Chapter 6: Air Quality and Climate

Coolglass Wind Farm Vol. 2 EIAR

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Acronyms and Abbreviations

EPA	Environmental Protection Agency
CO_2	Carbon Dioxide
NO_2	Nitrogen Dioxide
SO_2	Sulphur Dioxide
TDR	Turbine Delivery Route
DMRB	Design Manual for Roads and Bridges
AOD	above Ordnance Datum.
OMS	Operations, Maintenance and Surveillance
SG	Siemens Gamesa
CO_2eq	Carbon Dioxide Equivalent
MW	Megawatt
TWh	Terawatt Hours

6.0 Air and Climate

6.1 Introduction

This chapter identifies, describes, and assesses the potential significant direct, indirect and cumulative effects on air quality and climate arising from the construction, operation and decommissioning of the Proposed Development in accordance with Section 3.1 and 3.1.1 of Chapter 3 in this EIAR. Minimum and maximum hub height and rotor diameter parameters being proposed and all design permutations within that range as set out in Table 3.1 of Chapter 3 in this EIAR are being applied for.

Two cable connection route options (Options 1 and 2) which are part of the "Project" but not part of the Proposed Development that are being applied for are also assessed as part of this EIAR.

All elements of the Project are described in Section 3.5 of this EIAR and the description of the Proposed Development is found in section 3.8.1 of this EIAR.

The site spans Fossy Mountain and Wolfhill, north of Swan and south of Timahoe. These hills are the most prominent landscape features within the central study area and its wider surroundings, with Fossy Hill reaching a height of approximately 325m AOD.

The site is located in a rural area with no major settlements nearby. The village of Timahoe is the most approximate settlement located 2.8 km northwest of the Site, the village of Swan is located approximately 4km southwest of the site and the district town of Portlaoise is located approximately 12 km northwest of the site. The R426 regional route is located to the west of the site and the M7 national primary road is located to the north of the site.

The site is in a predominantly agricultural area, with elevations within the site ranging from 196 m to 325 m above sea level. The lens cover is classified in Corine Landcover 2018 as predominately Coniferous and Mixed Forest and Transitional Areas interspersed with Agricultural Areas.

The Proposed Development is divided into two distinct areas identified as Fossy Mountain and Wolfhill. The southern portion of the Proposed Development site (Wolfhill) is characterised by elevated lands with elevations between 196 – 300 m with moderate to gentle slopes down to the north and west throughout the site boundary. Slopes within the Proposed Development and at proposed infrastructure locations generally comprises gentle to moderate slopes.

The northern portion of the site (Fossy Mountain) is characterised by elevated lands with elevations between 285 – 325 m AOD with moderate to steep slopes to the west and north of the site boundary. Slopes within the Proposed Development and proposed infrastructure locations generally comprises gentle to moderate slopes.

The production of energy from wind turbines has no direct emissions unlike fossil fuel-based power generating stations. Harnessing more energy by means of renewable sources will reduce dependency on fossil fuels, thereby resulting in a reduction in harmful emissions that are damaging to human health and the environment. Some minor short term or temporary indirect emissions associated with the construction of the proposed development include vehicular and fugitive dust emissions.

6.1.1 Statement of Authority

The air quality impact assessment presented in this Chapter was prepared by SLR Consulting Ireland. The lead consultants for the study were

- Aldona Binchy MSc. Eng. PIEMA Environmental Engineering
- Conor Hughes MSc (Hons) Energy Science.

6.1.2 Limitations / Difficulties Encountered

This assessment is compiled based on published regional and local data, guidance documents. No difficulties were encountered in compiling the required information.

6.1.3 Consultations / Consultees

While preparing this Environmental Impact Assessment Report, a pre-planning consultation meeting was held with Laois County Council and with An Bord Pleanála. During the first pre-application consultation with An Bord Pleanála, it was noted in Page 9 of the meeting minutes that:

> *The Board's representatives advised that the Climate Chapter of the EIAR should adequately outline the carbon resources required to construct the proposed development and outline what the savings are by displacement of fossil fuel generated electricity.*

During the scoping period of the Proposed Development, several consultees were provided with a scoping report outlining the Proposed Development. While a number of responses were received, none of the responses received were of relevance to this chapter.

6.2 Assessment Methodology

6.2.1 Air Quality

The focus of this assessment is the potential impact on local residential amenity and ecological receptors of fugitive dust emissions and particulate matter generated by the Proposed Development. Dust emissions are likely to arise during the following activities:

- earthworks and topsoil stockpiling (site preparation works, new roads construction);
- construction operations;
- trafficking by heavy goods vehicles (HGVs) over paved / unpaved surfaces;
- decommissioning and final landscaping activities.

With respect to the potential for air quality impacts, the key objective at Site is to manage activities to ensure that dust emissions are prevented where possible, and the effects of any residual releases are minimised.

This EIA Report Chapter describes and assesses the existing air quality baseline characteristics of the area around the Proposed Development based on EPA data. Air emissions arising from the Proposed Development activities at the Site are then applied to these baseline conditions and the resulting air quality impacts assessed. Mitigation measures are identified where required, to eliminate or reduce these impacts insofar as practical.

The following sections of this Chapter describe the potential air quality impacts associated with the Proposed Development. The following issues are addressed separately:

- relevant legislation, standards, and guidance;
- baseline conditions pertaining to measured (or estimated) existing air quality levels around the various elements of the Project;
- methodology used to assess the potential impacts of the Proposed Development on air quality;
- assessment of the impacts;
- description of mitigation measures that are incorporated into the construction, design, operation and decommissioning of the Proposed Development to eliminate or reduce the potential for increased air quality impacts (if required);
- summary of any residual impacts and reinstatement;
- summary of cumulative impacts.

The following air quality specific significance criteria have been used to assess the significance of air quality impacts in preference to overall descriptors of significance.

To determine the significance of particulate matter effects associated with the Proposed Development, an evaluation of the sensitivity of the surrounding area is required. Receptors can demonstrate different sensitivities to changes in environment and are classified as per **Table 6-1** (and IAQM Construction Dust Guidance).

Table 6-1 Methodology for Defining Sensitivity to Dust and PM_{10} Effects

Sensitivity of Area	Human Receptors	Ecological Receptors(A)
Very High	Very densely populated area More than 100 dwellings within 20 m Local annual mean PM_{10} concentrations exceed the Objective. Works continuing in one area of the site for more than 1-year	European Designated sites
High	Densely populated area. 10-100 dwellings within 20 m of site. Local annual mean PM_{10} concentrations close to the Objective (36 – 40 µg/m^3)	Nationally designated sites
Medium	Suburban or edge of town Less than 10 receptors within 20 m Local annual mean PM_{10} concentrations below the Objective (30 – 36 µg/m^3)	Locally designated sites
Low	Rural area; industrial area No receptors within 20 m Local annual mean PM_{10} concentrations well below the Objective (<30 µg/m^3) Wooded area between site and receptors	No designations
Notes: (a) - Only applicable if ecological habitats are present which may be sensitive to dust effects.		

Table 6-2 illustrates how the interaction of magnitude and sensitivity results in the significance of an environmental effect, with the application of mitigation measures as per the IAQM Construction Dust Guidance.

Table 6-2 Impact Significance Matrix – Dust Effects (With Mitigation)

Sensitivity of Surrounding Area	Risk Of Site Giving Rise to Dust Or Pm_{10} Effects		
	HIGH	MEDIUM	LOW
Very High	Slight Adverse	Slight Adverse	Negligible
High	Slight Adverse	Negligible	Negligible
Medium	Negligible	Negligible	Negligible
Low	Negligible	Negligible	Negligible

The Proposed Development has been assessed in accordance with guidance from the Institute of Air Quality Management[1] (IAQM), 2018 '*Assessment of Risk at Construction And Decommissioning Stage*' is determined by considering the predicted change in conditions because of the Proposed Development. The risk category for potential effects arising from preparatory site works is divided into three potential activities:

- earthworks;
- new road construction activities; and
- trackout[2].

Based on the scale and nature of the works including areas, soils and operations at the site, a dust emission class is defined for each of the activities. These dust emission classes are then used to determine the risk categories presented below. These risk categories determine the potential risk of dust soiling effects assuming no mitigation measures are applied.

Table 6-3 illustrates how the interaction of distance to the nearest receptor and the dust emission class results in the determination of risk category from earthworks activities.

Table 6-3 Determination of Risk Category from Earthworks Activities

Distance to Nearest Receptor		Dust Emission Class		
HUMAN (M)	ECOLOGICAL (M)	LARGE	MEDIUM	SMALL
<20	-	High Risk Site	High Risk Site	Medium Risk Site
20 – 50	-	High Risk Site	Medium Risk Site	Low Risk Site
50 – 100	<20	Medium Risk Site	Medium Risk Site	Low Risk Site
100 – 200	20 – 40	Medium Risk Site	Low Risk Site	Negligible
200 – 350	40 – 100	Low Risk Site	Low Risk Site	Negligible

Table 6-4 illustrates how the interaction of distance to the nearest receptor and the dust emission class results in the determination of risk category from construction activities.

1 Institute of Air Quality Management https://iaqm.co.uk/text/guidance/guidance_monitoring_dust_2018.pdf date accessed 16/6/2023

2 The term 'trackout' refers to the movement of dust and dirt from a construction/demolition site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network.

Table 6-4 Determination of Risk Category from Construction Activities

Distance To Nearest Receptor (M)		Dust Emission Class		
Human	**Ecological**	**Large**	**Medium**	**Small**
<20	-	High Risk Site	High Risk Site	Medium Risk Site
20 – 50	-	High Risk Site	Medium Risk Site	Low Risk Site
50 – 100	<20	Medium Risk Site	Medium Risk Site	Low Risk Site
100 – 200	20 – 40	Medium Risk Site	Low Risk Site	Negligible
200 – 350	40 – 100	Low Risk Site	Low Risk Site	Negligible

Table 6-5 illustrates how the interaction of distance to the nearest receptor and the dust emission class results in the determination of risk category from trackout movements.

Table 6-5 Determination of Risk Category from Trackout Movements

Distance To Nearest Receptor (M)		Dust Emission Class		
Human	**Ecological**	**Large**	**Medium**	**Small**
<20	-	High Risk Site	Medium Risk Site	Medium Risk Site
20 – 50	<20	Medium Risk Site	Medium Risk Site	Low Risk Site
50 – 100	20 – 100	Low Risk Site	Low Risk Site	Negligible

Mitigation measures are recommended based on the evaluation of risk in accordance with the IAQM Dust and Air Emissions Mitigation Measures Guidance[3] (2012)- where relevant, these have been applied in section 6.3.6 of this chapter.

To assess the impacts of construction dust emissions, the NRA's Assessment Criteria for the Impact of Dust Emissions from Construction Activities with Standard Mitigation in Place was used. This table is provided in Appendix 8 of the National Roads Authority (NRA) Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes (NRA, 2011) and reproduced below in Table 6-6.

Table 6-6 Assessment Criteria for the Impact of Dust Emissions from Construction Activities, with Standard Mitigation in Place

Source		Potential Distance For Significant Effects (Distance From Source)		
Scale	Description	Soiling	PM_{10}	Vegetation Description
Major	Large construction sites, with high use of haul route	100 m	25 m	25 m
Moderate	Moderate sized construction sites, with moderate use of haul roads	50 m	15 m	15 m
Minor	Minor construction sites with limited use of roads	25 m	10 m	10 m

[3]Institute of Air Quality Management: http://www.iaqm.co.uk/text/guidance/iaqm_mitigation_measures_2012.pdf date accessed 16/6/2023

Table 6-7 Definition of Impact Magnitude

Magnitude Of Change	Annual Mean No_2/Pm_{10}	No. Days With Pm_{10} Conc. >50 µg/M^3	Annual Mean Pm_{10}
LARGE	Increase / Decrease ≥4 µg/m^3	Increase / Decrease > 4 days	Increase / Decrease ≥2.5 4 µg/m^3
MEDIUM	Increase / Decrease 2-< 4 µg/m^3	Increase / Decrease 3 or 4 days	Increase / Decrease 1.25 - <2.54 µg/m^3
SMALL	Increase / Decrease 0.4-<2 µg/m^3	Increase / Decrease 1 or 2 days	Increase / Decrease 0.25 - <1.25 µg/m^3
IMPERCEPTIBLE	Increase / Decrease <0.4 µg/m^3	Increase / Decrease <1 day	Increase / Decrease µg/m^3

Table 6-8 Air Quality Impact Descriptors for Change to Annual Mean Nitrogen Dioxide and PM_{10} and $PM_{2.5}$ Concentrations at Receptors

Absolute Concentration In Relation To Objective/Limit Value	Change In Concentration		
	Increase With Scheme		
	Small	**Medium**	**Large**
Above Objective / Limit Value with Scheme (≥40 µg/m^3 of NO_2 or PM_{10}) (≥25 µg/m^3 of $PM_{2.5}$)	Slight Adverse	Moderate Adverse	Substantial Adverse
Just below objective / Limit value with scheme (36 - <40 µg/m^3 of NO_2 or PM_{10}) (22.5 - <25 µg/m^3 of $PM_{2.5}$)	Slight Adverse	Moderate Adverse	Moderate Adverse
Below objective / Limit value with scheme (30 -<36 µg/m^3 of NO_2 or PM_{10}) (18.75 - <22.5 µg/m^3 of $PM_{2.5}$)	Negligible	Slight Adverse	Slight Adverse
Well below objective / Limit value (<30 µg/m^3 of NO_2 or PM_{10}) (<18.75 µg/m^3 of $PM_{2.5}$)	Negligible	Negligible	Slight Adverse
Decrease With Scheme			
Above objective/limit value without scheme (≥40 µg/m^3 of NO_2 or PM_{10}) (≥25 µg/m^3 of $PM_{2.5}$)	Slight Beneficial	Moderate beneficial	Substantial beneficial
Just below objective / limit value without scheme (36 - <40 µg/m^3 of NO_2 or PM_{10}) (22.5 - <25 µg/m^3 of $PM_{2.5}$)	Slight Beneficial	Moderate beneficial	Moderate beneficial
Below objective/Limit value without scheme (30 - <36 µg/m^3 of NO_2 or PM_{10}) (18.75 - <22.5 µg/m^3 of $PM_{2.5}$)	Negligible	Slight Beneficial	Slight beneficial

Absolute Concentration In Relation To Objective/Limit Value	Change In Concentration		
	Increase With Scheme		
	Small	Medium	Large
Below objective/Limit value without scheme (<30 µg/m^3 of NO_2 or PM_{10}) (<18.75 µg/m^3 of $PM_{2.5}$)	Negligible	Negligible	Slight beneficial

Atmospheric emissions Resulting from the proposed development mostly come from the exhaust emissions from heavy goods vehicles (HGVs). The decision as to whether an assessment of potential impact is required is based upon the criteria set out in the DMRB (Design Manual for Roads and Bridges).

The criterion for assessment of air quality contained within the latest guidance (LA 105[4]) focuses on roads with relatively high changes in flows or high proportion of HGV traffic. Affected roads are defined as those that meet any of the following criteria:

- road alignment will change by 5 m or more; or
- daily traffic flows will change by 1,000 Annual Average Daily Traffic (AADT) movements or more; or
- HGV flows will change by 200 AADT or more; or
- daily average speed will change by 10 km/hr or more; or
- peak hour speed will change by 20 km/hr or more.

6.2.2 Climate Change

In recent years, there has been increasing public awareness about the implications of past, ongoing, and continued future emissions of greenhouse gases on the earth's climate. The implications of such change will potentially have significant impact on local communities and national populations across the world. The ever-increasing awareness and acceptance of this reality has, in recent years, prompted significant public policy development around emissions and climate change.

The following sections of this chapter describe the potential climate change impacts associated with the Proposed Development. The following headings are addressed separately:

- climate change legislative framework/policy context;
- analysis of evolving environmental baseline trends;
- identifying climate change concerns in relation to the Proposed Development;
- assessing effects (cumulative effects and uncertainty);
- identifying alternatives and mitigation measures;
- identifying monitoring and adaptive management.

4 Design Manual for Roads and Bridges: Sustainability& Environment Appraisal LA105 Air quality. Available at: https://www.standardsforhighways.co.uk/tses/attachments/10191621-07df-44a3-892e-c1d5c7a28d90?inline=true. Date Accessed 16/6//2023

There are no specific tools developed for assessing climate change for wind farm developments. The Climate Change and Major Project guidelines 2014-2020[5] on how to make investments resilient to climate change provides a methodology for undertaking a vulnerability and risk assessment for climate change.

Climate change adaptation and mitigation are to be increasingly integrated in the preparation and approval of proposed developments. Adaptation seeks to ensure adequate resilience of a proposed development to the adverse impacts of climate change based on the Proposed Development vulnerability.

The aim of the vulnerability assessment is to identify the relevant climate hazards foreseen at the development location. Main steps include identifying and combining the sensitivity and exposure of the Proposed Development which will describe the vulnerability, while the risk will be determined by likelihood and impact. Adaptation through the Proposed Development options, appraisal, and planning will depend on the assessed Proposed Development's vulnerability and risk.

Timescale for the Proposed Development vulnerability and risk assessment shall correspond to the lifespan of the Proposed Development. During the lifespan, there could be significant changes in frequency and intensity of weather events due to climate change, which should be considered. Detailed methodology charts for development vulnerability assessment are presented in tables below.

The scale for assessing the likelihood of a climate hazard is presented in

Table 6-9. The output of the likelihood analysis is an estimation of the likelihood for each of the essential climate variables and hazards is based on the Climate Change and Major Project guidelines 2014-2020

Table 6-9 Scale of Likelihood of Climate Hazard

Term	Qualitative	Quantitative
Rare	Highly unlikely to occur	5%
Unlikely	Unlikely to occur	20%
Moderate	As likely to Occur	50%
Likely	Likely to Occur	80%
Almost certain	Very likely to occur	95%

The matrix for assessing the potential impact of a climate hazard is presented in **Table 6-10**. The impact analysis provides an assessment of the potential impact of each of the essential climate variables and hazards.

5 https://climate.ec.europa.eu/system/files/2016-11/major_projects_en.pdf

Table 6-10 Example Table for Climate Hazard Impact Analysis

Risk Areas	Insignificant	Minor	Moderate	Major	Catastrophic
Asset damage, engineering, operational					
Safety and Health					
Environment					
Social					
Financial					
Reputation					

The matrix for assessing the sensitivity of Proposed Development to climate hazards is presented in **Table 6-11**. The sensitivity is summarised, along with the ranking of the relevant climate variables and hazards relating to the Proposed Development.

Table 6-11 Example Table for Sensitivity of Proposed Development to Climate Hazards

	Extreme Rainfall, Flash Flood	Food	Health	Drought	Wildlife Fires	Storms And Winds	Landslides	Cold Spells And Snow	Freeze –Thaw Damage	Rising Sea Levels
On site assets										
Inputs - Water										
Inputs - Energy										
Outputs - product										
Transport links										

The matrix for assessing exposure of a Proposed Development to climate hazards is presented in **Table 6-12**. The exposure analysis ranks climate variables and hazards as low, medium, or high based on current and future climate.

Table 6-12 Example Table of Exposure of the Proposed Development to Climate Hazards

	Extreme Rainfall, Flash Flood	Food	Health	Drought	Wildlife Fires	Storms And Winds	Landslides	Cold Spells And Snow	Freeze –Thaw Damage	Rising Sea Levels
Current Climate										

	Extreme Rainfall, Flash Flood	Food	Health	Drought	Wildlife Fires	Storms And Winds	Landslides	Cold Spells And Snow	Freeze –Thaw Damage	Rising Sea Levels
Future Climate										

An example of the vulnerability of a Proposed Development to climate hazards is presented in **Table 6-13**. The vulnerability combines the sensitivity and the exposure analysis.

Table 6-13 Example Table for Vulnerability Analysis of Proposed Development to Climate Hazards

Sensitivity	Exposure (Current & Future Climate)		
	Low	**Medium**	**High**
Low			
Medium			
High			

A desk-top assessment of available climatic information from Met Éireann[6] (see section 6.4.2) was undertaken for the Proposed Development to characterise the existing environment. In terms of climatic impact, the appraisal considered the net impact that operating the proposed development will have in terms of CO_2 and its displacement of CO_2 from other energy sources over the carbon losses caused by its manufacturing, transportation, construction, and decommissioning using the 'Carbon calculator for wind farms on Scottish peatlands'[7] tool.

The impact assessment considered the positive impacts the proposed development will have on contributing to national targets for the reduction of greenhouse gas emissions.

The Proposed Development will result in the production of energy from a renewable source which, once fed into the National Grid, will avoid several thousand tonnes of carbon dioxide (CO_2) annually that would have been released had the energy been generated by the average Irish power generation mix.

RES-E forms the backbone of Ireland's strategy to achieve the overall renewable energy target for 2030. Ireland's National Energy and Climate Plan (NECP 2021-2030) includes a planned RES-E of 80% in 2030, while Ireland's Climate Action Plan 2023 (CAP 23) includes a target to increase the share of electricity generated from renewable sources where achievable and cost effective, without compromising security of electricity supply.

Ireland's Emissions Sharing Regulations (ESR) emissions annual limit for 2021 is 43.48 Mt CO_2eq. Ireland's provisional 2021 greenhouse gas ESR emissions are 46.19 Mt CO_2eq, this is 2.71 Mt CO_2eq more than the annual limit for 2021. This value is the national total emissions less emissions generated by stationary combustion and aviation operators that are within the EU's emissions trading scheme. This indicates that Ireland is not in compliance with its

[6] Met Éireann Climate data: https://www.met.ie/climate/available-data/monthly-data. Date Accessed 16/6/2023

[7] Scottish Government. https://informatics.sepa.org.uk/CarbonCalculator/ Date Accessed 6/6/23

2021 Effort Sharing Regulation annual limit, exceeding the allocation by 0.80 Mt CO_2eq after using the ETS flexibility. Agriculture and Transport accounted for 73.4% of total ESR emissions in 2021.

The latest projections (March 2022) indicate that Ireland can achieve overall Effort Sharing Regulation (ESR) compliance over the period 2021 to 2030 assuming full implementation of the Climate Action Plan.

Figures from the Sustainable Energy Authority of Ireland (SEAI, 2021) indicate that in 2021 renewable energy contribution to gross electricity from wind was 85.4% share.

Using renewable energy displaces the use of fossil fuels thereby avoiding CO_2 emissions and reducing the amount of fossil fuels we need to import. We estimate the amount of CO_2 avoided and fossil fuel imports displaced using the primary energy equivalent approach. This estimates the quantity of fossil fuels that would have been required to replace renewable energy use. The estimated amount of CO_2 avoided using renewable energy reached a peak in 2020 before decreasing slightly to 6.2 Mt CO_2 in 2021, with 4.0 Mt CO_2 avoided by wind energy.

In addition to the CO_2 factored for emissions purposes, greenhouse gas (GHG) emissions are also factored into the overall carbon calculation. GHG are associated with the manufacture, transport, construction, operation (linked to backup generation) and decommissioning of wind turbines. The Intergovernmental Panel on Climate Change (IPCC) in 'Renewable Energy Sources and Climate Change Mitigation' (2014) state that 50 estimates from 20 studies indicate that emissions "are small compared to the energy generated and emissions avoided over the lifetime of wind power plants [farms]: the GHG [greenhouse gas] emissions intensity of wind energy is estimated to range from 8 to 20g CO_2/kWh in most instances". The IPCC (2010) report that the energy payback time, based on lifecycle assessment procedures, per turbine vary between 0.25 years and 0.65 years for onshore developments.

The amount of CO_2 that could potentially be avoided on an annual basis due to the proposed development is estimated based on the expected output of the wind farm. The net displacement value may increase or decrease somewhat, as the generation mix in Ireland develops, under different fuel price scenarios and as demand changes over time, and as more storage, interconnection, and demand side management (smart meters) come online. Refer to Table 6-40 for details of the calculations for carbon saving because of the Proposed Development.

6.2.3 Carbon Emissions

Previously, guidance produced by Scottish Natural Heritage in 2003 had been widely employed to determine carbon payback in the absence of any more detailed methods. Concerns were raised about the methods of calculating carbon savings for large scale wind farms being developed in Scotland as many of the developments were located on peatlands and forestry which can contain large carbon stocks, and which are poorly protected. The methodology for calculating carbon losses was created in 2008 by scientists at the University of Aberdeen and the Macauley Institute with support from the Rural and Environment Research and Analysis Directorate of the Scottish Government, Science Policy, and Co-ordination Division. The document, 'Calculating Carbon Savings from Wind Farms on Scottish Peat Lands', was developed to calculate the impact of wind farm developments on the soil carbon stocks held in peat. This methodology was refined and updated in 2011 based on feedback from users of the initial methodology and further research in the area. The web-based version of the carbon calculator, which supersedes the excel based versions of the tool, was released in 2016. The tool provides a straightforward

method for estimating the impacts of wind farms on the carbon dynamics of peatlands. The tool also provides guidance when figure inputs are unknown. The carbon calculator, whilst designed for Scottish wind farm developments is used for assessing Irish wind farm developments due to the similarity in development sites, i.e., high ground on peatlands which contain forestry in a similar climate.

Whilst there is no peatland on the site of the Proposed Development, the carbon calculator incorporates the losses from acidic bog or fen habitats into its calculations, and defines peat soils as soils with a surface horizon greater than 50 cm deep. The calculator considers the carbon fixing potential from peatland plants (which is small) and calculates the total area of peat excavation and the total area of peat affected by drainage, using the annual gains due to carbon fixing potential and the time required for any habitat restoration. Carbon stored within the peat itself represents a large potential source of carbon which can be lost during excavation and drainage. Forestry on the site of proposed wind farm developments can affect wind energy yields and therefore clear felling is generally required. Carbon losses due to felling are calculated from the area to be felled, the average carbon sequestered annually, and the lifetime of the wind farm. The calculator also considers the carbon emissions from the life cycle analysis of the wind turbines and the backup source to calculate carbon savings and carbon payback times of a wind farm. Site specific capacity factor is also required to provide a realistic payback time for a site. The calculator also considers a grid mix emission factor. The calculator uses default values from the Intergovernmental Panel on Climate Change (IPPCC, 1997) as well as site specific equations from scientific literature to calculate carbon loss.

In keeping with guidance, specific figures have been inputted wherever possible and where this information was not available the guidance provided by the calculator was used. The assumption to use the fossil fuel generation emission factor was made based on the reality that additional wind generation will displace fossil fuel generation (Scot. Gov., 2018). With regards to the windfarm characteristics the following presumptions: the lifetime of the windfarm is 35 years, the MEC is 85.8 MW to 93.6 MW, the capacity factor is 33% and the fraction of output to back up is 1.65% (i.e., 5% of capacity factor[8]), in the case of residual load being required that cannot be covered by wind power.

The site has been cultivated and is dominated by conifer plantation meaning that the carbon content of the soil is much lower than that of an actual peatland habitat, with carbon having been released during the drainage and cultivation of the site previously. Whilst the carbon content for dry peat, dry bulk density and extent of drainage around drainage features was unknown and were likely to be below the figures provided in the accompanied guidance, guidance figures were used with a worst-case scenario of 0.001m[9] taken for drainage. Also with respect to forestry felling to be undertaken to facilitate bat buffers required around each turbine, the largest rotor diameter in the range of proposed turbines was assessed as it will require the largest area of clear felling, being 54.36ha of largely coniferous forestry. This allows for the assessment of all other permutations within the proposed range of the turbines as the effects would be no worse than those of the largest rotor diameter. All of forestry and hedges will be replanted at ex-situ replant land's locations, however, this is not taking into account on the carbon calculator tool. It is

8 The forestry input data is used to determine the capacity factor for the turbines at the site. This is dependent on tree height, forest width and distance of the forest from the turbine. The capacity factor, $p$cap (%), is calculated from the ratio of calculated annual power output from the turbine, Pact (MWh turbine-1 yr-1), and the theoretical power output of the turbine, Pmax (MW turbine-1 yr-1), removing the specified value for estimated downtime for maintenance, tdown (%)

9 Carbon calculator: technical guidance note requires a minimum measurement of .001m for peat.

therefore highly likely that the calculated carbon losses on the carbon calculator tool will be higher than the actual carbon losses for the Proposed Development. Both the minimum rotor diameter turbine and MW output of 6.6MW and maximum rotor diameter and MW output of 7.2MW have been assessed and the results are included in Technical Appendix 6.1 found in Volume III of this EIAR. As such, all permutations within the turbine range have been assessed in the Chapter

The Scottish Government on-line carbon calculator as outlined above, was used to assess the impacts of the proposed development in terms of potential carbon losses and savings considering drainage, and forestry felling. A copy of the outputs is provided as Technical Appendix 6.1 found in Volume III of this EIAR. A summary of the main CO_2 losses due to the proposed development are summarised in. **Table 6-40**.

6.3 Air Quality

6.3.1 Regulations

To protect our health, vegetation and ecosystems, EU Directives have set out air quality standards for Ireland and the other member states for a wide variety of pollutants. These Directives include how we should monitor, assess and manage ambient air quality. The European Commission set down the principles to this approach in 1996 with its Air Quality Framework Directive (96/62/EC). Four "daughter" directives lay down limits for specific pollutants:

- 1st Daughter Directive (99/30/EC): Sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter, and lead;
- 2nd Daughter Directive (2000/69/EC): Carbon monoxide and benzene;
- 3rd Daughter Directive (2002/69/EC): Ozone;
- 4th Daughter Directive (2004/107/EC): Polyaromatic hydrocarbons, arsenic, nickel, cadmium, and mercury in ambient air.

The Ambient Air Quality and Cleaner Air for Europe (CAFE) Directive (2008/50/EC) was published in May 2008. It replaced the Framework Directive and the first, second and third Daughter Directives. The fourth Daughter Directive (2004/107/EC) will be included in CAFE at a later stage. The limit and target values for both Directives are outlined below.

The CAFE 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 the Environmental Protection Agency Act, 1992 (Ambient Air Quality Assessment and Management) Regulations, 1999 (S.I. No. 33 of 1999). The fourth Daughter Directive was transposed into Irish legislation by the Arsenic, Cadmium, Mercury, Nickel, and Polycyclic Aromatic Hydrocarbons in Ambient Air Regulations 2009 (S.I. No. 58 of 2009). **Table 6-14** details the limit values for pollutants as per the CAFE Directive.

Table 6-14 Relevant Air Quality Limit Values for Protection of Human Health

Human Health	Limit Or Target Value			Information And Alert Thresholds (Where Applicable)		Long Term Objective
Pollutant	Averaging Period	Value	Maximum Number Of Allowed Occurrences	Period	Threshold Value	

Human Health	Limit Or Target Value			Information And Alert Thresholds (Where Applicable)		Long Term Objective
Nitrogen Dioxide (NO_2)	Hour Year	200 µg/m³ 40 µg/m³	18 0	1 hour alert	400 µg/m³ Exceeded for 3 consecutive hours	
Sulphur Dioxide (SO_2)	Hour Day	350 µg/m³ 125 µg/m³	24 3	1 hour alert	500 µg/m³ Exceeded for 3 consecutive hours	
Particulate matter with aerodynamic diameter of less than 10 µm (PM_{10})	Day Year	50 µg/m³ 40 µg/m³	35 0			
Particulate matter with aerodynamic diameter of less than 2.5 µm ($PM_{2.5}$)	Year	25 µg/m³ 20 µg/m³ (ECO)				0 8.5 to 18 µg/m³
Lead	Year	0.5 µg/m³				
Carbon Monoxide	8 Hours	10,000 µg/m³				
Benzene	Year	5 µg/m³				

Table 6-15 Summary of Air Quality Limit Values: Protection of Vegetation

Vegetation	Critical Level Or Target Value		Long-Term Objective	
Pollutant	Averaging Period	Value	Value	Date
Nitrogen oxide (NOx)	Calendar year	30 µg/m³		
Sulphur Dioxide (SO_2)	Calendar year and winter (October to March)	20 µg/m³		

6.3.1.1 Specific Guidance Relating to Air Quality / Dust Nuisance

A range of monitoring techniques exist for dust deposition rates (i.e., Bergerhoff and Frisbee gauges). There are currently no Irish, European Union (EU) or World Health Organisation (WHO) statutory standards or limits appropriate for the assessment of deposited dust and its propensity to generate annoyance.

Industry standard criteria levels for the gravimetric assessment of dust deposition in Ireland recommend the use of the Bergerhoff method for measuring dust deposition, the TA Luft dust deposition limit value of 350 mg/m²/day (total dust deposition averaged over a 30-day period), measured at development site boundaries.

When the rate of accumulation of the coarser fraction of dust (referred to as deposited dust) is sufficiently rapid to cause fouling or discolouration, then it is generally considered to introduce a nuisance. The point at which an individual perceives dust deposition as a nuisance and causes a complaint is highly subjective.

The action of wind over dry ground will carry dust particles into the air. Although large emissions of dust occur naturally, man-made dust events are caused by a range of activities including agriculture, road traffic, construction works (including the handling and storage of soils and particulate matter) and by vehicles using paved and unpaved haul roads.

For operations involving the mechanical break up of solids, the most common concern regarding dust emissions is the potential nuisance effect from the larger fractions of dust.

6.3.1.2 Ozone

In the CAFE Directive (2008/50/EC), the EU has set a target value and a long-term objective value for ozone (O_3) for the protection of human health. Target value: the maximum daily eight-hour mean may not exceed 120 micrograms per cubic metre (µg/m^3) on more than 25 days per calendar year averaged over three years. Long term objective value: the maximum daily eight-hour mean may not exceed 120 micrograms per cubic metre (µg/m^3) within a calendar year.

These are detailed in **Table 6-16** along with information threshold and alert threshold values.

Table 6-16 Target Values for Ozone

Objective	Calculation	Target Value
Protection of Human Health	Maximum daily 8-hour mean	120 µg/m^3
Protection of vegetation	AOT40*, calculated from 1-hour values from May to July	120 µg/m^3 -h
Information Threshold	1-hour average	180 µg/m^3
Alert Threshold	1-hr average	240 µg/m^3
*The sum of the differences between hourly ozone concentration and 40 ppb for each hour when the concentration exceeds 40 ppb during a relevant growing season, e.g., for forest and crops		

6.3.1.3 Air Quality and Health Effects

The recent EPA reports, *Air Quality in Ireland 2021*[10] detail the main air quality trends based on monitoring from the national ambient air quality network.

Ireland met all the EU legal requirements in 2021 but failed to meet the WHO guidance levels for health in 2021. Selected pollutants that failed the WHO AQG levels in 2021 were: PM_{10}, $PM_{2.5}$, NO_2, Ozone, SO_2, and PAHs.

Europe as part of the Green Deal and the EU's Zero pollution visions for 2050 is revising its air quality standards to align them closely with the lower WHO recommendations.

A summary of relevant Air Quality limit values in relation to human health was presented previously in **Table 6-14**.

6.3.2 Existing Environment

European air quality legislation requires that each member state be defined in terms of Zones and Agglomerations for air quality, with Ireland divided into four zones. The EPA has designated four zones within Ireland[11] :

- Zone A: Dublin City and its environs
- Zone B: Cork City and its environs

10 Air_Quality_Report_21_v13 (adobe.com)

11 EPA. Air Quality Zones

- Zone C: 24 cities and towns (such as Galway, Limerick and Waterford cities and towns such as Naas, Newbridge, Celbridge, Leixlip) with a population of greater than 15,000
- Zone D covers the remainder of the country.

These zones were defined to meet the criteria for air quality monitoring, assessment and management described in the Framework Directive and Daughter Directives.

The application site and surrounding area are located in Air Quality Zone D, categorised as rural Ireland. The location with the longest continuous PM_{10} air quality monitoring record within a similar Zone D area is located at Kilkitt, Co. Monaghan. Emo Court monitoring station is located the closest to the application site, however not all parameters are monitored at that location. Both monitoring stations, as such, are considered the most appropriate dataset available for assessment of air quality baseline concentrations within the study area.

6.3.2.1 Sulphur Dioxide (SO_2)

Sulphur Dioxide for the period of 2016-2021 recorded at the Kilkitt air monitoring station is presented in **Table 6-17**. Neither the hourly limit value nor the lower assessment threshold as set out in the CAFE Directive were exceeded during the monitoring period.

Table 6-17 Sulphur Dioxide Data for Kilkitt (µg/m³)

Year	Hourly Max	Daily Max	Annual Mean
2016	10.4	5.1	1.8
2017	6.1	2.7	1.6
2018	16	6	2.6
2019	6.7	1.3	0.7
2020	4.8	4	1.4
2021	7.7	6.6	1.7

6.3.2.2 Particulate Matter (PM_{10})

Particulate matter are very small particles which can be either solid or liquid. Some of these particles occur naturally, while many are man-made. Particulate matter is referred to as PM. The number following the PM is used to show how small the PM is, which is measured in micrometer (µm). The EPA monitors two types of PM and compare levels to limit values in the CAFE (Clean Air for Europe) Directive and WHO guidelines. These are PM_{10} and $PM_{2.5}$.

Particulate matter (PM_{10}) data for the 2014-2021 monitoring period in Kilkitt is presented in **Table 6-18**.

Table 6-18 Particular Matter (PM_{10}) Data for Kilkitt (µg/m³)

Year	Annual Mean (µg/M³)	Number Of Days >50 µg/M³
2014	9	2
2015	9	1
2016	8.1	0
2017	7.8	0
2018	9	0

Year	Annual Mean (µg/M^3)	Number Of Days >50 µg/M^3
2019	7	0
2020	8	0
2021	7.8	0

6.3.2.3 Nitrogen Dioxide (NO_2)

Nitrogen dioxide data for the 2016-2021 monitoring period in Emo Court and Kilkitt is presented in **Table 6-19** and **Table 6-20**.

Table 6-19 Nitrogen Dioxide (NO_2) for Emo Court (µg/m^3)

Year	Hourly Max	Annual Mean
2016	48.7	4.1
2017	33	3.4
2018	91	3
2019	56	4
2020	38	4
2021	63.8	3.6

Table 6-20 Nitrogen Dioxide (NO_2) for Kilkitt (µg/m^3)

Year	Hourly Max	Annual Mean
2016	80.2	3
2017	25.4	2.3
2018	37	3
2019	59	5
2020	18.3	2
2021	14.7	2.4

6.3.2.4 Sensitive Receptors

In total, there are 256 number of potential residential receptors within the study area. The study areas have been informed by best practice. This can be separated as follows:

- Within 1 km of both Option 1 and Option 2 cable routes: 190 residences.
- Within 500 m of both the proposed Option 1 and Option 2 cable routes: 171 residences.
- Within 1 km of the development site area (excluding cable route): 85 residences.
- Within 1 km of both the proposed site boundary and cable route: 256 residences.

The Proposed Development does not lie within any SAC or SPA. The study area for the SACs and SPAs is 20km in alignment with best practice. There are six SACs within 20 km of the Proposed Development. There are two SPAs within 20 km of the Proposed Development.

The only Ramsar site within 20 km is the Slieve Bloom Mountains (site no. 335). This site is also an SAC, SPA and Nature Reserve. There are no Important Bird Areas (IBAs) within 20 km.

6.3.3 Potential Impacts – Construction

6.3.3.1 Windfarm and TDR

The principal sources of potential dust emissions during the construction of the Proposed Development will be from the wind farm and turbine delivery route; from dust arising from earthworks, tree felling activities, construction of the new access tracks, the temporary storage of excavated materials, the construction of the proposed substation, the movement of construction vehicles, loading and unloading of aggregates/materials /movement of material around the site and turbines delivery.

Fugitives dust emissions arise when particulate matter becomes airborne making it available to be carried downwind from the source. Dust emissions can lead to elevated PM_{10} and $PM_{2.5}$ concentrations and may also cause dust soiling. The amount of dust generated and emitted from a working site and the potential impact on the surrounding areas varies according to:

- the type and quantity of material and working methods;
- distance between site activities and sensitive receptors;
- climate/local meteorology and topography.

An overview of the sources and processes associated with the preparatory site works and the construction / infrastructure installation activities, and their respective potential for dust deposition (both dust and smaller particles), is presented below in **Table 6-21**.

Table 6-21 Site Activities: Sources of Dust Emissions

Activity	Source	Emission Potential	Comments
Road and Substation Construction, Earthworks and Trackout	Excavators / Dozers / HGVs	High - dry or fine materials during strong windy weather	Temporary, variable from day to day depending on prevailing meteorological conditions, level, and location of activity. Soils immediately used to construct berms, used in restoration works or placed in stockpiles.
		Low – coarse or wet materials during conditions of low wind speed	
TDR	HGV / Road vehicles	Low - on paved road surfaces	Dependant on the amount of loose material on road surface available for re-suspension and track out.

Table 6-22 details the NRA assessment criteria used for assessing the impact of dust from construction activities of varying scale.

Table 6-22 NRA Assessment criteria for the Impact of Dust Emissions from Construction Activities with Standard Mitigation Place

Source		Potential Distance For Significant Effects (Distance From Source)		
Scale	Description	Soiling	Pm_{10}	Vegetation Effects

Source		Potential Distance For Significant Effects (Distance From Source)		
Major	Large Construction sites, with high use of haul roads	100 m	25 m	25 m
Moderate	Moderate Construction Sites, with moderate use of haul roads	50 m	15 m	15 m
Minor	Minor Construction sites, with limited use of haul roads	25 m	10 m	10 m

The overall construction of the proposed development is considered a major construction site as it will result in soiling effects which have the potential to occur up to 100m from the source, with PM_{10} deposition and vegetation effects occurring up to 25m from the source due to the quantity of construction works which are involved in the development of a wind farm. The nearest receptor is 722 from any of the proposed turbine and therefore will not experience the soiling, deposition, or vegetation effects. Construction vehicles and plant emissions have the potential to increase concentrations of compounds such as NO_2, Benzene and PM_{10} in the receiving environment. Due to distance between the nearest receptor and source of emissions the impact from these emissions will be Imperceptible. During the site preparatory and construction works will be completely confined within the proposed site.

Considering this, together with the separation distance to receptors and the screening provided by existing vegetation, the dust risk category for these construction activities is assessed as 'low risk' to 'negligible'. A summary of the determined risk category for the various activities around the proposed site is presented in **Table 6-23** below.

Table 6-23 Site Activities: Risk of Dust Emissions

Source	Risk Of Dust Soiling Effects	Ecological Effects
Earthworks	Negligible	Negligible
Construction	Negligible	Negligible
Trackout	Negligible	Negligible

While the overall risk category has been assessed as 'negligible, if the soils stripping activities were not mitigated, the effects of dust during dry and windy conditions could possibly lead to occasional increases in nuisance dust immediately surrounding the Proposed Development site. However, these are not considered to be significant given the limited duration of such meteorological conditions and the limited change in the extent and scale of the proposed activities.

It is not predicted that an air quality impact will occur due to traffic at the proposed development as the impacts will fall below the screening criteria set out in the UK Design Manual for Roads and Bridges guidance. This UK DMRB guidance states that road links meeting one or more of the following criteria can be defined as being 'affected' by a Proposed Development and should be included in the local air quality assessment:

- Road alignment change of 5 metres or more;
- Daily traffic flow changes by 1,000 AADT or more;
- HGVs flows change by 200 vehicles per day or more;
- Daily average speed changes by 10 km/h or more; or

- Peak hour speed changes by 20 km/h or more.

On the surrounding road network as detailed in Chapter Traffic and Transportation, there will be an average daily increase of 68 HGV trips per day for the construction of the proposed wind turbines over a construction period of 18 months and 8 HGV trips (16 two way) for the construction of the cable route. LGV traffic is expected to be 48 two-way movements per working day for the wind farm and substation and 25 trips per day (50 two way) for the cable route.

The combined HGV and LGV average daily increase are 125 trips per day. The combined HGV and LGV average daily increase are 251 two-way movements per day, which include the wind farm and cable route construction vehicles. This is based on the busiest day for both the wind farm construction and the cable route construction. Therefore, the model is not required in this instance.

On this basis, the impact of combustion emissions (primarily oxides of nitrogen) from vehicle exhaust emissions associated with the transfer and/or transportation of materials are screened out, and it is determined that there is no potential for emissions to contribute to local air pollution.

Plant and machinery such as generators, excavators etc. will be required at various stages of the construction works. These will be relatively small units which will be operated on an intermittent basis. Although there will be an emission from these units, given their scale and the length of operation time, the impacts of emissions from these units will be imperceptible.

6.3.3.2 Cable Routes

The construction of the either of the proposed cable route options is considered a moderate construction site as it will result in soiling effects which have the potential to occur up to 50 m from the source, with PM_{10} deposition and vegetation effects occurring up to 15 m from the source. The cable route will exit the proposed onsite substation heading south, before entering the L3851. From there, the route will head north along the R426 for approximately 10 km before entering private fields to the option 2 substation. For option 1 the route will head south over private lands and R430 before entering the option 1 substation. Some houses along the route may experience soiling and deposition of vegetation effects depending on how close to the road corridor they are located. Construction vehicles and plant emissions have the potential to increase concentrations of compounds such as NO_2, Benzene and PM_{10} in the receiving environment. However, due to the nature of construction along the proposed cable route as described in Chapter 3, which works as a "rolling" construction site, meaning that these works will not be concentrated in any one area of the route, these effects are considered to be short term, temporary and slight, irrespective of which option is progressed.

6.3.4 Potential Impact – Operational

6.3.4.1 Windfarm and TDR

Once the proposed development has been constructed there will be no significant direct emissions to atmosphere. A diesel generator of sufficient power to operate critical functions of the substation will be located at the proposed substation; however, this will only be operated as a back-up/emergency power supply.

Emissions from the diesel generator will therefore be infrequent. During use, a diesel generator will emit carbon dioxide, nitrogen oxide and particulate matter, however, due to the low usage, the impact will be imperceptible.

Maintenance vehicles will access the proposed development site monthly during the operational period, however, due to the low traffic movements involved, the impact will be imperceptible. The operational phase of the wind farm will result in positive impacts on air quality due to the displacement of fossil fuels as an energy source.

Maintenance vehicles will also access the joint bays for periodic monthly maintenance and carry out point works along the proposed cable route to address any issues during the operational period. However, given the low and infrequent traffic movements involved, the impact will be imperceptible. The operational phase of the cable route which connects to and operates the proposed development will result in positive and significant impacts on air quality due to the displacement of fossil fuels as an energy source.

In terms of TDR, there will be truck movements associated with delivering the wind turbines resulting in vehicular emissions and dust, however it will be done over paved surfaces thus dust soiling potential is very low along the route. Once all wind turbines are delivered the truck movements will cease and the vehicular emissions from HGV will greatly decrease.

6.3.4.2 Cable Route

Once the proposed cable route and substation are constructed there will be no significant direct emissions to atmosphere.

6.3.5 Potential Impacts – Decommissioning

6.3.5.1 Windfarm and TDR

In terms of decommissioning, there will be truck movements associated with removing the wind turbines from the wind farm resulting in vehicular emissions and dust. However, the number of truck movements would be significantly less than the construction phase and would potentially result in a slight temporary impact. There will also be emissions from machinery on site including for the movement of soil to cover the foundations, however, this is not likely to result in significant impacts.

During the decommissioning phase, the proposed cable route infrastructure including substations and ancillary electrical equipment will form part of the national grid and shall be left in situ. Substation, internal ducts of the Proposed Development, and all internal access roads, turbine hardstandings within the wind farm site will be left in situ, resulting in no additional truck movements and no impact from emissions from machinery along the cable route. The recreational amenity trail will also be left in situ.

6.3.5.2 Cable Route

During the decommissioning phase, the proposed cable route infrastructure including substations and ancillary electrical equipment will form part of the national grid and shall be left in situ.

6.3.6 Mitigation Measures

6.3.6.1 Windfarm and TDR

6.3.6.2 Construction Phase

A Construction Environmental Management Plan (CEMP) has been prepared and is included in Technical Appendix 3.2 found in Volume III of this EIAR. This includes the following mitigation measures that will be implemented in full during the construction phase of the proposed development relevant to air quality:

- The internal access roads will be constructed prior to the commencement of other major construction activities. These roads will be finished with graded aggregate;
- A water bowser will be available to spray work areas (wind turbine area and cable route) and haul roads, especially during periods of excavations works coinciding with dry periods of weather, to suppress dust migration from the site;
- All loads which could cause a dust nuisance will be covered to minimise the potential for fugitive emissions during transport;
- Gravel will be used at the site exit point to remove any dirt from tyres and tracks before travelling along public roads;
- Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.
- The access and egress of construction vehicles will be controlled to designated locations, along defined routes, with all vehicles required to comply with onsite speed limits;
- Construction vehicles and machinery will be serviced and in good working order;
- Wheel washing facilities will be provided at the entrance/exit point of the Proposed Development site;
- The developer in association with the contractor will be required to implement a dust control plan as part of the CEMP (a CEMP is contained in Technical Appendix 3.2 found in Volume III of this EIAR). In the event the Planning Authority decides to grant permission for the Proposed Development, the final CEMP will address the requirements of any relevant planning conditions, including any additional mitigation measures which are conditioned by the Planning Authority.
- Receptors which receive dusting and soiling from local routes entering the site; and dwellings directly adjacent to the cable route construction that experience dust soiling, where appropriate, and with the agreement of the landowner, will have the facades of their dwelling cleaned if required should soiling have taken place;
- All vehicles will switch off engines when stationary – no idling vehicles; and
- Exhaust emissions from vehicles operating within the site, including trucks, excavators, diesel generators or other plant equipment, will be controlled by the contractor by ensuring that emissions from vehicles are minimised through regular servicing of machinery.

6.3.6.3 Operational Phase

As the operation of the Proposed Development will have positive impacts on air quality, mitigation measures are considered unnecessary.

6.3.6.4 Decommissioning Phase

Proposed Development

Mitigation measures for the removal of wind turbines from the Proposed Development site would be similar as per the construction phase with respect to dust control and minimisation.

The proposed access tracks across the Proposed Development site and the 33kV collector circuit cable connection between the two clusters will be left in situ. Leaving the access tracks and the collector cable in situ results in no decommissioning works required, therefore no dust emissions from construction vehicles will be emitted. No mitigation measures are proposed

Cable Route

In terms of the chosen underground cable route, this will also be left in situ. Leaving the cable route in situ results in no decommissioning works required, therefore no dust emissions from construction vehicles will be emitted. No mitigation measures are proposed. Recreational Amenity Trail

The proposed recreational amenity trail across the Proposed Development site will be left in situ. Leaving the access tracks and the collector cable in situ results in no decommissioning works required, therefore no dust emissions from construction vehicles will be emitted. No mitigation measures are proposed.

6.3.7 Residual Impacts

6.3.7.1 Windfarm and TDR

Following the implementation of the above mitigation measures, the Proposed Development, proposed cable route and proposed substation are predicted to give rise to slight residual impacts arising from fugitive dust emissions during particular construction activities and decommissioning. These will be localised in nature and as they will be associated with particular elements of the construction phase and meteorological conditions, they will be temporary in nature and will not result in any permanent residual impacts.

Impacts related to vehicle emissions will practically cease following the operational phase and no significant impacts are anticipated, with minimal emissions expected during potential maintenance activities. There will be a low level of maintenance traffic during the operational period, which will have an imperceptible impact. During operations, the Proposed Development will result in the avoidance of emissions from fossil fuel generators which is a positive effect on air quality.

During operations, the Proposed Development will result in the avoidance of emissions from fossil fuel generators which is a significant positive effect on air quality. The effects in this section are not influenced by changes in the turbine range as set out in chapter 3. As such, the same effects are predicted irrespective of the turbine within the range.

6.3.7.2 Cable Route

There will be no significant permanent residual impacts from either cable route option.

6.4 Climate

6.4.1 Regulations and Guidance

6.4.1.1 National Adaptation to Climate Change

The Irish National Policy Position establishes the fundamental national objective of achieving transition to a competitive, low carbon, climate-resilient and environmentally sustainable economy by 2050. It sets out the context for the objective; clarifies the level of GHG mitigation ambition envisaged; and establishes the process to pursue and achieve the overall objective. Specifically, the National Policy Position envisages that policy development will be guided by a long-term vision based on:

- an aggregate reduction in carbon dioxide (CO^2) emissions of at least 80% (compared to 1990 levels) by 2050 across the electricity generation, built environment and transport sectors;
- in parallel, an approach to carbon neutrality in the agriculture and land-use sector, including forestry, which does not compromise capacity for sustainable food production.

The evolution of climate policy in Ireland will be an iterative process based on the adoption by Government of a series of national plans over the period to 2050. Greenhouse gas mitigation and adaptation to the impacts of climate change are to be addressed in parallel national plans – respectively through National Mitigation Plans and National Climate Change Adaptation Frameworks. The plans will be continually updated, as well as being reviewed on a structured basis at appropriate intervals, and at a minimum, every five years. This will include early identification and ongoing updating of possible transition pathways to 2050 to inform sectoral strategic choices.

The Climate Action and Low Carbon Development Act 2015[12] was enacted in December 2015. The Act identified and provided for the development and submission to Government of national mitigation and adaptation plans. It also established the institutional and governance framework within which these plans can be developed and implemented on a cyclical basis. The Climate Action and Low Carbon Development (Amendment) Act 2021[13], implemented on a statutory basis a 'national climate objective' which commits to pursue and achieve no later than 2050, the transition to climate resilient and climate-neutral economy.

The Department of Communications, Climate Action and Environment (DCCAE) published a National Adaptation Framework (NAF) in January 2018[14]. The NAF sets out the national strategy to reduce the vulnerability of the country to the negative effects of climate change and to avail of positive impacts.

12https://www.dccae.gov.ie/en-ie/climate-action/legislation/Pages/Climate-Action-and-Low-Carbon-Development-Act-2015.aspx

13https://www.gov.ie/en/publication/984d2-climate-action-and-low-carbon-development-amendment-bill-2020

14https://www.dccae.gov.ie/en-ie/climate-action/topics/adapting-to-climate-change/national-adaptation-framework/Pages/default.aspx

The NAF builds on the work already carried out under the National Climate Change Adaptation Network (NCCAF, 2012). Under the NAF a number of Government Departments will be required to prepare sectoral adaptation plans in relation to a priority area that they are responsible for. Local authorities are required to prepare local adaptation strategies NAF also aims to improve the enabling environment for adaptation through ongoing engagement with civil society, the private sector and the research community.

6.4.1.2 Climate Action Plan 2023

The Climate Action Plan is integral to the National Development Plan 2021-2030. It shows how Ireland is putting climate solutions at the very heart of social and economic development. Climate Action Plan 2023 has a greater focus on system change. Specifically, the Climate Action Plan 2023 envisages that change will be based on the Six Vital High Impact Sectors:

1. **Powering renewables: 75% reduction in emissions by 2030**

- A large-scale deployment of renewables that will be critical to decarbonising the power sector as well as enabling the electrification of other technologies.
- Accelerate the delivery of onshore wind, offshore wind, and solar.
- Dial up to 9 GW onshore wind, 8 GW solar, and at least 7 GW of offshore wind by 2030 (with 2 GW earmarked for green hydrogen production).
- Support at least 500 MW of local community-based renewable energy projects and increased levels of new micro-generation and small-scale generation.
- Phase out and end the use of coal and peat in electricity generation.
- New, dynamic Green Electricity Tariff will be developed by 2025 to incentivise people to use lower cost renewable electricity at times of high wind and solar generation.

2. **Building better: Commercial/public 45% residential 40% reduction in emissions by 2030**

- The energy efficiency of existing buildings will be increased, put in place policies to deliver zero-emissions new builds will be put in place and continue to ramp up our retrofitting programme will continue to be ramped up.
- Ramp up retrofitting to 120,000 dwellings to BER B2 by 2025, jumping to 500,000 by 2030.
- Put heat pumps into 45,000 existing and 170,000 new dwellings by 2025, up to 400,000 existing and 280,000 new dwellings by 2030.
- Generation up to 0.8 TWh of district heating by 2025 and up to 2.5 TWh by 2030.

3. **Transforming how we travel: 50% reduction in emissions by 2030**

- Policies to reduce transport emissions by improving our town will be driven up, cities and rural planning, and by adopting the Avoid-Shift-Improve approach: reducing or avoiding the need for travel, shifting to public transport, walking, and cycling and improving the energy efficiency of vehicles.
- Change the way we use our road space.
- Reduce the total distance driven across all car journeys by 20%.

- Walking, cycling and public transport to account for 50% of our journeys.
- Increase walking and cycling networks.
- 70% of people in rural Ireland will have buses that provide at least 3 trips to the nearby town daily by 2030.

4. Making family farms more sustainable: 25% reduction in emissions by 2030

- Farmers will be supported to continue to produce world class, safe and nutritious food while also seeking to diversify income through tillage, energy generation and forestry.
- Significantly reduce our use of chemical nitrogen as a fertilizer.
- Increase uptake of protected urea on grassland farms to 90-100%.
- Expand the indigenous biomethane sector through anaerobic digestion, reaching up to 5.7 TWh of biomethane.
- Increase organic farming to up to 450,000 hectares, the area of tillage to up to 400,000 ha.
- Contribute to delivery of the land use targets for afforestation and reduced management intensity of organic soils.

5. Greening business and enterprise: 35% reduction in emissions by 2030

- Changing how we produce, consume, and design our goods and services by breaking the link between fossil fuels and economic progress. Decarbonising industry and enterprise are key to Ireland's economy and future competitiveness.
- Decrease embodied carbon in construction materials produced and used in Ireland by at least 30%.
- Reduce fossil fuel use from 64% of final consumption (2021) to 45% by 2025 and further by 2030.
- Increase total share of heating to carbon neutral to 50-55% by 2025, up to 70-75% by 2030.
- Significantly grow the circular economy and bioeconomy.

6. Changing our land use: Exact reduction target for this sector is yet to be determined

- The first phase of the land use review will tell us how we are using our land now. Then, we can map, with evidence, how it can be used most effectively to capture and store carbon and to produce better, greener food and energy.
- Increase our annual afforestation rates to 8,000 hectares per annum from 2023 onwards.
- Rethink our Forestry Programme and Vision. Promote forest management initiatives in both public and private forests to increase carbon sinks and stores.
- Improve carbon sequestration of 450,000 ha of grasslands on mineral soils and reduce the management intensity of grasslands on 80,000 ha of drained organic soils;
- Rehabilitate 77,600 hectares of peatlands.

Other Actions included in The Climate Action Plan are as follows:

Research and innovation:

- National Agricultural Soil Carbon Observatory to be fully operational.
- Publish Ireland's Five-Year Assessment Report on Climate Change.
- Implement the €65m National Challenge Fund.

Governance:

- All Climate Delivery Taskforces in operation.
- Government Departments to evaluate the climate implications of policy proposals.

Just transition:

- Implement Just Transition Framework through climate sectoral policies.
- Establish Just Transition Commission to advise government.
- Continue targeted work in the Midlands with €169m Just Transition Fund.
- Targeted social welfare measures to prevent fuel poverty.
- Decarbonisation of public and private local rural bus routes.

Citizen engagement:

- Ongoing inclusive programme of citizen and stakeholder engagement to inform climate policy, improve climate literacy, ensure transparency in decision-making, and empower people to take climate action.

Public sector:

- 51% reduction in GHG emissions and a 50% improvement in public sector energy efficiency by 2030.
- Delivery of Local Authority Climate Action Plans.
- Climate related training and upskilling for public sector employees.
- Full implementation of green public procurement
- Carbon pricing and cross cutting policies:
- Continuing to implement successive carbon tax increases to be used for retrofitting of low-income homes, fuel allowance and addressing fuel poverty.
- Continue to support private finance and EIB investment in climate projects.

The Marine Environment

- Establish the new Maritime Area Regulatory Authority.
- Progress the mapping of all Irish offshore waters to support all marine activities.
- Legislation for the identification, designation, and management of Marine Protected Areas.

The Circular Economy:

- Whole-of-Government Circular Economy Strategy.
- Introduction of single use cup levy moving to a ban on all single use plastics.
- Start deposit-return scheme for plastic bottles and cans.

- Food Waste Prevention Roadmap.
- International Climate Action
- Provide at least €225m per year in Climate Finance to developing countries by 2025.

Adaptation:

- Development of a new National Adaptation Framework (NAF) and Sectoral Adaptation Plans.
- Development of Ireland's first set of standardised climate projections that can be used across multiple sectors to assist with adaptation planning. Improved availability of climate services and climate information through implementation of the National Framework for Climate Services (NFCS).
- Continued mainstreaming of climate change into the OPW's Flood Risk management policies.
- Improvements in the climate resilience of Ireland's water supply infrastructure.

6.4.1.3 Local Level Adaptation

The National Adaptation Framework identifies the critical role to be played by local authorities in addressing climate change adaptation. This will effectively build on their existing expertise and experience as first responders in emergency planning scenarios. Under the NAF each local authority will also be developing their own adaptation strategies in line with guidelines developed for the sector.

The NAF explores how local authorities might adopt a joint or regional approach to adaptation planning. In January 2018 the DCCAE entered a five-year financial commitment of €10m to establish four Climate Action Regional Offices (CAROs). Building on a business case prepared by the local government sector itself, this commitment recognises the significant obligation which has been placed on local government to develop and implement its own climate action measures, as well as the need to build capacity within the sector to engage effectively with climate change – both in terms of mitigation and adaptation.

The Climate Action Regional Offices are being operated by a lead local authority in four different regions that have be grouped together based on a climate risk assessment with a focus on the predominant risk(s) in each geographical area. The establishment of these offices will enable a more coordinated engagement across the whole of government and will help build on the experience and expertise which exists across the sector.

Table 6-24 summarises the adaptation actions to climate change in Ireland.

Table 6-24 Summary of Adaptation to Climate Change Actions in Ireland[15]

Item	Status	Programs
National Climate Adaptation Strategy	Legislation enacted. Statutory Framework adopted	Climate Action and Low Carbon Development Act 2021 (as amended) National Adaptation Framework

[15] http://climate-adapt.eea.europa.eu/countries-regions/countries/ireland

Item	Status	Programs
Action Plans	Sectoral Adaptation Plans in development. Local authority plans in development.	Local Authority Adaptation Strategy Development Guidelines (2016) Sectoral Planning Guidelines for Climate Change Adaptation Local Authority Adaptation Support Tool Climate Action Plan 2023
Impacts, Vulnerability and Adaptation Assessments	National Vulnerability Assessment	2012 National Climate Change Vulnerability Scoping Study Climate Change Impacts on Biodiversity in Ireland (2013) Climate change Impacts on Phenology in Ireland (2013) COCOADAPT (2013) 2013 Hydro Detect Project Robust Adaptation to Climate Change in the Water Sector in Ireland (2013) Ensemble of Regional Climate Projections for Ireland (2015) Urb-ADAPT Sectoral Adaptation Plan for Flood Risk Management (OPW, 2015) Adaptation Planning - Developing Resilience to Climate Change in the Irish Agriculture and Forest Sector (DAFM, 2017) Adaptation Planning - Developing Resilience to Climate Change in the Irish Transport Sector (DTTAS, 2017) Adaptation Plan for the Electricity and Gas Networks Sector (DCCAE, 2017)
Research Programs	EPA Research Programme (Climate Pillar)	http://www.epa.ie
Climate services / Met Office	Established	http://www.met.ie
Web Portal	Established	http://www.climateireland.ie
Monitoring, Indicators, Methodologies	In development	
Training, Education	Ongoing / in development	http://www.climateireland.ie

6.4.1.4 Laois County Council Climate Adaption Strategy

Laois County Council Climate Change Adaptation Strategy 2019-2024 features a range of actions across six thematic areas, including: Local Adaptation Governance and Business Operations; Infrastructure and Built Environment; Land Use and Development; Drainage and Flood Management; Natural Resources and Cultural Infrastructure; and Community Health and Wellbeing. The Strategy sets out several 'Adaptation Actions' including:

- To ensure that Climate Change adaptation considerations are mainstreamed and integrated successfully into all functions and activities of the local authority ensuring operational protocols, procedures and policies implement an appropriate response in addressing the diversity of impacts associated with climate change.

- To build capacity and resilience within Laois County Council to respond to climate change and climate change/severe weather events.
- To ensure and increase the resilience of infrastructural assets and the built environment, informing investment decisions.
- To integrate climate action considerations into land use planning policy and influence positive behaviour.
- To manage the risk of flooding through a variety of responses.
- To provide for enhancement of natural environment to work positively towards climate action.
- To promote effective bio-diversity management and enhance protection of natural habitats and landscapes.
- To build capacity and resilience within communities.

Aligning with the National Policy Objectives of the NPF, the RSES sets out 16 Regional Strategic Outcomes (RSOs) which set the framework for City and County Development Plans to build climate resilience into their policies and objectives and to support the transition to a low carbon economy by 2050. The Strategy identifies the following RSOs in relation to climate action:

- RPO 6. Integrated Transport and Land Use;
- RPO 7. Sustainable Management of Water, Waste, and other Environmental Resources;
- RPO 8. Build Climate Resilience;
- RPO 9 Support the Transition to Low Carbon and Clean Energy;
- RPO 10. Enhanced Green Infrastructure;
- RPO 11. Biodiversity and Natural Heritage.

The Strategy support and facilitate European and national objectives for climate adaptation and mitigation as detailed in the following documents, taking into account other provisions of the Plan (including those relating to land use planning, energy, sustainable mobility, flood risk management and drainage):

- Climate Action Plan (2019 and any subsequent versions);
- National Mitigation Plan (2017 and any subsequent versions);
- National Climate Change Adaptation Framework (2018 and any subsequent versions);
- Any Regional Decarbonisation Plan prepared on foot of commitments included in the emerging Regional Spatial and Economic Strategy for the Eastern and Midland Region;
- Relevant provisions of any Sectoral Adaptation Plans prepared to comply the requirements of the Climate Action and Low Carbon Development Act 2015, including those seeking to contribute towards the National Transition Objective, to pursue, and achieve, the transition to a low carbon, climate resilient and environmentally sustainable economy by the end of the year 2050; and
- Laois Climate Change Adaptation Strategy 2019 – 2024.

6.4.1.5 Future Management of Flood Risks

The Catchment Flood Risk Assessment and Management (CFRAM) Programme[16] (see www.cfram.ie) is the mechanism established to facilitate future adaptation to climate change. It provides for long-term flood risk management in Ireland and the embedment of flood risk assessment in the future development of capital projects. The future scenario flood maps produced under the CFRAM Programme will facilitate this approach, inform other industrial sectors, and provide a valuable resource for local adaptation planning and sustainable land use management and planning.

6.4.1.6 EIA Directive 2014/52/EU

Directive 2014/52/EU[17] of the European parliament and of the Council of 16 April 2014, amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment had to be transposed into national law by 16 May 2017, necessitating changes in laws, regulations, and administrative provisions across several legislative codes.

Key changes introduced in the 2014 Directive (in Annex IV - Information referred to in Article 5(1) – Information for the Environmental Impact Assessment Report) and the national transposing regulations (the European Union (Planning and Development)(Environmental Impact Assessment) Regulations, S.I. No. 296 of 2018) include a requirement for information on the impact of a Proposed Development on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the Proposed Development to climate change to be provided in the Environmental Impact Assessment Report.

6.4.1.7 Published Guidelines

Guidance on Integrating Climate Change and Biodiversity into EIA (EC, 2012)[18]

EU Guidelines provide recommendations on how to integrate climate change and biodiversity in Environmental Impact Assessment (EIA). The need for action on climate change and biodiversity loss is recognised across Europe and around the world. The guidelines include an explanation as to why climate change and biodiversity are so important in EIA, present the relevant EU-level policy background, provide advice on how to integrate climate change and biodiversity into selected stages of the EIA process. The annexes provide sources of further reading and links to other relevant information, data, and tools.

Climate Change and Major Projects (EC, 2016)[19]

This publication provides guidance for assessing vulnerability and risk from Climate Change for major projects funded by the European Regional Development Fund (ERDF) and the Cohesion Fund and listed in the concerned operational programmes.

16 https://www.cfram.ie/

17 http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32014L0052

18 http://ec.europa.eu/environment/eia/pdf/EIA%20Guidance.pdf

19 https://ec.europa.eu/clima/sites/clima/files/docs/major_projects_en.pdf

Sectoral Planning Guidelines for Climate Change Adaptation[20]

The guidelines aim to ensure that a coherent and consistent approach to adaptation planning is adopted by the key sectors in Ireland. Sectors preparing sectoral adaptation plans under the NAF are required to prepare their plans in line with the process described in these guidelines while also being aware of the overall requirements regarding the development of sectoral adaptation plans.

Local Authority Adaptation Strategy Development Guidelines[21]

Guidance was produced to provide a consistent and coherent process for local authorities in helping them develop local adaptation strategies and contain information on the process of developing an adaptation strategy:

- provide background information on what adaptation entails and provides the rationale behind implementing a local scale adaptation strategy;
- outline the initial steps required in launching a strategy development process, describing key roles and who can fulfil them, and setting out important factors to consider in the early stages of strategy development;
- explains how to assess the role that weather extremes and periods of climate variability currently play within the local jurisdiction, and it describes why doing so is a fundamental element of working towards a more climate-resilient future;
- moves from the present to the identification of future climate risks, describing a staged risk assessment process and positioning the adaptation strategy within more detailed risk assessments undertaken during shorter term decision-making processes such as statutory plan-making;
- based on the risk assessment process undertaken determination of adaptation goals and objectives and the types of adaptation actions that are available and outlines how each might be identified, assessed, prioritised, and implemented is described;
- outlines the steps required to move from a phase of planning to one of implementation, and it explains the importance of monitoring and evaluation in ensuring that the strategy is achieving its anticipated adaptation objectives.

6.4.2 Existing Environment

6.4.2.1 Regional Context

Climate is defined by the EPA as "the average weather over a period of time". Climate change is a term that is used to describe a "significant change in the measures of climate, such as temperature, rainfall, or wind, lasting for an extended period – decades or longer.[22]" There is scientific evidence[23] which suggests that the current climate is rapidly warming, having reached approximately 1°C above pre-industrial levels in 2017, increasing at a rate of 0.2 °C per decade. Warmer weather places pressure on flora and fauna which cannot adapt

20 https://www.dccae.gov.ie/en-ie/climate-action/topics/adapting-to-climate-change/national-adaptation-framework/Pages/Sectoral.aspx

21 https://www.dccae.gov.ie/en-ie/climate-action/topics/adapting-to-climate-change/national-adaptation-framework/Pages/Localadaptation.aspx

22 Climate change | Environmental Protection Agency (epa.ie)

23 https://www.ipcc.ch/sr15/download/#chapter

to a rapidly changing environment. In Ireland, the pressure on flora and fauna is mitigated due to the dominant influence of the Gulf Stream on Ireland's climate. Consequently, Ireland does not suffer from the extremes of temperature experienced by many other countries at similar latitudes.

Ireland has a typical maritime climate, with relatively mild and moist winters and cool, cloudy summers. The prevailing winds are south-westerly in direction. The climate is influenced by warm maritime air associated with the Gulf Stream which has the effect of moderating the climate, and results in high average annual humidity across the country. The area of least precipitation is along the eastern seaboard of the country, in the rain shadow of the Leinster uplands.

Mean seasonal temperature will change across Ireland. Several studies have applied selected IPCC Special Reports on Emissions Scenarios (SRESs) to model climatic changes across Ireland at a regional scale. Despite the different methods and scenario combinations used, there is agreement in projected changes in temperature for Ireland. However, there are more disparities in the magnitude and sign (i.e., +/-) for the precipitation changes projected for the island.

Table 6-25 summarises climate impact projections for Ireland, estimates of projections confidence are derived from published projection data from the Local Authority Adaptation Strategy Development Guidelines[1].

Table 6-25 Climate Impacts Projections: 30-Year Overview[24]

Variable	Summary	Confidence	Projected Changes
Sea Levels Rise	Strong increase	High	Projections of sea level rise to 2100 suggest a global increase in the range of 0.09-0.88 m with a mean value of 0.48 m. For 2050, it is reasonable to assume a sea level rise in the region of 25 cm above present levels. It should be noted that due to a limited understanding of some important effects that contribute to rates of increase, these estimates of sea level rise may prove optimistic, and estimates of up to 4-6 m have been projected by some models.
Storm Surge	Strong increase	Medium	An increase in the number of intense cyclones and associated strong winds are expected over the north - east Atlantic. By the 2050s, storm surge heights in the range of 50-100 cm are expected to increase in frequency for all coastal areas with exception of the southern coast.
Coastal Erosion	Moderate increase	Low	Currently approximately 20% of Ireland's coastline is at risk of coastal erosion, particularly areas of the south and east coast and also in isolated areas on the west coast. Rates of increase will be determined by local circumstances; however, it is expected that areas of the south-west are likely to experience the largest increase.
Cold Snaps / Frost	Moderate decrease (winter/night)	High	By mid-century, minimum temperatures during winter are projected to increase by ~2°C in the southeast and ~2.9°C in the north. This change will result in fewer frost days and milder night-time temperatures.
Heatwaves	Strong increase (summer)	High	Seven significant heatwaves (defined as 5+ days @ >25°C) have been recorded in Ireland over the past 30 years, resulting in approximately 300 excess deaths. By mid-century, a projected increase in summer maximum daily temperature of approximately 2°C will likely intensify heatwaves, with maximum temperatures increasing and heatwave duration lengthening.
Dry Spells	Strong increase (summer)	Medium	There have been eight periods of insignificant rainfall in Ireland in the past 40 years. Of these, the events of 1976, 1995 and 2018 were the most severe, averaging 52, 40 and 54 days in duration respectively across Irish rainfall stations. An approximate 20% decrease in summer precipitation in many areas is strongly indicated under a high emissions scenario. This decrease is likely to result in progressively longer periods without significant rainfall, posing potentially severe challenges to water sensitive sectors and regions.
Extreme Rainfall	Strong increase (winter)	Low	Heavy precipitation days (in which more than 20 mm of rain falls) are likely to increase in frequency in winter. By the 2050s an increase in the number of heavy precipitation days of around 20% above the level of 1981-2000 is projected under both low-medium and high emissions scenarios. This may have serious consequences for flood risk in sensitive catchments.
Flooding	Moderate increase (winter)	Low	An Irish Reference Network of hydrometric stations has been established to assess signals of climate charge in Irish hydrology. This network has detected an increasing trend in high river flows since 2000. Projections of future flows are beset by uncertainty at the catchment scale, but a broad signal of wetter winters and drier summers is evident across several independent studies.
Wind Speed	Minor increase (winter)	Medium	Observed wind speed over Ireland has not changed significantly in recent times, but it is anticipated that the distribution of wind will alter slightly in future, with winters marginally windier and summers marginally less so. Though the average wind speed is anticipated to change in only a minor way over the coming decades, the frequency of extreme windstorms is expected to increase due to alternations in the origin and track of tropical cyclones.

24 Local Authority Adaptation Strategy Development Guideline, EPA 2016

6.4.2.2 Local Context

The climatic conditions for the wider geographical area have been derived from historical meteorological measurements compiled by Met Éireann, the national meteorological service of Ireland. The nearest weather station to the Proposed Development is the Oak Park weather station which is approximately 21 km southwest of the Proposed Development and associated infrastructure. These meteorological conditions are presented in tables for the period January 2019 – December 2022 (source www.met.ie/climate).

The moderating influence of the Atlantic Ocean is felt throughout Ireland. The annual mean temperature for different areas in Ireland varies between mountainous regions, lowlands, and the coast. Mean daily temperatures are typically between minimum 3.8°C in winter to maximum 17.2°C in summer for the area surrounding Oak Park in 2022.

The east of Ireland, which is sheltered from Atlantic frontal systems, is sunnier than the west. The sunniest months are May and June.

In 2022 total for year rate of precipitation was 840.6 mm / year at Oak Park, with winter months receiving the heaviest amounts, refer to **Table 6-26**.

Table 6-26 Total Rainfall - Oak Park

Total Rainfall (mm)													
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2022	28.0	82.5	58.6	43.3	36.0	62.5	25.4	36.5	153.2	153.1	93.5	68.0	840.6
2021	86.0	110.9	37.0	14.4	123.6	16.3	61.8	59.2	39.9	112.2	20.9	102.6	784.8
2020	61.4	172.8	51.8	29.7	12.9	40.5	76.5	100.1	57.0	96.6	87.6	123.2	910.1
2019	30.9	36.8	122.9	72.5	14.1	55.0	42.6	86.4	116.7	102.3	117.2	68.0	865.4

Table 6-27 Mean Temperature – Oak Park

Mean Temperature (C°)													
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2022	5.4	7.2	7.4	8.4	12.6	14.2	17.2	16.9	13.5	12.1	8.9	3.8	10.7
2021	3.9	6.1	7.6	7.1	9.7	14.3	17.7	15.8	15.4	11.9	8.0	6.9	10.4
2020	5.9	6.0	6.6	10.1	12.3	14.3	15.2	16.0	13.7	9.8	8.2	5.0	10.3
2019	5.9	7.5	7.4	8.9	11.0	13.0	16.7	16.2	13.7	9.4	6.3	5.9	10.2

Table 6-28 Mean Soil Temperature- Oak Park

Mean Soil Temperature (C°)													
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2022	5.1	6.2	6.1	8.8	13.6	16.0	18.6	17.6	14.2	11.7	8.8	4.7	11.0
2021	3.3	4.7	6.4	8.1	10.9	16.3	18.9	16.1	15.6	11.8	8.1	6.3	10.6
2020	4.7	4.4	5.1	10.4	14.5	15.7	15.7	16.0	13.4	9.4	7.6	4.4	10.1
2019	5.3	5.5	6.3	8.8	12.8	14.8	17.7	16.1	13.8	8.8	5.7	4.6	10.0

Table 6-29 Potential Evaporation Oak Park

Potential Evaporation (mm)													
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2022	10.1	23.4	43.9	54.1	80.9	85.6	98.4	94.5	45.5	28.7	14.0	6.5	585.6
2021	8.2	20.6	35.4	59.1	73.4	90.7	98.5	70.1	46.6	27.8	13.6	10.8	554.8
2020	12.1	23.2	40.7	65.4	100.5	78.9	78.1	68.1	50.3	27.7	13.4	9.2	567.6
2019	12.6	20.6	37.5	52.0	76.6	82.3	94.1	77.3	51.3	25.9	11.2	11.1	552.5

Table 6-30 Evaporation Oak Park

Evaporation (mm)													
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2022	13.7	32.9	62.4	77.1	115.1	119.5	131.3	126.1	64.4	39.4	18.5	8.5	806.9
2021	11.3	29.2	52.1	84.7	106.6	126.6	130.5	94.5	62.0	38.0	17.9	13.7	767.1
2020	15.9	33.6	59.5	91.6	141.5	108.8	107.6	92.9	69.2	38.2	18.0	11.8	788.6
2019	16.5	28.8	55.5	74.6	107.4	115.4	127.0	106.0	70.1	35.8	15.3	14.1	766.5

Table 6-31 Days below 15.5 Degree Celsius

Degree Days Below 15.5 °C													
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2022	313	233	255	213	104	67	27	44	79	110	199	364	2008
2021	359	263	245	253	185	70	22	37	45	120	224	267	2090
2020	298	274	276	170	125	67	47	39	86	176	218	327	2102
2019	299	225	252	206	148	97	30	38	78	190	277	296	2135

Table 6-32 Mean Wind Speed Oak Park

Mean Wind Speed (m/s)													
Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
2022	3.2	6.2	3.7	3.5	3.8	3.6	3.1	2.8	3.0	4.5	4.4	3.2	3.8
2021	3.2	5.4	4.3	2.8	3.7	3.4	2.6	3.1	2.8	3.9	3.4	4.1	3.6
2020	4.3	6.6	4.7	3.0	3.6	4.0	3.8	3.7	3.3	4.3	4.2	4.2	4.1
2019	3.3	5.2	4.8	3.8	3.0	3.4	3.3	4.2	3.6	3.5	3.5	4.6	3.8

6.4.2.3 Microclimate

The significance of impacts associated with the conversion of vegetated surfaces to un-vegetated surfaces is assessed through the consideration of the area of the land experiencing such a change.

Should the Proposed Development, proposed cable route, substation and recreational amenity trail not be developed, fossil fuel power stations will be the primary alternative to provide the required quantities of electricity. This will further contribute to greenhouse gas and other air pollutant emissions, as well as hindering Ireland in its commitment to meet its target to increase electricity production from renewable sources and to reduce greenhouse gas emissions.

The proposed development site is predominately an upland commercial forestry location except for existing public roadways and internal track ways. The total area of proposed new permanent hardstanding surface is approximately 3% of the Proposed Development site and consequently there will be no direct or indirect impact on air temperature and microclimate. The felling of 54.36 hectares of coniferous forestry is required within and around the wind farm infrastructure to accommodate the construction of some turbines. Clear felling will be dispersed over several areas and will not consist of a single clear fell area and there will be no direct or indirect impact on site temperature and microclimate due to clear felling. It is important to note that clear felling forms part of the cycle of commercial forestry and without the Proposed Development clear felling would occur as normal.

Carbon dioxide (CO_2) is a greenhouse gas which if released in excessive amounts can lead to increases in global temperatures known as 'global warming' or 'greenhouse effect' which can influence climate change. The carbon balance section details the carbon savings that have been calculated for the Proposed Development.

The Proposed Development offers Ireland an indigenous form of sustainable electricity and would provide for security of supply against our dependence on imports in addition to the positive impact on the macroclimate.

6.4.3 Adaptation against Expected Climate Change Effects

The aim of the vulnerability assessment is to identify the relevant climate hazards for the Proposed Development at the foreseen location. A development vulnerability assessment for the Proposed Development is presented below.

Based on the development vulnerability assessment, measures to improve the resilience of the Proposed Development to extreme rainfall, flood, flash flood, storms, and winds are required.

The likelihood analysis of the Proposed Development to climate hazards is presented in **Table 6-33**.

Based on the SLR methodology following *Climate Change and Major Projects (EC, 2016) Guidelines* the Proposed Development has been assessed to be moderately affected by extreme rainfall, flash (pluvial) flood, storms, and winds. The Proposed Development would be unlikely affected to cold spells, landslides and snow and wildfires. The Proposed Development would not be affected by heat, drought, and freeze –thaw damage. The Proposed Development will not be affected by rising sea level.

Table 6-33 Analysis of Likelihood of Climate Hazards

	Extreme Rainfall, Flash Flood	Flood	Health	Drought	Wildlife Fires	Storms And Winds	Landslides	Cold Spells And Snow	Freeze –Thaw Damage	Rising Sea Levels
Rare		✓	✓	✓					✓	✓
Unlikely					✓		✓	✓		
Moderate	✓					✓				
Likely										
Almost certain										

Table 6-34 shows the climate hazard impact analysis of the Proposed Development. It was assessed that climate hazards will have major impacts on health and safety, the environment and financial areas, moderate impacts on asset damage and engineering, operational, social and reputation areas.

Table 6-34 Climate Hazard Impact Analysis

Risk Areas	nsignificant	Minor	Moderate	Major	Catastrophic
Asset damage, engineering, operational			✓		
Safety and Health				✓	
Environment				✓	
Social			✓		
Financial				✓	
Reputation			✓		

Table 6-35 assesses the sensitivity of the Proposed Development to climate hazard. It was assessed that site assets, energy inputs and transport links are of high sensitivity to extreme rainfall, flood, flash floods, storms, and winds; water inputs will be highly sensitive to droughts. On site assets will be medium sensitive to cold spells and snow and freeze – thaw damage. Transport links will be medium sensitive to cold spells and snow.

Table 6-35 Sensitivity of Proposed Development to Climate Hazards

	Extreme Rainfall, Flash Flood	Flood	Health	Drought	Wildlife Fires	Storms And Winds	Landslides	Cold Spells And Snow	Freeze –Thaw Damage	Rising Sea Levels
On site Assets	High	Low	Low	Low	Low	High	Low	Medium	Medium	Low
Inputs - Water	Low	Low	Low	High	Low	Low	Low	Low	Low	Low
Inputs - Energy	High	Low	Low	Low	Low	High	Low	Low	Low	Low
Transport Links	High	Low	Low	Low	Low	High	Low	Medium	Low	Low

In Table 6-36, the exposure of the planned development to climate hazards was assessed. In the current climate, the exposure of the development to extreme rainfall, flood, flash flood, storms and winds has been assessed to be medium. In the future, the Proposed Development was assessed to have high exposure to rainfall, flash flood, storms, and winds.

Table 6-36 Exposure of the Development to Climate Hazards without Mitigation

	Extreme Rainfall, Flash Flood	Flood	Health	Drought	Wildlife Fires	Storms And Winds	Landslides	Cold Spells And Snow	Freeze –Thaw Damage	Rising Sea Levels
Current Climate	Medium	Low	Low	Low	Low	Medium	Low	Low	Low	Low
Future Climate	High	Low	Low	Low	Medium	High	Low	Low	Low	Low

Table 6-37 shows the vulnerability analysis of the Proposed Development to climate hazards; it combines the sensitivity and the exposure analysis. The Proposed Development was assessed to be most sensitive to extreme rainfall, flash flood, storms, and winds.

Table 6-37 Vulnerability Analysis of Proposed Development to Climate Hazards

Sensitivity	Exposure (Current & Future Climate)		
	Low	**Medium**	**High**
Low	Rising sea levels, Flood, Landslides, Freeze –thaw damage, Drought, Heat,		
Medium		Cold Spells and Snow Wildlife Fires	
High			Extreme Rainfall, Flash Flood, Storms, and Winds

6.4.4 Potential Impacts – Construction

6.4.4.1 Proposed Development and Recreational Amenity Trail

In the current climate, the exposure of the development to extreme rainfall, flood, flash flood, storms and winds has been assessed to be medium, those climate hazards have the potential to impact the construction activities at the proposed site and the TDR. It was assessed that climate hazards will have major impacts on health and safety, the environment and financial areas, moderate impacts on asset damage and engineering, operational, social and reputation areas during the construction operations for windfarm and TDR.

6.4.4.2 Cable Route

In the current climate, the exposure of the development to extreme rainfall, flood, flash flood, storms and winds has been assessed to be medium, those climate hazards have the potential to impact the construction activities at proposed cable route. It was assessed that climate hazards will have major impacts on health and safety, the environment and financial areas, moderate impacts on asset damage and engineering, operational, social and reputation areas during grid construction. While extreme weather conditions are predicted to continue into the future, it is considered that the Proposed Development and its associated cable route linking the Proposed Development to the National Grid both play a part in the offset of CO_2 production, a known factor in the exacerbation of extreme weather and changing climate.

6.4.5 Potential Impact – Operational

6.4.5.1 Proposed Development and Recreational Amenity Trail

In the current climate, the exposure of the development to extreme rainfall, flood, flash flood, storms and winds has been assessed to be medium and of long-term duration.

The biggest severe weather challenge to wind farm operations is lightning and it is a constant severe weather threat. The next condition that makes severe weather and wind farms a dangerous combination is the wind, too much wind can be dangerous for both workers and equipment, with on-site maintenance crews will be alerted to ensure wind-farm employees are kept safe.

6.4.5.2 Cable Route

In the current climate, the exposure of the development to extreme rainfall, flood, flash flood, storms and winds has been assessed to be medium. The cable route options are planned to be underground therefore only floods/ flash flood will potentially affect it during operational phase, where it can be exposed by soil being washed out along the route.. The significance of this is rated as medium. While extreme weather conditions are predicted to continue into the future, it is considered that the Proposed Development and its associated cable route linking the Proposed Development to the National Grid both play a part in the offset of CO_2 production, a known factor in the exacerbation of extreme weather and changing climate.

Heavy or prolonged rainfall during construction and operation may lead to sediment transport or vegetation causing blockage to infrastructure drainage channels or any temporary watercourse crossing structures. Regular monitoring and prompt maintenance of these assets will ensure that the drainage system continues to function as designed.

6.4.6 Potential Impacts – Decommissioning

6.4.6.1 Proposed Development and Recreational Amenity Trail

In the current climate, the exposure of the development to extreme rainfall, flood, flash flood, storms and winds has been assessed to be medium, those climate hazards have the potential to impact the decommissioning activities at the proposed site and the TDR. During the decommissioning activities climate hazards will have major impacts on health and safety.

6.4.6.2 Cable Route

In the current climate, the exposure of the development to extreme rainfall, flood, flash flood, storms and winds has been assessed to be medium.

During the decommissioning phase, the proposed cable route infrastructure including substations and ancillary electrical equipment will form part of the national grid and shall be left in situ. The cable route is planned to be underground therefore only floods/ flash flood will potentially affect it, where it can be exposed by soil being washed out along the route – add text from water section.

6.4.7 Mitigation Measures

Mitigation is designed to increase the resilience of the development, or wider environmental receptors, to climate change and focuses on increasing capacity to absorb climate related shocks.

In the context of climate change, measures to increase the adaptive capacity of the Proposed Development and disaster risk reduction strategies will be developed with a view to reducing vulnerability and increasing its resilience. Significant incidents related to the climate change that affect operation of the Proposed Development will be recorded for future analysis.

To minimize this severe weather risk at wind farms, The applicant will implement new lightning safety procedures that rely on early warning systems based on total lightning detection. Total lightning is the combination of all cloud-to-ground lightning strikes and in-cloud lightning strikes. It's a best practice to rely on total lightning because nearly 80% of all lightning strikes happen in the clouds. While these aren't immediately dangerous to workers or infrastructure, they are a precursor to deadly cloud-to-ground strikes and other forms of severe weather like wind gusts, tornadoes, and hail.

The applicant will use weather intelligence by monitoring real-time wind gust information and the forecast. An accurate wind forecast at altitude will be used to help decision-makers extend automatic shutoffs when more wind is in the near forecast.

Procedures undertaken prior to attending and on site during inclement weather include:

General Weather Conditions

The applicant will confirm wind speeds and forecasted weather conditions prior to site access. The Operational Controller will provide alerts if high winds are lightening are forecasted for the duration of any work or visit on site. This will be dynamically assessed on site by the working party of visitor. If a storm occurs, personnel will return to their vehicles, leave the wind farm without delay, and inform the Operational Controller.

If there is snow or ice forecast, the condition of the approach roads will be noted and personnel will only proceed if safe to do so.

The approach roads may pass in proximity to wind turbines and ice may have accumulated on the blades. Vehicles will not be left for any reason and the Operational Controller will be advised if the vehicle becomes immobile in proximity to a wind turbine.

Good practice construction techniques will be adopted for the management of sediment and surface water run-off generated during the construction phase of the Proposed Development. Sustainable Drainage Systems (SuDS) will be used where applicable.

Drainage from the site will include elements of SuDS design. SuDS replicate natural drainage patterns and have a number of benefits:

- SuDS will attenuate run-off, thus reducing peak flow and any flooding issues that might arise downstream; and
- SuDS will treat run-off, which can reduce sediment and pollutant volumes in run-off before discharging back into the water environment; and
- SuDS measures, such as lagoons or retention ponds, where appropriate and correctly implemented would produce suitable environments for wildlife.
- In addition, a wet weather protocol would be implemented to manage activities during periods of heavy and prolonged precipitation to be approved by LCC in consultation with the EPA.

Extreme Weather Conditions Procedure

The turbines have systems that will automatically halt operations when wind speeds exceed 55 mph. This “survival mode” keeps the turbines standing upright because when the wind blows too fast through the turbines it can compromise the integrity of the foundation.

Therefore, the wind farm operator will have access to a weather forecast that indicates lightning strikes in real time. Furthermore, the capability to provide alerts to on-site maintenance crews is an effective way to keep wind-farm employees safe.

- At an average wind speed of 15 m/s, no work will be done outside the nacelle / No opening of nacelle hatch
- Work in or over hub will be prohibited at 12 m/s
- Work in nacelle will be prohibited at 20 m/s
- At an average wind speed of 20 m/s, all climbing of turbines will be prohibited
- At an average wind speed of 25 m/s, the site will be evacuated following the Emergency Evacuation Procedure

Snow and Ice Conditions

- If there is snow and ice forecast, before approaching a turbine. The turbine will be inspected from a safe distance.
- If ice build-up is evident on the wind turbine blades, the turbine will be stopped remotely, OMS will ask is it safe to go to the turbine. If not, they will keep a safe distance away and monitor the turbine. If ice build-up is still evident after 45 minutes, they will inform the Operational Controller and cancel works.
- If ice build-up has thawed or dislodged after 45 minutes, OMS will proceed with caution.

- Climbing is prohibited inside towers during mild ice and snow conditions, but no work will be carried out on the nacelle, in the hub, or on lattice met mast towers
- Will not approach turbines during icy conditions until they have been stopped or paused. There is a risk of ice throw.
- Where roads are difficult to pass due to snow/ice, all works will be ceased until conditions improve.
- Where necessary, the site will be evacuated via marked roads.

6.4.7.1 Windfarm and TDR

Based on a development vulnerability assessment, measures to improve the resilience of Proposed Development to extreme rainfall, flash flood, storms, and winds are required. **Table 6-38** details specific mitigation measures for the Proposed Development relating to climate change adaptation.

Table 6-38 Mitigation Measures Related to Climate Change Adaptation Windfarm and TDR

Main Concerns Related to:	Mitigation Measures
Extreme Rainfall, Flood, Flash Flood	Consider changes / flexibility in design that provide for increased run-off across paved areas and possible increases in seasonal groundwater levels.
	Design / provide adequate surface water drainage / discharge to ground. As discussed in section 9.9.3.4 of Chapter 9: the drainage design will implement SuDs.
Storms and Winds	Activities / production will be ensured they can proceed safely during high winds and storms.
	Ensure the choice of equipment deployed on the Proposed Development is weather efficient.
Risk Reduction Mechanism	Insurance for damage of assets / site incidences will be secured.

6.4.7.2 Cable Route

Based on a development vulnerability assessment, measures to improve the resilience of the Proposed Development to extreme rainfall, flash flood, storms, and winds are required. **Table 6-39** details specific mitigation measures for the Proposed Development relating to climate change adaptation.

Table 6-39 Mitigation Measures Related to Climate Change Adaptation Cable Route

Main Concerns Related to:	Proposed Alternatives or Mitigation Measures
Extreme Rainfall, Flood, Flash Flood	Consider changes / flexibility in design that provide for increased run-off and possible increases in seasonal groundwater levels. As discussed in section 9.9.3.4 of Chapter 9: there will be an implementation of a wet weather protocol
Risk Reduction Mechanism	Insurance for damage of assets / site incidences will be secured.

6.4.8 Residual Impacts

6.4.8.1 Windfarm and TDR

During operations, the Proposed Development will result in the avoidance of emissions from fossil fuel generators which is a positive effect on Climate Change.

6.4.8.2 Cable Route

There will be no significant impacts from the proposed cable route impacts of either cable route in relation to climate hazards.

6.5 Carbon Balance

CO_2 emissions occur naturally in addition to being released with the burning of fossil fuels. All organic material is composed of carbon, which is released as CO_2 when the material decomposes. Organic material acts as a store of carbon. Peatland habitats are significant stores of organic carbon. The vegetation on a peat bog slowly absorbs CO_2 from the atmosphere when it is alive and converts it to organic carbon. When the vegetation dies, in the acidic waterlogged conditions of bogs and peatlands, the organic material does not decompose fully, and the organic carbon is retained in the ground. The carbon balance of proposed wind farm developments in peatland habitats has attracted significant attention in recent years. When developments such as wind farms are proposed for peatland areas, there will be direct impacts and loss of peat in the area of the development footprint. There may also be indirect impacts where it is necessary to install drainage in certain areas to facilitate construction. The works can either directly or indirectly allow the peat to dry out, locally, which permits the full decomposition of the stored organic material with the associated release of the stored carbon as CO_2. It is essential therefore that any wind farm development in a peatland area displaces more CO_2 produced from fossil fuel sources than it releases during the construction, operation, and restoration of the wind farm site. The Proposed Development is situated in an area which has limited peat habitats. The site is not located on acid bog or fen habitats. Peat is not present throughout the site. Most of the site has been cultivated and forestry dominates the site. – The Proposed Development has been sensitively situated within an upland environment of limited habitat value.

The Scottish Carbon Calculator Tool was used to calculate carbon emissions and carbon savings as a result of the Proposed Development - www.gov.scot. Input data used in the calculations is presented in Technical Appendix 6.1 found in Volume III of this EIAR.

6.5.1 Existing Environment

Ireland's greenhouse gas (GHG) emissions are tracked and projected by the EPA for submission to the EU UNFCCC annually.

In 2021, Ireland's provisional GHG emissions are estimated to be 61.53 million tonnes carbon dioxide equivalent (Mt CO2eq), which is 4.7% higher (or 2.76 Mt CO2 eq) than emissions in 2020 (58.77 Mt CO2 eq). There was a decrease of 3.4% in emissions reported for 2020 compared to 2019. Emissions are over 1% higher than pre-pandemic 2019 figures.

In 2021 national total emissions excluding Land Use, Land Use Change and Forestry (LULUCF) increased by 4.7%, emissions in the stationary ETS sector increased by 15.2% and emissions under the ESR (Effort Sharing Regulation) increased by 1.6%. When LULUCF is included, total national emissions increased by 5.5%.

Increased emissions in 2021 compared to 2020 were observed in the largest sectors except for residential, waste, and commercial and public services. These 4 sectors showed decreases in emissions (-4.9%, -4.5%, -3.0% and -3.8% respectively).

The greenhouse gas emission inventory for 2021 is the first of ten years over which compliance with targets set in the European Union's Effort Sharing Regulation (EU 2018/842) will be assessed. This Regulation sets 2030 targets for emissions outside of the Emissions Trading Scheme (known as ESR emissions) and annual binding national limits for the period 2021-2030. Ireland's target is to reduce ESR emissions by 30% by 2030 compared with 2005 levels, with a number of flexibilities available to assist in achieving this.

Ireland's ESR emissions annual limit for 2021 is 43.48 Mt CO2eq. Ireland's provisional 2021 greenhouse gas ESR emissions are 46.19 Mt CO2eq, this is 2.71 Mt CO2eq more than the annual limit for 2021. This value is the national total emissions less emissions generated by stationary combustion and aviation operators that are within the EU's emissions trading scheme. This indicates that Ireland is not in compliance with its 2021 Effort Sharing Regulation annual limit, exceeding the allocation by 0.80 Mt CO2eq after using the ETS flexibility. Agriculture and Transport accounted for 73.4% of total ESR emissions in 2021.

The latest projections (March 2022) indicate that Ireland can achieve overall Effort Sharing Regulation (ESR) compliance over the period 2021 to 2030 assuming full implementation of the 2021 Climate Action Plan and the use of the flexibilities available.

Emissions per capita increased from an historic low of 11.8 tonnes CO_2eq/person in 2020 to 12.3 tonnes CO_2eq/person in 2021. Ireland's average tonnes of GHG/capita over the last ten years were 12.8 tonnes. With recent CSO preliminary 2022 census data showing a population of 5.12 million people and with population projected to increase to 5.5 million in 2030, 5.9 million in 2040 and 6.2 million by 2050, per capita emissions need to reduce significantly. At current per capita emission levels, each addition 500,000 people would contribute an additional 6 million tonnes of CO_2eq annually.

6.5.2 Potential Impacts

6.5.2.1 Windfarm / TDR / Recreational Amenity Trail and Cable Route

There is the potential for greenhouse gas emissions to the atmosphere during the construction phase of the proposed development such as those arising from construction vehicles, the use of on-site generators, pumps and excavation works.

In terms of carbon losses and savings, the online Scottish Windfarm Carbon Assessment Tool (https://informatics.sepa.org.uk/CarbonCalculator/index.jsp) was used to estimate carbon savings because of the proposed construction and operation of the development. The assumptions are in the methodology section and Technical Appendix 6.1 (found in Volume III of this EIAR) details the inputs to the model.

Based on the Scottish Windfarm Carbon Assessment Tool, during the manufacturing and transportation of turbines, and construction and decommissioning of the turbines, 205,406 (Vestas, 7.2 MW) or 192,952 (SG, 6.6 MW) tonnes of CO_2eq will be lost to the atmosphere. Losses during the construction and decommissioning phases will be due to reduced carbon fixing potential, losses from soil organic matter and losses due to felling forestry. Values for turbine life and felling of forestry are presented in Technical Appendix 6.1 found in Volume III of this EIAR.

For the Vestas turbine (the turbine candidate with the maximum megawatt power rating at 7.2 MW), it is estimated that, 52,325 tonnes of CO_2eq per annum will be displaced for the

Proposed Development. and 1,831,375 tonnes of CO_2eq will be displaced over the proposed thirty five-year lifetime of the wind farm. By way of contrast, the Siemens Gamesa turbine (the turbine candidate with the minimum megawatt power rating at 6.6 MW) will displace 47,964 tonnes of CO2eq per annum or 1,678,740 tonnes CO_2eq over the 35 year lifetime of the wind farm.

All permutations within the range will therefore assist in realising the ambitious goals of the Climate Action Plan 2023. From an operational perspective, the proposed development will displace the emission of CO_2 from other less clean forms of energy generation and will assist Ireland in meeting its renewable energy targets and obligations. The burning of fossil fuels for energy creates greenhouse gases, which contributes significantly to climate change. These and other emissions also create acid rain and air pollution.

The carbon payback time for the manufacture, construction, and decommissioning phases (including carbon losses from soil, felling of forestry etc.) of the Proposed Development is estimated within the range of 0.8 years for a turbine with the maximum MW power rating of 7.2 (Vestas) and within the range of 0.9 years for a turbine with the minimum MW power rating of 6.6 (Siemens Gamesa) (see Technical Appendix 6.1 found in Volume III of this EIAR). Should further restoration measures be put in place, the total carbon emissions and carbon payback time would be reduced.

The carbon calculator was created to calculate carbon loss from acid bog and fen habitats and the Proposed Development site does not meet the 0.5 m depth of peat required for it to be categorised as peatland. Also, the site has been cultivated and drained in the past and is mainly covered in conifer plantation which will have resulted in much of the carbon content of the peat being lost. The site does not function as acid bog or fen habitat and therefore does not contain the same high levels of carbon.

In addition, the calculator only considers the loss of forestry on site from felling (carbon release) and the loss of forestry growth (carbon sequestration) on site for the lifetime of the Proposed Development and does not consider the replanting of forestry outside of the site (there is no option of including external replant lands). Therefore, the carbon loss calculations for the Proposed Development are slightly overestimated. Carbon calculations are shown in **Table 6-40**.

Table 6-40 Carbon Balance Results[25]

Wind Turbine CO_2eq	**Vestas 162 (Maximum MW Power Rating of 7.2 MW)**
Ratio of CO_2 eq. emissions to power generation (g/kWh) (for info. only)	Exp.
	21.69
Total CO_2 losses due to wind farm (t CO_2 eq.)	Exp.
2. Losses due to turbine life (e.g., manufacture, construction, decommissioning)	83,273
3. Losses due to backup	61,987
4. Losses due to reduced carbon fixing potential	171
5. Losses from soil organic matter	34,860
6. Losses due to DOC & POC leaching	0

25 https://informatics.sepa.org.uk/CarbonCalculator/

Wind Turbine CO_2eq	Vestas 162 (Maximum MW Power Rating of 7.2 MW)
7. Losses due to felling forestry	25,115
Total losses of carbon dioxide	205,406
Windfarm CO_2 emission saving over...	Exp.
...coal-fired electricity generation (t CO_2 / yr)	271,120
...grid-mix of electricity generation (t CO_2 / yr)	52,325
...fossil fuel-mix of electricity generation (t CO_2 / yr)	116,890
Energy output from windfarm over lifetime (MWh)	9,470,261
Results	Exp.
Net emissions of carbon dioxide (t CO_2 eq.)	205,406
Carbon Payback Time	Exp.
...coal-fired electricity generation (years)	0.8
...grid-mix of electricity generation (years)	3.9
...fossil fuel-mix of electricity generation (years)	1.8

6.5.3 Mitigation Measures

It is considered that the proposed development will have an overall positive impact in terms of carbon reduction and climate change. It will assist Ireland in meeting the new binding renewable energy target for the EU of 32% by 2030. Also, it will aid in increasing the onshore wind capacity, as per the Climate Action Plan 2023. In terms of renewable energy, an increase in electricity generated from renewable sources is to increase to 80% by 2030, with up to 9 GW of increased onshore wind capacity. This will be achieved by:

- Phasing out fossil fuels
- Harnessing renewable energy
- Micro-generation; and
- Other measures.

As set out in the Climate Action Plan 2023, in terms of harnessing renewable energy, the volumes and frequencies of RESS will increase, so that the 80% target is met. The measures required to achieve this include finalising RESS, establishing a Community Framework to accompany RESS, begin the qualification process for the RESS 1 Auction and to finalise the design and implementation of RESS 2 and RESS 3.

As no significant impacts on climate are predicted during construction, no mitigation measures are proposed. In terms of the operational phase, the operation of the proposed development will have a positive effect on climate due to the displacement of fossil fuels.

6.5.4 Residual Impacts

There will be residual positive impacts from the operation of the proposed development in terms of the displacement of fossil fuel energy generation with renewable energy.

The potential impacts of the Proposed Development on climate were assessed. At the microclimate level, the Proposed Development encompasses approximately 3% of the entire site area with hardstanding surfaces (hardstanding, access tracks, structures). The assessment found that a 3% increase in hardstanding would not negatively impact the

vegetation necessary to maintain a microclimate. In terms of macroclimate, it is estimated that an annual average output for the proposed development will result in the net displacement of 5,868 tonnes of CO_2eq per annum for the turbine with an individual power rating of 7.2 MW (i.e. the highest MW output in the range, Vestas), and 5,512 tonnes of CO_2eq per annum from a turbine with an individual power rating of 6.6 MW (i.e. the lowest MW output in the range, Siemens Gamasa). This results in a positive impact by removing the GHG emissions that would have otherwise been part of the output of traditional energy manufacturing (i.e., biomass, peat, etc). Potential impacts to climate can have the potential to affect human health and the environment. No direct or indirect impact on air temperature, microclimate or macroclimate has been associated with the development of the proposed development due to the location of the site which is predominately an upland commercial forestry location with the exception of existing public roadways and internal track ways.

There are no potential direct or indirect impacts on air temperature, microclimate and macroclimate associated with the proposed cable route. Due to the nature of construction along the proposed cable route which works as a "rolling" construction site, no works will be concentrated in any one area of the route. Therefore, the construction phase of the Coolglass Wind Farm will not have a significant impact on climate.

Should the Proposed Development not be developed, fossil fuel power stations will be the primary alternative to provide the required quantities of electricity. This will further contribute to greenhouse gas and other air pollutant emissions, as well as hindering Ireland in its commitment to meet its target to increase electricity production from renewable sources and to reduce greenhouse gas emissions.

It is therefore considered that there will be no residual impacts on climate because of the development of the Proposed Development.

6.6 Do-Nothing Scenario

If the Proposed Development does not proceed, local air quality and the microclimate will remain unchanged. On a national scale, there will be an increase in greenhouse gas emissions if increasing future electricity needs are not met by alternative renewable sources which has the potential to contribute to air pollution and climate change. The opportunity to contribute to Ireland's commitments under the Kyoto Protocol and to meet national targets as set out in the Climate Action Plan would also be lost.

6.7 Cumulative Impacts

In terms of cumulative impacts, negative cumulative impacts in relation to air quality would only occur if a large development was located in the vicinity of the Proposed Development site and was in the process of construction at the same time. There are many existing and approved projects and developments in the planning system within the vicinity of the Proposed Development site including housing developments, agricultural developments mainly. These developments are small in nature and will not act cumulatively with the Proposed Development.

There are several large scale and renewable energy projects within 20 km of the Proposed Development, the closest of these are:

- Michael Johnson - restoration of existing quarry to agricultural grassland and to include the importation of inert soil and stones (EWC class 17 05 04) at a rate of 15,000 tonnes per year to facilitate same development and associated site works.

- Bilboa Wind Farm - installation of approximately 4.6 ('km') of underground cables within Carlow County Council ('CCC') boundary and approximately 2.0 km within Laois County Council ('LCC') boundary with a voltage of up to 38 kilovolts and associated works, including a new substation with LCC, for the connection of the consented Bilboa Wind Farm (Planning Register References: Carlow County Council 11/154; An Bord Pleanala PL 01.240245) to the national electricity grid; upgrading of an existing forestry track within CCC; construction of two new onsite access track within CCC; re-orientation and increasing in size of a crane hardstanding area within CCC; and road strengthening and widening along an updated turbine delivery route, within LCC, pursuant to the consented Bilboa Wind Farm (Planning Register References: Carlow County Council 11/154; An Bord Pleanala PL 01.240245). The application is accompanied by a Planning Report, Environmental Impact Assessment Report, and a Natura Impact Statement. Townland: Boolyvannanan and Coolnakisha, Bilboa, County Carlow. (Bilboa Wind Farm).
- Bord Na Móna Powergen Ltd. - Develop a Renewable Gas Facility, associated peat deposition area and external and internal road upgrades at Cúil Na Móna Bog within the townland of Clonboyne and Clonkeen, Portlaoise, Co. Laois. The total area of the Proposed Development is 17.34 ha and consists of the following elements: 1. Renewable Gas Facility (6.85 ha) including the following: Weighbridge and Weighbridge Office – 21 m^2 in area 4.45 m high, Administration Building 228 m^2 in area 5.1 m high, Reception Building 2,700 m^2 in area 11.75 m high, Odour Abatement unit 400 m^2 in area stack height 18 m, Tank Farm - 2 no. primary digestion tanks (6,500 m^3) 22 m high; 2 no. secondary digestion tanks (5,650 m^3) 17.2 m high; 2 no. buffer storage (450 m^3) 6 m high; 4 no. liquid feed intake tanks (100 m^3) 12 m high; 2 no. process water tanks (30 m^3) 7.5 m high; 4 no. pasteurisation tanks (30 m^3) 7.5 m high, Gas Upgrade and Injection Plant 1,278 m^2, Covered Digestate lagoon 55,100 m^3 capacity, Surface Water Attenuation pond 20 m x 30 m, Wastewater below ground holding tank 10 m^3 capacity, Palisade site fencing 2.4 m high, 1,420 m in length, On-site electrical sub-station up to 22 m^2, Circulation yard area 3,500 m^2 incl. 28 no. car parking spaces. 2. Peat deposition and surrounding area (9.13 ha) 3. External road upgrades including proposed new roundabout, upgrade of R445 and local access road to existing site entrance – 660 m in length (0.91 ha) 4. Internal upgrade of site access road – 443 m in length (0.45 ha). Permission is sought for a period of 10 years and is a development that is for the purpose of an activity requiring an Industrial Emission Licence from the EPA. An Environmental Impact Assessment Report (EIAR) and Natura Impact Statement (NIS) has been prepared and accompanies this planning application.
- Lagan Materials Limited (Spink Quarry) -Develop as follows: the continued use and operation of the existing quarry including deepening of the quarry. Extraction will be confined to the existing permitted quarry area (P.A. Ref. 10/383) comprising an extraction area of c. 14.5 ha within an overall application area of c. 19.6 ha. The development will include provision of new site infrastructure, including portacabin site office / canteen, toilets, concrete batching plant and truck washdown facility, hydrocarbon interceptors, mobile crushing and screening plant, upgrading of the water management system, provision of holding tank for wastewater, and other ancillaries. The Proposed Development will utilise/upgrade the existing in-situ quarry infrastructure, including site access, internal roads, storeroom, wheel wash, weighbridge, aggregate storage bays, refuelling hard stand, water settlement pond system, and other ancillaries. The planning application will be accompanied by an

Environmental Impact Assessment Report (EIAR) and a Natura Impact Statement (NIS). Address: Knockbaun, Spink, Co. Laois.

- Pinewood Wind Limited -11 wind turbines, electricity substation, switch room, equipment compound, site access tracks, 7 site entrances, meteorological mast, upgrade of road junction. Townlands: Knockardugar, Boleybawn, Garrintaggart, Ironmills, Co. Laois
- Pinewood Wind Limited – A 110 kv 'loop in/loop-out' Air-Insulated Switchgear substation, electricity lines, on-site access tracks and all associated site development works. Townlands: Knockardagur, Ballinakill, County Laois
- Pinewood Wind Limited - site access tracks, underground electricity and communications cabling and site drainage works. Townlands: Lands at Crutt, County Kilkenny.

Cumulative impacts may arise if the construction, operational, maintenance or decommissioning period of these projects occurs simultaneously with the construction of the Proposed Development. This could result in slight increased traffic emissions, however, provided the mitigation measures are implemented and the mitigation measures proposed for other developments are implemented, there will be no significant cumulative effects on air quality.

There will be no net carbon dioxide (CO_2) emissions from operation of the Proposed Development. Emissions of carbon dioxide (CO_2), oxides of nitrogen (NOx), sulphur dioxide (SO_2) or dust emissions during the operational phase of the proposed development will be minimal, relating to the use of operation and maintenance vehicles onsite, and therefore there will be no measurable negative cumulative effect with other developments on air quality and climate.

The nature of the proposed development and other energy developments within 20 kilometres are such that, once operational, they will have a cumulative long-term, significant, positive effect on the air quality and climate.

In terms of climate and carbon, the Proposed Development will act cumulatively with other renewable energy projects in reducing CO_2 emissions by displacing fossil fuel in the production of electricity, resulting in a slight moderate positive impact on climate.

6.8 Unplanned Events (Accidents)

Accidents, malfunctions, and unplanned events refer to events or upset conditions that are not part of any activity or normal operation of the Proposed Development planned by the Applicant. Even with the best planning and the implementation of preventative measures, the potential exists for accidents, malfunctions or unplanned events to occur during the proposed construction, operation and decommissioning activities.

Many accidents, malfunctions and unplanned events are, however, preventable and can be readily addressed or prevented by good planning, design, emergency response planning, and mitigation. In terms of air quality impact, the following unplanned events could influence the local area:

- equipment malfunction;
- vehicle collision;
- dry and windy weather conditions with loose material on road surface available for re-suspension and track out during vehicle movement;

- accidental material spillages during transport.

In relation to air quality, the impacts of any unplanned events are considered to be negligible. If unplanned events were not mitigated, the effects of dust during dry and windy conditions could possibly lead to occasional increases in nuisance dust and 24-hour mean PM_{10} concentration immediately surrounding the construction and decommissioning area. However, these are not considered to be significant given the limited duration of such meteorological conditions and the likely limited scale of any incident.

6.9 References

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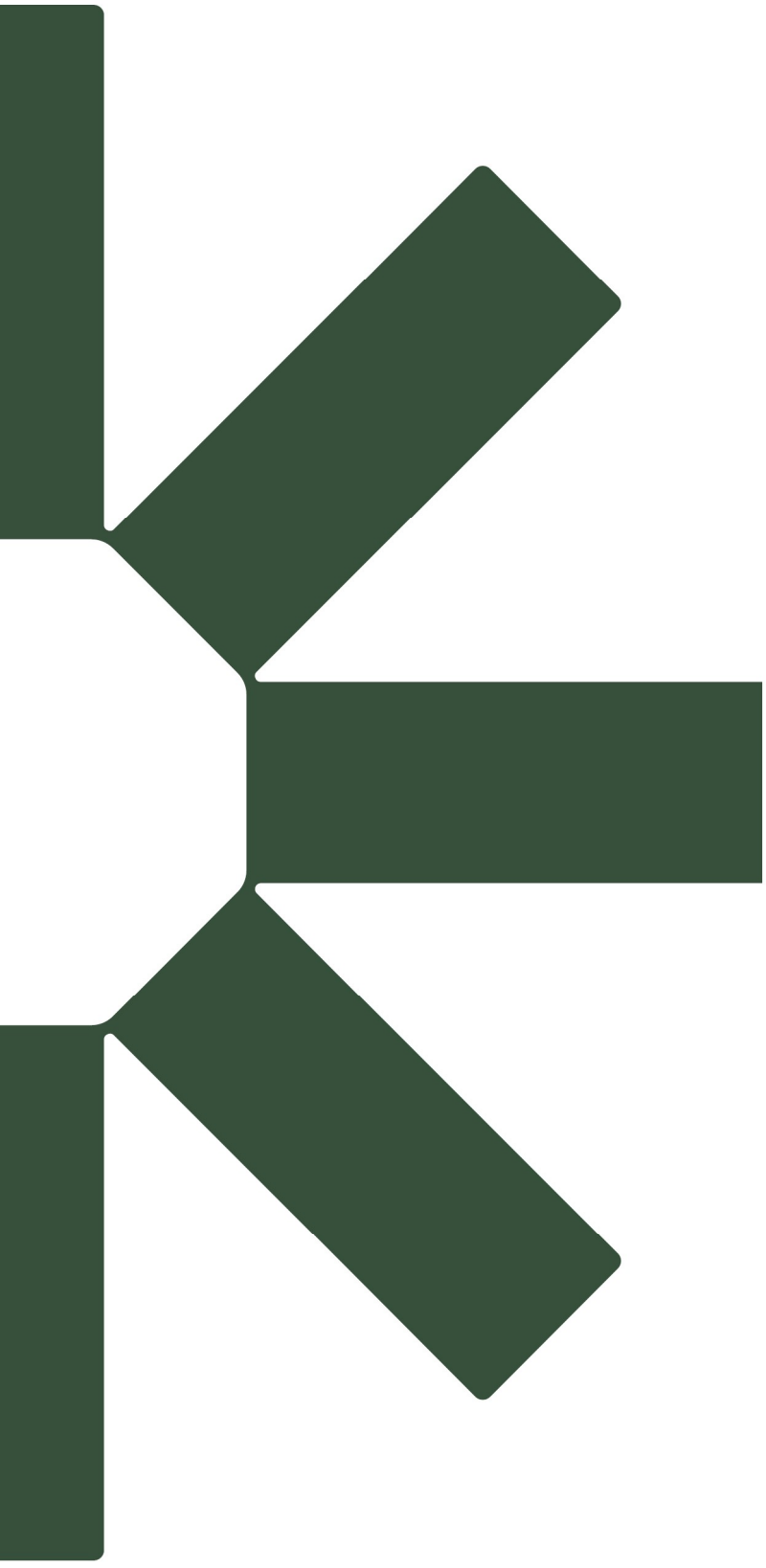

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