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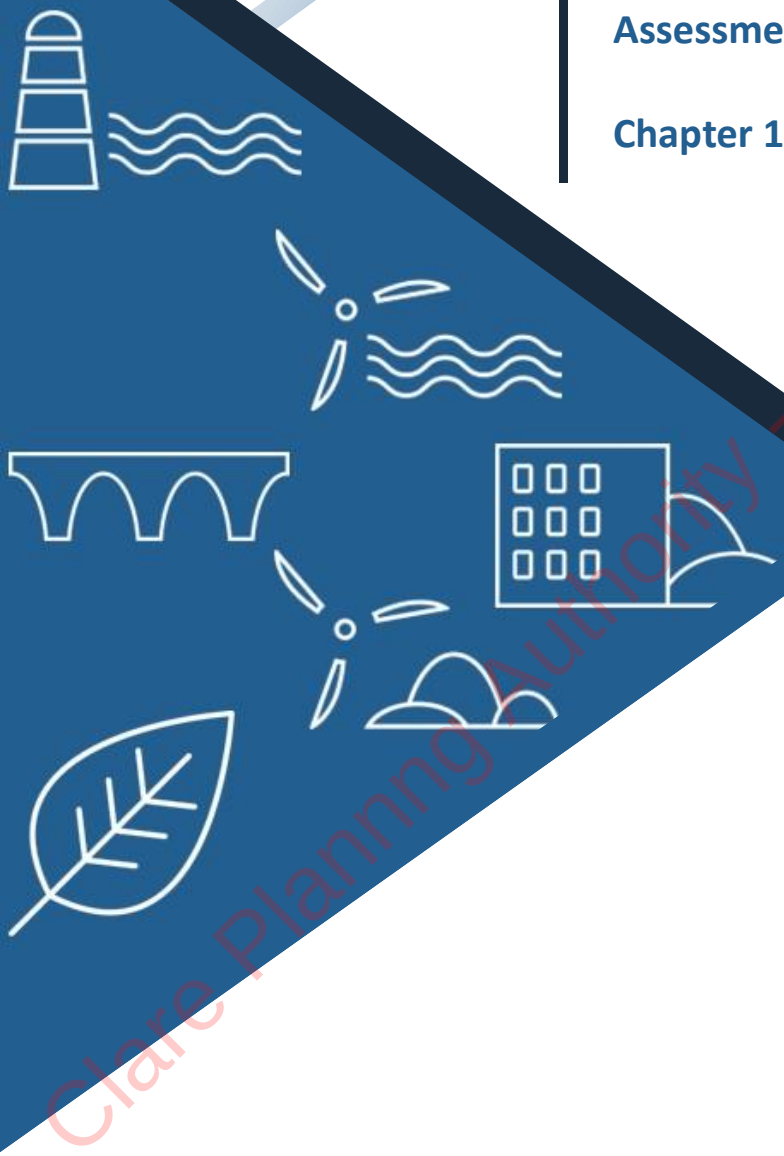
Illaunbaun Wind Farm – Environmental Impact Assessment Report

Chapter 12 – Climate



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ACRONYMS

AA	Appropriate Assessment
ABP	An Bord Pleanála
AMOC	Atlantic Meridional Overturning Circulation
AWS	Automatic Weather Station
CAP	Climate Action Plan
CCC	Clare County Council
CCRA	Climate Change Risk Assessment
CESSM	Civil Engineering Standard Method of Measurement
CO^2	Carbon Dioxide
CORDEX	Coordinated Regional Downscaling Experiment
DECC	Department of the Environment, Climate and Communications
DECC	Department of Energy and Climate Change
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EPA	Environmental Protection Agency
ESD	Effort Sharing Decision
ESR	Effort Sharing Regulation
ETS	Emissions Trading Scheme
EU	European Union
FRA	Flood Risk Assessment
GFDRR	Global Facility for Disaster Reduction and Recovery
GGBS	Ground Granulated Blastfurnace Slag
GHG	Greenhouse Gas
GHGA	Greenhouse Gas Assessment
GSI	Geological Survey Ireland
GW	Gigawatt
HGV	Heavy Goods Vehicle
HVO	Hydrotreated Vegetable Oil
IEC	International Electrotechnical Commission
IEMA	Institute of Environmental Management & Assessment
IPCC	Intergovernmental Panel on Climate Change
ISCC	International Sustainability and Carbon Certification
LGV	Large Goods Vehicle
LULUCF	Land Use, Land-use Change and Forestry
MCA	Multi-Criteria Analysis
MIAQM	Member of the Institute of Air Quality Management
MIEnvSc	Member of the Institution of Environmental Sciences
MW	Megawatt
NFCS	National Forest Carbon Stock
NPF	National Policy Framework
RCP	Representative Concentration Pathway
SEAI	Sustainable Energy Authority of Ireland
SHD	Strategic Housing Development
SST	Sea Surface Temperature
TII	Transport Infrastructure Ireland

UCD	University College Dublin
UK	United Kingdom

12 CLIMATE

12.1 INTRODUCTION

This chapter presents the assessment of the likely significant effects (as per the "EIA Regulations") of the Proposed Development on Climate arising from the construction and operation of the Proposed Development, both alone and cumulatively with other plans and projects, and was determined following the issue of the *Illaunbaun Wind Farm - Environmental Impact Assessment Scoping Report* to stakeholders described in Chapter 06: Project Scoping and Consultation.

The assessment presented is informed by the following technical chapters/appendices:

- Chapter 05: Project Description
- Appendix 10-01: Flood Risk Assessment

This chapter comprises the following elements:

- Summary of relevant climate policy and guidance;
- Data sources used to characterise the Study Area;
- Summary of consultations with stakeholders;
- Methodology followed in assessing the impacts of the Proposed Development (such as information of the Study Area and the approach taken in assessing the potential impacts);
- Review of baseline climate conditions;
- Assessment of likely effects on climate arising from the construction and operation of the Proposed Development;
- Assessment of likely effects of climate change on construction and operation of the Proposed Development;
- Identification of further mitigation measures and/or monitoring requirements (if any) in respect of any significant effects (following the 'mitigation hierarchy' of avoidance, minimisation, restoration and offsets in consecutive order); and
- Summary of residual impact assessment determinations in the case of any additional mitigation measures identified during this process.

12.1.1 RELEVANT LEGISLATION AND GUIDELINES

The following policy, legislation, plans and guidance are considered applicable to this chapter.

12.1.1.1 NATIONAL AND INTERNATIONAL LEGISLATION

In 2015, the Climate Action and Low Carbon Development Act 2015 (No. 46 of 2015) (Government of Ireland, 2015) was enacted (the Act). The purpose of the Act was to enable Ireland "to pursue, and achieve, the transition to a low carbon, climate resilient and environmentally sustainable economy by the end of the year 2050" (3.(1) of No. 46 of 2015). This is referred to in the Act as the *national transition objective*. The Act 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.

The first Climate Action Plan (CAP) was published by the Irish Government in June 2019 (Government of Ireland, 2018). The Climate Action Plan 2019 outlined the current status across key sectors including Electricity, Transport, Built Environment, Industry and Agriculture and outlined the various broadscale measures required for each sector to achieve ambitious decarbonisation targets. The 2019 CAP also detailed the required governance arrangements for implementation including carbon-proofing of policies, establishment of carbon budgets, a strengthened Climate Change Advisory Council and greater accountability to the Oireachtas. The Government published the second CAP in November 2021 (Government of Ireland, 2021a) with further updated CAPs in December 2022 (Government of Ireland, 2022) and December 2023 (DECC, 2023a). The fifth and most recent CAP, was published in April 2025 (Government of Ireland, 2025).

Following on from Ireland declaring a climate and biodiversity emergency in May 2019, and the European Parliament approving a resolution declaring a climate and environment emergency in Europe in November 2019, the Government approved the publication of the General Scheme in December 2019, followed by the publication of the Climate Action and Low Carbon Development (Amendment) Act 2021 (hereafter referred to as the 2021 Climate Act) in March 2021. The Climate Act was signed into Law on the 23rd of July 2021, giving statutory effect to the core objectives stated within the CAP.

The purpose of the 2021 Climate Act (Government of Ireland, 2021) is to provide for the approval of plans "for the purpose of pursuing the transition to a climate resilient, biodiversity rich and climate neutral economy by no later than the end of the year 2050". The 2021 Climate Act will also "provide for carbon budgets and a decarbonisation target range for certain sectors of the economy". The 2021 Climate Act defines the carbon budget as "the total amount of greenhouse gas emissions that are permitted during the budget period".

In relation to carbon budgets, the 2021 Climate Action and Low Carbon Development (Amendment) Act states

> "A carbon budget, consistent with furthering the achievement of the national climate objective, shall be proposed by the Climate Change Advisory Council, finalised by the Minister and approved by the Government for the period of 5

years commencing on the 1 January 2021 and ending on 31 December 2025 and for each subsequent period of 5 years (in this Act referred to as a 'budget period')".

The carbon budget is to be produced for 3 sequential budget periods, as shown in Table 12-1. The carbon budget can be revised where new obligations are imposed under the law of the European Union or international agreements or where there are significant developments in scientific knowledge in relation to climate change. In relation to the sectoral emissions ceiling, the Minister for the Environment, Climate and Communications shall prepare and submit to government the maximum amount of GHG emissions that are permitted in different sectors of the economy during a budget period and different ceilings may apply to different sectors. The sectorial emission ceilings for 2030 were published in July 2022 and are shown in Table 12-2. Electricity has a 75% reduction requirement and a 2030 emission ceiling of 3 Mt CO_2e.

Table 12-1: 5-Year Carbon Budgets 2021 – 2035

Budget Period	Carbon Budget	Reduction Required
2021-2025	295 Mt CO2e	Reduction in emissions of 4.8% per annum for the first budget period.
2026-2030	200 Mt CO2e	Reduction in emissions of 8.3% per annum for the second budget period.
2031-2035	151 Mt CO2e	Reduction in emissions of 3.5% per annum for the third provisional budget.

Table 12-2: 2030 Sectoral Emissions Ceilings

Sector	Baseline (Mt CO2e)	Carbon Budgets (Mt CO2e)		2030 Emissions (Mt CO2e)	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

Sector	Baseline (Mt CO2e)	Carbon Budgets (Mt CO2e)		2030 Emissions (Mt CO2e)	Indicative Emissions % Reduction in Final Year of 2025-2030 Period (Compared to 2018)
	2018	2021-2025	2026-2030		
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, CAP24 puts in place ambitious activity targets for the sector reflecting an EU-type approach.			
Total	68				
Unallocated Savings	-	-	26	-5.25	-
Legally Binding Carbon Budgets and 2030 Emission Reduction Targets	-	295	200	-	51

12.1.1.2 RELEVANT POLICIES AND PLANS

National Greenhouse Gas Policy

In 2024, the Government published its Long-Term Strategy on Greenhouse Gas Emissions Reductions (DECC, 2024). This strategy provides a long-term plan on how Ireland will transition towards net carbon zero by 2050, achieving the interim targets set out in the CAP.

In December 2023, CAP24 was published, establishing key actions to deliver a 51% reduction in GHG emissions by 2030 (compared to 2018 levels) and achieve climate neutrality by 2050 (DECC, 2023a). The updated and current CAP25, published in April 2025, builds on the progress of the previous four iterations of the CAP, with CAP23 first publishing carbon budgets and sectoral emission ceilings, and reaffirms Ireland's climate ambition, with a focus on delivery, implementation and measurable outcomes, particularly ahead of the second carbon budget period (2026–2030). 2025 is the last year in the first 5-year carbon budget period. During the initial 5-year budget period the average annual reduction required was 4.8%, this increases to 8.3% in the second budget period (2026-2030). CAP25 retains the high-impact sectors where the biggest savings can be achieved, while emphasising public sector leadership and green procurement. These sectors include renewable energy, energy efficiency of buildings, transport, sustainable farming, sustainable business and land-use change.

CAP25 also includes targeted actions to decarbonise industrial heat and support the transition to carbon-neutral manufacturing processes. Public sector leadership is strengthened through a new Buying Greener: Green Public Procurement Strategy and Action Plan (2024–2027), the development of mandatory Climate Action Roadmaps, and enhanced emissions monitoring and reporting across government operations. To support innovation and ensure future economic resilience, IDA Ireland

continues to attract and support businesses investing in climate technologies and low-carbon solutions.

CAP25 highlights a significant 17% reduction in electricity emissions in early 2024, with wind power supplying nearly 40% of Ireland's total electricity demand and over 100,000 rooftop microgenerators connected to the grid. Investments are ongoing in grid reinforcement, offshore wind development and interconnectors with France and the UK to enhance renewable generation capacity. EirGrid, Enterprise Ireland and IDA Ireland have recently signed an MoU to collectively support offshore wind development in Ireland.

As outlined in CAP25 the target for renewables on the national grid is 80% by 2030 which includes 9 gigawatts (GW) of onshore wind energy. This is a key target and action within CAP25.

CAP25 also reinforces targets first outlined in CAP24 to reduce the embodied carbon of construction materials, with a 10% reduction by 2025 and 30% reduction by 2030 for materials produced and used in Ireland. Cement and high embodied carbon construction materials can be reduced through product substitution, reduced clinker content in cement and uptake of low-carbon construction methods, including those outlined in the Construction Industry Federation 2021 report Modern Methods of Construction (Construction Industry Federation, 2021). There also remains scope for the construction industry to use more timber in construction. In 2022, 24% of new construction in Ireland was built using timber frames to satisfy the demand for housing. Public bodies are now required under the Public Sector Mandate to use best practice project design to reduce embodied carbon; procure concretes with clinker replacements (lower carbon); and require that large construction projects produce a whole life cycle GHG emissions assessment.

Furthermore, CAP25 advances sector-specific measures in green procurement, electrification of transport and heat, and just transition (with the introduction of a Just Transition Commission) to support vulnerable communities. Transport emissions increased by 0.3%. Electric vehicles and the use of biofuels are stated as the best means of transport emission reductions in the medium term.

In relation to renewable energy generation, CAP25 re-affirms the previous commitment to increasing the share of renewable electricity to 50% by 2025 and 80% by 2030.

The draft revised National Policy Framework (NPF) introduces regional renewable electricity capacity allocations for each of three 'Regional Assemblies' to be achieved by 2030. These 'Regional Assemblies' include - the Eastern and Midlands assembly, the Northern and Western assembly and the Southern assembly. County Clare can be considered as part of the Northern and Western assembly. The NPF indicates that the Northern and Western assembly has, as of 2023, an onshore wind energised capacity of 1,761 MW with the potential for an additional 1,389 MW renewable power capacity from onshore wind. The Proposed Development will form part of achieving this additional capacity. As per CAP25, the target capacity allocations are the minimum required for wind and solar generation to meet the 2030 emissions reductions in the electricity sector.

Local Greenhouse Gas Policy

Clare County Council (CCC) aims to reduce its direct carbon emissions by 51% by 2030, and supports the generation of renewable energy as part of this. The *Clare County Council Climate Action Plan*

2024 – 2029 (Clare County Council, 2024) outlines Clare County Council's goals to mitigate GHG emissions and plans to prepare for and adapt to climate change.

Additionally, as part of the Clare County Development Plan 2023 – 2029, the following strategies were produced:

- Volume 5 Clare County Renewable Energy Strategy (RES)
- Volume 6 Clare Wind Energy Strategy

The vision of the Clare County Renewable Energy Strategy is consistent with that of the Clare County Development Plan 2023-2029, which is:

> "to position the County as the national leader in renewable energy generation, supporting energy efficiency and conservation, and which achieves balanced social and economic development throughout the County and assists in achieving national climate change mitigation targets".

As part of the Clare Wind Energy Strategy, Clare County Council aim to achieve a minimum target of 550MW from wind energy by the conclusion of the strategy.

National Climate Adaptation Policy

The second National Adaptation Framework (NAF) (DECC, 2024) was published in June 2024, in line with the five-year requirement of the 2015 Act, as amended. The plan provides a whole of government and society approach to climate adaptation in Ireland to reduce Irelands' vulnerability to climate change risks including extreme weather events, flooding, drought, loss of biodiversity, sea level rise and increased temperatures. Similar to the "Just Transition" when considering carbon emissions, the NAF aims for "Just Resilience" stating that:

> "A climate resilient Ireland will have a reduced reliance on fossil fuel, it will have widely accessible electrified public transport and will have transitioned towards sustainable agricultural practices such as agroforestry and organic farming."

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) was published in May 2024 (EPA, 2024a). The NCCRA was required to be developed under Action 457 from the 2021 CAP (Government of Ireland 2021). Action 457 seeks to "Further develop Ireland's national climate change risk assessment capacity to identify the priority physical risks of climate change to Ireland". The NCCRA uses

definitions of the risk determinants from the Intergovernmental Panel on Climate Change (IPCC) Risk Framework (IPCC 2023):

- **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.
- **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.

When considering risk, the NCCRA assesses exposure and vulnerability for two future climate change scenarios or Representative Concentration Pathways (RCPs):

- RCP4.5 was selected as it represents a scenario aligned with the global temperature trajectory.
- RCP8.5 was selected as it represents a high-emissions scenario and achieves the highest level of modelled temperature increases by the end of the century. Consequently, this scenario will result in the highest level of physical risk for Ireland, and therefore the greatest requirement for adaptation.

These scenarios align with a conservative approach to the assessment of risks to Ireland and assume that global emission reduction targets are not met. This aligns with the principle of precaution as stated in the NAF (DECC 2024). In addition to the future climate scenarios, the NCCRA assesses the risk from the future climate during the following timeframes:

- Present (~2030)
- Medium term (~2050)
- Long term (~2100)

Local Climate Adaptation Policy

The Clare County Council Climate Action Plan 2024-2029 highlights the risks that climate change poses to the county, these include increases in the risk of river, pluvial, and coastal flooding and coastal erosion. The risk of these hazards is likely to increase in the future because of changes in both hazard frequency as a result of climate change and impact due to changes in exposure and vulnerability. Heatwaves and droughts are expected to occur more frequently due to climate change and with a greater impact on County Clare in the future.

12.1.1.3 GUIDANCE

The principal guidance and best practice documents used to inform the assessment of potential impacts on climate are summarised below. The assessment has made reference to national

guidelines where available, in addition to international standards and guidelines relating to the assessment of climate impacts. These are summarised below:

- Guidelines on the Information to be contained in Environmental Impact Assessment Reports (hereafter referred to as the EPA Guidelines) (EPA, 2022)
- Environmental Impact Assessment of Projects: Guidance on the preparation of the Environmental Impact Assessment Report (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 (TII, 2022a)
- Transport Infrastructure Ireland (TII) GE-ENV-01106: TII Carbon Assessment Tool for Road and Light Rail Projects and User Guidance Document (TII, 2022b)
- Institute of Environmental Management & Assessment (IEMA) Environmental Impact Assessment Guide to: Assessing GHG Emissions and Evaluating their Significance (hereafter referred to as the IEMA GHG guidance) (IEMA, 2022)
- IEMA Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation (hereafter referred to as the IEMA 2020 EIA Guide) (IEMA, 2020a).
- IEMA GHG Management Hierarchy (hereafter referred to as the IEMA 2020 GHG Management Hierarchy) (IEMA, 2020b)
- Technical Guidance on the Climate Proofing of Infrastructure in the Period 2021-2027 (European Commission, 2021)

12.2 ASSESSMENT METHODOLOGY

The climate assessment is divided into two distinct sections – a greenhouse gas assessment (GHGA) and a climate change risk assessment (CCRA):

- Greenhouse Gas Emissions Assessment (GHGA) – Quantifies 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 projects vulnerability to climate change and identifies adaptation measures to increase project resilience.

Climate impacts are assessed at a national level and in relation to national targets and sectoral emission ceilings. The study area for climate is the Republic of Ireland.

12.2.1 STATEMENT OF COMPETENCE

This chapter was completed by Ciara Nolan. Ciara is a Principal Environmental Consultant in the Air Quality & Climate section of AWN Consulting. She holds a BSc in Energy Systems Engineering from University College Dublin (UCD) and has also completed an MSc in Applied Environmental Science at UCD. She is a Member of the Institute of Air Quality Management (MIAQM) and the Institution of

Environmental Sciences (MIEnvSc). She has over 8 years of experience in undertaking air quality and climate assessments. She has prepared air quality and climate impact assessments as part of EIARs for residential developments including Woodbrook, Shankill (Planning Application Ref. ABP30584419), Ballygossan Park, Skerries (Planning Application Ref. LRD0010/S3), Strategic Housing Development (SHD) Ratoath (Planning Application Ref. SH305196), SHD Rathmullen, Drogheda (Planning Application Ref. SH305552), commercial and industrial developments by Dublin Airport Authority, Abbvie, Mountpark, Pfizer, Takeda, as well as renewable energy developments such as Crockahenny Windfarm, Upperchurch Windfarm, Knocknamona Windfarm and Keerglen Windfarm. She also specialises in conducting air dispersion modelling assessments of emissions from data centres, energy centres and the chemical industry as part of EPA Industrial Emissions Licences for Echelon DC, AWS, Takeda, MSD and Regeneron. She has undertaken air quality and climate impact assessments for transportation schemes, primarily regional and national road schemes, from constraints, through to route selection and EIAR stage.

12.2.2 CONSULTATION

The Scoping Report for the proposed Illaunbaun Wind Farm was circulated in February 2025 to a range of statutory stakeholders and relevant organisations. The purpose of this consultation was to inform stakeholders about the Proposed Development and to seek feedback to support the preparation of the EIA. The consultees were selected based on their statutory responsibilities, the location and environmental sensitivities of the project area, and the potential for interactions with environmental receptors.

Geological Survey Ireland (GSI), a division of the Department of the Environment, Climate and Communications, responded by providing guidance on the use of their national datasets for environmental assessment. These datasets, which include baseline data relevant to several EIA topics, were recommended for use in evaluating effects on geology, hydrology, and also climate change. GSI highlighted specific datasets available to support climate-related assessments, including:

- Carbon accounting / Carbon balance
- Carbon capture and storage
- Climate change trends
- National coastal change assessment

These resources were suggested as relevant to the preparation of the EIAR, particularly with respect to cumulative and long-term environmental trends and interactions.

Transport Infrastructure Ireland (TII) also referred to climate change in the context of national policy alignment. Specifically, TII cited Section 12.4.1.1 of the Climate Action Plan 2024 (CAP24), which outlines the Government objective to achieve 80% of electricity from renewable sources by 2030. TII emphasised that all relevant public bodies must carry out their functions in a manner consistent with these national targets TII recommended that the developer undertake a Multi-Criteria Analysis (MCA) to select the grid connection route, ensuring that the outcome is technically sound and climate policy-compliant. They also requested that climate adaptation aspects be considered in the

engineering design of public road crossings, particularly in relation to drainage infrastructure and culvert sizing. These comments are noted and will be addressed in detail when a separate planning application for the grid connection route is submitted.

No further submissions received as part of the consultation on the EIA Scoping Report explicitly addressed climate change, greenhouse gas emissions, climate adaptation, or climate resilience in relation to the proposed development.

Consultation with specific stakeholders and relevant bodies was not required as part of the climate assessment.

12.2.3 DATA SOURCES

The following data sources were used as part of the climate assessment:

- Environmental Protection Agency (EPA) (2024) Ireland's Final Greenhouse Gas Emissions 1990-2023
- Global Facility for Disaster Reduction and Recovery (GFDRR) (2025) Think Hazard! Available at: https://thinkhazard.org/en/ (Accessed: 24/04/2025)
- Met Éireann (2025a). Ireland's 30-year Climate Averages. Available at: https://www.met.ie/climate/30-year-averages (Accessed: 24/04/2025)
- Sustainable Energy Authority of Ireland (SEAI) (2024). Conversion Factors. Available at: https://www.seai.ie/data-and-insights/seai-statistics/conversion-factors (Accessed: 24/04/2025)
- Geological Society of Ireland (GSI) (2025) Landslide Susceptibility Mapping Database. Available at: https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=b68cf1e4a9044a5981f950e9b9c5625c (Accessed: 24/04/2025)

12.2.4 GREENHOUSE GAS ASSESSMENT METHODOLOGY

As per the EU guidance document *Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment* (European Commission, 2013) the climate baseline is first established with reference to EPA data on annual GHG emissions (see Section 12.3.1).

12.2.4.1 CONSTRUCTION PHASE

GHG Assessment – TII Carbon Tool

The GHG assessment has been conducted following the TII PE-ENV-01104 guidance[1] (TII, 2022a). PE-ENV-01104 (TII, 2022a) recommends the calculation of the construction stage GHG emissions, including embodied carbon, using the TII Online Carbon Tool (TII, 2022b). 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 TII Online Carbon Tool (TII, 2022b) has been commissioned by TII to assess GHG

[1] *PE-ENV-01104: Climate guidance for national roads, light rail and rural cycleways (offline & greenways) – Overarching technical document*.

emissions associated with road or rail projects using Ireland-specific emission factors and data. However, the tool can be used to estimate the GHG emissions from other development types such as the Proposed Development as a number of the material types and activities are somewhat similar. The TII Carbon Tool has been used to assess the GHG emissions associated with site clearance works, excavation, material transport, construction activities, construction worker travel and construction wastes for the windfarm (excluding the wind turbines) and grid connection.

The TII Carbon Tool (TII, 2022b) uses emission factors from recognised sources including the Civil Engineering Standard Method of Measurement (CESSM) Carbon and Price Book database (CESSM, 2013). The carbon emissions are calculated by multiplying the emission factor by the quantity of the material that will be used over the entire construction / maintenance phase. The outputs are expressed in terms of tCO_2e (tonnes of carbon dioxide equivalent).

The assessment commences with the high-level design, through the pre-construction (site clearance) stage, followed by the assessment of the embodied carbon associated with all materials used in the construction of the Proposed Development, the emissions during the construction phase activities and additionally emissions related to waste generated during the construction phase. The tool also assesses on-going maintenance associated with the lifetime of the Proposed Development.

The construction phase of the Proposed Development will result in GHG emissions from various sources. As part of the Proposed Development, Construction phase embodied GHG emissions are categorised under the following headings:

- Land clearance activities (i.e. tree felling);
- Transport of excavated material from the site;
- Manufacture of materials and transport to site;
- Construction works (including excavations, construction, water usage, electrical power/fuel usage, personnel travel and project size); and
- Construction waste products (including transport off-site).

Information on the material quantities, site activities, land clearance, waste product and construction traffic were provided by the project teams for input into the carbon tool. This information was used to determine an estimate of the GHG emissions associated with the development. Standard maintenance, as indicated through the TII Carbon Tool (TII 2022b), required over the operational phase has also been considered as part of the embodied construction emissions. Complete detailed information regarding the proposed construction materials and exact methodologies was not available at the time of this assessment and will be specified at the detailed design stage. Best estimates have been used in this assessment to provide an estimate of the GHGs associated with the Proposed Development.

GHG Assessment – Turbine Manufacture Lifecycle Assessment

In addition to the TII Carbon Tool, a lifecycle assessment was undertaken to determine the payback period for the turbines. Due to the flexibility sought regarding the range of design parameters associated with the wind turbines for the Proposed Development the make and manufacturer of the

turbines to be installed has not yet been decided at this stage of the project and will be decided post consent with the planning authority should permission be granted. As a result, indicative information from various wind turbine manufacturers has been reviewed. The life cycle assessment quantifies the power consumption associated with the production, operation, transport and end-of-life of the wind turbines. The assessment also quantifies the greenhouse gas emissions associated with the production, operation, transport and end-of-life of the wind turbines. The energy balance associated with the wind power production during its lifetime and the energy associated with the manufacturing, operation, transport, dismantling and disposal was also calculated on a site-specific basis as the energy balance is based on the expected GWh of production during its lifetime. The energy balance is expressed in terms of the time taken for the energy consumed by the turbine through its full life cycle to be repaid in terms of wind energy exported to the electricity grid.

12.2.4.2 OPERATIONAL 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.

Vehicular traffic is often a dominant source of greenhouse gas emissions as a result of developments. However, there is no predicted operational phase vehicle impact due to the relatively low volume of vehicles required for maintenance activities during operation.

12.2.4.3 SIGNIFICANCE CRITERIA FOR GHGA

The Transport Infrastructure Ireland (TII) guidance document entitled 'PE-ENV-01104 Climate Guidance for National Roads, Light Rail and Rural Cycleways (Offline & Greenways) – Overarching Technical Document' (TII, 2022a) outlines a recommended approach for determining the significance of both the construction and operational phases of a development.

The significance of GHG effects set out in PE-ENV-01104 (TII, 2022a) is based on the IEMA GHG guidance (IEMA, 2022) which is broadly consistent with the terminology contained within Figure 3.4 of the EPA's (2022) *Guidelines on the information to be contained in Environmental Impact Assessment Reports*.

The 2022 IEMA GHG guidance (IEMA, 2022) sets out the following principles for significance:

- When evaluating significance, all new GHG emissions contribute to a negative environmental impact; however, some projects will replace existing development or baseline activity that has a higher GHG profile. The significance of a project's emissions should, therefore, be based on its net impact over its lifetime, which may be positive, negative or negligible;
- Where GHG emissions cannot be avoided, the goal of the EIA process should be to reduce the project's residual emissions at all stages; and
- Where GHG emissions remain significant, but cannot be further reduced, approaches to compensate the project's remaining emissions should be considered.

The IEMA (2022) GHG guidance states that the crux of significance regarding impact on climate 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. A project that causes GHG emissions to be avoided or removed from the atmosphere has a beneficial effect that is significant. Only projects that actively reverse (rather than only reduce) the risk of severe climate change can be judged as having a beneficial effect. Where the fundamental reason for a proposed project is to combat climate change (e.g. a wind farm or carbon capture and storage project) and this beneficial effect drives the project need, then it is likely to be significant.

TII (TII, 2022a) states that professional judgement must be taken into account when contextualising and assessing the significance of a project's GHG impact. Significance is determined using the criteria outlined in Table 12-3 (derived from Table 6.7 of PE-ENV-01104 (TII, 2022a)) along with consideration of 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; and
- The level of mitigation taking place.

The significance of the effect of GHG emissions on climate is assessed for the total GHG emissions across all project stages.

Table 12-3: Greenhouse Gas Assessment (GHGA) Significance Criteria

Effects	Significance Level Description	Description
Significant Adverse	Major Adverse	The project's GHG impacts are not mitigated. The project has not complied with do-minimum standards set through regulation, nor provided reductions required by local or national policies; and No meaningful absolute contribution to Ireland's trajectory towards net zero.
	Moderate Adverse	The project's GHG impacts are partially mitigated. The project has partially complied with do-minimum standards set through regulation, and have not fully complied with local or national policies; and Falls short of full contribution to Ireland's trajectory towards net zero.
Not Significant	Minor Adverse	The project's GHG impacts are mitigated through 'good practice' measures. The project has complied with existing and emerging policy requirements; and Fully in line to achieve Ireland's trajectory towards net zero.
	Negligible	The project's GHG impacts are mitigated beyond design standards.

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

Ireland's carbon budgets can also be used to contextualise the magnitude of GHG emissions from the Proposed Development (TII, 2022a). The approach is based on comparing the net Proposed Development GHG emissions to the relevant carbon budgets (DECC, 2023). With the publication of the Climate Action Act in 2021 and the Climate Action Plan 2024, sectoral carbon budgets have been published for comparison with the net GHG emissions from the Proposed Development over its lifespan. The relevant sector budgets are for Electricity, Transport, Waste and Industry. The 2030 sectoral emissions ceilings and reduction requirements relative to the 2018 baseline are detailed in Table 12-2.

12.2.5 CLIMATE CHANGE RISK ASSESSMENT

The operational phase assessment involves determining the vulnerability of the Proposed Development to climate change. This involves an analysis of the sensitivity and exposure of the development to climate hazards which together provide a measure of vulnerability.

PE-ENV-01104 (TII, 2022a) states that the CCRA is guided by the principles set out in the overarching best practice guidance documents:

- EU (2021) Technical guidance on the climate proofing of Infrastructure in the Period 2021-2027 (European Commission, 2021); and
- The Institute of Environmental Management and Assessment, Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation (2nd Edition) (IEMA, 2020a).

The baseline environment information provided in Section 12.3, future climate change modelling and input from other experts working on the Proposed Development (i.e. hydrologists) should be used in order to assess the likelihood of a climate risk.

First an initial screening CCRA based on the operational phase is carried out, according to the TII guidance PE-ENV-01104. This is carried out by determining the sensitivity of Proposed Development assets (i.e. receptors) and their exposure to climate change hazards.

The Proposed Development asset categories must be assigned a level of sensitivity to climate hazards. PE-ENV-01104 (TII, 2022a) provides the below list of asset categories and climate hazards to

be considered. 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.

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.

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.

Once the sensitivity and exposure are categorised, a vulnerability analysis is conducted by multiplying the sensitivity and exposure to calculate the vulnerability.

12.2.5.1 SIGNIFICANCE CRITERIA FOR CCRA

The assessment of vulnerability to climate change combines the outcomes of the sensitivity and exposure analysis with the aim of identifying the key vulnerabilities and potentially significant climate hazards which could impact the Proposed Development.

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.

Vulnerability = Sensitivity x Exposure

The vulnerability assessment takes any proposed mitigation into account. Table 12-4 details the vulnerability matrix; vulnerabilities are scored on a high, medium and low scale.

TII guidance (TII, 2022a) and the EU technical guidance (European Commission, 2021a) 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, 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. An assessment of construction phase CCRA impacts is only required according to the TII guidance (TII, 2022a) if a detailed CCRA is required.

Table 12-4: Climate Change Vulnerability Matrix

		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

12.2.6 LIMITATIONS OF ASSESSMENT

There were no difficulties in completing this assessment.

12.3 BASELINE: CLIMATE IN RECEIVING ENVIRONMENT

PE-ENV-01104 (TII, 2022a) states that a baseline climate scenario should identify GHG emissions without the project for both the current and future baseline, consistent with the study area for the project. Climate impacts are assessed at a national level and in relation to national targets and sectoral emission ceilings. The study area for climate is the Republic of Ireland and the baseline is determined in relation to this study area.

Ireland declared a climate and biodiversity emergency in May 2019 and in November 2019 there was European Parliament approval of a resolution declaring a climate and environment emergency in Europe. This, in addition to Ireland's current failure to meet its EU binding targets under Regulation 2018/842 (European Union, 2018) results in changes in GHG emissions either beneficial or adverse being of more significance than previously considered prior to these declarations.

12.3.1 CURRENT GHGA BASELINE

Data published in July 2024 (EPA 2024a), indicates that Ireland exceeded, without the use of flexibilities, its 2023 annual limit set under EU's Effort Sharing Decision (ESD) (EU 2018/842) by 2.27 Mt CO_2e. However, the 2023 emissions were the first time that Ireland's emission were below (-1.2%) 1990 levels. ETS (Emissions Trading Scheme) emissions decreased (-17.0%) and ESR (Effort Sharing Regulation) emissions decreased (-3.4%). Ireland's target is an emission reduction of 626 kt of CO_2e by 2030 on an average baseline of 2016 to 2018.

The EPA estimate that 2023 total national GHG emissions, excluding LULUCF, have decreased by 6.8% on 2022 levels to 55.01 Mt CO_2e, with a 2.2 Mt CO_2e (-21.6%) reduction in electricity industries alone. This was driven by a 40.7% share of energy from renewables in 2023 and by increasing our

imported electricity. Manufacturing combustion and industrial processes decreased by 5.1% to 6.3 Mt CO_2e in 2023 due to declines in fossil fuel usage. The sector with the highest emissions in 2023 was agriculture at 37.6% of the total, followed by transport at 21.4%. For 2023, total national emissions (including LULUCF) were 60.62 Mt CO_2e (EPA 2024a), as shown in Table 12-5: Trends in Total National GHG Emissions 2021 – 2023 (EPA 2024a).

The provisional 2023 figures indicate that Ireland has used 63.9% of the 295 Mt CO_2e Carbon Budget for the five-year period 2021-2025.

Table 12-5: Trends in Total National GHG Emissions 2021 – 2023

Sector Note 1	2021	2022	2023	Total Budget (Mt CO2e) (2021-2025)	% Budget 2021-2025 Used
Electricity	9.893	9.694	7.558	40.0	67.9%
Transport	11.089	11.760	11.791	54.0	64.1%
Buildings (Residential)	6.868	5.753	5.346	29.0	62.0%
Buildings (Commercial and Public)	1.444	1.447	1.409	7.0	61.4%
Industry	7.093	6.622	6.288	30.0	66.7%
Agriculture	21.940	21.795	20.782	106.0	60.9%
Other Note 2	1.864	1.931	1.832	9.0	62.5%
LULUCF	4.628	3.983	5.614	–	–
Total including LULUCF	64.819	62.986	60.620	295.0	63.9%

Note 1 Reproduced from latest emissions data on the EPA website (EPA 2024a)

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)

12.3.2 FUTURE GHGA 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, 2022a) and IEMA GHG guidance (IEMA, 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. To meet the commitments under the Paris Agreement, 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). The Regulation aims to deliver, collectively by the EU in the most cost-effective manner possible, reductions in GHG emissions from the Emission Trading Scheme (ETS) and non-ETS sectors amounting to 43% and 30%, respectively, by 2030

compared to 2005. The Regulation was amended in April 2023, and Ireland must now limit its greenhouse gas emissions by at least 42% by 2030. The ETS is an EU-wide scheme which regulates the GHG emissions of larger industrial emitters Including electricity generation, cement manufacturing and heavy industry. The non-ETS sector includes all domestic GHG emitters which do not fall under the ETS scheme and thus includes GHG emissions from transport, residential and commercial buildings and agriculture.

In June 2024, the EPA released the report Ireland's *Greenhouse Gas Emissions Projections 2023-2050* (EPA 2024b), 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 under the "With Existing Measures" scenario, Ireland will achieve a reduction of 11% on 2018 levels by 2030. A reduction of 29% by 2030 can be achieved under the "With Additional Measures" scenario, which is still short of the 42% reduction target, set out in the carbon budgets.

12.3.3 CURRENT CCRA BASELINE

The Proposed Development will be located in an area that has a temperate, oceanic climate, resulting in mild winters and cool summers. A noticeable feature of the recent weather has been an increase in the frequency and severity of storms, with notable red warning level events including four in 2017 (Doris, Ophelia, Brian and Dylan), nine in 2018 (Eleanor, Fionn, David, Emma, Hector, Ali, Callum, Diana and Deirdre), seven in 2019 (Erik, Freya, Gareth, Hannah, Lorenzo, Atiyah and Elsa), seven in 2020 (Brendan, Ciara, Dennis, Jorge, Ellen, Aiden and Bella), two in 2021 (Arwen and Barra), two in 2022 (Eunice and Franklin) and two in 2023 (Noa and Agnes), as well as numerous orange warning level storms. Heavier historical rainfall events have also been recorded in recent years including heavy rainfall and flooding (Met Éireann 2024a).

Met Éireann's 2023 Climate Statement (Met Éireann, 2024a) states 2023's average shaded air temperature in Ireland is provisionally 11.20°C, which is 1.65°C above the 1961-1990 long-term average. Previous to this 2022 was the warmest year on record; however, 2023 was 0.38°C warmer (Figure 12-1).

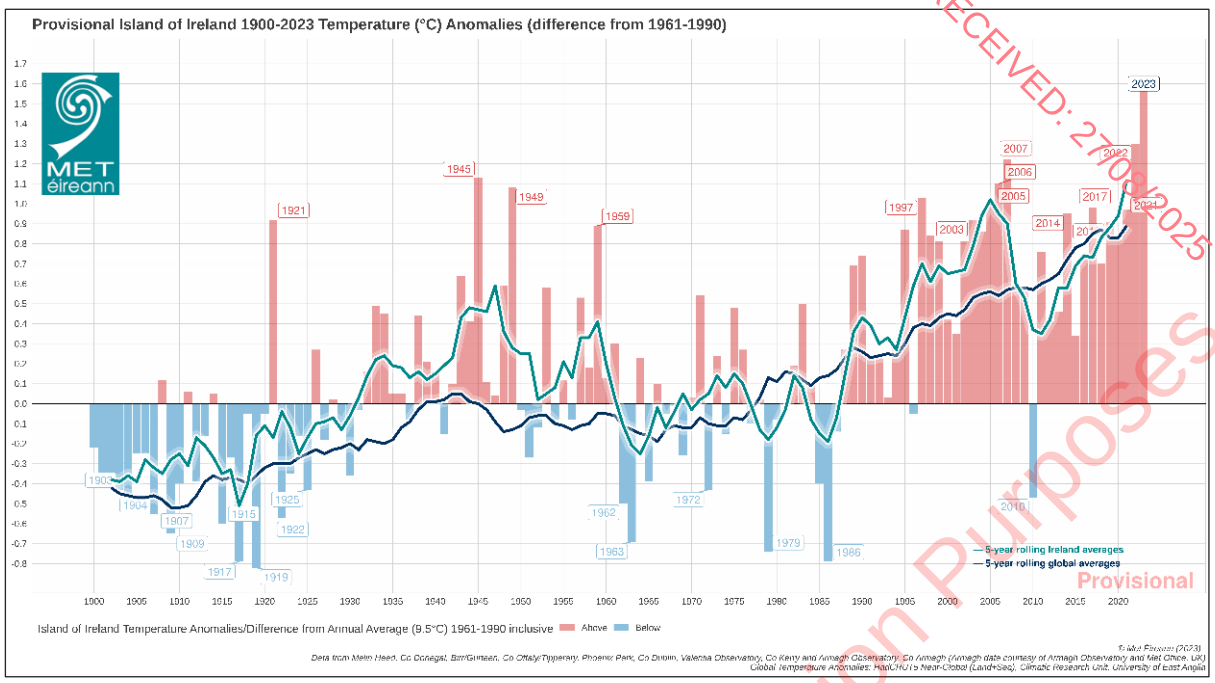

Figure 12-1: 1900-2023 Temperature (°C) Temperature Anomalies (differences from 1961-1990)

2023 also had above average rainfall, this included the warmest June on record and the wettest March and July on record. Record high sea surface temperatures (SST) were recorded since April 2023 which included a severe marine heatwave to the west of Ireland during the June 2023. This marine heatwave contributed to the record rainfall in July.

Met Éireann's 2024 *Climate Statement* (Met Éireann 2025b) states 2024's average shaded air temperature in Ireland is provisionally 10.72°C, which is 1.17°C above the 1961-1990 long-term average or 0.55°C above the most recent 1991-2020 long-term average. This is the 4th warmest year on record with 2023 breaking previous records. Seven of the top ten warmest years have occurred since 2005. Record high sea surface temperatures (SST) were recorded in 2022, and in 2024 continued at or near record high levels. 2024 was overall drier than average; however, there were many instances of heavy or intense rainfall which led to flooding events. This trend is predicted to continue with climate change with an increase in both dry periods and heavy rainfall events. Considering the extraordinary data, Met Éireann states that the latest Irish climate change projections indicate further warming in the future, including warmer winters. The record temperatures means the likelihood of extreme weather events occurring has increased. This will result in longer dry periods and heavy rainfall events. Storm surges and coastal flooding due to sea level rise. Compound events, where coastal surges and extreme rainfall events occur simultaneously will also increase. 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.

12.3.4 FUTURE CCRA BASELINE

Impacts as a result of climate change will evolve with a changing future baseline, changes have the potential to include increases in global temperatures and increases in the number of rainfall days per

year. Therefore, it is expected that the baseline climate will evolve over time and consideration is needed with respect to this within the design of the Proposed Development.

Ireland has seen increases in the annual rainfall in the north and west of the country, with small increases or decreases in the south and east including in the region where the Proposed Development will be located (EPA, 2021b). The EPA have compiled a list of potential adverse impacts as a result of climate change including the following which may be of relevance to the Proposed Development (EPA, 2021b):

- More intense storms and rainfall events
- Increased likelihood and magnitude of river and coastal flooding
- Water shortages in summer in the east
- Adverse impacts on water quality
- Changes in distribution of plant and animal species

TII's Guidance document PE-ENV-01104 (TII 2022a) states that for future climate change a moderate to high Representative Concentration Pathways (RCP) should be adopted. RPC4.5 is considered moderate, while RPC8.5 is considered high. Representative Concentration Pathways (RCPs) describe different 21st century pathways of GHG emissions depending on the level of climate mitigation action undertaken.

National Framework for Climate Services (NFCS) was founded in June 2022 to streamline the provision of climate services in Ireland and will be led by Met Éireann. The aim of the NFCS is to enable the co-production, delivery and use of accurate, actionable and accessible climate information and tools to support climate resilience planning and decision making. In addition to the NFCS, further work has been ongoing into climate projects in Ireland through research under the TRANSLATE project. TRANSLATE (Met Éireann, 2023b) has been led by climate researchers from University of Galway – Irish Centre for High End Computing (ICHEC), and University College Cork – SFI Research Centre for Energy, Climate and Marine (MaREI), supported by Met Éireann climatologists. TRANSLATE's outputs are produced using a selection of internationally reviewed and accepted models from both CORDEX and CMIP5. Representative Concentration Pathways (RCPs) provide a broad range of possible futures based on assumptions of human activity. The modelled scenarios include for "least" (RCP2.6), "more" (RCP4.5) or "most" (RCP8.5) climate change, see Figure 12-2.

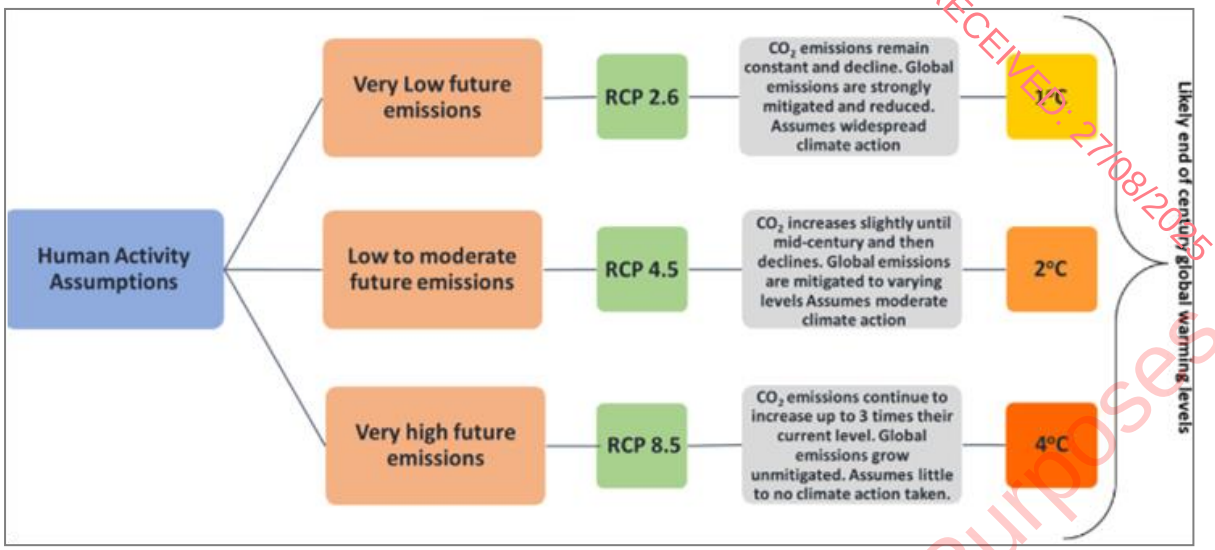

Figure 12-2: Representative Concentration Pathways associated emission levels from TRANSLATE project storymap (Met Éireann, 2023b)

TRANSLATE (Met Éireann, 2023b) provides the first standardised and bias-corrected national climate projections for Ireland to aid climate risk decision making across multiple sectors (for example, transport, energy, water), by providing information on how Ireland's climate could change as global temperatures increase to 1.5˚C ,2˚C, 2.5˚C, 3˚C or 4˚C. Projections broadly agree with previous projections for Ireland. Ireland's climate is dominated by the Atlantic Meridional Overturning Circulation (AMOC), a large system of ocean currents – including the Gulf Stream – characterised by a northward flow of warm water and a southward flow of cold water. Due to the AMOC, Ireland does not suffer from the extremes of temperature experienced by other countries at a similar latitude. Recent studies have projected that the AMOC could decline by 30 – 40 % by 2100, resulting in cooler North Atlantic Sea surface temperatures (SSTs) (Met Éireann, 2023b). Met Éireann projects that Ireland will nevertheless continue to warm, although the AMOC cooling influence may lead to reduced warming compared with continental Europe. AMOC weakening is also expected to lead to additional sea level rise around Ireland. With climate change Ireland's temperature and rainfall will undergo more and more significant changes e.g. on average summer temperature could increase by more than 2°C, summer rainfall could decrease by 9% while winter rainfall could increase by 24% (see Figure 12-3). Future projects also include a 10-fold increase in the frequency of summer nights (values > 15°C) by the end of the century, a decrease in the frequency of cold winter nights and an increase in the number of heatwaves. A heatwave in Ireland is defined as a period of 5 consecutive days where the daily maximum temperature is greater than 25°C.

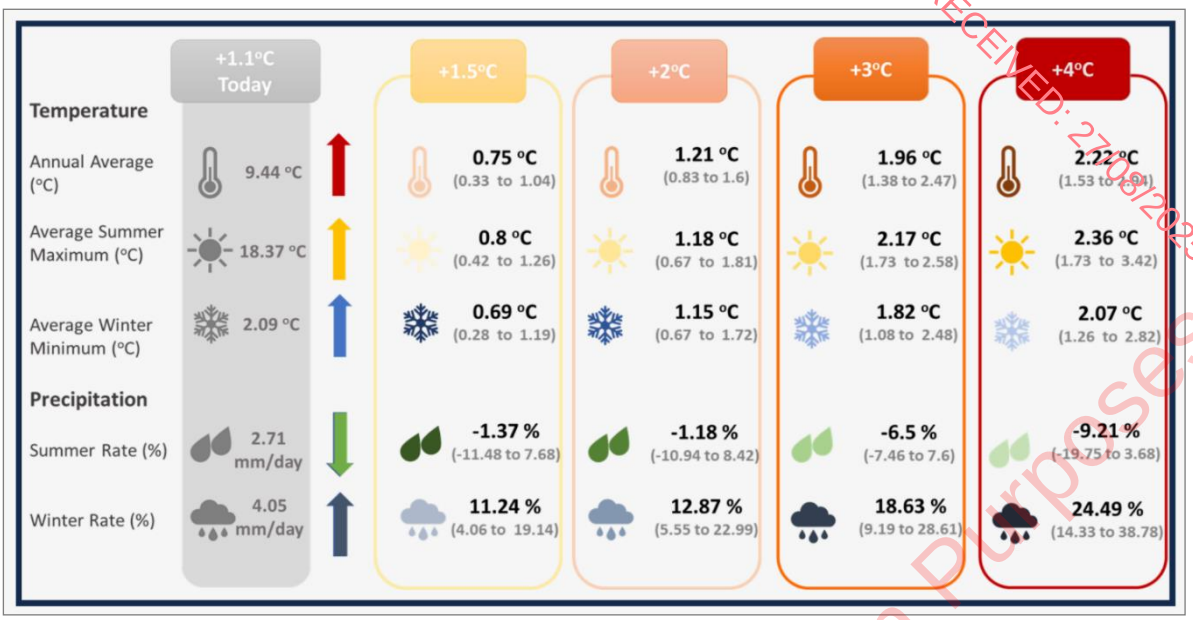

Figure 12-3: Change of climate variables for Ireland for different Global warming thresholds (Met Éireann 2023b)

The TRANSLATE research report (Met Éireann 2024d) finds that night-time temperatures will warm more than day-time temperatures, with temperatures increases across all seasons but the highest in the summer (with an increase of 0.5°C to 3.5°C). Autumn is projected to have the highest increase in average minimum temperatures (with an increase of 1.1°C to 4.4°C). The variance is dependent on the scenario that is being reviewed. While these temperatures are projected across all of Ireland, they increase most in the east of the country compared to the west. With respect to rainfall, increases of 4% to 38% are projected, however this will not be spread across the year as during summer months there are projected decreases in rainfall beyond the 2°C warming scenario.

In January 2024 the EPA published Ireland's *Climate Change Assessment Synthesis Report* (EPA, 2024e) which contained four volumes:

- Volume 1: Climate Science: Ireland in a Changing World
- Volume 2: Achieving Climate Neutrality by 2050
- Volume 3: Being Prepared for Ireland's Future Climate
- Volume 4: Realising the Benefits of Transition and Transformation

This report reinforces the existing and future risks arising from climate change. Volume 1 (EPA, 2024e) states that under Early action, the temperature increase averaged across the island of Ireland relative to the recent past (1976 to 2005) would reach 0.91°C (0.44 to 1.10°C) by mid-century before falling back to 0.80°C (0.34 to 1.07°C) at the end of the century. Whereas under Late action, by the end of the century it is projected that the temperature increases could be 2.77°C (2.02 to 3.49°C). Heat extremes will become more frequent and more severe and cold extremes will become less frequent and less severe with further warming.

Precipitation was 7% higher over the period 1991 to 2020 than over the 1961 to 1990 period. The average future predicted increase in precipitation is <10% in annual mean accumulated. By 2100 projected additional rises in sea level range from 0.32 to 0.6m under early action to 0.63 to 1.01m under late action scenarios, with greater storm surges potentially effecting critical infrastructure along the coastline. Projections of changes in storminess are highly uncertain and translate into large uncertainties in future frequency and intensity of extreme waves.

Volume 3 (EPA, 2024e) discusses how water supplies will face growing pressures resulting in increased water demand and how options need to be developed, including potential new sources. The report states the key role of critical infrastructure for delivering public services, economic development and a sustainable environment. These are exposed to a range of climate extremes. Failures in critical infrastructure can cascade across other sectors and present a multi-sector risk due to climate change.

The report references the EPA's *Critical Infrastructure Vulnerability to Climate Change* report (EPA, 2021a) as the most substantial research project in Ireland to date on climate change and critical infrastructure which assesses the future performance of Ireland's critical infrastructure when climate is considered. The Critical Infrastructure Vulnerability to Climate Change report states with respect to water availability and quality, that flood risk and heatwaves have a medium vulnerability index and the underground supply network has a high vulnerability to snowstorms and cold spells. However, while the vulnerability is high, the exposure is likely to reduce due to future climate change resulting in less cold weather events. The risk assessment highlights the co-dependence of the water sector to the energy sector, and how vulnerability in the energy sector may have cascading impacts.

Volume 4 (EPA, 2024e) calls for system change, including a transformation of urban settings. Stating that meaningful urban transformation can create a better living environment while simultaneously reducing emissions.

The projections were echoed by the *Updated High-resolution Climate Projections for Ireland Research Report: 471* (EPA, 2024f) which was in broad agreement with previous research. The future autumn and winter months are projected to be up to 10% wetter, while summer is projected to be up to 8% drier.

The Clare Climate Risk Assessment, prepared as part of the Clare County Council Climate Action Plan 2024 – 2029 (CCC, 2024), identified river flooding, pluvial flooding, coastal flooding and coastal erosion as the most significant risks to the delivery of the Clare County Council services. Figure 12-4 shows the predicted frequency for climate change hazards on CCC assets.

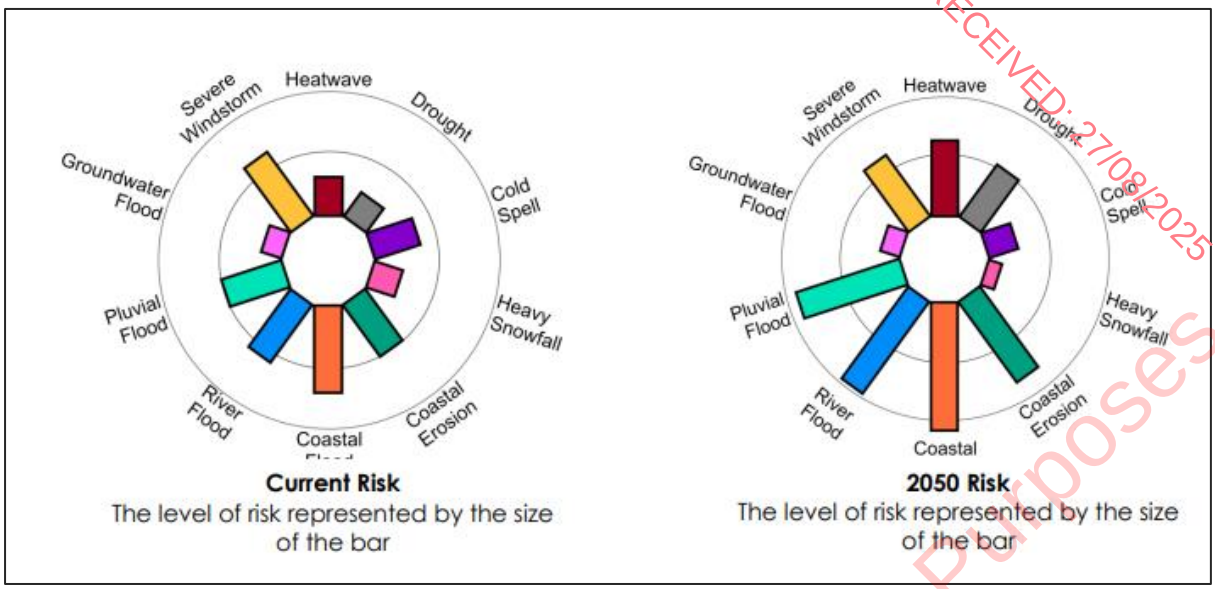

Figure 12-4: Future Projected Impacts of Climate Events on Clare County (CCC, 2024)

12.4 ASSESSMENT OF EFFECTS

12.4.1 "DO-NOTHING" SCENARIO

With respect to climate, the Do Nothing scenario will not assist the CAP 2025 goal of delivering up to 80% of the national grid electricity by renewable sources by 2030. Producing up to 80% renewables for the grid will reduce emissions from electricity and will also allow electrification of other sectors such as transport and heat and reduce emissions in these sectors too.

12.4.2 GREENHOUSE GAS ASSESSMENT

There is the potential for greenhouse gas emissions to atmosphere during the construction and operational phases of the Proposed Development. As per the TII guidance (TII, 2022a), the significance of the effect of GHG emissions on climate is assessed for the total GHG emissions across all project stages.

12.4.2.1 CONSTRUCTION PHASE

Wind Turbine Manufacture

The turbines selected for the Proposed Development will be Vestas V117-4.2MW. Each turbine manufacturer undertakes and prepares detailed lifecycle assessments for their wind turbines and typical wind farm developments in order to inform users and determine the payback period for their plant. The payback period is the time taken for the renewable energy production from the windfarm to offset the emissions from the windfarm construction. Information on the life cycle assessment undertaken by Vestas Wind Systems A/S (2019), the wind turbine manufacturer, has been reviewed as part of this chapter to provide an indication of the lifecycle assessment and GHG emissions associated with a similar wind turbine type as that proposed for the development.

The report *Life Cycle Assessment of Electricity Production from an onshore V117-4.2 MW Wind Plant* (Vestas Wind Systems A/S, 2019) indicates a potential payback period of 4.8 months.

The Proposed Development is smaller in scale than the wind plant assessed within Vestas report however, it can be used as an indication of the potential payback period for the proposed turbines. The Proposed Development will involve the erection of up to 6 No. wind turbines and an installed capacity of 25.2 MW. For the purposes of this assessment a capacity factor for wind generation of 36% was used based on Area D outlined in the EirGrid report *Enduring Connection Policy 2.3 Solar and Wind Constraints Report: Assumptions and Methodology* (EirGrid, 2024). Based on an installed capacity of approximately 25.2 MW and a capacity factor of 36% the expected electricity production is approximately 79,471 MWh per annum for the Proposed Development.

It is predicted that the energy produced by the Proposed Development will offset the construction stage GHG emissions within the first year of its operation. Thereby turning it from negative in relation to climate into an overall net positive development.

GHG Assessment – TII Carbon Tool

The total GHG emissions arising from the construction of the Proposed Development have been calculated using the TII online Carbon Tool (2024) and are summarised in Table 12-6: Greenhouse Gas Assessment Results. This includes GHG emissions associated with site clearance works, excavation, materials, material transport, construction activities, construction worker travel and construction wastes for the windfarm site and grid connection but excludes the wind turbines themselves. The assessment has also included operational stage emissions where information was available in relation to operational energy use, worker travel to site and operational wastes. Detailed project information including volumes of materials were obtained from the project team at Venterra Group for the purposes of this assessment. Complete detailed information regarding the proposed construction materials and exact methodologies was not available at the time of this assessment and will be specified at the detailed design stage. Additionally, exact material suppliers and waste disposal facilities are not known at this stage and therefore an estimated distance travelled has been used for the purpose of this assessment. The best estimates used in this assessment have been used to provide an estimate of the GHGs associated with the Proposed Development.

The predicted GHG emissions associated with the Proposed Development are presented in Table 12-6: Greenhouse Gas Assessment Results. The Proposed Development is estimated to result in total construction phase GHG emissions of 16,039 tonnes CO_2e. The assessment indicates that the key sources of GHG emissions are associated with the excavation works and site clearance activities, making up 27% and 21% of total emissions respectively.

Table 12-6: Greenhouse Gas Assessment Results

GHG Assessment Category	Elements Considered	GHG Emissions (tCO_2e)	% of Total
Materials	Aggregates and other fill material, plastic pipework and cabling, concrete, road pavement materials (e.g. asphalt), steel, geotextiles, timber	1,009	12%
Material Transport	HGV and LGV trips	609	10%
Land Use Change and Vegetation Loss	Site preparation and clearance, removal of trees	1,302	21%
Excavation	Rock, topsoil and other excavation	1,707	27%
Construction Water Use	Water used during construction	79	1%
Construction Worker Travel to Site	Car trips	56	0.9%
Construction Waste Disposal	Mixed construction and demolition waste	1	0.019%
Construction Waste Transport	Transport of waste offsite. Waste will be taken from the site by HGV. Conservatively estimated that destination waste management facility will be 50 km from the site (100 km to and from the site).	3	0.02%
Operational Energy	Electricity demand by site during operational phase	115	1.8%
Operational Water	Operational water use	0.22	0.003%
Operational Waste Disposal	Disposal of waste	0.02	0.0004%
Operational Waste Transport	HGV trips, assuming 50 km travel distance per trip.	1.3	0.02%
Operational Transport	Vehicle movements (other than waste disposal HGV)	213	3.4%
Potential Savings	Tree replanting	-1148	18.4%
	Total	**6,244**	

The predicted GHG emissions (as shown in Table 12-6) can be averaged over the lifespan of the Proposed Development to give the predicted annual emissions to allow for direct comparison with national annual emissions and targets.

The GHG emissions from the development as a total cannot be compared against one specific sector 2030 carbon budget, the emissions are broken down into different assessment categories and these must be compared separately to the relevant sectoral emissions budget which are detailed in Table 12-2: 2030 Sectoral Emissions Ceilings. The relevant sectoral emissions for the Proposed Development comparison include the Industry sector, Transport sector, Electricity sector and Waste sector. In Table 12-7, GHG emissions have been compared against the carbon budget for the electricity, transport, industry and waste sectors in 2030 (DECC, 2024a), against Ireland's total GHG emissions in 2023 and against Ireland's EU 2030 target of a 30% reduction in non-ETS sector emissions based on 2005 levels (27.7 Mt CO_2e) (set out in Regulation EU 2018/842 of the European Parliament and of the Council).

The estimated total construction phase GHG emissions, when annualised over the 30-year Proposed Development lifespan, are equivalent to 0.0003% of Ireland's total GHG emissions in 2023 and 0.0006% of Ireland's non-ETS 2030 emissions target. The estimated GHG emissions associated with energy use during the construction phase are equivalent to 0.0001% of the 2030 Electricity budget, while the total GHG emissions associated with transport-related activities are 0.0005% of the 2030 Transport budget and industry-related activities are 0.002% of the 2030 Industry budget (DECC, 2024a). Emissions associated with waste materials and transport off-site are equivalent to 0.000004% of the 2030 Waste sector budget.

Table 12-7: Estimated Project GHG emissions relative to sectoral budgets and GHG baseline

Target/Sectoral Budget	(tCO_2e)	Annualised Development GHG Emissions (tCO_2e)		% of Relevant Target/Budget
Ireland's 2023 Total GHG Emissions (existing baseline)	60,620,000	Total GHG Emissions	170	0.0003%
Non-ETS 2030 Target	27,721,670	Total GHG Emissions		0.0006%
2030 Sectoral Budget (Industry Sector)	4,000,000	Total Industry Emissions	93	0.002%
2030 Sectoral Budget (Transport Sector)	6,000,000	Total Transport Emissions	29	0.0005%
2030 Sectoral Budget (Electricity Sector)	3,000,000	Total Electricity Emissions	4	0.0001%

Target/Sectoral Budget	(tCO_2e)	Annualised Development GHG Emissions (tCO_2e)		% of Relevant Target/Budget
2030 Sectoral Budget (Waste Sector)	1,000,000	Total Waste Emissions	0.04	0.000004%

12.4.2.2 OPERATIONAL PHASE

During the operational phase there will be no significant GHG emissions from the operation of the wind turbines. The 25.2 MW from the turbines will generate approximately 79,471 MWh of renewable energy annually, assuming a 36% capacity factor.

In order to demonstrate the beneficial impact of this renewable energy, which will have zero GHG emissions, the GHG emissions produced by a typical fossil fuel plant generating the equivalent amount of energy has been calculated. The GHG emissions associated with a fossil fuel plant generating 79,471 MWh of energy will include emissions of CO_2, N_2O and CH_4. The CO_2 equivalent emissions of N_2O and CH_4 have been calculated using the global warm potentials in AR6 IPCC Guidelines (IPCC, 2023).

The most recent (2024) figure for carbon intensity of electricity generation in Ireland is 229.9 gCO_2e/kWh (SEAI, 2024). Using this carbon intensity and the IPPC emission rates for N_2O and CH_4 the total annual GHG emission savings of the Proposed Development will amount to approximately 18,291 tonnes of CO_2e when the GHG emissions from the construction phase are removed. This total figure excludes GHG emissions associated with the turbine manufacture as this will vary depending on the turbine type. However, as detailed in *Section 12.4.2.1 – Wind Turbine Manufacture*, the payback period with respect to carbon for the manufacture of the turbines is, potentially, 4.8 months.

The estimated total GHG emissions savings, when annualised over the 30-year Proposed Development lifespan, are equivalent to 0.03% of Ireland's total GHG emissions in 2023 (and 0.2% of GHG emissions from fossil fuel energy production), 0.6% of the total carbon budget for the electricity sector in 2030 and 0.1% of Ireland's ETS 2030 emissions target (DECC, 2024a) i.e. the Proposed Development has the potential to reduce Ireland's CO_2e emissions by these percentages (Table 12-8).

Table 12-8: Estimated Operational Phase Project GHG Savings

Development Emissions & Savings	tonnes CO_2e	Baseline / Relevant Target	tonnes CO_2e	% of Baseline / Relevant Target
Annual Equivalent GHG Emissions from Power Plant Producing 79 GWh	18,814			
Annualised GHG Emissions due to Construction Phase (averaged over lifespan)	159			
Total Annual Savings Due To Wind Farm (averaged over lifespan)	18,656	Ireland's Total GHG Emissions 2023 (existing baseline)	60,620,000	0.03%
		Ireland's GHG Emissions from Fossil Fuel Energy Production 2023 (existing baseline)	7,845,320	0.2%
		ETS 2030 Target (42% of 2005 ETS Level)	12,953,240	0.1%
		2030 Sectoral Budget (Electricity Sector)	3,000,000	0.6%

The Proposed Development will assist in the CAP 2025 goal of producing up to 80% renewables for the grid and 9 GW of onshore wind capacity, which is one of the Key Targets identified in Section 11 of the Climate Action Plan 2025. The Proposed Development will constitute up to 0.0028 GW annually of that capacity and will abate Ireland's greenhouse gas emissions by approximately 0.018 Mt CO_2e for every year of operation. As per Section 12.1.1.2, the draft National Planning Framework indicates that the Northern and Western assembly (of which Clare is part of) has the potential for an additional 1,389 MW renewable power capacity from onshore wind. The Proposed Development will form part of achieving this additional capacity. As per CAP25, the target capacity allocations are the minimum required for wind and solar generation to meet the 2030 emissions reductions in the electricity sector.

12.4.2.3 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.

The level of mitigation described in Section 12.5 has therefore been taken into account when determining the significance of the Proposed Development's GHG emissions. In addition, the IEMA GHG guidance (2022) states that a project that causes GHG emissions to be avoided or removed from the atmosphere has a beneficial effect that is significant. Only projects that actively reverse (rather than only reduce) the risk of severe climate change can be judged as having a beneficial effect. Where the fundamental reason for a proposed project is to combat climate change (e.g. a wind farm or carbon capture and storage project) and this beneficial effect drives the project need, then it is likely to be significant.

As the project is a windfarm development it directly aligns with Ireland's net zero trajectory by 2050 and the CAP25 goal of producing 80% renewable electricity. Additionally, the production of renewable electricity will offset the GHG emissions produced during the construction of the project within the first year of its operation. According to the TII significance criteria described in Section 12.2.4.3 the significance of the GHG emissions during the construction and operational phase is beneficial as the net project GHG emissions will be below zero (i.e. the renewable electricity will offset GHG emissions once operational) and the project is aligned with the 2050 net zero trajectory.

In accordance with the EPA guidelines (EPA, 2022), the above significance equates to a significance of effect of GHG emissions during the construction and operational phase which is direct, long-term, positive and slight, which is overall not significant.

12.4.3 CLIMATE CHANGE RISK ASSESSMENT

12.4.3.1 CONSTRUCTION PHASE

A detailed CCRA of the construction phase has been scoped out, as discussed in Section 12.2.5.1. However, consideration has been given to the Proposed Development's vulnerability to the following climate change hazards with best practice mitigation measures proposed in Section 12.5.1:

- Flood Risk due to increased precipitation, and intense periods of rainfall. This includes fluvial and pluvial flooding;
- Increased temperatures potentially causing drought, wildfires and prolonged periods of hot weather;
- Reduced temperatures resulting in ice or snow; and
- Major Storm Damage – including wind damage.

12.4.3.2 OPERATIONAL PHASE

In order to determine the vulnerability of the Proposed Development to climate change the sensitivity and exposure of the development to various climate hazards must first be determined. The following climate hazards have been considered in the context of the Proposed Development: flooding (coastal, pluvial, fluvial); extreme heat; extreme cold; wildfire; drought; extreme wind; lightning; hail; landslides; and fog.

The sensitivity of the Proposed Development to the above climate hazards is assessed irrespective of the project location. The sensitivity of the Proposed Development assets has been established on a

scale of high (3), medium (2) and low (1). Once the sensitivity has been established the exposure of the Proposed Development to each of the climate hazards is determined, this is the likelihood of the climate hazard occurring at the project location and is also scored on a scale of high (3), medium (2) and low (1). The product of the sensitivity and exposure is then used to determine the overall vulnerability of the Proposed Development to each of the climate hazards. The results of the vulnerability assessment are detailed Table 12-9.

Table 12-9: Climate Change Vulnerability Assessment

Proposed Development Assets	Vulnerability to Climate Hazards								
	Flooding (Pluvial/ Fluvial)	Extreme Heat	Extreme Cold	Drought	Wind	Wildfire	Lightning & Hail	Fog	Landslides
Sensitivity									
Earthworks	1	1	1	1	1	1	1	1	2
Drainage	1	1	1	1	1	1	1	1	2
Grid Connection	1	1	1	1	1	1	1	1	2
Buildings	1	2	2	1	1	1	1	1	2
Access Roads	1	2	2	1	1	1	1	1	2
Turbines	1	2	2	1	2	1	1	1	2
Exposure									
Earthworks	1	1	1	1	1	1	1	1	1
Drainage	1	1	1	1	1	1	1	1	1
Grid Connection	1	1	1	1	1	1	1	1	1
Buildings	1	1	1	1	1	1	1	1	1
Access Roads	1	1	1	1	1	1	1	1	1
Turbines	1	1	1	1	1	1	1	1	1
Vulnerability									
Earthworks	1 (Low Risk)	1 (Low Risk)	1 (Low Risk)	1 (Low Risk)	1 (Low Risk)	1 (Low Risk)	1 (Low Risk)	1 (Low Risk)	2 (Low Risk)
Drainage	1 (Low Risk)	1 (Low Risk)	1 (Low Risk)	1 (Low Risk)	1 (Low Risk)	1 (Low Risk)	1 (Low Risk)	1 (Low Risk)	2 (Low Risk)
Grid Connection	1 (Low Risk)	1 (Low Risk)	1 (Low Risk)	1 (Low Risk)	1 (Low Risk)	1 (Low Risk)	1 (Low Risk)	1 (Low Risk)	2 (Low Risk)

Proposed Development Assets	Vulnerability to Climate Hazards								
	Flooding (Pluvial/ Fluvial)	Extreme Heat	Extreme Cold	Drought	Wind	Wildfire	Lightning & Hail	Fog	Landslides
Buildings	1 (Low Risk)	2 (Low Risk)	2 (Low Risk)	1 (Low Risk)	1 (Low Risk)	1 (Low Risk)	1 (Low Risk)	1 (Low Risk)	2 (Low Risk)
Access Roads	1 (Low Risk)	2 (Low Risk)	2 (Low Risk)	1 (Low Risk)	1 (Low Risk)	1 (Low Risk)	1 (Low Risk)	1 (Low Risk)	2 (Low Risk)
Turbines	1 (Low Risk)	2 (Low Risk)	2 (Low Risk)	1 (Low Risk)	2 (Low Risk)	1 (Low Risk)	1 (Low Risk)	1 (Low Risk)	2 (Low Risk)

The sensitivity and exposure of the area was determined with reference to a number of online tools. It was concluded that, with design and management mitigation in place, the Proposed Development does not have any significant vulnerabilities to the identified climate hazards as described in the below sections.

The turbines will be designed to IEC 61400. This is a set of design requirements made to ensure that wind turbines are appropriately engineered against damage from hazards (including weather events caused by climate change) within the planned lifetime.

Flooding

A Flood Risk Assessment (FRA) for the Proposed Development was undertaken by JBA. The FRA concluded that the site is not at risk of flooding from fluvial, pluvial, groundwater sources. Additionally, due to the project location coastal flooding is not a risk to the site.

The FRA states

> "There are no watercourses located within the site that are in the vicinity of the turbines, and the turbines are located on elevated ground. Therefore, no residual risk has been identified".

A detailed drainage design will be undertaken post-planning consent as part of the detailed design of the Proposed Development. This will include a sizing of drainage infrastructure in order to accommodate a storm return period and considerable uplift which accounts for future increases in precipitation due to climate change.

Extreme Wind, Fog, Lightning & Hail

In relation to extreme winds, the turbines shall be designed to the appropriate standards to account for the relevant wind loadings. Auto shut off technology is installed within the turbines if wind speed is too high and has the potential to damage the turbines. With future climate change storms are likely to become more extreme, with storms in RCP8.5 likely to be even more extreme than in RCP4.5. Given the nature of their use, the turbines are designed to be placed in high wind

environments and therefore significant research has gone into their ability to withstand extreme wind loadings. The turbines are designed to accommodate extreme windspeeds up to 50 m/s. The wind turbine foundations will be sized to withstand high wind speeds. The grid connection route will be buried underground and so is protected from extreme winds.

If required as part of the building design, lightning protection shall be provided for. Due to their nature, wind turbines attract lightning strikes and are therefore designed with this in mind, and protection has been built in. Design mitigation has been put in place in order to alleviate the known vulnerability to future climate change increasing lightning storms. EC 61400-24:2019 provides guidance regarding lightning protection of wind turbine generators and wind power systems. It defines requirements for protection of blades, other structural components and electrical and control systems against both direct and indirect effects of lightning. Test methods to validate compliance are included.

Hail is not deemed to pose a significant risk to the turbines and associated infrastructure such as the substation. In addition, fog is unlikely to have an adverse effect on the turbines however lighting of the turbines will be required to ensure no impacts with low flying aviation.

Wildfires

In relation to wildfires, the *Think Hazard!* tool developed by the Global Facility for Disaster Reduction and Recovery (GFDRR) (2025), indicates that the wildfire hazard is classified as 'medium' for the Clare area. This means that there is between a 10% to 50% chance of experiencing weather that could support a hazardous wildfire that may poses some risk of life and property loss in any given year. Future climate modelling indicates that there could be an increase in the weather conditions which are favourable to fire conditions, these include increases in temperature and prolonged dry periods. However, land clearance activities will be conducted as required on site which will remove materials with a high potential for fire creating a buffer and fire breaks in the proximity of turbines Wildfire may cause issues with pavement softening for access roads This would be classed as an adverse event that may require repair work. However, it is unlikely to require emergency repair works given the level of access required to the site. Additionally, systems will be in place to prevent impacts from wildfires to the turbines. it can be concluded that the Proposed Development is of low vulnerability to wildfires.

Landslides

Landslide susceptibility mapping developed by Geological Survey Ireland (GSI, 2025) indicates that the Proposed Development location is within areas of low to moderately high susceptibility to landslides. Turbine location WTG4 is adjacent to an area categorised as 'high susceptibility' to landslides. It can be concluded that soil movement landslides are a risk to the Proposed Development site. However, there is no history of landslides within the site boundary (GSI, 2025).

The risk of landslide may become more pronounced with climate change in both RCP4.5 and RCP8.5 due to heavy rain fall and drought cycles which can increase the likelihood of a landslide. However, these risks have been taken into consideration within the design and have been accounted for with the foundation design and turbine location choices. The site has been designed in line with the peat and soil stability assessment completed by the design team geotechnical engineer to prevent landslides. With mitigation in place the risk remains medium but the exposure reduces as the design reduces the likelihood of the event occurring at the location that would affect the assets of the project. The initial medium risk is designed out for a final low vulnerability to landslides.

Extreme Temperatures (Heat & Cold)

Regarding extreme heat events, the Proposed Development will be designed for adequate temperature loads. The standard operating temperature for the turbines ranges from -20°C to +45°C. Additionally, there is the possibility to add a de-icing device and an ice detector if deemed necessary during detailed design.

High quality, durable building materials will be selected for the Proposed Development which reduce their sensitivity. Access roads have the potential to have some limited impacts during heat waves as damage to pavement, e.g. softening, traffic-related rutting, migration of liquid asphalt, roadway buckling, is known to occur at approximately 32 degrees Celsius. Management plans will be put in place in the event of extreme heat wave events to ensure internal roads are not affected by vehicles driving on them during road softening events. This will ensure the sensitivity of the asset is minimised to low. The grid connection route will be buried underground so protected from extreme temperatures by the thermal mass of the ground.

At the detailed design stage, the building materials chosen for ancillary structures including the substation will be high quality, durable and hard-wearing and chosen to withstand increased variations in temperature in the future as a result of climate change. Heightened temperatures have the potential to strain the cooling systems within the substation. However, the cooling systems will be designed to accommodate temperature extremes predicted for both RCP4.5 and RCP8.5 in Ireland and in a manner that they can be further upgraded should additional thermal loading become likely. This increases the resilience to potential climate risks. Should the updated EuroCodes be published prior to completion of detailed design, which will include consideration for climate impacts, these design standards will be taken into account.

Summary

Overall, the Proposed Development has at most low vulnerabilities to the identified climate hazards and therefore no detailed risk assessment is required. However, climate resilience will require ongoing monitoring and management during the detailed design, construction and operation.

Where information such as new Eurocodes of design practices, updated site surveys or additional climate data becomes available between EIAR stage and detailed design, they will be taken into account to improve resilience of the project against climate change hazards.

12.4.3.3 CCRA SIGNIFICANCE OF EFFECTS

With design mitigation in place, there are no significant risks to the project as a result of climate change however some vulnerability will remain. The predicted impact has accounted for events that can be absorbed by taking business continuity actions. 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, long-term, negative and imperceptible. This is overall not significant.

12.4.4 DECOMMISSIONING STAGE

Vehicles related to the decommissioning phase will give rise to CO_2 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 are predicted to be imperceptible as a result of the decommissioning.

In the decommissioning phase, the turbines are dismantled and the site is remediated to the agreed state. End-of-life recycling of metals will be carried out at the wind farm in order to reduce the climate impact as per the lifecycle assessments for the chosen wind turbine manufacturer. Metal components that are primarily mono-material (e.g. gears, transformers, tower sections, etc.) are assumed to be 98% recycled. It is expected that the reinforced concrete foundation bases will remain in-situ. Decommissioning has been considered as part of the lifecycle assessments and payback periods for the turbines completed by the manufacturer (see Section 12.4.2.1).

The effect on climate due to decommissioning will be direct, temporary, negative and imperceptible if recycling of components is carried out where possible. This impact is not significant in EIA terms.

12.4.5 CUMULATIVE EFFECTS AND OTHER INTERACTIONS

With respect to the requirement for a cumulative assessment the IEMA (2022) and TII (2022a) guidance on which the assessment is based states that:

> "The identified receptor for the GHG Assessment is the global climate and impacts on the receptor from a project are not geographically constrained, the normal approach for cumulative assessment in EIA is not considered applicable. By presenting the GHG impact of a project in the context of its alignment to Ireland's trajectory of net zero and any sectoral carbon budgets, this assessment will demonstrate the potential for the project to affect Ireland's ability to meet its

national carbon reduction target. This assessment approach is considered to be inherently cumulative".

As a result, the cumulative impact of the Proposed Development in relation to GHG emissions is considered direct, long-term, beneficial and slight, which is overall not significant in EIA terms.

12.5 MITIGATION MEASURES FOR CLIMATE

12.5.1 CONSTRUCTION PHASE MITIGATION MEASURES

The IEMA GHG Management Hierarchy (IEMA 2020b) will be followed for impact minimisation. The Hierarchy is as follows:

- First Eliminate
  - Influence business decisions/use to prevent GHG emissions across the lifecycle
  - Potential exists when organisations change, expand, rationalise or move business
  - Transition to new business model, alternative operation or new product/service
- Then Reduce
  - Real and relative (per unit) reductions in carbon and energy
  - Efficiency in operations, processes, fleet and energy management
  - Optimise approaches (e.g. technology) and digital as enablers
- If you can't eliminate or reduce, then Substitute
  - Adopt renewables/low-carbon technologies (on site, transport etc)
  - Reduce carbon (GHG) intensity of energy use and of energy purchased
  - Purchase inputs and services with lower embodied/embedded emissions
  - The final option is to Compensate
  - Compensate 'unavoidable' residual emissions (removals, offsets etc)
  - Investigate land management, value chain, asset sharing, carbon credits
  - Support climate action and developing markets (beyond carbon neutral)

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 include:

- Appointing a suitably competent contractor who will undertake waste audits detailing resource recovery best practice and identify materials can be reused/recycled;
- Alignment with requirements under the Local and National Climate Action Plans;
- The use in construction plant and equipment of sustainably (International Sustainability and Carbon Certification (ISCC) or similar) sourced Hydrotreated Vegetable Oil (HVO) as a 100%

replacement of fossil fuels. HVO use is considered a stepping stone towards the use of electric construction plant as they become available in the market;

- The replacement, where feasible, of concrete containing Portland cement with a low carbon concrete as per the Climate Action Plan, a 50% Ground Granulated Blastfurnace Slag (GGBS) replacement is currently the likely option and has been deemed appropriate by the project designers;
- Procurement contracts will ensure that lower carbon choices are considered favourable during tender;
- Low carbon design choices and materials will be prioritised within design where technically feasible;
- Materials will be reused on site where possible;
- Prevention of on-site or delivery vehicles from leaving engines idling, even over short periods;
- Ensure all plant and machinery are well maintained and inspected regularly;
- Minimising waste of materials due to poor timing or over ordering on site will aid to minimise the embodied carbon footprint of the site;
- Where practicable, opportunities for materials reuse will be incorporated within the extent of the Proposed Development including the use of reclaimed asphalt and recycled aggregate, which will reduce the virgin material needs; and
- Sourcing materials locally where possible to reduce transport related CO_2 emissions.

In terms of impact on the Proposed Development due to climate change, during construction the Contractor will be required to mitigate against the effects of extreme rainfall/flooding through site risk assessments and method statements. The Contractor will also be required to mitigate against the effects of extreme wind/storms, temperature extremes through site risk assessments and method statements. 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. During construction, the Contractor will be required to mitigate against the effects of fog, lighting and hail through site risk assessments and method statements.

12.5.2 OPERATIONAL PHASE MITIGATION MEASURES

During the operational phase of the Proposed Development, the works onsite will be limited to maintenance associated with the wind farm components. 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. No other mitigation is proposed.

12.6 ASSESSMENT OF RESIDUAL EFFECTS

The Proposed Development will result in some impacts to climate through the release of GHGs, however the Proposed Development aims to minimise it's impacts through design and management measures. TII reference the IEMA 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".

The purpose of the Proposed Development is to assist with the development of renewable wind energy in Ireland. Renewable energy is a key component of the National Climate goal of achieving net zero by 2050 detailed within the 2021 Climate Act. Once mitigation measures are put in place, the effect of the Proposed Development in relation to GHG emissions is considered direct, long-term, negative and slight. Guidance ((TII 2022b), see Table 12-3: Greenhouse Gas Assessment (GHGA) Significance Criteria) states that this is appropriate for a project which:

- The project's GHG impacts are mitigated through 'good practice' measures
- The project has complied with existing and emerging policy requirements
- Fully in line to achieve Ireland's trajectory towards net zero.

Irelands trajectory to net zero requires significant renewables generated from on and offshore windfarms.

The IEMA Guidance (IEMA 2022) (which has been embraced by the updated TII Guidance (TII 2022a) in Section 6.7.2) states as follows:

> "A minor adverse not significant impact is described with: A project that is compatible with the budgeted, science based 1.5°C trajectory (in terms of rate of emissions reduction) and which complies with up-to-date policy and 'good practice' reduction measures to achieve that has a minor adverse effect that is not significant. The project may have residual impacts but is doing enough to align with and contribute to the relevant transition scenario. A 'minor adverse' or 'negligible' non-significant effect conclusion does not necessarily refer to the magnitude of GHG emissions being carbon neutral (i.e. zero on balance) but refers to the likelihood of avoiding severe climate change and achieving net zero by 2050. A 'minor adverse' effect or better is a high bar and indicates exemplary performance where a project meets or exceeds measures to achieve net zero earlier than 2050."

In terms of EPA Guidance, which sets different criteria, the impact to climate can be described as direct, long-term, beneficial and slight, which is not significant in EIA terms (EPA 2022).

In relation to climate change vulnerability, it has been assessed that there is a low risk as a result of the majority of future climate change hazards with the exception of flooding which has a medium risk. However, the sensitivity of the Proposed Development's assets has been mitigated through best

design practices. The risk of the Proposed Development to future climate change will require periodical updates and active management to ensure the Proposed Development remains resilient to future climate impacts.

12.7 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 CEMP. The contractor will undertake monitoring including: 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 will also be conducted by the contractor to include the ongoing management of adaptation and mitigation to measure their effectiveness. If monitoring of adaptation measures and mitigation measures indicates that the measures are not effectively minimising embodied carbon then they should be reviewed and updated.

12.8 SUMMARY

Table 12.10 below details the predicted impacts to climate as a result of the Proposed Development. The terminology regarding rating of impacts and their significance is based on the EPA EIA guidance (2022).

Table 12.10 Summary of predicted climate related impacts

Potential Effect	Construction / Operation	Beneficial / Adverse/ Neutral	Extent (Site/Local/ National / Transboundary)	Short term/ Long term	Direct/ Indirect	Permanent / Temporary	Reversible / Irreversible	Significance of Effect (according to defined criteria)	Proposed mitigation	Residual Effects (according to defined criteria)
GHG emissions & renewable energy production	Construction & Operation	Beneficial	National	Long-term	Direct	Permanent	Irreversible	Not significant	Measures outlined in Section 11.5.1	Not significant
Vulnerability of the development to future climate change	Operation	Adverse	Local	Long-term	Direct	Permanent	Irreversible	Not significant	Incorporated design measures as per Section 11.4.3.2	Not significant

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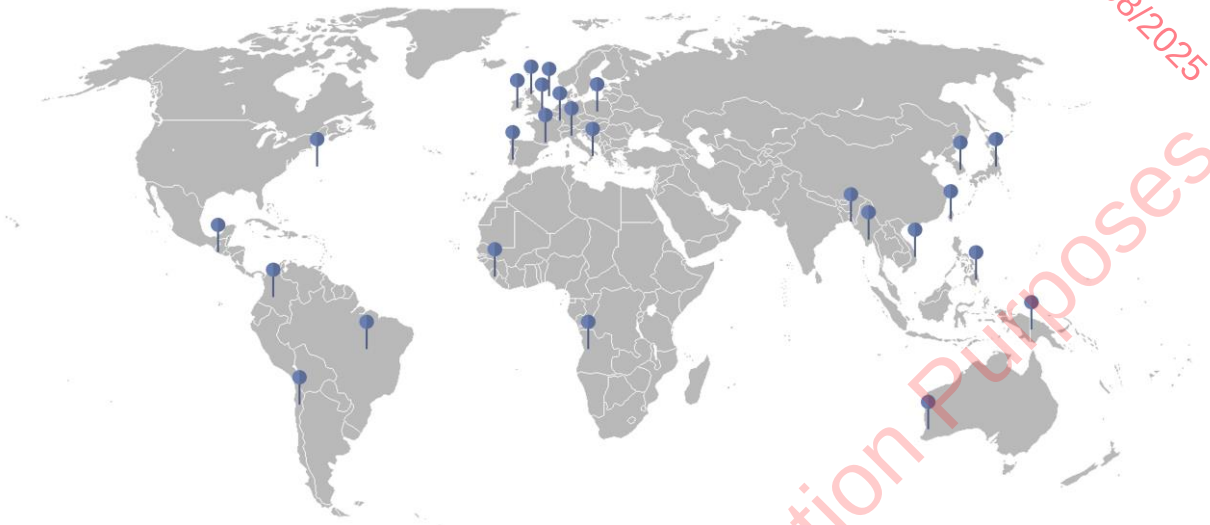
GLOBAL PROJECT REACH



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