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 of Phases 1 and Phase 2 only. 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. It also provides an assessment of the operational benefit of the wind farm in terms of CO_2 avoided and the overall benefit to the Irish economy in terms of displaced fuel import savings.

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).

Air quality standards are constantly reviewed by the European Commission and in particular alignment of the standards for Polycyclic Aromatic Hydrocarbons (PAH), particulate matter up to 10 microns in size (PM_{10}) and particulate matter up to 2.5 microns in size ($PM_{2.5}$) with World Health Organisation (WHO) may mean stricter limits in the future. Since 2012 the European Commission (EC) has been carrying out a review on air quality policy and legislation. This review is ongoing. The 7th Environmental Action Plan of the EC has outlined the pressing need for the update of the air quality Directives, setting out clear goals for the EU by 2020. However, until such time as any new limits are introduced by the EU then air quality assessment is made against the current standards.

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[137] 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 2013 at Davitt Road, Dublin, St. Anne's Park in Dublin and Finglas in Dublin. The EPA have also published air quality summary bulletins for PM10[138], Ozone[139] and Nitrogen Dioxide[140] in 2012, provide year to date monthly bulletins and also provide 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 2014 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, SO_2, 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 2013 is provided in Table 12.1.

Table 12.1: Summary of air quality assessment in Zone D

Parameter	Lower Assessment	Limit Value	Number of national Monitoring	Number of Zone D Monitoring	Zone D result

[137] Air Quality in Ireland (2013) – Key Indicators of Ambient Air Quality; Environmental protection Agency. http://www.epa.ie/pubs/reports/air/quality/Air_quality%20Report%202013.pdf

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

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

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

	Threshold		Locations	Locations	
NO_2 and NOx	26ug/m^3	200ug/m^3 one hour -, Calendar year 40ug/m^3	15	3	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	5	Below both the annual limit value and the lower assessment threshold.
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	20	3	Below both the annual limit value and the lower assessment threshold.
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. The daily limit for PM_{10} is 50 ug/m3. The limit is deemed breached if more than 35 exceedances occur during the year. The health information threshold for ozone is 180 ug/m^3. Table 12.2 shows the number of exceedances at stations in Castlebar and Claremorris based on 2014 report.

Table 12.2: EPA 2014 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	2
PM_{10}	Claremorris	Number of values greater than 50 ug/m^3	0

In general air quality is good with two exceedances 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[141], agriculture remains the single largest contributor to overall greenhouse gas emissions in Ireland, at 32.3%% of the total, followed by Energy (power generation and oil refining) at 19.6% and Transport at 19.1%. The remainder is made up by Industry and Commercial at 15.4%, the Residential sector at 11.1%, and Waste at 2.5% (see Figure 12-3).

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.

[141] Ireland's Provisional Greenhouse Gas Emissions in 2013, EPA Report (December 2014) http://www.epa.ie/pubs/reports/air/airemissions/GHGprov.pdf

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 2013 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 2013, total emissions of greenhouse gases in Ireland across the six key National Climate Change Strategy sectors (see Table 12.3) were estimated at 57.8 million tonnes carbon dioxide equivalent, which is approximately 4.5% higher than emissions in 1990. However, the total for 2013 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
2013	11.3	6.4	8.9	18.7	11.1	1.5	57.8

The EPA[142] indicated that CO_2 emissions from the energy (principally electricity) sector decreased by 11.1% in 2013 with a reduction in fossil fuel fired power generation and an increase in renewable energy generation.

Key emission reductions in 2013 occurred in Energy (Emission Trading Sector (ETS) 7.2%) and Industry and Commercial (0.7%) sectors. Increases occurred in the Residential sector (2.6%), Transport sector (2.1%), Waste sector (15.2%) and Agriculture Sector (2.6%).[142]

Lower emissions from the energy sector reflect an increase in the share of renewables in gross electricity consumption

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[143] 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.*

[142] EPA, Irelands Provisional Greenhouse Gas Emissions in 2013, Key Highlights, December 2014
[143] EPA, Irelands Greenhouse Gas emissions Projection 2011 – 2020, April 2012.

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[144]*. 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.*

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[145] and National Renewable Energy Action Plan[146] and their implementation.

Achieving greenhouse gas reduction targets not only requires a reduction in emissions from the energy sector it also requires emissions from agriculture, transport, industry and commerce and the residential areas to achieve significant reductions. These pose significant challenges in their own right. Critically, if the renewable energy target of 40% and energy efficiency targets are not achieved then emissions are predicted to increase over the period 2013 – 2020.

Policy context for greenhouse gas emission reductions beyond 2020:

The proposed National Climate Action and Low Carbon Bill 2015 was published in January 2015. It provides for five yearly "Mitigation Plans" to transition Ireland to a low

[144] http://www.epa.ie/pubs/reports/air/airemissions/EPA%202015%20GHG%20Projections%20Publication%20Final.pdf

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

[146] 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.

carbon economy in line with existing EU legislation and wider commitments made under the United Nations Framework Convention on Climate Change (UNFCCC)

The EU leaders have also agreed a European 2030 policy framework in October 2014 that will see a domestic greenhouse gas reduction of at least 40% compared to the 1990 level. To achieve this the energy sector (mainly electricity generation) will need to reduce emissions by 43% compared to 2005.

In the International sphere, UN negotiations to develop a new international climate change agreement that will cover all countries are underway. This is to be discussed and agreed at the Paris climate conference in December 2015 and subsequently implemented post 2020. At this conference all countries will propose their mission reduction targets.

The Environment Council approved the EU's intended nationally determined contribution as per the European 2030 policy framework.

The EPA greenhouse gas projections report noted that even if Ireland complies with its 2013-2020 obligations there will be new obligations (as yet undefined) for the years 2021- 2030. A starting point for post-2020 obligations in excess of the range of expected outcomes for 2020 (i.e. 9%-14% below 2005 levels) will inevitably lead to severe compliance challenges early in the following decade and beyond. In this context Ireland is not on track towards decarbonising the economy in the long term in line with the Climate Action and Low Carbon Development Bill 2015 and will face steep challenges post-2020 unless further polices and measures are put in place over and above those envisaged between now and 2020.

Benefit of the development

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 and reduce greenhouse gas emissions through displacement of fossil fuel energy generation.

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 SO2 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.

- NH3 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, 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.

Ireland's provisional position in 2013 in relation with respect to the limits to the above is set out in Table 12.4[147].

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
Emissions	25.4 kt	76.5 kt	90.0 kt	107.8 kt

SO_2 emissions are estimated to have decreased by 86% since 1990 with power generation plant responsible for about 34% of the remaining SO_2 emissions despite the fact that emissions in this sector have reduce by almost 92% in the same period.

NOx emissions in Ireland have decreased by 45% between 1990 and 2013 and have decreased by over 35.4 kt, or 32% since 2008. Nonetheless, limits were exceeded in 2011.

The transport sector is the principal source of NOx emissions, contributing approximately 53 per cent of the total in 2013. The industrial and power generation sectors are the other main source of NOx emissions, accounting for 16 and 11 per cent of emissions respectively 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 from manure management in agriculture and solvent use accounting for 74 per cent of the annual total in 2013. The

[147] EPA, Ireland Transboundary Gas Emissions in 2013, April 2015, http://www.epa.ie/pubs/reports/air/airemissions/NECD%20Summary%20Report%202015.pdf

agriculture sector is now the principal source of VOC emissions, contributing approximately 47 per cent of the total in 2013. Domestic coal burning in the residential sector is another important but declining source as coal consumption decreases.

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[148] 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 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

[148] Energy Technology Perspectives 2008

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 between 497,218MWh and 557,486MWh (units) of electricity per annum (based on 172MW of Phase 1 and Phase 2 MW rating per annum and a 33 - 37% 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. A Life Cycle analysis of Oweninny farm was calculated and provided as clarification at the oral hearing for the Oweninny wind farm. The calculation has been repeated allowing for a Phase 1 and Phase 2 development of 61 wind turbines operating at a 33% capacity factor. Accounting for the loss of CO_2 from manufacturing of turbines, transport, construction, loss from displaced peat material and loss of forest sequestration the wind farm would have a carbon footprint of 383,817 tonnes of CO_2

Over its 30-year operating life, the wind farm with a capacity factor of 33% would generate:

172 MW x 30 years x 365 days x 24 hours x 0.33 capacity = 14,916,5280 MWh.

Not all of the electricity generated by the wind farm will reach the target market. Collection, grid and transmission losses could account for up to 7% of the generated power. This would leave a total of 13,872,371 MWh delivered to the Irish grid.

The renewable electricity from Oweninny would displace electricity generated from non-renewable sources. This has an average carbon intensity of 0.489 tCO_2/MWh. Therefore, over the life of the wind farm, it would displace 6,908,441 tonnes CO_2.

In summary, the Oweninny wind farm built on a cutaway peatland area, with an operational life of 30 years:

- The carbon footprint is: 383,817 tonnes CO2
- The fossil carbon saved is: 6,908,441 tonnes CO2
- The carbon emitted is: 5.56% of the carbon saved
- The carbon payback period is: 1.67 years

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.

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)
213,804 t	3,490 t	2015 t

The above uses the 2012 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. The carbon loss from peat on the site has been accounted for in the lifecycle analysis). It should be noted that 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 CO_2 from construction arising from impact on them. Bord na Móna has 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.

12.2.1.3 Impact of Air emissions on Protected Areas

At the Oweninny Oral Hearing National Parks and Wild Life Service raised through submission the issue of potential impact of concrete dust on the Bellacorick Iron Flush cSAC from the operation of the proposed Batching Plant as follows:

“The batching plant lies directly south-west of the of the Bellacorick iron flush in line with prevailing winds. This plant in operation will be using 25 tons aggregate/cement combined to produce 50mJ of concrete per day. The potential risk of cement dust being wind borne and reaching the flush cannot be ignored. Cement can be considered lethal to any ecological site and the probability of some dust reaching the flush is deemed to be extremely serious. It is strongly recommended that the batching plant be placed somewhere else off the site entirely.”

Section 3.4.4 of the original EIS (Emissions and emission control) recognises the potential for impacts that can arise from the operation of a concrete batching plant. The main potential for emissions from the batching plant site will occur during the operational phase (of the batching plant) and will be very intermittent in nature. For example for turbine foundation pour the batching plant would produce concrete on 30 days, 31 days and 51 days during each of the indicative development phases.

The original EIS does acknowledge that with respect to dust emissions, these can arise from materials delivery and fugitive emissions from silos, conveyor belt system and batching plant operation.

The most effective means of reducing dust emissions at batching plants is to hard-surface roadways and any other areas where there is a regular movement of vehicles. The batching plant area itself within the site will consist of a concrete apron which will be cleaned on a regular basis to remove any spilled materials.

Suppression of dust emissions from unsealed yards and roadways, will be achieved by hard coring the stockpile areas and access tracks to these and regular light watering when required

Dust emissions due to vehicles will be minimised by provision of a hard surfaced access road within the batching plant site to the batching plant area.

The batching plant site will be operated in accordance with best practice with good maintenance practices, including regular sweeping to prevent dust build-up.

The batching plant will be operated to the highest standards and will include automatic control systems to ensure that no system failures would occur during cement loading from cement tankers to the cement silos.

Such control systems typically comprise interlocked systems linking pressure drop or particle emission from the bag filters or other containment areas to the control system that will instantaneously shut down the cement filling process in the event of a pressure drop or dust detection. These control systems typically respond in milliseconds. Hence if a rupture of the bag filter occurred the filling process would stop immediately and minimal release from the bag filter would occur.

An estimate of the impact of a cement dust release from the batching plant on the Bellacorick Iron Flush was provided at the oral hearing in the expert witness statement of Dr. Paddy Kavanagh ESBI. Farner[149] published a review of the effects of dust on vegetation. This included sensitive plant species including Sphagnum species (under less tolerant taxa of mosses, the species *Messia triquetra* and *Tomenthypnum nitens* are listed. The former is now assumed extinct at Bellacorick with the latter, being one of the current rare species). In the review paper, it is noted that the lowest rates of application of cement/lime dust deposition observed to cause an effect were 0.6 and 0.5 g /m2/day.

The estimated dust deposition on the iron flush arising from a one second release of cement dust from the proposed batching plant is 0.014g/m2 which is over 40 times lower than the value of 0.6 g/m2 as identified by Farner and which is the lowest rate of deposition which can cause impact on the sensitive plant species in the iron flush.

[149] Farner A. M.., , The Effects of Dust on Vegetation A Review, Environmental Pollution ,79 (1993) 63 – 75

The proposed cement batching plant is located a distance of 2.43 km from the Bellacorick Iron Flush. Filling of the cement silos from sealed cement transport vehicles is a strictly controlled operation incorporating interlocking control mechanisms to prevent cement dust release. Any drop in pressure associated with a loss of integrity of the dust control filter system will lead to an automatic shutdown in milliseconds preventing an escape of cement dust.

In the extremely rare event of an emission occurring from the batching plant the automatic system would shut down the transfer system in milliseconds.

This indicates that no significant impact on the vegetation of the iron flush will occur.

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 497,217 MWh of renewable electricity annually and displacing 213,804 tonnes of CO_2. 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 SO_2 and NO_x 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

Approximately 1.05 hectares of forest plantation will be clearfelled to facilitate the development of the windfarm. Assuming a conservative yield class of 16m^3/ha/year for the forest plantation on site this equates to a loss of 3.64 t.C/ha/annum or 13.3 t CO_2/ha/annum. Over the 30 year wind farm lifespan this would amount to 419 tons of CO2 .

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 Cumulative Impacts

12.4.1 Wind Farms

The proposed and permitted wind farm developments in the general region are as follows:

- Corvoderry Wind Farm Development comprising ten wind turbines with 100m overall height (Planning reference 11/838) and a rated output of 23MW.
- Planning permission 09/259 for a wind farm development at Dooleeg, Bellacorick (one 2MW wind turbine) granted on appeal to ABP (PL16.236402).
- Bellacorick Wind Farm - this 21 turbine wind farm has been operational since 1992 with an installed capacity of 6.45 MW. The final phase of the Oweninny Wind Farm project will be installed near where the existing turbines are located.
- Tawnanasool Wind Farm comprising 8 wind turbines

12.4.1.1 Cumulative Benefits to greenhouse gas reduction from Wind Farm Developments

Reductions in greenhouse gas and transboundary pollutants will occur through the displacement of energy derived from conventional fossil fuel combustion plant by renewable wind energy. The estimated displacement of CO2 from other windfarms which could operate in the immediate vicinity is as follows:

- Corvoderry wind farm at a rated output of 23MW, a capacity factor of 33% and a displacement factor of 0.46Kg per KWh would displace approximately 30,585 tonnes of C02 from fossil fuel energy production annually.
- Dooleeg wind turbine with a rated output of 2 MW a capacity factor of 33% and a displacement factor of 0.43Kg per KWh displace would displace approximately 2,660 tonnes of C02 from fossil fuel energy production annually.

- Tawnanasool wind farm at a rated output of 23MW a capacity factor of 33% and a displacement factor of 0.43Kg per KWh would displace approximately 21,276 tonnes of C02 from fossil fuel energy production annually.

However, as the existing Bellacorick wind farm, rated at 6.45MW will be decommissioned following Phase 1 and Phase 2. This would result in loss of the current CO_2 displacement from this wind farm, which is estimated at 8,643 tonnes per annum

Should all of the above windfarms operate simultaneously with the proposed Oweninny wind farm then a total displacement of 311,831 tonnes of CO_2 annually would occur from displacement of fossil fuel energy production.

Cumulatively, there would also be reductions in SO_2 emissions and NOx emissions from displaced fossil fuel energy arising from the combined operation of all the windfarms.

12.4.2 Cumulative impacts on air quality

There is potential for cumulative air quality impacts to arise from dust and equipment emissions arising from the construction activities associated with the developments. These are discussed below.

12.4.2.1 Wind farms

Corvoderry Wind Farm

Corvoderry wind farm is located within the Oweninny site and would comprise a development of 10 wind turbines, access tracks and hard stands and the construction activities could potentially give rise to localized dust from ground clearance, excavation, quarrying, stockpiling and fill placement. However, mitigation measures have been clearly set out in Section 8.4 of the Corvoderry the environmental impact statement which will ensure no significant impact will occur.

With the implementation of the mitigation measures set out in the Oweninny wind farm EIS and the Corvoderry EIS no significant cumulative impacts are predicted to occur with this wind farm.

Dooleeg, Bellacorick Wind Farm

This wind farm has permission to construct a single one 2 MW turbine at Dooleeg, Bellacorick. The level of construction, localised nature of any dust emissions and short duration together with good engineering practice during construction will ensure no significant cumulative impact with Oweninny wind farm development will occur.

Tawnanasool Wind Farm

The Tawnanasool proposed wind farm is located about 10km to the west southwest of the Oweninny site Although there is potential for dust and equipment emissions to occur during construction any impact of these would be very localised with dust settling out within 200- 300m of the construction location as stated in Chapter 11 of the Tawnanasool wind farm EIS. There will therefore be no potential for cumulative impact from dust.

Potential future development of Oweninny Phase 3

As described in Chapter 12, Air Quality & Climate, in the original EIS submitted as part of the planning application to An Bord Pleanála in 2013, a significant positive benefit of reducing greenhouse gas emissions with consequent positive impact on the climate change process would arise from the operation of all three phases of Oweninny. Although increased short term air quality impact could potentially arise during the construction of Phase 3, these were assessed as not been significant when mitigation measures are implemented. Overall the operation of all three phases of Oweninny would be very positive in terms of greenhouse gas reduction and meeting Ireland's commitments towards decarbonising our economy in line with National and EU policies.

12.4.2.2 Meteorological Mast

ABO Wind Ireland Limited have applied (22nd July 2015) for permission to install a temporary (3 yrs) meteorological mast at Sheskin Townland, Bellacorick, Co Mayo. The mast comprises a 100 m high steel lattice tower, supported by cable stays. The site for the proposed mast is within conifer forest plantation. The appropriate assessment screening document for the project identified that there would be no significant emissions to air from the project hence no significant cumulative air or climate impacts with Oweninny are foreseen.

12.4.2.3 Uprate of the Existing Bellacorick to Castlebar 110 kV Overhead Line (planning reference P14/410)

Planning permission has been granted to EirGrid for the project which will comprise upgrading activities of 100 structures over a distance of 19.5 km of power line. Most uprating work comprises replacing fittings and cross arms, some pole set replacement and six angle mast replacements. The dispersed nature of the construction activities will result in only very limited and localised air quality impacts from dust emissions associated with temporary access track construction and foundation replacement for the towers. This impact will be of very short duration and with the mitigation outlined in the planning and environmental considerations report accompanying the proposal will not result in any significant cumulative impact with the Oweninny wind farm development

12.4.2.4 Uprate of the Existing Bellacorick to Moy 110 kV Overhead Line (planning reference P15/45)

This EirGrid project was granted planning permission by Mayo County Council on 4th August 2015. Comprising the uprating of approximately 27 km of power line between Bellacorick and Gorteen construction activities and air emissions would be similar in nature to the uprating of the Bellacorick to Castlebar 110 kV OHL.

No significant cumulative impact is predicted to occur between the Oweninny project and the planning approved line uprates

12.4.2.5 Uprate of the Existing Bellacorick to Bangor Erris 38 kV Overhead Line (planning reference PL15/611)

A planning application has been submitted by ESB Networks for the project which will comprise upgrading activities over a distance of 12.3 km of power line. The proposed upgrading to the existing overhead transmission line will involve reinforcement of foundations of steel towers, changes to the conductors, replacement of intermediary/angle wooden pole sets and rerouting of existing line at two locations along with ancillary works.

The dispersed nature of the construction activities will result in only very limited and localised air quality impacts from dust emissions associated with temporary access track construction and foundation replacement for the towers. This impact will be of very short duration and with the mitigation outlined in the planning and environmental considerations report accompanying the proposal will not result in any significant cumulative impact with the Oweninny wind farm development

12.4.2.6 Substation Project

The works associated with the permission (Planning Reference 15/456) are all within the existing substation site at Bellacorick. The works are short term in nature with no significant impact on air quality and no significant cumulative impact will occur

12.4.2.7 Power Plants

Planning permission has been granted for the following power plants:

- 68 MW gas turbine peaking plant at Bellacorick – Bellacorick Power Plant (Planning reference 01/1250).
- Conventional 200 MW natural gas fired peaking plant along the Srahnakilla road (Planning permission 09/286 granted to Constant Energy on 16/11/2001). Site located between the eastern and western parts of the Oweninny site.

As the planning documentation for the above projects did not identify significant adverse impacts on air quality, it can be assumed that there would be no cumulative effects with the Oweninny development.

12.4.2.8 Grid 25/Grid West

The proposed EirGrid Grid West Project is located to the east of the Oweninny wind farms site. As stated in Section 5.6.8, Section 6.4.8 on Air Quality there are positive benefits that would result from the Grid West Project as it would facilitate the development of renewable power generation in north Mayo, by enabling the installation and integration of renewable energy sources. This facilitates a reduction in fossil fuel related energy generation having a net positive benefit of reducing carbon emissions. The proposed Grid West development will comprise a major improvement in electricity transmission system infrastructure.

With respect to potential negative cumulative impacts with the Oweninny project these could potentially occur from construction works associated with

- a fully underground direct current cable;
- a 400kV overhead line and;
- a 220kV overhead line with partial use of underground cable
- substation/converter station in north Mayo
- and a substation/converter station near Flagford, Co. Roscommon.

Potential impacts could occur from the dust emissions particularly the small diameter PM10 and PM2.5 which could impact sensitive receptors such as human beings and sensitive ecology. Construction vehicle emissions could also impact on air quality.

Air quality issues were assessed in Section 5.6.8 of the Independent Expert Panel Review Report published by EirGrid in July 2015. These concluded as follows:

In terms of the underground cable route option the report stated that

"Overall, the effect on local air quality as a result of the works along the cable route and at converter station sites will be negligible. It also has the potential to affect traffic flows due to construction, which, in turn, has the potential to increase pollutant concentration at sensitive receptors over a wider area than in the vicinity of the construction sites".

In terms of the 400kV OHL route options the IEEP report Section 6.4.8 states that

"Overall, the effect on local air quality and amenity of the construction works at the tower sites and substations will be negligible for the OHL option. Construction related traffic is also expected to be small in scale, less than 200 vehicles per day, at each site, and as such would not be capable of causing a significant adverse effect on local air quality at receptors located along site access roads".

in terms of the 220 kV OHL with partial undergrounding Section 7.5.1.7 of the IEP Report states that

"The effect on local air quality from the proposed works at the OHL tower sites, substations and sealing-end compounds will be negligible. Construction related traffic will be small and will not have significant adverse effects on local air quality at houses located along site access roads.

The effect on local air quality will be negligible for the UGC section(s). However, this section(s) has the potential to affect houses on the route and also affect traffic flow which, in turn, has the potential to increase pollutant concentration at the construction sites."

With the implementation of mitigation proposed for each option of the Grid West project relating to air quality no significant impacts have been identified and no significant negative Cumulative impact with Oweninny will occur.

12.5 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

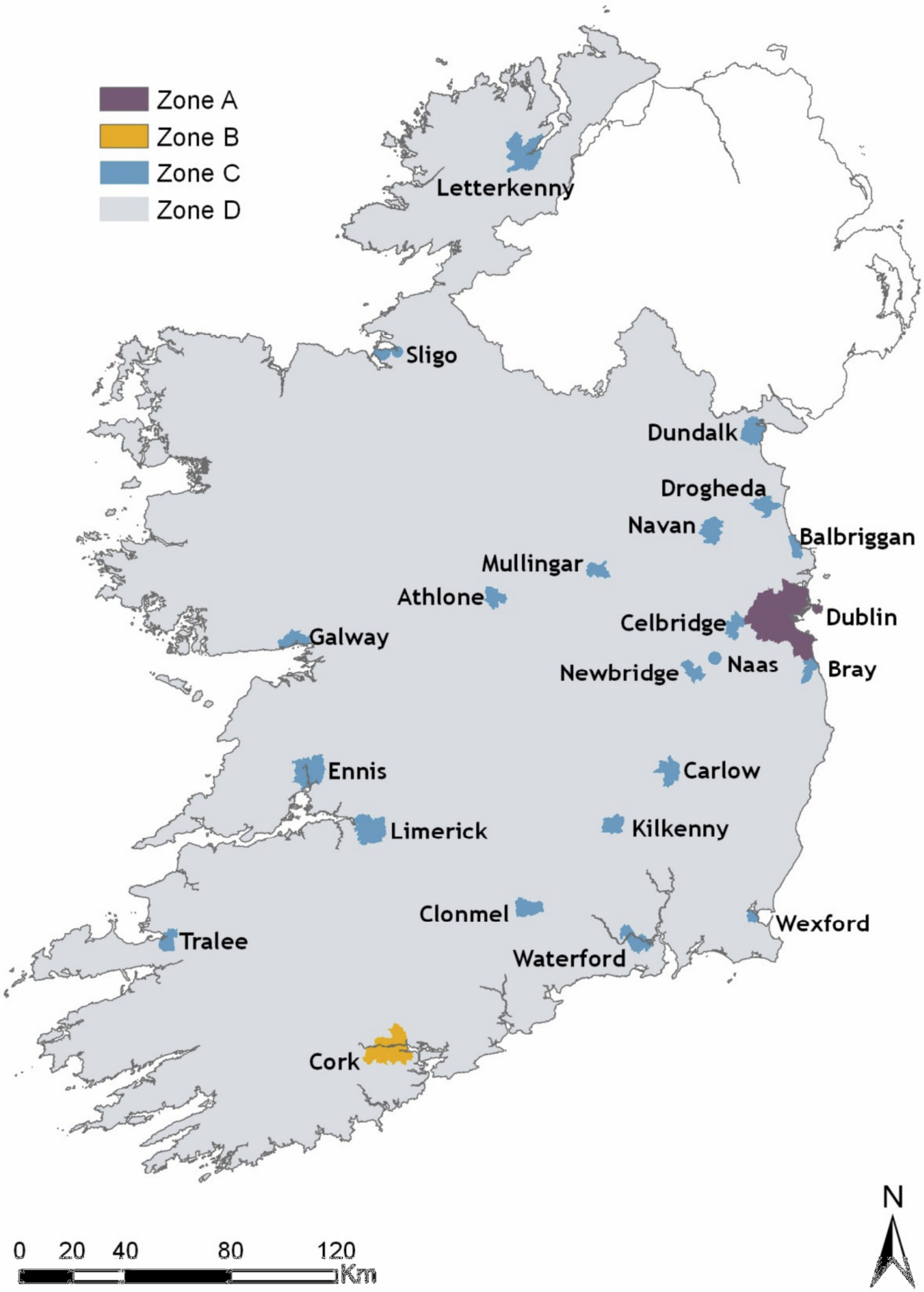

Figure 12-1: Air quality Zones

(Source: EPA Air Quality in Ireland 2013)

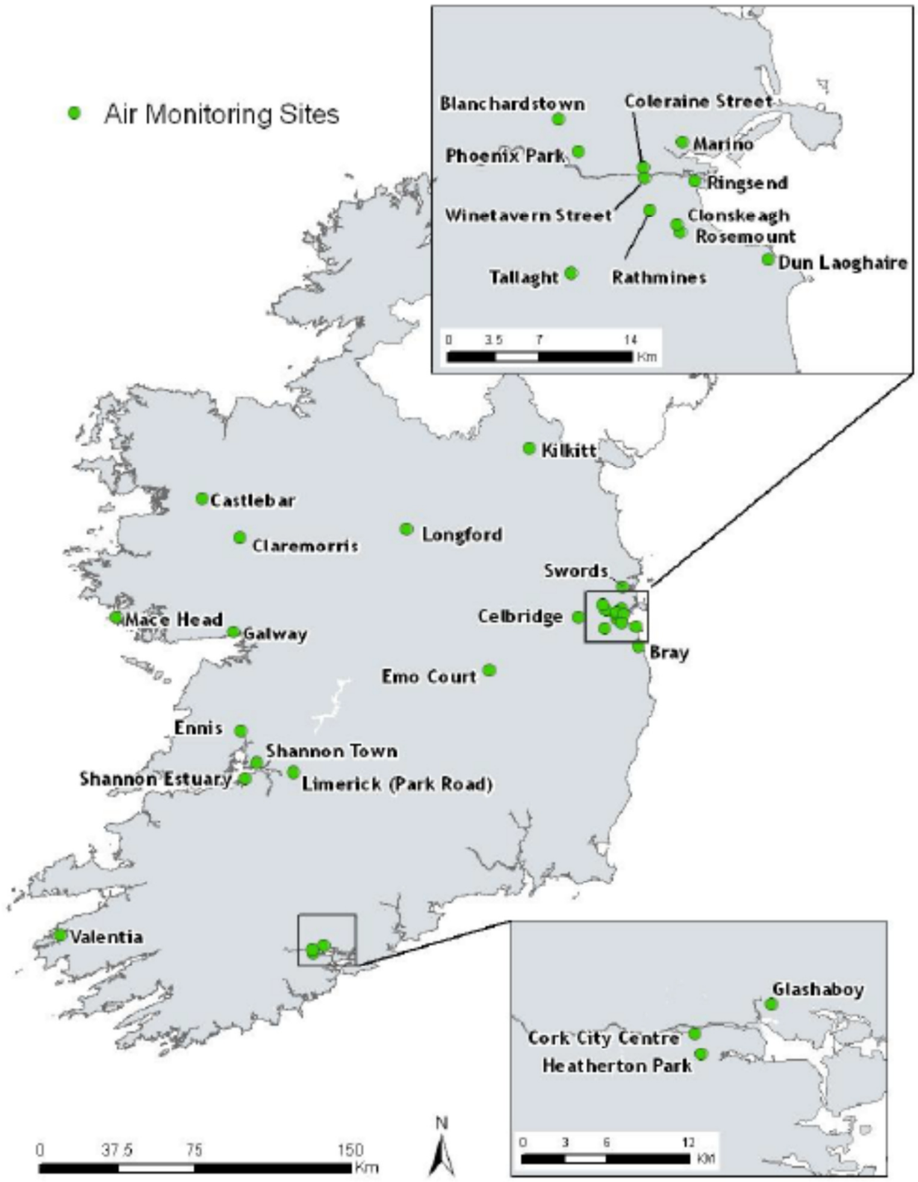

Figure 12-2: Air quality monitoring locations

(Source: EPA Air Quality in Ireland 2011)

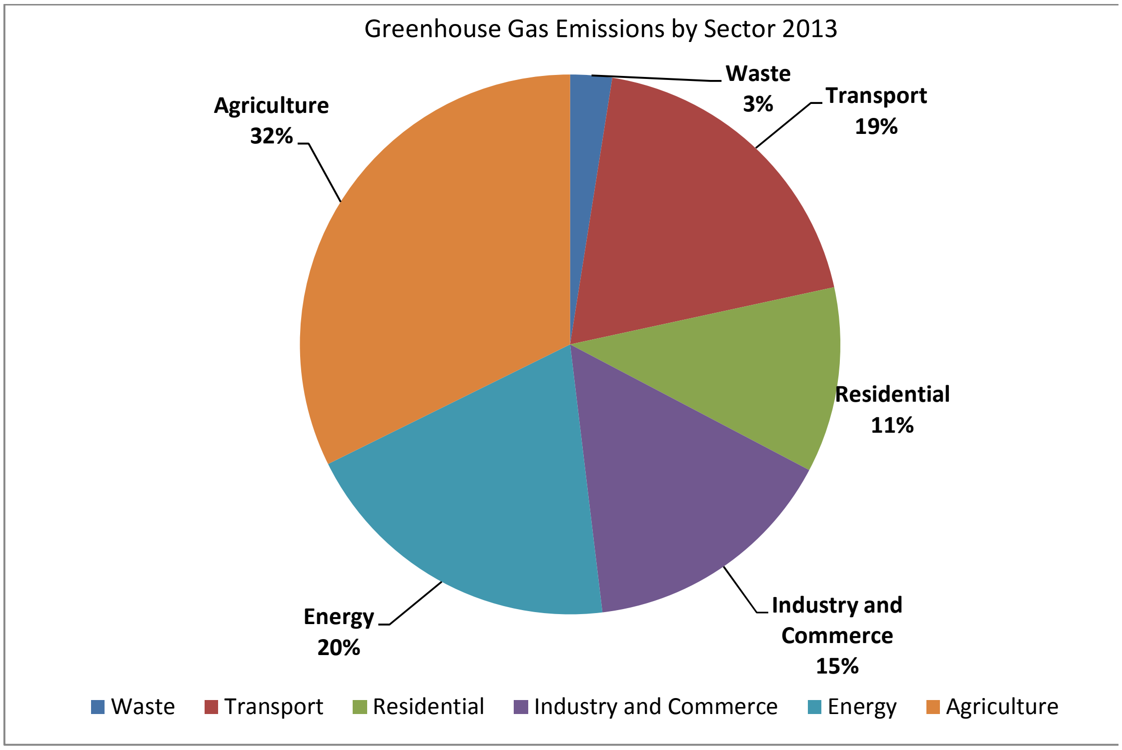

Figure 12-3: Greenhouse gas emissions in 2013 by Sector

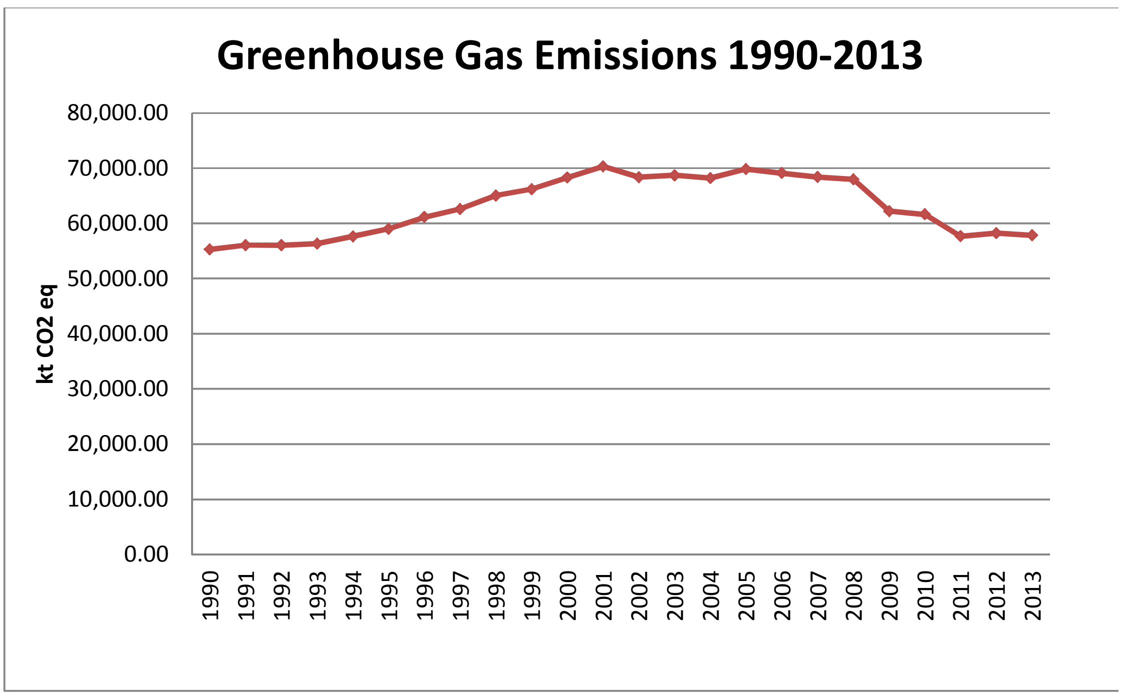

Figure 12-4: Greenhouse Gas Emissions in Ireland 1990 – 2013

(*EPA, IRELAND'S PROVISIONAL GREENHOUSE GAS EMISSIONS IN 2013*