10. AIR AND CLIMATE

10.1 Air Quality

10.1.1 Introduction

This chapter identifies, describes and assesses the potential significant direct and indirect effects on air quality and climate arising from the construction, operation and decommissioning of the Proposed Development. Alternative designs initially proposed for the Ballivor Wind Farm and their potential for effects on air and climate are considered in Chapter 3 Consideration of Reasonable Alternatives.

The Proposed Development site is located at the Ballivor Bog Group located 5 km south-southeast of Delvin and 4km east of Raharney in Co. Westmeath and 3.5km west of Ballivor Village in Co. Meath. The townlands in which the site is located, including the proposed 110kV substation are listed in Table 1-1 in Chapter 1 of this EIAR. The land cover within the Wind Farm Site comprises a mix of bare cutaway peat, re-vegetation of bare peat, degraded blanket bog, scrub, low woodland and remnants of high bog. Several Bord na Móna rail lines pass through the bogs.

Existing activities within the site include site management and environmental monitoring as required under IPC Licence P0-501, temporary wind measurement (a single 100m meteorological mast on Lisclogher Bog). Several telecommunication links traverse the site but there is no communication infrastructure e.g. communication towers within the Wind Farm Site. Please see Chapter 14 Material Assets for further details on this.

Active peat extraction permitted under IPC Licence No. 501 ceased in June 2020. Under IPC Licence, the applicant is required to commence decommissioning and rehabilitation of the Ballivor Bog Group. Part of the decommissioning involves removing previously harvested and stockpiled peat off the bogs. The removal of stockpiled peat will be completed by 2024. The surrounding land-uses and activities comprise a mixture of forestry, agricultural land, cutover and cutaway peatland, one-off rural housing and small village settlements. The consented Bracklyn Wind Farm site (Planning Reference: PC25M.306261) is located adjacent to the western boundary of the Proposed Development site.

Carbon Sequestration at the Ballivor Bog Group

Condition 10 of the IPC licence requires the applicant to produce peatland rehabilitation plans for all five bogs of the Ballivor Bog Group: Bracklin, Ballivor, Carranstown, Lisclogher and Lisclogher West. The Proposed Development falls within all of these bogs except Lisclogher West and therefore it does not form part of the Wind Farm Site Boundary. Please see Appendix 6-6 for the draft Cutaway Bog Decommissioning and Rehabilitation Plans. These plans take cognisance of the Proposed Development footprint and demonstrate that both peatland rehabilitation and renewable energy can coexist harmoniously onsite.

The key objective of the peatland rehabilitation plans is environmental stabilisation of all five bogs within the Ballivor Bog Group. The rehabilitation will support biodiversity and the formation of wetland habitats. It will also bring a range of benefits to the local community via improvements in the local landscape. More specifically, peatland rehabilitation complies with national policies and strategies regarding the reduction of carbon emissions as the restoration of peatlands facilitates the re-establishment of their carbon sink function.

The Peatland Climate Action Scheme (PCAS) which comprises enhanced peatland rehabilitation (above and beyond IPC licence requirements), commenced and was completed at Carranstown East, adjacent to the Wind Farm Site. Bracklin West, also adjacent to the Wind Farm Site has been selected for PCAS and it is expected to commence in 2023. This accelerated form of peatland rehabilitation has been

undertaken at the recently constructed Cloncreen wind farm. The PCAS scheme is supported by Government through the Climate Action Fund and Ireland's National Recovery and Resilience Plan administered by the Department of Environment, Climate and Communications (DECC). Please see https://www.bnmpcas.ie/ for details. The National Parks and Wildlife Service (NPWS) acts as the Scheme regulator and there is ongoing engagement with the EPA. This scheme is in addition to the IPC licence requirements and therefore does not form part of the proposed Ballivor Wind Farm application.

Research by Wilson et al. (2013) has indicated that rehabilitation of peatlands can mitigate carbon emitted as part of historic peat extraction. As such, the re-wetting activities of the rehabilitation plans under IPC licence and the PCAS scheme will have a materially beneficial impact in raising the carbon sink potential of the land when compared to its current state (post peat extraction). The PCAS scheme already been successfully implemented at Carranstown East. Its implemented is due to commence at Bracklin West in 2023.

The cumulative benefit of the carbon savings as a result of the proposed Ballivor Wind Farm along with the provision of providing a carbon sink within the re-wetted peatlands through the peatland rehabilitation of all bogs under IPC licence and the accelerated form of peatland rehabilitation at selected areas would assist the national and international objectives for offsetting CO2 emissions and achieving a climate neutral Ireland by 2050 as set out in the Climate Action and Low Carbon Development (Amendment) Act 2021.

10.1.1.2 Statement of Authority

This chapter of the EIAR has been prepared by Karen Mulryan and reviewed by Michael Watson, of MKO. Karen is an Environmental Scientist with MKO with over 6 years' experience in the private consultancy sector. Karen holds a BA and a MSc in archaeology. Karen has a wide range of experience in the commercial sector including watching briefs, surveys and desk based assessments for a wide range of projects including wind farms, solar farms, energy storage facilities, grid routes, mixed use and residential developments. Karen coordinates environmental assessments and site work for a wide range of developments such as solar, residential, energy storage, small wind projects. Karen has experience coordinating and managing Environmental Impact Assessment Reports and producing Air and Climate chapters for EIARs including wind farms, feasibility studies and screening reports. Michael Watson, CENV, PGeo, MCIWM, is a Project Director and head of the Environment Team with over 20 years professional consultancy experience, most recently as project director and lead coordinator of environmental impact assessments for large-scale infrastructure and industrial projects. His areas of expertise include Project Management, Environmental Impact Assessment (EIA), Industrial Emissions, Waste and IPPC Licensing, Contaminated Land Assessment, Environmental Regulatory Compliance, Waste Management Planning and Environmental Monitoring. Michael has extensive experience as project strategy advisor & coordinator on large multi-disciplinary project teams on complex projects which includes Air and Climate Impact Assessments. Michael has a BA in Geography and Economics and a MSc in Environmental Resource Management and Geography.

The CO2 calculations assessment was undertaken by Mr. Sean Creedon of Bord na Móna. Sean joined Bord na Mona in 2001 in the role of Environmental Consultant. During the period from 2001 to 2009, he filled the role of Environmental Consultant and Senior Environmental Consultant. During that time, he authored a range of Air and Odour impact assessment reports, Environmental Impact Statements, Waste and IPC licence applications and Greenhouse gas permit applications. He was a member of the Bord na Mona Carbon working group from 2008 to 2023 and oversaw the development of the Bord na Mona Carbon calculator that determines the overall losses and savings arising from wind farm developments on cutaway peatlands. Since 2009 in the role of a Senior Project Manager and Planning program manager he has directed the submission of range of large and medium scale renewable energy planning applications for wind, solar, battery and hydrogen developments.

10.1.2 Relevant Guidance and Legislation

The air quality and climate section of this EIAR is carried out in accordance with the 'EIA Directive' as mended by Directive 2014/52/EU and having regard, where relevant, to guidance listed below.

- Guidelines on the Information to be contained in Environmental Impact Assessment Reports – June 2022' (EPA, 2022).
- Environmental Impact Assessment of Projects: Guidance on the preparation of the Environmental Impact Assessment Report' (EC, 2017)
- Environmental Protection Agency (2022) Air Quality in Ireland Report 2021.
- Guidance on the Assessment of Dust from Demolition and Construction V1.1 (IAQM 2016);
- Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes (TII 2011);
- Guidelines for Assessment of Ecological Impacts of National Roads Schemes (TII 2009);
- UK Department of Environment Food and Rural Affairs (DEFRA) Part IV of the Environment Act 1995: Local Air Quality Management, LAQM.TG (16) (DEFRA 2018);
- UK Highways Agency (UKHA) Design Manual for Roads and Bridges (DMRB) – LA
- 105 Air Quality (UKHA 2019);
- World Health Organization (WHO) Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulfur Dioxide Global Update 2005 (WHO 2005).

10.1.2.1 Air Quality Standards

In 1996, the Air Quality Framework Directive (96/62/EC) was published. This Directive was transposed into Irish law by the Environmental Protection Agency Act 1992 (Ambient Air Quality Assessment and Management) Regulations 1999. The Directive was followed by four Daughter Directives, which set out limit values for specific pollutants:

- The first Daughter Directive (1999/30/EC) addresses sulphur dioxide, oxides of nitrogen, particulate matter and lead.
- The second Daughter Directive (2000/69/EC) addresses carbon monoxide and benzene. The first two Daughter Directives were transposed into Irish law by the Air Quality Standards Regulations 2002 (SI No. 271 of 2002).
- The third Daughter Directive, Council Directive (2002/3/EC) relating to ozone was published in 2002 and was transposed into Irish law by the Ozone in Ambient Air Regulations 2004 (SI No. 53 of 2004).
- The fourth Daughter Directive[1], published in 2004, relates to polyaromatic hydrocarbons (PAHs), arsenic, nickel, cadmium and mercury in ambient air and was transposed into Irish law by the Arsenic, Cadmium, Mercury, Nickel and Polycyclic Aromatic Hydrocarbons in Ambient Air Regulations, 2009 (S.I. No. 58 of 2009).

The Air Quality Framework Directive and the first three Daughter Directives have been replaced by the Clean Air for Europe (CAFE) Directive (Directive 2008/50/EC on ambient air quality), which encompasses the following elements:

- The merging of most of the existing legislation into a single Directive (except for the Fourth Daughter Directive) with no change to existing air quality objectives.

[1] *IEEP Fourth Daughter Directive 2004. Available at: https://ieep.eu/publications/the-fourth-air-quality-daughter-directive-impacts-and-consequences-of-mandatory-limits/*

- New air quality objectives for particulate matter less than 2.5 micrometers (µm) referred to as $PM_{2.5}$ including the limit value and exposure concentration reduction target.
- The possibility to discount natural sources of pollution when assessing compliance against limit values.
- The possibility for time extensions of three years for particulate matter less than 10µm (PM_{10}) or up to five years (nitrogen dioxide, benzene) for complying with limit values, based on conditions and the assessment by the European Commission.

Table 10-1 below sets out the limit values of the CAFE Directive, as derived from the Air Quality Framework Daughter Directives. 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 10µm or less (coarse particles) in aerodynamic diameter. $PM_{2.5}$ represents particles measuring less than 2.5µm (fine particles) in aerodynamic diameter.

The CAFE Directive was transposed into Irish legislation by the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011). These Regulations supersede the Air Quality Standards Regulations 2002 (S.I. No. 271 of 2002), the Ozone in Ambient Air Regulations 2004 (S.I. No. 53 of 2004) and the Ambient Air Quality Assessment and Management Regulations 1999 (S.I. No. 33 of 1999).

Table 10-1 Limit values of Directive 2008/50/EC (Source: https://www.epa.ie/air/quality/standards/)

Pollutant	Limit Value Objective	Averaging Period	Limit Value (µg/m3)	Limit Value (ppb)	Basis of Application of Limit Value	Attainment Date
Sulphur dioxide (SO_2)	Protection of Human Health	1 hour	350	132	Not to be exceeded more than 24 times in a calendar year	1st Jan 2005
Sulphur dioxide (SO_2)	Protection of human health	24 hours	125	47	Not to be exceeded more than 3 times in a calendar year	1st Jan 2005
Sulphur dioxide (SO_2)	Upper assessment threshold for the protection of Human Health	24 hours	75	28	Not to be exceeded more than 3 times in a calendar year	1st Jan 2005
Sulphur dioxide (SO_2)	Lower assessment threshold for the protection of human health	24 hours	50	19	Not to be exceeded more than 3 times in a calendar year	1st Jan 2005

Pollutant	Limit Value Objective	Averaging Period	Limit Value (µg/m3)	Limit Value (ppb)	Basis of Application of Limit Value	Attainment Date
Sulphur dioxide (SO_2)	Protection of vegetation	Calendar year	20	7.5	Annual mean	19th Jul 2001
Sulphur dioxide (SO_2)	Protection of vegetation	1st Oct to 31st Mar	20	7.5	Winter mean	19th Jul 2001
Nitrogen dioxide (NO_2)	Protection of human health	1 hour	200	105	Not to be exceeded more than 18 times in a calendar year	1st Jan 2010
Nitrogen dioxide (NO_2)	Protection of human health	Calendar year	40	21	Annual mean	1st Jan 2010
Nitrogen dioxide (NO_2)	Upper assessment threshold for the protection of human health	1 hour	140	73	Not to be exceeded more than 18 times in a calendar year	1st Jan 2010
Nitrogen dioxide (NO_2)	Lower assessment threshold for the protection of human health	1 hour	100	52	Not to be exceeded more than 18 times in a calendar year	1st Jan 2010
Nitrogen monoxide (NO) and nitrogen dioxide (NO_2)	Protection of ecosystems	Calendar year	30	16	Annual mean	19th Jul 2001
Particulate matter 10 (PM_{10})	Protection of human health	24 hours	50	-	Not to be exceeded more than 35 times in a calendar year	1st Jan 2005

Pollutant	Limit Value Objective	Averaging Period	Limit Value (µg/m3)	Limit Value (ppb)	Basis of Application of Limit Value	Attainment Date
Particulate matter 10 (PM_{10})	Upper assessment threshold for the protection of human health	24 hours	30	-	Not to be exceeded more than 7 times in a calendar year	Based on the indicative limit values for 1 January 2010
Particulate matter 10 (PM_{10})	Lower assessment threshold for the protection of human health	24 hours	20	-	Not to be exceeded more than 7 times in a calendar year	Based on the indicative limit values for 1 January 2010
Particulate matter 2.5 ($PM_{2.5}$)	Protection of human health	Calendar year	40	-	Annual mean	1st Jan 2005
Particulate matter 2.5 ($PM_{2.5}$) Stage 1	Protection of human health	Calendar year	25	-	Annual mean	1st Jan 2015
Particulate matter 2.5 ($PM_{2.5}$) Stage 2	Protection of human health	Calendar year	20	-	Annual mean	1st Jan 2020
Lead (Pb)	Protection of human health	Calendar year	0.5	-	Annual mean	1st Jan 2005
Carbon Monoxide (CO)	Protection of human health	8 hours	10,000	8,620	-	1st Jan 2005
Benzene (C_6H_6)	Protection of human health	Calendar Year	5	1.5	-	1st Jan 2010

The Ozone Daughter Directive 2008/50/EC is different from the other Daughter Directives in that it sets target values and long-term objectives for ozone rather than limit values. Table 10-2 presents the limit and target values for ozone.

Table 10-2 Target values for Ozone Defined in Directive 2008/50/EC.

Objective	Parameter	Target Value for 2010	Target Value for 2020
Protection of human health	Maximum daily 8-hour mean	120 mg/m^3 not to be exceeded more than 25 days per calendar year averaged over 3 years	120 mg/m^3
Protection of vegetation	AOT40* calculated from 1 hour values from May to July	18,000 $mg/m^3.h$ averaged over 5 years	6,000 $mg/m^3.h$
Information Threshold	1-hour average	180 mg/m^3	-
Alert Threshold	1-hour average	240 mg/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 g/m^3 and is expressed as g/m^3 hours.

10.1.2.2 Air Quality and Health

The Environmental Protection Agency (EPA) report 'Air Quality in Ireland 2021' noted that in Ireland, the premature deaths attributable to poor air quality are estimated at 1,300 people per annum. A more recent European Environmental Agency (EEA) Report, 'Air Quality in Europe – 2021 Report' highlights the negative effects of air pollution on human health. The report assessed that poor air quality accounted for premature deaths of approximately 307,000 people in the 27 EU Member States in 2019, with regards to deaths relating to PM2.5. The estimated impacts on the population in Europe of exposure to NO2 and O3 concentrations in 2019 were around 40,400 and 16,800 premature deaths per year, respectively. From this, 1,300 Irish deaths were attributable to fine particulate matter (PM2.5), 30 Irish deaths were attributable to nitrogen oxides (NO2) and 50 Irish deaths were attributable to Ozone (O3) (Source: Air Quality in Europe – 2021 Report', EEA, 2021).
These emissions, along with others including sulphur oxides, carbon monoxide, benzene and lead are produced during fossil fuel-based electricity generation and traffic in various amounts, depending on the fuel and technology used. Whilst there is the potential of such emissions to be generated from the site operations, a number of mitigation measures will be implemented at the Proposed Development site to reduce the impact from dust and vehicle emissions, which are discussed in Section 10.2 below.

10.1.3 Methodology

The air quality zone for the Wind Farm Site was selected, followed by a review of EPA collated baseline air quality data namely Sulphur Dioxide (SO_2), Particulate Matter ($PM10$), Nitrogen Dioxide (NO_2), Carbon Monoxide (CO) and Ozone (O_3) for the selected air quality zone to determine the representative levels of such emissions for the Wind Farm Site.

10.1.3.1 Air Quality Zones

The Environmental Protection Agency (EPA) has designated four Air Quality Zones for Ireland:

- Zone A: Dublin
- Zone B: Cork

- Zone C: Other cities and large towns including Limerick, Galway, Mullingar
- Zone D: Rural Ireland, i.e., the remainder of the State excluding Zones A, B and C.

These zones were defined to meet the criteria for air quality monitoring, assessment and management described in the Cafe Directive 2008/50/EC, and Daughter Directives. The Proposed Development site lies within Zone D which represents rural areas located away from large population centres.

10.1.3.2 Air Quality Data Review

The EPA publishes Air Monitoring Station Reports for monitoring locations in all four Air Quality Zones. The most recent report on air quality in Ireland, 'Air Quality in Ireland 2020' was published by the EPA in 2021. The EPA reports provide SO_2, PM_{10}, NO_2 and O_3 concentrations for areas in Zone D. These are detailed in the Baseline Air Quality section.

10.1.3.3 Dust

Dust emission data for the Derrygreenagh Bog Group, of which the Wind Farm Site is a subset, has been reported by the Applicant to the EPA each year in Annual Environmental Reports (AERs) as required under condition 5 of its Integrated Pollution Control Licence (P0-501). AERs for the period 2008-2021 are available for public viewing on the EPA website.[2]

It should be noted that since the commencement of dust monitoring at the site in 2000, there have been no breaches of dust limits (350 mg/m^2/day) or complaints pertaining to dust emissions from the surrounding receptors while peat extraction was ongoing. Peat extraction ceased in June 2020 and dust emissions have not been monitored since this period due to the limited onsite activities (environmental monitoring, site management, wind measurement). Using the baseline emissions data and assumptions regarding dust levels at the Wind Farm Site, the potential impact and significance of effects on air quality from emissions listed above during the construction, operation and decommissioning of the Proposed Development is assessed.

In addition to the above, the Institute of Air Quality Management in the UK (IAQM) guidance document '*Guidance on the Assessment of Dust from Demolition and Construction*' (2014) was considered. The Guidance document outlines an assessment method for predicting the impact of dust emissions from construction activities based on the scale and nature of the works and the sensitivity of the area to dust impacts. This methodology has been used to predict the likely risk of dust as a result of the construction phase works, operational phase activities and decommissioning phase. The use of UK guidance is considered best practice in the absence of applicable Irish guidance. The major dust generating activities are divided into four types within the IAQM guidance (2014) to reflect their different potential impacts. These are:

- Demolition (There are no demolition works required for any phase of the Proposed Development)
- Earthworks.
- Construction.
- Trackout. The transport of dust and dirt from the construction / demolition site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network. This arises when Heavy Goods Vehicles (HGVs) leave the construction / demolition site with dusty materials, which may then spill onto the road, and/or when HGVs transfer dust and dirt onto the road having travelled over muddy ground on site.

[2] *Annual Environment Reports for the year 2008-2021 inclusive are available at the following link: https://epawebapp.epa.ie/licsearchdownload/CombinedFileView.aspx?regno=P0501-01&classification=Enforcement.*

The magnitude of the three remaining categories is divided into Large, Medium or Small scale depending on the nature of the activities involved. The magnitude of each activity is combined with the overall sensitivity of the area to determine the risk of dust impacts from site activities. For the purposes of this assessment, high sensitivity receptors are regarded as residential properties where people are likely to spend the majority of their time. Commercial properties and places of work are regarded as medium sensitivity while low sensitivity receptors are places where people are present for short periods or do not expect a high level of amenity. Dust deposition impacts can occur for a distance of 350m from works areas, but the majority of deposition occurs within the first 50m (IAQM, 2014).

Table 10-3 Sensitivity of the Area to Dust Soiling Effects on People and Property. Guidance on the Assessment of Dust from Demolition and Construction (IAQM, 2014)

Receptor Sensitivity	Number Of Receptors	Distance from source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

The IAQM categorises of dust emissions from HGVs into three groups relating to the volume of HGV movements:

- Large: 50 HGV outward (offsite) movements or more per day, moderately dusty surface material, unpaved road greater than 100m
- Medium: 10-50 HGV outward movements per day, surface material with low potential for dust release, unpaved road length 50 m – 100 m;
- Small: less than 10 HGV outward movements per day, unpaved road length of less than 50m.

The category is combined with the sensitivity of area established through from the dust soiling effect assessment in Table 10-3 above to determine the impact from dust emissions through the transportation of HGVs to and from the construction site in Table 10-4.

Table 10-4 Risk of Dust Impacts from Trackout. Guidance on the Assessment of Dust from Demolition and Construction (IAQM, 2014)

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible Risk

As mentioned, peat extraction ceased at the Ballivor Bog Group in June 2020 and as current activities at the Wind Farm Site and surrounding landscape area non-industrial in nature, air quality sampling was deemed to be unnecessary for this EIAR.

10.1.4 Baseline Air Quality

The air quality in the vicinity of the Wind Farm Site is typical of that of rural areas in the midlands of Ireland, i.e., Zone D. Prevailing south-westerly winds carry clean, unpolluted air from the Atlantic Ocean onto the Irish mainland. The EPA publishes Air Monitoring Station Reports for monitoring locations in all four Air Quality Zones. The most recent report on air quality in Ireland, 'Air Quality in Ireland 2021' was published by the EPA in 2022. The EPA reports provide SO_2, PM_{10}, NO_2 and O_3 concentrations for areas in Zone D. These are detailed in the following tables.

10.1.4.1 Sulphur Dioxide (SO_2)

Sulphur dioxide data collected in 2021 at Cork Harbour, Kilkitt, Co. Monaghan, Askeaton in Co. Limerick and Letterkenny i.e. representative values for the State, is presented in Table 10-5.

Table 10-5 Average Sulphur Dioxide Data for Zone D Sites in 2021

Parameter	Measurement (ug/m^3)
Annual Mean	4.16
Hourly values > 350	0
Hourly max	95
Daily values > 125	0
Daily max	25.5

During the monitoring period there were no exceedances of the daily limit values for the protection of human health. As can observed from Table 10-5 the average maximum hourly value recorded during the assessment period was 95 µg/m^3. In addition, there were no exceedances of the annual mean limit for the protection of ecosystems. Given the non-industrial, rural nature of the Wind Farm Site and surrounds, it is considered that SO_2 values at the Wind Farm Site would be similar or lower than those recorded for the Zone D sites above.

10.1.4.2 Particulate Matter (PM_{10})

Sources of particulate matter include vehicle exhaust emissions, soil and road surfaces, construction works and industrial emissions. The EPA report[3] provide annual mean PM_{10} concentration for twelve Zone D towns, Tipperary Town, Carrick-on-Shannon Enniscorthy, Birr, Askeaton, Macroom, Castlebar, Cobh, Claremorris, Kilkitt, Cavan and Roscommon Town. PM_{10} data for 2021 is presented in Table 10-6. PM_{10} daily limit for the protection of human health: No more than 35 days >50 µg/m^3.

[3] *EPA (2022). Air Quality in Ireland 2021. https://www.epa.ie/publications/monitoring--assessment/air/EPA-Air_Quality_in-Ireland-Report_2021_-flat.pdf.pdf*

Table 10-6 Average Particulate Matter (PM_{10}) Data for Zone D Sites in 2021

Parameter	Measurement (ug/m^3)
Annual Mean	11.9
% Data Capture	91
Values > 50 ug/m^3	Max 5
Daily Max	60

The daily limit of 50 µg/m^3 for the protection of human health was not exceeded more than 35 times during the monitoring period. Given the non-industrial, rural nature of the Wind Farm Site and surrounds, it is considered that PM_{10} values at the Wind Farm Site would be similar or lower than those recorded for the Zone D sites above.

10.1.4.3 Nitrogen Dioxide (NO_2)

Nitrogen dioxide data for Emo Court, Birr, Castlebar, Carrick-on-Shannon and Kilkitt in 2021 is presented in Table 10-7.

Table 10-7 Average Nitrogen Dioxide Data for Zone D Sites in 2021

Parameter	Measurement (µg/m^3)
Annual Mean	7.5
NO_2 Values >200	0
Values > 140 (UAT)	0
Values >100 (LAT)	0
Hourly Max.	63

The annual NO_2 value was below the annual mean limit value for the protection of human health of 40 µg/m^3. Furthermore the lower and upper assessment thresholds of 100 and 140 µg/m^3 was not exceeded during the monitoring period. The average hourly max. NO_2 value of 63 µg/m^3 measured during the monitoring period was below the hourly max threshold of 200 µg/m^3. Given the non-industrial, rural nature of the Wind Farm Site and surrounds, it is considered that NO_2 values at the Wind Farm Site would be similar or lower than those recorded for the Zone D sites above.

10.1.4.4 Carbon Monoxide (CO)

The EPA report[3] provide rolling 8-hour carbon monoxide concentrations for Birr a zone D site. Carbon Monoxide data for 2021 is presented in Table 10-8.

Table 10-8 Carbon Monoxide Data for Birr - Zone D Site in 2021

Parameter	Measurement
Annual Mean	0.3 mg/m^3
Median	0.3 mg/m^3
% Data Capture	98.2%

Parameter	Measurement
Values > 10	0
Max	1.2 mg/m^3

The average concentration of carbon monoxide was 0.3 mg/m^3. The carbon monoxide limit value for the protection of human health is 10,000 µg/m^3 (or 10mg/m^3). On no occasions were values in excess of the 10 mg limit value set out in Directives 2000/69/EC or 2008/69/EC.

10.1.4.5 Ozone (O_3)

The EPA report[3] provide rolling 8-hour ozone concentrations for seven Zone D sites, Emo Court, Kilkitt, Carnsore Point, Mace Head, Castlebar, Valentia and Malin Head. Ozone (O_3) data for 2021 is presented in Table 10-9. As can be observed there were no exceedances of the maximum daily eight-hour mean limit of 120 µg/m^3. The legislation stipulates that this limit should not be exceeded on more than 25 days.

Table 10-9 Average Ozone Data for Zone D Sites in 2021

Parameter	Measurement
Annual Mean	60µg/m^3
Median	62 µg/m^3
% Data Capture	89%
No. of days > 1800	0 days

10.1.4.6 Dust

There are no statutory limits for dust deposition in Ireland. The German TA-Luft standard for dust deposition sets a maximum permissible emission level for dust deposition of 350 mg/m^2/day. Recommendations from the Department of the Environment, Health & Local Government[4]apply the Bergerhoff limit of 350 mg/m^2/day to the site boundary of quarries. This limit value can also be implemented with regard to dust impacts from construction activities associated with the Proposed Development.

Monitoring for dust deposition during peat extraction activities from 2000 to 2020 had been undertaken at the Wind Farm Site as a requirement of Condition 5 of the IPC licence for the Ballivor Bog Group. The monitoring typically took place between April to September of each year to correspond to the peat harvesting season and the results are reported in the Annual Environmental Report (AER) each year. The AERs for the Ballivor Bog Group covering the period 2008-2021 are publicly available on the EPA portal [5].

The AERs indicate that no exceedances of the dust emission limit value of 350 mg/m^2/day over the period 2000 – 2020 were recorded. Additionally, no complaints were made from sensitive receptors in relation to dust emissions generated at the Wind Farm Site for the period 2000-2020. As no peat extraction was carried out in 2021, no dust monitoring took place in that year. It is assumed that levels of dust generated

[4] *DOEHLG (2004) Quarries and Ancillary Activities, Guidelines for Planning Authorities*
[5] *AERs for the period 2008-2021 when peat extraction was underway at the Wind Farm Site can be found on the EPA licence portal at the following link. https://epawebapp.epa.ie/licsearchdownload/CombinedFileView.aspx?regno=P0501-01&classification=Enforcement*

at the Wind Farm Site since peat extraction ceased has reduced considerably and given that dust limits were not breached during the peat extraction years, it is assumed that dust emissions since June 2020 have not breached the daily dust limit either. Furthermore, no complaints pertaining to dust were received in 2021. This indicates that dust deposition was not a significant issue at the site.

Peat extraction ceased at the Ballivor Bog Group in June 2020. Therefore, the activities at the Wind Farm Site today which could generate dust are much reduced in comparison to the period 2000-2020 when peat extraction was ongoing. As such, it is considered that dust emissions today at the Wind Farm Site are significantly less than those recorded during the extraction phase and consequently, exceedances of the limit value of 350 mg/m2/day do not occur.

Existing Sensitive Receptors

According to the Institute of Air Quality Management in the UK (IAQM) guidance document '*Guidance on the Assessment of Dust from Demolition and Construction*' (2014), dust deposition impacts can occur for a distance of 350m from works areas, but the majority of deposition occurs within the first 50m (IAQM, 2014). For the purposes of this EIAR, high sensitivity receptors are regarded as residential properties where people are likely to spend the majority of their time. Commercial properties and places of work are regarded as medium sensitivity while low sensitivity receptors are places where people are present for short periods or do not expect a high level of amenity. There are 5 no high sensitivity residential properties within 100m of the Proposed Development footprint and a total of 23 no. high sensitivity residential properties within 350m of the Proposed Development footprint where construction activities with the potential to generate dust can occur.

10.2 Likely Significant Effects and Associated Mitigation Measures

10.2.1 'Do-Nothing' Effect

If the Proposed Development were not to proceed, the site would continue to be managed under the requirements of the relevant IPC licence and therefore the ongoing site management and environmental monitoring, peat stockpile removal (due to be completed by 2024), and wind measurement would continue. In addition, if the Proposed Development were not to proceed, the implementation of peatland rehabilitation plans as required under IPC License would occur. Likewise, the PCAS scheme in adjacent Bogs (where selected) would continue to be implemented. These land uses and activities will also continue if the Proposed Development does proceed.

In addition, there would be no exhaust emissions from the wind farm construction plant and vehicles, nor would there be dust emissions due to the movement of the same.

However, if the Proposed Development were not to proceed, the opportunity to capture part of Meath and Westmeath's valuable renewable energy resource would be lost, as would the opportunity to contribute to meeting Government and EU targets for the production and consumption of electricity from renewable resources and the reduction of greenhouse gas emissions. The opportunity to generate local employment and investment and to diversify the local economy would also be lost.

More specifically, the opportunity of this Proposed Development to contribute to the reduction of emissions of carbon dioxide, oxides of nitrogen (NO_x), and sulphur dioxide (SO_2) to the atmosphere would be lost resulting in a continued dependence on electricity derived from fossil fuel, rather than renewable energy sources such as from the proposed wind farm. In addition, the Proposed Development with assist in the achievement of 80% electricity generated from renewable sources by 2030. It is estimated that the Proposed Development, with a potential installed capacity in the range of 117MW to 169MW

will offer significant benefits in terms of renewable energy production and reductions in greenhouse gas emissions by its net displacement of approximately 6,035,010 tonnes and 8,717,237 tonnes of Carbon Dioxide (CO_2) per annum (Against EU FFC), see section 10.3.5 for details.

This will result in an **indirect negative** impact on air quality. Across the lifetime of the operational phase, this is considered to be a significant negative effect on air quality.

10.2.2 Construction Phase

10.2.2.1 Exhaust Emissions: Construction of Turbines and Other Infrastructure

The construction of turbine bases and hardstands, site roads, site entrances, anemometry mast bases, borrow pits, grid connection cabling and other onsite infrastructure will require the operation of construction vehicles and plant on and off site, and the transport of workers to and from the site. As the substation and grid connection point is wholly within the site boundary, is screened from the local road by vegetation and the nearest sensitive receptor is over 550m away, it is considered that the construction of the substation would give rise to similar impacts pertaining to dust emissions as would the turbines and other onsite infrastructure.

Exhaust emissions associated with vehicles and plant such as NO_2, Benzene and PM_{10} will arise as a result of construction activities. This potential effect will not be significant and will be restricted to the duration of the construction phase and localised to works areas. Therefore, this is considered a short-term, slight, negative impact.

Mitigation & Monitoring Measures

- Construction staff will be trained how to inspect and maintain construction vehicles and plant to ensure good operational order while onsite, thereby minimising any emissions that arise. The Site Supervisor/Construction Manager produce and follow a site inspection and machinery checklist which will be followed and updated if/when required.
- Machinery will be switched off when not in use.
- Turbines and construction materials will be transported to the site on specified routes only, unless otherwise agreed with the Planning Authority. Please see Chapter 14 Material Assets for details.
- Aggregate materials for the construction of site access tracks and all associated infrastructure will all be locally sourced, where possible, which will further reduce potential emissions.
- A Construction and Environmental Management Plan (CEMP) will be in place throughout the construction phase (see Appendix 4-3). The CEMP includes dust suppression measures.

Residual Impacts

With the implementation of the above measures for this phase construction phase, residual impacts on air quality from exhaust emissions generated during the construction of the turbines, substation and other infrastructure are considered a short-term imperceptible negative impact.

Significance of Effects

No significant effects on air quality are considered from exhaust emissions during the construction phase of the Proposed Development.

10.2.2.2 Exhaust Emissions: Construction of Borrow Pits

There are 2 No. proposed borrow pits as part of the construction phase of the Proposed Development and comprise:

- Borrow pit 1a located within cutover peat in Carranstown Bog, west of a proposed internal track, in the Grange More townland;
- Borrow pit 1b located within cutover peat in Carranstown Bog, east of the proposed internal track, in the Grange More townland;
- Borrow pit No. 2 located within third party pastureland in the Craddanstown townland.

The proposed borrow pits will require the use of construction machinery and plant, thereby giving rise to exhaust emissions. The borrow pit construction will commence at the beginning of the construction phase only during working hours only (7am to 7pm); they will not require continuous, ongoing construction of the duration of the construction phase. Furthermore, the borrow pit locations are over 200m from occupied non-involved landowners. should be noted that no rock breakers or blasting is proposed for the borrow pits, thus no dust or exhaust emissions from this type of plant will occur. The potential effect from exhaust emissions will not be significant and will be restricted to the duration of the construction phase and localised to works areas. Therefore, this is considered a short-term, slight, negative impact.

Mitigation & Monitoring Measures

- Measures listed in section above pertaining to exhaust emissions from turbine and other infrastructure construction will be implemented for the construction of the borrow pits.
- Sporadic wetting of loose stone surface in the borrow pits will be carried out during the construction phase to minimise movement of dust particles to the air. In periods of extended dry weather, dust suppression may be necessary along haul roads to ensure dust does not cause a nuisance. If necessary, water will be taken from stilling ponds in the site's drainage system and will be pumped into a bowser or water spreader to dampen down haul roads and site compound to prevent the generation of dust where required. Water bowser movements will be carefully monitored to avoid, insofar as reasonably possible, increased runoff.
- All plant and materials vehicles shall be stored in dedicated areas (on site).
- Wheel wash bays will be located at both the main site entrances into Ballivor Bog and Carranstown Bog off the R156. All vehicles will go through the wheel wash prior to exiting the site to ensure no materials are carried onto the local road network.
- Areas of excavation will be kept to a minimum, and stockpiling will be minimised by coordinating excavation, spreading and compaction.
- The transport of construction materials from the borrow pits around the site will be undertaken in tarpaulin or similar covered vehicles, where necessary.
- A Construction and Environmental Management Plan (CEMP) will be in place throughout the construction phase (see Appendix 4-3). The CEMP includes dust suppression measures.

Residual Effects

Based on the above, there will be a short-term slight negative impact on air quality from exhaust emissions during the construction of the onsite borrow pits.

Significance of Effects

No significance effects on air quality from exhaust emissions are considered for the construction of the onsite borrow pits.

10.2.2.3 Exhaust Emissions: Transport of Materials to Wind Farm Site

The transport of turbines and construction materials to the Wind Farm Site (which will occur on specified routes only, see in Chapter 4 Description of this EIAR), the departure of empty vehicles and/or minor waste volumes (please see accompanying CEMP Appendix 4-3) from the site and daily staff movements, will give rise to exhaust emissions associated with the transport vehicles.

Mitigation & Monitoring Measures

- Measures listed in the section above pertaining to exhaust emissions from turbine, other infrastructure and borrow pit construction will be implemented for the transportation of vehicles to and from the Wind Farm Site.
- Aggregate materials for the construction of site access tracks and all associated infrastructure will all be locally sourced, where possible, which will further reduce potential emissions.
- Turbines and construction materials will be transported to the site on specified haul routes only.
- The agreed haul route roads adjacent to the site will be regularly inspected for cleanliness and cleaned as necessary.
- A Construction and Environmental Management Plan (CEMP) will be in place throughout the construction phase (see Appendix 4-3). The CEMP includes dust suppression measures.

Residual Impact

This constitutes a short-term slight negative impact in terms of air quality brought about by the transportation of materials to the Wind Farm Site.

Significance of Effects

Based on this assessment there will be no significant direct or indirect effects on air quality from exhaust emissions during delivery of materials to the Wind Farm Site.

10.2.2.4 Dust Emissions: Construction of Turbines and Other Infrastructure

The construction of turbine bases and hardstands, substation, site roads, site entrances, anemometry mast bases and other onsite infrastructure will give rise to dust emissions during the construction phase.

The IAQM methodology for *the Assessment of Dust from Demolition and Construction* as discussed in section 10.1.3.3 is used to predict the likely risk of dust impacts as a result of the construction works.

Dust deposition impacts can occur for a distance of 350m from works areas, but the majority of deposition occurs within the first 50m (IAQM, 2014). In terms of sensitive receptors there are no residential properties within 50m of the Proposed Development footprint where construction activities with the potential to generate dust can occur. There are 5 no high sensitivity receptors within 100m of Proposed Development Footprint where construction activities with the potential to generate dust can occur and a total of 23 no. additional receptor within 350m of the Proposed Development footprint. As per the criteria

in Table 10-10 below the overall sensitivity of the area to dust soiling impacts is **Low**. For the construction phase, the impact is considered to be a short term, slight negative impact.

Table 10-10 Sensitivity of the Area to Dust Soiling Effects on People and Property. Guidance on the Assessment of Dust from Demolition and Construction (IAQM, 2014)

Receptor Sensitivity	Number Of Receptors	Distance from source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Mitigation & Monitoring Measures

- Sporadic wetting of loose stone surface will be carried out during the construction phase to minimise movement of dust particles to the air. In periods of extended dry weather, dust suppression may be necessary along haul roads to ensure dust does not cause a nuisance. If necessary, water will be taken from stilling ponds in the site's drainage system and will be pumped into a bowser or water spreader to dampen down haul roads and site compound to prevent the generation of dust where required. Water bowser movements will be carefully monitored to avoid, insofar as reasonably possible, increased runoff.
- All plant and materials vehicles shall be stored in dedicated areas (on site).
- Wheel wash bays will be located at both the main site entrances into Ballivor Bog and Carranstown Bog off the R156. All vehicles will go through the wheel wash prior to exiting the site to ensure no materials are carried onto the local road network.
- Areas of excavation will be kept to a minimum, and stockpiling will be minimised by coordinating excavation, spreading and compaction.
- Turbines and construction materials will be transported to the site on specified haul routes only.
- The agreed haul route roads adjacent to the site will be regularly inspected for cleanliness and cleaned as necessary.
- The transport of construction materials to the site that have significant potential to cause dust, will be undertaken in tarpaulin or similar covered vehicles where necessary.
- A Construction and Environmental Management Plan (CEMP) will be in place throughout the construction phase (see Appendix 4-3). The CEMP includes dust suppression measures.

Residual Impact

With the implementation of the above, it is considered to be a short-term imperceptible negative impact in terms of air quality brought about by dust emissions generated during the construction of turbines, substation and other infrastructure elements during the construction phase of the Proposed Development.

Significance of Effects

There will be no significant effects on air quality from dust emissions during the construction of turbines, 110kV substation and other onsite wind farm infrastructure.

10.2.2.5 Dust Emissions: Borrow Pits

The construction of the borrow pits will give rise to dust emissions during the construction phase. No rock breakers or blasting will be used in this area or indeed during the entire construction phase. Borrow pits no. 1a and 1b and are located within the Ballivor Bog Group at considerable distances (greater than 550m) from residential dwellings. As mentioned in section 10.1.3 Methodology, according to the Institute of Air Quality Management in the UK (IAQM) guidance document '*Guidance on the Assessment of Dust from Demolition and Construction*' (2014), dust deposition impacts can occur for a distance of 350m from works areas, but the majority of deposition occurs within the first 50m (IAQM, 2014).

There are 5 no high sensitivity receptors within 60-100m of borrow pit footprints and a total of 17 receptors within 350m of the borrow pit footprints where construction activities with the potential to generate dust can occur. Based on the criteria set out below in Table 10-11, the sensitivity of the area surrounding the borrow pits to dust soiling impacts is considered **Low.**

Table 10-11 Sensitivity of the Area to Dust Soiling Effects on People and Property. Guidance on the Assessment of Dust from Demolition and Construction (IAQM, 2014)

Receptor Sensitivity	Number Of Receptors	Distance from source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Upon completion of the construction phase or before, borrow pit No.2 in third party land will be reinstated by reseeding. As such, these impacts will be restricted to the duration of the construction phase and is considered to be a short-term slight negative impact. Dust suppression mitigation measures to reduce this impact are presented below.

Mitigation Measures

- Sporadic wetting of loose stone surface will be carried out during the construction phase to minimise movement of dust particles to the air. In periods of extended dry weather, dust suppression may be necessary along haul roads to ensure dust does not cause a nuisance. If necessary, water will be taken from stilling ponds in the site's drainage system and will be pumped into a bowser or water spreader to dampen down haul roads and site compound to prevent the generation of dust where required. Water bowser movements will be carefully monitored to avoid, insofar as reasonably possible, increased runoff.
- All plant and materials vehicles shall be stored in dedicated areas (on site).
- Wheel wash bays will be located at both the main site entrances into Ballivor Bog and Carranstown Bog off the R156. All vehicles will go through the wheel wash prior to exiting the site to ensure no materials are carried onto the local road network.
- Areas of excavation will be kept to a minimum, and stockpiling will be minimised by coordinating excavation, spreading and compaction.
- Turbines and construction materials will be transported to the site on specified haul routes only.
- The agreed haul route roads adjacent to the site will be regularly inspected for cleanliness and cleaned as necessary.

- The transport of construction materials to the site that have significant potential to cause dust, will be undertaken in tarpaulin or similar covered vehicles where necessary.
- A Construction and Environmental Management Plan (CEMP) will be in place throughout the construction phase (see Appendix 4-3). The CEMP includes dust suppression measures.

Residual Impact

With the implementation of the above, it is considered to be a short-term imperceptible negative impact on air quality from the construction of the borrow pits.

Significance of Effects

Based on the assessment above there will be no significant effects on air quality from dust emissions during the construction of the borrow pits.

10.2.2.6 Dust Emissions: Transport of Materials to Wind Farm Site

The transport of turbines and construction materials to the wind farm site will also give rise to some localised dust emissions during periods of dry weather. Likewise, the transportation of materials from the borrow pit No 2 in third party lands will be via a new floating access road from the third-party land directly onto the bog therefore minimising the use of the public road network and utilising the shortest route to site.

The Institute of Air Quality Management Construction Dust Guidance (IAQM 2014) states that the track out (the spreading of dust onto roads from the wheels of vehicles leaving construction sites) related construction dust impact increases with respect to the number of movements of HGV's per day, length of unpaved road, distance to receptors and the sensitivity of local receptors.

The construction phase timeframe is considered to be 24 months with a total of 510 working days. The total additional HGV numbers generated on public roads during the construction phase will be greater than 50+ HGVs per day. Please see Chapter 14 Material Assets for details on traffic volumes. Based on the methodology detailed in section 10.1.3.3, this is considered a large level of dust emissions from trackout. Combined with the established sensitivity of the area of Low (Table 10-10 and Table 10-11 above), the dust emission magnitude for the transportation of materials to and from site is Low. This is considered to be a short-term slight negative impact. Mitigation measures to reduce the significance of this effect are presented below.

Table 10-12 Risk of Dust Impacts from Trackout. Guidance on the Assessment of Dust from Demolition and Construction (IAQM, 2014)

Sensitivity of Area	Dust Emission Magnitude		
	Large (50+ HGVs)	Medium (10-50 HGVs)	Small (less than 10HGVs)
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible Risk

Mitigation & Monitoring Measures

- Sporadic wetting of loose stone surface will be carried out during the construction phase to minimise movement of dust particles to the air. In periods of extended dry

weather, dust suppression may be necessary along haul roads to ensure dust does not cause a nuisance. If necessary, water will be taken from stilling ponds in the site's drainage system and will be pumped into a bowser or water spreader to dampen down haul roads and site compound to prevent the generation of dust where required. Water bowser movements will be carefully monitored to avoid, insofar as reasonably possible, increased runoff.

- All plant and materials vehicles shall be stored in dedicated areas (on site).
- Wheel wash bays will be located at both the main site entrances into Ballivor Bog and Carranstown Bog off the R156. All vehicles will go through the wheel wash prior to exiting the site to ensure no materials are carried onto the local road network.
- Areas of excavation will be kept to a minimum, and stockpiling will be minimised by coordinating excavation, spreading and compaction.
- Turbines and construction materials will be transported to the site on specified haul routes only.
- The agreed haul route roads adjacent to the site will be regularly inspected for cleanliness and cleaned as necessary.
- The transport of construction materials to the site that have significant potential to cause dust, will be undertaken in tarpaulin or similar covered vehicles where necessary.
- A Construction and Environmental Management Plan (CEMP) will be in place throughout the construction phase (see Appendix 4-3). The CEMP includes dust suppression measures.

Residual Impact

Following implementation of mitigation measures as outlined above, residual impacts on air quality from dust emissions during the construction phase will have a Short-term Imperceptible Negative Impact.

Significance of Effects

Based on the assessment above there will be no significant direct or indirect effects on air quality from dust emissions generated by the transport of materials to the Wind Farm Site during the construction phase.

10.2.2.7 Air Quality

As discussed above, localised exhaust, dust and CO_2, NO_x and SO_2 emissions and will arise during the construction phase from plant machinery, additional transportation of HGVs to the area and due to the construction of the onsite infrastructure. However, mitigation measures as outlined above will be in place throughout the construction phase duration to minimise exhaust and dust where possible. Due to the isolated nature of the site and screening afforded by the site boundary vegetation, this potential effect will not be significant and will be limited to the construction period. Therefore, this is a short-term slight negative impact.

Residual Impact

Following implementation of mitigation measures as outlined above, residual impacts on air quality due to dust generation from the construction phase will have a Short-term Imperceptible Negative Impact. The residual impact will be the same for any selected turbine that is within the range of dimensions for which planning permission is sought.

Significance of Effects

Based on this assessment above there will be no significant effects on air quality during the construction phase of the Proposed Development.

10.2.3 Operational Phase

10.2.3.1 Exhaust Emissions

Exhaust emissions associated with the operational phase of the Proposed Development will arise from light goods vehicles (LGVs) intermittently required onsite for maintenance, estimated at 1-2 visits per month and visits from locals using private vehicles who want to park up and avail of the amenity paths provided for hiking, cycling etc. The maintenance vehicles will enter via the main operational site entrances off the R156 into Ballivor Bog and Carranstown Bog. Three amenity carparks in Ballivor Bog (50 car parking spaces), Carranstown (15 car parking spaces) and Bracklin Bog (15 car parking spaces) will be provided for the operational phase. These amenity carparks are spread out throughout the Wind Farm Site thus minimising the potential for traffic delays due to congestion building up at site entrance points. Amenity visitors will arrive to the site and park up at these carparks near site entrances. The type of vehicles visiting to the Wind Farm Site during the operational phase and volumes of traffic anticipated (up to a maximum of 40 car trips per day i.e. 20 cars, based on information from other similar Bord na Móna facilities), spread across carparks located between 650m and 3km from each other will give rise to a long-term imperceptible negative impact.

Mitigation

- Maintenance vehicles brought onsite during the operational phase will be maintained in good operational order, thereby minimising any emissions that arise.
- Amenity carparks are spread out throughout the Wind Farm Site thus minimising the potential for traffic delays due to congestion building up at site entrance points and consequently further exhaust emissions.

Residual Impact

Based on the above, the impact on air quality from exhaust emissions during the operational phase is a Long-term Imperceptible Negative Impact.

Significance of Effects

Based on this assessment above there will be no significant effects on air quality from exhaust emissions generated at the Wind Farm Site during the operational phase.

10.2.3.1.2 *Dust Emissions*

Dust emissions associated with the operational phase of the Proposed Development are considered to be much lower than the construction phase. Dust emissions will arise from light goods vehicles (LGVs) intermittently required onsite for maintenance, estimated at 1-2 visits per month and visits from locals using private vehicles who want to park up and avail of the amenity paths provided for hiking, cycling etc. As the dust emissions during the construction phase are considered to be an imperceptible negative impact, based on the type and volume of vehicles visiting the site during this phase (section 10.2.3.1 above, the impact is considered to have a long-term imperceptible negative impact on air quality from dust emissions.

Mitigation Measures

- Maintenance vehicles brought onsite during the operational phase will be maintained in good operational order, thereby minimising any dust emissions that arise.

- Amenity carparks are spread out throughout the Wind Farm Site thus minimising the potential for traffic delays due to congestion building up at site entrance points and consequently further dust emissions.

Residual Impact

Based on the above, the impact on air quality from exhaust emissions during the operational phase is a Long-term Imperceptible Negative Impact.

Significance of Effects

Based on this assessment above there will be no significant effects on air quality from exhaust emissions generated at the Wind Farm Site during the operational phase.

10.2.3.1.3 *Air Quality*

Although exhaust and dust emissions will arise during the operational phase, by providing an alternative to electricity derived from coal, oil or gas-fired power stations, the Proposed Development will result in emission savings of carbon dioxide (CO_2), oxides of nitrogen (NO_x), and sulphur dioxide (SO_2). The production of renewable energy from the Proposed Development will have a long-term significant positive impact on air quality due to the offsetting of approximately 3 approximately 6,035,010 tonnes and 8,717,237 tonnes of Carbon Dioxide (CO_2) per annum (Against EU FFC). Further details on the carbon dioxide savings associated with the Proposed Development are presented in Section 10.3.5 below.

Residual Impact

The overall impact will be a Long-term Moderate Positive Impact on air quality due to the offsetting of approximately 6,035,010 tonnes and 8,717,237 tonnes of Carbon Dioxide (CO_2) per annum (Against EU FFC), due to the provision of renewable energy in the range of approximately 70,036 to 101,163 Irish households with electricity per year.

Significance of Effects

Based on the assessment above there will be long-term Moderate Positive indirect effect on Air Quality.

10.2.3.2 Decommissioning Phase

A Decommissioning Plan for the Proposed Development can be found in Appendix 4-5 and has been considered in this assessment. Any impact and consequential effect that occurs during the decommissioning phase are similar to that which occur during the construction phase, be it of less impact. The mitigation measures prescribed for the construction phase of the Proposed Development will be implemented during the decommissioning phase thereby minimising any potential impacts.

10.3 Climate

The climate section of this EIAR is carried out in accordance with the 'EIA Directive' as mended by Directive 2014/52/EU and having regard, where relevant, to guidance listed below. A summary of these documents can be found in the following section. All relevant legislation and policy in relation to climate is outlined in detail in Chapter 2 Background to the Proposed Development.

10.3.1 Guidance and Legislation

- Climate Change Performance Index (CCPI) (2020) 2021 Results: Climate Mitigation Efforts of 57 Countries plus the EU. Covering 90% of the Global Greenhouse Gas Emissions.
- Department of Environment, Climate and Communications (2022). Climate Action Plan 2023.
- Department of Climate Change, Action & Environment (2021). Climate Action and Low Carbon Development (Amendment) Bill 2021.
- Department of the Environment, Climate and Communications (2022) National Implementation Plan for the Sustainable Development Goals 2022-2024
- Environmental Protection Agency (2022). Ireland's Provisional Greenhouse Gas Emissions 1990-2022. Environmental Protection Agency (2022): Guidelines on the Information to be contained in Environmental Impact Assessment Reports.
- European Commission (2021)Technical guidance on the climate proofing of infrastructure in the period 2021-2027
- European Union (2017) Guidance on the preparation of the EIA Report (Directive 2011/92/EU as amended by 2014/52/EU).
- European Union (2014). Directive 2014/52/EU. European Parliament and European Council.
- European Union (2011). Directive 2011/92/EU. European Parliament and European Council.
- Burke, W. (1961) Drainage Investigation on Bogland: The Effect of Drain Spacing on Ground Water Levels
- Galvin, L. F. 1976 Physical Properties of Irish Peats Irish Journal of Agricultural Research,Vol. 15, No. 2 (Aug, 1976), pp. 207-221. http://www.jstor.org/stable/25555820.
- United Nations (1997). Kyoto Protocol to the United Nations Framework Convention on Climate Change
- IPCC, 2022: Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change
- Meath County Development Plan 2021-2027 (Westmeath County Council)
- Mozhdeh. R., and James. M. T., (2013) Life Cycle Assessment of Energy Balance and Emissions of a Wind Energy Plant. Geotechnical and Geological Engineering 31(6).
- Stewart Alan J. A, and Lance, Art N. 1991. Effects of Moor-Draining on the Hydrology and Vegetation of Northern Pennine Blanket Bog
- United Nations (2012). Doha Amendment to the Kyoto Protocol
- United Nations (2015). COP21 Paris Agreement, Paris.
- United Nations (2019). COP25 Climate Change Conference, Madrid.
- United Nations (2021). COP27 Climate Change Conference, Sharm El-Sheikh
- United Nations (2015) Transforming our World: the 2030 Agenda for Sustainable Development.
- Wilson, D. and Farrell, E.P., (2007) The Effect of Management Strategies on Greenhouse Gas Balances in Industrial Cutaway Peatlands in Ireland (The CARBAL Report)
- Wilson et al (2013) Carbon Emissions and Removals from Irish Peatlands: Present Trends and Future Mitigation Measures Irish Geography 2013 Vol. 46 Nos. 1-2, 1-23

- Wilson et al (2015) Derivation of Greenhouse Gas Emission Factors for Peatlands Managed for Extraction in the Republic of Ireland and the United Kingdom, Biogeosciences, 12, 5291 – 5308.
- Wilson et al., (2016) Multiyear greenhouse gas balances at a rewetted temperate Peatland.
- Wilson et al., (2016) Greenhouse gas Emission Factors associated with rewetting of organic soils.

Section 17 (amendment of section 15 of Principal Act) of the Climate Action and Low Carbon Development Act 2021 states:

(1) A relevant body shall, in so far as practicable, perform its functions in a manner consistent with—

(a) the most recent approved climate action plan,
(b) the most recent approved national long term climate action strategy,
(c) the most recent approved national adaptation framework and approved sectoral adaptation plans,
(d) the furtherance of the national climate objective, and
(e) the objective of mitigating greenhouse gas emissions and adapting to the effects of climate change in the State."

10.3.2 Methodology

Literature review

A review of all current policy and guidelines pertaining to climate change and emissions projections was considered and the impact the Proposed Development may have on relevant policies and targets is discussed in section 10.3.3-10.3.5 below.

Climate and Weather in the Existing Environment

In order to establish the current climate and weather baseline for the Wind Farm Site, the long term weather averages for rainfall, temperature, wind, humidity and days with snow for the region as reported by the Met Éireann weather station at Mullingar, Co. Westmeath for the period 1979-2008 was reviewed. The average monthly values for humidity, temperature, evaporation, solar radiation soil temperature, the region from 2020 onwards was also reviewed.

Carbon loss/savings calculations

Bord na Móna has developed a methodology based on their extensive experience for calculating carbon losses and savings from proposed wind farm developments. This is detailed in section 10.3.7 below and the accompanying Appendix 10-1.

10.3.3 Climate Change and Greenhouse Gases

Although variation in climate is thought to be a natural process, the rate at which the climate is changing has been accelerated rapidly by human activities. Climate change is one of the most challenging global issues facing us today and is primarily the result of increased levels of greenhouse gases in the atmosphere. These greenhouse gases come primarily from the combustion of fossil fuels in energy use. Changing climate patterns are thought to increase the frequency of extreme weather conditions such as storms, floods and droughts. In addition, warmer weather trends can place pressure on animals and plants that cannot adapt to a rapidly changing environment. Moving away from our reliance on fossil fuel-driven power plants is essential to reduce emissions of greenhouse gases and combat climate change as put forward below in the following policies and reports.

10.3.4 International Legislation and Policy

10.3.4.1 Greenhouse Gas Emission Targets

10.3.4.1.1 *Kyoto Protocol*

Ireland is a Party to the Kyoto Protocol, which is an international agreement that sets limitations and reduction targets for greenhouse gases for developed countries. It is a protocol to the United Nations Framework for the Convention on Climate Change. The Kyoto Protocol came into effect in 2005, as a result of which, emission reduction targets agreed by developed countries, including Ireland, are now binding.

Under the Kyoto Protocol, the EU agreed to achieve a significant reduction in total greenhouse gas emissions in the period 2008 to 2012. Ireland's contribution to the EU commitment for the period 2008 – 2012 was to limit its greenhouse gas emissions to no more than 13% above 1990 levels.

10.3.4.1.2 *Doha Amendment to the Kyoto Protocol*

In Doha, Qatar, on 8th December 2012, the "Doha Amendment to the Kyoto Protocol" was adopted. The amendment includes:

- New commitments for Annex I Parties to the Kyoto Protocol who agreed to take on commitments in a second commitment period from 1 January 2013 to 31 December 2020.
- A revised list of greenhouse gases (GHG) to be reported on by Parties in the second commitment period; and
- Amendments to several articles of the Kyoto Protocol which specifically referenced issues pertaining to the first commitment period and which needed to be updated for the second commitment period.

During the first commitment period, 37 industrialised countries and the European Community committed to reduce GHG emissions to an average of five percent against 1990 levels. During the second commitment period, Parties committed to reduce GHG emissions by at least 18 percent below 1990 levels in the eight-year period from 2013 to 2020; however, the composition of Parties in the second commitment period is different from the first.

Under the protocol, countries must meet their targets primarily through national measures, although market-based mechanisms such as international emissions trading can also be utilised.

10.3.4.2 COP21 Paris Agreement

COP21 was the 21st session of the Conference of the Parties (COP) to the United Nations Convention. Every year since 1995, the COP has gathered the 196 Parties (195 countries and the European Union) that have ratified the Convention in a different country, to evaluate its implementation and negotiate new commitments.

COP21 closed on 12th December 2015 with the adoption of the first international climate agreement (concluded by 195 countries and applicable to all). The twelve-page text, made up of a preamble and 29 articles, provides for a limitation of the temperature rise to below 2°C above pre-industrial levels and even to tend towards 1.5°C. It is flexible and takes into account the needs and capacities of each country. It is balanced as regards adaptation and mitigation, and durable, with a periodical ratcheting-up of ambitions.

10.3.4.3 COP25 Climate Change Conference

The 25th United Nations Climate Change conference COP25 was held in Madrid and ran from December 2nd to December 13th, 2019. While largely regarded as an unsuccessful conference, the European Union launched its most ambitious plan, 'The European Green New Deal' which aims to lower CO_2 emissions to zero by 2050. The deal includes proposals to reduce emissions from the transport, agriculture and energy sectors and will affect the technology chemicals, textiles, cement and steel industries. Measures such as fines and pay-outs by member states who rely on coal power will be in place to encourage the switch to renewable clean energies such as wind. The EU Commission proposed to review and where necessary, revise all relevant policy instruments to deliver additional greenhouse gas emissions reductions in July 2021.

10.3.4.4 COP27 Climate Change Conference Sharm El-Sheikh

COP27 took place in Sharm el-Sheikh from the 6th of November 2022 to the 20th of November. The Conference of the Parties (COP) is a supreme decision-making body of the United Nations Framework Convention on Climate Change (UNFCCC). The three major topics of COP27 were:

- Closing the emissions gap to keep 1.5°C alive;
- Loss and damage;
- Climate finance.

The summit took place a year after its precedent COP26 summit in Glasgow, Scotland. In Glasgow, the final agreement was delayed due to the stance of China and India, among others, who were not comfortable with the 'phase out' of coal wording in the draft text. This led to the watering down of this commitment to a 'phase down' of coal use. The hope was that COP27 would work to include further language on coal and fossil fuel reduction efforts and be matched by increased ambition and action to meet agreed pledges. Initial texts represented more serious language than used at COP26 in Glasgow, however, the published final text retains the language of Glasgow, phase down, which does not use any binding language to reduce use and is still only applicable to coal, not oil and gas.

There has been the setting of a workplan for 2023 to help articulate the nature and components of a global collective goal on adaptation and resilience, however in order to achieve this, more work needs to be done by countries, cities and organisations as currently, the numbers on the NDCs don't add up. Currently, no country has an NDC in place that is able to meet Paris Agreement goals, making net zero by 2050 difficult to envision and 2030 commitments near impossible.

10.3.4.5 United Nations Sustainable Development Goals Report 2022

Transforming our World: the 2030 Agenda for Sustainable Development which includes 17 Sustainable Development Goals (SDGs), and 169 targets was adopted by all UN Member States at a UN summit held in New York in 2015. The agenda is universally applicable with all countries having a shared responsibility to achieve the goals and targets which came into effect on January 1st, 2016. The goals and targets are to be actions over the 15-year period, are integrated and indivisible i.e., all must be implemented together by each Member State. On 7th July 2022, The United Nations published '*The Sustainable Development Goals Report 2022'* using current data, highlighting how the COVID-19 pandemic, the war in Ukraine and subsequent refugee crisis have hindered the achievements of the Sustainable Development Goals, especially in terms of climate action. The report stipulates that due to these unprecedent events, the severity and magnitude before humankind demands sweeping change not yet seen in human history.

The Sustainable Development Goals National Implementation Plan 2018-2020 was published by the Department of Communications, Climate Action & Environment in partnerships with Ordnance Survey Ireland (OSI), Esri Ireland and the Central Statistics Office. The Plan sets out how Ireland will work to achieve the goals and targets of the *Agenda for Sustainable Development* both domestically and internationally. Relevant SDGs and how they are implemented into Irish National plans and policies can

be found in Table 10-13. The Department (now the Department of the Environment, Climate and Communications) published the Second National Implementation Plan for the SDG Goals 2022-2024 in October 2022. It sets out arrangements for interdepartmental coordination, stakeholder engagement and actions needed for further SDG Implementation.

Table 10-13 United Nations Sustainable Development Goals adopted in 2015. https://sustainabledevelopment.un.org/sdgs

SDG	Targets	International Progress to Date (2022)	Relevant National Policy
SDG 7 Affordable and Clean Energy: *Ensure access to affordable, reliable, sustainable and modern energy for all*	› By 2030, ensure universal access to affordable, reliable and modern energy services. › By 2030, increase substantially the share of renewable energy in the global energy mix. › By 2030, double the global rate of improvement in energy efficiency. › By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology. › By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States, and land-locked developing countries, in accordance with their respective programmes of support	The renewable energy share of total final energy consumption gradually increased from 16.6 per cent in 2010 to 17.5 per cent in 2016, though much faster change is required to meet climate goals. Global primary energy intensity (ratio of energy used per unit of GDP) improved from 5.9 in 2010 to 5.1 in 2016, a rate of improvement of 2.3 per cent, which is still short of the 2.7 per cent annual rate needed to reach target 3 of Sustainable Development Goal 7.	*Ireland's Transition to a Low Carbon Energy Future 2015-2030* *Strategy to Combat Energy Poverty in Ireland* *Ireland's Transition to a Low Carbon Energy Future 2015-2030* *National Mitigation Plan* *National Energy Efficiency Action Plan for Ireland # 4 2017-2020* *Better Energy Programme* *One World, One Future* *The Global Island*
SDG 13 Climate Action: *Take*	Strengthen resilience and adaptive capacity to climate-	In 2017, greenhouse gas concentrations reached new	*National Adaptation Framework*

SDG	Targets	International Progress to Date (2022)	Relevant National Policy
*urgent action to combat climate change and its impacts** **Acknowledging that the United Nations Framework Convention on Climate Change is the primary international, intergovernmental forum for negotiating the global response to climate change.*	related hazards and natural disasters in all countries. Integrate climate change measures into national policies, strategies and planning. Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilising jointly $100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible	highs, with globally averaged mole fractions of CO_2 at 405.5 parts per million (ppm), up from 400.1 ppm in 2015, and at 146 per cent of pre-industrial levels. Moving towards 2030 emission objectives compatible with the 2°C and 1.5°C pathways require a peak to be achieved as soon as possible, followed by rapid reductions. During the period 1998–2017, direct economic losses from disasters were estimated at almost $3 trillion. Climate-related and geophysical disasters claimed an estimated 1.3 million lives. As of April 2019, 185 parties had ratified the Paris Agreement. Parties to the Paris Agreement are expected to prepare, communicate and maintain successive nationally determined contributions, and 183 parties had communicated their first nationally determined contributions to the secretariat of the United Nations Framework Convention on Climate Change, while 1 party had communicated its second. Under the Agreement, all parties are required to submit new nationally determined contributions, containing revised and much more ambitious targets, by 2020. Global climate finance flows increased by 17 per cent in the period 2015–2016 compared with the period 2013–2014. As of 20 May 2019, 75 countries are seeking support from the Green Climate Fund for national adaptation plans and other adaptation planning processes, with a combined value of $191 million.	*Building on Recovery: Infrastructure and Capital Investment 2016-2021* *National Mitigation Plan* *National Biodiversity Action Plan 2017-2021* *National Policy Position on Climate Action and Low Carbon Development*

10.3.4.6 European Green Deal – European Climate Law (2021)

The European Green Deal, initially introduced by the European Commission in December 2019, sets out the 'blueprint' for a transformational change of the 27-country bloc from a high- to a low-carbon economy, without reducing prosperity and while improving people's quality of life, through cleaner air

and water, better health and a thriving natural world. The Green Deal is intended to work through a framework of regulation and legislation setting clear overarching targets, e.g. **a bloc-wide goal of net zero carbon emissions by 2050 and a 55% cut in emissions by 2030 (compared with 1990 levels).** This is a substantial increase compared to the existing target, upwards from the previous target of at least 40% (2030 Climate & Energy Framework), and furthermore, these targets demonstrate the ambition necessary to keep the global temperature increase to well below 2°C and pursue efforts to keep it to 1.5°C as per the Paris Agreement. With regard to the energy sector, the Green Deal focuses on 3 no. key principles for the clean energy transition, which will help reduce greenhouse gas emissions and enhance the quality of life for citizens:

- Ensuring a secure and affordable EU energy supply;
- Developing a fully integrated, interconnected and digitalised EU energy market; and
- Prioritising energy efficiency, improving the energy performance of our buildings and developing a power sector based largely on renewable sources (e.g. the subject development)

The European Climate Law 2021 writes into law the objectives set out above in the European Green Deal for Europe's economy and society to become climate-neutral by 2050. Climate neutrality by 2050 means achieving net zero greenhouse gas emissions for EU countries as a whole, mainly by cutting emissions, investing in green technologies and protecting the natural environment. The Climate Law includes:

- A legal objective for the Union to reach climate neutrality by 2050;
- An ambitious 2030 climate target of at least 55% reduction of net emissions of greenhouse gases as compared to 1990, with clarity on the contribution of emission reductions and removals;
- A process for setting a 2040 climate target, taking into account an indicative greenhouse gas budget for 2030-2050 to be published by the Commission;
- A commitment to negative emissions after 2050;
- The establishment of European Scientific Advisory Board on Climate Change, that will provide independent scientific advice;
- Stronger provisions on adaptation to climate change; and
- Strong coherence across Union policies with the climate neutrality objective

The law aims to ensure that all EU policies contribute to this goal and that all sectors of the economy and society play their part. All 27 no. EU Member States have committed to turning the EU into the first climate neutral continent by 2050. One third of the 1.8 trillion-euro investments from the NextGenerationEU Recovery Plan, and the EU's seven-year budget, will finance the European Green Deal. On 14th July 2021, the European Commission adopted a set of proposals to make the EU's climate, energy, transport and taxation policies fit for reducing net greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels. Achieving these emission reductions in the next decade which is crucial to Europe becoming the world's first climate-neutral continent by 2050 would clearly be assisted by the proposed development.

10.3.4.7 Intergovernmental Panel on Climate Change

In February 2022, the International Panel on Climate Change (IPCC) released the report 'Working Group II-Climate Change 2022: Impacts, Adaptation and Vulnerability' [6]regarding the impacts of climate change on nature and human activity. The report states that global warming of 1.5°C and 2°C will be exceeded during the 21st century unless deep reductions in CO_2 and other greenhouse gas emissions occur in the coming decades. the report identifies four key risks for Europe with most becoming more severe at 2 °C global warming levels (GWL) compared with 1.5 °C GWL. From 3°C GWL, severe risks remain for many sectors in Europe. The four key risks identified are:

[6] *Climate Change 2022: Impacts, Adaptation and Vulnerability. Working Group II Contribution to the IPCC Sixth Assessment Report. Available at: https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_SummaryForPolicymakers.pdf*

1) Key Risk 1: Mortality and morbidity of people and changes in ecosystems due to heat
2) Key Risk 2: Heat and drought stress on crops
3) Key Risk 3: Water scarcity
4) Key Risk 4: Flooding and sea level rise

In July 2022, the EPA[7] reported for the 2021 year, the total national greenhouse gas emissions are estimated to have increased by 4.7% on 2020 levels to 61.53 million tonnes carbon dioxide equivalent (Mt CO2eq). This increase in total emissions was driven by increased use of coal and oil for electricity generation and increases in both the Agriculture and Transport sectors. It highlights that transformative measures will be needed to meet National Climate ambitions. The report also states that Emissions in the Energy Industries sector increased by 17.6% or 1.53 MtCO2eq in 2021, attributed to a tripling of coal and oil use in electricity generation as gas fired plant were offline while simultaneously, electricity generated from wind and hydro decreased by 16% and 20% respectively in 2021. As such, the Proposed Development is critical to helping Ireland address these challenges as well as addressing the country's over-dependence on imported fossil fuels.

Greenhouse gas (GHG) emissions resulting from the provision of energy services have contributed significantly to the historic increase in atmospheric GHG concentrations with most of the observed increase in global average temperature since the mid-20th century is very likely due to the observed increase in anthropogenic GHG emissions with the consumption of fossil fuels accounts for the majority of global anthropogenic GHG emissions[8]. There are multiple options for lowering GHG emissions from the energy system while still satisfying the global demand for energy services. Wind energy has significant potential to reduce GHG emissions. Moreover, attempts to measure the relative impacts of various electricity supply technologies suggest that wind energy generally has a comparatively small environmental footprint.[9]

10.3.4.8 Climate Change Performance Index

Established in 2005, the Climate Change Performance Index (CCPI) is an independent monitoring tool which tracks countries climate protection performance. It assesses individual countries based on climate policies, energy usage per capita, renewable energy implementation and Greenhouse Gas Emissions (GHG) and ranks their performance in each category and overall. The 2023 CCPI was published in November 2022. While the CCPI 2023 indicated signs of potential reductions in global emissions, no country achieved its Paris Climate targets and therefore the first three places of the ranking system remain unoccupied.

Ireland, ranked 46th in 2022, has climbed 9 places to 37th for 2023, however still remains as a "low" performer in international performance. Ireland still remains at "very low" on the Greenhouse Gas Emissions ratings at 47th in the world and is one of the only two EU countries, along with Poland, to receive a "very low" performance rating. However, in the Renewable Energy rating table, Ireland is placed 23rd in the rankings in the "Medium" category.

[7] *EPA (July 2022) - Ireland's Provisional Greenhouse Gas Emissions 1990-2022. https://www.epa.ie/publications/monitoring--assessment/climate-change/air-emissions/EPA-Ireland's-Provisional-GHG-Emissions-1990-2021_July-2022v3.pdf*
[8] *Edenhofer et al 2011, Renewable Energy Sources and Climate Change Mitigation: Summary for Policy makers and Technical Summary. Technical Support Unit Working Group III Potsdam Institute for Climate Impact Research (PIK) Published for the IPCC. Available at: https://www.ipcc.ch/site/assets/uploads/2018/03/SRREN_FD_SPM_final-1.pdf*
[9] *ibid*

10.3.5 National Legislation and Policy

10.3.5.1 Climate Action and Low Carbon Development (Amendment) Act, 2021

The Climate Action and Low Carbon Development (Amendment) Act 2021, which was signed into law on the 23rd July 2021, legally binds Ireland to achieve Net-Zero emissions no later than 2050, and to a 51% reduction in emissions by 2030. The Act provides the framework for Ireland to meet its international and EU climate commitments and to become a leader in addressing climate change. As indicated by the premise of the legislation, the reduction of emissions is a key proponent of the Climate Action and Low Carbon Development (Amendment) Act 2021 and incorporates the following key provisions:

- Embeds the process of setting binding and ambitious emissions-reductions targets in law;
- Provides for a national climate objective, which commits to pursue and achieve no later than 2050, the transition to a climate resilient, biodiversity-rich, environmentally-sustainable and climate-neutral economy;
- Provides that the first two five-year carbon budgets proposed by the Climate Change Advisory Council should equate to a total reduction of 51% over the period to 2030, relative to a baseline of 2018;
- The role of the Climate Change Advisory Council has been strengthened;
- The government must adopt carbon budgets that are consistent with the Paris agreement and other international obligations;
- Actions for each sector will be detailed in the Climate Action Plan which must be updated annually; and
- Local Authorities must prepare individual Climate Action Plans which will include both mitigation and adaptation measures and will be updated every five years.

10.3.5.2 Climate Action Plan 2023

The Climate Action Plan 2023 (CAP 2023) was launched in December 2022. Following on from Climate Action Plans 2019 and 2021, CAP 2023 sets out the roadmap to deliver on Ireland's climate ambition. It aligns with the legally binding economy-wide carbon budgets and sectoral ceilings that were agreed by Government in July 2022 following the Climate Action and Low Carbon Development (Amendment) Act 2021, which commits Ireland to a *legally binding target of net-zero greenhouse gas emissions no later than 2050, and a reduction of 51% by 2030*. CAP 2023 sets out indicative ranges of emissions reductions for each sector of the economy.

There have been Six Vital High Impact Sectors identified within CAP 2023 and these are as follows:

Powering Renewables – 75% Reduction in emissions by 2030

We will facilitate a large-scale deployment of renewables that will be critical to decarbonising the power sector as well as enabling the electrification of other technologies.

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

Building Better – 45% (Commercial/Public) and 40% (Residential) Reduction in Emissions by 2030

We will increase the energy efficiency of existing buildings, put in place policies to deliver zero-emissions new builds and continue to ramp up our retrofitting programme.

- *Ramp up retrofitting to 120,000 dwellings to BER B2 by 2025, jumping to 500,000 by 2030.*
- *Put heat pumps into 45,000 existing and 170,000 new dwellings by 2025, up to 400,000 existing and 280,000 new dwellings by 2030.*
- *Generation up to 0.8 TWh of district heating by 2025 and up to 2.5 TWh by 2030.*

Turning Transport Around – 50% Reduction in Emissions by 2030

We will drive policies to reduce transport emissions by improving our town, cities and rural planning, and by adopting the Avoid-Shift-Improve approach: reducing or avoiding the need for travel, shifting to public transport, walking and cycling and improving the energy efficiency of vehicles.

- *Change the way we use our road space.*
- *Reduce the total distance driven across all car journeys by 20%.*
- *Walking, cycling and public transport to account for 50% of our journeys.*
- *Nearly 1 in 3 private cars will be an Electric Vehicle.*
- *Increase walking and cycling networks.*
- *70% of people in rural Ireland will have buses that provide at least 3 trips to the nearby town daily by 2030.*

Making Family Farms More Sustainable – 25% Reduction in Emissions by 2030

We will support farmers to continue to produce world class, safe and nutritious food while also seeking to diversify income through tillage, energy generation and forestry.

- *Significantly reduce our use of chemical nitrogen as a fertilizer.*
- *Increase uptake of protected urea on grassland farms to 90-100%.*
- *Increase organic farming to up to 450,000 hectares, the area of tillage to up to 400,000 ha.*
- *Expand the indigenous biomethane sector through anaerobic digestion, reaching up to 5.7TWh of biomethane.*
- *Contribute to delivery of the land use targets for afforestation and reduced management intensity of organic soils.*

Greening Business and Enterprise – 35% Reduction in Emissions by 2030

We're changing how we produce, consume, and design our goods and services by breaking the link between fossil fuels and economic progress. Decarbonising industry and enterprise is key to Ireland's economy and future competitiveness.

- *Reduce clinker content in cement and substitute products with lower carbon content for construction materials, ensuring 35% reduction in emissions by 2030 (against 2018).*
- *Reduce fossil fuel use from 64% of final consumption (2021) to 45% by 2025 and further by 2030.*
- *Increase total share of heating to carbon neutral to 50-55% by 2025, up to 70-75% by 2030.*
- *Significantly grow the circular economy and bioeconomy*

Changing Our Land-Use - Exact reduction target for this sector is yet to be determined.

The first phase of the land use review will tell us how we are using our land now. Then, we can map, with evidence, how it can be used most effectively to capture and store carbon and to produce better, greener food and energy.

- *Increase our annual afforestation rates to 8,000 hectares per annum from 2023 onwards.*
- *Rethink our Forestry Programme and Vision.*

- *Promote forest management initiatives in both public and private forests to increase carbon sinks and stores.*
- *Improve carbon sequestration of 450,000 ha of grasslands on mineral soils and reduce the management intensity of grasslands on 80,000 ha of drained organic soils.*
- *Rehabilitate 77,600 hectares of peatlands.*

10.3.5.3 Emissions Projections

In July 2022, the EPA[10] reported for the 2021 year, the total national greenhouse gas emissions are estimated to have increased by 4.7% on 2020 levels to 61.53 million tonnes carbon dioxide equivalent (Mt CO2eq). This increase in total emissions was driven by increased use of coal and oil for electricity generation and increases in both the Agriculture and Transport sectors. It highlights that transformative measures will be needed to meet National Climate ambitions. The report also states that Emissions in the Energy Industries sector increased by 17.6% or 1.53 MtCO2eq in 2021, attributed to a tripling of coal and oil use in electricity generation as gas fired plant were offline while simultaneously, electricity generated from wind and hydro decreased by 16% and 20% respectively in 2021. As such, the Proposed Development is critical to helping Ireland address these challenges as well as addressing the country's over-dependence on imported fossil fuels.

If planning consent is favourably granted by the Board for Proposed Development, the project represents a significant opportunity be a nationally important wind energy generator, contributing to the 51% reduction in emissions being sought, which is as outlined above a legally binding requirement. The output range for the 26 turbine Ballivor Wind Farm is considered within this EIAR to be from 4.5 MW to 6.5 MW, which would result in an estimated installed capacity of (117 MW to 169 MW). This output equates to between 300,302 to 433,769 MWh (Megawatt hours) of renewable electricity per year, which is sufficient to supply approximately 70,036 to 101,163 Irish households with electricity per year. Please see Chapter 4 Description for further details on these calculations. The Proposed Development is therefore considered compliant with the relevant planning policies and objectives set out at both the European (e.g. European Green Deal) and National tiers of governance in this regard.

10.3.6 Climate and Weather in the Existing Environment

Ireland has a temperate, oceanic climate, resulting in mild winters and cool summers. The Met Éireann weather station at Mullingar, Co. Westmeath is the nearest weather and climate monitoring station to the site that has meteorological data recorded for the 30-year period from 1979-2008. The monitoring station is located approximately 16km southwest of the site. Meteorological data recorded at Mullingar over the 30-year period is shown in Table 10-13. The wettest month tends to be October and the driest month on average tends to be April. July tends to be the warmest month with a mean temperature of 15.2° Celsius. Table 10-14 shows the average monthly values measured at Mullingar for the years 2020 to date.

[10] *EPA (July 2022) - Ireland's Provisional Greenhouse Gas Emissions 1990-2022. https://www.epa.ie/publications/monitoring–assessment/climate-change/air-emissions/EPA-Ireland's-Provisional-GHG-Emissions-1990-2021_July-2022v3.pdf*

Table 10-14 Data from Met Éireann Weather Station at Mullingar 1979– 2008: Monthly and Annual Mean and Extreme Values

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
TEMPERATURE (degrees Celsius)													
mean daily max	7.4	7.9	9.8	12.1	14.9	17.3	19.2	18.9	16.7	13.2	9.9	7.9	12.9
mean daily min	1.5	1.5	2.8	4.1	6.3	9.2	11.1	10.8	8.9	6.2	3.5	2.2	5.7
mean temperature	4.5	4.7	6.3	8.1	10.6	13.2	15.2	14.8	12.8	9.7	6.7	5.0	9.3
absolute max.	13.8	15.4	19.1	21.6	25.0	28.3	29.7	29.1	25.0	20.1	17.3	14.6	29.7
min. maximum	-3.2	-0.6	1.4	4.1	0.0	10.1	10.9	11.4	10.6	6.3	2.7	-1.7	-3.2
max. minimum	11.6	11.5	11.5	12.5	12.7	15.3	17.4	18.0	16.8	15.4	12.5	12.4	18.0
absolute min.	-14.9	-6.6	-8.0	-4.4	-2.6	0.2	3.8	2.1	0.0	-4.4	-6.9	-12.4	-14.9
mean num. of days with air frost	9.9	8.9	5.5	3.1	0.4	0.0	0.0	0.0	0.0	1.5	5.4	8.2	43.0
mean num. of days with ground frost	17.9	16.2	14.0	10.8	5.1	0.8	0.0	0.1	1.7	6.3	12.1	15.4	100.4
mean 5cm soil	3.3	3.3	5.0	8.1	11.8	14.8	16.3	15.5	12.8	8.9	5.7	4.1	9.1
mean 10cm soil	3.7	3.7	5.1	7.6	11.0	14.1	15.8	15.2	12.8	9.3	6.2	4.5	9.1
mean 20cm soil	4.3	4.4	5.8	8.1	11.4	14.3	16.1	15.8	13.7	10.3	7.2	5.2	9.7
RELATIVE HUMIDITY (%)													
mean at 0900UTC	90.8	89.8	87.6	81.9	78.3	79.7	82.1	84.8	87.6	89.9	91.7	91.8	86.3

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
mean at 1500UTC	83.4	77.8	72.8	68.1	67.1	69.1	69.9	70.6	72.1	77.0	82.2	85.9	74.7
SUNSHINE (hours)													
mean daily duration	1.8	2.5	3.2	4.9	5.8	5.0	4.6	4.6	3.9	3.2	2.2	1.6	3.6
greatest daily duration	8.2	9.9	10.9	13.6	15.4	15.9	15.3	14.4	12.2	10.1	8.6	7.3	15.9
mean num. of days with no sun	10.3	7.2	5.3	2.9	1.9	2.2	1.8	1.9	3.3	5.7	8.4	11.0	62.0
RAINFALL (mm)													
mean monthly total	91.7	72.0	78.3	62.1	68.7	70.5	61.8	80.8	73.8	102.1	82.4	97.1	941.3
greatest daily total	30.3	24.7	29.5	27.6	26.1	52.9	26.6	58.2	42.1	48.8	43.7	38.8	58.2
mean num. of days with >= 0.2mm	19	17	20	15	16	16	16	17	17	19	18	19	209
ean num. of days with >= 1.0mm	15	13	15	11	12	11	11	13	12	14	13	14	154
mean num. of days with >= 5.0mm	6	5	5	4	5	4	3	5	4	6	6	7	60
WIND (knots)													
mean monthly speed	9.0	9.1	9.1	7.7	7.3	6.7	6.4	6.3	6.7	7.5	7.8	8.3	7.6
max. gust	67	71	59	56	58	48	48	50	51	59	62	73	58.5
max. mean 10-minute speed	38	36	36	30	34	26	27	28	32	36	32	39	32.8

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
mean num. of days with gales	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.2	0.8
WEATHER (mean no. of days with)													
snow or sleet	5.0	4.4	3.5	1.6	0.2	0.0	0.0	0.0	0.0	0.0	0.4	2.7	17.8
snow lying at 0900UTC	2.7	0.9	0.8	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.0	5.7
hail	0.6	0.9	2.0	2.0	1.1	0.2	0.1	0.1	0.1	0.5	0.2	0.3	8.1
thunder	0.1	0.2	0.2	0.3	0.9	0.9	1.2	0.8	0.1	0.1	0.1	0.1	4.9
	3.4	3.0	2.4	2.0	1.8	1.3	1.9	2.9	4.0	4.1	4.1	4.3	35.1

Table 10-15 Monthly values 2020 to date measured at Mullingar weather station.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Mean temperature in degrees Celsius													
2023	5.3	6.6											
2022	5.1	6.2	6.6	8.1	12.0	13.5	16.2	15.5	12.9	11.3	8.2	3.4	9.9
2021	3.3	5.6	7.4	7.0	9.3	13.8	17.1	14.9	14.5	11.4	7.8	6.3	9.9
2020	5.5	5.2	6.1	9.5	11.7	13.6	14.1	14.9	12.7	9.4	7.6	4.5	9.6
Long Term Average	4.6	4.7	6.3	7.9	10.6	13.2	15.0	14.6	12.6	9.5	6.6	4.7	9.2
TOTAL RAINFALL (millimetres)													
2023	81.1	3.2											84.3
2022	47.6	131.8	46.2	48.7	53.4	100.6	31.6	35.2	104.1	208.8	109.3	84.5	1001.8
2021	126.9	80.3	80.9	25.5	107.4	17.4	74.9	142.1	58.1	97.7	41.6	128.0	980.8
2020	54.4	197.5	61.0	41.9	10.1	96.6	126.3	114.0	68.3	131.8	87.7	89.3	1078.9
Long Term Average	92.5	70.3	76.6	65.9	69.2	73.8	71.1	86.1	78.3	104.3	88.1	94.7	970.9
MEAN 10CM SOIL TEMPERATURE 0900 UTC													
2023	5.0	n/a											

2022	5.2	5.8	5.6	8.3	12.8	14.5	17.0	16.3	13.9	11.1	8.0	4.3	10.3
2021	3.6	4.7	6.8	7.8	10.5	15.1	17.7	15.8	15.2	11.7	8.2	6.3	10.3
2020	4.8	4.4	5.3	9.3	12.7	14.7	15.5	15.8	13.4	9.9	7.9	4.8	9.9
Long Term Average	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
GLOBAL SOLAR RADIATION Joules/cm2													
2023	7737	2436											
2022	7506	12118	33096	41344	50728	48493	47326	52370	29924	18013	9580	6439	356937
2021	7433	11533	24081	46797	52772	53260	53110	37271	25427	19091	9248	4733	344756
2020	6740	12997	28465	45748	64163	42879	42760	35211	28703	19466	8103	5579	340814
Long Term Average	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
POTENTIAL EVAPOTRANSPIRATION (mm)													
2023	9.2	3.4											
2022	8.8	18.0	41.1	54.4	76.4	78.3	84.2	82.9	44.3	25.9	13.1	6.2	533.6
2021	5.8	19.5	32.1	57.0	71.8	84.7	91.7	62.1	41.6	25.4	10.9	9.4	512.0
2020	10.9	17.5	36.1	63.2	94.6	72.8	68.6	59.6	42.4	24.5	10.7	6.7	507.4

Long Term Average	10.3	17.4	31.0	51.4	71.9	80.5	79.1	65.0	44.0	22.9	10.3	7.5	491.3
EVAPORATION (mm)													
2023	12.4	4.6											
2022	12.1	25.1	58.0	78.0	107.1	108.2	111.8	111.5	60.5	35.3	16.9	8.0	732.5
2021	8.5	26.9	46.1	81.4	102.1	115.9	120.8	83.4	55.7	34.9	14.9	12.1	702.7
2020	14.7	25.1	51.9	89.0	131.6	99.4	94.3	80.3	58.3	34.0	14.6	8.8	702.0
Long Term Average	13.8	25.2	46.1	75.5	103.7	113.0	109.2	89.4	61.4	32.3	14.2	9.7	693.5
DEGREE DAYS BELOW 15.5 DEGREE CELSIUS													
2023	317												
2022	322	262	278	223	116	78	38	59	95	135	219	374	2199
2021	379	278	251	258	199	79	29	52	62	134	232	284	2235
2020	311	298	293	186	141	81	64	53	103	190	238	342	2299
Mean	339	306	286	228	161	91	54	62	102	188	268	335	2419

10.3.7 Calculating Carbon Losses and Savings from the Proposed Development

10.3.7.1 Background

Carbon dioxide (CO_2) emissions occur naturally in addition to being released with the burning of fossil fuels. All organic material is composed of carbon, which is released as CO_2 when the material decomposes. Organic material acts as a store of carbon. Peatland habitats are significant stores of organic carbon. The vegetation on a peat bog slowly absorbs CO_2 from the atmosphere when it is active and converts it to organic carbon. When the vegetation dies, in the acidic waterlogged conditions of bogs and peatlands, the organic material does not decompose fully, and the organic carbon is retained in the accumulating mass of the peatland.

The carbon balance of proposed wind farm developments in peatland habitats has attracted significant attention in recent years. When developments such as wind farms are proposed for intact peatland areas, there will be direct effects and loss of peat in the area of the development footprint. There may also be indirect effects where it is necessary to install drainage in certain areas to facilitate construction. The works can either directly or indirectly cause the peat to dry out, which permits the full decomposition of the stored organic material with the associated release of the stored carbon as CO_2. It is essential therefore that any wind farm development in a peatland area saves more CO_2 than is released. The Proposed Wind Farm Site however, predominately comprises cutover peatland which has been subject to industrial peat extraction and drainage over several decades and consequently the peatland habitats and hydrology are highly degraded and modified from their original state. As such, the peatland habitat loss would not be as significant as that of an intact peatland.

10.3.7.2 Calculating Carbon Losses and Savings

Bord na Móna has developed a methodology based on their extensive experience for calculating carbon losses and savings from proposed wind farm developments. The methodology was informed by the Scottish Governments Carbon Calculator[11] and other relevant information sources such as:

- Multiyear greenhouse gas balances at a rewetted temperate peatland. (Wilson et al., 2016;
- Greenhouse gas Emission Factors. (Wilson et al., 2016);
- Derivation of GHG emission factors for peatlands managed for extraction in the ROI and the UK. (Wilson et al. 2015); and
- The Effect of Management Strategies on Greenhouse Gas Balances in Industrial Cutaway Peatlands in Ireland (The CARBAL Report) (Wilson, D. and Farrell, E.P., 2007).
- Wilson et al (2013) Carbon Emissions and Removals from Irish Peatlands: Present Trends and Future Mitigation Measures Irish Geography 2013 Vol. 46 Nos. 1-2, 1-23

This methodology was used to assess the effects of the Proposed Development in terms of potential carbon losses and savings taking into account peat removal, drainage and operation of wind farm. The methodology reflects the specific nature of the cutaway peat lands upon which the project is proposed to be located by utilising the output of research carried out on Bord na Mona lands.

The completed worksheet including the assumptions used in the model is provided as Appendix 10-1 Carbon Loss/Savings Balance for the Proposed Ballivor Wind Farm to this EIAR. The peat losses are based on the volume of peat disturbed and redistributed, and takes a 'worst case' approach, by assuming

11 Scottish Government (2016) http://informatics.sepa.org.uk/CarbonCalculator/

that the in-situ peat had been rewetted and therefore had zero net emissions, and the redistributed peat has high emissions associated with rushes and birch/willow scrub habitat type.

The model calculates the total carbon emissions associated with the proposed Ballivor Wind Farm development including manufacturing of the turbine technology, transport, construction of the development and carbon losses due to peatland disturbance.

The model also calculates the carbon savings associated with the proposed wind farm development against three comparators:

1. *The average fossil emissions on the Irish Grid – based on the SEM Reference mid-merit plant*
2. *The EU Fossil Fuel Comparator (a measure of the fossil intensity across the European market)*
3. *A displaced 'Load Following' combined cycle gas turbine plant.*

The range of worst-case scenario CO_2 losses due to the proposed wind farm development are summarised in Table 10-16 and the total savings based on an installed turbine capacity range of 4.5MW to 6.5MW against the three comparators listed above are summarised in Table 10-17.

Table 10-16 CO_2 losses from the Proposed Development

Origin of Losses	CO_2 Losses (tonnes CO_2 equivalent)
Losses due to turbine life (e.g., manufacture, construction, decommissioning)	164,152
Losses due to Additional Cycling Emissions	212,325
Losses from peat land disturbance emissions	7,553
Total	**384,030**

The peat losses are based on the volume of peat disturbed and redistributed and takes a 'worst case' approach as described above.

Table 10-17 Wind Farm Lifetime Savings

Comparator	CO_2 Savings		Payback	
	CO_2 Savings (tonnes CO_2 equivalent) - 4.5MW	CO_2 Savings (tonnes CO_2 equivalent) – 6.5MW	Payback (years) 4.5MW	Payback (years) 6.5MW
SEM Mid-Merit Plant	6,820,074	9,851,219	1.26	1.17
EU Fossil Fuel Comparator (FFC)	6,035,010	8,717,237	1.42	1.32
'Load Following' Combined Cycle Gas Turbine Plant	3,615,529	5,222,430	**2.37**	**2.21**

Based on the Bord na Móna model calculations as presented above, 384,030 tonnes of CO_2 will be lost to the atmosphere due to changes in the peat environment, changes in the cycling of mid-merit gas-fired generation units and due to the construction, operation and decommissioning of the Proposed

Development. This represents a small fraction of the total amount of CO_2 emissions that will be offset by the Proposed Development as set out in Table 10-16**,** namely between 6,035,010 tonnes and 8,717,237 tonnes of Carbon Dioxide (CO_2) per annum (Against EU FFC). The volume of CO_2 that will be lost to the atmosphere will be offset by the Proposed Development between 1.17 and 2.37 years of operation, depending on the comparator.

A study conducted by Mozhdeh and James in 2013 titled *Life Cycle Assessment of Energy Balance and Emissions of a Wind Energy Plant*, looked at the life cycle of a wind energy development. The study involved a quantitative, comparative analysis and rating of the manufacture and transportation of wind energy components, and the construction and operation of the wind farm. The study compared the total energy produced over the lifetime of the wind farm and compared it to the total energy used in the manufacture of materials, transportation to site and the subsequent construction phase. The study showed that the majority of energy used was in the manufacture of materials, transportation to site and earthworks. The study also looked at the Energy Payback Ratio (EPR), i.e. how efficient the wind farm development was in offsetting the energy required for its construction. The study concluded that the wind farm had a much more efficient EPR than an operational coal and gas plant would have. The study concluded that the energy used to construct the wind farm was offset within 12.2 months of the wind farm's operational period with the remaining 25 years of the intended operational period being a net gain of renewable energy; a considerable savings in terms of greenhouse gas emissions and energy consumption when compared to other conventional power sources.

During the construction and operation phase the lands beneath the Proposed Development footprint are not available to develop into carbon sequestering habitat. In addition, lands adjacent to the windfarm footprint may also be indirectly impacted and therefore also not reach their carbon sequestration potential. As stated in Section 1.4 Brief Description of the Proposed Development of the EIAR, the area of the wind farm site is 1,770ha and the total area of the permanent footprint of the Proposed Development is 32.4ha or less than 1.8% of the entire site. In order to assess the potential that the Proposed Development might have on the carbon balance of the lands over the lifetime of the project a number of conservative assumptions are made:

- 100% of the area beneath the wind farm footprint will actively sequester carbon continuously over the 30-year period and will begin to sequester carbon in 2024;
- The highest recorded rate of carbon sequestration for rewetted cutaway peatlands is utilised in the calculation[12];
- A total of 50% of the area outside of the windfarm footprint will actively sequester carbon at the stated rate and the remainder will be carbon neutral;
- The windfarm footprint is buffered by 5m around all of the permanent infrastructure to allow for any possible impact on habitat formation in those areas adjacent to the footprint.

It should be noted that the draft rehabilitation plans for Ballivor, Bracklin, Carranstown and Lisclogher bogs recognise that the surface topography for the bogs is heterogeneous. Therefore, it is not possible to re-wet all areas within the bogs and hence create the optimum conditions for carbon sequestration. In the drier areas, this will result in the formation of dry woodland areas or similar drier habitats in those parts of the bogs. Furthermore, in those areas where the optimum conditions for carbon sequestration will be created by the rehabilitation plan it will require time to transition to the desired habitat. This applies to both the areas within and outside the windfarm footprint. Finally, the application of a 5m buffer around the windfarm infrastructure is a conservative assumption. Research has indicated that the impact of drains

[12] *EPA (2018). Network Monitoring Rewetted and Restored Peatlands/organic Soils for Climate and Biodiversity Benefits (NEROS), EPA Research Programme 2014-2020, P23, Table 5.2.*

on the water table adjacent to the drain may extend only a few metres.[13][14] Habitat regeneration and the application of PCAS can be directly applied adjacent to wind farm infrastructure scheme.

The overall footprint of the proposed wind farm will be less than 2% (approximately 1.8%) of the total Bog Group, and therefore does not impact or change the overall goals and outcomes of the proposed rehabilitation plans. As such, it is the intention of the Applicant to integrate the peatland rehabilitation measures with the proposed wind farm. The key objectives of environmental stabilisation and re-wetting of the cutaway areas will occur between and surrounding the proposed windfarm infrastructure. For example, during construction for access tracks, hardstands and other areas, peat is excavated from the cutaway, moved to the side, graded into berms not more than 1 m and allowed to naturally re-vegetate. This has proven successful during construction of Mountlucas and Cloncreen Wind Farms. See Plate 10-1 below. The projected worst-case impact is outlined in Table 10-18.

Table 10-18 Assessment of potential loss of carbon sequestration due to Proposed Ballivor Wind Farm development

Description	Windfarm	Windfarm plus 5m Buffer (Note 1)
Total Footprint (Ha)	32.4	65
Carbon sequestration factor (tCO2/ha/yr)	3.82[15]	3.82[16]
Rewetted Footprint carbon savings (tCO2/ha/30yr)	2,943	7,443
Area of the Site (Ha)	1,770	1,770
Area of the site assume to actively sequester carbon (Ha)	885	885
Wind farm Site Carbon savings Total (tCO2/30yr)	101,336	101,336
% loss of carbon sequestration (30yr)	2.9	7.3

Note 1: 5m is considered to be a worst-case buffer.

In conclusion, on the basis of a number of conservative assumptions the % loss of carbon sequestration arising from the construction of the windfarm is determined to be range between 2.9% and 7.7% and therefore it does not have a significant impact on the carbon balance of the Wind Farm Site.

[13] *Stewart and Lance (1991) Effects of Moor-Draining on the Hydrology and Vegetation of Northern Pennine Blanket Bog. Journal of Applied Ecology,Dec., 1991,Vol. 28, No. 3 pp. 1105-1117. https://www.jstor.org/stable/2404228*
[14] *Galvin, L. F 1976 Physical Properties of Irish Peats. Irish Journal of Agricultural Research,Vol. 15, No. 2 (Aug., 1976), pp. 207-221. http://www.jstor.org/stable/25555820*
[15] *EPA (2018). Network Monitoring Rewetted and Restored Peatlands/organic Soils for Climate and Biodiversity Benefits (NEROS), EPA Research Programme 2014-2020, P23, Table 5.2.*
[16] *ibid.*

Plate 10-1 PCAS peatland rehabilitation implemented in the form of drain blocking proximal to wind farm infrastructure at the Cloncreen Wind Farm Site.

10.4 Likely Significant Effects and Associated Mitigation Measures

10.4.1 'Do-Nothing' Effect

If the Proposed Development were not to proceed, environmental monitoring and site management would continue, and the implementation of peatland rehabilitation plans across all bogs as required under IPC License would occur. Likewise, the PCAS scheme at Bracklin West would continue to be implemented.

If the Proposed Development were not to proceed, greenhouse gas emissions, e.g., carbon dioxide (CO_2), carbon monoxide and nitrogen oxides associated with construction vehicles and plant would not arise. However, the opportunity to significantly reduce emissions of greenhouse gases, including carbon dioxide (CO_2), oxides of nitrogen (NO_x), and sulphur dioxide (SO_2), which would otherwise result from more traditional electricity generation, would be lost. The opportunity to contribute to Ireland's commitments under the Kyoto Protocol and EU law would also be lost. This would be a long-term slight negative impact.

If the Proposed Development would not proceed, the cumulative impact of providing a carbon sink within the re-wetted peatlands through the peatland rehabilitation under IPC licence and the accelerated form of peatland rehabilitation at selected areas under the PCAS scheme, combined with the carbon savings as a result of the proposed Ballivor Wind Farm would be lost as would the change to assist in the national goal of achieving a climate neutral Ireland by 2050 as set out in the Climate Action and Low Carbon Development (Amendment) Act 2021.

This would be a long term significant negative impact on National CO2 emissions and climate action goals.

10.4.1.1 Construction Phase: Greenhouse Gas Emissions

10.4.1.1.1 *Turbines, 110kV substation, borrow pits and Other Infrastructure*

The construction of turbine bases and hardstands, 110kV substation, site roads, borrow pits, site entrances, anemometry mast bases and all associated infrastructures will require the operation of construction vehicles and plant on site. Greenhouse gas emissions, e.g., carbon dioxide (CO_2), carbon monoxide and nitrogen oxides associated with vehicles and plant will arise as a result of the construction and demolition activities. This potential impact will be slight, given the insignificant quantity of greenhouse gases that will be emitted, and will be restricted to the duration of the construction phase. Therefore, this is a short-term slight negative impact.

Mitigation and Monitoring Measures

- Construction staff will be trained how to inspect and maintain construction vehicles and plant to ensure good operational order while onsite, thereby minimising any emissions that arise. The Site Supervisor/Construction Manager produce and follow a site inspection and machinery checklist which will be followed and updated if/when required.
- Machinery will be switched off when not in use.
- The transport of construction materials from the borrow pits around the site will be undertaken in tarpaulin or similar covered vehicles, where necessary.
- Aggregate materials for the construction of site access tracks and all associated infrastructure will all be locally sourced or onsite where possible, which will further reduce potential emissions.

- Turbines and construction materials will be transported to the site on specified routes only unless otherwise agreed with the Planning Authority. Please see Chapter 14 Material Assets for details.
- A Construction and Environmental Management Plan (CEMP) will be in place throughout the construction phase (see Appendix 4-3). The CEMP includes dust suppression measures.

Residual Impact

The Proposed Development will have a Short-term Imperceptible Negative Impact on Climate as a result of greenhouse gas emissions in the construction phase.

Significance of Effects

Based on the assessment above there will be no significant effects on climate from the construction phase of the Proposed Development.

10.4.1.1.2 *Transport of components and materials to the Wind Farm Site*

The transport of turbines and construction materials, which will occur on specified routes only (see Chapter 4 Description and Chapter 14 Material Assets of this EIAR), and staff movements to and from the Wind Farm Site will also give rise to greenhouse gas emissions associated with the transport vehicles. This constitutes a slight negative impact in terms of air quality.

Mitigation and Monitoring Measures

- Construction staff will be trained how to inspect and maintain construction vehicles and plant to ensure good operational order while onsite, thereby minimising any emissions that arise. The Site Supervisor/Construction Manager produce and follow a site inspection and machinery checklist which will be followed and updated if/when required.
- Machinery will be switched off when not in use.
- The transport of construction materials from the borrow pits around the site will be undertaken in tarpaulin or similar covered vehicles, where necessary.
- Aggregate materials for the construction of site access tracks and all associated infrastructure will all be locally sourced or onsite where possible, which will further reduce potential emissions.
- Turbines and construction materials will be transported to the site on specified routes only unless otherwise agreed with the Planning Authority. Please see Chapter 14 Material Assets for details.
- A Construction and Environmental Management Plan (CEMP) will be in place throughout the construction phase (see Appendix 4-3). The CEMP includes dust suppression measures.

Residual Impact

The Proposed Development will have a Short-term Imperceptible Negative Impact on Climate as a result of greenhouse gas emissions from the transportation of vehicles to and from the Wind Farm Site during the construction phase.

Significance of Effects

Based on the assessment above there will be no significant effects on climate from the transportation of turbine components, materials and staff during the construction phase of the Proposed Development.

10.4.1.2 Operational Phase: Greenhouse Gas Emissions

The Proposed Development will generate energy from a renewable source. This energy generated will offset energy and the associated emission of greenhouse gases from electricity-generating stations dependent on fossil fuels, thereby having a positive effect on climate. As detailed in Table 10-17 above, the Proposed Development will displace carbon dioxide from fossil fuel-based electricity generation over the proposed 30-year lifespan of the proposed wind farm. The Proposed Development will assist in reducing carbon dioxide (CO_2) emissions that would otherwise arise if the same energy that the proposed wind farm will generate were otherwise to be generated by conventional fossil fuel plants. This is a long-term significant positive effect.

Residual Impact

Long-term Moderate Positive Impact on Climate as a result of reduced greenhouse gas emissions due to replacing more traditional electricity generation with renewable generation. The residual impact will be the same for any selected turbine that is within the range of dimensions for which planning permission is sought.

Significance of Effects

Based on the assessment above there will be a direct long-term moderate, positive effect.

10.4.1.3 Decommissioning Phase

Any impact and consequential effect that occurs during the decommissioning phase are similar to that which occur during the construction phase, be it of less impact. This is the case due the lower level of onsite works proposed as part of the decommissioning in comparison to the construction plan. The mitigation measures prescribed for the construction phase of the Proposed Development will be implemented during the decommissioning phase thereby minimising any potential impacts.

10.5 Cumulative Assessment

Potential cumulative effects on air quality and climate between the Proposed Development and other projects in the vicinity were also considered as part of this assessment. The projects considered as part of the cumulative effect assessment including the consented Bracklyn Wind Farm (Planning Reference: PC25M.306261), the Peatland Rehabilitation Plans and PCAS are described in Chapter 2 Background to the Proposed Development of this EIAR and considered below. Of note is the consented Bracklyn Wind Farm (Planning Reference: PC25M.306261) which located adjacent to the Proposed Development Wind Farm Site. The consented development concluded in its corresponding Environmental Impact Assessment that there will be no significant effects on air quality during the construction phase of the Bracklyn Wind Farm.

As part of the IPC licence rehabilitation requirements, the applicant is required to produce peatland rehabilitation plans. Please see Appendix 6-6. These plans have considered the Proposed Development footprint and demonstrate that both peatland rehabilitation and renewable energy can coexist harmoniously onsite.

The Peatland Climate Action Scheme (PCAS) which comprises enhanced peatland rehabilitation (above and beyond IPC licence requirements), commenced and was completed at Carranstown East, adjacent to the Wind Farm Site. Bracklin West, also adjacent to the Wind Farm Site has been selected for PCAS and it is expected to commence in 2023. This accelerated form of peatland rehabilitation has been undertaken at the recently constructed Cloncreen wind farm. This scheme is in addition to the IPC licence requirements and therefore does not form part of the proposed Ballivor Wind Farm application.

10.5.1 Construction Phase

Air Quality

As established above in section 10.2, there are no significant effects on air quality during the construction phase from:

- Exhaust emissions during the construction of turbines, substation and all other infrastructure
- Exhaust emissions during the construction of borrow pits.
- Exhaust emissions through the transportation of materials to the Wind Farm Site
- Dust emissions during the construction of turbines, substation and all other infrastructure
- Dust emissions during the construction of borrow pits.
- Dust emissions through the transportation of materials to the Wind Farm Site
- Carbon dioxide (CO_2), oxides of nitrogen (NO_x), and sulphur dioxide (SO_2) emissions through plant and vehicle emissions

Therefore, it is considered there will be no cumulative effects on air quality should other proposed or consented plans and projects (including the consented Bracklyn Wind Farm and peatland rehabilitation measures) within the surrounding landscape be constructed in parallel with the Proposed Development.

Climate

As established above in section 10.4, there are no significant effects on climate during the construction phase from:

- construction of turbines, substation and all other infrastructure
- construction of borrow pits.
- transportation of materials to the Wind Farm Site

Therefore, it is considered there will be no cumulative effects on climate and greenhouse gas emission should other proposed or consented plans and projects (including the consented Bracklyn Wind Farm and peatland rehabilitation measures) within the surrounding landscape be constructed in parallel with the Proposed Development.

10.5.2 Operational Phase

Air Quality

As established above in section 10.2, there are no significant effects on air quality during the operational phase from:

- Exhaust emissions from maintenance and amenity visitors to the site
- Dust emissions from maintenance and amenity visitors to the site

Therefore, it is considered there will be no cumulative effects on air quality should other proposed or consented plans and projects (including the consented Bracklyn Wind Farm and peatland rehabilitation measures) within the surrounding landscape be operational in parallel with the Proposed Development.

Climate

As established above in section 10.4 there is a significant long-term Moderate Positive indirect effect on Air Quality during the operational phase. There will be emission savings of carbon dioxide (CO_2), oxides of nitrogen (NO_x), and sulphur dioxide (SO_2). The production of renewable energy from the Proposed Development will have a long-term significant positive impact on air quality due to the offsetting of approximately 6,035,010 tonnes and 8,717,237 tonnes of Carbon Dioxide (CO2) per annum (Against EU FFC and supply renewable energy in the range of approximately 70,036 to 101,163 Irish households with electricity per year. This is a significant long-term Moderate Positive indirect effect on Air Quality. The nature of the Proposed Development and other wind energy developments both within 20 kilometres and on the island of Ireland are such that, once operational, they will have a Cumulative Long-term, Significant, Positive effect on the air quality and climate.

Furthermore, the aim of proposed peatland rehabilitation plans (produced as per IPC licence requirements) is re-wetting the bogs which will aid in restoring the carbon store function and promote the carbon sink potential of the land. This will have a materially beneficial impact in raising the carbon sink potential of the land when compared to its current status. The PCAS scheme is an accelerated form of the peatland rehabilitation measures. Both schemes will be implemented within (IPC peatland rehabilitation and adjacent to the Wind Farm Site Boundary (PCAS in selected areas) regardless of the planning decision for the current Proposed Development, and both are designed to coexist onsite harmoniously with renewable energy developments as is evident at the operational Mount Lucas and Cloncreen wind farms where rehabilitation and PCAS has been implemented.

The cumulative benefit of the carbon savings (potentially over 5 million per annum) as a result of the proposed Ballivor Wind Farm along with the provision of providing a carbon sink within the re-wetted peatlands through the peatland rehabilitation of all bogs under IPC licence and the accelerated form of peatland rehabilitation, would assist the national and international objectives for offsetting CO2 emissions and achieving a climate neutral Ireland by 2050 as set out in the Climate Action and Low Carbon Development (Amendment) Act 2021.

10.6 Summary of Significant Effects

Table 10-19 below provides a summary of significant effects on the air and climate as a result of the construction, operation and decommission of the Proposed Development. It also summaries the cumulative significant effects.

Table 10-19 Summary of Significance of Effects

Impact	Construction Phase	Operational Phase	Decommissioning Phase	Cumulative	
				Construction	Operation
Exhaust emissions construction/decommissioning of turbines, substation and other infrastructure	No significant effects	No significant effects	No significant effects	No cumulative effects	N/A
Exhaust emissions during the construction of borrow pits	No significant effects	N/A	N/A	No cumulative effects	N/A
Exhaust emissions through the transportation of materials and/or personnel to/from the Wind Farm Site	No significant effects	N/A	No significant effects	No cumulative effects	N/A
Dust emissions during the construction/removal of turbines, substation and all other infrastructure	No significant effects	No significant effects	No significant effects	No cumulative effects	N/A
Dust emissions during the construction of borrow pits	No significant effects	N/A	N/A	No cumulative effects	N/A
Dust emissions through the transportation of materials	No significant effects	No significant effects	No significant effects	No cumulative effects	No cumulative effects

Impact	Construction Phase	Operational Phase	Decommissioning Phase	Cumulative	
				Construction	Operation
and/or personnel to/from the Wind Farm Site					
Carbon dioxide (CO2), oxides of nitrogen (NOx), and sulphur dioxide (SO2) emissions through plant and vehicle emissions	No significant effects	Long term moderate positive effect on greenhouse gas emissions	No significant effects	No cumulative effects	Significant cumulative positive effect on greenhouse gas emissions with Bracklyn Wind Farm and significant cumulative positive effects through CO2 offset and carbon sink formation through peatland rehabilitation plans (IPC) and schemes (PCAS)
Climate	No significant effects	Significant positive effect on greenhouse gas emissions	No significant effects	No cumulative effects	Significant cumulative positive effect on climate goals with Bracklyn Wind Farm and established peatland rehabilitation plans (IPC) and schemes (PCAS)