



Cush Wind Farm
Phase II

Environmental Impact Assessment Report

Chapter 9: Climate

Cush Wind Limited

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9.1 INTRODUCTION

This chapter comprises an assessment of the likely significant effect on climate associated with the proposed project.

The project site is located in rural Co. Offaly, approximately 4km north of the town of Birr and c. 28km south-west of Tullamore, Co. Offaly.

The project assessed within this EIAR comprises a 3 no. wind turbine extension to the permitted Cush Wind Farm Phase I, together with all associated and ancillary infrastructure and works. This includes turbine foundations, crane hardstanding areas, access tracks, internal wind farm underground cabling, site drainage and rehabilitation works, peat/spoil management, a proposed electrical switch room building, and c.5km of underground electricity line to connect the proposed wind farm to the national electricity network at the proposed Mullanafawnia 110kV substation.

The turbine component haul route and associated temporary and permanent upgrade works as described in **Chapter 3**, are located within Counties Galway, Roscommon, Westmeath and Offaly. Turbine components will be transported from the Port of Galway to the project site via the N6, M6, N52 and N62, before accessing the project site from the permitted construction phase site entrance from the N62 national road.

A full detailed description of the project is presented in **Chapter 3**.

This chapter assesses the project's greenhouse gas emissions and its vulnerability to climate change during the construction, operation and decommissioning phases. Where required, appropriate mitigation measures to minimise significant adverse climate impacts are recommended.

The climate assessment comprises two elements:

- Greenhouse gas emissions assessment (GHGA) – Assesses the GHG emissions from a project over its lifetime. The assessment compares these emissions to relevant carbon budgets, targets, and policy to contextualise magnitude.
- Climate change risk assessment (CCRA) – Identifies the impact of a changing climate on a project and receiving environment. The assessment considers a project's vulnerability to climate change and identifies adaptation measures to increase project resilience.

9.2 EXPERTISE AND QUALIFICATIONS

This chapter was compiled by Mobin Ud Din. Mobin Ud Din is a Senior Climate Consultant in the Climate and Air Quality team at Awn Consulting, a Trinity Consultants Company. He holds a BE in Environmental Engineering from the National University of Sciences and Technology, Pakistan, and an MSc in Transition, Innovation and Sustainability Environments from University College Dublin. He has over five years of experience in climate change, sustainability and environmental management. Mobin specialises in climate and carbon assessment, including greenhouse gas and lifecycle assessment, climate change risk assessment and coordination of climate inputs to Environmental Impact Assessment Reports. He has experience delivering climate assessments for large scale infrastructure, transport and built environment projects, with detailed knowledge of Irish climate policy and guidance, including TII climate standards and the Climate Action and Low Carbon Development Acts.

This chapter was also compiled by Ciara O'Connor. Ciara O'Connor is a Junior Environmental Consultant in the Air Quality and Climate section of AWN Consulting, a Trinity Consultants Company. She holds a BSc in Environmental Science from University College Cork. She has completed air quality and climate impact assessments as part of EIARs for residential developments and renewable energy developments.

This chapter was reviewed by Sarah Berry. Sarah is a Principal Climate Consultant in the Air Quality & Climate section of AWN Consulting, a Trinity Consultants Company. Sarah holds a BSc in Physical Geography from the University of Leeds. She has 9 years' experience in climate change and sustainability, with expertise in greenhouse gas permitting, accounting and verification. Her experience includes conducting strategic sector-specific GHG audits across a range of industries (data centres, industrial facilities, hospitals, manufacturing, power stations and airports). She has prepared climate chapters for EIARs for proposed developments across Ireland including large residential developments, windfarms, industrial developments and wastewater treatment works.

9.3 METHODOLOGY

9.3.1 LEGISLATION, POLICY AND GUIDANCE

In common with all environmental legislation, in Ireland climate legislation is driven primarily by international agreements or European Directives that are then transcribed into domestic law by the Government of Ireland. This is then interpreted through European and domestic policy instruments that clarify aspects, objectives, targets and requirements described in the legislation.

9.3.1.1 Legislation

The United Nations Paris Agreement (United Nations, 2015) treaty binds signatory nations to a commitment to hold global average temperature increase well below 2°C above pre-industrial levels with efforts to limit the increase to 1.5°C above pre-industrial levels. Signatories commit to Nationally Determined Contributions (NDCs) which are self-defined climate pledges made by countries in response to climate change, which also includes the direction of finance. Adaptation to the adverse impacts of climate change and lowering greenhouse gas emissions should be undertaken in an equitable manner so as not to disadvantage populations on lower incomes or those most at risk from climate change.

Regulation (EU) 2026/667 of the European Parliament and of the Council of 11 March 2026 amends Regulation (EU) 2021/1119 as regards the setting of a Union intermediate climate target for 2040. It establishes a binding Union-wide target of a 90% net reduction in greenhouse gas emissions by 2040 compared with 1990 levels. These targets are also applied to member states.

Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (European Parliament and Council, 2014) acknowledges that climate change will play a crucial role in the sustainable development of society. Directive 2014/52/EU requires assessment of the impact of specific types of new development on the climate. There is a requirement for the quantification of greenhouse gases from a development, and an assessment of the risk posed to specific types of new development by the adverse effects of climate change.

The Climate Action and Low Carbon Development Act 2015 (Government of Ireland, 2015) enables Ireland 'to pursue, and achieve, the transition to a low carbon, climate resilient and environmentally sustainable economy by the end of the year 2050'. This is referred to in the 2015 Act (as amended) as the 'national transition objective'. The 2015 Act (as amended) made provision for a national mitigation plan, and a national adaptation framework. In addition, the Act provided for the establishment of the Climate Change Advisory Council with the function to advise and make recommendations on the preparation of the national mitigation and adaptation plans and compliance with existing climate obligations.

Section 15 of the 2015 Act, sets out the duties imposed by certain bodies, including local authorities and An Coimisiún Pleanála. This section was amended by the 2021 Act and states:

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

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

The Climate Action and Low Carbon Development (Amendment) Act 2021 (Government of Ireland, 2021) provides the framework for Ireland to achieve a climate resilient and climate neutral economy by the end of the year 2050. The Act allows for the setting of carbon budgets and sectoral emissions ceilings to apply to sectors of the economy whilst promoting climate justice and just transition to the climate resilient and climate neutral economy. The Act provides for the establishment of carbon budgets and sectoral emissions ceilings to support the achievement of Ireland's national climate objective. The Climate Action and Low Carbon Development (Amendment) Act 2021 should be read together with the Climate Action and Low Carbon Development Act 2015, and together are referred to in this report as the "Climate Act".

9.3.1.2 Policy

The European Green Deal published by the European Commission in December 2019, provides an action plan which aims for the EU to achieve climate neutrality by 2050. The EU Green Deal highlights a reduction in emissions of 55% in comparison to 1990 levels by 2030 and 90% by 2040. The deal outlines plans for a just and fair transition to a climate neutral society through funding and social investment, carbon pricing, the Emissions Trading Scheme, green industry, the circular economy and stakeholder engagement in the processes at every level.

The 2021 EU Strategy on Adaptation to Climate Change (European Commission, 2021a) sets out the pathway to prepare for the unavoidable impacts of climate change. The aim is that "by 2050, when we aim to have reached climate neutrality, we will have reinforced adaptive capacity and minimised vulnerability to climate impacts..."

The latest iteration of the Government of Ireland's *Climate Action Plan* ('CAP25') (Government of Ireland, 2025a) was published in 2025 updating many of the suggested measures and actions required to achieve carbon budgets and sectoral emissions ceilings from CAP24, (Government of Ireland, 2024a). Both CAP24 and CAP25 should be read together. The plans taken together provide the roadmap for halving Ireland's emissions by 2030 and achieving carbon neutrality by 2050. The CAP25 advances sector-specific measures including decarbonising the residential building sector. This includes the complete phase-out of fossil fuel heating for both new builds and retrofits. CAP25 details the 5-year carbon budget periods, shown in **Table 9.1**, and the Sectoral Emissions Ceilings, shown in **Table 9.2**, as required by the Climate Act.

Budget Period	Carbon Budget	Reduction Required
2021-2025	295 Mt CO ₂ e	Reduction in emissions of 4.8% per annum for the first budget period.
2026-2030	200 Mt CO ₂ e	Reduction in emissions of 8.3% per annum for the second budget period.
2031-2035	151 Mt CO ₂ e	Reduction in emissions of 3.5% per annum for the third provisional budget.

Table 9.1 Carbon Budgets for the CAP25 5-Year Periods

Sector	Baseline (Mt CO ₂ e)	Carbon Budgets (Mt CO ₂ e)		2030 Emissions (Mt CO ₂ e)	Indicative Emissions % Reduction in Final Year of 2025- 2030 Period (Compared to 2018)
	2018	2021- 2025	2026- 2030		
Electricity	10	40	20	3	75
Transport	12	54	37	6	50
Built Environment - Residential	7	29	23	4	40
Built Environment - Commercial	2	7	5	1	45
Industry	7	30	24	4	35
Agriculture	23	106	96	17.25	25
Other (F-gases, waste, petroleum refining)	2	9	8	1	50
Land Use, Land-use Change and Forestry (LULUCF)	5	Reflecting the continued volatility for LULUCF baseline emissions to 2030 and beyond, a new approach aligned with the EU LULUCF Regulation has been adopted.			
Total	68				
Unallocated Savings	-	-	26	-5.25	-

Sector	Baseline (Mt CO ₂ e)	Carbon Budgets (Mt CO ₂ e)		2030 Emissions (Mt CO ₂ e)	Indicative Emissions % Reduction in Final Year of 2025- 2030 Period (Compared to 2018)
	2018	2021- 2025	2026- 2030		
Legally Binding Carbon Budgets and 2030 Emission Reduction Targets	-	295	200	-	51

Table 9.2: CAP25 Sectoral Emission Ceilings for 2030

The Long-Term Strategy on Greenhouse Gas Emissions Reductions (Government of Ireland, 2023) provides the indicative pathways beyond 2030 on how Ireland will transition towards carbon neutrality by 2050. The strategy is intended to bridge the gap between the short-term objectives of the Climate Action Plans and the longer-term objectives of EU Climate Law and Ireland's National Climate Objective.

The National Planning Framework (First Revision) (Government of Ireland, 2025b) specifies policies relevant for the proposed project:

- **National Policy Objective 69:** Reduce our carbon footprint by integrating climate action into the planning system in support of national targets for climate policy mitigation and adaptation objectives, as well as targets for greenhouse gas emissions reductions as expressed in the most recently adopted carbon budgets.
- **National Policy Objective 70:** Promote renewable energy use and generation at appropriate locations within the built and natural environment to meet national objectives towards achieving a climate neutral economy by 2050.
- **National Policy Objective 71:** Support the development and upgrading of the national electricity grid infrastructure, including supporting the delivery of renewable electricity generating development.

9.3.1.3 Climate Change Vulnerability Policy

The Second National Adaptation Framework (NAF) (Government of Ireland, 2024b) outlines a comprehensive, whole-of-government and whole-of-society approach to climate adaptation. Its core objective is to enhance Ireland's resilience to a wide range of climate risks, including extreme weather events, flooding, drought, biodiversity loss, sea level rise, and rising temperatures. The NAF sets out the roles of the Taoiseach, Government and non-governmental organisations, incorporates an evidence base for climate change and incorporates sectoral and local requirements and indicators for adaptation planning.

In relation to the built environment, the NAF states in Chapter 3, "deepening of adaptation considerations in the planning and building standards processes is considered the most appropriate way of increasing the resilience of the built environment". Within the NAF it mentions that there is a risk of damage to buildings and structures from severe weather events such as high winds and intense rainfall. New development should accommodate predicted future climate change impacts without requiring major redesign or redevelopment in the future, which may be costly and inefficient. This will require facilitating innovative building design, new materials and standards (to accommodate hotter summers while withstanding changes in precipitation patterns and more intense storms for example).

The *National Climate Change Risk Assessment (NCCRA)* (Environmental Protection Agency, 2025) was required as part of the 2021 CAP. The NCCRA approached the risk assessment through:

- **Hazard** - the potential occurrence of a natural or human-induced physical event or trend or physical impact that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems, and environmental resources
- **Exposure** - the presence of people, livelihoods, species or ecosystems, environmental functions, services, and resources, infrastructure, or economic, social, or cultural assets in places and settings that could be adversely affected
- **Sensitivity** - refers to the degree to which a system or asset is affected by climate hazards. It reflects how vulnerable something is to changes such as temperature extremes, flooding, or drought, based on its physical, functional, or ecological characteristics
- **Vulnerability** - the propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts including sensitivity
- **Risk** - the potential for adverse consequences for human or ecological systems

Compilation of the NCCRA was undertaken using scenarios from the fifth *Intergovernmental Panel on Climate Change Assessment Report (AR5)*. The NCCRA used a high concentration scenario resulting in a predicted average global temperature increase of 4.3°C by 2100 (RCP8.5) generally accepted as an extreme worst-case scenario, and a moderate scenario (RCP4.5) where emissions are predicted to peak by 2040 and then decline resulting in an average global temperature increase of between 2.5°C and 3°C. Both scenarios are considered conservative for Ireland as they assume that emissions targets are not met.

9.3.2 LOCAL POLICY

The *Offaly County Council (OCC) Climate Action Plan 2024–2029* (Offaly County Council (OCC), 2024) outlines Offaly County Council's strategic approach to climate mitigation, adaptation and biodiversity enhancement, with a stated vision to achieve a climate resilient, biodiversity rich, environmentally sustainable and climate neutral economy no later than 2050. The Plan is structured around six thematic focus areas: Governance and Leadership; Built Environment; Transport; Natural Environment and Green Infrastructure; Community Resilience and Transition; and Sustainability and Resource Management.

Renewable energy and decarbonisation objectives relevant to the proposed wind farm are addressed through the *Offaly County Development Plan 2021–2027*, which includes a County Wind Energy Strategy. This strategy sets a wind energy target of 466.3 MW by the end of the plan period.

Specific policy actions and measures relevant to renewable energy development include:

- **G1.2.1:** Promote and support carbon adaptation and mitigation policies, objectives and standards of the Offaly County Development Plan 2021–2027, having due regard to environmental sensitivities such as European sites, biodiversity, air and water quality.
- **G1.4.5:** Continue to utilise and promote EU Just Transition funding through the mechanisms of each available pillar and call.

- **C5.3.1:** Support the North Offaly Development Fund to promote Rhode Business Park – 13 serviced sites with access to National Grid and encourage energy companies and companies testing new technologies to avail of the facilities.
- **C5.3.2:** Support the Junction Business Innovation Centre, Tullamore – Coworking hub for businesses developing Green Energy Technologies, Software and Design businesses.
- **S6.1.4–S6.1.6:** Seek funding for geothermal mapping, a county-wide energy master plan and investigation of district heat networks – all of which reflect the Council's wider support for low carbon energy transition.

The OCC Climate Action Plan also identifies severe windstorms, river flooding (fluvial flooding), and heatwave amongst the most frequent climate hazard events in the past. They have also identified heavy snowfall, cold spell, pluvial flood, river flood, and windstorm as hazards that impact the county on a moderate level. The plan expects pluvial and fluvial flooding to have a major impact on the county in the future.

9.3.2.1 Guidance

The following guidance is considered relevant to this assessment:

- *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* (hereafter referred to as the EPA Guidelines) (Environmental Protection Agency, 2022)
- *Environmental Impact Assessment of Projects – Guidance on the Preparation of the Environmental Impact Assessment Report* (hereafter referred to as the EU Guidance) (European Commission, 2017)
- *Transport Infrastructure Ireland (TII) PE-ENV-01104: Climate Guidance for National Roads, Light Rail and Rural Cycleways (Offline & Greenways) – Overarching Technical Document* (Transport Infrastructure Ireland, 2022);
- *Transport Infrastructure Ireland (TII) GE-ENV-01106: TII Carbon Assessment Tool for Road and Light Rail Projects and User Guidance Document* (Transport Infrastructure Ireland, 2025)
- *Institute of Sustainability and Environmental Professionals (ISEP) (formerly known as Institute of Environmental Management & Assessment (IEMA)) Environmental Impact Assessment Guide to: Assessing GHG Emissions and Evaluating their Significance Edition 2.1* (hereafter referred to as the ISEP 2026 GHG Guidance) (Institute of Sustainability & Environmental Professionals, 2026);
- *ISEP Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation* (hereafter referred to as the ISEP 2020 EIA Guide) (Institute of Sustainability & Environmental Practitioners, 2020a)
- *ISEP GHG Management Hierarchy* (hereafter referred to as the ISEP 2020 GHG Management Hierarchy) (Institute of Sustainability & Environmental Practitioners, 2020b)
- *Carbon Management in Infrastructure and Built Environment - PAS 2080* (The British Standards Institution, 2023)
- *Technical Guidance on the Climate Proofing of Infrastructure in the Period 2021-2027* (European Commission, 2021b)

9.3.3 GREENHOUSE GAS ASSESSMENT

9.3.3.1 Construction Phase

The assessment of GHG emissions resulting from the construction phase is quantified using the categories described in BS EN 15978. These are:

- Product Stages (Category A1 to A3)

The carbon emissions generated at this stage arise from extracting the raw materials from the ground, their transport to a point of manufacture and then the primary energy used (and associated carbon impacts that arise) from transforming the raw materials into construction products.

- Construction (Category A4 to A5)

These carbon impacts arise from transporting the construction products to site, and their subsequent processing and assembly into the building.

- Use Stage (Category B1 to B7)

This covers a wide range of sources from the GHG emissions associated with the operation of the building (B1), maintenance (B2), repair (B3), refurbishment (B4) and replacement (B5) of materials, and operational energy use (B6) and water use (B7).

- End of Life Stages (Category C1 to C4)

The eventual deconstruction and disposal of the existing building at the end of its life takes account of the on-site activities of the demolition contractors. No “credit” is taken for any future carbon benefit associated with the reuse or recycling of a material into new products.

PE-ENV-01104 (Transport Infrastructure Ireland, 2022) recommends the calculation of the construction phase embodied carbon using the TII Online Carbon Tool or an appropriate alternative tool. Embodied carbon refers to the sum of the carbon needed to produce a good or service. It incorporates the energy needed in the mining or processing of raw materials, the manufacturing of products and the delivery of these products to site. The purpose of the embodied carbon assessment is to engage the design team in the consideration of embodied carbon at an early stage in the development and mitigate embodied carbon. This engagement aims to ensure carbon savings are made and to assist in aligning the project to Ireland's CAP25 goal of achieving carbon neutrality by 2050.

The TII Online Carbon Tool has been commissioned by TII to assess GHG emissions associated with road or rail projects in Ireland. The TII Carbon Tool uses emission factors from recognised sources including, but not limited to:

- Civil Engineering Standard Method of Measurement (CESSM) Carbon and Price Book database
- Circular Ecology ICE v4.0 ICE DB Advanced V4.0

The tool can be applied to a variety of developments, not just road or rail and aligns with PAS 2080.

The TII Carbon Tool was utilised to estimate the GHG emissions associated with the non-turbine elements of the proposed project site including construction activities, land clearance activities and construction wastes.

Turbine Dimension Range

As set out in **Chapter 1**, the final turbine model has not yet been selected. The climate assessment has therefore been undertaken having regard to the proposed turbine dimension range assessed within this EIAR. For the purposes of the greenhouse gas assessment, the construction phase has been assessed on the basis of the maximum development footprint and associated construction quantities, as this represents the scenario most relevant to construction-stage material requirements, land clearance, construction activity, transport movements and embodied greenhouse gas emissions.

For the operation phase, the assessment adopts a conservative representative generating capacity scenario. As operational climate benefit is principally related to renewable electricity output and the associated displacement of fossil-fuel generation, a range of minimum and maximum energy generation is considered to assess the range of annual GHG savings.

The final turbine model will be selected within the following range:

- Turbine Tip Height – Maximum height 200 metres, Minimum height 199.1 metres
- Hub Height – Maximum height 120.9 metres, Minimum height 111.6 metres
- Rotor Diameter – Maximum diameter 175 metres, Minimum diameter 158 metres.

The candidate turbine technologies within the assessed dimension range have a rated electrical output of approximately 6.1MW to 7.2MW per turbine, giving the project a total generating capacity of approximately 18.3MW to 21.6MW. Annual electricity generation has been calculated separately for each assessed turbine configuration using the corresponding capacity factor supplied for that configuration. On this basis, the project is expected to generate approximately 48.3GWh to 55.1GWh of electricity per annum. This electricity generation range has been used in this assessment.

Turbine Manufacture Lifecycle Assessment

The quantitative construction phase greenhouse gas assessment presented in this chapter has been undertaken using the TII Carbon Tool and includes the non-turbine construction elements of the project, including civil works, construction materials, land clearance, construction activities and construction wastes.

As the final turbine model has not yet been selected, project specific greenhouse gas data for turbine manufacture are not available at this stage. Publicly available lifecycle assessment information for comparable modern wind turbine technologies has therefore been reviewed to provide context in relation to the greenhouse gas emissions associated with turbine manufacture and the typical greenhouse gas payback period for such turbines.

Manufacturer lifecycle assessments are generally prepared for specific turbine models and are based on assumptions relating to turbine design, component manufacture, transport, installation, operational life, wind resource and end-of-life treatment. They are not generally prepared on a project specific basis for an individual wind farm site. In addition, publicly available lifecycle assessments (LCAs) typically present greenhouse gas emissions as an overall lifecycle value and do not always provide sufficient detail to isolate the emissions associated with turbine materials and manufacture in a manner that can be directly incorporated into the quantitative assessment for this project.

For the purposes of this assessment, the LCA for the turbine model Vestas V172 – 7.2MW was reviewed as this is representative of the wind turbines that may eventually be installed.

Whilst the Vestas LCA included a list of materials included within each individual turbine there was insufficient detail and data to allow for a calculation of embodied carbon associated with the turbines themselves, and thus, a quantitative assessment of the GHG emissions associated with the turbines was not undertaken as part of this assessment. However, GHG emissions released during the construction phase will be offset by the production of renewable electricity once the windfarm is operational. The Vestas LCA reports that the typical energy payback period for the type of turbine specified is approximately 7 months for the scenario modelled in the LCA, however it can be as little as two months for some installations. No site-specific payback period has been calculated as part of this assessment, the 7-month figure from the Vestas LCA is a useful reference point.

9.3.3.2 Operation Phase

There will be no greenhouse gas emissions from the operation of the wind turbines. However, due to the displacement of electricity which otherwise would have been produced from fossil fuels, there will be a net benefit in terms of greenhouse gas emissions. The savings are calculated and compared to Ireland's 2030 sectoral emissions ceilings.

In order to quantify these GHG savings from the proposed project relative to fossil fuel energy production, the GHG emissions produced by a typical fossil fuel plant generating the equivalent amount of energy (based on the carbon intensity of electricity generation in Ireland (SEAI, 2026)) has been calculated. The GHG emissions associated with an equivalent fossil fuel plant generating 48.3 to 55.1 GWh of energy will include emissions of CO₂, nitrous oxide (N₂O) and methane (CH₄). The most recent (2025) figure for carbon intensity of electricity generation in Ireland is 197.8 gCO₂/kWh (SEAI, 2026). The CO₂ equivalent emissions of N₂O and CH₄ have been calculated using the global warming potentials in 6th Assessment Report IPCC Guidelines. As per the IPCC AR6 report, N₂O has a GWP of 273 and CH₄ has a GWP of 27. These figures have been used in the calculations presented in **Table 9.10**.

Vehicular traffic is often a dominant source of greenhouse gas emissions as a result of developments. However, due to the relatively low volume of vehicles required for maintenance activities during operation (see **Chapter 14** for more detail), emissions from operational vehicles have been scoped out of this assessment.

9.3.3.3 Decommissioning Phase

Vehicles related to the decommissioning phase will give rise to CO₂ emissions. It is not predicted that this development will involve the use of a significant number of vehicles during the decommissioning phase. Therefore, emissions from vehicular traffic have been scoped out of this assessment.

Decommissioning will involve the dismantling and removal of all above-ground infrastructure from the site, with materials either reused, repurposed, recycled or disposed of at appropriately licensed facilities in accordance with the Decommissioning Management Plan (see **Chapter 3** for more detail). Turbine components, transformers, recovered cabling and other electrical equipment contain significant quantities of recyclable metals, which will be removed off-site to approved waste handling and recycling facilities. In line with current industry

developments and the assumptions set out in **Chapter 3**, turbine blades are expected to be repurposed or recovered through appropriate licensed recovery pathways, thereby minimising disposal requirements.

Concrete foundations will be removed to approximately 1 m below ground level, with recovered steel recycled and concrete either reused on-site as inert fill or processed for use in other construction projects. Hardstands, the electrical switch room and associated infrastructure will also be removed, with materials segregated for reuse, recycling or disposal as appropriate. Access tracks may be retained where required for continued agricultural or other landowner use, as described in **Chapter 3**. Excavated areas will be reinstated using suitable material and allowed to revegetate naturally.

Decommissioning activities have been considered within the turbine life cycle assessments and associated payback periods discussed in **Section 9.3.3.1**. As demonstrated by these studies, decommissioning typically accounts for a relatively small proportion of the total life cycle GHG emissions associated with wind farm developments. Consequently, the contribution of the decommissioning phase to the project's overall GHG emissions is considered negligible and has therefore been scoped out of further assessment.

9.3.3.4 *Significance Criteria*

The significance of the impacts of GHG emissions on the climate is an area of scientific consensus that is described clearly in the IPCC AR5 reports, and as such all GHG emissions are considered to contribute adversely towards climate change.

In accordance with ISEP and TII guidance, the significance of the impacts of GHG emission resulting from a given project is based on how it contributes to the overall GHG emissions within the sectoral and national carbon budgets and whether that project contributes or not to the CAP25 objective for Ireland to achieve carbon neutrality by 2050, which means that a project contributes to reducing GHG emissions. This process requires an assessment of the quantified GHG emissions against the sensitivity of receptors (Ireland's national GHG targets or National Climate Objective), qualification of the potential measures that might mitigate against GHG emissions, and a degree of professional judgement that takes account of the balance of all of these factors. Both the ISEP and TII guidance documents are explicit in this concept.

ISEP guidance (2026) highlights the importance of mitigation in determination of significance, committing the project to go further than minimum regulatory compliance. It determines embodied carbon must be addressed and generalised measures found in a CEMP cannot be relied upon to materially reduce significance. Where no sufficient and meaningful mitigation is proposed which supports an applicable 1.5°C or net zero compatible trajectory, beyond minimum compliance with current regulations, this would typically indicate a significant adverse effect.

In order to streamline the process and provide accountability, the criteria outlined in PE-ENV-01104 (Transport Infrastructure Ireland, 2022) and reproduced in ISEP 2022 are used together with the following two factors:

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

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

Table 9.3: TII Significance Criteria for Greenhouse Gas Assessment

9.3.4 CLIMATE CHANGE RISK ASSESSMENT

The Climate Change Risk Assessment (CCRA) involves determining the vulnerability of the project to climate change. This requires an analysis of the sensitivity and exposure of the development to climate hazards which together provide a measure of vulnerability.

- **Step 1:** First an initial, high level climate screening of physical hazards is carried out based on location and type of development. This is a qualitative screening intending to only proceed with relevant hazards.
- **Step 2:** The Proposed Development asset categories must be assigned a level of sensitivity to climate hazards. PE-ENV-01104 (TII, 2022) provides the list of asset categories and climate hazards to be considered, as per the below. The asset categories will vary for development type and need to be determined on a development-by-development basis.

- **Asset Categories** Pavements; drainage; structures; utilities; landscaping; signs; light posts; buildings; and fences.
- **Climate Hazards** Flooding (coastal, pluvial, fluvial); extreme heat; extreme cold; wildfire; drought; extreme wind; lightning and hail; landslides; fog.

Following this, all asset categories are assessed on their sensitivity to climate change. The sensitivity is based on a High, Medium or Low rating with a score of 1 to 3 assigned as per the criteria below.

- **High Sensitivity** The climate hazard will or is likely to have a major impact on the asset category. This is a sensitivity score of 3.
- **Medium Sensitivity** It is possible or likely the climate hazard will have a moderate impact on the asset category. This is a sensitivity score of 2.
- **Low Sensitivity** It is possible the climate hazard will have a low or negligible impact on the asset category. This is a sensitivity score of 1.
- **Step 3:** Once the sensitivities have been identified the exposure analysis is undertaken. The exposure analysis involves determining the level of exposure of each climate hazard at the project location irrespective of the project type. For example, flooding could be a risk if the project location is next to a river in a floodplain. Exposure is assigned a level of High, Medium or Low as per the below criteria.
 - **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. This is an exposure score of 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. This is an exposure score of 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. This is an exposure score of 1.
- **Step 4:** Once the sensitivity and exposure are categorised, a vulnerability analysis is conducted by multiplying the sensitivity and exposure to calculate the vulnerability:

$$\text{Vulnerability} = \text{Sensitivity} \times \text{Exposure}$$

9.3.4.1 Significance Criteria for CCRA

The CCRA involves an initial screening assessment to determine the vulnerability of the Proposed Development to various climate hazards. The vulnerability is determined by combining the sensitivity and the exposure of the Proposed Development to various climate hazards.

The vulnerability assessment at this stage excludes mitigation. **Table 9.4** details the vulnerability matrix; vulnerabilities are scored on a high, medium and low scale.

The PE-ENV-01104 guidance note that if all vulnerabilities are ranked as low in a justified manner, no detailed climate risk assessment may be needed. Therefore, the impact from climate change on the Proposed Development can be considered to be not significant.

However, following the embedding of mitigation measures, where residual medium

or high vulnerabilities exist the assessment may need to be progressed to a detailed climate change risk assessment and further mitigation implemented to reduce risks. According to PE-ENV-01104, an assessment of construction phase CCRA impacts is only required if a detailed CCRA is required. Where a CCRA for the construction phase is not required, best practice mitigation against climate hazards should still be recommended.

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

Table 9.4: Vulnerability Matrix

9.4 DESCRIPTION OF EXISTING ENVIRONMENT

9.4.1 CURRENT GHG BASELINE

Data published in July 2026 (Environmental Protection Agency, 2026a), indicates that Ireland exceeded, without the use of flexibilities, its 2025 annual limit set under EU's Effort Sharing Regulation (ESR) (EU 2018/842) by 5.01 MtCO₂e. However, the reported emissions for 2025 represent the third consecutive year in which Ireland's emissions were below 1990 levels by 5.5%. Emissions Trading Scheme emissions have decreased by 52.4% or 11.8 MtCO₂e compared to 2005 and Effort Sharing Regulation emissions decreased by 11.8% or 5.6 MtCO₂e. Ireland is now a net 3,198 ktCO₂e distant from its target under the Effort Sharing Regulation.

The EPA estimate that 2025 total national GHG emissions, excluding LULUCF, have decreased by 2.3% on 2024 levels to 52.65 MtCO₂e. The sector with the highest emissions in 2025 was agriculture at 38.7% of the total, followed by transport at 22.0%. For 2025, total national emissions (including LULUCF) were 55.16 MtCO₂e (**Table 9.5**). Agriculture emissions decreased by 0.2% in 2025, primarily due to a 3.3% reduction in cattle herd numbers. However, a 12.7% increase in fertilizer nitrogen lessened the impact of the herd reduction on emissions. Greenhouse gas emissions from the transport sector decreased by 1.5% in 2025, the increase in the use of biofuels contributed to the majority of this emission reduction in addition to the increasing number of electric vehicles on Irish roads. Emissions from the energy industries sector decreased for the fourth consecutive year by 7.1% in 2025. This reduction can be attributed to an increase in imported electricity as well as increased renewable generation. Renewables accounted for 40.6% of electricity generation in 2025 (EPA, 2026b).

The current estimates of National greenhouse gas emissions (including LULUCF) in 2025 are 14.5% below 2018 levels, at considerable variance from the National Climate ambition of a 51% reduction by 2030. The data indicate that from 2021 to 2025 Ireland has used 99.6% or 293.9 MtCO₂e of the 295 MtCO₂e Carbon Budget for the five-year period 2021-2025. This leaves 1.1 Mt CO₂e of the budget available to be carried over into budget 2 for 2026-2030. In order to achieve Ireland's climate ambition of a 51% reduction by 2030, annual emission reductions of over 10% are required for the next 5

years.

In relation to compliance with the sectoral emissions ceilings (SECs), the provisional GHG emissions estimates (see **Table 9.5**) indicate that four sectors, Buildings (Residential), Buildings (Commercial and Public), Agriculture and Other, have stayed within their sectoral emissions ceilings. The other three sectors, Electricity, Transport and Industry have exceeded their sectoral emissions ceilings. The EPA state that the National Climate objective of a 51% reduction by 2030 will be unattainable unless every sector meets its indicative percentage reduction target.

Sector ^{Note 1}	Annual Total Emissions for Carbon Budget 1 (Mt CO ₂ e)					Total Budget (Mt CO ₂ e) (2021-2025)	Sectoral Emissions Ceiling 2021-2025	% SEC 2021-2025 Used
	2021	2022	2023	2024	2025			
Electricity	9.82	9.62	7.50	6.89	6.30	40.12	40	100.3%
Transport	11.19	11.88	11.93	11.78	11.61	58.40	54	108.1%
Buildings (Residential)	6.71	5.62	5.23	5.49	5.21	28.26	29	97.4%
Buildings (Commercial and Public)	1.42	1.38	1.34	1.44	1.39	6.97	7	99.6%
Industry	7.25	6.82	6.47	6.20	6.00	32.74	30	109.1%
Agriculture	21.97	21.78	20.72	20.44	20.40	105.30	106	99.3%
Other ^{Note 2}	1.82	1.85	1.73	1.64	1.75	8.79	9	97.6%
LULUCF	2.87	2.47	2.97	2.51	2.51	13.33	-	N/A
Total including LULUCF	63.05	61.42	57.89	56.38	55.16	293.90	295	99.6%

Note 1 Reproduced from latest emissions data from the EPA (EPA, 2026).

Note 2 Other includes Petroleum refining, F-Gases and Waste (emissions from solid waste disposal on land, solid waste treatment (composting and anaerobic digestion), wastewater treatment, waste incineration and open burning of waste).

Table 9.5: Trends in Total National GHG Emissions 2021 – 2025

9.4.2 FUTURE GHG BASELINE

The future baseline with respect to the GHGA can be considered in relation to the future climate targets which the assessment results will be compared against. In line with TII (TII, 2022) and ISEP guidance (ISEP, 2022) the future baseline is a trajectory towards net zero by 2050, “*whether it [the project] contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050*”.

The future baseline will be determined by Ireland meeting its targets set out in the CAP25, and future CAPs, alongside binding 2030 EU targets. The European Union (EU)

enacted 'Regulation (EU) 2018/842 on binding annual GHG emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No. 525/2013' (hereafter referred to as the Regulation) (European Union, 2018) to meet the commitments under the Paris Agreement. The Regulation was amended in April 2023 by Regulation (EU) 2023/857, and Ireland must now reduce its non-ETS greenhouse gas emissions by at least 42% by 2030 compared with 2005. Regulation (EU) 2026/667 establishes an EU-wide target of reducing net greenhouse gas emissions by 90% by 2040 compared with 1990.

In May 2026, the EPA released the report Ireland's Greenhouse Gas Emissions Projections 2025-2030 (EPA, 2026b), which includes total projected emissions and a breakdown of projected emissions per sector under the 'With Existing Measures' and 'With Additional Measures' scenarios. The EPA projections indicate that currently implemented measures (With Existing Measures) will achieve a reduction of 12.7% on 2005 levels by 2030, significantly short of the 42% reduction target. If measures in the higher ambition (With Additional Measures) scenario are implemented, EPA projections show that Ireland can achieve a reduction of 23.4% by 2030, still short of the 42% reduction target.

The EPA GHG emissions projections report for 2025 - 2030 (EPA, 2026b) states that Ireland is not on track to meet the 51% emissions reduction target by 2030 (compared to 2018). Full implementation of a wide range of policies and plans across all sectors that deliver carbon savings is required to achieve a projected reduction of 25%.

The estimates of GHG emissions from the EPA for the 2021 – 2025 period indicate that the first carbon budget for 2021 – 2025 will be met but that Budget period 2 (2026-2030) of 200 MtCO_{2e} is expected to be exceeded by 53 to 81 MtCO_{2e}.

9.4.3 CURRENT CCRA BASELINE

9.4.3.1 Climate Hazard Screening

Table 9.6 sets out a qualitative assessment of climate hazards relevant to the project. This high-level screening ensures focus is given to relevant climate hazards throughout the remainder of the assessment. The initial climate hazard list is taken from TII PE-ENV-01104.

Climate-related Hazard	Hazard Screening Rationale	Screening
Extreme Heat temperatures	High temperatures are a key consideration for both construction and long-term operation of the proposed project. Heat and thermal expansion can damage materials, road surfaces, and auxiliary systems such as electrics while also affecting the lifecycle of assets.	Screen in
Extreme Cold Temperature	Snow and ice events pose significant risks to health, safety, and site operations. Road access may be disrupted, and low temperatures can affect assets such as fuel tankers, workers, and infrastructure. Freeze-thaw cycles may cause cracking in concrete and road surfaces, requiring snow clearance and ice management.	Screen in

Climate-related Hazard	Hazard Screening Rationale	Screening
High precipitation and pluvial flooding	Surface water remains a key vulnerability for any proposed development during both construction and operation phases due to the sensitivity of construction materials, site access, and site assets to water exposure therefore it is screened in.	Screen in
Fluvial flooding	The wind farm site is located in Fluvial Flood Zone C where there is a low risk of fluvial flooding. NIFM flood zones are mapped along the course of the Rapemills River to the east of the project site which also encroach the proposed underground electricity line route. Therefore, fluvial flooding is screened in.	Screen in
Drought	Droughts have occurred across Ireland, previously impacting water supply. However, future reductions in availability would not directly impact the development and its operation.	Screen out
Wildfire	The wildfire hazard for County Offaly is classified as 'medium' (GFDRR, 2026) but there have not been any wildfires in close proximity to the site and it is not listed as a risk in Offaly County Action Plan 2024-2029 and therefore can be screened out.	Screen out
High winds and storms	Turbines, switch room and other assets of the proposed project may be exposed to high winds. Historically, Ireland has experienced several notable storm events including Storm Éowyn (2025) and Storm Darragh (2024), which caused widespread damage across Ireland. These storms often bring heavy rainfall and flood warnings, increasing overall risk.	Screen in
Fog	Fog is not considered a significant hazard for this development, as it does not involve transport, aviation, or activities requiring high visibility and is therefore screened out.	Screen out
Lightning	The proposed design is elevated and includes electrically charged components such as a switch room, making it susceptible to lightning strikes so is screened in.	Screen in
Landslides and Subsidence	The Geological Society of Ireland (GSI) landslide susceptibility mapping database (GSI, 2026) was reviewed to determine a low risk from landslides at the proposed development location, therefore it is screened out of this assessment.	Screen out
Sea level rise and coastal flooding	Sea level rise and coastal flooding can lead to permanent loss of land and property. The site is ca. 75 km from the coast therefore can be screened out.	Screen out

Table 9.6: Climate Hazard Screening

9.4.3.2 Extreme temperatures and precipitation

Ireland has a temperate, oceanic climate, resulting in mild winters and cool summers. This baseline data is derived from the European Centre for Medium-Range Weather

Forecasts (ECMWF) ERA5 data reanalysis and presented on the World Bank Group Climate Change Knowledge Portal (World Bank Group, 2026b) which includes observed data from local meteorological weather stations across Ireland from 1950-2023. This data is reanalysed to model a complete picture of Ireland's historical climate. This method has been chosen to ensure data can be analysed at the daily level and harmoniously compared with future scenarios. The baseline time-period referred to in this assessment was from 1991-2020 and is specific to the county of Offaly.

Climate averages for the 30-year period from 1991-2020 are shown in **Figure 9.1**. The data shows that, on average, August, November, and December experience the most amount of precipitation (87.5 mm – 88.1 mm) with November being the wettest month (88.1 mm). The autumn months (Sept-Nov) have the most rainfall, compared to the rest of the year, with an average rainfall of 86mm. The driest month is March with 69.9 mm of rainfall which is below the annual average.

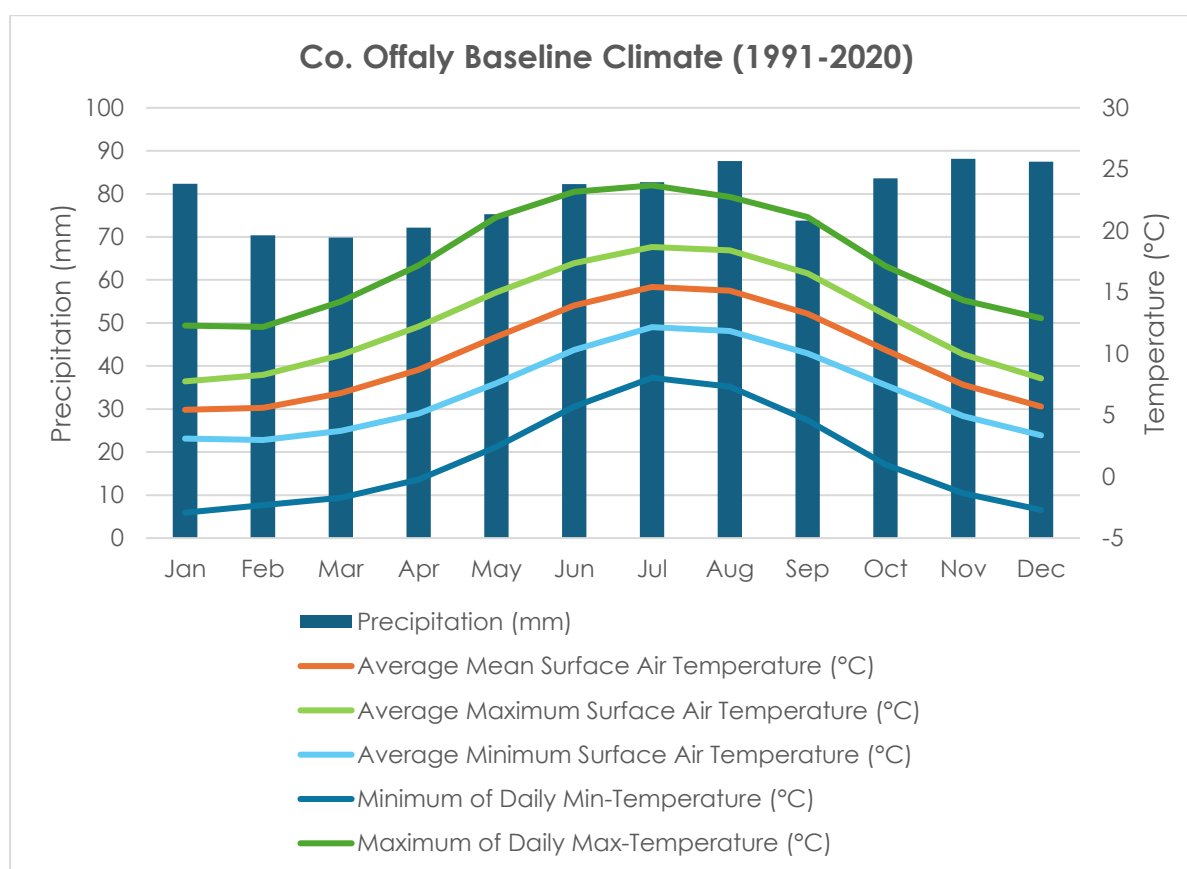


Figure 9.1: Climate Averages for County Offaly, Ireland, for the period 1991-2020

July and August are the warmest months on average with a mean surface air temperature ranging from 15.1°C to 15.4°C. Both months also experience the highest average maximum surface air temperature (18.7°C and 18.4°C respectively). July has the highest daily maximum temperature (23.7°C). January is the coldest month on average with a mean average surface temperature of 5.4°C and recording the daily minimum temperature (-2.9°C), however the average minimum surface air temperature of 3.0°C occurs in February.

9.4.3.3 Wind and storms

At Shannon Airport during the period 1991-2020 (**Figure 9.2**), the average wind speed

was 9.1 knots (16.9 kmph), the average windiest month being February at 10.1 knots (18.7 kmph). Historically, the highest absolute gust of 86.0 knots (159.3 kmph) was recorded in February 2014 during Storm Darwin. With reference to recent extreme weather events in Ireland, storm Éowyn hit the island in January 2025 and recorded a 10-minute mean wind speed of 142 kmh in Galway, with the highest gust being 184 kmh. Four weather stations broke their highest gust records during this storm and two stations reached hurricane force 12 on the Beaufort scale.

Later in the year storm Amy also resulted in strong winds such that five recording stations broke their records for 10-minute mean wind speeds. Overall, there were five named storms to hit Ireland in 2025.

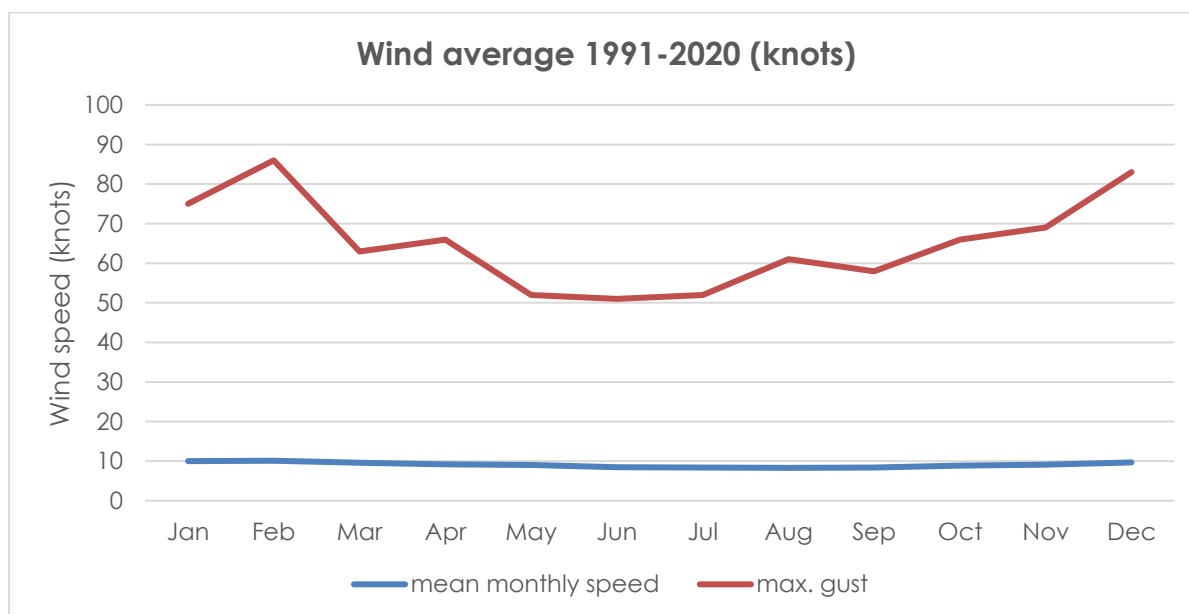


Figure 9.2: Wind Averages Shannon Airport for the period 1991-2020

9.4.3.4 Flood

A Site Specific Flood Risk Assessment undertaken by Hydro-Environmental Services indicates that the wind farm site is generally located within Fluvial Flood Zone C, where the probability of fluvial flooding is low. While the bog surface exhibits flat to undulating topography in places, resulting in localised ponding or temporary flooding following heavy rainfall events, the mapped surface water flood zones and ponding areas do not significantly interact with the proposed wind farm infrastructure. Furthermore, there are no identified sources of fluvial flooding within the wind farm site and no CFRAM or NIFM fluvial flood zones are mapped across the site itself. Although sections of the underground electricity line are located within Fluvial Flood Zone A and NIFM fluvial flood zones are mapped along portions of the route, no instances of historical flooding were identified on historic OS mapping, and no recurring flooding has been recorded on OPW flood maps within either the wind farm site or the underground electricity line corridor. The GSI Winter 2015/2016 Surface Water Flooding and Groundwater Flood Mapping do indicate a potential for temporary localised flooding within the wind farm site; however, such ponding is expected to be short-lived and associated with heavy rainfall events rather than fluvial flooding.

9.4.4 FUTURE CCRA BASELINE

The current global climate is in a state of extreme flux. This is illustrated in the latest

IPCC AR6 Synthesis Report Summary for Policymakers (IPCC, 2023) using the climate stripes representation pioneered by Professor Ed Hawkins of the University of Reading, reproduced in **Figure 9.3**.

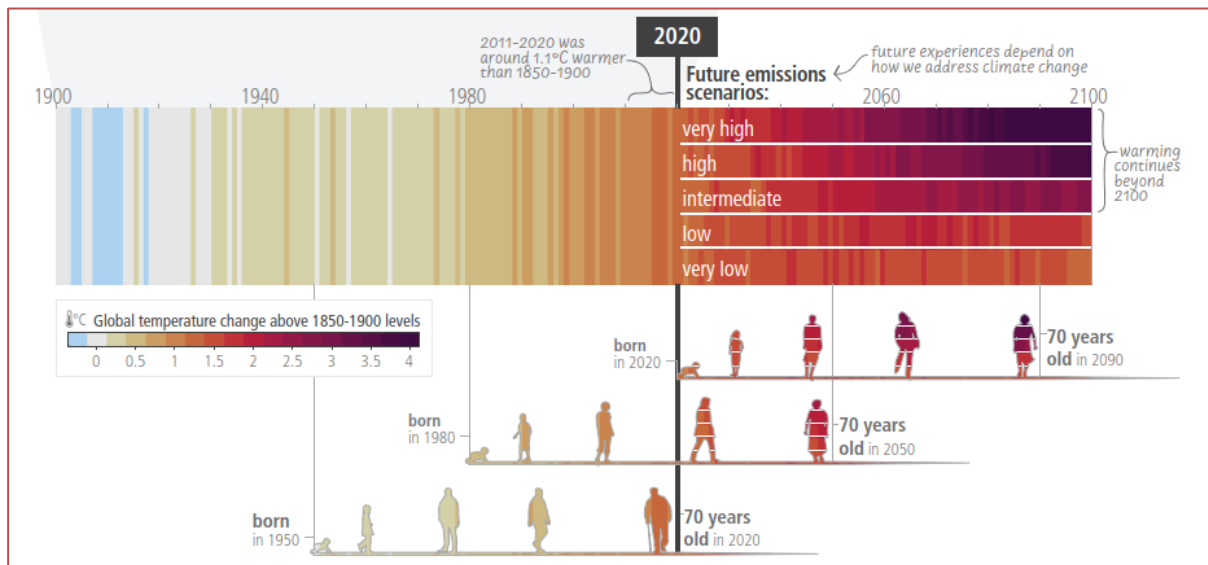


Figure 9.3: Global Climate Change Representation (IPCC, 2023)

Figure 9.3 shows that global average temperatures are already substantially above the 1850-1900 baseline level, and potential increases under future emissions scenarios are also presented.

The United Nations reported that 2024 was the first calendar year to exceed the 1.5°C average increase (United Nations, 2026) with an average temperature 1.55°C above the 1850-1900 average. Whilst this is not an indication of a definite exceedance of the 1.5°C Paris Agreement commitment, as there will be some natural variation in the coming years, it is a clear indication that the climate is continuing to significantly warm.

In addition, the CMIP6 climate model predicts a severe weakening of the Atlantic Meridional Overturning Current (AMOC) due to ocean surface warming and glacial meltwater entering the system from the Greenland ice sheets that is known to be highly influenced by anthropogenic emissions. Normally this current has a stabilising effect on the climate in Ireland, however a weakening or cessation of the ocean current would have profound consequences for Ireland in terms of overall climate stability and the magnitude of temperature extremes. Recent observations have been coupled with prediction models (Observational constraints project a ~50% AMOC weakening by the end of this century, 2026) that show AMOC weakening that is far greater than predicted in CMIP6. A weakening or cessation of flow within AMOC is projected to have severe implications to Ireland's climate. The climate would be similar to that experienced in regions at comparable latitudes to Ireland, which do not benefit from the moderating influence of the AMOC, such as parts of Canada or southern Siberia, with markedly colder winters, hotter summers, and greater seasonal variability.

The CMIP7 model is now available and is based on a new set of global emissions scenarios that differ from CMIP6. The highest emission scenario is now lower than in CMIP6 whilst the lowest emission scenario now results in temperature changes that

exceed the 1.5°C change that was part of the Paris Agreement. The highest emission scenario still results in substantial climate change above 4°C by 2100. CMIP7 results are expected to be published for public use later in 2026.

9.4.4.1 *Climate Change Impacts and Projections for Ireland*

Ireland is already experiencing increased annual rainfall in the north and west, with more variable patterns in the south and east (EPA, 2021b). Key risks identified by the EPA relevant to Ireland:

- Increased likelihood of more frequent and intense North Atlantic low-pressure systems bringing high rainfall and high winds.
- More intense rainfall periods which may lead to pluvial flooding and elevated fluvial levels.
- Longer dry spells and increased temperatures will elevate the risk of wildfire.

9.4.4.2 *Climate Modelling and Planning*

International best practice and national policy such as the NCCRA (2024), IPCC (2023), and Transport Infrastructure Ireland (TII, 2022) recommends using two emission scenarios to project future climate change. This includes a moderate and high emission scenarios (RCP4.5 and RCP8.5) for future planning. These Representative Concentration Pathways (RCPs) reflect varying levels of global climate mitigation explained below.

- RCP 4.5 (a 'moderate' scenario) represents an approximate 2.4°C increase in global average temperatures (1.7-3.2°C). It assumes moderate mitigation efforts leading to stabilisation of emissions by mid-century and is generally aligned with current policies for emission reduction.
- RCP 8.5 (a 'worst case' / high emissions scenario) represents an approximate 4.3°C increase in global average temperatures (3.2-5.4°C) and assumes continued high emissions with minimal mitigation. This high-end scenario is useful for understanding potential impacts of current emission trends continue. Consequently, this scenario will result in the highest level of physical risk for Ireland, and therefore the greatest requirement for adaptation.

This climate change assessment uses the latest climate change projections standardised and bias corrected for Ireland available through the EPA and the TRANSLATE project (EPA, 2025e).

9.4.4.3 *Key Findings from Climate Projections*

Error! Reference source not found. **Table 9.7** provides a detailed comparison of baseline and future climatology across a medium (RCP4.5) and high emissions scenario (RCP8.5) up to 2100. Key Projected changes include:

- Average maximum temperatures rising by over 1°C and overall mean temperatures increasing 1.1°C and 1.5°C by mid-century under RCP4.5 and RCP8.5 respectively.
- Annual precipitation rising by 51 mm and 91mm by 2100, in RCP4.5 and RCP 8.5 respectively, with maximum 1-day rainfall increasing by 9 mm.
- Fewer frost days (76% reduction of frost days in RCP 8.5 in the long term).
- Increased number of heatwaves (5 consecutive days >25°C).

This will result in longer dry periods and heavy rainfall events. Met Éireann has high confidence in maximum rainfall rates increasing but not in how the frequency or

intensity of storms will change with climate change.

Impacts resulting from climate change hazards will evolve and have the potential to include increases in global temperatures and increases in the intensity and frequency of rainfall days per year combined with increases in the intensity and frequency of low-pressure systems in the north Atlantic during the winter storm period. Therefore, it is expected that the climate over the proposed windfarm will evolve over time and consideration is needed with respect to this within the design of the proposed windfarm site.

Overall 10m mean windspeed is projected to decrease marginally ($\sim <1\%$) across all seasons of the year with a high degree of certainty (EPA, 2025c).

Climate Hazard	Indicator	Baseline	RCP4.5		RCP8.5	
		(1976-2005) <small>Note 1</small>	(2041-2070)	(2071-2100)	(2041-2070)	(2071-2100)
Temperature	Mean temp (°C)	9.68	10.8 (+1.1)	11.2 (+1.5)	11.2 (+1.5)	12.4 (+2.8)
	Mean Max temp (°C)	13.51	14.6 (+1.0)	14.9 (+1.4)	15.0 (+1.5)	16.1 (+2.6)
	Mean Min temp (°C)	5.86	7.0 (+1.2)	7.4 (+1.6)	7.5 (+1.6)	8.7 (+2.9)
	Average of Daily Max temp (°C)	26.27	28.7 (+2.4)	29.4 (+3.2)	29.2 (+2.9)	29.9 (+3.6)
	Frost Days (Nr.)	39.50	24.6 (-14.9)	19.8(-19.7)	19.4 (-20.1)	9.6 (-29.9)
Precipitation and Flooding	Annual precipitation (mm)	853	885 (+3.8%)	904 (+6.0%)	901 (+5.7%)	944 (+10.7%)
	Max 1-day (mm)	29	33 (+15.2%)	34 (+19.7%)	34 (+18.4%)	38 (+31.6%)
Storms and high winds	Storm Frequency and Average speed	On Average 8 named storms annually with speeds exceeding 100km/hr ^{Note 2}	Winter storm frequency is projected to increase, with a possible extension of the storm season. While the intensity of individual storms cannot be accurately projected, storm wind speeds are likely to remain above 100 km/hr.			
	(Descriptive)					
	Max gust Speed ^{Note 3}	86 knots (159.3 kmh)				
Wildfire	Qualitative (Descriptive)	Medium	Rising temperatures and prolonged dry spells are projected to elevate wildfire risk.			
Drought	Absolute Drought	Rare	Marginal increase	Increased Likelihood	Increased Likelihood	Increased Likelihood

Climate Hazard	Indicator	Baseline	RCP4.5		RCP8.5	
		(1976-2005) Note1	(2041-2070)	(2071-2100)	(2041-2070)	(2071-2100)
	(≥15 days with less than 1mm of rain)					
Lightning	Qualitative (Descriptive)	Occurring during summer periods	This hazard may modestly increase in the future due to more favourable conditions, such as rising temperatures and extended warm periods beyond the traditional summer season			
Note-1: 1976–2005 TRANSLATE baseline dataset is used as the reference period for climate change projections.						
Note-2: Data from combined Met Éireann, UK Met Office and Dutch Meteorological services.						
Note-3: Data from Shannon Airport weather station (~84km from site), 1991-2020 (Birr is the nearest weather station, but the required data i.e. max gust records are not available from Met Éireann).						

Table 9.7: Future Climate Change Summary of Projections under both RCP scenarios taken from the EPA Climate Ireland Translate Projections

9.5 DESCRIPTION OF LIKELY EFFECTS

9.5.1 GREENHOUSE GAS ASSESSMENT

9.5.1.1 Construction Phase

The results of the GHGA using the TII Carbon Tool are shown in **Table 9.8** and include the GHG emissions associated with the non-turbine elements of the proposed project site including construction activities, land clearance activities and construction wastes. As discussed in Section 9.3.3.1 a quantitative assessment of GHG emissions associated with manufacture of the individual turbine components has not been undertaken due to the limited data available.

Construction materials make up the majority of GHG emissions for the construction phase of the proposed project, accounting for approximately 44% of the total construction phase GHG emissions. The second highest contribution comes from land use change and vegetation loss at approximately 30%.

It has been calculated that the total construction phase (A1- A5) GHG emissions for the project, excluding the material emissions from the manufacture of the turbines, will be 3,304 tCO₂e as shown in **Table 9.8**.

Stage	GHG Category	Assessment	Predicted GHG Emissions (tCO ₂ e)	Predicted GHG Emissions as % of Construction phase	Relevant Sector for Carbon Budget Comparison
A1-A3	Materials		1452	43.8	Industry
A4	Material Transport		519.54	15.7	Transport

Stage	GHG Category	Assessment	Predicted Emissions (tCO ₂ e)	GHG Emissions as % of Construction phase	Relevant Sector for Carbon Budget Comparison
A5	Land Use Change and Vegetation Loss		1008.33	30.5	LULUCF
	Clearance and Demolition		2	0.06	Industry
	Excavations		66.31	2.0	Industry
	Construction energy		170.43	5.2	Electricity
	Construction worker travel to site		51.84	1.6	Transport
	Construction water		0.95	0.03	Industry
	Construction Waste Disposal		32.42	1.0	Other (incl. waste & wastewater)
	Construction Waste Transport		0.47	0.01	Transport
Total			3,304		

Table 9.8: Construction GHG Assessment Results

In **Table 9.9**, the GHG emissions from Table 9.8 have been summed for each relevant sector and have been compared against the carbon budget for the industry, transport, and other (incl. waste and wastewater) sectors in 2030 (DECC, 2024). Total project GHG emissions have also been compared against Ireland's total GHG emissions in 2025, and against Ireland's EU 2030 target of a 42% reduction in non-ETS sector emissions based on 2005 levels (27.7 Mt CO₂e) (set out in Regulation EU 2018/842).

Emissions associated with the LULUCF category have not been included in the sectoral breakdown in **Table 9.9** as this sector does not have a sectoral budget for comparison with. The GHG emissions from **Table 9.8** associated with the LULUCF category have been included within the total proposed project GHG emissions in **Table 9.9**.

The estimated total GHG emissions annualised over the 35-year project lifespan are shown in **Table 9.9** and are a small fraction of the sectoral budgets.

Target/Sectoral Budget (tCO ₂ e)		Annualised Development non-turbine GHG Emissions (tCO ₂ e)		% of Relevant Target/Budget
Ireland's 2025 Total GHG Emissions (existing baseline)	55,163,780	95	Total GHG Emissions	0.0002
Non-ETS 2030 Target	27,722,000			0.0003

Target/Sectoral Budget (tCO ₂ e)				Annualised Development non-turbine GHG Emissions (tCO ₂ e)		% of Relevant Target/Budget
2030 Sectoral Budget (Industry Sector)		4,000,000		43	Total Industry Emissions	0.001
2030 Sectoral Budget (Transport Sector)		6,000,000		17	Total Transport Emissions	0.0003
2030 Sectoral Budget (Electricity Sector)		3,000,000		5	Total Electricity Emissions	0.0002
2030 Sectoral Budget (Other Sector incl. waste and wastewater)		1,000,000		0.9	Total Waste Emissions	0.0001

Table 9.9: Estimated GHG Emissions Relative to Sectoral Budgets and National GHG Baseline

9.5.1.2 Operation Phase

During the operation phase there will be no GHG emissions from the operation of the wind turbines. The estimated 18.3 MW to 21.6 MW from the turbines will generate 48.3 GWh to 55.1 GWh of renewable energy annually. This energy production will displace electricity which otherwise would have been produced from fossil fuels and therefore will be a net benefit in terms of greenhouse gas emissions.

As per the methodology in **Section 9.3.3.2**, the potential annual GHG emission savings of the proposed project have been estimated. These are based on the provisional 2025 carbon intensity of electricity of 197.8 gCO₂/kWh and a GWP of 273 for N₂O and 27 for CH₄.

Total net GHG savings due to the proposed project amount to approximately 9,469 – 10,815 tCO₂e once the annualised quantified non-turbine construction emissions (95 tCO₂e as outlined in **Section 9.5.1.1** and **Table 9.8**) have been considered (see **Table 9.10**).

The estimated total GHG emissions savings for the 48.3 GWh to 55.1 GWh scenario are equivalent to 0.017 – 0.020% of Ireland's total GHG emissions in 2025 (and 0.14 – 0.16% of GHG emissions from equivalent fossil fuel energy production), 0.32 – 0.36% of the sectoral budget for the electricity sector in 2030 (see **Table 9.10**)

	CO ₂	N ₂ O	CH ₄	Baseline / Relevant Target	tonnes CO ₂ e	Total Annual Project Savings as % of Baseline / Relevant Target
Annual Equivalent GHG Emissions from Power Plant Producing 48.3-55.1 GWh (tonnes)	9,554 – 10,899	0.02 – 0.02	0.17 – 0.2			
Annual Equivalent GHG Emissions from Power Plant	9,554 – 10,899	4.75 – 5.42	4.69 – 5.36			

	CO ₂	N ₂ O	CH ₄	Baseline / Relevant Target	tonnes CO ₂ e	Total Annual Project Savings as % of Baseline / Relevant Target
Producing 48.3-55.1 GWh (tCO ₂ e)						
Annualised GHG Emissions due to Construction Phase (averaged over lifespan) (tCO ₂ e)	95					
Net Annual GHG Savings Due To Wind Farm Following Deduction of Construction Phase GHG Emissions (averaged over lifespan) (tCO ₂ e)	9,469 – 10,815			Ireland's Total GHG Emissions 2025 (existing baseline)	55,163,780	0.017% - 0.02%
				Ireland's GHG Emissions from Fossil Fuel Energy Production 2025 (existing baseline)	6,589,560	0.14% - 0.16%
				2030 Sectoral Emissions Ceiling (Electricity Sector)	3,000,000	0.32% - 0.36%

Note: Quantified construction emissions exclude turbine manufacture, which is considered qualitatively in **Section 9.3.3.1**. The construction emissions deducted above are annualised over the 35-year operation phase.

Table 9.10: Estimated Operation Phase Project GHG Savings

9.5.1.3 GHGA Significance of Effects

The TII guidance states that the following two factors should be considered when determining significance:

- 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.

Therefore, prior to mitigation, any impact on climate as a result of GHG emissions arising from the construction and operation of the project is considered significant.

9.5.2 CLIMATE CHANGE RISK ASSESSMENT

9.5.2.1 Construction Phase

Whilst the development is likely to be exposed to potential weather extremes due to climate change during the construction phase, the potential length of the construction phase and its transient nature means that a detailed CCRA of this phase is scoped out.

The following non-exhaustive list of risks has been identified:

- Flood Risk due to increased precipitation, and intense periods of rainfall. This includes fluvial and pluvial flooding affecting unfinished structures or access roads/pavement.
- Increased temperatures potentially causing drought, wildfires and prolonged periods of hot weather potentially affecting setting concrete or cement, dust suppression and construction worker health and safety.
- Reduced temperatures resulting in ice or snow potentially affecting setting concrete or cement, landscaping and construction worker health and safety.
- Major storm damage including wind damage potentially affecting landscaping, stored materials, vertical infrastructure and construction worker health and safety.
- Wind turbines are exposed to lightning strikes due to their height. Although equipped with lightning protection systems, direct strikes can damage blades, control systems, and electrical equipment, resulting in operational disruption. Electrical and electronic equipment is susceptible to lightning-induced surges, which could result in temporary operational outages.

9.5.2.2 Operation Phase

Sensitivity Analysis

The aim of the sensitivity analysis is to identify which climate hazards are relevant to the specific type of project, irrespective of its location. Individual components within the Proposed Development are assessed against each climate hazard.

Receptors	Sensitivity to Climate Hazards (No consideration of site location)					
	Extreme Heat	Extreme Cold	Flood (Pluvial)	Flood (Fluvial)	Extreme Wind	Lightning
Wind farm	1	1	1	2	2	2
Drainage	1	1	2	2	1	1
Roads	2	1	2	1	1	1
Critical systems	2	1	2	2	2	2
Underground utilities	1	1	1	1	1	1
1= Low, 2= Medium, 3= High						

Table 9.11: Receptors and their Sensitivity to Climate Hazards

Table 9.11 shows low sensitivity and medium sensitivity for relevant climate hazards when assessed against sensitivity receptors. High sensitivity was not proposed for any of the sensitivity receptors. The majority of the medium risks are to the critical systems

followed by roads and drainage. By the TII PE-ENV-01104 guidance definition, a medium risk is “It is possible or likely the climate hazard will have a moderate impact on the asset category”. Due to the nature of the proposed project and applicable turbine design and certification standards ensuring wind farms in Ireland are constructed to a high quality and with resilience to climate hazards, the sensitivity to the receptors are not considered high. However, the medium sensitivity ratings have been assigned where climate hazards could affect asset performance, operation or accessibility. Extreme heat may reduce efficiency and reliability of critical electrical and control systems and accelerate deterioration of road surfaces. Pluvial and fluvial flooding could affect site access, damage drainage infrastructure, disrupt maintenance activities, and increase erosion or asset degradation. Extreme wind may increase loading on turbine and electrical infrastructure, leading to increased wear, temporary shutdowns, or maintenance requirements.

Exposure Analysis

The exposure of the Proposed Development to climate risks is highly dependent on the project location. The aim of the exposure analysis is to identify which climate hazards are relevant to the planned project location. This assessment is based on current and future climate described in **Section 9.4.3**.

Climate Exposure	Exposure Risk to Climate Hazards (Consider the site location)					
	Extreme Heat	Extreme Cold	Flood (Pluvial)	Flood (Fluvial)	Extreme Wind	Lightning
Exposure at project location	2	1	2	1	2	1
1= Low, 2= Medium, 3= High						

Table 9.12: Exposure of Proposed Development to the Climate Hazards

Table 9.12 shows the locality of the Proposed Development is at low or medium exposure to the climate hazards. Medium exposure is defined as “this climate hazard occurs at the project location a number of times in a decade”. The assessment has been based on information in **Section 9.4.3** for example extreme wind is evidenced by the number of named storms discussed in **Section 9.4.3.3**. Occurrences of extreme heat also sit within the medium exposure category based on the current climate. Exposure of the project to pluvial and fluvial flooding was determined by the FRA prepared by Hydro-Environmental Services (**Chapter 7** and **Annex 7.1**). The FRA determines that the site is generally low lying and flat in places and therefore localised pluvial flooding is very likely after heavy or prolonged rainfall. Sections of the underground electricity line route cross or intersect the Rapemills River and are located within mapped fluvial flood zones. However, the wind farm site is located within Fluvial Flood Zone C.

Vulnerability Analysis

This assessment combines the outcomes of the sensitivity and exposure analysis to determine which climate hazards pose a risk to the Proposed Project. The vulnerability of the Proposed Project to climate risks is determined based on the sensitivity and the exposure as follows:

$$\text{Vulnerability} = \text{Sensitivity} \times \text{Exposure}$$

The vulnerability of the proposed project to the risks of Climate Change impacts is shown in **Table 9.13** below:

Receptors	Vulnerability Analysis					
	Extreme Heat	Extreme Cold	Flood (Pluvial)	Flood (Fluvial)	Extreme Wind	Lightning
Wind Farm	2	1	2	2	4	2
Drainage	2	1	4	2	2	1
Roads	4	1	4	1	2	1
Critical systems	4	1	4	2	4	2
Underground utilities	2	1	2	1	2	1
1, 2 = Low; 3, 4 = Medium; 6,9 = High						

Table 9.13: Vulnerability of the Proposed Project to the risks of climate change impacts

Table 9.13 shows a collective rating of each receptor's vulnerability to the hazards that were screened in. Critical systems, followed by roads, of the proposed project are relatively more vulnerable to the physical hazards. As the temperatures are expected to increase in the medium term, extreme heat poses a threat to the receptors as it can cause overheating of critical systems and cause road surfaces to buckle.

Prior to mitigation, extreme wind poses as a medium risk to the Wind Farm and the critical systems infrastructure like the switch room. Tall structures, such as Wind Turbines are especially vulnerable to extreme winds and storms if the strength and resilience is not considered. Flying debris might damage the switch room and the associated electrical infrastructure.

Pluvial flooding has the potential to put the drainage systems under stress during an extreme flooding event which may exceed the design limits. The site is generally low-

lying and flat in places, making localised pluvial flooding very likely following heavy or prolonged rainfall events when surface water is unable to drain efficiently. It is also a cause of medium vulnerability which can easily be mitigated through design measures.

9.5.2.3 CCRA Significance of Effects

In the absence of design mitigation, there is a medium risk to the project as a result of climate change. In accordance with the EPA Guidelines (EPA, 2022), the significance of effect of the impacts to the project as a result of climate change are **direct** as climate extremes have a direct physical effect on buildings and infrastructure, **long-term** due to the response times of the climate in relation to changes in anthropogenic emissions, **negative** as climate extremes have been shown to damage or adversely affect infrastructure, and **moderate** due to the medium vulnerability of the project to the effects of climate change, which is overall **significant** in EIA terms.

9.6 GHG MITIGATION MEASURES

9.6.1 Construction Phase

Embodied carbon of materials and construction activities will be the primary source of climate impacts during the construction phase. Best practice measures to reduce the embodied carbon of the construction works will be implemented:

- Prevention of on-site or delivery vehicles from leaving engines idling, even over short periods.
- Ensuring that fossil fuel powered plant and equipment meet the Euro Stage V emission standard.
- Ensure all plant, machinery and vehicles are well maintained and inspected regularly.
- Ensuring, that site vehicles and delivery vehicles meet the Euro VI/Euro 6 standards for emissions.
- Excavated material will be reused within the project where suitable, with remaining peat and spoil managed within the designated peat/spoil deposition areas in accordance with the Peat and Spoil Management Plan.
- Specifying electrically powered plant and equipment where practicable and using grid connections for electric power when practicable instead of fossil fuel powered generators.

In addition to the above, during the construction phase the following additional measures exceeding standard construction practices shall be implemented on site to prevent significant GHG emissions and reduce impacts to climate in line with ISEP 2026 GHG Guidance:

- On-site segregation of all waste materials into appropriate categories including, for example, topsoil, bedrock, concrete, bricks, tiles, oils /diesels, metals, dry recyclables e.g. cardboard, plastic, timber.
- Sourcing materials locally will be prioritised. This will help to reduce transport related CO₂ emissions and helps support local suppliers, further promoting economic sustainability.
- For procurement of low carbon materials, the following low carbon material choices will be implemented unless there is a specific design practicality that prohibits it:

- Concrete: GGBS (Ground granulated blast-furnace slag), 30% lower clinker content cement, or better, where practicable;
- Fibre reinforced concrete or similar instead of steel reinforcement
- Steel: recycled or electric arc foundry steel, cross laminated timber;
- Bricks and aggregates: reclaimed or recycled.

9.6.2 Operation Phase

During the operation phase of the proposed project, the works onsite will be limited to maintenance. Although the intensity of activity will be only a small fraction of the construction phase, all employees and contractors that are on site will ensure that machinery used is properly maintained and is switched off when not in use to avoid unnecessary exhaust emissions from maintenance traffic.

9.7 CCRA MITIGATION MEASURES

9.7.1 EMBEDDED ADAPTATION

Several measures have been adopted as part of the project design, primarily in terms of reducing risk to the project from climate change hazards. These have been discussed in detail previously in **Section 9.4.3**, and are summarised as follows:

- The wind farm drainage system has been designed to accommodate a 1-in-100-year rainfall event, as described in **Chapter 7**.
- The proposed turbines to be installed, are designed to the appropriate standards to account for the high wind loadings.
- The wind turbines are also resilient towards high temperatures with standard operating temperatures of approximately -20°C to +45°C. The projected climate of Ireland is well within limits.
- High quality, durable building materials will be selected for the proposed project to reduce their sensitivity to extreme temperatures.
- Lightning protection conduits are integral to the construction of the blades.

However, a project's climate resilience benefits from review of climate hazards and management of their impacts during the detailed design, construction and operation. The Proposed Project will be constructed having taken the most up to date Eurocodes, design practices and climate data into account prior to maximise resilience of the project against climate change hazards.

9.7.2 CONSTRUCTION PHASE

In terms of impact on the proposed project due to climate change, during construction the Contractor will be required to mitigate against the effects of extreme rainfall/flooding, extreme temperatures and wind and storms through site risk assessments, method statements and good site management practice. All materials used during construction will be accompanied by certified datasheets which will set out the limiting operating temperatures. Temperatures can affect the performance of some materials, and this will require consideration during construction.

9.7.3 OPERATION PHASE

During the operation phase of the proposed project, the Operation and Maintenance (O&M) manual will include details regarding maintaining the functionality and resilience of the proposed project and all its components to ensure that the climate

hazards do not pose a high risk. No other mitigation is proposed.

9.7.4 Cumulative

No specific mitigation is proposed for the cumulative impact.

9.7.5 Monitoring

Monitoring and reporting of the embodied carbon in the construction phase will be conducted. The aim of monitoring will be to seek further ways to minimise climate impacts. Monitoring will include contractual obligations, in line with the most recent Climate Action Plan and sectoral targets, for the successful tenderer to ensure that the proposed development stays in line with updated aims. Commitments to monitor GHG emissions during the construction phase will also be secured through the final Construction Environmental Management Plan (CEMP). Monitoring will include embodied carbon of construction materials, water usage, power and fuel usage, and waste generation (including reuse and recycling rates). Where monitoring shows that the proposed development is not meeting its targets, further mitigation will be put in place.

Monitoring should also include reviewing potential for extreme weather events which may cause damage during construction. Contractors' Environmental Management System (EMS) will include measures to address risks during such events i.e. flooding.

9.8 RESIDUAL EFFECTS

9.8.1 GHGA RESIDUAL EFFECTS

TII reference the ISEP guidance (2022) which states that the crux of assessing significance is:

"not whether a project emits GHG emissions, nor even the magnitude of GHG emissions alone, but whether it contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050".

9.8.1.1 Construction Phase

As set out in **Table 9.9**, during the construction and decommissioning phases, the proposed project will negatively impede Ireland's trajectory to achieving net zero by 2050 as GHG emissions produced during the construction phase will contribute a small fraction towards the national and sectoral budgets. The proposed project will minimise its impacts through design, management and reduction measures (see Section 9.6.1). The level of mitigation described in Section 9.6.1 surpasses best-practice and minimum regulatory requirements. This has been taken into account when determining the residual significance of the proposed project's GHG emissions against ISEP Guidance (2026).

Based on the above reasoning in accordance with the EPA Guidelines (EPA, 2022), the above criteria equates to an impact of GHG emissions during the construction and decommissioning phases of a **direct** impact due to its presence, that is **long-term** as a result of the atmospheric lifetime of GHG emissions, **negative** due to the emission of GHGs and **slight** based on the minor contribution of GHG emissions to Ireland's national trajectory to net zero. Overall, the impact on the climate is considered to be **not significant** in EIA terms.

9.8.1.2 Operation Phase

As set out in **Table 9.10**, the proposed project will positively contribute towards Ireland's trajectory to achieving net zero by 2050 as the proposed project will displace approximately 9,469 – 10,815 tCO₂e annually (after deduction of annualised quantified non-turbine construction emissions) from fossil fuel energy generation across its lifespan.

In accordance with the EPA Guidelines (EPA, 2022), the above criteria equates to an impact of GHG emissions during the operation phase of an **indirect** impact due to its presence, that is **long-term** as a result of the estimated lifetime of the infrastructure, **positive** due to the displacement of fossil fuels through the production of renewable electricity and **slight** based on its overall contribution to global climate mitigation. Overall, the impact on the climate is considered to be **not significant** in EIA terms.

9.8.1.3 Net GHG Significance of Effect

ISEP guidance (2026) states "Significance of each project lifecycle stage should be assessed (and where applicable mitigated) before reaching any overall lifecycle net effect conclusions." Although the construction phase has a negative, not-significant impact on the climate, the operational phase has a more substantial positive, not-significant impact on the climate. As expressed in Section 9.3.3.1 an LCA for the Vestas V172-6.8/7.2 wind turbines was reviewed as a representative LCA for the proposed project. The Vestas LCA specified an energy payback period for the wind turbines of 7 months. Across the 35-year lifespan of the turbines, the positive impact far outweighs the adverse.

Overall, having regard to the **direct**, **long-term**, **slight** and **negative** effects arising during the construction and decommissioning phases and the **indirect**, **long-term**, **slight** and **positive** effect arising during the operation phase, the project will have a **long-term**, **slight** and **positive** effect on climate, which is **not significant** in EIA terms (EPA 2022).

9.8.2 CCRA RESIDUAL EFFECTS

With design mitigation in place, there are no significant residual risks to the project as a result of climate change. In accordance with the EPA Guidelines (EPA, 2022), the significance of effect of the impacts to the project as a result of climate change are **direct** as climate extremes have a direct physical effect on infrastructure, **long-term** due to the response times of the climate in relation to changes in anthropogenic emissions, **negative** as climate extremes have been shown to damage or adversely affect infrastructure, and **not significant** due to the low vulnerability of the project to the effects of climate change once mitigation measures have been embedded, which is overall **not significant** in EIA terms.

9.8.3 CUMULATIVE

In accordance with guidance from the ISEP (ISEP, 2026) the climate is not constrained by project, regional or national boundaries and therefore the GHG assessment has been presented in the context of the national and sectoral carbon budgets for the whole of Ireland and the ability of the Proposed Development to assist or impede the national relevant targets. Given the contribution of such targets to the global efforts to reduce the impact of society upon the climate the assessment is considered to be inherently cumulative.

In addition, while Cush Wind Farm Phase I and the associated Section 146B alteration request have been identified as related developments, they have not been separately quantified in this chapter, as they are considered within the inherently cumulative national and sectoral carbon budget context.

As per the above, the cumulative impact of the project in relation to GHG emissions is considered **indirect, long-term, positive** and **slight**, which is overall **not significant** in EIA terms.

9.9 SUMMARY

This chapter of the EIAR has assessed the potential environmental effects on climate, focusing on:

- The potential greenhouse gas emissions during the construction, operation, and decommissioning phases of the project.
- The displacement of GHG emissions through renewable electricity generation, which will contribute to reducing Ireland's reliance on fossil fuels.
- The vulnerability of the project to climate change, including considerations for increased rainfall and other projected climate hazards.
- The long-term benefits of the project in helping Ireland achieve its Climate Action Plan targets and the National Climate Objective of Net Zero by 2050.

Overall, there are no significant effects on climate as a result of the proposed development, and no significant effects on the proposed development itself as a result of climate change hazards.

9.9.1 GREENHOUSE GAS ASSESSMENT

The impact of GHG emissions during the construction and operation phases on climate was assessed in line with TII guidance PE-ENV-01104 (TII, 2022) and ISEP GHG guidance (ISEP, 2026), which states that the significance of the impact of GHG emissions was based on the proposed project's net impact over its lifetime.

The GHG assessment considered the GHG emissions arising from embodied carbon in materials, material transportation, land use change, water usage, fuel usage, site excavation, waste disposal, turbine LCA, and the carbon savings from the operation of the proposed project.

The estimated generating capacity of 18.3 MW to 21.6 MW from the proposed project will generate 48.3 GWh to 55.1 GWh annually, which will amount to an estimated annual GHG emission savings of approximately 9,469 – 10,815 tCO₂e (after deduction of annualised quantified non-turbine construction emissions). These figures are based on the provisional 2025 carbon intensity of electricity of 197.8 gCO₂/kWh and a GWP of 273 for N₂O and 27 for CH₄. The estimated GHG savings are equivalent to 0.32% – 0.36% of the electricity sector's annual emissions ceiling for 2030 (Government of Ireland, 2025).

The proposed project will assist in the CAP25 goal of producing up to 80% renewables for the grid and the key actions of installing at least 9 GW of onshore wind energy. CAP25 states that “rapid and significant reductions in GHG emissions are required if we are to meet the 2015 Paris Agreement Goals”.

The construction and decommissioning phases will result in **direct, long-term, slight** and **negative** effects on climate. During the operation phase, the displacement of greenhouse gas emissions associated with fossil-fuel electricity generation will result in

an **indirect, long-term, slight** and **positive** effect. Overall, the effect on climate is assessed as **long-term, slight** and **positive**, and **not significant** in EIA terms.

9.9.2 CLIMATE CHANGE RISK ASSESSMENT

The vulnerability of the proposed project to climate change was assessed by the CCRA, in line with EPA National Climate Change Risk Assessment Guidance (2025), TII guidance PE-ENV-01104 (TII, 2022), European Commission Technical Guidance on the Climate Proofing of Infrastructure in the Period 2021–2027 (European Commission, 2021a) and ISEP guidance Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation (2nd Edition) (ISEP, 2020a). This involved an analysis of the sensitivity and exposure of the proposed project to climate hazards which together provide a measure of vulnerability.

Sensitive elements of the proposed project included drainage, access roads, buildings, underground utilities, turbines, foundations, and cables. Climate hazards included flooding (pluvial and fluvial), extreme temperatures and wind.

Mitigation measures for sensitive elements, such as adequate drainage design, wind turbine design and control during high winds, and consideration to extreme high and low temperatures have been incorporated into the design and the vulnerability analysis of the proposed project.

Having taken these into account, this results in a worst-case low residual vulnerability to climate change hazards. In accordance with the EPA EIAR Guidelines (2022), and with the design mitigation in place, the significance of effect on the proposed project as a result of climate change are **direct, negative, long-term** and **not significant** in EIA terms.

In summary, there are no likely significant effects on the proposed project as a result of climate change hazards.

9.10 REFERENCES

- BSI (2023) Carbon Management in Infrastructure and Built Environment - PAS 2080
- EirGrid (2024) Enduring Connection Policy 2.3. Online: [ECP-2.3-Solar-and-Wind-Constraints-Report-Assumptions-and-Methodology-v1.1.pdf](#).
- Environmental Protection Agency (EPA) (2021a) Critical Infrastructure Vulnerability to Climate Change
- Environmental Protection Agency (EPA) (2021b) What impact will climate change have for Ireland? [Online] Available at <https://www.epa.ie/environment-and-you/climate-change/what-impact-will-climate-change-have-for-ireland>
- Environmental Protection Agency (EPA) (2022) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports
- Environmental Protection Agency (2024) National Climate Change Risk Assessment Technical Guidance for Sectoral Assessment.
- Environmental Protection Agency (2025a) Ireland's Provisional Greenhouse Gas Emissions 1990-2024
- Environmental Protection Agency (2025b) Ireland's Greenhouse Gas Emissions Projections 2024-2055
- Environmental Protection Agency (2025c) National Climate Change Risk Assessment Main Report.
- Environmental Protection Agency (2025e) Climate Ireland Data Explore - TRANSLATE Database
- European Centre for Medium-Range Weather Forecasts (ECMWF) (2023) ERA5 Fifth Generation Atmospheric Reanalysis: Copernicus Climate Change Service - Complete ERA5 global atmospheric reanalysis. Accessed through: DOI: 10.24381/cds.143582c
- European Commission (2013) Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment
- European Commission (2017) Environmental Impact Assessment of Projects: Guidance on the Preparation of the Environmental Impact Assessment Report
- European Commission (2021) Technical Guidance on the Climate Proofing of Infrastructure in the Period 2021-2027
- European Parliament and Council (2026) Regulation (EU) 2026/667 of the European Parliament and of the Council of 11 March 2026 amending Regulation (EU) 2021/1119 as regards the setting of a Union intermediate climate target for 2040. Online, <https://eur-lex.europa.eu/eli/reg/2026/667/oj/eng>.
- European Union (2018) Regulation 2018/842 on Binding Annual Greenhouse Gas Emission Reductions by Member States from 2021 to 2030 Contributing to Climate Action to Meet Commitments under the Paris Agreement and Amending Regulation (EU) No. 525/2013
- Geological Survey of Ireland (2026) Landslide susceptibility mapping. Available at: <https://gsi.geodata.gov.ie/portal/apps/webappviewer/index.html?id=be808e49f2be4808bd4e2e60820fa856>
- Global Facility for Disaster Reduction and Recovery (2026) Think Hazard Wildfire Risk – Offaly. Available at: Think Hazard - Offaly - Wildfire

Government of Ireland (2015) Climate Action and Low Carbon Development Act 2015 (No. 46 of 2015). Online, <https://www.irishstatutebook.ie/eli/2015/act/46/enacted/en/html>, Accessed February 2026

Government of Ireland (2021) Climate Action and Low Carbon Development (Amendment) Act 2021 (No. 32 of 2021). Online, <https://www.irishstatutebook.ie/eli/2021/act/32/enacted/en/print>, Accessed February 2026

Government of Ireland (2023) Long-Term Strategy on Greenhouse Gas Emissions Reductions. Online, <https://www.gov.ie/en/department-of-climate-energy-and-the-environment/publications/long-term-strategy-on-greenhouse-gas-emissions-reductions/>, Accessed February 2026

Government of Ireland (2024) Climate Action Plan (CAP24). Online, <https://www.gov.ie/en/department-of-climate-energy-and-the-environment/publications/climate-action-plan-2024/>, Accessed February 2026

Government of Ireland (2024) Second National Adaptation Framework (NAF). Online, <https://www.gov.ie/en/department-of-climate-energy-and-the-environment/publications/national-adaptation-framework-naf/>, Accessed February 2026

Government of Ireland (2025) Climate Action Plan (CAP25). Online, <https://www.gov.ie/en/department-of-climate-energy-and-the-environment/publications/climate-action-plan-2025/>, Accessed February 2026

Government of Ireland (2025) National Planning Framework (First Revision). Online, <https://www.gov.ie/en/department-of-housing-local-government-and-heritage/publications/national-planning-framework-first-revision/>, Accessed February 2026

Institute of Sustainability and Environmental Professionals (2026) Assessing Greenhouse Gas Emissions and Evaluating their Significance Edition 2.1 April 2026, with supplementary guidance

Institute of Sustainability and Environmental Professionals (2020) ISEP Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation.

Institute of Sustainability & Environmental Professionals (ISEP) (formerly known as IEMA) (2020a) Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation

Institute of Sustainability & Environmental Professionals (ISEP) (2020b) GHG Management Hierarchy

Institute of Sustainability & Environmental Professionals (ISEP) (2022) Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance

International Organization for Standardization (ISO) (2021) ISO 14091:2021. Adaptation to climate change — Guidelines on vulnerability, impacts and risk assessment. Available at: ISO 14091:2021 - Adaptation to climate change — Guidelines on vulnerability, impacts and risk assessment

Intergovernmental Panel on Climate Change (IPCC) (2023) 6th Synthesis report. Available at: AR6 Synthesis Report: Climate Change 2023 — IPCC

Offaly County Council OCC (2023) Climate Change Risk Assessment

Offaly County Council (OCC) (2024) Climate Action Plan 2024-2029

Met Éireann (2026a) 30-year averages. Available at: Historical Data - Met Éireann - The Irish Meteorological Service

Met Éireann (2026b) Shannon Airport Weather Data. Available at: Historical Data - Met Éireann - The Irish Meteorological Service

Portmann V, Swingedouw D, Khattar O, Chavent M. (2026) Observational constraints project a ~50% AMOC weakening by the end of this century. Sci. Adv.12.DOI:10.1126/sciadv.adx4298

Sustainable Energy Authority of Ireland, 2025 (SEAI, 2025). Online, <https://seaiprod.prod.acquia-sites.com/EPBD/life-cycle-global-warming-potential-methodology>

Transport Infrastructure Ireland (TII) (2022) Transport Infrastructure Ireland (TII) PE-ENV-01104: Climate Guidance for National Roads, Light Rail and Rural Cycleways (Offline & Greenways) – Overarching Technical Document. Online, <https://www.tiipublications.ie/document/?id=3215>, Accessed February 2026

Transport Infrastructure Ireland (TII) (2025) Transport Infrastructure Ireland (TII) GE-ENV-01106: TII Carbon Assessment Tool for Road and Light Rail Projects and User Guidance Document. Online, <https://www.tiipublications.ie/document/?id=3219>, Accessed February 2026

Transport Infrastructure Ireland (TII) (2025) TII Online Carbon Tool.

United Nations (2015) United Nations Paris Agreement. Online, https://treaties.un.org/pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-7-d&chapter=27&clang=_en, Accessed February 2026

United Nations (2026) 1.5°C: what it means and why it matters. Online, <https://www.un.org/en/climatechange/science/climate-issues/degrees-matter>, Accessed May 2026

Vestas Wind Systems A/S (2022) *EnVentus V172-6.8/7.2 MW: Results of Life Cycle Assessment – Streamlined Study*, Document No. 0122-0965, Version 01

World Bank Group (2026) Climate Change Knowledge Portal. Online, <https://climateknowledgeportal.worldbank.org/>, Accessed February 2026