Environmental Impact Assessment Report - Volume 2C

# Chapter 17:
# Climate

ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

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ESB Energy for generations

# ORIEL WIND FARM PROJECT

## Environmental Impact Assessment Report
## Chapter 17: Climate

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## 17.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) presents an assessment of the potential impacts of the Oriel Wind Farm Project (hereafter referred to as “the Project”) on climate and also the vulnerability of the Project to climatic factors. This chapter considers the potential impacts to climate from the Project including each of the following during the construction, operational and maintenance and decommissioning phases:

- The offshore wind farm area;
- The offshore cable corridor and landfall;
- The onshore cable route; and
- The onshore substation site.

Directive 2011/92/EU included climate as a criteria for assessment in EIA both in terms of the impact of the project on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change (e.g. such as through flood risk or the risk of major accidents and/or disasters caused by climate change).

The main objectives of this assessment are to:

- Undertake a desktop study of the existing climate trends to assess current environmental baseline conditions locally and nationally;
- Assess the potential impact of the proposed construction, operational and decommissioning phases of the Project on climate; and
- Recommend mitigation measures in relation to the proposed construction, operation and decommissioning phases, if necessary, and predict residual impacts.

The assessment presented is informed by the following key chapters of the EIAR:

- Chapter 4: Consideration of Alternatives (this chapter sets out design decisions that were made to reduce impact on climate); and
- Chapter 5: Project Description.

Other aspects relevant to climate are addressed in the specific chapters of the EIAR, namely:

- Chapter 22: Hydrology and Flood Risk and appendix 22-1: Flood Risk Assessment;
- Chapter 24: Risks of Major Accidents and Natural Disasters (susceptibility of the Project and/or the surrounding area to risk of major accidents and/or natural disasters);
- Chapter 28: Traffic and Transport (predicted traffic effects); and
- Chapter 30: Resource and Waste Management (emissions arising from waste management).

The details and competencies of the specialist who prepared this chapter can be found in volume 2A, chapter 1: Introduction.

## 17.2 Purpose of this chapter

The primary purpose of the EIAR chapter is to provide an assessment of the likely direct and indirect significant effects of the Project on climate. In particular, this EIAR chapter:

- Presents the existing environmental baseline established from desk studies, relevant datasets and consultation (section 17.7);
- Identifies any limitations encountered in compiling the environmental information (section 17.7.4);
- Presents an assessment of the potential likely significant effects on climate arising from the Project (section 17.9) based on the information gathered and the analysis and assessments undertaken. An assessment of potential cumulative impacts is provided in section 17.11 and an assessment of transboundary effects is outlined in section 17.12; and
- Highlights any necessary monitoring (section 17.10.5) and/or measures (see section 17.10.4 and section 17.10.4) to prevent, minimise, reduce or offset the likely significant environmental effects identified in the assessment (section 17.11.2).

## 17.3 Study area

The Climate Study Area includes the national environment (Ireland), where the receptor is the climate and the global atmosphere. Effects arising from the potential impacts on climate are considered to impact on a national level. National, regional and local data has been considered where relevant and available.

## 17.4 Policy context

### 17.4.1 EU legislation and policy

Successfully tackling climate change requires cooperation and ambition on an international level and the United Nations Framework Convention on Climate Change (UNFCCC) was established in 1994 to build international cooperation to limit the increase in the average global temperature and deal with the impacts of climate change.

These efforts led to the signing of the Paris Agreement 2015 at the Conference of the Parties 21 (COP21). The Paris Agreement 2015 is a legally binding international treaty on climate change which was signed by all 196 member countries, including Ireland, and entered into force on 4 November 2016. Through two clearly defined goals the Paris Agreement strives for progressive and ambitious climate action over time to avoid dangerous climate change by:

- Holding global average temperature increases to well below 20 °C and pursuing efforts to limit the temperature increase to 1.5 °C above pre-industrial levels; and
- Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience.

Towards achieving greenhouse gas emission reductions as part of Paris Agreement commitments, the European Commission announced the European Green Deal in December 2019 aimed at making Europe the first climate neutral continent. The Deal seeks to achieve no net emissions of Greenhouse Gases (GHG) by 2050, to decouple economic growth from resource use, and to leave no one behind. The EU introduced a set of proposals to align the EUs climate, taxation, energy, and transport policies to support achieving this aim. The European Climate Law made these targets legally binding, which also includes achieving a reduction in net greenhouse gas emissions of at least 55% by 2030.

Also as part of the implementation of the Paris Agreement, the EU introduced the Effort Sharing Regulation as a law that sets binding yearly emission reductions for the Member States from 2021 to 2030. Under the Regulation, Ireland must limit its greenhouse gas emissions by at least 42% by 2030 (compared with 2005 levels). This national target concerns emissions from the following sectors: domestic transport, buildings, agriculture, small industry and waste and excludes large industry and aviation which are regulated by the EU Emissions Trading Scheme (ETS).

### 17.4.2 National legislation and policy

In relation to national climate regulation, the following legislation is relevant for this chapter:

- Climate Action and Low Carbon Development Act 2015 ('the 2015 Act'); and
- Climate Action and Low Carbon Development (Amendment) Act 2021 ('the 2021 Amendment Act').

The 2021 Amendment Act embeds the process of setting binding and ambitious emissions-reductions targets in law. In addition, the Act provides for a national climate objective, which commits the State to pursue and achieve no later than 2050, the transition to a climate resilient, biodiversity-rich, environmentally-sustainable and climate-neutral economy. The act 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 carbon budget programme, comprising three 5-year budgets came into effect on 6 April 2022 for the following periods:

- Budget 1 from 2021-2025 has been set at 295 Mt $CO_2$eq. representing an average of 4.8% reduction per annum for the first budget period;
- Budget 2 from 2026-2030 has been set at 200 Mt $CO_2$eq. representing an average of 8.3% reduction per annum for the second budget period; and
- Budget 3 from 2031-2035 has been set at 151 Mt $CO_2$eq. representing an average of 3.5% reduction per annum for the third provisional budget.

To deliver these targets, in July 2022 the government has established Sectoral Emissions Ceilings which set maximum limits on greenhouse gas emissions for each sector of the Irish economy to the end of the decade.

For the electricity generating sector, the 2030 ceiling is 3 Mt $CO_2$eq which represents approximately 75% reduction on 2018 levels (10 Mt $CO_2$eq). Further details were provided in the September 2022 Sectoral Emissions Ceilings Summary Report[1] and these are summarised in Table 17–1 for the sector.

**Table 17–1: Electricity generating sector emissions ceiling.**

| Period | GHG (Mt $CO_2$eq) |
|---|---|
| 2018 Baseline | 10 |
| Sectoral Emission Ceilings for 2021-2025 (for the 5 year period) | 40 |
| Sectoral Emission Ceilings for 2026-2030 (for the 5 year period) | 20 |
| Indicative Emissions in Final Year of 2021-2025 carbon budget period (Mt $CO_2$eq) | 6 |
| Indicative Reduction in Emissions in Final Year of 2021-2025 budget period compared to 2018 | ~ 40% |
| Emissions in final year of 2026-2030 carbon budget period (Mt $CO_2$eq) | 3 |
| Reduction in Emissions final year of 2026-2030 carbon budget period compared to 2018 | ~ 75% |

Consideration has been given to the following key climate policy in the preparation of this chapter:

- National Policy Position on Climate Action and Low Carbon Development (Department of the Environment, Climate and Communications (DECC), 2013);
- National Adaptation Framework (DECC, 2018); and
- Climate Action Plan 2023 (DECC, 2022).

[1] Link: https://www.gov.ie/en/publication/76864-sectoral-emissions-ceilings/

The highest tier policy is the Climate Action Plan 2023 (CAP23)[2] which is the first national climate plan to be prepared under the Climate Action and Low Carbon Development (Amendment) Act 2021 and following the introduction of carbon budgets and sectoral emissions ceilings in 2022. CAP23 implements the carbon budgets and sectoral emissions ceilings and sets a roadmap for taking decisive action to halve national emissions by 2030 and reach net zero no later than 2050.

For this Project, the key impact is electricity generation and the relevant policy is listed in Chapter 12 of CAP23 which identifies the national targets for renewable energy (including offshore) to meet the climate ambition and these targets are listed in Table 17–2.

**Table 17–2: Targets for the Electricity Generating Sector (CAP23).**

| Theme | 2025 Target | 2030 Target |
|---|---|---|
| Renewable Electricity Share | 50% | 80% |
| Offshore Wind | - | At least 5GW |

Planning policy on renewable energy infrastructure is presented in volume 2A, chapter 2: Policy and Legislation. This section presents planning policy that specifically relate to climate, which is contained in the National Marine Planning Framework (NMPF) (Department of Housing, Local Government and Heritage (DHLGH), 2021). A summary of the policy provisions relevant to climate are provided in Table 17–3.

**Table 17–3: Summary of NMPF policy framework provisions relevant to climate.**

| Summary of relevant policy framework | How and where considered in the EIAR |
|---|---|
| **Climate Change Policy 1**: Proposals should demonstrate how they:<br>• Avoid contribution to adverse changes to physical features of the coast; and;<br>• Enhance, restore or recreate habitats that provide a flood defence or carbon sequestration ecosystem services where possible.<br>Where potential significant adverse impacts upon habitats that provide a flood defence or carbon sequestration ecosystem services are identified, these must be in order of preference and in accordance with legal requirements:<br>a) avoided,<br>b) minimised,<br>c) mitigated,<br>d) if it is not possible to mitigate significant adverse impacts, the reasons for proceeding must be set out.<br>This policy should be included as part of statutory environmental assessments where such assessments are required. | The Project will indirectly result in a net reduction in greenhouses gases through the development of a renewable energy generating system that will offset the existing combustion based generating systems. These details are provided in section 17.10.2. |
| **Climate Change Policy 2**: For the lifetime of the proposal, the following climate change matters must be demonstrated:<br>• Estimation of likely generation of GHG emissions, both direct and indirect;<br>• Measures to support reductions in GHG emissions where possible;<br>• Likely impact of climate change effects upon the proposal from factors including but not limited to: sea level rise, ocean acidification, changing weather patterns;<br>• Measures incorporated to enable adaptation climate change effects; | Adverse climate impacts during construction have been quantified and a series of measures (or controls) are outlined in section 17.10. |

[2] The Climate Action Plan 2024 (CAP 2024) was published by the DECC in December 2023 and is approved by Government, subject to Strategic Environmental Assessment and Appropriate Assessment. CAP 2024 builds upon CAP 2023 by refining and updating the measures and actions required to deliver the carbon budgets and sectoral emissions ceilings.

| Summary of relevant policy framework | How and where considered in the EIAR |
|---|---|
| • Likely impact upon climate change adaptation measures included in the coastal area relevant to the proposal and/or adaptation measures included in adjacent activities; and<br>• Where likely impact upon climate change adaptation measures in the coastal area relevant to the proposal and/or adaptation measures adopted by adjacent activities is identified, these impacts must be in order of preference and in accordance with legal requirements:<br>a) avoided,<br>b) minimised,<br>c) mitigated,<br>d) if it is not possible to mitigate significant adverse impacts, the reasons for proceeding must be set out. | |

A summary of local and regional policy provisions and related policy framework relevant to accidents and natural disasters and hazards are provided in Table 17–4.

**Table 17–4: Summary of other policy provisions relevant to climate.**

| Summary of relevant policy framework | How and where considered in the EIAR |
|---|---|
| **DHLGH and OPW Planning System and Flood Risk Management Guidelines (2009)** | |
| Objectives of the Guidelines are to:<br>• Avoid inappropriate development in areas at risk of flooding;<br>• Avoid new developments increasing flood risk elsewhere, including that which may arise from surface run-off;<br>• Ensure effective management of residual risks for development permitted in floodplains;<br>• Avoid unnecessary restriction of National, Regional or Local economic and social growth;<br>• Improve the understanding of flood risk among relevant stakeholders;<br>• Ensure that the requirements of EU and national law in relation to the natural environment and nature conservation are complied with at all stages of flood risk management. | A Flood Risk Assessment has been completed for the Project (see appendix 22-1: Flood Risk Assessment). The potential impacts of the Project on Hydrology and Flood Risk are addressed in chapter 22: Hydrology and Flood Risk. |
| **Louth County Council Development Plan 2021-2027** | |
| **Seveso** | |
| **Policy Objective ENV 27**<br>To comply with the SEVESO II Directive in reducing the risk and limiting the potential consequences of major industrial accidents | A review of the Health and Safety Authority (HSA) list of Upper and Lower Tier COMAH Establishments was conducted to determine the presence of any establishments within the vicinity of the Project (see section 24.6.10 of chapter 24: Risks of Major Accidents and Natural Disasters). |
| **Policy Objective ENV 28**<br>To ensure that land use policies take account of the need to maintain appropriate distance between future major accident hazard establishments and residential areas, areas of substantial public use and of particular natural sensitivity or interest. | |
| **Policy Objective ENV 29**<br>To have regard to the advice of the HSA when proposals for a new SEVESO site, modifications to an existing SEVESO site or when proposals for development within the consultation zone of a SEVESO site are being considered (including and as detailed in Table 11.1 of the Louth CDP 2021-2027[3]) | |
| **Coast Protection and Flooding** | |
| **Policy Objective ENV 50** | |

[3] https://www.louthcoco.ie/en/publications/development-plans/louth-county-development-plan-2021-2027/volume-1-all.pdf.

| Summary of relevant policy framework | How and where considered in the EIAR |
|---|---|
| To require that all proposed developments within 100m of the coastline of Louth, outside the main settlements (Levels 1-4) submit a Coastal Erosion Assessment Report. New developments will be prohibited, unless it can be objectively established based on the best scientific information at the time of the application, that the likelihood of erosion at a specific location is minimal taking into account, inter alia, any impacts.<br>**Policy Objective ENV 51**<br>To recognise the concept of coastal evolution and fluvial flooding as part of our dynamic physical environment and adopt an adaptive approach to working with these natural processes. The focus of a flood management strategy should not solely be driven by conservation of existing lands. It should recognise that marshes, mud flats and other associated eco-systems evolve and degenerate and appropriate consideration should be given to the realignment of defences and use of managed retreat and sacrificial flood protection lands to maintain such habitats as part of an overall strategy.<br>**Policy Objective ENV 52**<br>To ensure the County's natural coastal defences (beaches, sand dunes, salt marshes and estuary lands) are protected and to ensure they are not put at risk by inappropriate works or development.<br>**Policy Objective ENV 53**<br>To explore, where coastal erosion is considered a threat to existing properties, the technical, environmental and economic feasibility of coastal adaptation and coastal retreat management options.<br>**Policy Objective ENV 54**<br>To employ soft engineering techniques as an alternative to hard coastal defence works, wherever possible.<br>**Policy Objective ENV 55**<br>To identify, prioritise and implement necessary coastal protection works subject to the availability of resources, whilst ensuring a high level of protection for natural habitats and features, and ensure due regard is paid to visual and other environmental considerations in the design of any such coastal protection works. | A Flood Risk Assessment has been completed for the Project (see appendix 22-1: Flood Risk Assessment and chapter 22: Hydrology and Flood Risk).<br>Coastal erosion is addressed in volume 2B, chapter 21: *Soils, Geology and Hydrogeology* . The clay cliff at Dunany Point may be vulnerable to coastal erosion, however, works in this area will be temporary and measures are incorporated into the design to reduce the risk of coastal erosion (see chapter 21: Soils, Geology and Hydrogeology). The design of such measures has had consideration to the local biodiversity and visual landscape.<br>See chapter 22: Hydrology and Flood Risk, which presents the results of the assessment of the potential impacts of the Project on Hydrology and Flood Risk. |
| **Development in Coastal Areas** | |
| **Policy Objective ENV 56**<br>To protect the special character of the coast by preventing inappropriate development, particularly on the seaward side of coastal roads. New development, wherever possible, shall be accommodated within existing developed areas and be climate resilient in their design.<br>**Policy Objective ENV 57**<br>To strictly control the nature and pattern of development within coastal areas and ensure that it is designed and landscaped to the highest standards and sited appropriately so as not to detract from the visual amenity of the area. Development shall be prohibited where the development poses a significant or potential threat to coastal habitats or features, and/or where the development is likely to result in altered patterns of erosion or deposition elsewhere along the coast<br>**Policy Objective ENV 58**<br>To prohibit development along the coast outside existing urban areas where such development is not adequately safeguarded over the lifetime of the development without the need to construct additional coastal defences. | See chapter 22: Hydrology and Flood Risk and appendix 22-1: Flood Risk Assessment, which present an assessment of the potential impacts of the Project on Hydrology and Flood Risk. |
| **Louth County Development Plan 2021-2027 Strategic Flood Risk Assessment (SFRA)** | |

| Summary of relevant policy framework | How and where considered in the EIAR |
|---|---|
| A Strategic Flood Risk Assessment has been published as a separate document in conjunction with the Louth CDP 2021-2027 and is available in Volume 5[4] of the CDP:<br>*"The Louth CDP 2021-2027 SFRA has been prepared in accordance with requirements of the Department of Environment Communities and Local Government (DECLG) and Office Public Works OPW Planning Guidelines, 'The Planning System and Flood Risk Management' (2009)".*<br>*"The SFRA provides tools and methods to assist users in identifying the level of flood risk associated with an area to inform planning decisions. It supports the application of the sequential approach and provides data and maps to help in assessing sites against flood risk criteria. Where development is or would be at risk of flooding, it provides information on the mitigation measures considered deliverable to reduce the actual risk to that development and on the residual risks that would remain and how they might be managed".* | A Flood Risk Assessment has been completed for the Project. See appendix 22-1: Flood Risk Assessment and chapter 22: Hydrology and Flood Risk, which presents the results of the assessment of the potential impacts of the Project on Hydrology and Flood Risk. |
| **Louth County Council Climate Change Adaptation Strategy 2019-2024[5]** | |
| • The Louth County Council Climate Change Adaptation Strategy forms part of the National Adaptation Framework (NAF) which was published in response to the provisions of the Climate Action and Low Carbon Development Act 2015.<br>• Flood management is a central theme within the Climate Change Adaptation Strategy for County Louth which has an overarching objective to manage the risk of flooding through a variety of responses.<br>• The strategy states that *"climate change is likely to have a considerable impact on flood risk in County Louth, such as through rising mean sea levels, increased wave action and the potential increases in winter rainfall and intense rainfall events, as demonstrated by storms of 2002 and 2005 where breaches of existing flood defence infrastructure causing property damage".*<br>• The strategy also states *"County Louth has also experienced extreme temperatures, as witnessed in 2010 and recently in 2018, with Met Éireann issuing its first ever Status Red warning for snow in February, followed by one of the hottest summers on record. All these extreme weather events clearly highlight the need to reduce the impacts that climate change is having on the citizens, environment and the economy of County Louth, and on the services Louth County Council provide".*<br>• The strategy outlines the Impacts of Climate Change in the county in a Risk Register for Louth, including the following hazards:<br>  ○ ***All weather events** - can impact on all services, Local Authority Assets, business operations and continuity, infrastructure, structural, community, and cultural and heritage assets;*<br>  ○ ***Storms** - can impact business operations and continuity;*<br>  ○ ***Heavy rainfall** - can impact on critical infrastructure, flood/water management, water services, and environment and biodiversity;*<br>  ○ ***Extreme heat/drought conditions** - can impact on the community, Emergency services, infrastructure, and environment and biodiversity;*<br>  ○ ***Storm Surges/Sea level rise** - can impact on roads, water services, community, emergency services, and environment.* | See section 24.5.9 of chapter 24: Risk of Major Accidents and N*atural Disasters* for the assessment of hazards related to climate change, extreme weather and natural disasters.<br><br>A Flood Risk Assessment has been completed for the Project (see appendix 22-1). Chapter 22: Hydrology and Flood Risk presents the results of the assessment of the potential impacts of the Project on Hydrology and Flood Risk.<br>See section 17.10 for an assessment of climate impacts relating to the Project. |

[4] https://www.louthcoco.ie/en/publications/development-plans/louth-county-development-plan-2021-2027/volume-5-environmental-reports1.html

[5] https://www.louthcoco.ie/en/services/environment/climate-change-adaptation/climate-change-adaption-strategy.pdf

## 17.5 Consultation

Table 17–5 summarises the issues raised relevant to climate, which have been identified during consultation activities undertaken to date, together with how these issues have been considered in the preparation of this EIAR chapter. Chapter 6: Consultation provides details on the types of consultation activities undertaken for the Project between 2019 and 2024 and the consultees that were contacted.

**Table 17–5: Summary of key consultation issues raised during consultation activities undertaken for the Project relevant to climate.**

| Date | Consultee and type of response | Issues raised | Response to issue raised and/or where considered in this chapter |
|---|---|---|---|
| 27 September 2019 | Louth County Council – Response to EIA Scoping consultation | No issues raised. Reference to Climate Action Plan 2019 targets for 2030 and the wider support for wind energy. | This is noted and referenced in relation to climate policy in section 17.4. |
| January – February 2023 | Public consultation Member of the public | What is the carbon footprint of the project and how is it being mitigated? | The carbon footprint of the project is outlined in section 17.10. Section 17.8.2 outlines the measures to reduce carbon footprint including use of materials. |

## 17.6 Methodology to inform the baseline

### 17.6.1 Desktop study

Information on climate within the Climate Study Area was collected through a detailed desktop review of existing studies and datasets. These are summarised in Table 17–6. These sources provide the most up to date data for this assessment.

**Table 17–6: Summary of key desktop reports.**

| Title | Source | Year |
|---|---|---|
| Ireland's Greenhouse Gas Emissions Inventory 1990-2021 | EPA | 2023 |
| Ireland’s Greenhouse Gas Emissions Projections 2021-2040 | EPA | 2022 |
| 30 Year Averages: Dublin Airport 1982-2010 | Met Éireann | 2022 |
| Met Éireann Monthly Values for Dunsany and Dublin Airport | Met Éireann | 2022 |
| Climatological Note No. 14: A Summary of Climate Averages for Ireland 1981-2010 | Met Éireann | 2012 |

### 17.6.2 Site-specific surveys

No site-specific baseline surveys were undertaken as part of the assessment for climate. The baseline data presented in this section is derived from EPA inventories and projections, and Met Éireann monitoring network, and may be taken as representative of the background conditions.

## 17.7 Baseline environment

### 17.7.1 Current baseline environment (baseline scenario)

The weather in Ireland is influenced by the Atlantic Ocean, resulting in mild, moist weather dominated by maritime air masses. The prevailing wind direction is from a quadrant centred on west southwest. These are relatively warm winds from the Atlantic and frequently bring rain. Easterly winds are weaker and less frequent and tend to bring cooler weather from the northeast in spring and warmer weather from the southeast in summer.

The World Meteorological Organisation (WMO) defines climate as the average weather over an extended period of 30 years. This period is used as it is considered long enough to account for year-to-year variations. Therefore, the existing climate for the environs around the Climate Study Area is estimated using 30-year (1981-2010) average meteorological data from Met Éireann.

The Project is situated on and close to the east coast, with the onshore cable route travelling approximately 20 km inland from the landfall south of Dunany Point to the onshore substation site at Stickillin. Due to its proximity to the east coast, the Climate Study Area is more likely to experience a higher frequency of easterly winds than more inland locations or those on the west coast.

The nearest Met Éireann meteorological station to the Project is the station in Dublin Airport, which lies approximately 48 km south of the Climate Study Area and approximately 9 km from the east coast. The 30-year average Meteorological Data from the station at Dublin Airport is presented in Table 17–7. Recent rainfall and temperature data (2016-2020) for this location have also been included.

**Table 17–7: 30-year average meteorological data from Dublin Airport (annual values from 1981-2010, source: www.met.ie).**

| Parameter | 30-Year Average |
|---|---|
| Mean Temperature (°C) | 9.8 |
| Mean Relative Humidity at 0900 UTC (%) | 83.0 |
| Mean Daily Sunshine Duration (Hours) | 3.9 |
| Mean Annual Total Rainfall | 758.0 |
| Mean Wind Speed (knots) | 10.3 |

Source: Met Éireann. Available at: https://www.met.ie/climate-ireland/1981-2010/dublin.html. Accessed March 2022.

* UTC: International abbreviation for 'Coordinated Universal Time', the successor to Greenwich Meantime (GMT).

## Temperature

At Dublin Airport the 30-year record for temperature (Table 17–8) shows that the average daily temperature across a calendar year is 9.8 °C with an average maximum of 13.3 °C and an average minimum of 6.4 °C. Across the calendar year the average number of days with air frost is 29.4.

**Table 17–8: 30-year average data for temperature at Dublin Airport (annual values from 1981-2010, source: www.met.ie).**

| Temperature (°C) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean daily max | 8.1 | 8.3 | 10.2 | 12.1 | 14.8 | 17.6 | 19.5 | 19.2 | 17 | 13.6 | 10.3 | 8.3 | 13.3 |
| Mean daily min | 2.4 | 2.3 | 3.4 | 4.6 | 6.9 | 9.6 | 11.7 | 11.5 | 9.8 | 7.3 | 4.5 | 2.8 | 6.4 |
| Mean temperature | 5.3 | 5.3 | 6.8 | 7.3 | 10.9 | 13.6 | 15.6 | 15.3 | 13.4 | 10.5 | 7.4 | 5.6 | 9.8 |
| Mean no. days with air frost | 6.4 | 6.5 | 3.8 | 2.4 | 0.3 | 0 | 0 | 0 | 0 | 0.5 | 3.0 | 6.4 | 29.4 |

Source: Met Éireann. Available at: https://www.met.ie/climate-ireland/1981-2010/dublin.html Accessed March 2022.

At Dublin Airport for the period 2019 through to the end of May 2022, the yearly Long Term Average (LTA) temperature is 9.7 °C with a highest average maximum of 9.8 °C recorded in 2021, and a lowest average minimum of 9.6 °C recorded in 2019 and 2020 as shown in Table 17–9.

**Table 17–9: Monthly values for mean temperature for Dublin Airport 2019-2022 (source: www.met.ie).**

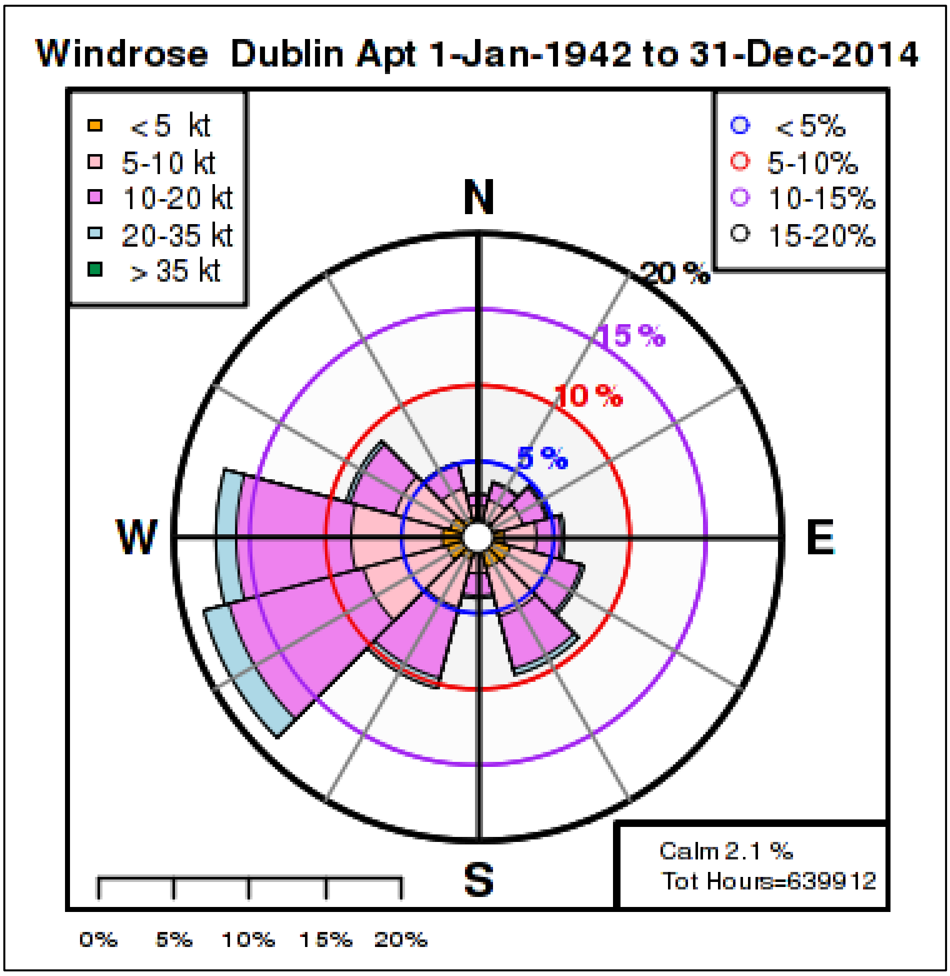
| Temperature (°C) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2022 | 5.4 | 6.7 | 6.6 | 7.6 | 11.9 | – | – | – | – | – | – | – | **7.6** |
| 2021 | 3.9 | 6.2 | 7.2 | 5.6 | 9.2 | 13.7 | 16.1 | 14.7 | 14.7 | 11.9 | 7.6 | 6.5 | **9.8** |
| 2020 | 6.3 | 5.8 | 5.8 | 8.5 | 10.9 | 13.4 | 14.4 | 14.7 | 12.8 | 9.5 | 8.2 | 4.9 | **9.6** |
| 2019 | 5.1 | 7.0 | 7.3 | 8.0 | 10.2 | 12.5 | 15.9 | 15.4 | 13.0 | 9.1 | 6.0 | 5.9 | **9.6** |

| Temperature (°C) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LTA | 5.3 | 5.3 | 6.7 | 8.1 | 10.7 | 13.4 | 15.4 | 15.1 | 13.1 | 10.3 | 7.3 | 5.6 | **9.7** |

Source: Met Éireann. Available at: https://www.met.ie/climate/available-data/monthly-data. Accessed March 2022.

## Wind

The prevailing wind direction for the area is between northwest and southwest (5-20%) as presented in the wind-rose for Dublin Airport Meteorological Station for 1942-2014 in Figure 17-1. North and northeasterly winds tend to be very infrequent (less than 5%), with easterly and southeasterly winds more frequent (5-9%).




Source: Met Éireann. Available at: https://www.met.ie/climate/what-we-measure/wind.

**Figure 17-1: Wind-rose for the Dublin Airport Meteorological Station (1942 – 2014).**

Wind characteristics are typically moderate with relatively infrequent gales with an average of 8.2 days with gales per annum and an average wind speed of 10.3 knots during the period as illustrated in Table 17–10.

The highest levels of gales and gusts were both recorded on average in the month of January, with an average of 2.3 days of gales recorded, and an average maximum wind gust of 80 knots.

**Table 17–10: 30-year average data for wind at Dublin Airport (annual values from 1981-2010).**

| Wind | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean monthly speed (knots) | 12.5 | 12.0 | 11.6 | 9.9 | 9.2 | 8.6 | 8.7 | 8.7 | 9.2 | 10.4 | 11.0 | 11.3 | **10.3** |
| Max. gust (knots) | 80 | 73 | 66 | 59 | 58 | 53 | 54 | 56 | 59 | 69 | 66 | 76 | **80** |
| Mean no. of days with gales | 2.3 | 1.5 | 1.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.5 | 0.8 | 1.3 | **8.2** |

Source: Met Éireann. Available at: https://www.met.ie/climate-ireland/1981-2010/dublin.html. Accessed March 2022.

## Rainfall

The 30-year average rainfall for Dublin Airport is 758.0 mm. This is further broken down into monthly averages in Table 17–11, with the highest monthly total average for the period recorded in October (79.0 mm). The greatest daily average total of rain is recorded per year for the period is 73.9 mm, with greatest daily average for rainfall generally observed in the month of June (also noted as 73.9 mm) with moderately frequent days with ≥ 5.0 mm rainfall recorded per annum (42 days).

**Table 17–11: 30-Year average data for rainfall at Dublin Airport (annual values from 1981-2010).**

| Rainfall (mm) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean Monthly Total | 62.6 | 48.8 | 52.7 | 54.1 | 59.5 | 66.7 | 56.2 | 73.3 | 59.5 | 79.0 | 72.9 | 72.7 | **758.0** |
| Greatest Daily Total | 27.1 | 28.1 | 35.8 | 30.4 | 42.1 | 73.9 | 39.2 | 72.2 | 40.6 | 53.2 | 62.8 | 42.4 | **73.9** |
| Mean No. Days with ≥ 5.0 mm | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | **42** |

Source: Met Éireann. Available at: https://www.met.ie/climate-ireland/1981-2010/dublin.html. (Accessed March 2022).

Table 17–12 shows the monthly values for rainfall (mm) across a calendar year at Dublin Airport for 2019 through to the end of May 2022. The LTA rainfall for this period at Dublin Airport is 757.9 mm with an average maximum of 886.1 mm observed in 2019 and an average minimum of 666.6 mm observed in 2021.

**Table 17–12: Monthly values for total rainfall for Dublin Airport (2019-2022).**

| Rainfall (mm) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2022** | 14.4 | 88.5 | 45.6 | 28.1 | 48.4 | – | – | – | – | – | – | – | **225.0** |
| **2021** | 115.1 | 55.0 | 32.1 | 10.8 | 83.5 | 12.6 | 72.9 | 65.3 | 42.0 | 79.8 | 11.7 | 85.8 | **666.6** |
| **2020** | 36.0 | 130.4 | 31.8 | 12.8 | 9.3 | 69.6 | 98.9 | 87.1 | 60.9 | 80.6 | 48.1 | 83.1 | **748.6** |
| **2019** | 26.8 | 30.5 | 92.5 | 74.6 | 33.4 | 82.9 | 41.0 | 91.9 | 104.6 | 77.2 | 173.0 | 57.7 | **886.1** |
| **LTA** | 62.6 | 48.8 | 52.6 | 54.1 | 59.5 | 66.7 | 56.2 | 73.3 | 59.5 | 79.0 | 72.9 | 72.7 | **757.9** |

Source: Met Éireann. https://www.met.ie/climate/available-data/monthly-data. Accessed March 2022.

## Weather events

The Project must consider weather events relating to cold weather, wind, rain and events (storms, snow etc.) that may disrupt operations.

Table 17–13 displays the mean number of days per annum on average across the 30-year average a weather event occurs. Snow lying at 09:00 UTC is infrequent occurring on average 3.4 days per annum, posing a low risk to operations. Fog is the most frequent weather event observed at the Dublin Airport monitoring location during the 30-year average records, occurring on average 41.5 days per annum.

**Table 17–13: 30-Year average data for weather events at Dublin Airport (annual values from 1981-2010, source www.met.ie).**

| Weather (mean no. of days with the below) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Snow or Sleet | 4.6 | 4.2 | 2.8 | 1.2 | 0.2 | 0 | 0 | 0 | 0 | 0 | 0.8 | 2.9 | 16.6 |
| Snow lying at 0900UTC | 1.6 | 0.6 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.1 | 0.9 | 3.4 |
| Hail | 1.2 | 1.5 | 2.0 | 1.9 | 1.3 | 0.1 | 0.2 | 0.1 | 0.1 | 0.3 | 0.3 | 0.7 | 9.7 |
| Thunder | 0.3 | 0.2 | 0.3 | 0.2 | 0.9 | 0.8 | 0.8 | 0.9 | 0.3 | 0.3 | 0.2 | 0.2 | 5.5 |
| Fog | 3.3 | 3.1 | 3.6 | 3.6 | 3.4 | 2.8 | 3.3 | 3.8 | 4.2 | 3.2 | 3.1 | 4.1 | 41.5 |

Source: Met Éireann. Available at: https://www.met.ie/climate-ireland/1981-2010/dublin.html. Accessed March 2022.

## 17.7.2 Existing carbon sources (baseline national emissions)

GHG in the atmosphere are rising as a result of human activity, largely emanating from the agricultural, transport, energy and residential sectors. The main existing sources of GHG in the vicinity of the Project (local and national extents) are from existing road traffic, rail, shipping, agriculture, residential space heating, commercial and industrial activity and waste facilities.

At a national level, according to the latest Ireland's Provisional Greenhouse Gas Emissions 1990-2021 report (EPA, 2022), emissions of GHGs in Ireland are estimated to be 61.53 million tonnes (Mt) carbon dioxide equivalents ($CO_2$eq). This is 4.7% higher than emissions in 2020. The EPA also reported that Ireland is estimated to exceed its 2021 annual limit by 2.71 Mt $CO_2$eq set under the EU's Effort Sharing Regulation (ESR).

In 2021, emissions from Ireland's ETS sector (which covers power stations, large industrial plants and airlines) increased by 15.2% or 2.02 Mt $CO_2$eq while non-ETS emissions (which includes for transport, buildings, agriculture and waste) increased by 1.6% or 0.73 Mt $CO_2$eq. Since 2005, ETS sector emissions have decreased by 31.7% or 7.12 Mt $CO_2$eq whereas emissions under the non-ETS sectors only decreased by 5.1% or 2.5 Mt $CO_2$eq, considerably short of Ireland's 20% reduction commitment.

The evidence points to emissions increasing as a result of economic activity and employment. *Agriculture* remains the single largest contributor to the overall emissions at 37.5% of the total. *Transport* and *Energy Industries* (which includes waste-to-energy incineration) are the second and third largest contributors at 17.7% and 16.7% respectively. Emissions from the *Residential* and *Manufacturing Combustion* sectors account for 11.4% and 7.5% respectively. The remainder is made up of *Industrial Processes* (4%), *F-Gases* (1.2%), *Commercial Services* (1.3%), *Public Services* (1.1%) and *Waste* (1.5%).

## 17.7.3 Future baseline scenario

The European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (hereafter the EIA Regulations 2018) require that '*a description of the relevant aspects of the current state of the environment (baseline scenario) and an outline of the likely evolution thereof without development as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge*' is included within the EIAR. With the evolving baseline climate in Ireland caused by climate change, the following are the changes predicted by Met Éireann[6] and the EPA[7] specific to Ireland with relevance to the Project:

- Ireland's climate is changing in line with global trends, with a temperature increase of, on average, 0.8 °C compared with 1900. By the middle of this century (2041-2060) the average annual temperatures are projected to increase by between 1–1.2℃ and 1.3–1.6℃ depending on the emissions trajectory. The number of warm days is expected to increase and heat waves are expected to occur more frequently;

[6] https://www.met.ie/climate/climate-change

[7] https://www.epa.ie/environment-and-you/climate-change/what-impact-will-climate-change-have-for-ireland/

- Ireland has seen an increase in average annual national rainfall of approximately 60 mm or 5% in the period 1981-2010, compared to the 30- year period 1961-1990. Reductions are expected in average levels of annual, spring and summer rainfall. Projections indicate a substantial increase in the frequency of heavy precipitation events in Winter and Autumn (approximately 20%). In short, while average rainfall will decrease, the frequency of heavy rainfall events will increase with a greater risk of future flooding;

- The last five-year (2015–2019) and ten-year (2010–2019) average temperatures are the warmest on record. Since the 1980s, each successive decade has been warmer than any preceding decade since 1850. In Ireland, 2019 was the ninth consecutive year with temperatures above normal;

- The number of very intense storms is projected to increase over the North Atlantic region. Projections suggest that the winter track of these storms may extend further south and over Ireland more often;

- Sea surface temperature in Irish waters has increased at a rate of approximately 0.6 °C per decade since 1994, which is unprecedented in the 150-year observational record; and

- The rate of global sea level rise for 2006–2015 of 3.6 mm per year, is unprecedented over the last century, and about 2.5 times the rate for 1901–1990. Sea level is projected to continue to rise at this rate or greater. All major cities in Ireland are in coastal locations subject to tides, any significant rise in sea levels will have major economic, social and environmental impacts. Rising sea levels around Ireland would result in increased coastal erosion, flooding and damage to property and infrastructure.

The climate projections for the next century indicate that observed climate trends will continue and intensify over the coming decades including the following:

- Changes in wind speeds and storm tracks;

- Increased likelihood of river and coastal flooding;

- Changes in distribution of plant and animal species and in the phenology (the timing of lifecycle events) of native species;

- Water stress for crops, pressure on water supply and adverse impacts on water quality; and

- Negative impacts on human health and wellbeing.

These changes are well established with the extent of the relative changes having been accurately predicted by the climate scientists for all parts of the country, including the Irish Sea and the east coast (which is particularly vulnerable to increased coastal flooding). The design of the Project has accounted for these predicted changes in sea level rise, coastal flooding, extreme weather, etc. to ensure that the Project remains resilient to these changes for the lifetime of the Project and further details are provided in chapter 5: Project Description.

In addition, the assessment on climate for the Project has had due consideration to the Department of Communications, Climate Action and Environment's 'Electricity & Gas Networks Sector Climate Change Adaptation Plan' (2019).

Looking forward, the EPA state in their 2022 report, '*Ireland's Greenhouse Gas Emissions Projections 2021-2040'* (EPA, 2022), that implementation of the '*With Additional Measures*' (WAM) scenario (including those in the Climate Action Plan 2021[8]) is projected to save 58 Mt $CO_2$eq over the period 2021-2030 compared to the '*With Existing Measure*s' (WEM) scenario. This represents a reduction of 1.8% per annum in emissions over the period. These projections indicate that Ireland can meet its non-ETS EU targets over the period 2021 to 2030, assuming full implementation of the Climate Action Plan 2021 and the use of the flexibilities available. Future, more ambitious targets as presented in the European Climate Law[9] and Ireland's pending Carbon Budget 2022 will require many (as yet unidentified) additional measures.

[8] Ireland's new Climate Action Plan 2021 published November 2021, which superseded the 2019 Climate Action Plan.

[9] European Climate Law: https://ec.europa.eu/clima/eu-action/european-green-deal/european-climate-law_en.

In the event that the Project does not progress an assessment of the future baseline conditions has been carried out and is described within this section.

Should the Project not go ahead, the predicted reductions in GHG emissions associated with this renewable source of electricity generation will not be achieved. The EPA projections for renewable energy in electricity generation and GHG reductions, as outlined above may be compromised and would require other renewable projects to meet these projections to avoid the need for the continued use of carbon based electricity generation.

### 17.7.4 Data validity and limitations

The climate data provided is the most recent available data and considered representative of Climate Study Area. Climate data provided is based on Met Éireann 30 year averages, 1981 to 2010. Additional recent climate data has been included for rainfall and temperature.

It is difficult to assess the scale and significance of any adverse (increased) changes in $CO_2$ emissions resulting from the Project in a similar way to other impacts within this EIAR. The effect, the term used to describe an environmental response resulting from an impact or series of impacts, is not possible to assess for individual $CO_2$ emissions. However, commentary and context to the calculated $CO_2$ emissions reported is provided with reference to historic and projected national emissions in Ireland. This is the standard approach adopted for climate impact assessment in EIA.

The quantification of materials to assess the embodied construction carbon (see section 17.10.2) is based on the design details provided in chapter 5: Project Description. The exact volumes of materials, sourcing of products and technical specification for materials will finalised when the design is refined. Throughout the assessment, efforts have been made to provide the most likely scenario of the embodied carbon assessment. Where it is required to make assumptions as the basis of the assessment presented here, these assumptions are based on advice from the design team.

This assessment has been undertaken in line with the Institute of Environmental Management and Assessment (IEMA) guide '*Assessing Greenhouse Gas Emissions and Evaluating their Significance*', 2nd Edition, 2022. One of the core principles of the IEMA guidance relates to the quantification of impacts using standardised quantification techniques including Publicly Available Specification (PAS) 2080: 2016 Carbon Management in Infrastructure. The following aspects of the Project are assessed in this chapter:

- **Potential direct greenhouse gas (GHG) emissions associated with the construction** of the Project – this includes site clearance, embodied carbon, material transport, construction activities and waste management;
- **Potential direct GHG emissions during the operational phase from Sulphur Hexafluoride ($SF_6$)** leakage. Sulphur Hexafluoride is used in onshore and offshore substation switchgear to maintain the optimum operating conditions. $SF_6$ is also used in the operation of the offshore substation and the WTGs;
- **Potential indirect GHG emissions reduction** as a result of the renewable electricity generating plant reducing the generation of fossil fuel emissions at gas, peat and coal powered plants across the State. These changes in GHG emissions are associated with the operational phase of the Project; and
- **Vulnerability** of all phases of the Project to climate change.

## 17.8 Key parameters for assessment

### 17.8.1 Project design parameters

The project description is provided in volume 2A, chapter 5: Project Description. Table 17–14 outlines the project design parameters that have been used to inform the assessment of potential impacts of the construction, operation and maintenance and decommissioning phases of the Project on climate. A summary of the approach for the vulnerability of the project to climate change is provided in section 17.10.3.

**Table 17–14: Project design parameters used for the assessment of potential impacts on climate.**

| Potential impact | Phase[1] | | | Project design parameters | Justification |
|---|---|---|---|---|---|
| | C | O | D | | |
| Direct Greenhouse Gas Emissions | ✓ | ✓ | ✓ | **Construction and decommissioning phases:**<br>• Embodied carbon in materials required to construct the Project (offshore and onshore infrastructure as outlined in chapter 5: Project Description);<br>• Transport emissions and plant emissions; and<br>• Waste quantities (excess materials that will be disposed off site).<br>**Operational and maintenance phase**<br>• Use of $SF_6$<br>– Use of $SF_6$ in switchgear (offshore) (1,750 kg);<br>– Use of $SF_6$ in WTG (15 kg/WTG);<br>– Use of $SF_6$ in switchgear (onshore) (1,750 kg);<br>• Transport emissions from Crew Transfer Vessels (CTV) and other maintenance vessels (352 vessel round trips);<br>• Materials and spare parts for maintenance. | The greatest volume of materials to construct the Project to consider embodied carbon.<br>The greatest number of Heavy Vehicle (HV) and vessel round trips.<br>The greatest number of plant to be used in construction.<br>The greatest volume of material to be disposed of offsite (assumes no reuse of material).<br>The greatest volume of $SF_6$ to be used.<br>Quantities are the total within the equipment.<br>The greatest number of vessel round trips. |
| Indirect Greenhouse Gas Emissions Reduction | ✗ | ✓ | ✗ | **Operational and maintenance phase**<br>Maximum export capacity of 375 MW for an operational phase of 40 years. | Assumed maximum export capacity. |
| Climate vulnerability | ✓ | ✓ | ✓ | **All phases**<br>Vulnerability of all aspects of the Project infrastructure:<br>• Offshore wind farm area;<br>• Offshore cable corridor;<br>• Onshore cable route; and<br>• Onshore substation site. | The construction, operation and decommissioning of these onshore and offshore infrastructure elements. |

1. C= Construction, O = Operation, D = Decommissioning.

## 17.8.2 Measures included in the Project

As part of the project design process, a number of measures have been proposed to reduce the potential for impacts on climate (see Table 17–15). These measures include designed-in and management measures (controls). As there is a commitment to implementing these measures, they are considered inherently part of the design of the Project and have therefore been considered in the assessment (i.e. the determination of magnitude assumes implementation of these measures). These measures are considered standard industry practice for this type of development.

**Table 17–15: Project design parameters included in the Project.**

| Measures included in the Project | Justification |
|---|---|
| Measures included in the Project regarding traffic are outlined in chapter 28: Traffic and Transport of this EIAR and will mitigate the effects these impacts may have in terms of climate.<br>• Reducing the idle times by providing an efficient material handling plan that minimizes the waiting time for loads and | There will be an increase in traffic along local roads during the construction phases of the Project. These are standard measures to reduce vehicle emissions (see chapter 28: Traffic and Transport for further details on the traffic environment). |

| Measures included in the Project | Justification |
|---|---|
| unloads. Reducing idle times could save 10% of total emissions during construction phase;<br>• Turning off vehicular engines when not in use for more than five minutes. This restriction will be enforced strictly unless the idle function is necessary for security or functionality reasons; and<br>• Regular maintenance of plant and equipment. Technical inspection of vehicles to ensure they will perform the most efficiently. | |
| There are a series of standard operating procedures that ensure no significant $SF_6$ leakage from all onshore and offshore switchgear including the following:<br>• Indication from control room where the densimeter has alarms to indicate a reduction in $SF_6$ gas pressure below threshold level such as 'low' or 'lockout';<br>• Indication at local level:<br>– Indication from densimeter of a reduction in $SF_6$ gas pressure since previous inspection or below threshold marked on densimeter;<br>– $SF_6$ audible and visual alarms (as wired to a station alarm);<br>– Sound of leak from local inspection;<br>– Proof of leak from periodic gas sniff test;<br>• In addition, personnel safety measures for ESB Networks (once handed over) include:<br>– Training and certification in accordance with EU Regulation No. 517/2014;<br>– Risk Assessment/JSSP for every site specific task; and<br>– $SF_6$ Standard and $SF_6$ Procedures which include response to leaks and faults, reporting, transport, storage, labelling and signage, maintenance, $SF_6$ gas handling, quality testing and end of life considerations. | These are standard measures designed to ensure no significant losses of $SF_6$ from the substation switchgear to maintain the optimum operating conditions.<br>$SF_6$ is replaced periodically based on the maintenance plan and a standard operating procedure is in place to ensure no accidental release of $SF_6$ during maintenance. |
| An Environmental Management Plan (EMP) (see volume 2A appendix 5-2: Environmental Management Plan) will be implemented during the construction, operational and maintenance and decommissioning phases of the offshore infrastructure for the Project. The EMP will include measures and commitments relating to energy use:<br>• Regular maintenance of plant and equipment used during the construction phase. Technical inspection of vessels and plant to ensure they will perform efficiently;<br>• All vessel engines should be properly maintained in line with manufacturers requirements ensure emissions are minimised;<br>• Implement energy efficiency measures such as fuel efficiency for the duration of the works; and<br>• The contractor will be required to measure and record all activity data (fuel use, material use, transport, etc.) to allow for the development of a carbon footprint for the construction phase of the Project.<br>A Construction Environmental Management Plan (CEMP) (see volume 2A, appendix 5-1: Construction Environmental Management Plan) will be implemented by the Contractor during the construction phase of the onshore infrastructure. The Contractor will be required to implement energy management measures for the duration of the works such as:<br>• The use of thermostatic controls on all space heating systems in site buildings to maintain optimum comfort at minimum energy use;<br>• The use of sensors on light fittings in all site buildings and low energy lighting systems; | To manage and minimise GHG emissions from the construction phase and operational and maintenance phases. |

| Measures included in the Project | Justification |
|---|---|
| • The use of adequately insulated temporary building structures for construction compounds fitted with suitable vents;<br>• The use of low energy equipment and 'power saving' functions on all PCs and monitors in the site offices;<br>• The use of low flow showers and tap fittings; and<br>• The use of solar/thermal power to heat water for the on-site welfare facilities and contamination unit (sinks and showers). | |
| Materials with a reduced environmental impact will be incorporated into the construction design through re-use of materials or incorporation of recycled materials in place of conventional building materials. The following materials will be considered for the construction phase:<br>• Ground Granulated Blast Furnace Slag (GGBS) and Pulverised Fuel Ash – Used as replacements for Portland cements to increase sustainability and carbon footprint of civil and structural works; and<br>• Steel – The recovery rates associated with using recycled steel are high and research exists which shows that 99% of structural steel arising from demolition sites is recycled or re-used. The carbon emissions emitted during the production of virgin steel can be higher than some other structural materials on a tonne-by-tonne basis, and recycled steel should be used where possible. | Standard practice in modern construction is to select material with an inherently low environmental impact and embodied carbon. These design decisions will be taken as standard on the Project. |
| A range of best practices design and construction measures are committed to for the Project to ensure that all phases of the Project are suitably resilient to the effects of climate change. Volume 2A, chapter 5: Project Description includes the detailed description but a non-exhaustive list of measures includes:<br>• Each monopile foundation will be specifically designed for the ground conditions and metocean conditions encountered at each WTG location;<br>• Scour protection will be employed on the seabed and will be installed after foundation installation;<br>• All offshore cables will be buried below the seabed where feasible or laid on the seabed and protected with materials such as matting and/or rock; and<br>• WTG will shut down in very high wind speeds to protect the wind turbine and foundation. The cut-out wind speed depends on WTG type and is between 28 and 35 m/s. | Standard practices for design construction and operation of offshore wind farms and associated infrastructure to protect infrastructure against the prevailing and changing weather patterns. |

### 17.8.3 Impacts scoped out of the assessment

On the basis of the baseline environment and the project description outlined in volume 2A, chapter 5: Project Description, a number of impacts are proposed to be scoped out of the assessment for climate. These impacts are outlined, together with a justification for scoping them out, in Table 17–16.

**Table 17–16: Impacts scoped out of the assessment for climate.**

| Potential impact | Justification |
|---|---|
| Operational and maintenance road traffic emissions | Minimal operational traffic requirements proposed with no potential for significant climate impact. |

## 17.9 Impact assessment methodology

### 17.9.1 Overview

The methodology and associated impact assessment had regard to the general guidance regarding the undertaking of an EIA, as presented in volume 2A, chapter 3: Environmental Impact Assessment Methodology and the following climate specific guidance as follows:

- IEMA (2022) Guidance on 'Assessing Greenhouse Gas Emissions and Evaluating their Significance', 2nd Edition;
- GCB (2016) Publicly Available Specification (PAS) 2080: Carbon Management in Infrastructure ;
- EU (2021) Technical guidance on the climate proofing of Infrastructure in the Period 2021-2027 (European Commission, 2021);
- DCCAE (2017) Guidance on EIS and NIS Preparation for Offshore Renewable Energy Projects; and
- The Institute of Environmental Management and Assessment, Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation (2nd Edition) (IEMA, 2020).

### 17.9.2 Assessment criteria for GHG emissions

Potential direct and indirect greenhouse gas (GHG) emissions associated with the construction and maintenance of the Project includes site clearance, embodied carbon, material transport, construction activities and waste management. This has been quantified using a Life Cycle Assessment (LCA) which is the analysis of environmental impacts associated with the project life cycle from the material extraction to the production, use and its end of life.

The LCA model follows the international standards ISO 14040 and 14044 and is aligned with guidance set out in PAS 2080 which suggests a modular structure for capturing and reporting carbon emissions according to lifecycle phase. A full suite of all materials, transport distances and operations during construction, operation and decommissioning have been compiled from the PDE and used to inform this assessment.

In the absence of sector specific guidance on assessment criteria, the Transport Infrastructure Ireland '*Climate Guidance for National Roads, Light Rail, and Rural Cycleways (Offline and Greenways) – Overarching Technical Document PE-ENV-01104'* (December 2022) is applied. This approach to assessing significance is based on the Institute of Environmental Management and Assessment, '*Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation*' (2nd Edition) (IEMA, 2020).

The TII guidelines state that the climate assessment is not solely based on whether a project emits GHG emissions alone but how it makes a relative contribution towards achieving a science based 1.5 °C aligned transition towards net zero. The guidance states that the impact assessment must give regard to two major considerations when assessing the significance of a project GHG emissions including:

- The extent to which the trajectory of GHG emissions from the project aligns with Ireland's GHG trajectory to net zero by 2050; and
- The level of mitigation taking place.

The criteria for defining the significance in this chapter for the GHG Assessment are outlined in Table 17–17. Ireland's national sectoral carbon budgets (refer Table 17–1) are used to contextualise the magnitude of GHG emissions from the operation phase of the Project in order to demonstrate the level of impact of the Project on Ireland's ability to meet its reduction targets.

**Table 17–17: Significance matrix for the GHG assessment.**

| Effects | Magnitude of impact | Definition |
|---|---|---|
| Significant adverse | Major adverse | • The Project's GHG impacts are not mitigated;<br>• The Project has not complied with do-minimum standards set through regulation, nor provide reductions required by local or national policies; and<br>• No meaningful absolute contribution to Ireland's trajectory towards net zero. |
| | Moderate adverse | • The Project's GHG impacts are partially mitigated;<br>• The Project has partially complied with do-minimum standards set through regulation, and have not fully complied with local or national policies; and<br>• Falls short of full contribution to Ireland's trajectory towards net zero. |
| Not significant | Minor adverse | • The Project's GHG impacts are mitigated through 'good practice' measures;<br>• The Project has complied with existing and emerging policy requirements; and<br>• Fully in line to achieve Ireland's trajectory towards net zero. |
| | Negligible | • The Project's GHG impacts are mitigated beyond design standards;<br>• The Project has gone well beyond existing and emerging policy requirements; and<br>• Well 'ahead of the curve' for Ireland's trajectory towards net zero. |
| Beneficial | Beneficial | • The Project's net GHG impacts are below zero and it causes a reduction in atmosphere GHG concentration;<br>• The Project has gone well beyond existing and emerging policy requirements; and<br>• Well 'ahead of the curve' for Ireland's trajectory towards net zero, provides a positive climate impact. |

### 17.9.3 Assessment criteria for climate vulnerability

The EU '*Technical guidance on the climate proofing of Infrastructure in the period 2021-2027*' (European Commission, 2021) guidance outlines an approach for undertaking a risk assessment where there is a potentially significant impact on the Project due to climate change. The risk assessment assesses the likelihood and consequence of the impact occurring to a receptor, leading to the evaluation of the significance of the impact. This is further considered in chapter 24: Risks of Major Accidents and Natural Disasters.

The assessment methodology is a two-stage process with the first stage is a climate vulnerability assessment and if the results of this first phase indicate the climate hazard is a vulnerability, then the second stage of the assessment is carried out and referred to as a climate change risk assessment.

The Stage 1 Vulnerability Analysis is a combination of sensitivity analysis and exposure analysis and is undertaken through the following methodology:

- In undertaking the sensitivity analysis the asset categories and climate hazards to be considered in the climate screening must be identified and the list of asset categories and climate hazards include:
  - Asset categories – WTGs, substations, cables, vessels, etc.; and
  - Climate hazards - Flooding (coastal); flooding (fluvial); extreme heat; extreme cold; wildfire; drought; extreme wind; lightning and hail; fog.

- Determine the sensitivity (low, medium, or high) of each asset category to each of the climate hazards by assigning a sensitivity score of 1 to 3;
- Using the historic climate data, assess the level of exposure for each climate hazard within the Project and;
- Take the product of sensitivity and exposure, for each climate hazard and each asset category identified. Any climate hazards with vulnerabilities marked as high have been included in the Stage 2 detailed climate change risk assessment.

The Stage 2 climate change risk assessment is a combination of a likelihood analysis and impact analysis:

- The asset categories considered in the climate screening have formed the key project receptors in this assessment as well as any critical connecting infrastructure and significant parts of the surrounding environment;
- Define the climate baseline (historic extreme climate events) using historic climate conditions and gathering climate change projection data to understand future climate conditions;
- The probability levels of future climate projections are determined for the CCR Assessment using relevant resources such as Climate Ireland (https://www.climateireland.ie/#!/); and
- The climate data gathered is used to identify climate-related risks to the project to generate a comprehensive list of risks based on the climate change hazards that have been deemed relevant to the Project and location.

To undertake the sensitivity analysis, a score is applied for each asset category (pavements, drainage, structures, earthworks, etc.) against each climate hazard (flooding, extreme temperature, etc.). Table 17–18 provides the definitions and scoring used when assessing sensitivity.

**Table 17–18: Sensitivity definition and scoring.**

| Level | Definition | Scoring |
|---|---|---|
| High sensitivity | The climate hazard will or is likely to have a major impact on the asset category. | 3 |
| Medium sensitivity | It is possible or likely the climate hazard will have a moderate impact on the asset category. | 2 |
| Low sensitivity | It is possible the climate hazard will have a low or negligible impact on the asset category. | 1 |

The aim of the exposure analysis is to identify which climate hazards are relevant to the planned project location (e.g. flooding could represent a significant hazard for a project located next to a river in a floodplain). Therefore, whilst sensitivity analysis focuses on the type of project, exposure focuses on location. The hazards assessed are the same as those used for the sensitivity analysis.

To undertake the exposure analysis, an exposure score is applied for each climate hazard at the project location. The allocation of exposure level is informed by the high-level climate data collected. Table 17–19 shows the exposure definitions and scoring.

**Table 17–19: Exposure definition and scoring.**

| Level | Definition | Scoring |
|---|---|---|
| High exposure | It is almost certain or likely this climate hazard will occur at the project location (i.e. might arise once to several times per year). | 3 |
| Medium exposure | It is possible this climate hazard will occur at the project location (i.e. might arise a number of times in a decade). | 2 |
| Low exposure | It is unlikely or rare this climate hazard will occur at the project location (i.e. might arise a number of times in a generation or in a lifetime). | 1 |

The vulnerability assessment combines the outcomes of the sensitivity and exposure analysis with the aim to identify the key vulnerabilities and the potentially significant climate hazards associated with the Project. To complete the vulnerability assessment, the product of sensitivity and exposure for each climate hazard and each asset category identified and mapped as per Table 17–20.

**Table 17–20: Vulnerability matrix.**

| | | Exposure | | |
|---|---|---|---|---|
| | | Low (1) | Medium (2) | High (3) |
| Sensitivity | Low (1) | 1 | 2 | 3 |
| | Medium (2) | 2 | 4 | 6 |
| | High (3) | 3 | 6 | 9 |

Any high vulnerabilities (score >5) are then subjected to the second stage – a climate risk assessment using a combination of likelihood analysis and impact analysis. The likelihood analysis looks at how likely the identified climate hazards are to occur within a given timescale. Table 17–21 presents the likelihood analysis key used for this assessment.

**Table 17–21: Likelihood analysis key.**

| Term | Qualitative | Quantitative |
|---|---|---|
| Rare | Highly unlikely to occur | 5% |
| Unlikely | Unlikely to occur | 20% |
| Moderate | As likely to occur as not | 50% |
| Likely | Likely to occur | 80% |
| Almost certain | Very likely to occur | 95% |

The impact analysis investigates the consequences of the climate hazards and also refers to the severity and magnitude. Table 17–22 provides guidance to ranking the risk areas and this table was taken from the European Commission (2021) technical guidance on the climate-proofing of infrastructure in the period 2021-2027.

**Table 17–22: Consequence analysis key.**

| Risk areas | Insignificant | Minor | Moderate | Major | Catastrophic |
|---|---|---|---|---|---|
| **Asset damage, engineering, operational** | Impact can be absorbed through normal activity | Adverse event that can be absorbed by taking business continuity actions | A serious event that requires additional emergency business continuity actions | A critical event that requires extraordinary / emergency business continuity action | Disaster with the potential to lead to shut down or collapse or loss of the asset / network |
| **Health and safety** | First aid case | Minor injury, medical treatment | Serious injury or lost work | Major or multiple injuries, permanent injury or disability | Single or multiple fatalities |
| **Environment** | No impact on baseline environment. Localised in the source area. No recovery required | Localised within site boundaries. Recovery measurable within one month of impact | Moderate harm with possible wider effect Recovery in one year | Significant harm with local effect Recovery longer than one year. Failure to comply with environmental regulations / consent | Significant harm with widespread effect. Recovery longer than one year. Limited prospect of full recovery |

| Risk areas | Insignificant | Minor | Moderate | Major | Catastrophic |
|---|---|---|---|---|---|
| **Social** | No negative social impact | Localised, temporary social impacts | Localised, long-term social impacts | Failure to protect poor or vulnerable groups. National, long- term social impacts | Loss of social license to operate. Community protests |
| **Financial** | x % internal rate of return (IRR) < 2% of turnover | x % IRR 2-10% of turnover | x % IRR 10-25% of turnover | x % IRR 25-50% of turnover | x % IRR > 50% of turnover |
| **Reputational** | Localised, temporary impact on public opinion | Localised, short-term impact on public opinion | Local, long-term impact on public opinion with adverse local media coverage | National, short-term impact on public opinion. negative national media coverage | National, long-term impact with potential to affect the stability of the government |
| **Cultural heritage and cultural premises** | Insignificant impact | Short-term impact. Possible recovery or repair | Serious damage with a wider impact to tourism industry | Significant damage with national and international impact | Permanent loss with resulting impact on society |

Table 17–23 presents summary outcome of the assessment of likelihood and consequence of each climate hazard in the form of a climate risk matrix.

**Table 17–23: Climate risk matrix.**

| | | Magnitude of consequence | | | | |
|---|---|---|---|---|---|---|
| | | **Insignificant** | **Minor** | **Moderate** | **Major** | **Catastrophic** |
| Likelihood | **Rare** | Low | Low | Medium | High | Extreme |
| | **Unlikely** | Low | Medium | Medium | High | Extreme |
| | **Moderate** | Low | High | High | Extreme | Extreme |
| | **Likely** | Medium | High | High | Extreme | Extreme |
| | **Almost Certain** | High | High | Extreme | Extreme | Extreme |

## 17.10 Assessment of significance

The potential impacts arising from the construction, operational and maintenance and decommissioning phases of the Project are listed in Table 17–4 along with the project design parameters against which each impact has been assessed.

A description of the potential effect on climate caused by each identified impact is given below.

### 17.10.1 Direct GHG emissions

#### Construction Phase

Consideration is given in this section to specific measures associated with the Project and the GHG emissions that may arise during the construction phase. Emissions of GHG from the Project may arise from the following sources:

- Embodied emissions in the infrastructure including Wind Turbine Generators (WTG) and associated site materials (foundations, scour protection etc), cables, OSS, onshore substation;
- Direct emissions from plant machinery/equipment; and
- Transport emissions from vehicles and vessels importing/exporting material and personnel to and from the development site(s).

Embodied emissions are the carbon footprint of a material (i.e. the total emissions released throughout the supply chain of the material). This includes the energy required for extraction, processing, operation and disposal of a material. For some materials, such as steel, the use of recycled materials has a lower embodied GHG emission than the use of virgin material.

These emissions have been estimated using the One Click LCA and the results are presented in Table 17–24. The results indicate that the primary source of GHG emissions from the construction of the Project is from embodied carbon in the steel used for the turbines and for the piles. The total estimated GHG emissions associated with the construction phase of the Project is calculated to be 347,882 tonnes of $CO_{2eq}$.

**Table 17–24: Estimated construction GHG emissions.**

| Item | Estimated GHG emissions ($tCO_{2eq}$) |
|---|---|
| Embodied carbon in materials | 313,652 |
| Transport of materials and personnel | 19,116 |
| Construction activities | 15,114 |
| **TOTAL** | **347,882** |

During the construction phase the project's GHG impacts are only partially mitigated and the project has only partially complied with do-minimum standards. As such and in the absence of further significant mitigation to mitigate these lifecycle carbon losses to atmosphere, the Project is predicted to have a **moderate adverse** impact on climate which is considered significant in EIA terms (refer to section 17.9.2) but needs to be considered in the context of the life cycle on the Project during operation where there will be an overall net beneficial impact for climate.

## Operational and maintenance phase

The switchgear employed at the onshore and offshore substations will employ the gas sulphur hexafluoride ($SF_6$) as an insulating and circuit breaking medium. $SF_6$ is a non-toxic gas but is a greenhouse gas with a high $CO_2$ equivalence if released to the atmosphere. This gas has a Global Warming Potential (GWP) (100 year time horizon) of 22,800 GWP meaning that a release of 1 tonne of $SF_6$ has an equivalent climate impact to 22,800 tonnes of $CO_2$. As such, any loss of $SF_6$ during operation or maintenance has the potential for adverse impacts to climate.

The estimated use of $SF_6$ on the Project is approximately 3.875 tonnes in total. This estimation is based on a 1,750 kg in the offshore and onshore substations as well as 15 kg in each of the 25 WTG.

Gas handling on-site is required all phases of the Project. Specialised gas handling and maintenance procedures and training are incorporated into management systems. Maintenance of $SF_6$ gas containing equipment will be undertaken by the maintenance contractor in accordance with these operating procedures. $SF_6$ is replaced periodically based on the maintenance plan and a Standard Operating Procedure is in place to ensure no accidental release of $SF_6$ during maintenance.

Alternatively, a specialist switchgear provider (such as the original equipment provider) may be employed, to undertake maintenance of $SF_6$ containing equipment. The electrical switchgear equipment will also be equipped with a pressure or density monitoring device which will detect any loss of $SF_6$.

Any loss of $SF_6$ is anticipated to be a temporary leak of minor significance that is quickly identified through leak detection and resolved through reactive or routine maintenance. As such, the project's GHG impacts are mitigated through 'good practice' measures and the impact is predicted to have a **minor adverse** impact on climate which is considered not significant given the level of control measures set out in Table 17–15.

Other GHG emissions are associated with the operational and maintenance phase of the project include material replacement and refurbishment of the WTG's and use of vessels. These emissions have also been estimated using the One Click LCA The total estimated GHG emissions associated with the operational and maintenance phase of the Project is calculated to be 51,069 tonnes of $CO_{2eq}$ over the 40 year lifetime of the Project equating to 1,277 tonnes of $CO_{2eq}$ per annum on average. These measures have been partially mitigated through good practice design and, as such, the operation and maintenance phase impact is considered to have a **minor adverse** impact on climate which is considered not significant.

### Decommissioning phase

At the end of the operational lifetime of the Project, it is anticipated that all structures above the seabed or ground level will be completely removed. The decommissioning sequence will generally be the reverse of the construction sequence and involve similar types and numbers of vessels and equipment. The predicted emissions for the transport of materials and personnel and construction/decommissioning activities would also be realised at decommissioning (i.e. 34,230 tonnes of $CO_{2eq}$).

Embodied materials have been quantified in the construction phase and therefore will not be encountered again in the decommissioning phase. If these materials are reused there may be potential for indirect positive impacts through reducing materials needs on other projects though this potential impact is unknown.

The impact is predicted to have a **minor adverse** impact on climate which is considered not significant (refer section 17.9.2).

## 17.10.2 Indirect GHG emissions

The development of renewable electricity generating infrastructure has the potential to meet the State's energy demand and thereby offset the requirements for fossil fuel combustion to contribute to the energy mix. Indirect effects will arise as a result of the renewable electricity generating plant potentially reducing the generation of fossil fuel emissions at gas, peat and coal powered plants across the State. These potential indirect impacts are associated with the operation stage only and no significant indirect effects for the construction or decommissioning stages are identified and therefore construction and decommissioning impacts are scoped out from further assessment.

### Operational and maintenance phase

The associated reduction in greenhouse gas emissions associated with the Project may be calculated using the following formula:

$$\text{Tonnes } CO_{2eq} = (A \times B \times C \times D) / 1000$$

Where:

A = The rated capacity of the wind energy development in MW (in this case 375 MW).

B = The capacity factor, which takes into account the intermittent nature of the wind, the availability of wind turbines and array losses etc. A capacity factor of 45% has been assumed for the Project.

C = The number of hours in a year, 8,760 hours.

D = Carbon load in grams per kWh (kilowatt hour) of electricity generated and distributed via the national grid. The latest data reported by the EPA states that the emissions intensity of power generation in 2021 was 331 $gCO_2$/kWh[10].

Based on the above, the Project has the potential to displace approximately 489,300 tonnes per annum of $CO_{2eq}$ from the largely carbon-based traditional energy mix in the national grid. Electricity generation from renewables was at 35% in 2021 with fossil fuels (gas, oil, coal and peat) making up the remaining 65% generation source.

[10] Link: https://www.epa.ie/news-releases/news-releases-2022/epa-data-shows-irelands-2021-greenhouse-gas-emissions-above-pre-covid-levels.php#:~:text=This%20resulted%20in%20an%20increase,3.0%20per%20cent%20on%202020.

Over the 40 year design lifetime of the Project this equates to potential displacement of approximately 19,572,030 tonnes of $CO_{2eq}$ from the national grid which will result in a major beneficial impact for climate. Note that this future impact is based on the 2021 emissions intensity of power generation which is likely to decrease in future years as electricity generation from renewables increases and fossil fuel generation decreases in line with CAP23. As such, the 19 million tonne reduction should be viewed as the upper limit of any beneficial impact.

With a construction phase moderate adverse impact at 347,882 tonnes of $CO_{2eq}$ generated (see Table 17–24), a further 51,069 tonnes of $CO_{2eq}$ generated during the operation and maintenance phase and 34,230 tonnes of $CO_{2eq}$ generated at decommissioning, the cumulative adverse impact is 433,181 tonnes of $CO_{2eq}$. With the potential to reduce 489,300 tonnes of $CO_{2eq}$ from the current electricity generating sector in year one, the Project will have a net benefit for climate after year one of operation for the remaining 39 years of the project lifetime.

As such, the net indirect and direct climate impact of the Project is predicted to meet the following criteria in Table 17–17:

- The project's net GHG impacts are below zero and cause a reduction in atmosphere GHG concentration;
- The project has gone well beyond existing and emerging policy requirements; and
- Well 'ahead of the curve' for Ireland's trajectory towards net zero, provides a positive climate impact.

When the indirect beneficial impact is compared to the direct adverse impact, the Project is predicted to have a **net major beneficial impact** on climate which is considered significant, and more than offsets the direct carbon losses reported for the construction, operation and decommissioning phases (refer section 17.9.2).

### 17.10.3 Vulnerability of the Project to climate change

Details of current climate hazards impacting the area have been derived from the Global Facility for Disaster Reduction and Recovery 'Think Hazard!' tool with data specific to County Louth extracted from the tool. This data is supplemented as required with information from the Office of Public Works FloodInfo.ie resource and the EPA climate information database. This data is summarised in Table 17–25 to illustrate the current climate hazard threat to the area of the Project. A more detailed appraisal of flood risk for the Project is presented in chapter 22: Hydrology and Flood Risk.

**Table 17–25: Observed hazard level in the area of the Project.**

| Hazard type | Hazard level |
|---|---|
| **Sea level rise** | Moderate – Estimates show that globally, average sea level has risen approximately 160 mm since 1902, at a rate of approximately 1.4 mm per year. Satellite observations indicate that the sea level around Ireland has risen by approximately 2-3 mm/year since the early 1990s. |
| **Wave height** | Moderate – Increasing wave heights have been observed over the last 70 years in the North Atlantic with typical winter season trends of increases of 20 cm per decade, along with a northward displacement of storm tracks. |
| **Coastal flood** | High – Potentially-damaging waves are expected to flood the coast at least once in the next 10 years.<br>This is confirmed by the CFRAM mapping for the area which shows the coast to the north of the landfall area has a High Probability coastal flood event risk (i.e. approximately a 1-in-a-10 chance of occurring or being exceeded in any given year). |
| **Fluvial flood** | Low – That there is a chance of more than 1% that potentially damaging and life-threatening river floods occur in the coming 10 years (return period of c. 1 in 1000 years).<br>The CFRAM mapping for the area indicates that the River Dee has a high probability of localised river flooding (i.e. approximately a 1-in-a-10 chance of occurring or being exceeded in any given year). |
| **Extreme heat** | Low – There is between a 5% and 25% chance that at least one period of prolonged exposure to extreme heat, resulting in heat stress, will occur in the next five years. |
| **Extreme wind** | High – An average of 8.2 days with gales per annum as illustrated in Table 17–10. The highest levels of gales and gusts were both recorded on average in the month of January, |

| Hazard type | Hazard level |
|---|---|
| | with an average of 2.3 days of gales recorded, and an average maximum wind gust of 80 knots. |
| **Wildfire** | Low – There is between a 4% and 10% chance of experiencing weather that could support a problematic wildfire in the project area that may cause disruptions and low but tangible risk of life and property loss in any given year. |
| **Landslide** | Very Low – This area has rainfall patterns, terrain slope, geology, soil and land cover that make localized landslides a rare hazard phenomenon. |

In addition to the hazard types listed in Table 17–25, this analysis also has due regard for past major weather events which are used to inform future potential hazards and adaption. Table 17–26 presents a list of historically recorded extreme weather events recorded nationally which have been extracted from the Met Éireann Major Weather Events database.

**Table 17–26: Major weather events.**

| Year | Event | Climate hazard |
|---|---|---|
| 2022 | Highest Temperature Recorded in Ireland since 1887 (July 2022) | High temperature |
| 2022 | Storm Eunice | Strong wind |
| 2021 | Storm Barra | Strong wind |
| 2020 | Storm Ellen | Strong wind |
| 2018 | Heatwaves and Drought | High temperature |
| 2018 | Snowstorm Emma and Beast from the East | Snowfall |
| 2018 | Storm Doris | Strong wind |
| 2018 | Storm Eleanor | Strong wind |
| 2017 | Storm Dylan | Strong wind |
| 2017 | Storm Ophelia | Strong wind |
| 2017 | Heavy Rain | Extreme rainfall |
| 2016 | Storm Jake | Strong winds |
| 2015 | Storm Frank | Strong winds |
| 2015 | Storm Eva | Strong winds |
| 2015 | Storm Desmond | Flooding |
| 2015 | Storm Darwin | High temperature |
| 2013/14 | Winter Storms | Cold snaps |
| 2011 | Tropical Storm Katia | Strong winds |
| 2010 | Winter Cold Spell | Cold snaps |
| 2009/10 | Winter Cold Spell | Cold snaps/ frost |
| 2009 | Severe Flooding | Flooding |
| 2008 | Heavy Rain and Flooding | Extreme rainfall |
| 2006 | High Temperature/ Heatwave | High temperature |
| 2003 | Heavy Rainfall/ Cloud Burst | Extreme rainfall |
| 2002 | Severe Flooding in Eastern Areas | Flooding |
| 2002 | Coastal flooding along the eastern and southern coasts | Flooding |
| 2000 | Severe flooding in east and southern coasts | Flooding |
| 1998 | Hurricane-force winds over north and northeast | Strong wind |
| 1997 | Windstorm | Strong wind |
| 1986 | Hurricane Charley | Strong wind |

The Climate Data Tool from Climate Ireland provides a detailed dataset of observed and projected climate data at national and county level. Observed data is based on the period 1981 to 2010 (i.e. the latest 30-year average data) and projections are provided for the period 2041 to 2060. Projections are presented for two climate scenario a most likely scenario and a maximum design parameter and the range of impacts from both are employed in this analysis.

The results of the data compiled for County Louth and the landfall area is presented in Table 17–27 as reflective of the onshore and offshore areas in the absence of offshore data. In short, the results predict increasing average temperatures leading to increased frequency of heatwave and reduced frequency of frost and ice. Average precipitation is predicted to decrease but the number of wet and very wet days are projected to increase suggesting more intense rainfall events.

**Table 17–27: Predicted climate data in the area of the Project.**

| Climate variable | Observed climate at Project location |
|---|---|
| Average temperature | For the period 1981 to 2010, the area of the Project experienced average annual temperature of 10.4 $^{0}$C.<br>For the period 2041 to 2060, the area of the Project is predicted to experienced average annual temperatures of 1.2-1.6 $^{0}$C higher than the current averages. In addition, the number of dry days in this period is projected to increase by 6.8 to 15.7%. |
| Average precipitation | For the period 1981 to 2010, the area of the Project experienced average annual precipitation of 720 mm.<br>For the period 2041 to 2060, average annual precipitation is projected to change from a decrease of 2.2% to an increase of 0.7%. The number of wet days (>20 mm rain) will increase by 14.5-25.4% and the number of very wet day (>30 mm rain) will increase by 26.7-48.9%. |
| Maximum temperature | For the period 1981 to 2010, the maximum annual average temperature in the area of the Project was 13.4 $^{0}$C.<br>For the period 2041 to 2060, there is a projected increase of five to seven heatwaves in this period relative to baseline. |
| Minimum temperature | For the period 1981 to 2010, the minimum annual average temperature in the area of the Project was 7.4 $^{0}$C.<br>For the period 2041 to 2060, there is a projected decrease in annual frost days of the order of 69.9-82.4% and a similar decrease in the number of ice days of the order of 91.6-95.6%. |
| Wind speed and energy | Dublin Airport met station shows an average of 8.2 days with gales per annum and an average wind speed of 10.3 knots. The highest levels of gales and gusts were both recorded on average in the month of January, with an average of 2.3 days of gales recorded, and an average maximum wind gust of 80 knots.<br>For the period 2041 to 2060, annual average wind speeds are predicted to decrease by 1.7-2.4% while annual average wind energy will decrease by 4.6-6%. |

## Construction Phase

As per the guidance, a sensitivity analysis was carried out on all construction elements (construction compounds) as well as asset categories including WTGs, substations, cables, etc. The sensitivity analysis was used to identify which climate hazards are relevant to the construction phase of the Project. Table 17–28 presents the sensitivity analysis and the rationale for the sensitivity score for the construction of the Project.

**Table 17–28: Sensitivity analysis of climate hazards to the construction of the Project.**

| Climate hazard | Sensitivity | Sensitivity score |
|---|---|---|
| **Sea level rise** | Moderate sensitivity for the short-term construction phase as offshore and onshore elements as rising sea levels can result in increased coastal erosion, flooding and damage to property and infrastructure. | 2 |

| Climate hazard | Sensitivity | Sensitivity score |
|---|---|---|
| **Wave height** | Moderate sensitivity to vessels and working platforms during the construction phase potentially damaging infrastructure, delaying works or causing safety issues. | 2 |
| **Flooding (coastal)** | High sensitivity to coastal flooding for works around the landfall. Coastal flooding may damage or flood excavations and other works, delay construction and result in damage to the environment. In addition, worker safety may be impacted by such an event for works. | 3 |
| **Flooding (fluvial)** | High sensitivity to fluvial flooding. As above, flooding may damage or flood excavations and other works, delay construction and result in damage to the environment. | 3 |
| **Extreme heat** | Medium sensitivity to extreme heat. Extreme heat can cause concrete to crack, difficulties in managing some materials and can delay works through cessation or works to protect outdoor workers. | 2 |
| **Extreme cold** | Generally moderate sensitivity to the assets under construction. Extreme cold can cause concrete to crack, pipes to burst impacting the integrity of concrete or structures. Extreme cold can result in cessation or delay in construction works such as for pouring concrete. | 2 |
| **Wildfire** | All onshore assets are considered to have a high sensitivity to wildfires. Such fires can cause significant asset damage, cease construction and impact on the health of workers and the community. | 3 |
| **Drought** | Low sensitivity to drought on all assets. | 2 |
| **Extreme wind** | High sensitivity to extreme wind in particular for cranes or other elevated operations such as for installation of WTGs which may result in damaging infrastructure, delaying works or causing safety issues. | 3 |
| **Lightning and hail** | Low sensitivity to lightning and hail for all assets. Potential for short term interruptions to works. | 1 |
| **Fog** | Low sensitivity to fog for all assets. May have short term impacts on cranes or other elevated operations but not significant. | 1 |

An exposure analysis was also carried out on the construction phase of the Project based on the known climate hazards. Given that the construction phase is anticipated to take place within the medium term, the analysis focusses on the current climate hazards but the long-term future climate hazards are also considered as appropriate. Table 17–29 presents the rationale for the exposure scoring for the construction phase.

**Table 17–29: Exposure analysis based on past and predicted climate events.**

| Climate event | Detail | Exposure score |
|---|---|---|
| **Sea level rise** | Moderate – Climate Ireland (www.climateireland.ie) report that County Louth has 90 km of coastline and approximately 39 km of this coastline is at risk of coastal erosion due to sea level rise. However, this excludes the area of the landfall and onshore infrastructure. | 2 |
| **Wave height** | Moderate – Measurement at ay buoy M2 by the Irish Marine Data Buoy Observation Network (IMDBON) off the east coast of Ireland shows mean monthly average significant wave height of 2.5 metres observed in February 2014. | 2 |
| **Flooding (coastal)** | Moderate exposure based on the Flood Risk Assessment (appendix 22-1) which provides greater detail than the county wide assessment in Table 17–25. The potential coastal flooding area is north of the landfall location with no significant exposure at the landfall location.<br>In addition, the 0.1% AEP predicted flood extents for the present day, MRFS and HEFS scenarios showed negligible increases in predicted flooding within landfall location as a result of climate change. Hence the climate change impact is considered to be negligible. | 2 |
| **Flooding (fluvial)** | Moderate exposure based on the Flood Risk Assessment (appendix 22-1) which provides greater detail than the county wide assessment in Table 17–25. | 2 |

| Climate event | Detail | Exposure score |
|---|---|---|
| | The CFRAM predicted flood map indicates a potential 0.1% AEP flooding from the River Dee within the Hydrology and Flood Risk Study Area to the northwest from the footprint of the onshore substation site. The 0.1% AEP predicted flood extents for the present day, Mid-range Future Scenario (MRFS) and High-end Future Scenario (HEFS) scenarios showed minor increase in predicted flooding from River Dee within the Hydrology and Flood Risk Study Area as a result of climate change. The increase does not encroach on the permanent footprint of the onshore substation site and is considered to be negligible.<br>The 0.1% AEP predicted flood extents for the present day, MRFS and HEFS scenarios showed minor increase in predicted flooding in vicinity of onshore cable route and no new flooding as a result of climate change. The increase is considered to be negligible. | |
| **Extreme heat** | Extreme heat is rated as moderate exposure. Extreme heat events do occur in Ireland, such as in 2022 when temperatures reached 33.0 °C. In 2018 temperatures were high causing heatwaves and drought. 2006 was warmest summer ever recorded since 1995. The maximum temperature recorded between 1979 – 2010 was 28.7 °C. | 2 |
| **Extreme cold** | Extreme cold spells are rated moderate exposure. While extreme cold spells do occur in the area these are generally rare. In Ireland in 2018 there was heavy snowfall and in 2010 there was snow and a severe cold spell. | 2 |
| **Wildfire** | Low exposure to wildfires as per Table 17–25. No wildfires have been recorded in the area. | 1 |
| **Drought** | Drought is rated as low exposure. Only one recorded drought has been recorded nationally in 2018. | 1 |
| **Extreme wind** | Extreme wind is rated as high exposure. Storms occur in the area regularly. Between 1981-2010 there were an average of 8.2 days with gales (approximately 2% of the year). Given the level of exposure to high winds for the offshore works in particular, there is a high level of exposure to extreme wind conditions. | 3 |
| **Lightning and hail** | Lightning and hail are rated as high exposure. Between 1981 and 2010 there were 9.7 days of hail and the mean number of thunder days was 5.5 days equating to approximately 3% of the year on average. | 3 |
| **Fog** | Fog is rated as high exposure. Between the years 1981 and 2010 there were 41.5 days of fog on average per annum equivalent to 11% of the year. | 3 |

Based on the estimated sensitivity and exposure the vulnerability of the construction phase may be assessed and is summarised in Table 17–30.

The analysis indicates that extreme wind, coastal and fluvial flooding represent the highest vulnerabilities for the construction phase. These elements are considered in more detail under the climate risk assessment.

**Table 17–30: Vulnerability analysis for the construction phase.**

| | | Exposure | | |
|---|---|---|---|---|
| | | **Low** | **Medium** | **High** |
| **Sensitivity** | **Low** | - | - | Lightning and Hail, Fog |
| | **Medium** | Drought | Sea Level Rise, Wave Height, Extreme Heat, Extreme Cold, | - |
| | **High** | Wildfire | Flooding (Coastal), Flooding (Fluvial) | Extreme Wind |

The EU Technical Guidance on climate proofing (2021) presents a sample risk framework to assess climate risks which has been adopted for this Project to evaluate the risk associated with the hight risk hazards on the construction phase of the Project. This risk register is presented in Table 17–31.

The register shows that with the controls in place the risk to the works from flooding and extreme winds has been mitigated to reduce the likelihood of such an event having a significant adverse impact. As such, the risk of flooding (both fluvial and coastal) and extreme winds have been suitably mitigated through good working practice to reduce the risk of climate change to not significant.

In short, the vulnerability of the works to climate change has been suitably mitigated and the potential impact is considered to be **minor adverse** for the short term construction phase.

During the decommissioning phase, the potential impact is considered to be the same as outlined for the construction phase, however the vulnerability of the works to climate change should be reviewed again at the time of decommissioning.

**Table 17–31: Risk register (construction phase).**

| Risk identification | | | | | Risk assessment | | | | Significance |
|---|---|---|---|---|---|---|---|---|---|
| Risk ID | Climate variable | Risk statement | Project receptors | Impact type | Current risk and controls | Initial risk rating | | | |
| | | | | | | Likelihood | Consequence | Risk rating | |
| 1 | Flooding (Coastal) | Damage to infrastructure, flooding of works or excavations, damage to the environment and worker safety. | All assets under construction within the foreshore and onshore areas including the landfall. | Asset damage, human health, environment and financial (project delays). | The National Coastal Flood Hazard Mapping 2021 predicted flood extents indicate the 0.5% AEP and 0.1% AEP predicted coastal extents encroaching the coastline in the vicinity of the landfall location.<br>The highest 0.5% and 0.1% AEP predicted coastal flood levels in the vicinity of the landfall location is 3.58 m.AD and 3.75 m.AD respectively for northeast Coast Point 6 from the Irish Coastal Wave and Water Level Modelling Study 2018 Phase 1 – Extreme Water Levels Report, Appendix L (RPS, 2020).<br>The 0.1% AEP predicted flood extents for the present day, MRFS and HEFS scenarios showed negligible increases in predicted flooding within landfall location as a result of climate change. Hence the climate change impact is considered to be negligible. | Unlikely | Moderate | Medium | Not significant |
| 2 | Flooding (Fluvial) | Damage to infrastructure, flooding of works or excavations, damage to the environment and worker safety. | Works at the onshore substation site as well as river crossings CP1, CP2, CP3, CP4, CP7 and CP8. | Asset damage, human health, environment and financial (project delays). | The National Indicative Flood Mapping predicted flood maps indicate potential localised 1% AEP and 0.1% AEP flooding within the onshore cable route including the public road at the following locations: | Unlikely | Moderate | Medium | Not significant |

| Risk identification | | | | | Risk assessment | | | | Significance |
|---|---|---|---|---|---|---|---|---|---|
| Risk ID | Climate variable | Risk statement | Project receptors | Impact type | Current risk and controls | Initial risk rating | | | |
| | | | | | | Likelihood | Consequence | Risk rating | |
| | | | | | • Approximately 110 m southeast of CP2 – predicted flooding from Newhall Stream;<br>• Within public road and adjacent fields at crossing points no. 7 - predicted flooding from Port Stream and Ardballan Stream; and<br>• At crossing point no. 8 - predicted flooding from Salterstown Stream.<br>The 0.1% AEP predicted flood extents for the present day, MRFS and HEFS scenarios showed minor increase in predicted flooding in vicinity of onshore cable route and substation and no new flooding as a result of climate change. The increase is considered to be negligible. | | | | |
| 3 | Extreme Wind | Cranes or other elevated operations which have a high sensitivity to extreme winds. | Cranes, jibs, masts or other elevated working operations. | Asset damage, human health and financial (project delays). | The CEMP will include a procedure to manage operations to ensure no adverse impact during emergency situations such as extreme wind. As a minimum, measures will be specified to ensure that lifting operations are programmed in advance of a favourable weather window of sufficient duration to complete the works. | Unlikely | Moderate | Medium | Not significant |

## Operational and maintenance phase

The approach to assessing the climate risk associated with the operational and maintenance phase is analogous to that presented for the construction phase. While the sensitivity of the operational and maintenance phase has slight variation to the construction phase and is revised in this section, the exposure criteria apply to both phases and the exposure data presented in Table 17–29 is also applied for the operational and maintenance phase. Table 17–32 presents the sensitivity analysis and the rationale for the sensitivity score for the operational and maintenance phase of the Project.

**Table 17–32: Sensitivity analysis of climate hazards to the operational and maintenance phase of the Project.**

| Climate hazard | Sensitivity | Sensitivity score |
|---|---|---|
| **Sea level rise** | Offshore elements designed to operate within current and projected oceanic conditions. The stabilised gangway to the external platform for each WTG are designed above projected sea level rise to provide for safe access from vessels. The project design parameters for the WTGs are defined relative to Lowest Astronomical Tide which is the lowest tide level which can be predicted to occur under average meteorological conditions and under any combination of astronomical conditions. | 2 |
| **Wave height** | As above, offshore elements designed to operate within current and projected oceanic conditions. | 2 |
| **Flooding (coastal)** | Moderate sensitivity for damage to the landfall area given the known high risk in the coastal area to the north. | 2 |
| **Flooding (fluvial)** | Moderate sensitivity to fluvial flooding and only at the aforementioned river crossings CP1, CP2, CP3, CP4, CP7 and CP8 which will all be below ground with limited sensitivity to flooding. | 2 |
| **Extreme heat** | Low sensitivity to extreme heat. Potential to cause some deterioration in materials but only if occurring over long periods. | 2 |
| **Extreme cold** | Moderate sensitivity to extreme cold whereby the asset suffers limited impact but ice or snow may result in cessation of turbine operations. | 2 |
| **Wildfire** | All onshore assets are considered to have a moderate sensitivity to wildfires. Can cause some surface damage to the asset and may lead to cessation of operations with economic or social impacts. | 2 |
| **Drought** | Low sensitivity to drought on all assets. | 1 |
| **Extreme wind** | Moderate sensitivity to extreme wind as WTGs are designed to operate in north Atlantic weather conditions and the WTG are automatically turned off in high wind conditions to protect the asset. However, some damage to WTG have been recorded within the EU in recent years as a result of storms albeit very rare. | 2 |
| **Lightning and hail** | Low sensitivity to lightning and hail for all assets. | 1 |
| **Fog** | Low sensitivity to fog for all assets. Potential to affect vessel safety for maintenance. | 1 |

Based on the estimated sensitivity and exposure, the vulnerability of the operation phase is summarised in Table 17–33. The analysis indicates that extreme winds represent the highest vulnerability for the operation phase and this element is considered in more detail under the climate risk assessment.

**Table 17–33: Vulnerability analysis for the operational and maintenance phase.**

| | | Exposure | | |
|---|---|---|---|---|
| | | **Low** | **Medium** | **High** |
| Sensitivity | **Low** | - | - | Lightning and Hail, Fog |
| | **Medium** | Drought, Wildfire | Sea Level Rise, Wave Height, Extreme Heat, Extreme Cold, Flooding (Fluvial), Flooding (Coastal) | Extreme Wind |
| | **High** | - | - | - |

This risk register for the operational and maintenance phase is presented in Table 17–34 and shows that with the committed design measures in place, the risk of adverse climate change impact on the Project is low. In short, the vulnerability of the operational and maintenance phase to climate change has been suitably mitigated and the potential impact is considered to be **minor adverse** in the long-term.

**Table 17–34: Risk register (operational and maintenance phase).**

| Risk identification | | | | | Risk assessment | | | | Significance |
|---|---|---|---|---|---|---|---|---|---|
| Risk ID | Climate variable | Risk statement | Project receptors | Impact type | Current risk and controls | Initial risk rating | | | |
| | | | | | | Likelihood | Consequence | Risk rating | |
| 4 | Extreme Wind | WTGs or other elevated infrastructure which have a high sensitivity to extreme winds causing damage and/or collapse. | Wind Turbines and associated above ground infrastructure | Asset damage and loss of generating potential | All WTG and associated infrastructure will be designed in accordance with IEC 61400-3-1 which outlines the minimum design requirements for fixed offshore wind turbines. This includes an assessment of current wind conditions and the appropriate design measures to mitigate against turbine failure. | Unlikely | Moderate | Medium | Not significant |

### 17.10.4 Mitigation and residual effects

The assessment of impacts has concluded that there are no significant adverse effects with the implementation of the measures included in the Project. Therefore, no measures over those outlined in section 17.8.2 are required.

With the implementation of the measures included in the Project , the residual effects are as outlined in the assessment provided in section 17.10.

### 17.10.5 Future monitoring

It is recommended that the One Click LCA, or similar carbon recording, is developed through the detailed design, procurement, and construction phases to allow the design team and contractor to make informed choices on the materials/activities required for the Project and to allow for a recording of the final footprint of the Project. Table 17–35 outlines the proposed monitoring commitments for climate.

**Table 17–35: Monitoring commitments for climate.**

| Environmental effect | Monitoring commitment |
|---|---|
| Construction GHG | The contractor will be required to measure and record all activity data (fuel use, material use, transport, etc.) to allow for the development of a carbon footprint for the construction phase of the Project. This requirement will be implemented as part of the CEMP. |

## 17.11 Cumulative Impact Assessment (CIA)

### 17.11.1 Methodology

The Cumulative Impact Assessment (CIA) takes into account the impact associated with the Project together with other projects. The selected as relevant to the CIA presented within this chapter are based upon the results of a screening exercise (see volume 2A, appendix 3-1: CIA Screening Annex). Each project has been considered on a case-by-case basis for screening in or out of this chapter's assessment based upon data confidence, effect-receptor pathways and the spatial/temporal scales involved.

The approach to CIA examines the effects of the Project alongside the following other offshore renewable energy projects in the Climate Study Area (i.e. nationally):

- Other projects with consent but not yet constructed/construction not completed:
- Other projects in a consent application process but not yet determined (including planning applications, foreshore lease/licence applications, Dumping at Sea Permit applications;
- Other projects currently operational that were not operational when baseline data were collected, and/or those that are operational but have an ongoing impact; and
- Projects, which satisfy the definition of ‘relevant maritime usage’ under the Maritime Area Planning Act (2021) (i.e. wind farm projects designated as ‘Relevant Projects’ or ‘Phase 1 Projects’) including Arklow Bank II, Bray Bank and Kish Bank; North Irish Sea Array, Codling Wind Park (I and II), Sceirde Rock Wind Farm.

The specific projects scoped into this CIA, are outlined in Table 17–36.

**Table 17–36: List of other projects considered within the CIA.**

| Project | Status | Distance from offshore wind farm area (km) | Distance from offshore cable corridor (km) | Description of Project/Plan | Dates of construction (if applicable) | Dates of operation (if applicable) | Overlap with Project |
|---|---|---|---|---|---|---|---|
| North Irish Sea Array (NISA) | Maritime Area Consent | 16.2 | 18.1 | EIA Scoping Report (2021) refers to the construction of an offshore wind farm of up to 500 MW, consisting of 36 turbines with a maximum height of 320 m and rotor diameter of up to 290 m. Offshore substation platforms may be required.[11] | Unknown | Unknown (Design life minimum 35 years) | This project has the potential to indirectly reduce GHG emissions and therefore has potential for positive impacts on climate within the Climate Study Area. |
| Dublin Array | Maritime Area Consent | 61.2 | 56.9 | Scoping report (2020) refers to the construction of Bray and Kish offshore wind farm of up to 900 MW, consisting of up to 61 turbines with a maximum height of 308 m and rotor diameter of up to 285 m and up to three offshore substation platforms.[12] | Unknown | Unknown (Design life minimum 35 years) | This project has the potential to indirectly reduce GHG emissions and therefore has potential for positive impacts on climate within the Climate Study Area. |
| Codling Wind Park | Maritime Area Consent | 61.4 | 57.1 | EIA Scoping report (2020) refers to the construction of an offshore wind farm of up to 1500 MW, consisting of up to 140 turbines with a maximum height of 320 m and rotor diameter of up to 288 m. The project will also contain up to five offshore substation platforms.[13] | Unknown | Unknown (Design life minimum 35 years) | This project has the potential to indirectly reduce GHG emissions and therefore has potential for positive impacts on climate within the Climate Study Area. |
| Arklow Bank Wind Park Phase 1 | Operational | 107.1 | 104.6 | Phase 1 was the first operational offshore wind farm in Ireland and consists of seven wind turbines with a capacity of 25.2 MW. | – | 2003 – ongoing | This project indirectly reduces GHG emissions and therefore has potential for positive impacts on climate within the Climate Study Area. |

[11] Project website https://northirishseaarray.ie/: states that wind farm will consist of 35 to 46 turbines.

[12] Project website: https://dublinarray.com/project-information/key-facts/: states between 39 and 50 turbines (total project capacity 824 MW) individual tip heights between approx. 270 m and 310 m.

[13] Project website: https://codlingwindpark.ie/the-project/: states max energy output 1300 MW, 100 turbines, turbine tip height max 320 m.

| Project | Status | Distance from offshore wind farm area (km) | Distance from offshore cable corridor (km) | Description of Project/Plan | Dates of construction (if applicable) | Dates of operation (if applicable) | Overlap with Project |
|---|---|---|---|---|---|---|---|
| Arklow Bank Wind Park Phase 2 | Maritime Area Consent | 107.1 | 104.6 | EIA Scoping Report: The project will include between 37 and 56 turbines ad up to two Offshore Substation Platforms (OSP) and foundation substructures. The area in which the proposed wind turbines, inter-array cables and OSP(s) will be located on Arklow Bank covers an area of seabed approximately 64km2.[14] | Unknown | Unknown (Design life minimum 35 years) | This project has the potential to indirectly reduce GHG emissions and therefore has potential for positive impacts on climate within the Climate Study Area. |
| Sceirde Rocks Windfarm | Maritime Area Consent | 259.3 | 248.4 | Project website:[15] The Sceirde Rocks Windfarm is a proposed offshore wind project, located off the Connemara coast in County Galway. It is expected to generate 450 Megawatts | Unknown | Unknown (Design life minimum 35 years) | This project has the potential to indirectly reduce GHG emissions and therefore has potential for positive impacts on climate within the Climate Study Area. |

[14] Project website https://www.sserenewables.com/: states between 36 and 60 turbines (up to 800MW) along with one to two OSS and foundation substructures, a network of inter-array cabling and two offshore export cables.

[15] https://www.sceirderockswindfarm.com/project-info/.

Table 17–37 presents the relevant project design parameters from Table 17–14, which are used to assess the potential cumulative impact of the Project with the other projects identified in Table 17–36 (where information is available).

**Table 17–37: Project design parameters considered for the assessment of potential impacts on climate.**

| Potential impact | Phase | | | Project design parameters | Justification |
|---|---|---|---|---|---|
| | C | O | D | | |
| Direct Greenhouse Gas Emissions | ✓ | ✓ | ✓ | Project design parameters as described for the Project assessed cumulatively with the following other projects:<br>• North Irish Sea Array (NISA)<br>• Dublin Array<br>• Codling Wind Park<br>• Arklow Bank Wind Park<br>• Sceirde Rocks Windfarm | Maximum potential for cumulative effects of emissions to atmosphere during construction and decommissioning phases. |
| Indirect Greenhouse Gas Emissions | × | ✓ | × | | Outcome of the CIA will be greatest when the greatest number of other schemes are considered operating at full capacity. |
| Climate Vulnerability | ✓ | ✓ | ✓ | | The construction, operation and decommissioning of these onshore and offshore infrastructure elements and the PDE scale. |

C = Construction, O = Operational and maintenance, D = Decommissioning.

## 17.11.2 Assessment of significance

A description of the significance of cumulative effects upon climate receptors arising from each identified impact is provided in the following sections.

### Direct and indirect greenhouse gas emissions

For each of the identified projects there is potential for cumulative GHG emissions through the following phases:

- Construction phase direct generation of GHG through the use of materials, transport of materials/personnel and the use of construction plant. The extent of these construction phase impacts are largely related to the scale of the construction site coupled with the nature of the materials employed; and
- Indirect reduction of GHG emissions through the operation phases whereby these renewable projects will offset the combustion of fossil fuels for the production of electricity. Again, the extent of the indirect emission reductions are related to the installed capacity of each of the developments.

Each of the above are presented in the following sections.

#### Construction phase

During the construction phase each project's GHG impacts may be partially mitigated through sustainable material choices and construction methods. As such, the cumulative impact of all; projects is predicted to have a moderate adverse impact on climate which is considered significant in EIA terms.

Overall, the magnitude of the impact is deemed to be medium and the sensitivity of the receptor is considered to be medium. The effect of construction will, therefore, be of a **moderate adverse** impact, which is significant in EIA terms.

#### Operational and maintenance phase

A significant cumulative loss of $SF_6$ from one or more of these projects has the potential for a minor adverse cumulative impact on climate which is considered not significant.

Other GHG emissions are associated with the operational and maintenance phase of the project include material replacement and refurbishment of the WTG's and use of vessels. These measures may be partially mitigated through good practice design and are considered to have a minor adverse cumulative impact on climate which is considered not significant.

Overall, the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The direct effect of operation and maintenance will, therefore, be of **a minor adverse** impact, which is not significant in EIA terms.

### Decommissioning phase

The predicted emissions from decommissioning of all projects includes the transport of materials and personnel and construction/decommissioning activities. The combined impact is predicted to have a minor adverse impact on climate which is considered not significant .

Overall, the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The effect of decommissioning will, therefore, be of **a minor adverse impact,** which is not significant in EIA terms.

## Indirect greenhouse gas emissions

### Operational and maintenance phase

The combined renewable energy projects have the capacity to cumulatively reduce GHG emissions from the current electricity generating sector for the operational lifetime of each project. As such, the net impact of each project individually and combined will be a net reduction in GHG emissions whereby the operational reductions more than offset the construction, operation and decommissioning emissions. As such, the cumulative impact of all projects is predicted to have a net major beneficial impact on climate which is considered significant.

Overall, the magnitude of the impact is deemed to be high and the sensitivity of the receptor is considered to be medium. The indirect effect will, therefore, be of **major beneficial significance**, which is significant in EIA terms and more than offsets the direct carbon losses reported for the construction stage.

#### Mitigation and residual effect

No mitigation is proposed and therefore residual effects are as outlined above.

### Future monitoring

No future monitoring proposed for this parameter on a cumulative level.

## Climate vulnerability

### Construction and decommissioning phases

The vulnerability of the works to climate change has been suitably mitigated and the potential impact is considered **to be minor adverse** for the short-term construction and decommissioning phase (Table 17–30).

With the standard construction and decommissioning procedures and controls in place, the risk to the works on each project from climate hazards may be suitably mitigated to reduce the likelihood of such an event having a significant adverse impact. As such, the cumulative vulnerability of the works on all projects to climate change may be suitably mitigated and the potential impact is considered to be **minor adverse** for the short term of each construction phase.

### Operational and maintenance phase

The vulnerability of the works to climate change has been suitably mitigated and the potential impact is considered to be minor adverse for the short-term construction phase (Table 17–33).

For all projects, the WTG and associated infrastructure will be designed in accordance with IEC 61400-3-1 which outlines the minimum design requirements for fixed offshore wind turbine. With these committed design measures in place, the risk of adverse climate change impact on the operation phase of the projects is low. In short, the cumulative vulnerability of the operational phases of the projects to climate change has been suitably mitigated and the potential impact is considered to be **minor adverse** in the long-term.

### Mitigation and residual effect

No mitigation proposed.

### Future monitoring

No future monitoring proposed for this parameter on a cumulative level.

## 17.12 Transboundary effects

The increase in direct GHG emissions will not result in significant transboundary effects with regard to climate from the Project upon the interests of other EEA States or within the UK. However, the changes in national GHG emissions predicted for the Project and cumulatively with the other offshore renewable projects, will lead to a net reduction in global GHG emissions from electricity generation. This is considered a slight beneficial transboundary impact.

## 17.13 Interactions

A description of the likely inter-related effects arising from the Project on climate is provided in volume 2C, chapter 32: Interactions.

## 17.14 Summary of impacts, mitigation measures and residual effects

Information on climate was established from desk studies. Table 17–38 presents a summary of the potential impacts, mitigation measures and residual effects in respect to climate. Table 17–39 presents a summary of the potential cumulative impacts, mitigation measures and residual effects.

As set out in detail in this chapter the following is concluded in relation to the potential for the Project to have a significant effect on climate:

- The total estimated direct GHG emissions associated with the construction of the Project are calculated at 347,882 tonnes of $CO_{2eq}$ which will result in a **moderate adverse** impact;
- Any direct operational loss of $SF_6$ may be mitigated through ‘good practice’ measures and the impact is predicted to have a **minor adverse** impact on climate which is considered not significant;
- Direct emissions associated with the operational and maintenance phase of the project equate to 1,277 tonnes of $CO_{2eq}$ per annum on average and the impact is considered to have a **minor adverse** impact on climate which is considered not significant;
- Indirect climate effects will arise as a result of the Project potentially reducing the generation of fossil fuel emissions at gas, peat and coal powered plants across the State. The Project has the potential to displace approximately 489,300 tonnes of $CO_{2eq}$ from the largely carbon-based traditional energy mix in the national grid per annum (based on the 2021 grid). As such, the Project is predicted to have a have a net **major beneficial** impact on climate which is considered significant;
- The vulnerability of the construction or decommissioning works to climate change has been suitably mitigated and the potential impact is considered to be **minor adverse** for the short term construction phase; and
- The vulnerability of the operational phase to climate change has been suitably mitigated and the potential impact is considered to be **minor adverse** in the long-term.

The cumulative impacts assessed include: direct greenhouse gas emissions, indirect gas emissions and climate vulnerability.

Overall, no potential significant transboundary impacts have been identified in regard to effects on climate for the Project.

**Table 17–38: Summary of potential environment effects, mitigation and monitoring.**

| Description of impact | Phase C | Phase O | Phase D | Measures included in the project | Significance of effect | Further measures | Residual effect | Proposed monitoring |
|---|---|---|---|---|---|---|---|---|
| Direct emissions of Greenhouse Gases | ✓ | ✓ | ✓ | None | C: Moderate adverse<br>O: Minor adverse<br>D: Minor adverse | N/A | C: Moderate adverse<br>O: Minor adverse<br>D: Minor adverse | As part of the CEMP, the contractor will be required to measure and record all activity data (fuel use, material use, transport, etc.) to allow for the development of a carbon footprint for the construction phase of the Project. |
| Indirect emissions of Greenhouse Gases | × | ✓ | × | None | O: Beneficial | N/A | O: Beneficial | None |
| Climate Vulnerability | ✓ | ✓ | ✓ | **Construction and decommissioning phase**<br>The 0.1% AEP predicted flood extents for the present day, Mid-range Future Scenario (MRFS) and High-end Future Scenario (HEFS) scenarios showed minor increase in predicted flooding from River Dee within the Hydrology and Flood Risk Study Area as a result of climate change. The increase does not encroach on the permanent footprint of the onshore substation site and is considered to be negligible.<br>The National Indicative Flood Mapping (NIFM) predicted flood maps indicate potential localised 1% AEP and 0.1% AEP flooding within the onshore cable route including the public road at the following locations:<br>• Approximately 110 m southeast of CP2 – predicted flooding from Newhall Stream;<br>• Within public road and adjacent fields at crossing points no. 7 - predicted flooding from Port | C: Minor adverse<br>O: Minor adverse | N/A | C: Minor adverse<br>O: Minor adverse | None |

| Description of impact | Phase C O D | Measures included in the project | Significance of effect | Further measures | Residual effect | Proposed monitoring |
|---|---|---|---|---|---|---|
| | | Stream and Ardballan Stream; and<br>• At crossing point no. 8 - predicted flooding from Salterstown Stream.<br>The 0.1% AEP predicted flood extents for the present day, MRFS and HEFS scenarios showed minor increase in predicted flooding in the vicinity of onshore cable route and no new flooding as a result of climate change. The increase is considered to be negligible.<br>The CEMP will include an Emergency Response Plan to plan and manage operations to ensure no adverse impact during emergency situations such as extreme wind. As a minimum, measures will be specified to ensure that lifting operations are programmed in advance of a favourable weather window of sufficient duration to complete the works.<br>**Operational and maintenance phase**<br>All WTG and associated infrastructure will be designed in accordance with IEC 61400-3-1 which outlines the minimum design requirements for fixed offshore wind turbines. This includes an assessment of current wind conditions and the appropriate design measures to mitigate against turbine failure. | | | | |

**Table 17–39: Summary of potential cumulative environment effects, mitigation and monitoring.**

| Description of impact | Phase C | Phase O | Phase D | Measures included in the project | Significance of effect | Further measures | Residual effect | Proposed monitoring |
|---|---|---|---|---|---|---|---|---|
| Direct emissions of Greenhouse Gases | ✓ | ✓ | ✓ | None | C: Moderate adverse<br>O: Minor adverse<br>D: Minor adverse | N/A | C: Moderate adverse<br>O: Minor adverse<br>D: Minor adverse | As part of the CEMP, the contractor will be required to measure and record all activity data (fuel use, material use, transport, etc.) to allow for the development of a carbon footprint for the construction phase of the Project. |
| Indirect emissions of Greenhouse Gases | × | ✓ | × | None | O: Major beneficial | N/A | O: Major beneficial | None |
| Climate Vulnerability | ✓ | ✓ | ✓ | **Construction and decommissioning phase:**<br>The 0.1% AEP predicted flood extents for the present day, Mid-range Future Scenario (MRFS) and High-end Future Scenario (HEFS) scenarios showed minor increase in predicted flooding from River Dee within the Hydrology and Flood Risk Study Area as a result of climate change. The increase does not encroach on the permanent footprint of the onshore substation site and is considered to be negligible.<br>The National Indicative Flood Mapping (NIFM) predicted flood maps indicate potential localised 1% AEP and 0.1% AEP flooding within the onshore cable route including the public road at the following locations:<br>• Approximately 110 m southeast of CP2 – predicted flooding from Newhall Stream; | C: Minor adverse<br>O: Minor adverse | N/A | C: Minor adverse<br>O: Minor adverse | None |

| Description of impact | Phase C O D | Measures included in the project | Significance of effect | Further measures | Residual effect | Proposed monitoring |
|---|---|---|---|---|---|---|
| | | • Within public road and adjacent fields at crossing points no. 7 - predicted flooding from Port Stream and Ardballan Stream; and<br>• At crossing point no. 8 - predicted flooding from Salterstown Stream<br>The 0.1% AEP predicted flood extents for the present day, MRFS and HEFS scenarios showed minor increase in predicted flooding in vicinity of onshore cable route and no new flooding as a result of climate change. The increase is considered to be negligible.<br>The CEMP will include an Emergency Response Plan to plan and manage operations to ensure no adverse impact during emergency situations such as extreme wind. As a minimum, measures will be specified to ensure that lifting operations are programmed in advance of a favourable weather window of sufficient duration to complete the works.<br><br>**Operational and maintenance phase:**<br>All WTG and associated infrastructure will be designed in accordance with IEC 61400-3-1 which outlines the minimum design requirements for fixed offshore wind turbines. This includes an assessment of current wind conditions and the appropriate design measures to mitigate against turbine failure. | | | | |

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