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CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED COOM GREEN ENERGY PARK, COUNTY CORK

CHAPTER 6 – AIR AND CLIMATE

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6. AIR AND CLIMATE

6.1 Introduction

This section describes the existing air and climate environment of the proposed Coom Green Energy Park (CGEP) project as a whole. It examines the various elements of the construction, operational and decommissioning phases of the proposed green energy project which consists of 22 no. wind turbines, grid connection route, turbine delivery route (TDR), internal site access tracks, cable trenching and electrical infrastructure and associated works which have the potential to impact on air quality and climate. Mitigation measures and the residual impacts after the proposed mitigation measures have been implemented are also described. A cumulative impacts assessment is also carried out.

A detailed description of the project assessed in this EIAR is provided in Chapter 3 and is comprised of three main elements:

- The wind farm (hereinafter referred to as the 'main wind farm site');
- Turbine delivery route (hereinafter referred to as the 'turbine delivery route' or 'TDR');
- Grid connection (hereinafter referred to as the 'grid connection').

6.1.1 Statement of Authority

This chapter of the EIAR was completed by Elaine Bennett, Crystal Leiker and Donna O'Halloran. Elaine is a Senior Scientist with Fehily Timoney and holds a PhD in Ecology, with a BSc in biological Science from UCC. Crystal is a project planner with Fehily Timoney & Company with 5 years of experience. Crystal holds an M.A. (Hons) in Planning and Sustainable Development from UCC, Cork. Donna is a project environmental scientist with Fehily Timoney and Company with 5 years' experience. Donna holds an MSC (Hons) Environmental Resource Management from UCD, Dublin and an MSc (Hons) Ecological Assessment from UCC, Cork.

6.1.2 Air Quality

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

- 1st Daughter Directive (99/30/EC): Sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead;
- 2nd Daughter Directive (2000/69/EC): Carbon monoxide and benzene;
- 3rd Daughter Directive (2002/69/EC): Ozone;
- 4th Daughter Directive (2001/107/EC): Polyaromatic hydrocarbons, arsenic, nickel, cadmium and mercury in ambient air.

The Ambient Air Quality and Cleaner Air for Europe (CAFE) Directive (2008/50/EC) was published in May 2008. It replaced the Framework Directive and the first, second and third Daughter Directives.

The fourth Daughter Directive (2004/107/EC) will be included in CAFE at a later stage. The limit and target values for both Directives are outlined below.

The CAFE Directive was transposed into Irish legislation by the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011). It replaces the Air Quality Standards Regulations 2002 (S.I. No. 271 of 2002), the Ozone in Ambient Air Regulations 2004 (S.I. No. 53 of 2004) and the Environmental Protection Agency Act, 1992 (Ambient Air Quality Assessment and Management) Regulations, 1999 (S.I. No. 33 of 1999). The fourth Daughter Directive was transposed into Irish legislation by the Arsenic, Cadmium, Mercury, Nickel and Polycyclic Aromatic Hydrocarbons in Ambient Air Regulations 2009 (S.I. No. 58 of 2009). Table 6.1 details the limit values for pollutants as per the CAFÉ Directive.

Table 6-1: Limit Values of CAFE Directive 2008/50/EC

Pollutant	Limit Value Objective	Averaging Period	Limit Value ug/m3	Limit Value ppb	Basis of Application of the Limit Value
SO_2	Protection of human health	1 hour	350	132	Not to be exceeded more than 24 times in a calendar year
SO_2	Protection of human health	24 hours	125	47	Not to be exceeded more than 3 times in a calendar year
SO_2	Protection of vegetation	calendar year	20	7.5	Annual mean
SO_2	Protection of vegetation	1 Oct to 31 Mar	20	7.5	Winter mean
NO_2	Protection of human health	1 hour	200	105	Not to be exceeded more than 18 times in a calendar year
NO_2	Protection of human health	calendar year	40	21	Annual mean
$NO + NO_2$	Protection of ecosystems	calendar year	30	16	Annual mean
PM_{10}	Protection of human health	24 hours	50		Not to be exceeded more than 35 times in a calendar year
$PM_{2.5}$	Protection of human health	calendar year	40		Annual mean
$PM_{2.5}$ - stage 1	Protection of human health	calendar year	25		Annual mean
$PM_{2.5}$ - stage 2	Protection of human health	calendar year	20		Annual mean
Lead	Protection of human health	calendar year	0.5		Annual mean

Pollutant	Limit Value Objective	Averaging Period	Limit Value ug/m3	Limit Value ppb	Basis of Application of the Limit Value
Carbon Monoxide	Protection of human health	8 hours	10,000	8620	Not to be exceeded
Benzene	Protection of human health	calendar year	5	1.5	Annual mean

There are no statutory limits for dust deposition, however, the TA Luft (German Government 'Technical Instructions on Air Quality') state a guideline value of 350 mg/m^2/day.

There are no limit values in relation to ozone, however, the Ozone Daughter Directive sets target values. These are detailed in Table 6.2 along with information threshold and alert threshold values.

Table 6-2: Target Values for Ozone

Objective	Calculation	Target Value for 2020
Protection of Human Health	Maximum daily 8-hour mean	120 µg/m^3
Protection of vegetation	AOT40*, calculated from 1 hour values from May to July	6000 µg/m^3-h
Information threshold	1-hour average	180 µg/m^3
Alert Threshold	1-hour average	240 µg/m^3
*The sum of the differences between hourly ozone concentration and 40 ppb for each hour when the concentration exceeds 40 ppb during a relevant growing season, e.g. for forest and crops.		

Air Quality and Health

The World Health Organisation (WHO) in 2016 estimated that ambient air pollution caused 4.2 million deaths worldwide in 2016 (WHO, 2018). According to the EPA (Air Quality in Ireland 2018 – Indicators of Air Quality (EPA 2018), in Ireland the number of deaths directly linked to air pollution is estimated at 1,180 premature deaths in Ireland in 2016 due to poor air quality (predominantly due to PM2.5), with a figure of 538,014 premature deaths across the wider EU[1].

Generally, air quality in Ireland is acceptable. However, in the short term, when compared with WHO guideline values and EEA reference level values; ozone, particulate matter and PHAs are of concern and NO2 is expected to increase as traffic on our roads increase.

The use of fossil fuel-based electricity generation leads to NOx and SOx emissions; however, wind generation does not produce any NOx or SOx emissions.

[1] EEA, 2019, cited in 'Air Quality in Ireland 2018 – Indicators of Air Quality, EPA 2019, p. 25.

6.1.3 Climate

Carbon dioxide (CO_2) is a greenhouse gas which, if released in excessive amounts, can lead to increases in global temperatures known as 'global warming' or the 'greenhouse effect' which can influence climate change. Once the proposed wind farm is constructed there will be no negative impacts on climate change and in fact it will have a long-term positive impact by providing a sustainable energy source.

Should the proposed wind farm not be developed, fossil fuel power stations will be the primary alternative to provide the required quantities of electricity. This will further contribute to greenhouse gas and other emissions, and hinder Ireland in its commitment to meet its target to increase electricity production from renewable sources and to reduce greenhouse gas emissions.

At the Paris climate conference (COP21) in December 2015, 195 countries adopted the first-ever universal, legally binding global climate deal. The agreement sets out a global action plan to put the world on track to avoid dangerous climate change by limiting global warming to well below 2°C above pre-industrial levels and to limit the increase to 1.5°C. Under the agreement, Governments also agreed on the need for global emissions **t**o peak as soon as possible, recognising that this will take longer for developing countries, and to undertake rapid reductions thereafter in accordance with the best available science.

The International Panel on Climate Change (IPCC) has put forward its clear assessment that the window for action on climate change is rapidly closing and that renewable energy sources such as wind will have to grow from 30% of global electricity at present to 80% by 2050 if we are to limit global warming. In this regard, the Government enacted the *Climate Action and Low Carbon Development (Amendment) Bill 2020*[2] which provides for a series of actions to be undertaken by Government to ensure that our 2050 targets are met. These include annual updates to the Climate Action Plan 2019, the preparation of a long-term climate action strategy, the provision of a carbon budget programme, and sets out a roadmap of actions and other measures.

Under the Kyoto Protocol and the Doha Amendment, during the first commitment period, 37 industrialized countries and the European Community committed to reduce GHG emissions to an average of five percent below 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.

In December 2018, the revised Energy Efficiency Directive, the revised Renewable Energy Directive and the new Governance Regulation were formally adopted. The new regulatory framework includes a binding renewable energy target for the EU for 2030 of 32% with an upwards revision clause by 2023. This agreement will help the EU meet the Paris Agreement goals. The commission has also indicated an intention to adopt the increased target of 55% at the EU's Nationally Determined Contribution (NDC) under the Paris Agreement by the end of 2020. As well as the target being given legislative force in the EU through the proposed EU Climate Law, it will oblige all EU institutions across all areas of competence, and the Member States, to work collectively to achieve the target of 55%[3].

The main achievements of this agreement in terms of renewable energy production are:

- Sets a new, binding renewable energy target for the EU for 2030 of 32%, including a review clause by 2023 for an upward revision of the EU level target;
- A financial framework for investors is to be established to facilitate investment in renewable energy projects;

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[2] Climate Action and Low Carbon Development (Amendment) Bill 2020, Section 4.

[3] European Commission. (2020). State of the Union: Commission raises climate ambition and proposes 55% cut in emissions by 2030

- Increases competition and market integration of renewable electricity;
- Will reduce dependence on energy imports and increase energy security;
- Improves the design and stability of support schemes for renewables;

The Irish government has recently published the Climate Action Plan 2019 (CAP) which sets out a plan of action to address climate change and sets decarbonisation targets. In terms of renewable energy, an increase in electricity generated from renewable sources is to increase to 70% by 2030, with up to 8.2GW of increased onshore wind capacity.

Chapter 1 of the CAP sets out the nature of the challenge which Ireland faces over the coming years. The CAP notes that the evidence for warming of our climate system is beyond dispute with observations showing that global average temperatures have increased by more than 1°C since preindustrial times. These changes will cause extensive direct and indirect harm to Ireland and its people, as well as to other countries more exposed and less able than we are to withstand the associated environmental impacts such as extremes in weather, flooding, displacement of population by the creation of climate refugees poorer water quality and poorer air quality. In order to help reduce CO_2 emissions and reach our 2030 and 2050 emissions targets, CAP has set out a list of renewable energy goals which includes implementing up to 8.2 GW total of increased onshore wind capacity on the island.

6.1.3.1 Climate Action Network Europe Off Target Report 2018

The June 2018 'Off Target Report' published by the Climate Action Network (CAN) Europe which ranks EU countries ambition and progress in fighting climate change listed Ireland as the second worst performing EU member state in tackling climate change. It also stated that Ireland is set to miss its 2020 climate (20% reduction in greenhouse gases) and renewable (40% increase in overall energy from renewable electricity sources) energy targets. Additionally, it was noted that Ireland is also off course for its 2030 emissions target.

In March 2019, the Minister for Communications, Climate Action, and the Environment, Richard Bruton, announced a renewable electricity target of 70% by 2030 for Ireland. Furthermore, the release of the CAP in June 2019 has noted a 30% reduction in greenhouse gases by 2030. Considering only renewable energy from electricity as part of this plan and to meet the required level of emissions reduction by 2030, Ireland will:

- Reduce CO_2 eq. emissions from the sector by 50–55% relative to 2030 NDP projections.
- Deliver an early and complete phase-out of coal- and peat-fired electricity generation.
- Increase electricity generated from renewable sources to 70%, indicatively comprised of:
  - at least 3.5 GW of offshore renewable energy;
  - up to 1.5 GW of grid-scale solar energy; and
  - up to 8.2 GW total of increased onshore wind capacity.
- Meet 15% of electricity demand by renewable sources contracted under Corporate PPAs.

Achieving the 70% renewable electricity target by 2030 will involve phasing out coal and peat-fired electricity generation plants, increasing our renewable electricity generation, reinforcing our grid (including greater interconnection to allow electricity to flow between Ireland and other countries), and putting systems in place to manage intermittent sources of power, especially from wind.

6.1.3.2 Climate Change Performance Index

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 2020 CCPI was published in December 2019 and presented at the COP25. While the CCPI 2020 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 has ranked as the worst EU performer in the CCPI 2019. However, Ireland has climbed 7 places from 48th out of 60 globally ranked countries to 41st place and has moved from a "very low" to "low" in international performance. Despite these gains however, it remains at "very low" at a national performance level. The CCPI report states that while some improvements have been made, GHG per capita emissions are at a high level and "significant challenges lie ahead in closing Ireland's emission gap, meeting the current (2030) target and aligning Ireland's emission trajectory with a net zero goal for 2050. Therefore, the country still ranks among the bottom ten performers in this indicator."

Recognising Ireland's Climate Action Plan 2019, the CCPI states:

> *"the government must go much further in implementing policies across all sectors that drive sustained emissions reductions over the next decade. Near-term ambition needs to be ratcheted up quickly by specifying deep cuts in fossil fuel and reactive nitrogen usage to put Ireland on a net zero emissions pathway aligned with the Paris temperature goals".*

6.1.4 Carbon Emissions

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

The carbon balance of proposed wind farm developments in peatland habitats has attracted significant attention in recent years. When developments such as wind farms are proposed for peatland areas, there will be direct impacts and loss of peat in the area of the development footprint. There may also be indirect impacts where it is necessary to install drainage in certain areas to facilitate construction. The works can either directly or indirectly allow the peat to dry out, locally, which permits the full decomposition of the stored organic material with the associated release of the stored carbon as CO_2. It is essential therefore that any wind farm development in a peatland area displaces more CO_2 produced from fossil fuel sources than it releases during the construction, operation and restoration of the wind farm site.

The proposed development is situated in an area which has limited peat habitats. The site is not located on active bog or fen habitats. Peat is present at limited depths (0.1-0.4m) throughout most of the site with one area (near T4) where peat is found at a depth of 0.5m. Most of the site has been cultivated and forestry dominates the site. The proposed development has been sensitively situated within an upland environment of limited habitat value.

The Scottish Carbon Calculator Tool was used to calculate carbon emissions and carbon savings as a result of the proposed wind farm - www.gov.scot. Input data used in the calculations is presented in Appendix 6.1.

6.1.4.1 *Ireland's Carbon Emissions*

Ireland's greenhouse gas (GHG) emissions are tracked and projected by the EPA for submission to the EU UNFCCC annually. Carbon dioxide emissions are reported alongside methane (CH4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6), and nitrogen trifluoride (NF_3).

For 2018, the total national greenhouse gas emissions was estimated to be 60.93 million tonnes[4] carbon dioxide equivalent (Mt CO_{2eq}) (EPA, 2019). This is 0.19% lower (0.53Mt CO_{2eq}) than emissions in 2017. Emissions reductions have been recorded in 6 of the last 10 years, however, two of the last four years have seen large increases in emissions. In the last 3 years national total emissions increased by 5.5% or 3.58 Mt CO_{2eq}.

Emissions in the Energy Industries sector showed a decrease of 10.7% between 2017 and 2018 which is attributable to decreases in the consumption of coal, peat and oil while there were increases in renewable electricity generation. In 2017, electricity generated from wind and hydro increased by 21.1% and 1.6% respectively, reflected in a 9.1% decrease in the emissions intensity of power generation in 2017 (437g CO_2/kWh) compared with 2016 (480 g CO_2/kWh). Renewables now account for 29.6% of electricity generated in 2017 (the EPA figures and SEAI figures differ slightly), up from 25.5% in 2016. Ireland exported 2.3% of electricity generated in 2017 and total final consumption of electricity increased by 1.1% (EPA, 2019).

SEAI estimate that the use of renewables in electricity generation in 2018 reduced CO_2 emissions by 4.9 Mt. Renewable energy accounts for 82% of the CO2 emissions avoided. A total of 358 MW of wind capacity was installed in 2018 and wind generation now accounts for 28% of the electricity generated[5].

The EPA's latest projections report, 'Ireland's Greenhouse Gas Emissions Projections 2019-2040' (July 2020[6]) projected Ireland's greenhouse gas emissions under two scenarios: The With Existing Measures scenario and the With Additional Measures scenario. The With Existing Measures (WEM) scenario incorporates the anticipated impact of policies and measures that were in place (and legislatively provided for) by the end of 2018. The With Additional Measures (WAM) scenario is primarily based on SEAI's Advanced energy projection (which includes existing and planned policies and measures) and anticipated progress in the implementation of Government renewable and energy efficiency policies and measures including those set out in the National Renewable Energy Action Plan (NREAP), the National Energy Efficiency Action Plan (NEEAP) and Ireland's National Development Plan 2018 - 2027. Plate 15.1 illustrates the WEM and WAM projected emissions in relation to Energy Industries.

[4] EPA. (2019) 'Irelands National Inventory Report, 2020: Greenhouse Gas Emissions 1990-2018'. Table 2.1.

[5] SEAI (2020) Renewable Energy in Ireland: 2020 Report

[6] EPA (2020) '2020 Greenhouse Gas Emissions Projections' 2019-2040.

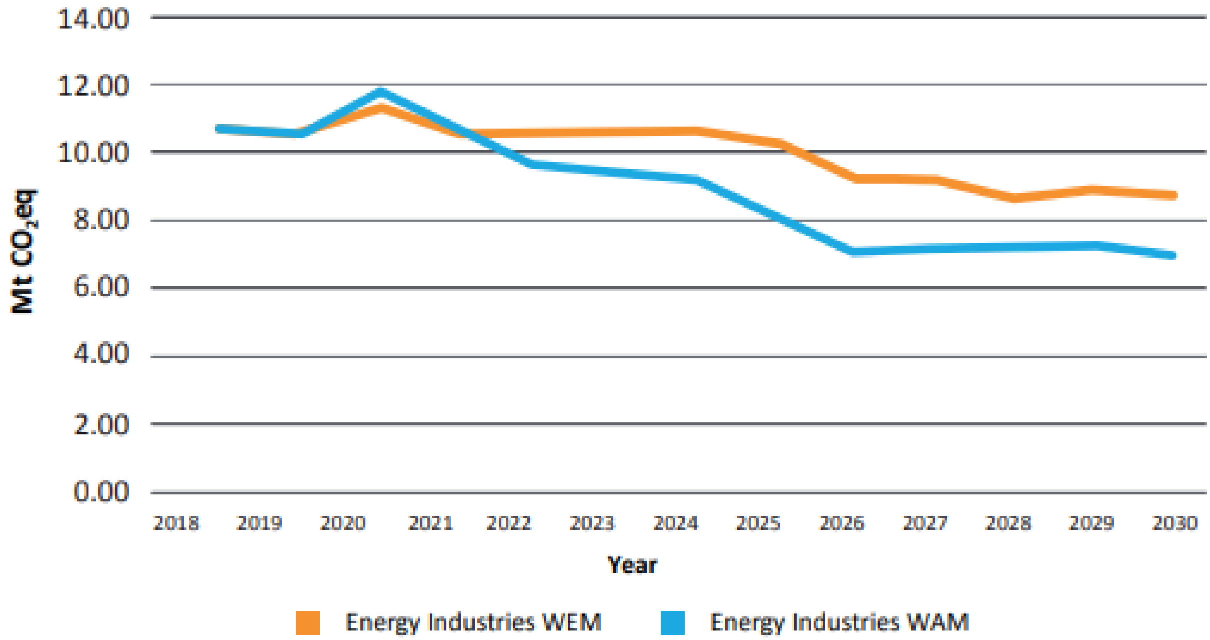

Plate 6-1: Greenhouse Gas Emissions Projections from the Energy Industries Sector under the WEM and WAM scenarios out to 2030

Ireland's 2020 target was to achieve a 20% reduction of non-Emission Trading Scheme (non-ETS) sector emissions i.e. agriculture, transport, residential, commercial, non-energy intensive industry and waste, on 2005 levels, with annual binding limits set for each year over the period 2013 – 2020. Ireland exceeded the binding targets in 2014-2016.

A new Effort Sharing Regulation setting out 2030 targets for EU Member States has recently been adopted by the European Council. Irelands 2030 target is a 30% reduction of emissions compared to 2005 levels by 2030 with binding annual limits over the 2021-2030 period to meet that target. Over the longer-term, Ireland's National Policy Position on Climate change has set a target of an aggregate reduction in carbon dioxide (CO_2) emissions of at least 80% (compared to 1990 levels) by 2050 across the electricity generation, built environment and transport sectors.

According to 'Ireland's Greenhouse Gas Emissions Projections 2018-2040' (EPA, 2019), 2018 greenhouse gas emissions projections show total emissions increasing from current levels by 1% and 6% by 2020 and 2030 respectively, under the With Existing Measures scenario. Under the With Additional Measures, emissions are estimated to decrease by 0.4% by 2020 and decrease by 10% by 2030.

On 14th May 2018, the European Council adopted a regulation on greenhouse gas emission reductions. The regulation sets out binding emission reduction targets for Member States in sectors falling outside the scope of the EU emissions trading system for the period 2021- 2030. The results of the EPA projections show that in a low fuel price scenario, Ireland will exceed the carbon budget over the period 2021 – 2030 by 86-101 Mt CO_2 equivalent or by 40-56 Mt CO_2 with full use of the ETS and LULUCG flexibilities (EPA, 2019).

6.2 Methodology

As the operation of the wind farm does not give rise to emissions (with the exception of back-up generators which would not be in use regularly), in respect of air and climate, this chapter focusses on the potential emissions which may arise during the construction and decommissioning phases of the proposed CGEP and associated grid connection, turbine delivery route and substation The Scottish Windfarm Carbon Assessment Tool was used to predict the carbon savings for the energy park for an operational period of 30 years and includes all activities and associated potential impacts during the construction and decommissioning phase.

6.2.1 Air Quality

A review of existing air quality monitoring data undertaken by the Environmental Protection Agency (EPA) was reviewed and used to characterise the existing environment.

The impact assessment methodology involved the review and assessment of the proposed energy park, grid connection and turbine delivery route to identify the potential for air emissions during construction and decommissioning. The activities which were assessed are as follows:

1) the proposed energy park and associated infrastructure (including earthworks, tree felling and replant lands, new access tracks, temporary storage of excavated materials, the movement of construction vehicles (including movement and works along the TDR and haul routes), the loading and unloading of aggregates and the movement of material around the site),
2) Grid connection works including trench excavation and the movement of construction vehicles.

To assess the impacts of construction dust emissions, the NRA's Assessment Criteria for the impact of dust emissions from construction activities with standard mitigation in place was used. This table is provided in Appendix 8 of the National Roads Authority (NRA) Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes (NRA, 2011) and reproduced below in Table 6.3.

Table 6.4 details the definitions of impact magnitude for changes in ambient pollutant concentrations and Table 6.5 details the descriptors for changes in annual mean nitrogen dioxide, PM_{10} and $PM_{2.5}$ at receptors.

Table 6-3: Assessment Criteria for the Impact of Dust Emissions from Construction Activities, with Standard Mitigation in Place

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

(source: NRA/TII, 2011)

Table 6-4: Definition of Impact Magnitude

Magnitude of Change	Annual Mean NO_2/PM_{10}	No. Days with PM_{10} conc. >50µg/m³	Annual Mean PM_{10}
Large	Increase/Decrease ≥4µg/m³	Increase/Decrease > 4 days	Increase/Decrease ≥2.5 µg/m³
Medium	Increase/Decrease 2-< 4µg/m³	Increase/Decrease 3 or 4 days	Increase/Decrease 1.25 - <2.5 µg/m³
Small	Increase/Decrease 0.4 - <2 µg/m³	Increase/Decrease 1 or 2 days	Increase/Decrease 0.25 - <1.25 µg/m³
Imperceptible	Increase/Decrease <0.4 µg/m³	Increase/Decrease <1 day	Increase/Decrease <0.25 µg/m³

(source: NRA/TII, 2011)

Table 6-5: Air Quality Impact Descriptors for Changes to Annual Mean Nitrogen Dioxide and PM_{10} and $PM_{2.5}$ Concentrations at a Receptor

Absolute Concentration In relation to Objective/Limit Value	Change in Concentration		
	Small	Medium	Large
Increase with Scheme			
Above Objective/Limit Value with Scheme (≥40µg/m³ of NO_2 or MP_{10}) (≥25µg/m³ of $PM_{2.5}$)	Slight adverse	Moderate adverse	Substantial adverse
Just below objective /limit value with scheme (36- <40 µg/m³ of NO_2 or PM_{10}) (22.5 - <25 µg/m³ of $PM_{2.5}$)	Slight adverse	Moderate adverse	Moderate adverse
Below objective / limit value with scheme (30- <36 µg/m³ of NO_2 or PM_{10}) (18.75 - < 22.5 µg/m³ of $PM_{2.5}$)	Negligible	Slight adverse	Slight adverse
Well below objective /limit value (<30 µg/m³ of NO_2 or PM_{10}) (<18.75 µg/m³ of $PM_{2.5}$)	Negligible	Negligible	Slight adverse
Decrease with Scheme			
Above objective/limit value without scheme (≥40 µg/m³ of NO_2 or PM_{10}) (≥25 µg/m³ of $PM_{2.5}$)	Slight beneficial	Moderate beneficial	Substantial beneficial
Just below objective / limit value without scheme (36 - <40 µg/m³ of NO_2 or PM_{10}) (22.5 - <25 µg/m³ of $PM_{2.5}$)	Slight beneficial	Moderate beneficial	Moderate beneficial
Below objective/limit value without scheme (30 - <36 µg/m³ of NO_2 or PM_{10}) (18.75 - <22.5 µg/m³ of $PM_{2.5}$)	Negligible	Slight beneficial	Slight beneficial
Well below objective/limit value without scheme (<30 µg/m³ of NO_2 or PM_{10}) (<18.75 µg/m³ of $PM_{2.5}$)	Negligible	Negligible	Slight beneficial

(source: NRA/TII, 2011)

6.2.2 Climate

A desk-top study assessment was undertaken of available climatic information to characterise the existing environment. In terms of climatic impact, the appraisal considered the net impact that operating the proposed energy park will have in terms of CO_2 and its displacement of CO_2 from other energy sources over the carbon losses caused by its construction using the Scottish Carbon Calculator tool.

The impact assessment considered the positive impacts the proposed energy park will have on contributing to national targets for the reduction of greenhouse gas emissions. The proposed development will result in the production of energy from a renewable source which, once fed into the National Grid, has the potential to avoid several thousand tonnes of carbon dioxide (CO_2) annually that would have been released had the energy been generated by the average Irish power generation mix.

Figures from the Sustainable Energy Authority of Ireland (SEAI, 2018) indicate that the net CO_2 displacement intensity by wind generation was 577 kilo tonnes of CO_2 in 2005, and this increased to 2,188 kilo tonnes CO_2 in 2016. It was estimated that in 2016, approximately €192 million in fossil fuel imports were avoided, with €155 million attributed to wind generation.

Greenhouse gas emissions are associated with the manufacture, transport, construction, operation and decommissioning of wind turbines.

The Intergovernmental Panel on Climate Change (IPCC) in 'Renewable *Energy Sources and Climate Change Mitigation*' (2014) state that 50 estimates from 20 studies indicate that emissions "*are small compared to the energy generated and emissions avoided over the lifetime of wind power plants* [farms]*: the GHG* [greenhouse gas] *emissions intensity of wind energy is estimated to range from 8 to 20g CO_2/kWh in most instances*". The IPCC (2010) report that the energy payback time, based on lifecycle assessment procedures, per turbine vary between 0.25 years and 0.65 years for onshore developments.

The amount of CO_2 that could potentially be avoided on an annual basis due to the proposed energy park is estimated based on the expected output of the energy park. The net displacement value may increase or decrease somewhat, as the generation mix in Ireland develops, under different fuel price scenarios and as demand changes over time, and as more storage, interconnection and demand side management (smart meters) come online. Refer to Section 6.4.4 for details of the calculations for carbon saving as a result of the proposed energy park.

6.2.3 Carbon Calculation

Previously, guidance produced by Scottish Natural Heritage in 2003 had been widely employed to determine carbon payback in the absence of any more detailed methods.

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

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

The calculator was created to calculate the loss of carbon from acidic bog or fen habitat and defines peat soils as soils with a surface horizon greater than 50cm deep. The calculator takes into account the carbon fixing potential from peatland plants (which is small) and calculates the total area of peat excavation and the total area of peat affected by drainage, using the annual gains due to carbon fixing potential and the time required for any habitat restoration. Carbon stored within the peat itself represents a large potential source of carbon which can be lost during excavation and drainage. Forestry on proposed wind farm sites can affect wind energy yields and therefore clear felling is generally required (tree felling is limited to the minimum required for infrastructure construction and bat mitigation in this project). Carbon losses as a result of felling are calculated from the area to be felled, the average carbon sequestered annually, and the lifetime of the wind farm. The calculator also takes into account the carbon emissions from the life cycle analysis of the wind turbines and the back-up source in order to calculate carbon savings and carbon payback times of a wind farm. Site specific capacity factor is also required to provide a realistic payback time for a site. The calculator also takes into account a grid mix emission factor. The calculator uses default values from the Intergovernmental Panel on Climate Change (IPPCC, 1997) as well as site specific equations from scientific literature to calculate carbon loss.

In keeping with guidance specific figures have been inputted wherever possible and where this information was not available the guidance provided by the calculator was used[7]. The assumption to use the fossil fuel generation emission factor was made based on the reality that additional wind generation will displace fossil fuel generation (Scot. Gov., 2018). With regards to the windfarm characteristics the following presumptions for the proposed 22 turbine wind farm were made: the lifetime of the windfarm is 30 years, the capacity factor is 33% and the fraction of output to back up is 5.28% (i.e. 5% of capacity factor[8]). With regards to the characteristics of the 'peatland' before development, the peat on the site does not meet the standards for peatland in that it is less than 0.5m in depth. The site has been cultivated and is dominated by forestry meaning that the carbon content of the peat is much lower than that of an actual peatland habitat, with carbon having been released during the drainage and cultivation of the site.

An average depth of peatland was provided for the entire site (0.3m) and turbine areas (0.5m). Whilst the carbon content for dry peat, dry bulk density and extent of drainage around drainage features was unknown and were likely to be below the figures provided in the accompanied guidance, guidance figures were used with a worst-case scenario of 0.5m taken for drainage. Also, whilst 62.8 ha of forestry is to be clear felled, 62.8 ha of forestry will be replanted elsewhere, and the carbon calculator does not take this into account. It is therefore highly likely that the carbon loss figure for the proposed development will be slightly higher than the actual carbon loss for the site.

The Scottish Government on-line carbon calculator as outlined above, was used to assess the whole life impacts of the proposed wind farm in terms of potential carbon losses and savings taking into account peat removal, drainage, and forestry felling.

A copy of the outputs is provided as Appendix 6.1 of this EIAR. A summary of the main CO_2 losses due to the proposed wind farm development are summarised in Table 6.12.

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[7] Scottish Government. Calculating potential carbon losses and savings from wind farms on Scottish peatlands Technical Note Version 2.10.0

[8] The capacity factor, $p$cap (%), is calculated from the ratio of calculated annual power output from the turbine, Pact (MWh turbine-1 yr-1), and the theoretical power output of the turbine, Pmax (MW turbine-1 yr-1), removing the specified value for estimated downtime for maintenance, tdown (%) (Source: *Calculating potential carbon losses and savings from wind farms on Scottish peatlands Technical Note* Version 2.10.0.

6.3 Existing Environment

6.3.1 Air Quality

European air quality legislation requires that each member state be defined in terms of Zones and Agglomerations for air quality, with Ireland divided into four zones.

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

These zones were defined to meet the criteria for air quality monitoring, assessment and management described in the Framework Directive and Daughter Directives. The proposed wind farm and grid connection are located in Zone D. the proposed TDR is located in both Zones B and D.

The air quality in each zone is monitored by the EPA and classified with respect to upper and lower assessment thresholds based on measurements over the previous five years. The number of monitoring locations required is dependent on population size and whether ambient air quality concentrations exceed the upper assessment threshold, are between the upper and lower assessment thresholds, or are below the lower assessment threshold. The Air Quality In Ireland 2017 – Indicators of Air Quality (EPA 2018) noted that Ireland's overall air quality was good and compares favorably with other member states and all the parameters were below the EU limit and target values. However, when compared to the tighter WHO Air Quality Guideline values, Ireland exceeded the WHO Guideline values in 2017 for PM_{10}, , O_3 and PAH. $PM_{2.5}$ has been highlighted by the EPA as being predominantly responsible for most of the 1,180 estimated premature deaths. The Air Quality Index for Health map on the EPA website, shows that the current air quality within the proposed energy park and grid connection site is classed as 1 – Good.

An assessment of air quality was carried out in Cork Harbour from 31st August 2007 – 15th March 2008[9].The monitoring assessment at Cork Harbour is the closest site to the application site and provides an environmental baseline of air quality conditions in the region. A summary of findings for sulphur dioxide, Particulate Matter (PM_{10}), Nitrogen Dioxide (NO_2) and Carbon Monoxide (CO) is found in the following sections.

6.3.1.1 Sulphur Dioxide

Sulphur Dioxide for the period of August 2007 to March 2008 recorded at the Cork Harbour air monitoring station is presented in Table 6.6. The hourly limit value was not exceeded during the measurement period. There were no exceedances of the 50 µg.m-3 lower assessment threshold. The directive stipulates that the lower assessment threshold should not be exceeded more than three times in a calendar year.

[9] EPA. Ambient Air Monitoring in Cork Harbour. http://www.epa.ie/pubs/reports/air/monitoring/Cork%20harbour%20assessment.pdf

Table 6-6: Sulphur Dioxide Data for Cork Harbour 2007-2008

Parameter	Measurement
Number of Hours	4668
No. of measured values	4620
Percentage Coverage	98.97%
Maximum hourly value	32.7 $\mu g.m^{-3}$
98 percentile for hourly values	9.3 $\mu g.m^{-3}$
Mean hourly value	3.4 $\mu g.m^{-3}$
Maximum 24 hour mean	11.6 $\mu g.m^{-3}$
98 percentile for 24-hour mean	6.9 $\mu g.m^{-3}$

6.3.1.2 Particulate Matter (PM_{10})

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

Particulate matter (PM_{10}) data for the 2007-2008 monitoring period in Cork Harbour is presented in Table 6.7. The 24 hour limit value for the protection of human health (50 µg.m-3) was not exceeded during the measurement period. The directive stipulates that the limit value should not be exceeded more than 35 times in a calendar year. The upper assessment threshold was exceeded on 7 days, the lower assessment threshold was exceeded on 24 days. The directive stipulates that each of the assessment thresholds should not be exceeded more than 7 times in a calendar year. The mean of the daily values during the measurement period (16.7 µg.m-3) is below the annual limit value for the protection of human health (40 µg.m-3).

Table 6-7: Particular Matter (PM_{10}) data Carlow Town

Parameter	Measurement
No. of Days	207
No of measure values	81
Percentage coverage	39%
Maximum daily value	48.8 $\mu g.m^{-3}$
Mean daily value	16.7 $\mu g.m^{-3}$

6.3.1.3 Nitrogen Dioxide (NO_2)

Nitrogen dioxide and oxides of nitrogen data for the 2007-2008 monitoring period in Cork Harbour is presented in Table 6.8. No hourly mean NO_2 values were above the lower assessment for the protection of human health (Figure 6). The directive stipulates that the lower assessment threshold should not be exceeded more than 18 times in a calendar year. The mean hourly NO_2 value (10.4 µg.m-3) during the measurement period was below the annual lower assessment threshold for the protection of human health (26 µg.m-3).

Table 6-8: Nitrogen Dioxide and Oxides of Nitrogen Cork Harbour

Parameter	Measurement
No. of Hours	4642
No of measure values	4579
Percentage coverage	98.6%
Maximum hourly value (NO_2)	62.8 $\mu g.m^{-3}$
98 percentile for hourly rates (NO_2)	43.9 $\mu g.m^{-3}$
Mean hourly value (NO_2)	10.4 $\mu g.m^{-3}$
Mean hourly value (NO_x)	15.4 $\mu g.m^{-3}$

6.3.1.1 Carbon Monoxide (CO)

Carbon Monoxide data for the 2007-2008 monitoring period in Cork Harbour is presented in Table 6.9. The mean hourly concentration of carbon monoxide recorded was 0.26 mg/m^3. The CO limit value for the protection of human health is 10 mg/m^3.

Table 6-9: Carbon Monoxide Data for Carlow Town 2004-2005

Parameter	Measurement
No of hours	4398
No. of measured values	4086
Percentage coverage	92.91%
Maximum hourly value	3.02 $mg.m^{-3}$
98 percentile for hourly values	0.81 $mg.m^{-3}$
Mean hourly value	0.26 $mg.m^{-3}$
Maximum 8 hour mean	2.67 $mg.m^{-3}$
98 percentile for 8 hour mean	0.68 $mg.m^{-3}$

6.3.1.2 Dust

There are no statutory limits for dust deposition in Ireland. However, EPA guidance suggests that a deposition of 10 mg/m2/hour can generally be considered as posing a soiling nuisance. This equates to 240 mg/m2/day. The EPA recommends a maximum daily deposition level of 350 mg/m2/day when measured according to the TA Luft Standard 2002.

Construction dust has the potential to be generated from on-site activities such as excavation and backfilling. The extent of dust generation at any site depends on the type of activity undertaken, the location, the nature of the dust, (i.e. soil, sand, peat) and the weather. In addition, dust dispersion is influenced by external factors such as wind speed and direction and/or, periods of dry weather. Construction traffic movements also have the potential to generate dust as they travel along the haul route.

6.3.2 Climate

Changing climate patterns are thought to increase the frequency of extreme weather conditions such as droughts, floods and storms. Warmer weather places pressure on flora and fauna which cannot adapt to a rapidly changing environment. The dominant influence on Ireland's climate is the Gulf Stream. Consequently, Ireland does not suffer from the extremes of temperature experienced by many other countries at similar latitudes.

The climatic conditions for the wider geographical area have been derived from historical meteorological measurements compiled by Met Éireann at Cork Harbour weather station which is approximately 21km south west of the proposed wind farm and associated infrastructure. These meteorological conditions are presented in Table 6.6 for the period January 2016-September 2020 (source www.met.ie/climate).

Table 6-10: Climate Records January 2016-September 2020

Total rainfall in millimetres for CORK AIRPORT												
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
2020	112.2	199.3	64.7	72.3	68.8	94.1	97.6	175.0	13.6	N/A	N/A	N/A
2019	74.3	81.5	128.6	135.8	41	110.5	43.9	107.6	91.1	179.2	145.0	125.6
2018	156.6	48.7	164.9	180.7	82.8	10.4	40.1	59	77.4	62	201.5	193.2
2017	108.5	113.3	115	24.6	60.6	109	60.2	72.2	169	127.9	74.8	126.3
2016	251.7	150.9	84.4	103.3	85.4	65.6	56.7	84.7	136.3	48.7	40.7	94.2
mean	131.4	97.8	97.6	76.5	82.3	80.9	78.8	96.8	94.6	138.2	120	133.1
Mean temperature in degrees Celsius for CORK AIRPORT												
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
2020	6.2	6.0	6.1	9.6	11.4	`13.6	14.8	15.5	14.7	N/A	N/A	N/A
2019	6.4	7.3	7.2	8.9	11.1	12.5	16	15.2	13.6	9.8	6.6	6.2
2018	6.2	4.1	4.4	8.4	11.8	15.8	17.4	15.1	12.3	9.9	8	8.3
2017	6.3	6.5	8.1	9	11.6	14	15.3	14.3	12.7	11.3	7.7	6.3
2016	6.1	5	6.1	7.3	11.9	14.4	15.2	15	13.4	10.9	5.9	7.4
mean	5.6	5.7	6.8	8.2	10.7	13.3	15.1	15	13.2	10.3	7.7	6.1
Mean 10cm soil temperature for CORK AIRPORT at 0900 UTC												
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
2020	5.1	5.0	4.9	9.1	11.9	14.1	14.9	15.3	N/A	N/A	N/A	N/A
2019	6	6.3	6.4	8.7	11.8	13.3	16.6	15.0	13.5	9.1	6.2	5.2
2018	5	3.1	3.7	8	12	16.9	18.2	15.5	12.4	9.2	7.1	7.5
2017	5.5	5.7	6.9	9.1	12	14.9	15.8	14.4	12.5	11.2	7.2	5.4
2016	5.4	4.3	5.3	7.2	12.1	15.3	15.6	15.3	13.3	10	5.4	6.4
mean	4.8	4.8	5.9	7.9	11.3	14.1	15.7	15.2	13	10	7.2	5.6

Potential Evapotranspiration (mm) for CORK AIRPORT

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2020	10.7	19.6	36.1	57.4	83.9	78.4	88.0	71.2	13.7	N/A	N/A	N/A
2019	13	16	35.3	51.1	81	79.4	87.6	67.7	47.0	27.1	13.9	11.5
2018	11.3	19	26.9	41.6	73.5	102.6	103.6	68.9	46.3	29	14.1	9.7
2017	12.7	17.7	35	52.5	71.4	83.3	87.7	62.7	42	19.3	11.1	10
2016	9	17.1	31.1	53.7	78	83.7	79.2	67.6	37	30.1	14.3	10.6
mean	12.8	20.1	32.1	52.5	71.2	81.7	81.3	69.1	46.1	24.7	13.8	10.9

Evaporation (mm) for CORK AIRPORT

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2020	14.3	30.0	55.5	86.2	127.8	117.7	124.8	101.6	18.5	N/A	N/A	N/A
2019	17.4	24.5	54.3	80.4	120.5	118.4	131.8	104.7	70.6	40.6	18.1	14.1
2018	16.3	27.8	43	66.3	108.3	143.7	140.4	97	68.2	40.7	19.8	13.8
2017	17.2	26.5	52.7	75.9	106	124.3	125.3	90.8	62.8	29.6	15.6	13.8
2016	13.8	25.6	47.6	83.3	115.5	121.3	115.3	97.9	53.3	41.3	19.2	14.4
mean	18.1	30.2	50.2	81.4	109.3	121.6	118.3	100	67.5	36.2	19.2	14.7

DEGREE DAYS BELOW 15.5 DEGREE CELSIUS FOR CORK AIRPORT

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2020	290	276	290	181	132	74	50	38	N/A	N/A	N/A	N/A
2019	284	229	256	201	141	103	27	39	70	176	267	288
2018	289	320	344	213	129	39	24	50	105	175	226	224
2017	285	251	230	195	124	69	43	56	93	130	234	284
2016	291	304	292	245	121	54	43	42	75	143	287	252
Mean	306	278	269	219	153	81	46	48	82	161	234	292

MEAN WIND SPEED (KNOT) FOR CORK AIRPORT

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2020	9.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2019	8.3	12.3	10.9	11.0	8.7	8.9	8.5	9.8	9.2	9.9	10.6	10.7
2018	12.2	10.8	10.5	10.3	8.0	7.6	7.7	8.1	9.1	9.4	11.5	10.8
2017	8.9	12.2	10.8	8.1	8.6	10.1	8.2	8.1	9.6	10.4	8.7	10.2
2016	11.8	10.8	9.7	10.0	8.1	8.4	8.4	9.3	9.2	8.9	9.0	8.7

6.4 Impact Assessment

6.4.1 Do-Nothing Impact

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

6.4.2 Air Quality

6.4.2.1 Construction Phase Impacts

The principal source of potential air emissions during the construction of the proposed CGEP will be from the energy park, grid connection route and TDR; from dust arising from earthworks, tree felling activities, trench excavation along cable routes, construction of the new access tracks, the temporary storage of excavated materials, the movement of construction vehicles, loading and unloading of aggregates/materials and the movement of material around the site.

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

- The type and quantity of material and working methods
- Distance between site activities and sensitive receptors
- Climate/local meteorology and topography.

Table 6.11 details the NRA assessment criteria used for assessing the impact of dust from construction activities sites of varying scale:

Table 6-11: NRA Assessment Criteria for the Impact of Dust Emissions from Construction Activities with Standard Mitigation in Place

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

Source: NRA / TII, 2011

Applying the NRA criteria in Table 6.11, the overall construction of the proposed energy park would be considered a major construction site. This would result in soiling effects which have the potential to occur up to 100m from the source, with PM_{10} deposition and vegetation effects occurring up to 25m from the source. The nearest receptor is c. 755m from the nearest turbine and therefore will not experience the soiling, deposition or vegetation effects. Construction vehicles and plant emissions have the potential to increase concentrations of compounds such as NO_2, Benzene and PM_{10} in the receiving environment. Due to distance between the nearest receptor and source of emissions the impact from these emissions will be Imperceptible.

The construction of the proposed grid connection would be considered a moderate construction site. This would result in soiling effects which have the potential to occur up to 50m from the source, with PM_{10} deposition and vegetation effects occurring up to 15m from the source. There are approximately 51 one-off houses along the proposed grid connection route. There are 559 no. receptors along Option 1 and 587 receptors along Option 2 of the proposed Turbine Delivery Route. Some houses may experience soiling and deposition of vegetation effects depending on how close to the road corridor they are located. Construction vehicles and plant emissions have the potential to increase concentrations of compounds such as NO_2, Benzene and PM_{10} in the receiving environment. However, due to the nature of construction along the proposed grid connection, which works as a “rolling” construction site, these effects are considered to be short term, temporary and slight.

It is not predicted that an air quality impact will occur due to traffic at the proposed CGEP as the impacts will fall below the screening criteria set out in the UK DMRB guidance (UK Highways Agency 2007), on which the TII guidance is based. This UK DMRB guidance states that road links meeting one or more of the following criteria can be defined as being ‘affected’ by a proposed development and should be included in the local air quality assessment:

- Road alignment change of 5 metres or more;
- Daily traffic flow changes by 1,000 AADT or more;
- HGVs flows change by 200 vehicles per day or more;
- Daily average speed changes by 10 km/h or more; or
- Peak hour speed changes by 20 km/h or more.

As detailed in Chapter 13 Traffic and Transportation and Appendix 13.1, the proposed green energy park, grid connection and TDR will result in an average daily increase of 43 HGV trips per day and 68 LGV trips per day over a construction period of 24 months (111 combined trips per day) with a peak average daily count of 46 HGVs and 100 LGV trips per day (146 combined trips per day). Therefore, the model is not required in this instance.

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

6.4.2.2 Operational Phase Impacts

Once the proposed CGEP and associated grid connection are constructed there will be no significant direct emissions to atmosphere. A diesel generator will be located at the energy parks’ substation; however, this will only be operated as a back-up/emergency power supply.

Emissions from the diesel generator will therefore be infrequent. During use, a diesel generator will emit carbon dioxide, nitrogen oxide and particulate matter, however, due to the low usage, the impact would be imperceptible. Maintenance vehicles will access the energy park site during the operational period, however, due to the low traffic movements involved, the impact will be imperceptible. The operational phase of the CGEP will result in positive impacts on air quality due to the displacement of fossil fuels as an energy source.

Maintenance vehicles will also access the proposed grid connection route during the operational period. However, given the low and infrequent traffic movements involved, the impact will be imperceptible. The operational phase of the grid connection, which connects and operates the proposed wind farm, will result in positive impacts on air quality due to the displacement of fossil fuels as an energy source.

6.4.2.3 Decommissioning Phase Impacts

In terms of decommissioning, there will be truck movements associated with removing the wind turbines from the energy park and reinstating the access tracks and hardstandings around turbines 3 and 6 resulting in vehicular emissions and also dust. However, the number of truck movements would be significantly less than the construction phase and would potentially result in a slight temporary impact. There will also be emissions from machinery on site including for the movement of soil to cover the foundations, however, this is not likely to result in significant impacts.

During the decommissioning phase, the proposed grid connection will be left in situ, resulting in no additional truck movements and no impact from emissions from machinery along the grid connection route.

6.4.3 Climate

There is the potential for greenhouse gas emissions to the atmosphere during the construction phase such as those arising from construction vehicles, the use of on-site generators, pumps etc. The potential climatic impacts arising from these emissions are assessed hereunder with respect to micro and macro climates.

Microclimate

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

The proposed energy park site is predominately a greenfield site with the exception of existing public road ways and internal track ways. The total area of proposed new permanent hardstanding surface is approximately 3.4% of the energy park planning development area, and consequently there will be no direct or indirect impact on air temperature and microclimate due to the development. There will also be the loss of 62.8 ha of conifer plantation within the site. Tree felling will be dispersed over several areas and will not consist of a single clear fell area and there will be no direct or indirect impact on site temperature and microclimate due to tree felling. It is important to note that tree felling forms part of the cycle of commercial forestry and without the proposed development, would occur as normal.

Macroclimate

Carbon dioxide (CO_2) is a greenhouse gas which if released in excessive amounts can lead to increases in global temperatures known as ‘global warming’ or ‘greenhouse effect’ which can influence climate change. Section 6.4.4 details the carbon savings that have been calculate for the CGEP.

Should the Coom Green Energy Park Project be developed, fossil fuel power stations will be the primary alternative to provide the required quantities of electricity. This will further contribute to greenhouse gas and other air pollutant emissions, as well as hindering Ireland in its commitment to meet its target to increase electricity production from renewable sources and to reduce greenhouse gas emissions.

The proposed Coom Green Energy Park Project offers Ireland an indigenous form of sustainable electricity and will provide for security of supply, reducing our dependence on imports in addition to the positive impact on the macroclimate.

6.4.4 Carbon Balance

In terms of carbon losses and savings, the online Scottish Windfarm Carbon Assessment Tool (https://informatics.sepa.org.uk/CarbonCalculator/index.jsp). was used to estimate carbon savings as a result of the proposed construction and operation of the energy park. Section 6.2.3 and Appendix 6.1 detail the inputs to the model.

Based on the Scottish Windfarm Carbon Assessment Tool, during the manufacturing of turbines, and construction and decommissioning of the turbines 216,938 tonnes of CO_2 will be lost to the atmosphere. This represents 2.36% of the total amount of CO_2 emissions that will be offset by the proposed CGEP project. Losses during the construction and decommissioning phases will be due to reduced carbon fixing potential, losses from soil organic matter and losses due to felling forestry. Values for turbine life and felling of forestry are presented in Table 6-12.

In total, it is estimated that **6,508,140** tonnes of CO_2 will be displaced over the proposed thirty-year lifetime of the wind farm i.e. **137,371** tonnes of CO_2 per annum, which assists in realising the ambitious goals of the Climate Action Plan 2019. From an operational perspective, the proposed development will displace the emission of CO_2 from other less clean forms of energy generation and will assist Ireland in meeting its renewable energy targets and obligations. The burning of fossil fuels for energy creates greenhouse gases, which contributes significantly to climate change. These and other emissions also create acid rain and air pollution.

For the proposed energy park development with up to 22 turbines assuming a turbine power rating of 4.8MW, and operational period of 30 years, the payback time for the manufacture, construction and decommissioning phases (including carbon losses from soil, felling of forestry etc.) of the CGEP Project is estimated at approximately 1.6 years. The total carbon emissions and carbon payback time will in reality be much reduced due to replanting of forestry and because carbon loss associated with soil organic matter has been overestimated.

As discussed in Section 6.1.3, the carbon calculator was created to calculate carbon loss from acid bog and fen habitats and the proposed development site does not meet the 0.5m depth hectares of new forestry will be replanted at alternative sites to compensate the loss of 62.8 hectares of forestry at the development site which will offset a significant quantum of the 24,869 tonnes of CO_2 lost due to the felling of forestry.

Table 6-12: Carbon Balance Results

Origin of Losses	Total CO_2 Losses (tonnes $C0_2$ equivalent)
Turbine manufacture, construction and decommissioning	92,173
Losses from soil organic matter	65,938
Losses due to Backup	33,666
Felling of Forestry	24,869
Other	292
Total Expected Losses	216,938
Emissions Savings	**Expected C02 emission savings (tonnes CO_2 per Annum)**
fossil fuel mix electricity generation	137,371
Energy output from windfarm	**MWh**
Estimated Annual Output	305,268
Carbon payback time	**Years**
Fossil fuel mix of electricity generation	1.6

6.5 Cumulative Impacts

In terms of cumulative impacts, negative cumulative impacts in relation to air quality would only occur if a large development was located in the vicinity of the site and was being constructed at the same time. There are a large number of developments in the planning system within the vicinity of the site including housing developments, agricultural developments mainly. There is 1 wind farm within 20 km of the proposed development. This is the Pluckanes Wind Farm which is located c. 12.6km from the site and comprises 1 no. turbine. This wind farm development has been constructed and is not considered as part of this cumulative impact assessment.

There are a number of projects and activities which are consented, ongoing or operational within the vicinity of the proposed CGEP. These include:

- **Bottlehill Waste Facility** – constructed, but not operational, immediately south of the proposed CGEP. Negative or adverse effects on the receiving environment in terms of emissions associated with the Bottlehill Facility and the proposed CGEP are considered to be short term in duration and slight in significance during the construction phase of the proposed GCEP and associated grid connection. Following the operational phase of both projects, the emissions of the proposed CGEP will be significantly less than the emissions from the Bottlehill facility as there will only be operational maintenance vehicles servicing the proposed GCEP. These effects are considered to be imperceptible in significance.

- **Existing Forestry Activities** – These are existing forestry operations in immediate vicinity of the proposed CGEP which involve HGV usage during clearfelling and replant operations. There is a potential for these HGV movements to overlap with construction phase works on the proposed CGEP. Negative or adverse effects on the air quality of the receiving environment and sensitive receptors associated with the existing forestry activities adjacent to the site are considered to be short term in duration and slight in significance.
- **Moneygorm Replant Lands** – There is a current replanting site adjacent to the propose CGEP. This replant land area is also proposed to be utilised as one of the two replant land sites for the proposed development. Negative or adverse effects on the air quality of the receiving environment and sensitive receptors associated with replanting activities at Moneygorm are considered to be short-term in duration and imperceptible in significance and no additional mitigation is required.
- **M20 Motorway Project-** - There is a proposed road upgrade of the N20 Limerick to Cork road to a Motorway c. 2.6km to the west of the proposed CGEP which is anticipated to begin in 2027. Negative or adverse effects on the air quality of the receiving environment and sensitive receptors associated with the M20 Motorway project will occur only during the construction and operational phase of both projects. If both the proposed CGEP and the motorway project were under construction at the same time, these effects are considered to be temporary in duration and not significant without adequate mitigation. During the operational phase of the proposed CGEP and M20 Motorway, given the low numbers of operational traffic for the proposed CGEP and the large quantity of traffic on the M20 Motorway, these effects are considered insignificant without mitigation.
- **M28 Motorway Project –** while outside the 20km area, this project interacts with the proposed TDR between Ringaskiddy and Dunkettle. This project has been included in the government's Infrastructure and Capital Investment Plan 2016 – 2021, however the project is currently subject to a judicial review. The only negative or adverse effects on the air quality of the receiving environment and sensitive receptors associated with the M20 Motorway project is during the construction and operational phase of both projects. If both projects were under construction at the same time, these effects are considered to be temporary in duration and not significant. During the operational phase of the proposed CGEP and M28 Motorway, given the low numbers of operational traffic for the proposed CGEP and the large quantity of traffic on the M28 Motorway, these effects are considered insignificant.
- **Dunkettle Interchange Upgrade Project** – this interchange is strategically important as it links the M8, N25 and N40 roads to Waterford, Cork and Dublin, which may impact upon the proposed TDR. Works are likely to commence in 2021 and be built by 2024. Negative or adverse effects on the air quality of the receiving environment and sensitive receptors associated with the construction phase of the Dunkettle Interchange Upgrade project coinciding with the proposed CGEP is considered to be temporary in duration and not significant. During the operational phase of the proposed CGEP and Dunkettle Interchange, given the low numbers of operational traffic for the proposed CGEP and the large quantity of traffic on the Dunkettle Interchange, these effects are considered insignificant.

Following a review of these developments, it is considered that the proposed CGEP project including the associated grid connection and use of the proposed TDR route is not likely to act cumulatively in terms of dust during construction, due to the separation distances to other projects – dust is likely to settle within ca. 100m of the source and PM_{10} and vegetation effects are only likely within 25m.

Cumulative impacts may arise if the construction period of these projects occurs simultaneously with the construction of the proposed CGEP development. This could result in increased traffic emissions, however, provided the mitigation measures as detailed in Section 6.5 are implemented and the mitigation measures proposed for other developments are implemented, there will be no significant cumulative effects on air quality.

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

In terms of the waste facility at Bottlehill, there is potential for dust to arise and act cumulatively with any dust generated during the construction stage of the CGEP, associated grid connection or use of the proposed TDR. However, following the implementation of mitigation measures and daily visual checks during construction, no significant effects are likely to occur. In terms of any gas venting from the landfill, as there are no gaseous emissions from the CGEP, there is no potential for cumulative effects to occur.

In terms of climate and carbon, the proposed CGEP, associated grid connection and use of the proposed TDR will act cumulatively with other renewable energy projects in reducing CO_2 emissions by displacing fossil fuel in the production of electricity, resulting in a slight-moderate positive impact on climate.

6.6 Mitigation Measures

6.6.1 Air Quality

6.6.1.1 Construction Phase

A Construction Environmental Management Plan (CEMP) has been prepared and is included in Appendix 3.1. This includes for the following mitigation measures during the construction phase of the proposed CGEP relevant to air quality:

- The internal access roads will be constructed prior to the commencement of other major construction activities. These roads will be finished with graded aggregate;
- A water bowser will be available to spray work areas (wind turbine area and grid connection route) and haul roads, especially during periods of excavations works coinciding with dry periods of weather, in order to suppress dust migration from the site;
- All loads which could cause a dust nuisance will be covered to minimise the potential for fugitive emissions during transport;
- Gravel will be used at the site exit point to remove any dirt from tyres and tracks before travelling along public roads;
- Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.
- The access and egress of construction vehicles will be controlled to designated locations, along defined routes, with all vehicles required to comply with onsite speed limits;
- Construction vehicles and machinery will be serviced and in good working order;
- Wheel washing facilities will be provided at the entrance/exit point of the proposed wind farm site;
- The developer in association with the contractor will be required to implement a dust control plan as part of the CEMP (a CEMP is contained in Appendix 3.1. In the event An Bord Pleanála decides to grant permission for the proposed CGEP, the final CEMP will address the requirements of any relevant planning conditions, including any additional mitigation measures which are conditioned by the Board.).

- Receptors which receive dusting and soiling from local routes entering the site; and dwellings directly adjacent to the grid connection route that experience dust soiling, where appropriate, and with the agreement of the landowner, will have the facades of their dwelling cleaned if required should soiling have taken place;
- Ensure all vehicles switch off engines when stationary – no idling vehicles; and
- Exhaust emissions from vehicles operating within the site, including trucks, excavators, diesel generators or other plant equipment, will be controlled by the contractor by ensuring that emissions from vehicles are minimised through regular servicing of machinery.

6.6.1.2 Operational Phase

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

6.6.1.3 Decommissioning Phase

Mitigation measures for the removal of wind turbines from the energy park would be similar as per the construction phase with respect to dust control and minimisation. If Cork County Council requires the removal of access tracks from the energy park as part of decommissioning, dust mitigation measures similar to those undertaken for the construction phase will be put in place to reduce any dust nuisance.

The proposed grid connection route will be left in situ in the public roadway, no mitigation measures are required.

6.6.2 Climate

It is considered that the proposed CGEP will have an overall positive impact in terms of carbon reduction and climate change. It will assist Ireland in meeting the new binding renewable energy target for the EU of 32% by 2030. Also, it will aid in increasing the onshore wind capacity, as per the Climate Action Plan 2019. In terms of renewable energy, an increase in electricity generated from renewable sources is to increase to 70% by 2030, with up to 8.2GW of increased onshore wind capacity. This will be achieved by:

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

As set out in the Climate Action Plan 2019, in terms of harnessing renewable energy, the volumes and frequencies of RESS will increase, so that the 70% target is met. The measures required to achieve this include finalising RESS, establishing a Community Framework to accompany RESS, begin the qualification process for the RESS 1 Auction and to finalise the design and implementation of RESS 2 and RESS 3.

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

6.7 Residual Impacts

6.7.1 Air Quality

Following the implementation of the above mitigation measures, the proposed CGEP may result in slight to moderate residual impacts arising from fugitive dust emissions during particular construction activities. These will be localised in nature and as they will be associated with particular elements of the construction phase, they will be temporary in nature and will not result in any permanent residual impacts. Impacts related to vehicle emissions will practically cease following construction and no significant impacts are anticipated. There will be a low level of maintenance traffic during the operational period, which will have an imperceptible impact.

During operations, CGEP will result in the avoidance of emissions from fossil fuel generators which is a positive effect on air quality.

6.7.2 Climate

There will be residual positive impacts from the operation of the proposed energy park in terms of the displacement of fossil fuel energy generation with renewable energy. It is estimated that an output of approximately 105MW for the wind farm will result in the net displacement of 137,371 tonnes of CO_2 per annum.

6.8 References

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