cause of climate change. The most important long-lived greenhouse gases are Carbon Dioxide (CO_2), Nitrous Oxide (N_2O), and Methane (CH_4). CO_2 arises from a range of sources including the combustion of fossil fuels. According to the EPA[5], agriculture remains the single largest contributor to overall greenhouse gas emissions in Ireland, at 32.1% of the total, followed by Energy (power generation and oil refining) at 20.8% and Transport at 19.7%. The remainder is made up by Industry and Commercial at 14.0%, the Residential sector at 11.5%, and Waste at 1.8% (see Figure 12-3).

[5] Ireland's Greenhouse Emissions in 2011, EPA report (October 2012)

Under the Kyoto agreement, Ireland committed to limiting the increase of greenhouse gases to 13% above its 1990 levels during the period 2008-2012 and a 20% reduction in emissions of 1990 levels by 2020. The baseline emissions total for Ireland was calculated as the sum of carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) emissions in 1990 and the contribution from fluorinated gases in 1995.

Key objectives for reductions in greenhouse gases across the agriculture, energy, transport, industrial, forestry and built environment sectors, which will ensure that Ireland can meet its international commitments, are set out in the National Climate Change Strategy 2007 – 2012. This strategy includes the Government's target of achieving 40% of electricity consumption on a national basis from renewable energy sources by 2020, including a significant contribution from more wind energy. Achieving this target will potentially contribute significantly to limiting the increase of greenhouse gases in Ireland.

Under the EU National Emissions Ceiling Directive (2001/81/EC), Member States are required to limit their annual national emissions of SO_2, NO_x, VOC and NH_3 to amounts not greater than the emissions ceilings laid down in Annex 1 of the Directive, by the year 2010 at the latest.

12.1.2.2. Greenhouse Gas Emissions

Ireland is subject to several conventions and protocols that place limits on and force reductions in these emissions.

The baseline value in CO_2 equivalent was established based on 1990 levels at 55.3 Mt and results in total allowable emissions of approximately 314.2 Mt over the commitment period, which equates to an average of 62.8 Mt per annum. Compliance with the Kyoto Protocol limit is achieved by ensuring that Ireland's total emissions in the period 2008-2012, adjusted for any offsets from activities under Article 3.3 and the surrender of any purchased Kyoto Protocol credits, are below 314.2 Mt at the end of the five-year period.

Estimates of greenhouse gas emissions between the period 1990 to 2011 indicated a peak in 2001 (70,128 million tonnes carbon dioxide equivalent) when emissions reached a maximum following a period of unprecedented economic growth and began to reduce from 2008 on, see Figure 12-4. In 2011, total emissions of greenhouse gases in Ireland across the six key National Climate Change Strategy sectors (see Table 12-3) were estimated at 57.34 million tonnes carbon dioxide equivalent, which is approximately 3.7% higher than emissions in 1990. However, the total for 2011 is 18.2% lower than the peak level of 2001. This is 6.7% lower (4.12 Mt CO2eq) than emissions in 2010.

Table 12-3: Greenhouse Gas Emissions in Ireland (in Mt of $C0_2$ equivalent)

Year	Energy	Residential	Industry	Agriculture	Transport	Waste	Total
1990	11.4	7.5	9.6	20.5	5.1	1.3	55.3
2011	11.9	6.6	8.1	18.4	11.3	1.0	57.3

Key emission reductions in 2011 occurred in Energy (principally electricity generation 10.5%), Residential sector (15.6%), Industry and Commercial (10.7%), Transport sector

(2.7%) and Agriculture (1.9%).[6]

Lower emissions from the energy sector reflect an increase in the share of renewables in gross electricity consumption from 12.9% in 2010 to 19.4% in 2011. Wind resources were significantly higher in 2011 than in 2010 (up 56%). Climatic conditions are reflected in the lower residential emissions while the reduction in industry and commerce largely reflects the decline in construction and associated cement production. Transport emissions are also down reflecting the continued decline in the economy and vehicle taxation bands. Lower emissions in the agricultural sector are due mainly to a reduction in the use of gas oil and a decrease in nitrogenous fertiliser.

Ireland's combined emissions in 2008, 2009, 2010 and 2011 were 1.77 million tonnes above its Kyoto limit when the EU Emissions Trading Scheme (ETS) and approved Forest Sinks are taken into account. Ireland is on track to meet its Kyoto commitment taking unused allowances from the ETS into account. However, the country still faces considerable challenges in meeting EU 2020 targets and developing a low-carbon emission pathway to 2050.

Commenting on the figures Dara Lynott, Deputy Director General, EPA said:

> *"Ireland's progress in meeting its commitments under the Kyoto Protocol is very welcome. However, we must not assume that recession induced reductions mean that environmental pressures are being managed in a sustainable way. Reducing our reliance on fossil fuels and moving Ireland to a resource efficient and sustainable society will require an integrated approach by policy makers and behavioural change by us all."*

The EPA is also designated under the National Climate Change Strategy to prepare annual national emission projections for greenhouse gases relating to key sectors of the national economy. In their latest projection report[7] the following was stated with respect to the energy sector:

> *" Energy sector emissions comprise emissions from power generation, oil refining, peat briquetting and fugitive emissions. Emissions from power generation accounted for 97% of energy sector emissions in 2010 and are responsible for a similar share of emissions over the projection period.*
>
> *Under the With Measures scenario, total energy sector emissions are projected to decrease by 8.7% over the period 2010 – 2020 to 12.2 Mtonnes of CO2eq. The decrease in emissions is caused by a displacement of gas by renewables which are projected to reach 27% penetration in 2020.*
>
> *Under the With Additional Measures scenario, total energy sector emissions are projected to decrease by 19.8% over the period 2010 – 2020 to 10.7 Mtonnes of CO2eq. In this scenario, it is assumed that renewable energy reaches 40% penetration by 2020 with the largest contribution coming from wind[4]. It is envisaged there will be an expansion of biomass electricity generation capacity to 270 MW through the implementation of co-firing biomass, the construction of two waste to energy units and the continued development of landfill gas electricity generation and biomass CHP. In addition the construction of at least 75 MW of wave energy is forecast.*

[6] EPA Press release, Ireland is on track to meet its Kyoto agreement commitments, October 2011

[7] EPA, Irelands Greenhouse Gas emissions Projection 2011 – 2020, April 2012.

The “with measures scenario” incorporates the effects of policies and measures in place by 2010. The “with additional measures” is based on Sustainable Energy Authority of Ireland’s National Energy Efficiency Action Plan[8] and National Renewable Energy Action Plan[9] and their implementation.

The development of renewable wind energy, such as that at Oweninny, will significantly reduce Ireland’s dependence on imported fossil fuels helping the country achieve its Kyoto and 2020 target in line with the National Renewable Energy Action Plan

12.1.2.3. Other Emissions

The pollutants sulphur dioxide (SO_2), nitrogen oxides (NO_x), volatile organic compounds (VOC) and ammonia (NH_3) are responsible for long-range transboundary air pollution such as acidification, eutrophication and ground-level ozone pollution.

- SO_2 is the major precursor to acid deposition, which is associated with the acidification of soils and surface waters and the accelerated corrosion of buildings and monuments. Emissions of SO_2 are derived from the sulphur in fossil fuels such as coal and oil used in combustion activities.
- NOx emissions contribute to acidification of soils and surface waters, tropospheric ozone formation and nitrogen saturation in terrestrial ecosystems. Power generation plants and motor vehicles are the principal sources of NOx emissions, through high-temperature combustion.
- VOCs are emitted as gases by a wide array of products including paints, paint strippers, glues, adhesives and cleaning agents. They also arise as a product of incomplete combustion of fuels and as such are a component of car exhaust and evaporative emissions.
- NH_3 emissions are associated with acid deposition and the formation of secondary particulate matter. The agriculture sector accounts for virtually all (over 98%) ammonia emissions in Ireland.

Under Article 4.1 of the National Emissions Ceiling Directive [2001/81/EC], Member States are required to limit their annual national emissions of SO_2, NOx, VOC and NH3 to amounts not greater than the emissions ceilings laid down in Annex 1 of the Directive, by the year 2010 at the latest.

Ireland’s position in 2011 in relation with respect to the limits to the above is set out in Table 12-4[10].

Table 12-4: Table 12.2: Annual Air Emissions

Pollutant	Sulphur Dioxide	Nitrogen Oxides	VOC	Ammonia
Limit	42 kt	65 kt	55 kt	116 kt

[8] Maximising Ireland’s Energy Efficiency. The National Energy Efficiency Action Plan 2009-2020. Department of Communications, Energy and Natural Resources, 2009.

[9] National Renewable Energy Action Plan, Ireland. Submitted to the European Commission under Article 4 of Directive 2009/28/EC. Department of Communications, Energy and Natural Resources, 2010.

[10] EPA, Ireland Transboundary Gas Emissions in 2011, February 2013

Emissions	23.4 kt	67.6 kt	43.6 kt	108.7 kt

SO_2 emissions are estimated to have decreased by 87% since 1990 with power generation plant responsible for about 40% of the remaining SO2 emissions despite the fact that emissions in this sector have reduce by almost 91% in the same period.

NOx emissions in Ireland have decreased by 47% between 1990 and 2011 and have decreased by over 36.8 kt, or 35% since 2008. Nonetheless, limits were exceeded in 2011.

The transport sector is the principal source of NOx emissions, contributing approximately 55 per cent of the total in 2011. The industrial and power generation sectors are the other main source of NOx emissions, each accounting for 12 per cent of emissions with the remainder emanating from the residential/commercial and the agriculture sectors.

The agricultural sector accounts for virtually all ammonia emissions.

The main sources of VOC emissions in Ireland are solvent use and transport accounting for 85 per cent of the annual total in 2011. Domestic coal burning in the residential sector is another important but declining source Reductions corresponding to 48 per cent have been achieved from 1990 to 2011 with improved emission control for VOCs in motor vehicles has been largely been responsible for the decrease in overall emissions.

The development of Oweninny wind farm will increase the availability of renewable energy contributing to further reductions in SO_2 and NO_x emissions associated with displaced fossil fuelled power generation.

12.1.3 Local Emission Sources and Receptors

The site is situated in a remote rural landscape mainly on cutover and cutaway peat with areas of bog remnants, standing water and commercial forest plantation within its boundaries. Beyond the boundaries of the site, the land is predominantly blanket bog and commercial forest plantation. The closest population centres are the towns of Crossmolina to the east and Bangor Erris to the west. The main N59 passes to the south of the site and provides access to it. The local roads are of tertiary standard and facilitate the movement of the local landowners.

The closest receptors to the proposed wind farm development are the isolated houses dotted around the local road network. The main local emissions from these sources arise from the burning of fossil fuels for heating purposes and from vehicles using the N59 and the local road network. In general, air quality impacts on local receptors from these emission sources are considered negligible.

12. 2 IMPACT OF THE DEVELOPMENT

12.2.1 Construction Phase impacts

12.2.1.1. Atmospheric Emissions

Electricity generation by wind turbines does not lead to environmental emissions.

A study[11] by the International Energy Agency (IEA) showed that renewable energy, and particularly wind energy, must dominate the electricity generation sector in a sustainable energy future. The IEA has clearly acknowledged that wind power is now a mainstream

[11] Energy Technology Perspectives 2008

energy technology and that it must play a central role in combating climate change.

The IEA report acknowledges that wind power, along with energy efficiency and fuel-switching will play the major role in reducing emissions in the power sector in the next 10-20 years, the critical period during which global emissions must peak and then begin to decline if the worst effects of climate change are to be avoided.

Amongst the benefits of electricity generation from wind are considered to be its contribution to environmental sustainability and displacement of imported fossil fuels. It is estimated that Oweninny Wind Farm will generate up to 1,069,596 MWh (units) of electricity per annum (based on 370 MW rating per annum and a 33% capacity factor).

Construction, maintenance and operation of the wind farm will result in some CO_2 emissions from transport and construction activities. These include emissions from steel and cement production and quarrying as well as from transport, erection, road building and maintenance. Transport of materials to Oweninny will be the major contributor to CO_2 emissions associated with the project construction. Using the CEFIC Guidelines[12] for CO_2 emissions from transport and based on average round trip of 50 km with 10 tonne payload it is estimated that 4,500 tonnes of CO_2 emissions will occur in the Phase I and Phase 2 construction period with a further 8,000 tonnes emitted by transport during Phase 3.

Such emissions are of course also involved with constructing, maintaining and operating conventional electricity plants, where particularly procurement of the energy source needs to be taken into account.

Based on figures published by the Sustainable Energy Authority of Ireland (SEAI), which was formerly the Irish Energy Centre and was established by the Government in 2002 as Ireland's national energy agency, indicate that, using the 2008 average carbon dioxide emission for the grid (average including all generating technologies such as coal, gas, oil, peat, CHP and wind), each new MW of wind installed displaces the emission of 1,500 t of carbon dioxide. The development of Oweninny Wind Farm will lead typically to an annual reduction in equivalent direct air emissions as shown in Table 12-5.

Thus, the wind farm development will have a significant positive impact on air quality and climate.

Table 12-5: Approximate Annual Equivalent Air Emissions

Carbon Dioxide (CO2)	Sulphur Dioxide (SO2)	Oxides of Nitrogen (NOx)
558,000 t	6,409 t	3699 t

The above uses the 2008 average carbon dioxide emission for the grid (average including all generating technologies such as coal, gas, oil, peat, combined heat and power (CHP), and wind). Sulphur dioxide and nitrous oxide estimates are based on displacement of energy derived from coal combustion.

Construction on peat lands has also been identified as potentially giving rise to CO_2 emissions. This arises as peat is comprised of dead plant material which in a natural bog land has failed to decompose completely. Hence peat acts as a carbon store. Wind farm construction such as excavations and drainage can cause peat to dry out over time releasing its stored carbon content. In the case of Oweninny however, the footprint of the

[12] CEFIC, guidelines for Measuring and Managing CO2 Emission from Freight Transport Operations, March 2011

development will comprise about 5.4% of the total site area, including the borrow pit, gravel storage and peat repository area (4% excluding these areas). Additionally the site has already been subject to significant drainage and peat harvesting and now comprises cutover and cutaway bog land with isolated areas of remnant intact peat. Although there will be some peat excavation required for access track and turbine foundation construction these bog remnants will not be impacted significantly by the wind farm development hence there will be no additional significant loss of CO2 arising from construction arising from impact on them. Bord na Móna have also completed a bog rehabilitation programme on the site aimed at restoring water tables and providing the conditions for natural peat flora to develop. As the rehabilitation progresses the site will provide additional carbon fixing potential, as evidenced by the EPA's carbon restore programme on the site.

In Ireland, cement manufacture is the second largest industrial source of CO_2 and NO_X emissions, after the generation of electricity from fossil fuels. At Oweninny construction, there will be a small amount of emissions associated with the cement used in concrete production.

In addition to its position regarding CO_2, Ireland also has binding international commitments to meet targets for emissions of air pollutants and for local and regional air quality, including cuts in SO_2 and NOx. Meeting these will require significant reductions in emissions from electricity generation.

There are continuing strong pressures for further reductions in these air emissions. The development of renewable energy and, particularly wind energy with zero emissions, is seen as an essential element in achieving these reductions while allowing continuing economic expansion. Increased utilisation of renewable energy for electricity generation forms part of the national response strategy in relation to climate change and is a central feature in the strategy for greenhouse gas abatement.

12.2.1.2. Air Quality

There is some potential for local air quality to be impacted during the construction phase periods. Dust generated by construction activity can give rise to local nuisance. However, the impact of this will depend largely on climatic factors. For example the potential for dust to be emitted depends on the type of construction activity being carried out in conjunction with environmental factors including levels of rainfall, wind speeds and wind direction. The potential for impact from dust also depends on the distance to potentially sensitive locations and whether the wind can carry the dust to these locations.

The primary air quality issue related to construction is dust potentially arising from the following activities:

- Earth moving and excavation equipment including handling and storage of soils and subsoil material.
- Extraction from borrow pits for use on access track construction.
- Transport and unloading of crushed stone around the site during road construction.
- Vehicle movement over hard dry surfaces on the site, particularly freshly laid access tracks.
- Vehicle movement over surfaces off-site contaminated by muddy materials brought off the site.

- Operation of the batching plant

In general the main wind turbine, substations, O&M building, borrow pit and visitor centre construction sites are located more than one kilometre from occupied dwellings and the potential for dust impact will be insignificant.

Construction vehicles and machinery within the site and transport associated with delivery of materials will also give rise to exhaust emissions during the construction phase. The potential impact is not considered significant in the context of the extent of traffic movements arising and the extended period of construction.

12.2.2 Operational phase impacts

12.2.2.1. General

In terms of climate change the wind farm will contribute significantly to achieving the Governments 2020 target for renewable energy producing an estimated 1,069,596 MWh of renewable electricity annually and displacing over half a million tonnes of CO2. This will significantly reduce Ireland's greenhouse gas emissions and contribute towards controlling global climate. It will also contribute significantly to reducing transboundary air pollution through displacement of SO2 and NOx emissions from fossil fuels.

There will be no impacts on local ambient air quality during operation of the wind farm. The wind farm will have no emissions to atmosphere and thus no adverse impact on general air quality.

It will have a beneficial effect in providing for energy without emissions of the primary recognised pollutants.

12.2.2.2. Loss of Forestry

Carbon sequestration rates in forestry vary by tree species, soil type, regional climate, topography and management practice. In the US, representative annual carbon sequestration rates are cited as being in the range 1.5 – 6.6 t of Carbon per hectare of trees for afforestation, with a range of 0.7 – 5.3 t being cited for reforestation. In Ireland it has been estimated that forests on average sequester approximately 3.3 t of Carbon per hectare per year.

Approximately 36 ha of forestry will be lost as a result of the wind farm development with an associated loss of carbon sequestration. Sitka Spruce plantation for example with a yield class of 16 will sequester an average of 204 tons of CO_2 per hectare per year up to year 40 the normal felling rotation period, or approximately 5,000 tons of CO_2 in total.

However, the extent of forestry loss will be inconsequential when compared to the equivalent environmental benefit in avoided annual air emissions that Oweninny Wind Farm will confer.

12. 3 MITIGATION

The potential for dust during construction depends on a number of factors, most notably the prevalent weather conditions. While a need for significant active dust control during construction is not foreseen, good practice site management measures will be implemented as necessary and will include:

- Wheel wash facilities and use of mechanical road sweeper at the entrance from the public road.

- Dust suppression by water spray on access tracks.
- Use of appropriately covered trucks during delivery of materials to the site.
- Control of vehicle speeds within the site.
- Regular inspection of public roads outside the site for cleanliness and cleaning as necessary.
- Regular inspection and maintenance of the concrete batching plant equipment and dust control equipment.
- Use of recycled cement products where feasible, e.g. pulverised fly-ash (PFA) or blast furnace slag cement.

The dust minimisation measures will be reviewed at regular intervals during the construction phase to ensure the effectiveness of the procedures in place and to maintain the goal of minimisation of dust through the use of best practice and procedures.

12. 4 CONCLUSION

The proposed development will result in significant positive contribution towards management of environmental emissions from electricity generation leading to a reduction in greenhouse gas emissions and transboundary pollutants with the consequential effect on climate

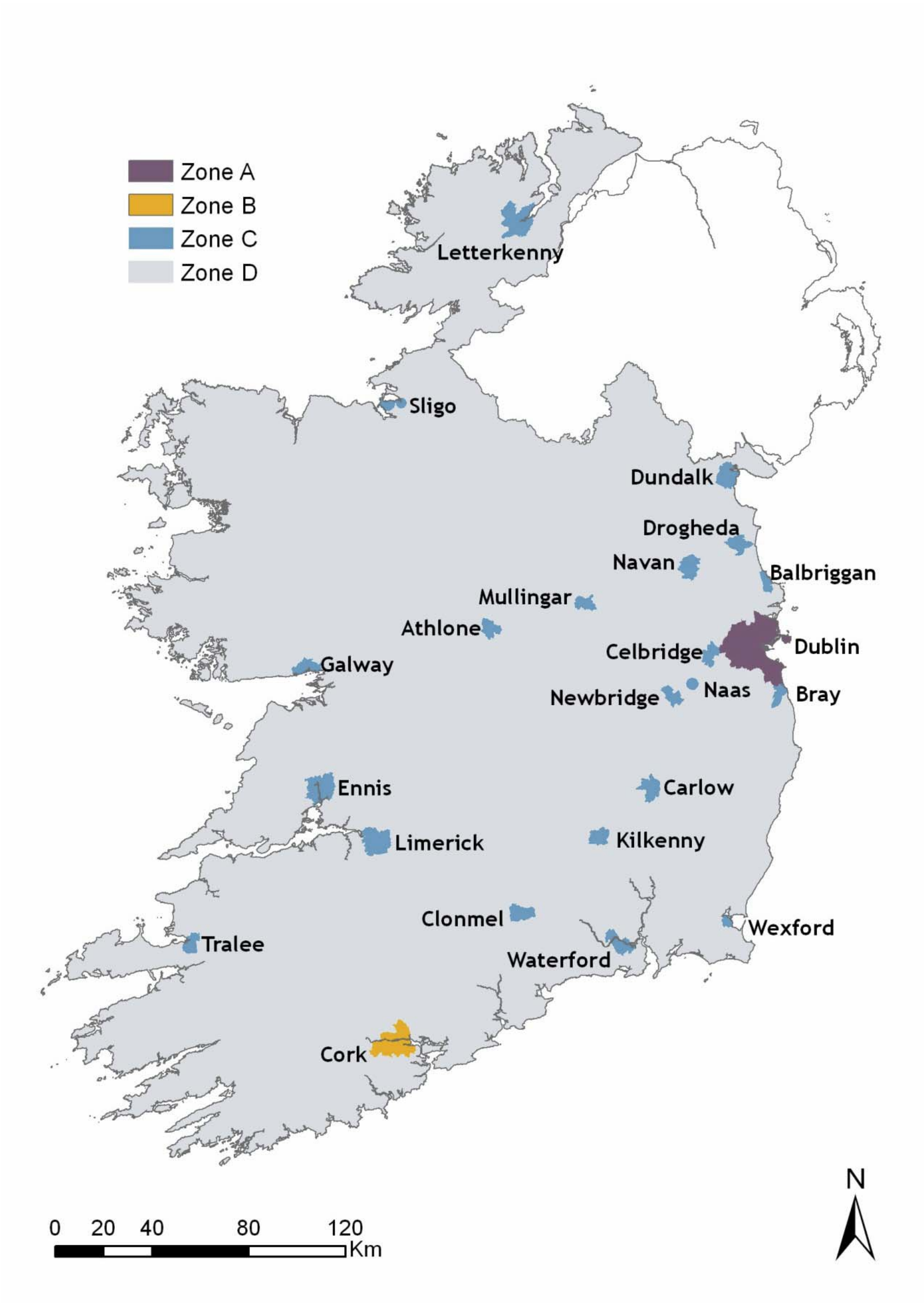

Figure 12-1: Air quality Zones

(Source: EPA Air Quality in Ireland 2011)

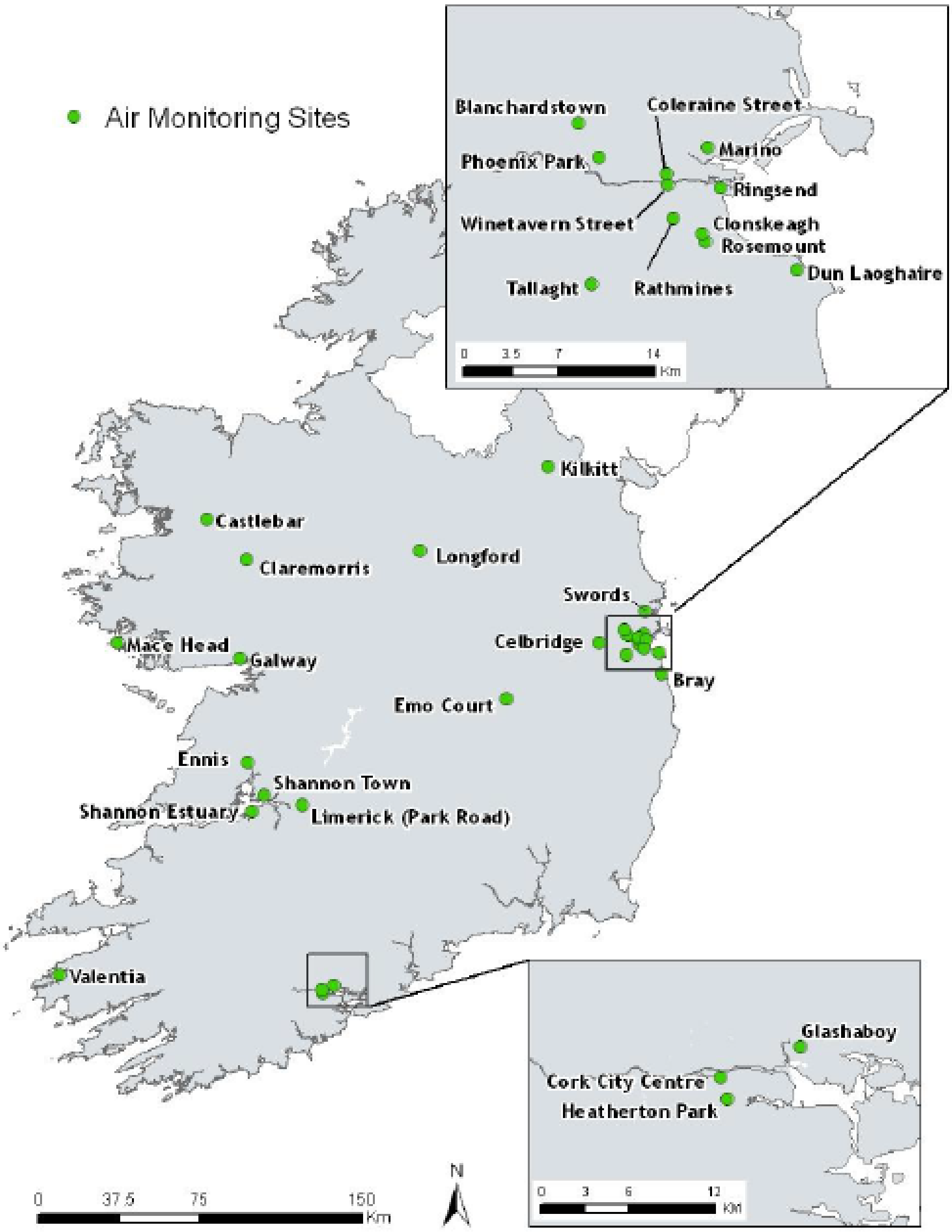

Figure 12-2: Air quality monitoring locations

(Source: EPA Air Quality in Ireland 2011)

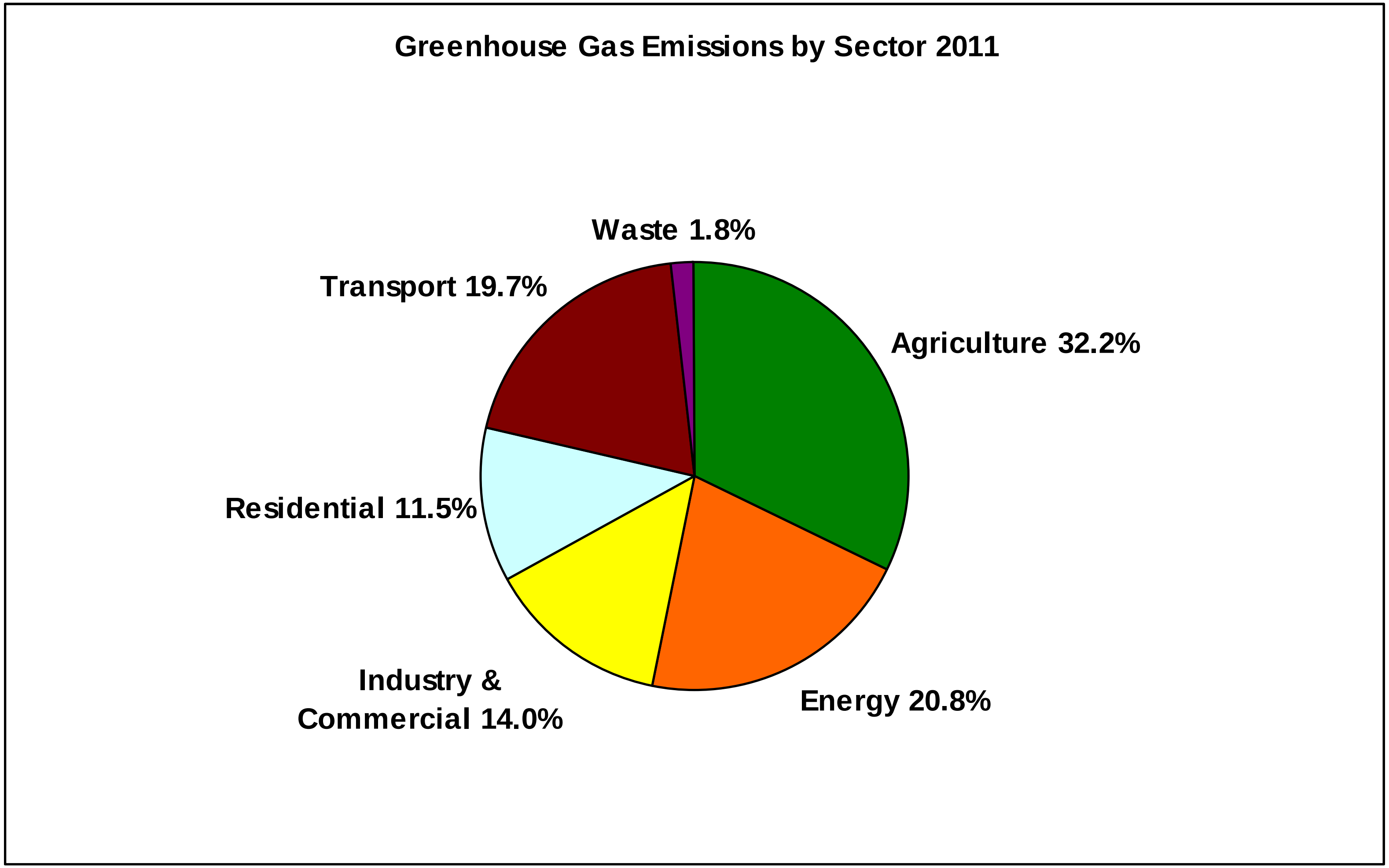

Figure 12-3: Greenhouse gas emissions in 2011 by Sector

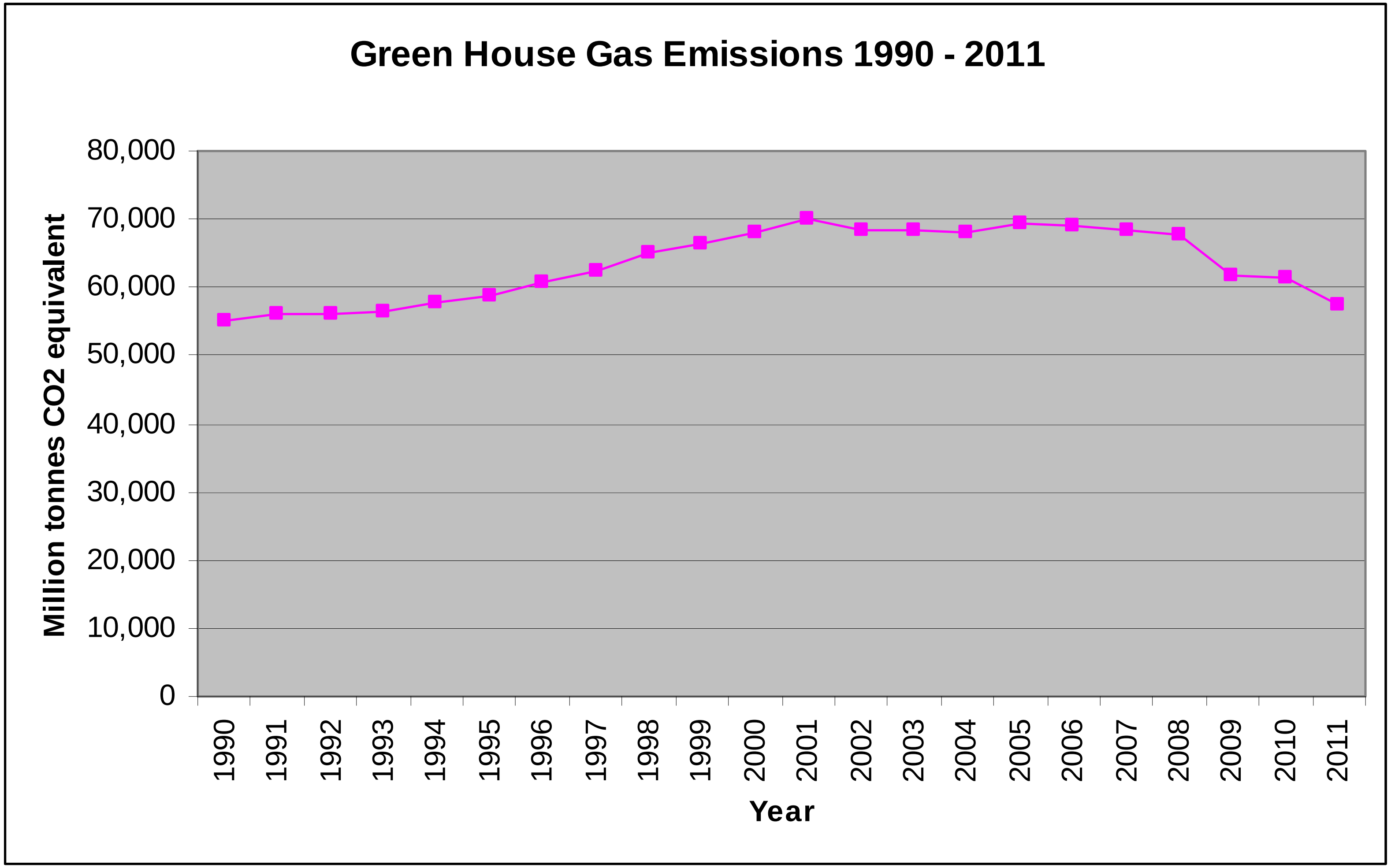

Figure 12-4: Greenhouse Gas Emissions in Ireland 1990 – 2011

(*Source: EPA, Ireland Greenhouse Gas emissions in 2011, October 2012*)