13 AIR QUALITY AND CLIMATE

13.1 INTRODUCTION

This chapter assesses the effects of the Garrane Green Energy Project (the Project) (**Figure 1.2**) on air and on climate in **Section 13.2** and **13.3** respectively. The Project refers to all elements of the application for the construction of Garrane Green Energy Project (**Chapter 2: Project Description**). Where adverse effects are predicted, the chapter identifies appropriate mitigation strategies therein. The assessment considers the potential effects during the following phases of the Project:

- Construction of the Project
- Operation of the Project
- Decommissioning of the Project

Common acronyms used throughout this EIAR can be found in **Appendix 1.4.** This chapter of the EIAR is supported by Figures provided in Volume III and by the following Appendix documents provided in Volume IV of this EIAR:

- **Appendix 13.1 Scottish Government – Carbon Calculator Input and Output Data**

13.1.1 Statement of Authority

Jennings O'Donovan & Partners Ltd. (JOD) have extensive experience in all aspects of wind farm development, from design and planning stages through to construction. JOD have been active as engineering consultants in the wind energy market in Ireland since 1998 and have completed numerous wind farm projects, varying from single wind turbine installations to large-scale, multi-turbine developments with a total of over 2,000 MW generation capacity

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13.1.2 Background and Objectives

Air quality in Ireland is generally of a high standard across the country and is amongst the best in Europe; however, levels of some pollutants remain of concern, with those produced by traffic approaching limit values in urban areas. The combustion of fossil fuels for energy results in the release of several gases which contribute to climate change and acid rain, including carbon dioxide (CO_2), sulphur dioxide (SO_2), nitrogen oxides (NOx), and Particulate Matter (PM_{10} and $PM_{2.5}$).

The factors that indicate climate change are well established in Ireland, with increased air temperatures, sea level rises and changes in precipitation patterns. In 2005, greenhouse gas emissions data estimated that Ireland was 25.4 % above 1990 levels. Emissions data from 2007 show that Ireland was 24.6 % above the level for 1990 (the base year for Kyoto targets). By 2013, total emission levels in Ireland had dropped back almost to 1990 levels, largely as a result of the economic downturn, with indications that individual households had reduced their emissions (EPA, 2014)[1]. However latest EPA greenhouse gas emissions projections indicate an overall increase in greenhouse gas emissions from most sectors. The projected growth in emissions is largely underpinned by projected strong economic growth and relatively low fuel prices leading to increasing energy demand over the period[2]. The EU Commission has also imposed targets on Ireland's emissions. 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. 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 2023 Effort Sharing Regulation annual limit, exceeding the allocation by 2.27 Mt CO_2eq after using the ETS flexibility[3].

[1] Environmental Protection Agency "Air Quality in Ireland 2014 - Key Indicators of Ambient Air Quality" Available at: https://www.epa.ie/publications/monitoring--assessment/air/air-quality-in-ireland-2014.php [Accessed 09/06/2025]
[2] Environmental Protection Agency "Ireland's Greenhouse Gas Emissions Projections 2017-2035 Available at: https://www.epa.ie/publications/monitoring--assessment/climate-change/air-emissions/EPA_2018_GHG_Emissions_Projections_Summary_Report.pdf [Accessed: 09/06/2025]
[3] Environmental Protection Agency "Latest emissions data (2023)
Available at: https://www.epa.ie/our-services/monitoring--assessment/climate-change/ghg/latest-emissions-data/
[Accessed: 09/06/2025]

This chapter assesses the following as per the EIA Directive:

- The air quality environment of the area of the Proposed Project site and the potential effects on air quality during the construction, operation and decommissioning phases of the Project. This assessment includes mitigation measures, residual effects and cumulative impacts of the Project.
- The climatic environment of the area of the Proposed Project site and the potential effects on climate through GHG emissions during the construction, operation and decommissioning phases of the Project. This assessment includes mitigation measures, residual effects and cumulative impacts of the Project.

13.1.3 Relevant Legislation and Guidance

- The Ambient Air Quality and Cleaner air for Europe (recast) Directive 2024/2881
- The Clean Air for Europe (CAFE) Directive, as amended by Commission Directive (EU) 2015/1480, as amended (the "**CAFE Directive**")
- The Ambient Air Quality Standard Regulations 2022 (S.I. No. 739/2022)
- Guidelines on the Information to be contained in Environmental Impact Assessment Reports – June 2022 (EPA, 2022).
- Environmental Protection Agency (2024) Air Quality in Ireland Report 2023
- WHO global air quality guidelines (2021) Particulate matter (PM2.5 and PM 10), ozone, nitrogen dioxide, sulphur dioxide and carbon monoxide https://www.who.int/publications/i/item/9789240034228
- IAQM (2024) Guidance on the assessment of dust from demolition and construction, version 2.2
- IAQM (2016) Guidance on the Assessment of Mineral Dust Impacts for Planning, Institute of Air Quality Management. 2016.
- Government of Ireland (2023) Clean Air Strategy for Ireland https://www.gov.ie/pdf/?file=https://assets.gov.ie/255392/efe212df-d9a7-4831-a887-bea2703e2c64.pdf
- Limerick Climate Action Plan (2024 - 2029) - LCAP 2024-2029
- Limerick County Development Plan (2022 -2028) – LCDP 2022-2028
- Air Quality Assessment of Specified Infrastructure Projects – PE-ENV-01106 (TII, 2022a)
- Limerick Biodiversity Action Plan 2025-2030

13.1.4 Assessment Structure

In line with the revised EIA Directive and current EPA guidelines listed in **Chapter 1: Introduction**, **Section 1.6** the structure of this Air and Climate chapter is as follows:

- Assessment Methodology and Significance Criteria
- Description of baseline conditions at the Site
- Do Nothing Impact Assess
- Identification and assessment of effects to air and climate associated with the Project, during the construction, operational and decommissioning phases of the Project
- Mitigation measures to avoid or reduce the effects identified
- Identification and assessment of residual effects of the Project considering mitigation measures
- Identification and assessment of cumulative effects if and where applicable
- Conclusion as to likely significant effects of the Development on Air Quality and Climate.

The desktop study as outlined in **Section 13.2** and **Section 13.3**, together with the other assessments detailed in this chapter, and related assessments within this EIAR, provide the planning authority with sufficient details regards Air Quality and Climate assessment for the Project.

There are 166 sensitive receptors within 2km of the proposed turbines. This includes 3 No. commercial properties, 6 No. derelict houses and 157 No. residential receptors of which 5 No. are involved in the Project (**Figure 1.3**), mostly along existing public roads . For general dust and exhaust emissions, receptors situated within 1km of the Wind Farm Site infrastructure are defined as sensitive receptors this is a conservative approach based on professional judgement. There are 33 sensitive receptors within 1km of Wind Farm Site infrastructure. Users of the public roads within the vicinity of the Project are also considered as sensitive receptors.

For nuisance dust (larger dust particles) receptors situated within 250m the Wind Farm Site infrastructure are defined as sensitive receptors based on IAQM 2024. There are no sensitive receptors within 250m of Wind Farm Site infrastructure.

13.2 AIR QUALITY

13.2.1 Assessment Methodology and Significant Criteria

In this section, a description of the methods employed for each part of the assessment are outlined. The methodology complies with guidance and best practice.

The following data and reports were employed to assess the baseline Air Quality and Climate:

- Ambient air quality limits set out in the Ambient Air Quality Recast Directive 2024/2881
- Air quality limit values of CAFE Directive 2008/50/EC is compared with the recorded local and national emission values for year 2022
- Review of relevant WHO and EPA Air Quality reports
- Review of Air Quality Zones in Ireland
- A review of the contributors to the local air quality conditions
- A review of local and national climate conditions

This following tool was employed to assess Climate effect of the Project:

- Carbon calculator for wind farms[4], developed under the guidance of the Scottish Government, Scottish Environment Protection Agency (SEPA), Scottish Natural Heritage (SNH) and Forestry Research. The tool's purpose is to assess, in a comprehensive and consistent way, the carbon impact of wind farm developments.

Do Nothing Impact Assessment: This section outlines the impact if the Proposed Project were not to go ahead and the likely evolution thereof without the Proposed Project as far as natural changes from the baseline scenario.

Significance of effects: The significance of effects resulting from the Project is determined through consideration of a combination of the sensitivity of the receiving environment and the predicted level of change from the baseline state, as outlined in **Chapter 1: Introduction**, **Table 1.5** and **Table 1.6**. Where adverse effects are predicted, appropriate mitigation approaches are identified.

Mitigation measures: The mitigation hierarchy approach, as outlined in Chapter 1 of Avoidance, Reduction/ Elimination and Remedy aims to avoid significant impact through embedded mitigation (avoidance), and where avoidance is not possible, through mitigation measures. Remedy, the lowest rung of the mitigation hierarchy is only considered where mitigation measures are not feasible or possible.

Cumulative Assessment: Other large developments (operational and in the planning process) within a 20km radius of the Project are shown in **Chapter 2: Project Description – Table 2.1**, in conjunction with the Project, are assessed to determine the potential cumulative effects on Air Quality and Climate. The study area for cumulative assessment is

[4] SEPA, 2023, Carbon calculator for wind farms, Available at: https://informatics.sepa.org.uk/CarbonCalculator/ [Accessed 09/06/2025]

consistent with the EPA "Guidelines on the information to be contained in environmental impact assessment reports" (2022) and best practice.

13.2.2 Air Quality Standards

The new Directive, recasting Directives 2004/107/EC4 and 2008/50/EC, prioritises the health of EU citizens. It sets new air quality standards for pollutants to be reached by 2030 which are more closely aligned with the WHO air quality guidelines. It will also ensure early action, with air quality roadmaps that need to be prepared ahead of 2030 if there is a risk that the new standards will not be attained by that date.

This directive entered into force on December 10, 2024 and has to be implemented in national regulation on December 11, 2026 at the latest. **Table 13.1** outlines the limit values and target dates set out in the Ambient Air Quality Recast Directive.

Table 13.1: Limit values of Ambient Air Quality Recast Directive 2024/2881

Pollutant	Limit Value Objective	Averaging Period	Limit Value (µg/m^3) Attained by 11/12/2026	Basis of Application of Limit Value	Limit Value (µg/m^3) Attained by 01/01/2030	Basis of Application of Limit Value
$PM_{2.5}$	Protection of Human Health	1 day	na	na	25	not to be exceeded more than 18 times per calendar year
		Calendar year	25	na	10	na
PM_{10}	Protection of Human Health	1 day	50	not to be exceeded more than 35 times per calendar year	45	not to be exceeded more than 18 times per calendar year
		Calendar year	40	na	20	na
Nitrogen dioxide (NO_2)	Protection of Human Health	1 hour	200	not to be exceeded more than 18 times per	200	not to be exceeded more than 3 times per calendar year

Pollutant	Limit Value Objective	Averaging Period	Limit Value (µg/m^3) Attained by 11/12/2026	Basis of Application of Limit Value	Limit Value (µg/m^3) Attained by 01/01/2030	Basis of Application of Limit Value
				calendar year		
		1 day	na	na	50	not to be exceeded more than 18 times per calendar year
		Calendar year	40	na	20	na
Sulphur dioxide (SO_2)	Protection of Human Health	1 hour	350	not to be exceeded more than 24 times per calendar year	350	not to be exceeded more than 3 times per calendar year
		1 day	125	not to be exceeded more than 3 times per calendar year	50	not to be exceeded more than 18 times per calendar year
		Calendar year	na	na	20	na
Benzene	Protection of Human Health	Calendar year	5	na	3.4	na
Carbon monoxide (CO)	Protection of Human Health	Maximum daily 8-hour mean	10,000		10,000	na
		1 day	na	4,000	na	not to be exceeded more than 18 times per calendar year

Pollutant	Limit Value Objective	Averaging Period	Limit Value (μg/m^3) Attained by 11/12/2026	Basis of Application of Limit Value	Limit Value (μg/m^3) Attained by 01/01/2030	Basis of Application of Limit Value
Lead (Pb)	Protection of Human Health	Calendar year	0.5	na	na	na

The limit values of the CAFE Directive are set out in **Table 13.2**. Limit values are presented in micrograms per cubic metre (μg/m^3) and parts per billion (ppb). The notation PM_{10} is used to describe particulate matter or particles of ten micrometres or less in aerodynamic diameter. $PM_{2.5}$ represents particles measuring less than 2.5 micrometres in aerodynamic diameter.

Table 13.2: Limit values of CAFE Directive 2008/50/EC (Source: EPA 11/11/2023)

Pollutant	Limit Value Objective	Averaging Period	Limit Value (μg/m^3)	Limit Value (ppb)	Basis of Application of Limit Value
Sulphur Dioxide (SO_2)	Protection of human health	1 hour	350	132	Not to be exceeded more than 24 times in a calendar year
Sulphur Dioxide (SO_2)	Protection of human health	24 hours	125	47	Not to be exceeded more than 3 times in a calendar year
Sulphur Dioxide (SO_2)	Protection of vegetation	Calendar Year	20	7.5	Annual mean
Sulphur Dioxide (SO_2)	Protection of vegetation	1 Oct to 31 Mar	20	7.5	Winter mean
Nitrogen dioxide (NO_2)	Protection of human health	1 hour	200	105	Not to be exceeded more than 18 times in a calendar year
Nitrogen dioxide (NO_2)	Protection of human health	Calendar Year	40	21	Annual mean

Pollutant	Limit Value Objective	Averaging Period	Limit Value (µg/m³)	Limit Value (ppb)	Basis of Application of Limit Value
Nitric oxide (NO) + Nitrogen dioxide (NO_2)	Protection of ecosystems	Calendar Year	30	16	Annual mean
PM_{10}	Protection of human health	24 hours	50	-	Not to be exceeded more than 35 times in a calendar year
PM_{10}	Protection of human health	Calendar Year	40	-	Annual mean
$PM_{2.5}$ - Stage 1	Protection of human health	Calendar Year	25	-	Annual mean
$PM_{2.5}$ - Stage 2	Protection of human health	Calendar year	20	-	Annual mean
Lead (Pb)	Protection of human health	Calendar year	0.5	-	Annual mean
Carbon Monoxide (CO)	Protection of human health	8 hours	10,000	8620	Not to be exceeded
Benzene (C_6H_6)	Protection of human health	Calendar year	5	1.5	Annual mean

Table 13.3 presents the limit and target values for ozone as per the Ambient Air Quality and Cleaner Air for Europe (CAFE) Directive (2008/50/EC).

Table 13.3: Target values for Ozone Defined in Directive 2008/50/EC

Objective	Parameter	Target Value from 2010	Target Value from 2020 onwards
Protection of human health	Maximum daily 8- hour mean	120 µg /m³ not to be exceeded more than 25 days per	120 µg /m³

Objective	Parameter	Target Value from 2010	Target Value from 2020 onwards
		calendar year averaged over 3 years	
Protection of vegetation	*AOT_{40} calculated from 1 hour values from May to July	18,000 µg /m^3 h^{-1} averaged over 5 years	6,000 µg /m^3 h^{-1}
Information Threshold	1-hour average	180 µg /m^3	180 µg /m^3
Alert Threshold	1-hour average	240 µg /m^3	240 µg /m^3

*AOT_{40} is a measure of the overall exposure of plants to ozone. It is the sum of the excess hourly concentrations greater than 80 µg/m^3 and is expressed as µg/m^3 hours.

13.2.3 Air Quality & Health

Environmental Protection Agency (EPA, 2020)[5], European Environmental Protection Agency (EEA, 2024)[6] and World Health Organisation (WHO, 2014) reports estimate that poor air quality accounted for premature deaths of approximately 600,000 people in Europe in 2012, with 1,300 Irish deaths predominantly due to fine particulate matter ($PM_{2.5}$) in 2020 and 30 Irish deaths attributable to Ozone (O_3) in 2016[9&10]. Air pollution concentration in 2021 remained well above the levels recommend by the World Health Organization (WHO). The most recent EEA study (2024) of air pollution across Europe has shown in 2022, European citizens remained exposed to air pollutant concentrations that were considerably above the levels recommended by the World Health Organization (WHO). Reducing air pollution to these WHO guideline levels would prevent a significant number of annual deaths in EU Member States (EU-27): 239,000 from exposure to fine particulate matter ($PM_{2.5}$); 70,000 from exposure to ozone (O_3) and 48,000 from exposure to nitrogen dioxide (NO_2).

Air quality has greatly improved in Ireland over the last ten years and would be considered generally good. The most recent projections (2022) show Ireland is on track to meet the majority of its EU commitments for national emissions levels by 2030 and Ireland had only one exceedance of EU ambient air quality limit values since 2010. An exceedance of the

5 Ireland's Environment – An Integrated Assessment 2020, EPA, 2020 [Accessed 09/06/2025]
6 EEA (European Environment Agency), Harm to human health from air pollution in Europe: burden of disease status, 2024 (https://www.eea.europa.eu/en/analysis/publications/harm-to-human-health-from-air-pollution-2024) [Accessed 09/06/2025]
9 https://www.euro.who.int/en/health-topics/environment-and-health/air-quality/news/news/2014/03/almost-600-000-deaths-due-to-air-pollution-in-europe-new-who-global-report, [Accessed 09/06/2025]
10 Irelands Environment 2016 – An Assessment', EPA, 2016 [Accessed 09/06/2025]

EU ambient air quality limit value for NO_2 was recorded at a monitoring station in Dublin in 2019 (Clean Air Strategy, 2023). Ireland is committed to achieving climate neutrality no later than 2050, with a 51% reduction in GHG emissions by 2030 (Climate Action Plan, 2025).

Fine particulate matter, ozone, along with others including carbon dioxide (CO_2), nitrogen oxides (NO_x) and sulphur oxides (SO_x) are produced during the burning of fossil fuels for energy generation, transport or home heating. There are no such emissions associated with the operation of wind turbines. Therefore, wind turbines such as in the Project will result in lower environmental levels of such parameters, and consequential beneficial effects on human health.

13.2.4 Air Quality Zones

The EPA has designated four Air Quality Zones for Ireland:

- Zone A: Dublin City and environs
- Zone B: Cork City and environs
- Zone C: 16 urban areas with population greater than 15,000
- Zone D: Remainder of the country

These zones were defined to meet the criteria for air quality monitoring, assessment and management described in the CAFÉ Directive. The Project lies within Zone D, which represents rural areas located away from large population centres.

13.2.5 Existing Air Quality Conditions

13.2.5.1 Existing Air Quality Conditions in Ireland

Generally, Ireland is recognised as having some of the best air quality in Europe. However, from time to time, and under certain weather conditions, it is possible to experience some air pollution in the larger towns and cities. The most recent published report on air quality in Ireland is the 'Air Quality in Ireland 2023' report published by the EPA in 2024[11]. This report provides an overview of the ambient air quality in Ireland in 2023. It is based on monitoring data from 115 stations across Ireland. The measured concentrations are compared with both EU legislative standards and WHO air quality guidelines[13] for a range of air pollutants.

Results from the monitoring campaign across Ireland during 2023 show:

[11] EPA 2023, Air Quality in Ireland Report 2024, Available at: https://www.epa.ie/publications/monitoring--assessment/air/air-quality-in-ireland-2023.php [Accessed 09/06/2025]
[13] WHO global air quality guidelines: particulate matter (PM2.5 and PM10), ozone, nitrogen dioxide, sulphur dioxide and carbon monoxide https://www.who.int/publications/i/item/9789240034228 [Accessed 09/06/2025]

- No levels above the EU limit value (CAFÉ Directive) as shown in **Table 13.2** were recorded at any of the ambient air quality network monitoring sites in Ireland in 2023. WHO guideline values were exceeded at a number of monitoring sites for fine particulate matter ($PM_{2.5}$) and (PM_{10}), ozone (O_3), Nitrogen Dioxide (NO_2). WHO guideline values for Sulphur dioxide (SO_2) were exceeded at one monitoring station.

13.2.5.2 Existing local Air Quality Conditions

The closest monitoring site (National Network) to the Project within the same air quality zone is Mallow, Co. Cork. Mallow monitoring site is located 27.8km South-east of the Site. Results from the monitoring campaign during 2023 show:

- Mallow exceeded WHO 24-hour mean guideline (15µg/m^3 24-hour mean) for (PM2.5) on 8 occasions in 2023 and exceeded the annual mean (5µg/m^3) guideline with a mean of (6.1µg/m^3) for 2023. Mallow also exceed WHO guideline (50µg/m^3 24-hour mean) for (PM_{10}) on two occasions in 2023. Mallow did not exceed WHO guidelines for any other parameter in 2023.

The annual mean PM_{10} and $PM_{2.5}$ levels for Mallow were (10.5 µg/m^3) and (6.1 µg/m^3) respectively. These values are below the limit values set out by Directive 2008/50/EC as per **Table 13.2.**

13.2.6 Do Nothing Effect

If the Project was not to proceed, the opportunity to reduce emissions of carbon dioxide (CO_2), nitrogen oxides (NO_x), and sulphur dioxide (SO_2) to the atmosphere would be lost due to the continued dependence on electricity derived from coal, oil and gas-fired power stations, rather than renewable energy sources such as the Project. This would result in an indirect, adverse effect on air quality.

13.2.7 Potential Effects of the Project

13.2.7.1 Construction Phase

13.2.7.1.1 Dust Emissions

The main potential source of effects on air quality during construction is dust. There is potential for the generation of dust from excavations and from construction including construction of Site access tracks, turbine hardstands and the trenches for the cable ducting for the Grid Connection (GC).

The potential nuisance issues arising from this are dependent on the terrain, weather conditions, (i.e., dry and windy conditions), and the proximity of receptors. Dust from cement can cause ecological damage if allowed to migrate to water courses, however, ready-mix concrete will be used with no on-site batching taking place. Therefore, this will not be a potential source of emissions. Potentially dust generating activities are as follows:

- Earth moving and excavation plant and equipment for handling and storage of soils and subsoils.
- Transport and unloading of stone materials for Access Track construction.
- Rock that is suitable will be won on site or imported from a local quarry, turbine foundation areas and the Substation and this will be used in the construction of Access Tracks and turbine hardstands.
- Vehicle movements over dry surfaces such as Access Tracks and public roads.

The potential effect from dust becoming friable and a nuisance to workers and local road users, if unmitigated, is considered, a slight, adverse, short-term, direct effect during the construction phase based on the UK IAQM 2024 guidance which is considered best practice in Ireland. There is no likely significant effects from dust.

Friable dust cannot remain airborne for a very long time. The distance it can travel depends on the particle sizes, disturbance activities and weather conditions. Larger dust particles tend to travel shorter distances than smaller particles. Particle sizes greater than 30μm will generally deposit within approximately 100m of its source, while particles between 10-30μm travel up to approximately 250-500m and particle sizes of less than 10μm can travel up to approximately 1km [15].

Generally, (depending on the conditions outlined), dust disturbance is most likely to occur at sensitive receptors within approximately 250m of the source of the dust, IAQM (2024). It is considered that the principal sites of friable dust generation will be the Turbine Foundations, Hardstands, and also along new site access tracks. The closest inhabited dwelling not involved in the Project is (H33) located 702m from the nearest turbine (T8). The closest dwelling involved in the Project is H28 located 529m from T3. Therefore, these principal source sites of dust generation are greater than 250m distance from these sensitive receptors. In addition, vegetation such as trees and hedgerows in the vicinity will help to mitigate any airborne dust migrating off the Site. Any effects of dust on vegetation will be confined to the construction and possibly the Decommissioning phases and be temporary, slight, adverse and not a significant effect.

[15]Department of the Environment, Transport and the Regions (DETR) (2000a) Controlling and mitigating the environmental effects of minerals extraction in England. Mineral Planning Guidance Note 11, consultation paper. DETR, London. Cited in Technical Guidance Document (Monitoring) M17 – Environment Agency March 2004

If unmitigated, there would also be dust deposition arising from mud on public roads, resulting from traffic leaving the construction Site. Effects from dust deposition at sensitive receptors would give rise to disturbance issues for residents of those properties. The effect would be short-term, slight adverse and not significant on sensitive receptors. There is no likely significant effect of dust emissions during the construction, operation and decommissioning phases.

13.2.7.1.2 Exhaust Emissions

Emissions from plant and machinery, including trucks, during the construction of the Project are a potential effect. The engines of these machines produce emissions such as carbon dioxide (CO_2), carbon monoxide (CO), nitrogen oxides (NO_x), and particulate matter (PM_{10} and $PM_{2.5}$).

Particulate matter ("PM") less than ten micrometres in size (PM_{10}) can penetrate deep into the respiratory system increasing the risk of respiratory and cardiovascular disorders. PM_{10} arises from direct emissions of primary particulate such as black smoke and formation of secondary particulate matter in the atmosphere by reactions of gases such as sulphur dioxide (SO_2) and ammonia (NH_3). The main sources of primary PM_{10} are incomplete burning of fossil fuels such as coal, oil and peat and emissions from road traffic, in particular diesel engines. Other sources of particulates include re-suspended dust from roads. Natural particulate matter includes sea-salt and organic materials such as pollens.

Nitrogen oxides (NO_x), include the two pollutants, nitric oxide (NO) and nitrogen dioxide (NO_2). Anthropogenic (human) activities such as power-generation plants and motor vehicles are the principal sources of nitrogen oxides through high temperature combustion. Nitrogen oxides are an important air pollutant by themselves but can also react in the atmosphere to contribute to the formation of tropospheric ozone (ozone in the air we breathe) and acid rain. Short-term exposure to nitrogen dioxide is associated with reduced lung function and airway responsiveness, and increased reactivity to natural allergens. Long-term exposure is associated with increased risk of respiratory infection in children.

The construction phase is likely to result in an increase in exhaust emissions from construction vehicles and transport vehicles associated with the site works. The impact on air quality from an increase in exhaust emissions will be a short-term, slight adverse and not significant effect. There will be no likely significant effects on air quality from an increase in exhaust emissions during the construction phase.

13.2.7.2 Operational Phase

13.2.7.2.1 Dust Emissions

There will be a small number of light vehicles accessing the Site during the operational phase. This could lead to some localised dust being generated, though this will be small and sporadic as only approximately one to two site visits per week will occur at the Project. In the unlikely event that a turbine or elements of a turbine need to be replaced during the lifetime of the wind farm, there would be significantly less traffic than during the initial construction phase. There would only be one turbine delivered, compared to nine No. turbines and the Site access tracks and other Site infrastructure will already have been established. Therefore, the operational phase will have an imperceptible, adverse, long-term and not significant effect on dust effects.

13.2.7.2.2 Exhaust Emissions

As there is expected to be only a small number of light vehicles accessing the Site during the operational phase, the operational phase will have an imperceptible, adverse, long-term and not significant effect on exhaust emissions.

13.2.7.3 Decommissioning Phase

13.2.7.3.1 Dust Emissions

Effects during the decommissioning phase of the Project are anticipated to be less than those arising during the construction phase. The Site Access Tracks will remain in place to serve agriculture activity, and the turbine hardstands will be reduced in level to the same level as the surrounding area and allowed to revegetate into the surrounding habitat. The turbines being removed from Site for recycling/reconditioning. The turbine blades can be cut into manageable lengths on decommissioning and hauled off site. The decommissioning phase is expected to last approximately 12-24 weeks.

As Site access tracks and other site infrastructure will be left in place, and dust generation will be limited to that generated from a low volume of HGV traffic, the decommissioning phase will have a not significant, adverse and temporary effect on dust effects.

13.2.7.3.2 Exhaust Emissions

The exhaust emissions associated with the low volume of HGV traffic during the decommissioning phase will have a not significant, adverse and temporary effect on exhaust emissions.

13.2.8 Mitigation Measures and Residual Effects

13.2.8.1 Construction Phase Mitigation

The main potential effect during the construction phase of the proposed Project will be from dust nuisance at sensitive receptors close to the Site. Good practice construction procedures will be followed by the appointed contractor to prevent dirt and dust being transported onto the local road network and all mitigation measures outlined in the CEMP (**Appendix 2.1**) will be implemented on site. Good practice site control measures will comprise the following:

- Site access tracks will be upgraded and built in the initial construction phases. These tracks will be finished with graded aggregate which compacts, preventing dust.
- Approach roads and construction areas will be cleaned on a regular basis to prevent build-up of mud and prevent it from migrating around the Site and onto the public road network.
- Wheel wash facilities will be provided near the Site entrance to prevent mud/dirt being transferred from the site to the public road network (Drawing No. **6839-JOD-GGE-XX-DR-C-0803**). The Wheel wash will be located outside the 50m watercourse buffer zone.
- Public roads along the construction haul routes will be inspected and cleaned daily. In the unlikely event that dirt/mud is identified on public roads, the roads will be cleaned. The wheel wash facility will be investigated and the problem fixed to prevent this from happening again.
- During periods of dry and windy weather, there is potential for dust to become friable and cause nuisance to nearby residences and users of the local road network. This requires wetting material and ensuring water is supplied at the correct levels for the duration of the work activity. The weather will be monitored so that the need for damping down activities can be predicted. Water bowsers will be available to spray work areas (Turbine Hardstand areas and Grid Connection route) and construction haul route roads to suppress dust migration from the Site. See **Appendix 2.1 CEMP Sections 5.4** and **5.5**.
- Vehicles delivering materials to the Site will be covered appropriately when transporting materials that could result in dust, e.g., crushed rock or sand.
- 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.
- All machinery when not in use will be turned off and stored in a secure, bunded location (e.g. construction compound).
- Ready-mix concrete will be delivered to the Site; no batching of concrete will be permitted on Site. Only washing out of chutes will take place on Site and this will be undertaken at

a designated concrete washout facility at the contractor's Temporary Construction Compound see **Appendix 2.1: CEMP Section 5.4, 5.5** and **5.6**. The concrete washout facility is a lined containment system designed to prevent run-off into soil, surface water or groundwater. The concrete wash water will be disposed of at a licensed facility.

- Speed restrictions of 15km/h on Site access tracks will be implemented to reduce the likelihood of dust becoming airborne. Consideration will be given to how Site speed limits are policed by the Contractor and referred to in the toolbox talks.
- Good practice will be applied and care will be taken with stockpiled materials to minimise their exposure to wind; stockpiles will be covered with geotextiles layering and damping down will be carried out when weather conditions require it.
- Earthworks and exposed areas/soil stockpiles will be re-vegetated to stabilise surfaces as soon as practicable.
- An independent, qualified Geotechnical Engineer will be contracted for the detailed design stage of the project and geotechnical services and will be retained throughout the construction phase, including monitoring and supervision of construction activities on a regular basis. The methodology statement will be signed off by a suitably qualified Geotechnical Engineer.
- A complaints procedure will be implemented on Site where complaints will be reported, logged and appropriate action taken.

The appointed contractor responsible for the detailed design of the project will provide details to the planning authority for agreement in writing prior to the commencement of development of environmental safety methodology including best practice procedures to manage construction activities. The methodology statement will be signed off by a suitably qualified geotechnical engineer/engineering geologist. An independent, qualified geotechnical engineer/engineering geologist will be contracted for the detailed design stage of the project and geotechnical services will be retained throughout the construction phase, including monitoring and supervision of construction activities on a regular basis.

13.2.8.2 Operational Phase Mitigation

As the operation of the proposed wind farm will have positive effects on air quality, as detailed in **Section 13.6.3.2**, mitigation measures are considered unnecessary. Where turbine components are being replaced the same mitigation measures as per the construction phase will apply.

13.2.8.3 Decommissioning Phase Mitigation

Mitigation measures during the decommissioning phase will be similar to those employed during the construction phase as outlined above. The Decommissioning Plan (Management plan no. 6 to the CEMP, **Appendix 2.1**) is a live document and outlines the mitigation measures required during decommissioning.

13.2.9 Cumulative Effects

In terms of cumulative impacts, adverse cumulative effects in relation to air quality would only occur if a large development was located in the vicinity of the Site and in the process of construction at the same time as the Project.

Table 2.1 of **Chapter 2: Project Description** (**Section 2.3.2**) sets out the existing and proposed wind farms within 20km of the Site.

There are 10 wind farms listed in **Table 2.1**, of which 7 No. are operational, 1 No. is consented and 2 No. are proposed wind farms within 20km of the Site. The above-mentioned Wind Farms will not impose any cumulative air quality impacts if constructed simultaneously to the proposed Project as they are located outside the zone of influence for air emissions. Also all permitted wind farms will have to comply with site specific planning conditions and mitigations measures that were detailed in their planning application.

The nearest operational wind farm is Rathnacally Wind Farm which is located 5.9km to the south of the Site.

The Limerick City and County Council Planning portal and the Cork County Council Planning portal were accessed to check planning permissions granted within a 10km radius (as is consistent with the EPA "Guidelines on the information to be contained in environmental impact assessment reports" (2022)) of the wind farm and other major development or proposed developments (larger than a one-off house) are summarised in **Table 2.2** of **Section 2.3.3** of **Chapter 2: Project Description**.

Much of the non-wind energy planning permissions relate to (see **Table 2.2** of **Chapter 2: Project Description**):

- 110kV substation;
- residential development;
- Anaerobic Digestion;
- Solar Farm;
- Wastewater Project;

- Telecommunications;
- Road Projects and
- Astro turf pitch.

In terms of their scale, it is considered that the construction and use of the agricultural buildings would only have a negligible to minor localised impact on air quality should their construction and operational use be concurrent with the Project as none are located close to the proposed Project (all are >1.5km distant).

In a worst-case scenario cumulative effect may arise if the construction, operational and maintenance period and decommissioning of any of the projects listed in **Appendix 1.2** occur simultaneously with the construction of the Project, Grid Connection Route (GCR) and Turbine Delivery Route (TDR) works. The existing and consented wind energy developments within 20 kilometres of the Site as listed in **Chapter 2: Project Description - Table 2.1** have been considered for cumulative air quality effects. Only those wind energy developments that would be under construction at the same time as the Project are relevant in the context of cumulative effects. There is currently two (1 no. consented (appealed) and 1 No. proposed)) not yet built wind energy development within 20 kilometres of the Site.

- Annagh Wind Farm: 8.6km south
- Tullacondra Wind Farm: 20.7km

Given the distances from the Site, they are not in the direct vicinity of the Project. Even if construction of the above wind energy development takes place at the same time as construction for the proposed Project, given the distances from the Site, there would not be any cumulative air quality effects.

During the operational phase emissions of carbon dioxide (CO_2), nitrogen oxides (NO_x), and sulphur dioxide (SO_2) or dust emissions from the Project and other developments listed in **Chapter 2: Project Description - Table 2.2**, will result from the operation and maintenance vehicles on the Site. However, these emissions will be minimal. Therefore, there will be a long-term, imperceptible, adverse, cumulative effect on air quality.

Cumulative effects during the Decommissioning phase will be similar to the construction phase although slightly less as a result of the reduced works required during the decommissioning phase as some infrastructure will be left in-situ e.g., Turbine Foundations and the Site access tracks.

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

13.2.10 Residual Impacts of the Project

The use of plant and machinery will impact air quality in the area, both in terms of dust generation and exhaust emissions. In this section the impact of the Project on air quality is re-assessed given the mitigation measures prescribed in **Section 13.2.8**.

13.2.10.1 Construction phase

With mitigation measures in place, any effects of dust on vegetation during the construction phase will be reduced short term and imperceptible.

With mitigation measures in place, any effects of dust emissions during the turbine base and hardstand construction will reduce the impact to imperceptible, adverse, short-term and not significant.

With mitigation measures in place, any effects of dust disturbance during the construction of new/ upgraded access tracks will reduce the impact to imperceptible, adverse, short-term and not significant.

With mitigation measures in place, the effects of exhaust emissions during the construction phase, will remain short-term, slight adverse effect.

13.2.10.2 Operational phase

During the operational phase of the Project exhaust emissions will arise from occasional machinery use and Light-Good Vehicles (LGV) that will be required for occasional onsite maintenance works. The impact on dust emission during the operational phase will remain imperceptible, adverse and long-term. The impact on exhaust emissions during the operational phase will remain imperceptible, adverse and long-term.

The wind energy created by the Project once it goes into operation, will avoid the production of electricity from coal, oil or gas-fired power stations resulting in emission savings of carbon dioxide (CO_2), nitrogen oxides (NO_x), and sulphur dioxide (SO_2). This will lead to a moderate positive and long-term effect on air quality.

13.2.10.3 Decommissioning phase

With mitigation measures in place, any effects of dust emissions during the decommissioning phase will be reduced to Imperceptible, adverse and temporary.

Mitigated, any effects of exhaust emissions during the decommissioning phase will remain not significant, adverse and temporary.

13.2.11 Summary of Significant Effects

This assessment has identified no potentially significant effects, given the mitigation measures embedded in the design which will be implemented in the Project.

13.2.12 Statement of Significance

The significance of potential effects of the Project on air quality has been assessed as having the potential to result in slight, adverse and temporary/short-term effects on air Quality during construction and decommissioning. There will be no significant effect on air quality during construction and decommissioning.

The avoidance of the production of electricity from coal, oil or gas-fired power stations, will lead to a moderate, positive and long-term effect on air quality.

The Project has been assessed as having no significant direct or indirect effects on air quality during the construction, operation or decommissioning phases of the Project.

13.3 Climate and Greenhouse Gases

Greenhouse gases (GHGs) constitute a group of gases contributing to global warming and climate change. GHGs with the most global warming potential are carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O). Other greenhouse gases are 'F-Gases' (hydrofluorocarbons and perfluorocarbons), sulphur hexafluoride (SF6) and man-made gases used in refrigeration and air conditioning appliances.

Continued greenhouse gas emissions will lead to increasing global warming, with the best estimate of reaching 1.5°C in the near term in considered scenarios and modelled pathways. Widespread and rapid changes in the atmosphere, ocean, cryosphere and biosphere have occurred. Human-caused climate change is already affecting many weather and climate extremes in every region across the globe. This has led to widespread adverse impacts and related losses and damage to nature and people (IPCC, 2023[16]).

[16] Climate Change 2023 – Synthesis Report (IPCC, 2023)

Human activities that produce GHGs include:

- Carbon dioxide emissions through burning fossil fuels such as coal, oil and gas and peat
- Methane and nitrous oxide emissions from agriculture
- Emissions through land use changes such as deforestation, reforestation, urbanization, desertification

Current projections indicate that continued emissions of greenhouse gases, including the burning of fossil fuel to produce electricity, will cause further warming and changes to our climate. Climate is predicted to have indirect and direct impacts on Ireland including:

- Rising sea-levels threatening habitable land and particularly coastal infrastructure;
- Extreme weather, including more intense storms and rainfall affecting our land, coastline and seas;
- Further pressure on our water resources and food production systems with associated impacts on fluvial and coastal ecosystems;
- Increased chance and scale of river and coastal flooding;
- Giving rise to:
    - Greater political and security instability;
    - Displacement of population and climate refugees;
    - Heightened risk of the arrival of new pests and diseases;
    - Poorer water quality, and
    - Changes in the distribution and time of lifecycle events of plant and animal species on land and in the oceans[17].

Climate change means a significant change in the measures of climate, such as temperature, rainfall, or wind, lasting for an extended period – decades or longer. Earth's climate has changed naturally many times during the planet's existence. However, currently human activities are significantly contributing to climate change through greenhouse gas emissions. The global average temperatures have increased by more than 1°C since pre-industrial times, and there is an 80% chance that the annual global average temperature will temporarily exceed 1.5°C above pre-industrial levels for at least one of the next five years[18].

At the Paris climate conference (COP21) in 2015, 195 countries adopted the first-ever universal, legally binding global climate deal. The agreement sets out a global action plan

[17] Climate Action Plan 2019 – To Tackle Climate Breakdown, Department of Environment, Climate and Communications, https://www.gov.ie/en/publication/ccb2e0-the-climate-action-plan-2019/, [Accessed 09/06/2025]
[18] World Meteorological Organisation (WMO) Press Release, 05 June 2024, Available at: https://wmo.int/news/media-centre/global-temperature-likely-exceed-15degc-above-pre-industrial-level-temporarily-next-5-years [Accessed 09/06/2025]

to put the world on track to avoid dangerous climate change by limiting global warming to below 2°C above pre-industrial levels and to limit the increase to 1.5°C. Under the agreement, Governments also agreed on the need for global emissions to peak as soon as possible, recognising that this will take longer for developing countries and to undertake rapid reductions thereafter in accordance with the best available science.

The Glasgow Climate Pact (COP26) of 2021 aims to limit the rise in global temperature to 1.5°C and finalise the outstanding elements of the Paris Agreement. The Glasgow Climate Pact is manifested across three United Nations climate treaties, including the United Nations Framework Convention on Climate Change (the COP), the Kyoto Protocol (the CMP), and the Paris Agreement (the CMA).

The United Nations Climate Change Conference (COP 28) held in November 2023 was particularly momentous as it marked the conclusion of the first 'global stocktake' of the world's efforts to address climate change under the Paris Agreement. Having shown that progress was too slow across all areas of climate action – from reducing greenhouse gas emissions, to strengthening resilience to a changing climate, to getting the financial and technological support to vulnerable nations – countries responded with a decision on how to accelerate action across all areas by 2030. This includes a call on governments to speed up the transition away from fossil fuels to renewables such as wind and solar power in their next round of climate commitments.

At COP29 in Baku (Dec. 2024), several pivotal agreements were reached. A new climate finance goal was set to mobilize $300 billion annually by 2035, with efforts to raise $1.3 trillion per year from public and private sources. An agreement on carbon markets was established, creating pathways for sustainable business actions. Additionally, a new loss and damage fund was operationalized, with $800 million pledged to aid adaptation efforts. Enhanced measures for transparent climate reporting were also agreed upon to ensure accountability and progress tracking. These agreements aim to accelerate global climate action and support vulnerable nations in adapting to climate impacts.

The e Climate Action Plan 2024 as set out by the Department of the Environment, Climate and Communications provides a detailed plan for Ireland. It plans for taking decisive action to achieve a 51% reduction in overall greenhouse gas emissions by 2030 and setting us on a path to reach net-zero emissions by no later than 2050, as committed to in the Programme for Government and set out in the Climate Act 2024. This Plan makes Ireland one of the most ambitious countries in the world on climate.

The Climate Action Plan 2025[19] (CAP2025) was published in April 2025 and is the latest assessment and measurement of what has been achieved over the past year, building on actions taken in 2024. It sets out what need to be done in 2025 so Ireland is prepared to take on the challenges of our second carbon budget period 2026-2030.

CAP25 re-affirms the previous commitment to increasing the share of renewable electricity to 50% by 2025 and 80% by 2030. Overall, the share of renewable electricity generation in Ireland increased from 38.6% to 40.7% from 2022 to 2023. The figure for 2024 will likely be between 40% and the interim, end of year target of 50% set out in CAP25.

The targets are:

- onshore wind, 2GWs by 2025 and 9 GWs by 2030
- offshore wind, at least 8GWs by 2030
- solar, up to 5GW by 2025 and 8GW by 2030

The provision of the Project will have a long-term positive impact by providing a sustainable energy source. Should the Project not proceed, 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 emissions. It will also hinder Ireland in its commitment to meet its target to increase electricity production from renewable sources and to reduce greenhouse gas emissions as agreed at the Paris climate conference (COP21) in 2015, Glasgow Climate Pact (COP26) in November 2021 and COP28 in November 2023.

13.3.1 Relevant Legislation and Guidance

Greenhouse gases are the subject of international agreements, such as the United Nations framework convention on climate change, Kyoto protocol and the Paris agreement. The Glasgow climate pact is manifested across these three united nations climate treaties. The LCA 2024-2029 sets out how Limerick Council is responsible for reducing greenhouse gas emissions from across its own assets and infrastructure, whilst also taking on a broader role of influencing and facilitating others to meet their own targets. The LCA 2024-2029 strengthens the alignment between national climate policy and the delivery of effective local climate action. The targets of the plan are as follows:

- 50% improvements in the Council's energy efficiency by 2030
- 51% reduction in the Councils' greenhouse gas emissions by 2030

[19] Department of Communications, Climate Action and Environment. (2025). Climate Action Plan 2025. https://www.gov.ie/en/department-of-the-environment-climate-and-communications/publications/climate-action-plan-2025/ [Accessed: 29/04/2025]

- To make Limerick a climate resilient county by reducing the impacts of future climate change related events; and
- To actively engage and inform our communities on climate action.

The LDP 2022-2028 includes renewable energy targets for 2030, including a 386.45MW target for wind. The current installed capacity of County Limerick stands at 243.35MW[20], leaving a short fall of 152.1MW to be achieved in the next 5 years. The Project would contribute circa 36% of this target for new onshore wind energy in Limerick.

These agreements along with international and national policy and legislation including CAP 2025 and Carbon Development Act 2015 as amended by the Climate Action and Low Carbon Development (Amendment) Act 2021 (the "Climate Act") are discussed in **Chapter 4: Planning Policy**. This assessment has been prepared in accordance with the relevant legislation and all plans within Section 15 of the Climate Act have been considered. The Project has been assessed against and is consistent with those plans as demonstrated in **Chapter 4: Planning & Policy**.

13.3.2 Assessment Methodology

As outlined in section 13.2 of this chapter:

- an assessment of climate has been carried out by means of a desk study of the climate in the area of the Project and nationally (baseline description)
- The climate impact of the Project will be assessed using the Carbon Calculator Tool (version 1.8.1, released date 11 Dec 2023). This carbon calculator specifically designed for assessing the climate impact of wind farms was developed under the guidance of the Scottish Government, Scottish Environment Protection Agency (SEPA), Scottish Natural Heritage (SNH) and Forestry Research (impact assessment). Commonly used guidance produced by SNH in 2003 (in a technical guidance note) has been used to determine carbon payback in the absence of any more detailed methods to determine the impacts on soil carbon stocks. The use of the Scottish carbon calculator in assessing the climate impact and determining carbon payback for this Development is acceptable, as the peat habitat of Scotland is similar to Ireland and at similar latitudes, the simulated land-atmosphere interactions are applicable. This accepted as best practice in Ireland.

[20] https://www.limerick.ie/sites/default/files/media/documents/2023-05/Limerick-Development-Plan-Volume-1-Written-Statement-including-Variation-No-1.pdf Accessed 26/07/2024

- A limitation of the Scottish Carbon Calculator is the model assumes that the Development is constructed on peatlands (the only options in the model are acid bog and fen). Therefore, the carbon losses calculated are considered worst-case and conservative.

The methodology approach taken to evaluate the 'do nothing scenario', 'significance of effects', 'mitigation measures' and 'assessment of cumulative effect' is outlined in section 13.2.

13.3.3 Existing Climate

The Köppen climate classification divides regions of the globe based on seasonal precipitation and temperature patterns. The five main groups are tropical, dry, temperate, continental, and polar. The Irish climate is defined as a temperate oceanic climate on the Köppen climate classification system[21]. Ireland's climate is mild, moist and changeable with abundant rainfall and a lack of temperature extremes. The country generally receives cool summers and mild winters and it is considerably warmer than other areas on the same latitude. Ireland's land mass is warmed by the North Atlantic Current all year and as a result does not experience a great annual range of air temperatures.

Nationally, annual average rainfall over the period 1991-2020 is approximately 1,288mm. There is large variation in rainfall. Annual average rainfall ranges from 878 mm in regions along the east coast to 2,044 mm in the southwest mountainous regions. December is the wettest month with average rainfall of approximately 142mm over the same period. The driest months are April and May with average rainfall of 82mm and 79mm, respectively. The highest number of rain days and wet days are observed in elevated western and northwest regions. The average annual number of very wet days observed over the period 1991-2020 again shows that these events are more frequent in the west of the country than in eastern and midland regions. Annual rainfall totals on the west coast generally average between 1,000 mm and 1,400 mm with the wettest months being December and January and April being the driest month. The annual average rainfall for Ireland has increased by approximately 7% between the period 1961-1990 and 1991-2020.

The prevailing wind direction is between south and west. Average wind speed ranges from 3 m/s in south Leinster to 8 m/s in the extreme north of the country. On average there are less than 2 days with gales each year at some inland places like Carlow, but more than 50 a year at northern coastal locations such as Malin Head.

[21] https://www.britannica.com/science/Koppen-climate-classification/World-distribution-of-major-climatic-types, [Accessed 09/06/2025]

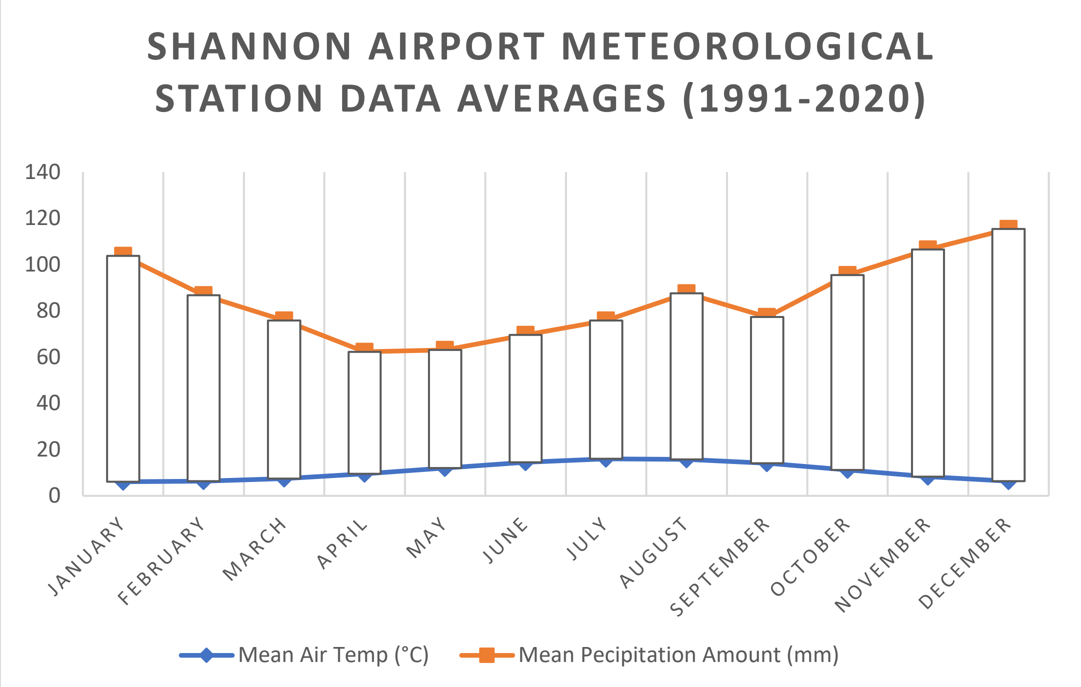
For the purpose of this assessment of changes to the climate, meteorological data from the nearest meteorological station to the Project, Shannon Airport monitoring station, over a period of 1991-2020 is shown in **Table 13.4**. **Graph 13.1** shows the mean air temperature and precipitation amount (mm) recorded at Shannon Airport from 1991 to 2020. Shannon Airport is located 37km north-west of the Project and is the closest Met Éireann meteorological station to the Project.

The mean annual air temperature as shown in **Table 13.4** is between 1981 and 2020 was 10.70°C. Mean monthly temperatures ranged from 6.1°C in January to 15.8°C in August. Mean annual rainfall over this period was 1019.70mm, with a maximum monthly mean rainfall of 115.40mm in December and a minimum monthly mean rainfall of 62.3mm in April[22].

[22] https://www.met.ie/cms/assets/uploads/2023/09/www_met_ie_shannon_airport_9120.htm [Accessed 09/06/2025].

Table 13.4: Shannon Airport Meteorological Station Data Averages (1991- 2020)

Month	Mean Air Temperature (°C)	Maximum Air Temperature (°C)	Minimum Air Temperature (°C)	Mean Precipitation Amount (mm)	Mean Wind Speed (knot)	Mean Monthly Speed(knot)	Sunshine Daily Duration (hours)
January	6.1	8.9	3.3	103.8	75	10	1.7
February	6.3	9.4	3.3	86.7	86	10.1	2.4
March	7.5	10.9	4	75.8	63	9.6	3.6
April	9.6	13.4	5.8	62.3	66	9.2	5.4
May	12	16	8.1	63.1	52	9	5.9
June	14.5	18.3	10.8	69.6	51	8.5	5.5
July	16	19.5	12.6	75.8	52	8.4	4.4
August	15.8	19.1	12.4	87.6	61	8.3	4.6
September	14.1	17.5	10.7	77.4	58	8.4	3.9
October	11.2	14.2	8.1	95.5	66	8.9	3
November	8.3	11.1	5.5	106.6	69	9.1	2.1
December	6.4	9.2	3.7	115.4	75	9.7	1.5



Graph 13.1: Shannon Airport Meteorological Station Data for the last 30 years

The next section examines the Carbon losses and savings from the Project and its impact on the Climate.

13.3.4 Calculating Carbon Losses and Savings

13.3.4.1 Carbon Calculator

To assess the impact of the Project on the climate, the carbon emitted or saved as a result of the Project was determined using a carbon calculator. The Scottish Government have produced an online carbon calculator which aims to assess, in a comprehensive and consistent way, the carbon emission offset effects of wind farm developments. This is done by comparing the carbon costs of wind farm developments with the carbon savings attributable to the wind farm. The carbon calculation takes into account the carbon released from a number of sources during the construction, operational and decommissioning stages. These include the effects of drainage works on peat soils, forestry felling, losses associated with harvesting and transport of felled trees, changes in land use and wind turbine manufacture, transportation and construction. Peat disturbance is factored into the assessment tool. The proposed Project will not directly or indirectly disturb any peat.

Assessments are also carried out to estimate the carbon saving over the lifetime of the wind farm, compared to electricity produced using fossil fuel. The assessment of carbon savings relates to the capacity of the wind farm over the number of years for which it is operational, site improvement works, (i.e., habitat creation (peat etc.) and site restoration works, (i.e., removal of infrastructure and restoration of previous site conditions), when the wind farm will be decommissioned.

The completed worksheet, including the assumptions used in the model, is provided in **Appendix 13.1** of this EIAR. The model calculates the total carbon emissions associated with the Project including manufacturing of the turbine technology, transport and construction of the Project. All metal components can be recycled, while there is limited potential at present for the recycling/reuse of the fibreglass blades.

The model also calculates the carbon savings associated with the Project against three comparators:

i. Coal fired Electricity Generation

ii. Grid mix of Electricity Generation

iii. Fossil fuel mix of Electricity Generation (oil, gas and coal)[23].

This is to compare this renewable source of electricity generation to traditional methods of electricity generation to assess the carbon savings and losses.

13.3.4.2 Carbon Losses

The potential carbon losses were assessed for the Project.

The main CO_2 losses due to the Project are summarised in **Table 13.5**. A copy of the input and output data is provided in the completed worksheet in **Appendix 13.1**. The model assumes that projects are constructed on peatlands (the only options in the model are acid bog and fen). Based on the calculations as presented above, the worst case scenario is that 92,764 tonnes of CO_2 are expected to be lost to the atmosphere due to the construction, operation and decommissioning of the Project.

[23] Ireland's energy imports comprise oil (56%), gas (31%) and coal (10%). http://ireland2050.ie/present/oil-and-gas/?q=where-does-ireland-get-its-electricity#:~:text=Ireland%20has%20only%20small%20proven,%25)%20and%20coal%20(10%25, [Accessed 09/06/2025

Table 13.5: Carbon Losses

Origin of Losses	Total CO_2 Losses (tonnes CO_2 equivalent)
	Range Output (6MW Turbine)
Loss due to Turbine Life (i.e., Turbine manufacture, construction and Decommissioning)	53,153
Losses due to Backup	38,742
Losses due to reduced carbon fixing potential	269
Losses from soil organic matter	-262
Losses due to DOC and POC leaching	862
Total Expected Losses	92,764

13.3.4.3 Carbon Savings

The carbon calculator is pre-loaded with information specific to the CO_2 emissions from the United Kingdom's electricity generation plant, which is used to calculate emissions savings from proposed wind farm projects in the UK and similar data was not available in the model for the Irish electricity generation plant. Therefore, these CO_2 emissions savings from the Project were calculated separately from the worksheet.

A simple formula is used to calculate carbon dioxide emissions reductions resulting from the generation of electricity from wind power rather than from carbon-based fuels such as peat, coal, gas and oil. The formula is:

$$CO_2 \text{ (in tonnes)} = \frac{(A \times B \times C \times D)}{1000}$$

where:

A = The maximum capacity of the wind energy development in MW

B = The capacity or load factor, which takes into account the availability of wind turbines and array losses etc[24].

C = The number of hours in a year

[24]EirGrid, 2022, Enduring Connection Policy 2.2 Constraints Report for Area B Solar and Wind Available at: https://cms.eirgrid.ie/sites/default/files/publications/ECP-2-2-Solar-and-Wind-Constraints-Report-Area-B-v1.0.pdf [Accessed 09/06/2025]

D = Carbon load in grams per kWh (kilowatt hour) of electricity generated and distributed via the national grid[25].

For the purposes of this calculation, the rated capacity of the Project is assumed to be approximately 54MW (9 turbines at 6 MW each). A load factor of 0.35 (or 35%) has been used for the Project.

There has been a strong reduction in the CO_2 intensity of electricity supply in the last 2 decades, with more sharper reductions occurring between 2016 and 2020, falling to its lowest in 2020. These falls are due to increased use of higher-efficiency gas turbines, increased electricity generated from zero-carbon renewable sources, especially wind. In 2021 and 2022, the CO_2 intensity of electricity supply increased marginally, due an increase in emissions from coal and, to a lesser extent, oil. The most recent data for the carbon load of electricity generated in Ireland comes from the Infrastructure Guidelines Supplementary Guidance: Measuring & Valuing Changes in Greenhouse Gas Emissions in Economic Appraisal, published in March 2024. According to this, the conversion factors for changes in energy use in Ireland for electricity usage will give rise to CO_2 emissions of 282g CO_2/kWh.

The calculation for carbon savings at the lower range and higher range are therefore as follows:

$$CO_2 \text{ (in tonnes)} = \frac{(54 \times 0.35 \times 8{,}760 \times 282)}{1000}$$

= 46,689 tonnes per annum

Based on this calculation, approximately 46,689 of CO_2 will be displaced per annum from the largely carbon-based traditional energy mix by the Project.

In total, it is estimated that 1,634,117 tonnes of CO_2 will be displaced over the proposed 35-year lifetime of the wind farm.

The Scottish Government carbon calculator results as presented in **Table 13.5** calculated 92,764 (tonnes of CO_2 – worst case) will be lost to the atmosphere due to changes in the peat environment (model assume the whole site is peat) and due to the construction and operation of the Project. This represents 5.7% of the total amount of carbon dioxide

[25] SEAI, ENERGY IN IRELAND 2023 Report, Available at: https://www.seai.ie/publications/Energy-in-Ireland-2023.pdf [Accessed 09/06/2025]

emissions that will be offset by the Project. Given the calculated carbon savings over the expected 35 year period of the wind farm, the carbons losses due to the construction and operation of the Project will be offset by the Project in approximately 24 months of operation.

13.3.5 Do Nothing Effect

If the Project was not to proceed, greenhouse gas emissions, e.g., carbon dioxide (CO_2), carbon monoxide (CO) and nitrogen oxides (NO_x) associated with construction and decommissioning works would not arise. However, the greenhouse gas savings that would be gained from the operation of the Project would also be lost leading to a long-term, moderate, adverse effect.

13.3.6 Potential Effects of the Project

13.3.6.1 Construction Phase

Greenhouse gas emissions, e.g., carbon dioxide (CO_2), carbon monoxide (CO) and nitrogen oxides (NO_x) are associated with vehicles and plant utilised for construction activities.

It is estimated that during the wind farm construction, an approximate total of 7,965 loads of material and building supplies will be delivered and removed from the Site. The majority of HGV movements to and from Site will occur during the first six months of the construction period and will be associated with Access Track construction, Turbine Hardstand construction and Turbine Foundation construction. It is estimated that 55-60 staff light goods vehicles (LGV) will visit the Site daily during the peak construction period. There will also be a number of vehicles working on Site during the construction phase including excavators, dump trucks and cranes.

The main GHG produced by vehicles is CO_2. Smaller quantities of N_2O and CH_4 are also produced (and emitted) by the fuel consumption process. The potency of these GHGs are very high, with 1kg of N_2O releasing the equivalent of 298kg of CO_2 into the atmosphere and 1kg of CH_4 releasing the equivalent of 25kg CO_2.

The relatively insignificant quantity of greenhouse gases that will be emitted over the short duration of the construction phase, will have at worst, a slight, adverse and short-term potential effect. There will be no likely significant effects on air quality from vehicle movements.

13.3.6.2 Operation Phase

The Project is a renewable energy project in that it will generate electricity from a renewable source. This energy generated will be in direct contrast to traditional energy and the associated emission of greenhouse gases from electricity-generating stations dependent on fossil fuels, thereby having a positive effect on the climate.

The operational phase of the Project does not contain any element which will produce greenhouse gaseous emissions or odorous emissions. The Project will displace carbon dioxide from fossil fuel-based electricity generation, over the proposed 35-year lifespan of the Project. The Project will assist in reducing carbon dioxide (CO_2) emissions 46,689 tonnes per annum that would otherwise arise if the same energy that the Development will generate were otherwise to be generated by conventional fossil fuel plants. This is expected to have a **moderate, positive** and **long-term** effect on the climate. There will be no significant effect on climate.

Table 13.6 shows the number of homes that can be powered each year from the electrical energy produced by the Project. This was calculated at the minimum and maximum expected capacity of 54MW, using a figure of 4.459 MWh of electrical energy per home (In 2022 the average home used 17.15 MWh of energy 26% of which was from electric sources[26], equivalent to 4.459 MWh of energy). The CO_2 offset from the electricity generated (tonnes per annum) is also shown in **Table 13.6**, using the most recent SEAI emission factor (0.282 kg of CO_2 per kWh).

The approximate emission savings that can be achieved each year at a running capacity of 35%, instead of the equivalent output from the current mix of generating fuel in Ireland. This assessment assumes a scenario of a 54 MW output for the Project.

Table 13.6: Statistics relating to Emissions Avoidance of the Project

Factor	Contribution (54 MW)
Energy Produced (MWh per annum) 54MW x 0.35 x 365 x 24 (35% capacity factor)	165,564 MWh per annum

[26] Sustainable Energy Authority of Ireland (2022) Available at: https://www.seai.ie/data-and-insights/seai-statistics/residential/ [Accessed23/09/2024]

Factor	Contribution (54 MW)
Number of Homes Powered (per annum) (at 4.459 MWh/ house of electrically sourced energy)	37,130 homes per annum
CO_2 offset of electricity generated (tonnes per annum) (0.282 Kg of CO2 per kWh)	46,689 tonnes per annum

These calculations show that the annual electrical needs for 37,130 homes can be met by the electricity produced from the Project. In terms of CO_2 offset of electricity generated, between 46,689 tonnes of CO_2 will be offset annually. This will have a **moderate, positive** and **long-term** effect in helping Ireland reduce its greenhouse gas emissions and meet its international obligations.

13.3.6.3 Decommissioning Phase

Any effects that occur during the decommissioning phase are similar to that which occur during the construction phase, albeit to a substantially lesser extent. Firstly, stone will be imported to increase the hardstand size of hardstands located in the floodplain to allow for turbines within the floodplain (T4, T5,T6, T7 & T8) to be dismantled. The turbines will be dismantled and removed from site and the reinforced concrete bases. The plinths from the turbine foundations location within the floodplain will be removed. Once the turbines have been removed all the hardstands will be covered with topsoil and reseeded. The site access tracks will also be left in-situ; however, they will not be covered in topsoil and remain in use for landowners. The site access tracks within the floodplain will be left in-situ. Keeping the turbine foundations, buildings and site roads in-situ will greatly reduce the effect on GHGs; there will be deliveries associated with the delivery of stone for hardstands within the floodplain. However, this will be minimal compared to the construction phase. The mitigation measures prescribed for the construction phase of the Project will be implemented during the decommissioning phase thereby minimising any potential effects.

13.3.7 Climate - Mitigation Measures

All mitigation measures detailed and assessed in this EIAR and outlined in the CEMP (**Appendix 2.1**) will be implemented onsite. Good practice site control measures are detailed below.

It is considered that the Project will have an overall positive effect in terms of carbon reduction and climate.

13.3.7.1 Construction Phase

- All machinery when not in use will be turned off.
- 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.
- Use of local quarries, materials suppliers and waste facilities will be used, as outlined in **Chapter 17: Traffic and Transport**, minimising travel distances
- A robust Traffic Management Plan (**Appendix 17.2**) has been developed, utilising the most direct routes where possible. This Plan will be updated to reflect project needs.

13.3.7.2 Operation Phase

The operation phase of the Project will have a positive effect on the climate due to the displacement of fossil fuels and therefore no mitigation is necessary for this phase. Where turbine components are being replaced the same mitigations measures as per the construction phase will apply.

13.3.7.3 Decommissioning Phase

Mitigation measures during the decommissioning phase will be same as those employed during the construction phase as outlined above. The decommissioning plan (Management plan no. 6 to the CEMP, **Appendix 2.1**) is a live document and outlines the mitigation measures required during decommissioning.

13.3.8 Cumulative Effects

Potential cumulative effects on the climate between the Project and other developments in the vicinity were also considered as part of this assessment. The other developments considered as part of the cumulative effects assessment are described in **Appendix 1.2**. and in **Chapter 2: Project Description**, **Table 2.2 in Section 2.3.3**.

During the construction phase of the Project and other consented developments within 20 km (as is consistent with the EPA "Guidelines on the information to be contained in environmental impact assessment reports" (2022)) that are yet to be constructed, there will be minor exhaust emissions from construction plant and machinery and dust emissions from construction activities. Given the distances from the Site, they are not in the direct vicinity of the Project. Even if construction of the above wind energy development takes place at the same time as construction for the proposed Project, given the distances from the Site, there would not be any cumulative air quality effects.

The nature of the Project is such that, once operational, it will have a long-term, moderate, positive effect on the climate. It is considered that the cumulative effect will be positive in terms of carbon reduction and the climate.

During the operational phase emissions of carbon dioxide (CO_2), nitrogen oxides (NO_x), and sulphur dioxide (SO_2) or dust emissions from the Project and other projects listed in **Table 2.1** and **Table 2.2 of Chapter 2: Project Description**, will result from the operation and maintenance vehicles onsite. However, these emissions will be minimal. Therefore, there will be a long-term imperceptible adverse cumulative effect on the climate.

Cumulative effects during the Decommissioning phase will be similar to the construction phase although slightly less as a result of the reduced works required because some infrastructure will be left in-situ e.g., turbine foundations and the site roads.

The nature of the Project, once operational, they will have a cumulative long-term, significant, positive effect on the climate.

13.3.9 Residual Effects of the Project

13.3.9.1 Construction Phase

There will be a short-term, imperceptible, adverse effect on climate as a result of greenhouse gas emissions. There will be no significant residual effect on air and climate as a result of the Project during the construction phase.

13.3.9.2 Operational Phase

There will be a long-term, moderate, positive effect on climate as a result of reduced greenhouse gas emissions. There will be no significant residual effect on greenhouse gas emissions as a result of the Project during the operational phase.

13.3.9.3 Decommissioning Phase

Any effects and consequential effects that occur during the Decommissioning phase are similar to that which occur during the construction phase, albeit of less impact. For example, turbine foundations and site roads will be left in-situ. There will be no significant residual effect on air and climate as a result of the Project decommissioning phase.

13.3.10 Summary of Significant Effects

This assessment has identified no potentially significant adverse effects, given the mitigation measures embedded in the design and the measures that will be implemented as part of the Project.

The nature of the Project is such that, once operational, it will have a moderate, positive and long-term effect on the climate. It is considered that the cumulative effect will be positive in terms of carbon reduction and the climate also.

13.3.11 Statement of Significance

This chapter section has assessed the significance of potential effects of the Project on climate. The Project has been assessed as having the potential to result in slight, adverse, temporary/short-term effects during construction and decommissioning. There will be a moderate, positive, long-term effect in terms of helping Ireland meet its international obligations to reduce greenhouse gas emissions.

Potential cumulative effects were assessed as being of a slight, adverse, short-term effect during the construction and decommissioning phases.

The potential effects of the Project on both air quality (See **section 13.2.11**) and climate are considered not significant.