12 AIR QUALITY AND CLIMATE

12.1 INTRODUCTION

This chapter assesses the likely significant direct and indirect effects of the Project (**Figure 1.2**) on air and on climate in **Section 12.2** and **12.3** respectively. The Project refers to all elements of the application for the construction of Moanmore Lower Wind Farm (**Chapter 2: Project Description**). Where negative 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 12.1 Scottish Government – Carbon Calculator Input and Output Data**

12.1.1 Statement of Authority

This chapter has been prepared jointly by Ms. Sarah Moore, with the assistance of Mr. Padraig O' Dowd and Ms Siobhan Roddy of Jennings O'Donovan & Partners Limited. The final review was conducted by Managing Director Mr David Kiely.

Mr. David Kiely is Managing Director of JOD and holds a BE in Civil Engineering from University College Dublin and MSc in Environmental Protection from IT Sligo. He is a Fellow of Engineers Ireland, a Chartered Member of the Institution of Civil Engineers (UK). David has over four decades of experience in the preparation of EIARs and EISs for environmental projects including Wind Farms, Solar Farms, Wastewater Projects, and various commercial developments. David has also been involved in the construction of over 60 wind farms since 1997.

Ms. Sarah Moore is an Environmental Scientist in JOD with over 17 years of environmental consultancy experience. She has obtained a MSc in Environmental Engineering from Queens University, Belfast, and a BSc in Environmental Science from University of Limerick. Since joining JOD, Sarah has been involved as a Project Environmental Scientist on a range of renewable energy, wastewater, structures and commercial projects. She has experience in the preparation of Appropriate Assessments, Ecological Impact Assessments, Environmental Impact Assessments and Geographic Information Systems.

Mr. Padraig O' Dowd is a Junior Environmental Scientist at JOD. He holds a BA (Hons) in Creative Design, an MSc in Design Innovation, and a GradDip in Design Thinking for Sustainability. As a Graduate Member of IEMA, his expertise includes EIAR report writing, grant-funded research applications, and data analysis, with a focus on the environmental and renewable energy sectors. He also has research experience with Wind Energy Ireland.

Ms. Siobhan Roddy is a Graduate Environmental Scientist and holds a BSc (Hons) in Environmental Science and Technology from Dublin City University. Siobhan's key capabilities are in report writing, and ArcGIS. She forms part of the Environmental team responsible for preparing the EIAR Chapters and Appropriate Assessments for Wind Farms. For detailed information on all contributors, including their qualifications and experience, please refer to **Appendix 1.1: Author Qualifications.**

12.1.2 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[2]. The projected growth in emissions is largely underpinned by projected strong economic

[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 23/09/2024]
[2] Environmental Protection Agency " Ireland's Grenhouse Gas Emissions Projections 2023-2050" Available at: https://www.epa.ie/publications/monitoring--assessment/climate-change/air-emissions/irelands-greenhouse-gas-emissions-projections-2023-2050.php [Accessed 17/04/2025]

growth and relatively low fuel prices leading to increasing energy demand over the period[3]. 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[4].

This chapter assesses the following as per the EIA Directive:

- The air quality environment of the area of the Proposed Project 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 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.

12.1.3 Relevant Legislation and Guidance

The assessment has been prepared in accordance with the relevant legislation and having regard to the relevant guidance listed below:

- 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

[3] 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: 23/09/2024]

[4] Environmental Protection Agency "Latest emissions data (2023)
Available at: https://www.epa.ie/our-services/monitoring--assessment/climate-change/ghg/latest-emissions-data/
[Accessed: 23/09/2024]

- 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
- Clare County Council Climate Action Plan (2024 2029)
- Clare County Development Plan (2023 -2027)
- Air Quality Assessment of Specified Infrastructure Projects – PE-ENV-01106 (TII, 2022a)

12.1.4 Assessment Structure

In line with the EIA Directive and current EPA guidelines listed in **Chapter 1: Introduction**, **Section 1.9.2** the structure of this Air and Climate chapter is as follows:

- Assessment Methodology and Significance Criteria
- Description of baseline conditions at the Site
- Identification and assessment of impacts to air and climate associated with the Project, during the construction, operational and decommissioning phases
- 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 12.2** and **Section 12.3**, together with the other assessments detailed in this chapter, provide the planning authority with sufficient details regards Air Quality and Climate assessment for the Project.

12.1.5 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

In this section, a description of the methods employed for each part of the assessment, are outlined.

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

- Air quality limit values of CAFE Directive 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

The following tool was employed to assess Climate impact of the Project:

- Carbon calculator for wind farms[5], developed under the guidance of the Scottish Government, Scottish Environment Protection Agency (SEPA), Scottish Natural Heritage (SNH) and Forestry Research is accepted best practice in Ireland. 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 potential impacts if the Proposed Development does not proceed, including the likely natural evolution of the site in the absence of the development, based on 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, Table 1.6 and Table 1.7. Where negative 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: The potential cumulative effects on Air Quality and Climate are assessed by considering other large developments (both operational and in the planning process) within a 20km radius of the Project, as shown in **Appendix 1.2** of the EIAR. This assessment takes into account all phases of the Development (construction, operation, and decommissioning) in conjunction with these nearby projects.

[5] SEPA, 2023, Carbon calculator for wind farms, Available at: https://informatics.sepa.org.uk/CarbonCalculator/ [Accessed Sep 2024]

12.2 AIR QUALITY

12.2.1 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 12.1** outlines the limit values and target dates set out in the Ambient Air Quality Recast Directive.

Table 12.1: 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 calendar year	200	not to be exceeded more than 3 times per calendar year

Pollutant	Limit Value Objective	Averaging Period	Limit Value (μg/m³) Attained by 11/12/2026	Basis of Application of Limit Value	Limit Value (μg/m³) Attained by 01/01/2030	Basis of Application of Limit Value
		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
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 12.2**. Limit values are presented in micrograms per cubic metre (μg/m³) 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 12.2: Limit values of CAFE Directive 2008/50/EC (Source: EPA 11/11/2023)

Pollutant	Limit Value Objective	Averaging Period	Limit Value to be attained by 2030 (μg/m³)	Limit Value to be attained by 20 (μg/m³)	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
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

Pollutant	Limit Value Objective	Averaging Period	Limit Value to be attained by 2030 (µg/m³)	Limit Value to be attained by 20 (µg/m³)	Basis of Application of Limit Value
$PM_{2.5}$ - 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 12.3 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 12.3: 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 calendar year averaged over 3 years	120 µg /m³
Protection of vegetation	*AOT_{40} calculated from 1 hour values from May to July	18,000 µg /m³ h⁻¹ averaged over 5 years	6,000 µg /m³ h⁻¹
Information Threshold	1-hour average	180 µg /m³	180 µg /m³

Objective	Parameter	Target Value from 2010	Target Value from 2020 onwards
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.

12.2.2 Air Quality & Health

Environmental Protection Agency (EPA, 2020)[6], European Environmental Protection Agency (EEA, 2024)[7] 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[8&9]. 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 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

6 Ireland's Environment – An Integrated Assessment 2020, EPA, 2020 [Accessed 22/10/24]
7 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 22/01/2025]
8 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 22/10/24]
9 Irelands Environment 2016 – An Assessment', EPA, 2016 [Accessed 22/10/24]

lower environmental levels of such parameters, and consequential beneficial effects on human health.

12.2.3 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.

12.2.4 Existing Air Quality Conditions

12.2.4.1 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 (September) 2024[10]. This report provides an overview of the ambient air quality in Ireland in 2022. It is based on monitoring data from 87 stations across Ireland. The measured concentrations are compared with both EU legislative standards and WHO air quality guidelines for a range of air pollutants.

Results from the monitoring campaign across Ireland during 2022 show:

- No levels above the EU limit value (CAFÉ Directive) as shown in **Table 12.2** were recorded at any of the ambient air quality network monitoring sites in Ireland in 2022.
- WHO guideline values were exceeded at a number of monitoring sites for fine particulate matter (PM2.5) and (PM10), ozone (O3), Nitrogen Dioxide (NO2). WHO guideline values for Sulphur dioxide (SO2) were exceeded at one monitoring station. PAHs exceeded the European Environment Agency reference at 3 monitoring sites.

[10] EPA Air Quality Ireland Report 2023. Available at: https://www.epa.ie/publications/monitoring--assessment/air/Air_Quality_Report_23_v14.pdf. Accessed at: 08/01/2025

12.2.4.2 Existing Air Quality Conditions Locally

The closest National Network monitoring site to the project, within the same air quality zone, is located at Askeaton, Co. Limerick, approximately 36.65km southeast of the site:

- At Askeaton, WHO's 24-hour mean guideline (15 µg/m^3) for $PM_{2.5}$ was exceeded on eight occasions in 2021, and the annual mean guideline (5 µg/m^3) was also exceeded, with a recorded mean of 5.7 µg/m^3. No other WHO guideline exceedances were observed at Askeaton for any other parameters in 2021.
- The annual mean PM_{10} and $PM_{2.5}$ levels for Askeaton were 8.7 µg/m^3 and 5.7 µg/m^3, respectively, both below the limit values set out by Directive 2008/50/EC; See **Table 12.1.**

12.2.5 Do Nothing Impact

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, negative effect on air quality. There would be no likely significant effect on air quality.

12.2.6 Potential effects of the Project

12.2.6.1 Construction Phase

During the construction phase standard methodologies are being used given known ground conditions and soil stability. These standard methodologies are described and assessed.

12.2.6.1.1 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 Route (GCR).

The potential for dust to cause disturbance is 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, though it is proposed that 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 Site access track construction.
- Vehicle movements over dry surfaces such as Site access tracks and public roads.

The potential effect from dust becoming friable and to cause disturbance to workers and local road users, if unmitigated, is considered, a slight, negative, 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[11].

Generally, (depending on the conditions outlined), dust disturbance is most likely to occur at sensitive receptors within approximately 350m (UKIAQM, 2016) of the source of the dust. It is considered that the principal sites of friable dust generation will be the Turbine Foundations and Hardstands, and also along new site access tracks. All turbines are situated greater than 600m away from inhabited dwelling houses. Therefore, these principal source sites of dust generation are greater than 350m distant from these sensitive receptors (**Figure 1.3**).

In addition, vegetation such as trees and hedgerows in the vicinity will help to mitigate any airborne dust migrating off the Site as outlined in UK IAQM 2016. Any effects of dust on vegetation will be confined to the construction and possibly the Decommissioning phases and be short-term, slight, negative and not significant effect.

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, temporary and slight negative and not sensitive on sensitive receptors. There is no likely significant effect of dust emissions during the construction, operation and decommissioning phases.

[11]Department of the Environment, Transport and the Regions (DETR) (2000a) Controlling and mitigating the environmental effects of minerals extraction in England. Available at: https://cumbria.gov.uk/elibrary/Content/Internet/538/755/1929/17716/17720/17723/42130142312.PDF. [Accessed at 03/12/2024]

12.2.6.1.2 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 negative and not significant effect. There will be no likely significant effects on air quality from an increase in exhaust emissions during the construction phase.

12.2.6.2 Operational Phase

12.2.6.2.1 Dust Emissions

During the operational phase, only a small number of light vehicles will access the site, resulting in minimal and sporadic dust generation, similar to the movement of agricultural vehicles. Site visits are expected to occur approximately once or twice a week. In the unlikely event that a turbine or its components need to be replaced during the wind farm's lifetime, the traffic generated will be significantly lower than during the initial construction phase. There would only be one turbine delivered, compared to 3 No. turbines and the Site access tracks and other Site infrastructure will already have been established. Therefore, the operational phase will have an imperceptible negative and not significant effect.

12.2.6.3 Decommissioning Phase

Effects during the Decommissioning phase of the Project are anticipated to be less than those arising during the construction phase. The Decommissioning phase will be as follows:

- Removal of 3 No. wind turbines;
- Removal of all associated underground electrical and communications cabling connecting the wind turbines to the wind farm Electrical Substation. Ducting is to remain *in-situ.*

All other elements of the Project will remain in-situ. The Site access tracks, and associated drainage systems will also serve existing ongoing agricultural activity in the area. All other hard surfaced areas will be allowed to revegetate naturally.

The Decommissioning phase would be expected to last approximately 3-6 months, and any air quality effects would be predicted to be imperceptible.

12.2.7 Mitigation Measures and Residual Effects

12.2.7.1 Construction Phase Mitigation

The main potential effect during the construction phase of the Project will be from the potential for dust to cause disturbance at sensitive receptors close to the Site. The contractor will be contractually required to follow best practice construction procedures to prevent dirt and dust being transported onto the local road network and to minimise vehicle exhaust emissions. All mitigation measures detailed and assessed in this EIAR and outlined in the CEMP (**Appendix 2.1**) will be implemented on site. Best practice site control measures will comprise the following:

- Site access tracks will be upgraded and constructed during the initial phases. These tracks will be surfaced with graded aggregate, which compacts to reduce dust generation.
- Approach roads and construction areas will be regularly monitored and maintained, including routine sweeping and cleaning, to prevent the buildup of mud. This will help prevent mud from migrating around the site, onto the public road network, and into roadside drains. Wheel wash facilities will be provided, managed, and maintained near the site entrance to prevent mud and dirt from being transferred onto the public road network. The wheel wash will be located outside the 50m watercourse buffer zone, as outlined in **Appendix 2.1, CEMP Section 3.6.1.**

- 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 disturbance 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 Section 3.6.1**
- 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 3.6.1**. The concrete washout facility is a lined containment system designed to prevent run-off into soil, surface water or groundwater.
- Speed restrictions of 15 km/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.
- Careful management of the L6132 is essential, as sections of this road are within the Doonbeg catchment, which supports a viable population of Freshwater Pearl Mussels. Excessive sweeping or washdown of solids from the road could result in the deposition of sediment into small streams, potentially affecting water quality. Particular attention will be given to this route to ensure that mud and silt do not accumulate, preventing washdown into the local natural drainage system.

12.2.7.2 Operational Phase Mitigation

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

12.2.7.3 Decommissioning Phase Mitigation

Mitigation measures during the decommissioning phase will be similar to those employed during the construction phase as outlined above.

12.2.8 Cumulative Effects

Table 2.1 in **Chapter 2: Project Description (Section 2.3.3)** outlines the existing and proposed wind farms within 20km of the site.

Apart from two proposed wind farms, Ballykett and Shronowen, and Crossmore which is under construction, all other wind farms listed in **Table 2.1** are operational. Shronowen Wind Farm, located in County Kerry, was granted permission by An Bord Pleanála on 27/09/2022 (Case Reference: PA08-309156). A review of the Environmental Impact Assessment Report (EIAR) attached to the application indicates that the construction of Shronowen Wind Farm will not result in any cumulative air quality effects when built concurrently with the proposed Moanmore Lower Wind Farm as it is a considerable distance away.[12]

The proposed Ballykett Wind Farm, a 4-turbine site, is located approximately 3.7km north-east of Moanmore Lower Wind Farm. There is potential for cumulative effects during the delivery of concrete, stone, or turbines. During the placement of concrete for the foundation, the number of HGV loads (75 per day) is expected to be similar for both wind farms.

[12] An Bord Pleanála: Available at: https://www.pleanala.ie/en-ie/case/309156. [Accessed: 03/12/2024]

The Clare County Council Planning portal was accessed to check planning permissions granted within a 10km radius of the proposed Project and other major development or proposed developments (larger than a one-off house) are summarised in **Table 2.2** in **Section 2.3.4** of **Chapter 2: Project Description**.

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

- Livestock slatted units;
- Solar Farm;
- Ballroom;
- Wastewater Project;
- 400kV Electrical Line Upgrade Works;
- Graveyard Extension;
- Pitch and Putt Course;
- Conversion of building to apartments; and
- External Refrigeration Unit.

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 Moanmore Lower Wind Farm Development.

In a worst-case scenario cumulative air effects 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. The consented (not yet built) and the proposed wind energy developments within 20 kilometres of the Site include Ballykett Wind Farm, and Shronowen Wind Farm.

Given the distances from the Site, they are not in the direct (>350m) of the Project. Even if construction of these wind energy developments takes place at the same time as construction of Moanmore Lower Wind Farm Development, 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 negative cumulative impact on air quality and 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 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.

12.2.9 Residual Effects of the Project

The use of plant and machinery during the construction phase is not likely to have a significant impact on air quality in the area, both in terms of dust generation and exhaust emissions. Overall, with mitigation in place this effect is assessed as slight/imperceptible, negative, direct and temporary/short-term in nature.

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 on-Site maintenance works. The effects will be long-term imperceptible and negative.

The wind energy created by the Project will displace 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 long-term significant positive effect on air quality. **Section 12.5.2** of this EIAR chapter details the calculated carbon dioxide and combustion savings in greater detail.

The Decommissioning phase, and consequential effects will be similar to the construction stage, albeit of less effect as the works required will be less as described in **Chapter 2: Project Description**. For example, the Turbine Foundations will remain in-situ, covered with earth and reseeded as appropriate. The Electrical Substation building will also be left in-situ. This means there will be no additional excavation works required for the Decommissioning of these infrastructure components. Therefore, no additional truck movements are required for the demolition and removal of this infrastructure. The mitigation measures outlined for the construction phase of the Project will be implemented during the Decommissioning phase thereby minimising any potential effects.

12.2.10 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.

12.2.11 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, negative 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 slight, 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.

Potential cumulative effects were assessed as being of a slight, negative and short-term impact and not significant.

12.3 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 (CO_2), methane (CH_4) and nitrous oxide (N_2O). Other greenhouse gases are 'F-Gases' (hydrofluorocarbons and perfluorocarbons), sulphur hexafluoride (SF_6) 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 damages to nature and people (IPCC, 2023[13]).

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[14].

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

[13] Climate Change 2023 – Synthesis Report (IPCC, 2023)
[14] 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 03/12/2024]

will temporarily exceed 1.5°C above pre-industrial levels for at least one of the next five years15.

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 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.

The 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.

[15] 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 03/12/2024]

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.

12.4 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 Clare Climate Action Plan sets out how Clare County 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 Clare Climate Action Plan strengthen the alignment between national climate policy and the delivery of effective local climate action. A strategic goal of the plan is to achieve the carbon emission and energy efficiency targets for 2030 and 2050.

To help achieve the carbon emission targets for 2023 and 2050 the Clare CPD 2023-2029 included a County Wind Energy Strategy, a plan led approach to wind energy development in County Clare and sets out areas 'open for consideration' for wind energy developments and considerations for the evaluation of wind energy planning applications. The wind energy target set for County Clare is 550MW. Currently, there is currently 246MW installed wind energy capacity in the county[16].

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.

12.5 ASSESSMENT METHODOLOGY

The methodology accord with guidance and best practice.

[16] Wind Energy Ireland – Wind Energy by County https://windenergyireland.com/about-wind/wind-energy-by-county -[Accessed 17/04/2025]

As outlined in **Section 12.1.5** of this chapter:

- A climate assessment has been conducted through a desk study of the local and national climate in relation to the Project area (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 Project is considered best practice, as the peat habitat of Scotland is similar to Ireland and at similar latitudes, the simulated land-atmosphere interactions are applicable.

The methodology approach taken to evaluate the 'do nothing scenario', 'significance of effects', 'mitigation measures' and 'assessment of cumulative effect' is outlined in **Section 12.2.**

12.5.1 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[17]. 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.

The 30-year climate period (1991-2020) in Ireland saw an annual mean air temperature of 9.8°C, ranging from approximately 8.5°C to 10.8°C. The national average annual rainfall over this period was about 1,288 mm, with higher amounts observed in the Ox Mountain area (2,000-2,400mm) due to its elevation.

[17] Britannica. World distribution of major climatic types. Available at:https://www.britannica.com/science/Koppen-climate-classification/World-distribution-of-major-climatic-types, [Accessed at 03/12/2024]

Nationally, the mean air temperature typically falls between 9 and 11 degrees, with west coast annual rainfall averaging between 1,000mm and 1,400mm. December and January are the wettest months, while April tends to be the driest. Prevailing winds are mainly from the south and west, with average speeds ranging from 3m/s to 8m/s across the country.

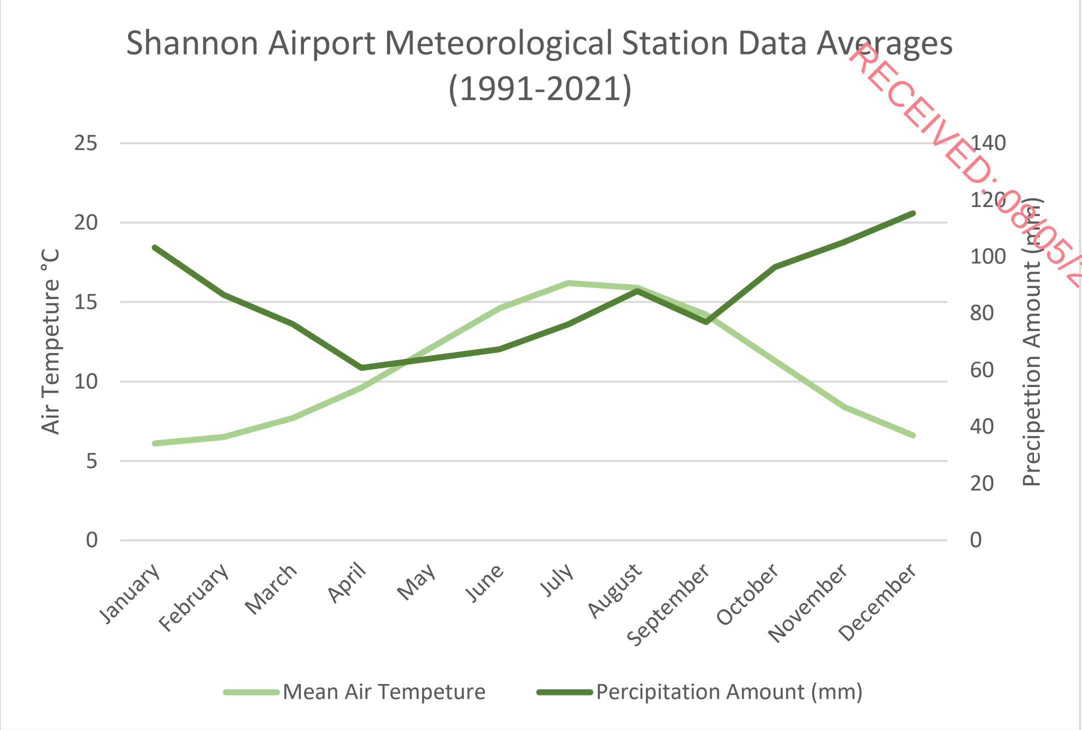
For the purpose of this assessment of changes to the climate, meteorological data from the nearest meteorological station to the Project, Shannon Airport monitoring station, over a period of 1991-2021 is shown in **Table 12.3**. Shannon Airport is located 39.5km east of the Project and is the closest Met Éireann meteorological station to the Project.

The mean annual air temperature as shown in **Table 12.3** is between 1991 and 2021 was 10.8 °C. Mean monthly temperatures ranged from 6.1°C in January to 16.2°C in July. Mean annual rainfall over this period was 1,016.2mm, with a maximum monthly mean rainfall of 115mm in December and a minimum monthly mean rainfall of 61 mm in April[18].

[18] DATA.GOV.IE. https://data.gov.ie/dataset/shannon-airport-monthly-data?package_type=dataset [03/12/2024]

Table 12.3: Shannon Airport Meteorological Station Data Averages (1991- 2021)

Month	Mean Air Temperature (°C)	Maximum Air Temperature (°C)	Minimum Air Temperature (°C)	Mean Maximum Temperature (°C)	Mean Minimum Temperature (°C)	Mean Precipitation Amount (mm)	Grass Minimum Temperature (°C)	Mean Wind Speed (knot)	Highest Gust (knot)	Sunshine Duration (hours)
January	6.1	14.8	-11.2	8.9	3.5	103.2	-7.8	9.9	75.0	52.7
February	6.5	15.5	-5.0	9.5	3.5	86.5	-7.0	10.1	86.0	68.8
March	7.7	19.6	-5.8	11.2	4.2	76.3	-6.9	9.6	63.0	109.2
April	9.6	23.5	-2.9	13.6	5.6	60.8	-4.4	9.2	66.0	164.1
May	12.1	27.8	-0.6	16.2	8.1	64.1	-1.6	9.0	52.0	183.5
June	14.6	32.0	3.7	18.5	10.7	67.3	2.0	8.5	51.0	163.9
July	16.2	30.2	6.7	19.7	12.7	76.2	4.6	8.3	52.0	136.1
August	15.9	29.8	4.4	19.4	12.4	87.9	3.7	8.2	61.0	142.4
September	14.2	27.9	1.7	17.8	10.6	77.0	1.0	8.4	58.0	117.2
October	11.3	22.3	-2.0	14.4	8.1	96.4	-2.2	8.8	66.0	93.6
November	8.4	17.7	-6.6	11.2	5.6	105.2	-4.9	9.1	69.0	62.2
December	6.6	15.4	-11.4	9.2	4.0	115.3	-6.1	9.7	83.0	46.4



Graph 12.1: 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.

12.5.2 Calculating Carbon Losses and Savings

12.5.2.1 Carbon Calculator

To assess the effect 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 embodied carbon from wind turbine manufacture, transportation and construction. Also included in the assessment tool is the assessment of peat disturbance.

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., peatland improvement, habitat creation, etc.), forestry felling, 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 12.1** 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. The model, which is assessed for both the lower range (4 MW) and the higher range (5 MW), accounts for improvement works (see **Appendix 6.11 Biodiversity Enhancement and Management Plan (BEMP)**) and the years taken for the site to return to its original characteristics but does not factor in the potential re-use of turbine components. 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)[19].

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

12.5.2.2 Carbon Losses

The potential carbon losses were assessed for the Project.

The main CO_2 losses due to the Project are summarised in **Table 12.4**. A copy of the input and output data is provided in the completed worksheet in **Appendix 12.1**.

[19] Ireland 2050, Available at: https://irelandenergy2050.ie/present/oil-and-gas/?q=how-dependent-on-imports-are-we#:~:text=Ireland%20has%20only%20small%20proven,%25)%20and%20coal%20(10%25).[Accessed at 03/12/2024]

Table 12.4: Carbon Losses

Origin of Losses	Total CO_2 Losses (tonnes CO_2 equivalent)	
	Lower Range Output (4MW Turbine)	Higher Range Output (5MW Turbine)
Loss due to Turbine Life (i.e., Turbine manufacture, construction and Decommissioning)	9,810	12,613
Losses due to Backup	9,082	11,353
Losses due to reduced carbon fixing potential	520	520
Losses from soil organic matter	9,268	9,268
Losses due to DOC and POC leaching	2,382	2,382
Felling of Forestry	449	449
Total Expected Losses	31,511	36,585

The worksheet model calculated that the Project is expected to give rise to up to 31,511 tonnes of CO_2 equivalent losses at the lower range (4MW) and 36,585 tonnes of CO_2 equivalent losses at the higher range (5MW) over its 40-year life. Of this total figure, the proposed wind turbines (i.e., manufacture, construction, decommissioning) directly account for 9,810 tonnes, or approximately 31% at the lower range and 12,613 tonnes, or approximately 34% at the higher range, of the expected total CO_2 losses. Losses due to backup account for 9,082 tonnes or approximately 29% at the lower range and 11,353 tonnes or approximately 31% of the expected total CO_2 losses.

Losses from soil organic matter, reduced carbon fixing potential, DOC and POC leaching, and the felling of forestry account for the remaining 40%, or 12,619 tonnes at the lower range and 35%, or 12,619 tonnes at the higher range. The estimated 31,511 to 36,585 tonnes of CO_2 (higher and lower range) arising from ground activities associated with the Project is calculated based on the entire Project footprint being classified as "Acid Bog," as this is one of only two choices, the other being fen. The main difference between a fen and an acid bog is that fens have greater water exchange and are less acidic, so their soil and water are richer in nutrients. Therefore, fens generally lose less carbon than acid bogsbecause they have higher mineral levels and less acidity, which allows for a more diverse community of plants and animals that can help maintain the carbon sink function. Fens are often found near bogs, and over time most fens become bogs. Although the peat area is degraded and shallow at the Site, "Acid Bog" is a much more suitable term to describe it.

The habitat that will be impacted by the Project footprint comprises predominantly agricultural land and commercial forestry rather than the (cutaway) acid bog assumed by the model that gives rise to the 31,511 to 36,585 tonnes (lower and higher range), and therefore the actual CO_2 losses are expected to be lower than this value.

The figures discussed above are based on the assumption that the hydrology of the Site and habitats within the site are not restored on decommissioning after its expected 40-year useful life. However, at the end of the 40-year lifespan of the Project, the turbines may be replaced with newer models, subject to a consent for the same being obtained. This would mean the carbon losses associated with not restoring the habitats' hydrology at the Site would be offset by the carbon-neutral energy that the new turbines would generate.

Based on the calculations as presented above, the worst-case scenario is that 31,511 tonnes of CO_2 at the lower range (4MW) and 36,585 tonnes of CO_2 at the higher range (5MW) are expected to be lost to the atmosphere due to the construction, operation, and decommissioning of the Project.

12.5.2.3 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.

C = The number of hours in a year

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

For the purposes of this calculation, the rated capacity of the Project is assumed to be approximately 12MW at the lower range and 15 MW at the higher range. A load factor of 0.283 (or 28.3%) has been used for the Project.

There has been a strong reduction in the CO_2 intensity of electricity generation, especially after 2016, with intensity falling below 300 g CO_2/kWh for the first time in 2020. It is now less than a third of its 1990 value. The number of hours in a year is 8,760. 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.

This figure reflects the current average composition of the generating plant, which includes a mix of renewable and fossil fuel generators. However, as future renewable generation is expected to replace fossil fuel generators, this figure may overestimate future CO_2 emissions. It is important to consider the likely reduction in CO_2 intensity over time as Ireland continues to decarbonise its electricity grid.

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

$$CO_2 \text{ (in tonnes)} = \frac{(12 \times 0.283 \times 8{,}760 \times 282)}{1000}$$

= 8,389 tonnes per annum at the **lower range**.

$$CO_2 \text{ (in tonnes)} = \frac{(15 \times 0.283 \times 8{,}760 \times 282)}{1000}$$

= 10,487 tonnes per annum at the **higher range.**

Based on this calculation, approximately 8,389 (lower range) or 10,487 (higher range) tonnes 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 335,568 tonnes (lower range) or 419,460 tonnes (higher range) of CO_2 will be displaced over the proposed 40-year lifetime of the wind farm.

12.5.3 Do Nothing Impact

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, negative impact.

12.5.4 Potential Impacts of the Project

12.5.4.1 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 4,227 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 35-40 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.

In the absence of mitigation measures the effect of vehicle movements associated with the construction phase will have, a short-term, moderate potential effects on GHG emissions. There will be no likely significant effects on air quality from vehicle movements.

Cabon losses from excavation works and deforestation is included in the carbon calculator accounts for 40% (12,619t) of the total carbon losses associated with the Project. This is considered to be a permanent, moderate, negative effect. There is no likely significant effects on carbon losses due to the construction of the Project.

12.5.4.2 Operation Phase

The Project is a renewable energy project which 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 impact on the climate. The Project will displace carbon dioxide from fossil fuel-based electricity generation, over the proposed 40-year lifespan of the Project. The Project will assist in reducing carbon dioxide (CO_2) emissions (8,389 tonnes per annum at the lower range or 10,487 tonnes per annum at the higher range) that would otherwise arise if the same energy that the Project will generate were otherwise to be generated by conventional fossil fuel plants. This is a long-term, moderate, positive effect on the climate. There will be no significant effect on climate.

12.5.4.3 Decommissioning Phase

Any impacts and consequential effects that occur during the decommissioning phase are similar to that which occur during 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 impacts.

12.5.5 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 will comprise the following.

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

This Project will have a local/regional and national impact on carbon reduction. The Project will assist Ireland in meeting an 80% reduction in overall greenhouse gas emissions by 2030 and support increasing the onshore wind capacity to 9 GW, as per the Climate Action Plan 2024 and 2025. It will also contribute to Clare County Councils target of 550MW of onshore wind set out in the Clare County Development plan 2023 -2029. It will help to meet the objective to "*C2-Minimise emissions of greenhouse gases and contribute to a reduction and avoidance of human induced global climate change*" with a target to "*Establish incentives/increase no. of permission or renewable energy projects*." as set out in the Clare County Council Strategic Environmental Report (2019).

12.5.5.1 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 16: Traffic and Transport**, minimising travel distances
- A robust Traffic Management Plan (**Appendix 16.2**) has been developed, utilising the most direct routes where possible. This Plan will be updated to reflect project needs.

12.5.5.2 Operation Phase

The operation phase of the Project will have a positive impact on the climate due to the displacement of fossil fuels and therefore no mitigation is necessary for this phase.

12.5.5.3 Decommissioning Phase

Mitigation measures during the decommissioning phase will be similar to those employed during the construction phase as outlined above.

12.5.6 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** (20km radius from the Site for large scale developments such as wind farms and 10km radius from Site for other major developments, as is consistent with the EPA "Guidelines on the information to be contained in environmental impact assessment reports" (2022) and in **Chapter 2: Project Description**, **Table 2.2 in Section 2.3.4**.

During the construction phase of the Project, there may be other consented developments within 10 kilometres and wind farms within 20km that are yet to be constructed, which will have minor exhaust emissions from construction plant and machinery and dust emissions from construction activities. In a worst-case scenario if any of these developments were constructed at the same time as the Project in Moanmore Lower, there would be short-term slight negative cumulative impact on climate due to exhaust and dust emissions.

The nature of the Project is such that, once operational, it will have a long-term, moderate, positive impact on the air climate. It is considered that the cumulative impact 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 **Chapter 2: Project Description**, **Table 2.1** and **Table 2.2** emissions will result from the operation and maintenance vehicles onsite. However, these emissions will be minimal. Therefore, there will be long-term imperceptible negative cumulative effects on the climate. Importantly, the positive effects from fossil fuel replacement, particularly in reducing greenhouse gas emissions, are expected to far outweigh any negative operational effects, contributing significantly to climate mitigation efforts.

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.

12.5.6.1 Potential Cumulative Effects with Other Wind Farm Developments

The greatest potential for cumulative effects to occur would be if the construction phase of permitted and/or proposed wind farms, as listed in **Table 2.1**, and the construction phase of the Project overlapped. In an unmitigated scenario, there may be potential for some cumulative effects on air quality.

There are 16 No. wind farms within the 20km study area. Of these 16 no. wind farms there are 14 no. which are operational and therefore the construction phase of these wind farms cannot overlap with that of the Project. Wind farms are renewable energy projects which will displace the traditional use of fossil fuels in energy production, thereby having a positive impact on the climate during operation.

The 2 no. proposed wind farms within the 20km study area are Ballykett and Shronowen. Shronowen Wind Farm, located in County Kerry, was granted permission by An Bord Pleanála on 27/09/2022 (Case Reference: PA08-309156). A review of the Environmental Impact Assessment Report (EIAR) attached to the application indicates that the construction of Shronowen Wind Farm will not result in any cumulative air quality effects when built concurrently with the proposed Moanmore Lower Wind Farm as it is a considerable distance away.

The proposed Ballykett Wind Farm, a 4-turbine site, is located approximately 3.7km north-east of Moanmore Lower Wind Farm. There is potential for cumulative effects during the delivery of concrete, stone, or turbines. During the placement of concrete for the foundation, the number of HGV loads (75 per day) is expected to be similar for both wind farms.

With regards to potential cumulative effects associated with the proposed Ballykett Wind Farm. The EIAR for Ballykett Wind Farm and the EIAR for the Project detail strict mitigation measures for the protection of air quality and climate during the construction phase of this proposed Project.

An overlap of ~570m was identified between the GCR and the proposed onshore grid connection route for the proposed Sceirde Rocks Offshore Wind Farm along the L2034 to the east of the Site. Similarly, practicalities (and road safety issues) will make it highly unlikely that the construction phase of the overlapping sections of the grid connections would occur at the same time as this would result in road closures (two trenches being excavated at the same time). Furthermore, the EIARs for onshore elements of Sceirde Rocks Wind Farm and the EIAR for the Project detail mitigation measures for the protection of air quality during the construction of the grid connections. Therefore, with the implementation of the prescribed mitigation measures there will be no cumulative effects.

Therefore, with the implementation of the proposed mitigation measures (both for the Project and for the other wind farms) there will be no significant cumulative effects associated with the construction, operational or decommissioning phases of the Project and other wind farms within the cumulative study area.

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

12.5.6.2 Potential Cumulative Effects with Other Developments

A detailed cumulative assessment has been carried out for all planning applications (granted and awaiting decisions) within the cumulative study area (10km). The 10km radius distance search area selected for other development, other than wind farms, is considered to be reasonable for cumulative impact assessment for EIAR and consistent with the EPA "Guidelines on the information to be contained in environmental impact assessment reports" (2022).

The planning applications identified within the study area are of small scale, consisting mostly of new dwellings or renovations of existing dwellings, as well as for the erection of farm buildings (refer to **Chapter 2: Project Description, Table 2.2**). Based on the small scale of the works and the temporal period of likely works, combined with the mitigation measures prescribed in this report for protection of air quality during the construction phase, no significant cumulative effects will occur as a result of the Project (construction, operation and decommissioning phases) and other developments.

12.5.7 Residual Effects of the Project

12.5.7.1 Construction Phase

There will be a short-term imperceptible negative effect to air and 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.

12.5.7.2 Operational Phase

There will be a long-term, moderate, positive effects to air and 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.

12.5.7.3 Decommissioning Phase

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

12.5.8 Summary of Significant Effects

This assessment has identified no likely significant effects, given the mitigation measures embedded in the design and recommended for the Project.

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

12.5.9 Statement of Significance

The Project has been assessed as having the potential to result in a short-term imperceptible, negative effects on climate during construction. There will be long-term

moderate, positive effect to air and climate as a result of reduced greenhouse gas emission during the operational phase. *The Project complies with and is for the purpose of achieving the objectives of the Climate Action Plan 2024 and Clare CPD 2023-2029. It ensures the achievement of carbon budgets and compliance with sectoral emissions ceilings.*
Potential cumulative effect of the Project on climate was assessed as having a long-term, significant, positive impact on the Climate.

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