

EIAR FOR POWERSTOWN BIOENERGY

Volume 2: Main Body of the EIAR

Chapter 9: Climate

Prepared for:

Greengate Biogas 001 Ltd.



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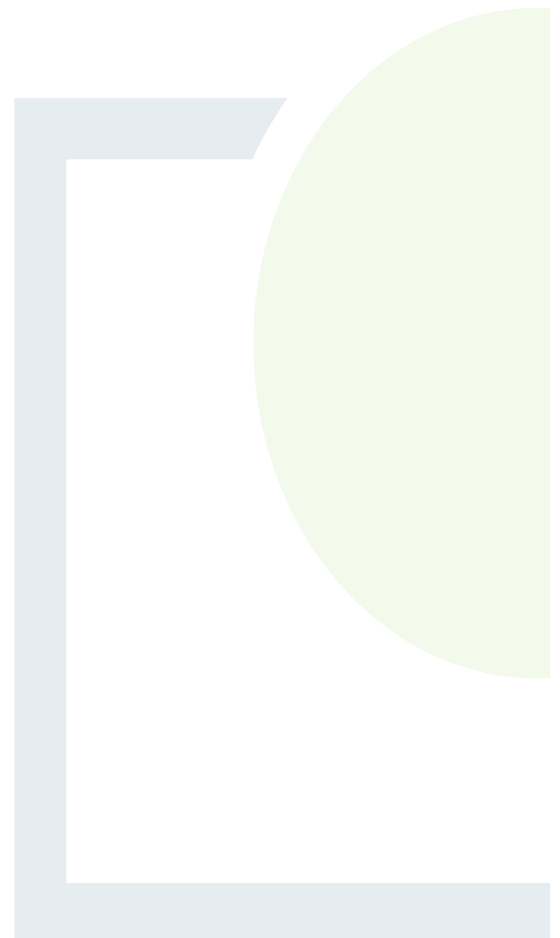


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9. CLIMATE

9.1 Introduction

This chapter assesses the likely climate impact of the proposed development. The assessment of impacts has been undertaken in the context of current relevant standards and guidance and identifies any requirements or possibilities for mitigation. A full description of the development can be found in Chapter 3 - Description of the existing and proposed development.

Mitigation measures are included, where relevant, to ensure the proposed development is constructed in an environmentally sustainable manner in order to ensure minimal impact on the receiving environment.

9.2 Statement of Authority

CVs are included in Appendix 1.1 of Volume 3 of this EIAR.

This chapter was prepared by Lee Shelton. Lee is a Principal Environmental Consultant in the Air Quality & Climate section of AWN Consulting, a Trinity Consultants Company. Lee is a Chartered Environmentalist with 11 years' experience in environmental assessment and holds a BSc (Hons) in Environmental Protection from Scotland's Rural College through the University of Edinburgh. Lee has a specialism in air quality assessment having worked on a number of projects requiring the quantification of emissions specific to local air quality, a skill transferrable to climate assessment, and undertook early assessments in the history of climate assessment such as those for the Design Manual for Roads and Bridges Stage 2 assessment for the A47 Improvements at Tuddenham and Guyhirn in England and more recently was involved in the Midlands Connect Transport Carbon Quantification in England. One of Lee's more recent air quality assessment projects is the Grangemouth Air Quality Assessment in support of the revocation of the Grangemouth Air Quality Management Area in Falkirk, Scotland, which involved the quantification of pollutant emissions from multiple industrial sources of numerous types. Lee specialises in air quality dispersion modelling and assessment of emissions, odour and accidental releases, emission inventories, air quality and odour monitoring and geographical information systems.

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9.3 Assessment Methodology

9.3.1 Legislation, Policy and Guidance

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



9.3.1.1 Legislation

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

Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 (European Parliament and Council, 2021) follows from the Paris Agreement and writes into EU law the goal set out in the European Green Deal for Europe's economy and society to become climate-neutral by 2050. The law also sets the intermediate target of reducing net greenhouse gas (GHG) emissions by at least 55% by 2030, compared to 1990 levels. These targets are also applied to member states.

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

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

The Climate Action and Low Carbon Development (Amendment) Act 2021 (Government of Ireland, 2021) provides the framework for Ireland to achieve a climate resilient and climate neutral economy by the end of the year 2050. The Act allows for the setting of carbon budgets and sectoral emissions ceilings to apply to sectors of the economy whilst promoting climate justice and just transition to the climate resilient and climate neutral economy. Carbon budgets are determined based on the requirements for reductions in GHG described in EU Regulation 2018/842 (European Union, 2018). The Climate Action and Low Carbon Development (Amendment) Act 2021 should be read together with the Climate Action and Low Carbon Development Act 2015 and together are referred to in this report as the "Climate Act". Refer to Chapter 2 Policy and Planning for further detail on climate legislation and how the proposed development aligns.

9.3.1.2 Policy

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



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

The latest iteration of the Government of Ireland’s Climate Action Plan (CAP25) (Government of Ireland, 2025) was published in 2025 updating many of the suggested measures and actions required to achieve carbon budgets and sectoral emissions ceilings from CAP24 (Government of Ireland, 2024). Both CAP24 and CAP25 should be read together. The plans taken together provide the roadmap for halving Ireland’s emissions by 2030 and achieving carbon neutrality by 2050. The CAP25 advances sector-specific measures including decarbonising the residential building sector. This includes the complete phase-out of fossil fuel heating for both new builds and retrofits. CAP25 details the 5-year carbon budget periods, shown in Table 9-1, and the Sectoral Emissions Ceilings, shown in Table 9-2, as required by the Climate Act.

Table 9-1: 5 Year Carbon Budgets 2021-2023

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

Table 9-2: Sectoral Emission Ceilings 2030

Sector	Baseline (MtCO ₂ e)	Carbon Budgets (MtCO ₂ e)		2030 Emissions (MtCO ₂ e)	Indicative Emissions % Reduction in Final Year of 2025 – 2030 Period (Compared to 2018)
	2018	2021-2025	2026-2030		
Electricity	10	40	20	3	75
Transport	12	54	37	6	50
Built Environment – Residential	7	29	23	4	40
Built Environment – Commercial	2	7	5	1	45
Industry	7	30	24	4	35
Agriculture	23	106	96	17.25	25
Other (F-gases, waste, petroleum refining)	2	9	8	1	50
Land Use, Land-use Change and Forestry (LULUCF)	5	Reflecting the continued volatility for LULUCF baseline emissions to 2030 and beyond, CAP24 puts in place ambitious activity targets for the sector reflecting an EU-type approach.			
Total	68				
Unallocated Savings	-	-	26	-5.25	-



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

Ireland's National Biomethane Strategy (Government of Ireland, 2024) was published in 2024. This is Ireland's first major policy statement on biomethane and is an important milestone in the development of an indigenous sector. The Strategy sets out twenty-five actions to be delivered in the coming years to enable the development of the sector and to achieve the government's target of 5.7 TWh of indigenously produced biomethane by 2030. The proposed development represents 1.4% of the 5.7 TWh by 2030 goal. The publication of this Strategy was coupled with the launch of grant aid towards development of the sector which is expected to drive expansion of the anaerobic digestion sector towards achieving the 2030 target.

Biomethane that satisfies the Renewable Energy Directive's life cycle sustainability criteria can be classified as "a zero-carbon rated fuel". Biomethane can therefore directly contribute to meeting Ireland's decarbonisation targets.

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

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

- National Policy Objective 53: Support the circular and bio economy including in particular through greater efficiency in land management, greater use of renewable resources and by reducing the rate of land use change from urban sprawl and new development.
- National Policy Objective 69: Reduce our carbon footprint by integrating climate action into the planning system in support of national targets for climate policy mitigation and adaptation objectives, as well as targets for greenhouse gas emissions reductions as expressed in the most recently adopted carbon budgets.
- National Policy Objective 78: Promote sustainable development by ensuring flooding and flood risk management informs place-making by avoiding inappropriate development in areas at risk of flooding that do not pass the Justification Test, in accordance with the Guidelines on the Planning System and Flood Risk Management, and taking account of the potential impacts of climate change on flooding and flood risk, in line with national policy regarding climate adaptation.

The Framework also discusses support of the bio-energy industry and support for the circular economy in terms of provision of employment in rural areas.

There is further information in Chapter 2 Policy and Planning demonstrating how the proposed development is compliant with national climate policy.



9.3.1.2.1 Climate Change Vulnerability Policy

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

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

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

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

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



9.3.1.2.2 Local Policy

The Carlow Local Authority Climate Action Plan 2024–2029 (Carlow County Council, 2025) outlines Carlow County Council’s objectives to mitigate greenhouse gas emissions and strategies to prepare for and adapt to climate change. The plan outlines the sectors with the highest GHG emissions in Carlow, which are agriculture; transport; manufacturing & commercial; and residential. All actions to reduce GHG emissions will be measured with Key Performance Indicators (KPIs). The plan encompasses actions across several thematic areas, including Governance & Leadership; Built Environment & Transport; Natural Environment & Green Infrastructure; Communities: Resilience & Transition; and Sustainability & Resource Management. The Plan aligns with the Government’s National Climate Objective, which aims to achieve, by no later than 2050, a transition to a climate-resilient, biodiversity-rich, environmentally sustainable, and climate-neutral economy. The Carlow Local Authority Climate Action Plan sets ambitious targets, including a 51% reduction in the Council’s GHG emissions by 2030.

9.3.1.3 Guidance

The principal guidance and best practice documents used to inform the assessment of potential impacts on climate are summarised below. In addition to specific climate guidance documents, the following guidelines were considered and consulted in the preparation of this chapter:

- Environmental Protection Agency Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (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 (Transport Infrastructure Ireland, 2022)
- TII GE-ENV-01106: TII Carbon Assessment Tool for Road and Light Rail Projects and User Guidance Document (Transport Infrastructure Ireland, 2025)
- Institute of Sustainability and Environmental Professionals (ISEP) Environmental Impact Assessment Guide to: Assessing GHG Emissions and Evaluating their Significance Edition 2.1 with Supplementary Guidance (Institute of Sustainability & Environmental Professionals, 2026)
- ISEP Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation (Institute of Sustainability & Environmental Practitioners, 2020a)
- ISEP GHG Management Hierarchy (Institute of Sustainability and Environmental Professionals, 2020)
- Carbon Management in Infrastructure and Built Environment - PAS 2080 (The British Standards Institution, 2023)
- Technical Guidance on the Climate Proofing of Infrastructure in the Period 2021-2027 (European Commission, 2021)
- European Commission Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment (European Commission, 2013)



9.3.2 Greenhouse Gas Assessment

9.3.2.1 *Construction Phase*

The GHG assessment accounts for various components relating to the project during different life stages to determine the total impact of the development on climate. The reference study period (i.e. the assumed building life expectancy) for the purposes of the assessment is 30 years. Embodied carbon emissions are attributed to four main categories, taken from BS EN 15978 (BSI, 2011). The categories are:

- **Product Stages (Categories A1 to A3)**

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

- A1: Raw material supply
- A2: Transport of raw materials
- A3: Manufacture of the construction products

- **Construction (Categories A4 and A5)**

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

- A4: Transport to the building site
- A5: Installation into the development

- **Use Stage (Categories B1 to B7)**

This covers a wide range of sources from the GHG emissions associated with:

- B1: Use or application of the installed product (operation of the building)
- B2: Maintenance
- B3: Repair
- B4: Replacement
- B5: Refurbishment
- B6: Operational energy use
- B7: Operational water use

PE-ENV-01104 (Transport Infrastructure Ireland, 2022) recommends the calculation of the construction stages (A1-A5) embodied carbon using the TII Online Carbon Tool or an appropriate alternative tool. Embodied carbon refers to the sum of the carbon needed to produce a good or service. It incorporates the energy needed in the mining or processing of raw materials, the manufacturing of products and the delivery of these products to site. The purpose of the embodied carbon assessment is to engage the design team in the consideration of embodied carbon at an early stage in the development and mitigate embodied carbon. This engagement aims to ensure carbon savings are made and to assist in aligning the project to Ireland's CAP goal of Net Carbon Zero by 2050.

The TII Online Carbon Tool has been commissioned by TII to assess GHG emissions associated with road or rail projects in Ireland. The TII Carbon Tool uses emission factors from recognised sources including the Civil Engineering Standard Method of Measurement (CESSM) Carbon and Price Book database (Institute of Civil Engineers, 2023), which can be applied to a variety of developments, not just road or rail. The tool aligns with PAS 2080:2023.

Reasonable conservative estimates have been used in this assessment where necessary to provide an estimate of the GHGs associated with the proposed development.



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 budgets, which are detailed in Table 9-5. The relevant sectoral emissions for the proposed development comparison include the Industry sector, Transport sector, and Waste sector. The predicted emissions for the proposed development are annualised over the assumed 30-year lifespan and then compared to the relevant sector 2030 carbon budgets. Annualising the full carbon emissions over the lifetime of the development allows for appropriate comparison with annual GHG targets.

9.3.2.2 Construction Phase Traffic Emissions

Traffic during the construction phase has the potential to emit GHGs which will impact climate.

The guidance PE-ENV-01106 (Transport Infrastructure Ireland, 2025) states that road links meeting one or more of the following criteria can be defined as being 'affected' by a proposed development and should be included in the local air quality assessment, and also the climate assessment. While the guidance is specific to infrastructure projects the approach can be applied to any development that causes a change in traffic.

- annual average daily traffic (AADT) changes by 1,000 or more
- heavy duty vehicle (HDV) AADT changes by 200 or more
- daily average speed change by 10 kph or more
- peak hour speed change by 20 kph or more
- a change in road alignment by 5 m or greater

Based on the information available in Chapter 6 – Traffic and Transportation it was determined by the traffic consultant that construction traffic will not meet the PE-ENV-01106 TII criteria for assessment. The construction traffic volumes were also reviewed as part of Chapter 8– Air Quality and it was determined that the criteria of changes in overall traffic volumes of 1,000 AADT and changes in HDV flows of 200 AADT would not be met, therefore further assessment of construction traffic is scoped out of this assessment.

9.3.2.3 Operational Phase

The EU Guidance (European Commission, 2013) also states that indirect GHG emissions as a result of a development must be considered, which include emissions associated with energy usage.

The quantification of operational phase GHG emissions has considered the following for the renewable biogas plant site:

- Transport (by heavy duty vehicles (HGV)) of feedstock from local sources to the proposed development, as well as transport of product to various destinations. Factors from the TII Carbon Tool have been used to quantify the transport emissions.
- Energy consumption for pre-treatment processes for received liquids and solids.
- Biomass fuel consumption for the 6 MW wood biomass boiler within the Heating Centre.
- Energy use and fugitive CO₂ emissions from the Gas Upgrade Plant.
- Energy use and fugitive CO₂ emissions from the Liquification Plant.
- CO₂ emissions from the Gas Flare(s).
- General energy usage from administration of the facility.



9.3.2.4 Decommissioning Phase

Vehicles related to the decommissioning phase could give rise to CO₂ emissions. It is not predicted that this project 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.

It is assumed during the decommissioning phase that any interior equipment and fixings would be removed and either reconditioned, recycled or disposed of as appropriate to their condition and function. Any buildings would be deconstructed and the assumption is that suitable building materials would be taken for recycling. It is assumed that buildings and concrete bases would remain in situ for repurposing.

Emissions from this stage cannot accurately be calculated but are generally held to be minimal in comparison to the proposed development as a whole, and as such are scoped out from further assessment.

9.3.2.5 Greenhouse Gas Assessment Significance

The significance of the impacts of GHG emissions on the climate is an area of scientific consensus that is described clearly in the IPCC AR6 reports (IPCC, 2023), and as such all GHG emissions are considered to contribute adversely towards climate change.

ISEP Supplementary Guidance (Assessing Greenhouse Gas Emissions and Evaluating their Significance) (Institute of Sustainability & Environmental Professionals, 2026) highlights the importance of mitigation in determination of significance, committing the project to go further than minimum regulatory compliance. This is particularly relevant in the context of the severity of the climate situation and potential exceedance of the 1.5°C Paris Agreement target as described in Section 9.4.4. It explains it is no longer sufficient for developments to comply with national policies or regulatory standards as mitigation and achieve non-significant effects. It determines embodied carbon must be addressed and generalised measures found in a CEMP cannot be relied upon to materially reduce significance. Where no sufficient and meaningful mitigation is proposed which supports an applicable 1.5°C or net zero compatible trajectory, beyond minimum compliance with current regulations (such as Technical Guidance Document L Conservation of Fuel and Energy – Buildings other than Dwellings (Government of Ireland, 2022), this would typically indicate a major or moderate, significant adverse effect.

The ISEP (Institute of Sustainability & Environmental Professionals, 2026) points set out above and the TII definitions set out in Table 9-3 are well aligned but the ISEP goes a step further in requiring mitigation beyond 'good practice'.

In order to streamline the process and provide accountability, the criteria outlined in PE-ENV-01104 (Transport Infrastructure Ireland, 2022) (which are based on the 2026 ISEP guidance and are consistent with the terminology contained within Figure 3.4 of the Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA, 2022), are used together with the following two factors:

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



Table 9-3: Significance Criteria for Greenhouse Gas Assessments

Effects	Significance Level	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 has 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. - 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	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.

9.3.3 Climate Risk Assessment

As per the PE-ENV-01104 (Transport Infrastructure Ireland, 2022) guidance, an initial screening of risk during the operational phase is conducted. 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 provides the 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.



First an initial screening of physical hazards is carried out based on the proposed site location. This is a qualitative screening which intends to only proceed with relevant hazards (e.g., sea level rise is not an applicable hazard to inland areas or wildfire is not considered a hazard in an urban location). Following this, all-relevant hazards are assessed on their exposure under future climate change.

The sensitivity is based on a High, Medium or Low rating with a score of 1 to 3 assigned as per the criteria below.

- **High Sensitivity** - The climate hazard will or is likely to have a major impact on the asset category. This is a sensitivity score of 3
- **Medium Sensitivity** - It is possible or likely the climate hazard will have a moderate impact on the asset category. This is a sensitivity score of 2
- **Low Sensitivity** - It is possible the climate hazard will have a low or negligible impact on the asset category. This is a sensitivity score of 1.

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.

9.3.3.1 *Significance Criteria for the Climate Change Risk Assessment*

The Climate Change Risk Assessment (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 9-4 details the vulnerability matrix; vulnerabilities are scored on a high, medium and low scale.

The PE-ENV-01104 guidance (Transport Infrastructure Ireland, 2022) and the EU technical guidance (European Commission, 2021b) 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. According to PE-ENV-01104, an assessment of construction phase CCRA impacts is only required if a detailed CCRA is required.



Table 9-4: Climate Change Vulnerability Index

		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

The screening CCRA, detailed in Section 9.5.2.2, did not identify any residual medium or high risks to the proposed development as a result of climate change. Therefore, a detailed CCRA for the construction and operational phase was scoped out.

While a CCRA for the construction phase was not required, best practice mitigation against climate hazards is still recommended in Section 9.6.

9.4 Baseline Environment

9.4.1 Current Greenhouse Gas Baseline

Data published in March 2026 (Environmental Protection Agency, 2025c), indicates that Ireland exceeded, without the use of flexibilities, its 2024 annual limit set under EU's Effort Sharing Decision (ESD) (EU 2018/842) by 3.93 MtCO₂e. However, the reported emissions for 2024 represent the second consecutive year in which Ireland's emission were below 1990 levels by 4.2%. Emissions Trading Scheme emissions have decreased by 49.7% or 11.1 MtCO₂e compared to 2005 and Effort Sharing Regulation emissions decreased by 10.2% or 5 MtCO₂e. Ireland is now a net 2,020 ktCO₂e distant from its target under the Effort Sharing Regulation.

The EPA estimate that 2024 total national GHG emissions, excluding LULUCF, have decreased by 1.9% on 2023 levels to 53.93 MtCO₂e, with an 8.8% reduction in electricity industries alone. This was driven by an increase in generation from renewables in 2024 by 1.6% and the complete phase-out of peat for electricity generation. Manufacturing combustion and industrial processes decreased by 4.4% to 6.2 MtCO₂e in 2024 due to declines in fossil fuel usage. The sector with the highest emissions in 2024 was agriculture at 36.2% of the total, followed by transport at 20.9%. For 2024, total national emissions (including LULUCF) were 56.45 MtCO₂e (Table 9-5).

The current estimates of national greenhouse gas emissions (including LULUCF) in 2024 are 12.6% below 2018, well below the National Climate ambition of a 51% reduction by 2030. The data indicate that from 2021 to 2024 Ireland has used 85.2% of the 295 MtCO₂e Carbon Budget for the five-year period 2021-2025. This leaves 17.5% of the budget available for 2025, requiring a substantial 14.8% annual emissions reduction across all sectors for 2025 to stay within the budget.

Figures for 2025 emissions are due to be provisionally published by the EPA in July 2026. The final 2025 emissions outturn will determine whether the first carbon budget (2021 to 2025) has been exceeded and, consequently, may necessitate adjustments to the subsequent carbon budget period for 2026 to 2030 in accordance with national carbon budgeting arrangements under the Climate Action and Low Carbon Development (Amendment) Act 2021.



Table 9-5: Ireland Sectoral Carbon Budgets

Sector ^{Note 1}	Annual Total Emissions for Carbon Budget 1 (Mt CO ₂ e)				Total Budget (Mt CO ₂ e) (2021-2025)	% Budget 2021-2025 Used	Annual % Change 2023-2024
	2021	2022	2023	2024			
Electricity	9.88	9.68	7.56	6.95	40	85.19%	-8.11%
Transport	11.19	11.88	11.93	11.78	54	86.66%	-1.26%
Buildings (Residential)	6.71	5.62	5.23	5.48	29	79.47%	4.84%
Buildings (Commercial and Public)	1.42	1.38	1.34	1.44	7	79.69%	8.05%
Industry	7.25	6.81	6.46	6.18	30	89.00%	-4.37%
Agriculture	21.97	21.78	20.72	20.45	106	80.11%	-1.33%
Other ^{Note 2}	1.82	1.85	1.75	1.65	9	78.45%	-5.82%
LULUCF	2.87	2.47	2.96	2.51	-		
Total including LULUCF	63.11	61.48	57.96	56.45	295	81.01%	-2.61%
Total excluding LULUCF	60.24	59.01	54.99	53.93	-	-	-1.93%

Note 1 Reproduced from latest emissions data from the EPA (2026).
Note 2 Other includes Petroleum refining, F-Gases and Waste (emissions from solid waste disposal on land, solid waste treatment (composting and anaerobic digestion), wastewater treatment, waste incineration and open burning of waste).

9.4.2 Future Greenhouse Gas Baseline

The future GHG baseline is considered in relation of the ability of the proposed development to contribute positively or negatively to the ability of Ireland to meet the binding commitment as part of the Climate Act for carbon neutrality by 2050.

The targets for 2030 and 2050 are described in CAP24 and CAP25 as required by the Climate Act. The Act codified the GHG reductions required by EU Regulation 2018/842 amended by EU Regulation 2023/857 put in place to enable European Member States to meet their obligations under the Paris Agreement. The future baseline is determined by Ireland being able to meet its requirements under these regulations.

Ireland's Greenhouse Gas Emissions Projections 2024-2055 (Environmental Protection Agency, 2025d) summarises total projected emissions and provides a breakdown of projected emissions per sector under the 'With Existing Measures' and 'With Additional Measures' scenarios. The EPA projections indicate that currently implemented measures (With Existing Measures) will achieve a reduction of 10% on 2005 levels by 2030, significantly short of the 42% reduction target. If measures in the higher ambition (With Additional Measures) scenario are implemented, EPA projections show that Ireland can achieve a reduction of 22% by 2030, still short of the 42% reduction target.



9.4.3 Current Climate Risk Baseline

The region of the proposed development has a temperate, oceanic climate, resulting in mild winters and cool summers. This baseline data is derived from the European Centre for Medium-Range Weather Forecasts (ECMWF) ERA5 data reanalysis (ECMWF, 2023) which includes observed data from local meteorological weather stations across Ireland from 1950-2023. This data is reanalysed to model a complete picture of Ireland's historical climate. This method has been chosen to ensure data can be analysed at the daily level and harmoniously compared with future scenarios. The baseline time-period referred to in this assessment was from 1991-2020 and is specific to the county of Carlow.

9.4.3.1 Precipitation

Climate averages for the 30-year period from 1991-2020 are shown in Figure 9-1. The data show that there are two distinct precipitation patterns, one occurring in the period February to September with no specific peak, and another wetter period from October to January. The period from February to September experiences rainfall below the average for the year (90.3 mm). December is when the peak rainfall of 109.8 mm occurs and is also the period with the wettest days at 36.5 mm. The driest month is June with 78.9 mm of rainfall.

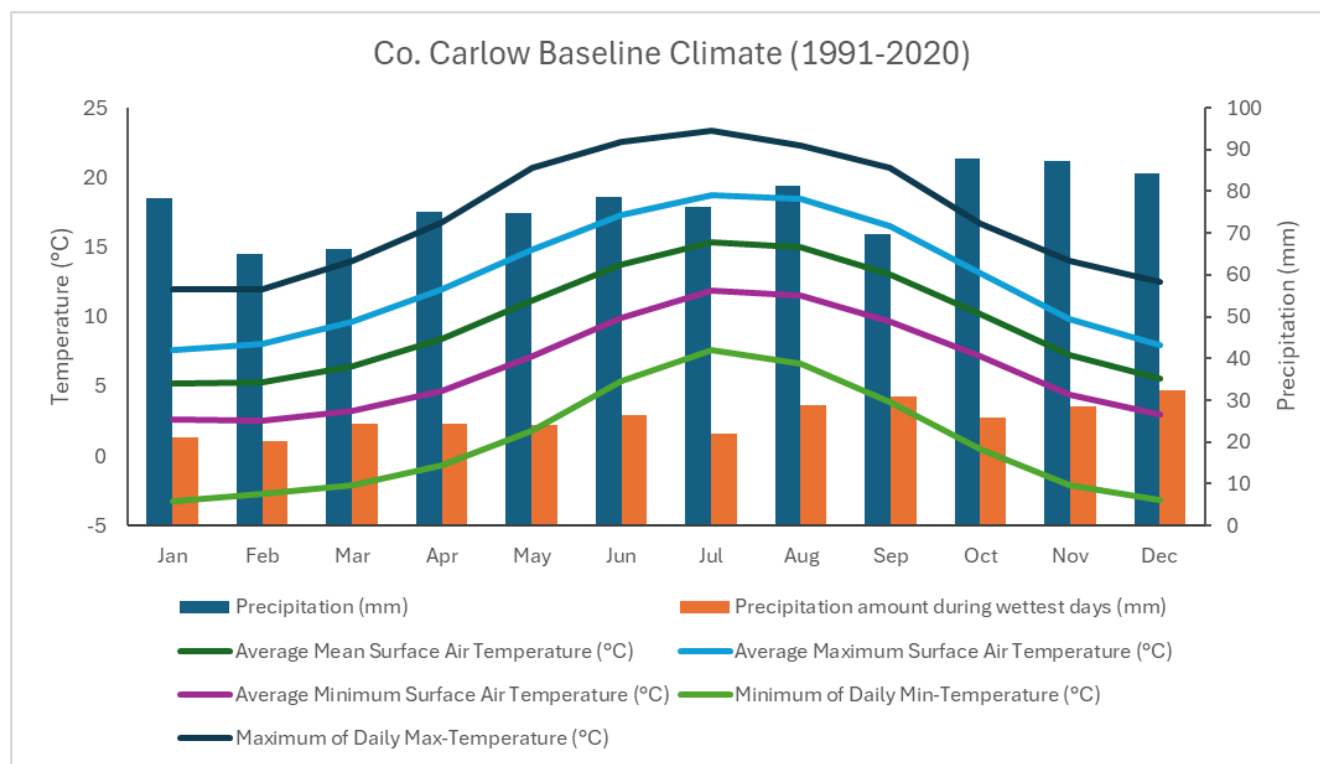


Figure 9-1: County Carlow Baseline Climate Averages (1991-2020)

9.4.3.2 Temperature

July is the warmest month on average with a mean surface air temperature of 15.0°C. July also experiences the average maximum surface air temperature (18.4°C) and the daily maximum temperature (17.8°C). February is the coldest month on average with a mean average surface temperature of 6.1°C. January records the lowest daily minimum temperature of -1.5°C, however the average minimum surface air temperature of 3.7°C occurs in February.



9.4.3.3 *Wind and Storms*

There are no nearby Met Éireann weather stations nearby that could be considered to be representative that have been recording data continuously suitable for the creation of a 30 year average dataset.

Kilkenny weather station at Kilkenny Airport, with data up to 2008, recorded a peak gust of 139 kph in 1997 whilst Carlow weather station, with data from 2008, recorded a peak gust of 126 kph during 2014.

With reference to recent extreme weather events in Ireland, storm Éowyn hit the island of Ireland in January 2025 and recorded a maximum 10-minute mean wind speed of 142 kph in Ireland, with the highest gust in Ireland being 184 kmh. Four weather stations broke their highest gust records during this storm and two stations reached hurricane force 12 on the Beaufort scale.

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

9.4.3.4 *Wildfire*

County Carlow is subject to a medium risk of wildfire according to the World Bank Group Global Facility for Disaster Reduction and Recovery (GFDRR) Think Hazard dataset. This means that there is there is between a 10% and 50% chance of the occurrence of weather conditions that could be favourable to the formation and fuelling of wildfires within the county.

9.4.3.5 *Flooding*

The Site-Specific Flood Risk Assessment (SSFRA) has been undertaken for the proposed development at Powerstown, in accordance with the core principles of The Planning System and Flood Risk Management Guidelines for Planning Authorities (DEHLG & OPW, 2009), together with Circular PL 2/2014.

A Stage 1 and Stage 2 Flood Risk Identification was completed to determine whether any flooding or surface water management issues may arise in relation to the proposed development. This assessment confirmed that the Site is not at risk of flooding from fluvial, coastal, pluvial, or groundwater sources. Refer to Appendix 13.2 of Volume 3 for the site specific flood risk assessment. The report concludes that progression to a Stage 3 Detailed Flood Risk Assessment is not required.

9.4.3.6 *Landslides*

The Geological Society of Ireland (GSI) Landslides Susceptibility Mapping dataset shows that there is a low risk of landslides of land instability at the location of the development. There are also no recorded incidences of landslides at the location of the development.

9.4.4 Future Climate Risk Baseline

The current global climate is in a state of extreme flux. This is illustrated in the latest IPCC AR6 Synthesis Report Summary for Policymakers (IPCC, 2023) using the climate stripes representation pioneered by Professor Ed Hawkins of the University of Reading, reproduced in Figure 9-2.

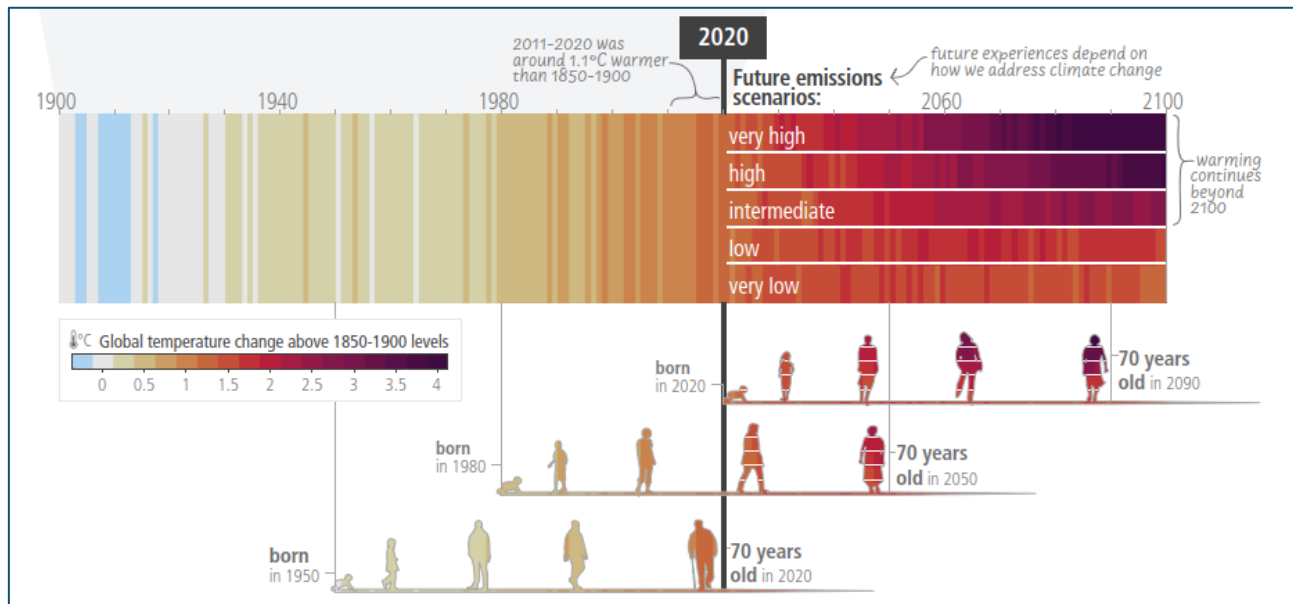


Figure 9-2: Global Climate Change Representation (IPCC, 2023)

Figure 9-2 shows that global average temperatures are already substantially above the 1850-1900 baseline level, and potential increases under future emissions scenarios are also presented. The United Nations reported that 2024 was the first calendar year to exceed the 1.5°C average increase (United Nations, 2026) with an average temperature 1.55° above the 1850-1900 average. Whilst this in itself is not an indication of a definite exceedance of the 1.5°C Paris Agreement commitment, as there will be some natural variation in the coming years, it is a clear indication that the climate is continuing to significantly warm. In addition, the CMIP6 climate model predicts a severe weakening of the Atlantic Meridional Overturning Current (AMOC) due to ocean surface warming and glacial meltwater entering the system from the Greenland ice sheets that is known to be highly influenced by anthropogenic emissions. Normally this current has a stabilising effect on the climate in Ireland, however a weakening or cessation of the ocean current would have profound consequences for Ireland in terms of overall climate stability and the magnitude of temperature extremes. Recent observations have been coupled with prediction models (Observational constraints project a ~50% AMOC weakening by the end of this century, 2026) that show AMOC weakening that is far greater than predicted in CMIP6. The implications of such a weakening or cessation of flow within AMOC for the climate in Ireland are predicted to be severely negative.

9.4.4.1 Climate Change Impacts and Projections for Ireland

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

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



9.4.4.2 Climate Modelling and Planning

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

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

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

9.4.4.3 Key Findings from Climate Projections

Table 9-6 provides a detailed comparison of baseline and future climate across the medium (RCP4.5) and the high emissions (RCP8.5) scenarios up to 2100 whilst Figure 9-3 shows the changes graphically in a national context. Key Projected changes include:

- Summer temperatures rising by over 1.7°C and overall mean temperatures increasing 1.1°C and 1.6°C by mid-century under RCP4.5 and RCP8.5 respectively
- By 2100 overall mean temperatures are predicted to be 1.5°C and 2.8°C higher under RCP4.5 and RCP8.5 respectively
- Mean minimum temperatures are predicted to increase by 1.6°C and 3°C under RCP4.5 and RCP8.5 respectively by 2100
- Summer rainfall decreasing while winter rainfall increases sharply, contributing to an overall increase in rainfall annually for the site location.
- Fewer cold winter nights and more frequent short heatwaves (≥5 days >25°C).
- Increased likelihood of dry spells and drought which may elevate the risk of wildfire.

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

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



Table 9-6: Future Climate Projections from Met Éireann TRANSLATE

Climate Hazard	Indicator	Baseline (1976-2005)	RCP4.5 (2041-2070)	RCP8.5 (2041-2070)	RCP4.5 (2071-2100)	RCP8.5 (2071-2100)
Temperature	Mean temp (°C)	9.9	11 (+1.1°C)	11.5 (+1.6°C)	11.4 (+1.5°C)	12.7 (+2.8°C)
	Mean Max temp (°C)	13.7	14.8 (+1.1°C)	15.3 (+1.6°C)	15.2 (+1.5°C)	16.5 (+2.8°C)
	Mean Min temp (°C)	6.0	7.2 (+1.2°C)	7.7 (+1.7°C)	7.6 (+1.6°C)	9.0 (+3°C)
	Average of Daily Max temp (°C)	26.1	28.4 (+2.3°C)	28.9 (+2.8°C)	28.7 (+2.6°C)	30.6 (+4.5°C)
Precipitation and Flooding	Annual precipitation (mm)	942	969 (+27)	995 (+53)	994 (+52)	1039 (+97)
	Max 1-day (mm)	32	39 (+7)	39 (+7)	40 (+8)	44 (+12)
Storms and high winds	Storm Frequency and Average speed	On Average 8 named storms annually with speeds exceeding 100 kph ^{Note 1}	Winter storm frequency is projected to increase, with a possible extension of the storm season. While the intensity of individual storms cannot be accurately projected, storm wind speeds are likely to remain above 100 km/hr.			
	Max gust Speed ^{Note 2}	75 knots (139 kph)				
Wildfire	Qualitative	Several wildfires have occurred across Ireland	Rising temperatures and prolonged dry spells are projected to elevate wildfire risk.			
Drought	Absolute Drought (≥15 days with less than 1mm of rain)	Rare	Marginal increase	Increased Likelihood	Marginal increase	Increased Likelihood
Lightning	Qualitative	Occurring during summer periods	This hazard may modestly increase in the future due to more favourable conditions, such as rising temperatures and extended warm periods beyond the traditional summer season			

Note-1: Data from combined Met Éireann, UK Met Office and Dutch Meteorological services.

Note-2: Data combined from Kilkenny weather station (c.26 km from site), 1991-2008 and Oak Park weather station (c.10 km from site) 2008-2010.

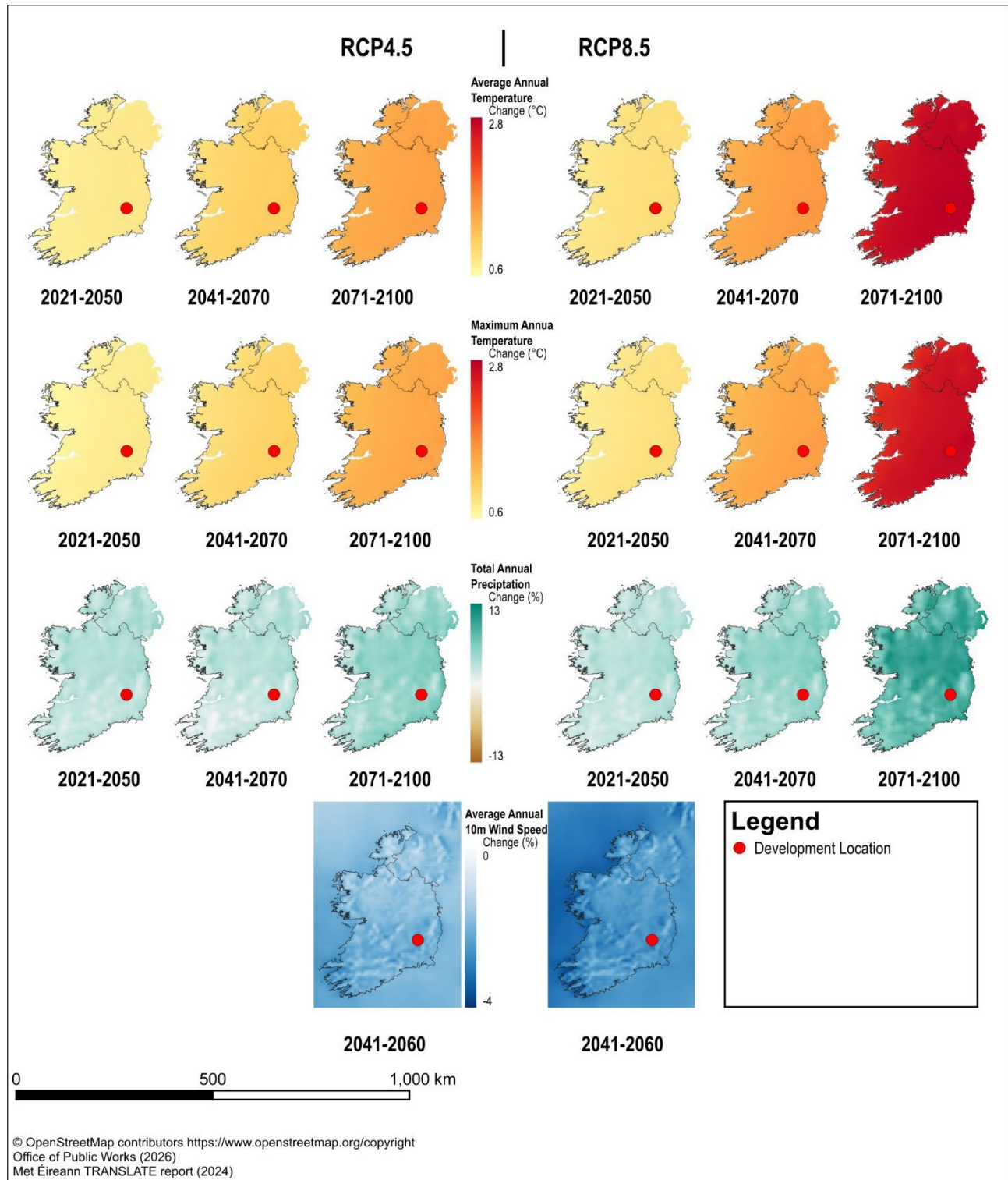


Figure 9-3: Climate Predictions for RCP4.5 and RCP8.5 from Met Éireann TRANSLATE



9.5 Potential Impacts

9.5.1 'Do Nothing' Impacts

Under the 'Do Nothing' Scenario, the proposed development will not be constructed, no construction works associated with the proposed development will take place and any previously identified or recorded effects of the climate will remain as predicted or recorded.

9.5.2 Greenhouse Gas Assessment

9.5.2.1 Construction Phase Impacts

As per Section 9.3.2.1, the TII tool was used to calculate Greenhouse Gas Emissions. Volumes and types of construction materials including construction materials, fuel, transport, excavation, water and waste were entered into the tool. The results of the Greenhouse Gas Assessment (GHGA) are shown in Table 9-7. Construction materials make up the majority of GHG emissions for the proposed development, accounting for approximately 76.9% of the total construction phase GHG emissions. The second highest contribution comes from construction energy at 18.0%.

It has been calculated that the total construction phase embodied carbon for the proposed development will be 22,037 tCO₂e as shown in Table 9-7.

Table 9-7: Construction Phase Greenhouse Gas Emissions (Unmitigated)

Stage	GHG Assessment Category	Predicted GHG Emissions (tCO ₂ e)	Predicted GHG Emissions as % of Project Total	Relevant Sector for Carbon Budget Comparison
A1-A3	Materials	17,203	78.1	Industry
A4	Material Transport	737	3.3	Transport
A5	A5.1 Site Clearance	4	<0.1	Industry
	A5.1 Excavation	104	0.5	Industry
	A5.1 Restoration/replanting	-98	-0.4	LULUCF
	A5.2 Construction energy	3,834	17.4	Electricity
	A5.2 Construction water	3	<0.1	Industry
	A5.3 Construction Waste Disposal	31	0.1	Waste
	A5.3 Construction site material waste transport	<1	<0.1	Transport
	A5.4 Construction Worker Travel to Site	219	1.0	Transport
Total		22,037		



In Table 9-8 construction phase GHG emissions have been compared against the carbon budget for the electricity, industry, transport, and waste sectors in 2030, against Ireland's total GHG emissions in 2024, and against Ireland's EU 2030 target of a 42% reduction in non-ETS sector emissions based on 2005 levels (27.7 Mt CO₂e) (set out in Regulation EU 2018/842).

Table 9-8: Estimated Construction Phase GHG Emissions Relative to Sectoral Budgets and GHG Baseline (Unmitigated)

Target/Sectoral Budget (tCO ₂ e)		Annualised Development GHG Emissions (tCO ₂ e)		% of Relevant Target/Budget
Ireland's 2024 Total GHG Emissions (existing baseline)	5,764,000	22,037	Total GHG Emissions	0.0390
Non-ETS 2030 Target	27,722,000			0.0795
2030 Sectoral Budget (Industry Sector)	4,000,000	17,313	Total Industry Emissions	0.4328
2030 Sectoral Budget (Transport Sector)	6,000,000	957	Total Transport Emissions	0.0159
2030 Sectoral Budget (Waste Sector)	1,000,000	31	Total Waste Emissions	0.0031
2030 Sectoral Budget (Electricity Sector)	3,000,000	3,834	Total Electricity Emissions	0.1278

9.5.2.2 Operational Phase Impacts

Operational emissions have been calculated using the information provided by the design team as shown in Table 9-9. These equate to 20,792 tCO₂e.

Table 9-9: Annual Operational Phase Greenhouse Gas Emissions (Unmitigated)

Stage	GHG Assessment Category	Predicted GHG Emissions (tCO ₂ e)	Predicted GHG Emissions as % of Project Total	Relevant Sector for Carbon Budget Comparison
B1	Operational Transport	3,698	19.1	Transport
	Operational Waste Disposal	0	0.0	Waste
	Operational Waste Transport	2	<0.1	Transport
B2	Maintenance	-	-	Industry
B3	Repair	-	-	Industry
B4	Replacement	-	-	Industry
B5	Refurbishment	-	-	Industry
B6	Operational energy use	16,822	80.9	Electricity
B7	Operational water use	0	0	Industry
Sub Total		20,792		



The impact of annual GHG emissions from the operational stage of the proposed development have been compared against Ireland's overall and sectoral GHG targets in Table 9-10. All of the values are a small fraction of the carbon budgets.

Table 9-10: Estimated Operational Phase GHG Emissions Relative to Sectoral Budgets and GHG Baseline (Unmitigated)

Target/Sectoral Budget (tCO ₂ e)		Annualised Development GHG Emissions (tCO ₂ e)		% of Relevant Target/Budget
Ireland's 2024 Total GHG Emissions (existing baseline)	57,646,200	20,792	Total GHG Emissions	0.0361
Non-ETS 2030 Target	27,722,000			0.0750
2030 Sectoral Budget (Industry Sector)	4,000,000	0	Total Industry Emissions	0
2030 Sectoral Budget (Transport Sector)	6,000,000	3,969	Total Transport Emissions	0.0662
2030 Sectoral Budget (Waste Sector)	1,000,000	0	Total Waste Emissions	0
2030 Sectoral Budget (Electricity Sector)	3,000,000	16,822	Total Electricity Emissions	0.5607

9.5.2.2.1 Biomethane Production

In addition to the operational data above, the primary function of the proposed development is the creation of renewable natural gas from feedstocks. The comparison for the production of biomethane versus the equivalent burning of fossil fuels is shown in Table 9-11.

Table 9-11: Comparison of burning biomethane and fossil fuels

Parameter	Value	Unit
Feedstock supply	664,000	tonnes/annum
Biogas production	41,240,000	Nm ³ /annum
Methane	23,448,500	Nm ³ /annum
Energy Content	933,963,134	MJ/annum
Biomethane GHG emissions (default) (Directive 2018/2001)	-100	gCO ₂ /MJ
Biomethane combustion	-93,396	tCO₂/annum
Fossil fuel comparator value (Directive 2018/2001)	94	gCO ₂ e/MJ
Fossil fuel comparator emissions	89,793	tCO₂/annum
Total CO₂ Saving	181,189	tCO₂/annum
Percentage of Ireland's 2024 Total GHG Emissions (existing baseline)	0.314	%



The proposed project will assist in the national goal of reducing overall emissions by 51% by 2030 and towards carbon neutrality by 2050. The emission saving in Table 9-11 represents 0.314% of the GHG emissions for 2024, the latest year for which verified emissions are available. The saving is representative of the emissions avoided through using biogas instead of fossil gas.

9.5.2.3 Greenhouse Gas Assessment Significance of Effects

The assessment of significance has been made following the PE-ENV-01104 (Transport Infrastructure Ireland, 2022), the EPA (EPA, 2022) and the ISEP guidance (Institute of Sustainability & Environmental Professionals, 2026). Following the guidance, the impact is determined based on the unmitigated impact of the proposed development. The overall unmitigated impact of GHG emissions from the proposed development, including from the construction period and the annualised emissions from the 30-year operational lifetime, are shown in Table 9-12 and are a small fraction of the sectoral budgets.

The estimated total GHG emissions annualised over the 30-year proposed development lifespan are shown in and are a small fraction of the sectoral budgets.

Table 9-12: Estimated Overall GHG Emissions Relative to Sectoral Budgets and GHG Baseline (Unmitigated)

Target/Sectoral Budget (tCO ₂ e)		Annualised Development GHG Emissions (tCO ₂ e)		% of Relevant Target/Budget
Ireland's 2024 Total GHG Emissions (existing baseline)	57,646,200	-159,663	Total GHG Emissions	0.2770
Non-ETS 2030 Target	27,722,000			0.5760
2030 Sectoral Budget (Industry Sector)	4,000,000	577	Total Industry Emissions	0.0144
2030 Sectoral Budget (Transport Sector)	6,000,000	4,001	Total Transport Emissions	0.0667
2030 Sectoral Budget (Waste Sector)	1,000,000	1	Total Waste Emissions	0.0001
2030 Sectoral Budget (Electricity Sector)	3,000,000	16,950	Total Electricity Emissions	0.5650

9.5.2.3.1 Construction Phase

With reference to Section 9.3.2.5 the magnitude and significance of effect from GHG emissions resulting from the construction stage has been determined to be of a **direct** impact due the use of material and emissions from plant and equipment, that is **long-term** as a result of the estimated lifetime of the buildings and **negative** due to the emission of GHG to the global climate. Discounting any potential mitigation measures and on the assumption that without mitigation the development may impede the trajectory towards net zero, the impact on the climate is considered to be **moderate adverse** and **significant**.



Greenhouse gas emissions from the construction stage make up a large proportion of the emissions from the Proposed Development and within that proportion the contribution to GHG emissions from construction materials is the largest source of GHG emissions. At this stage in the assessment no assumptions on mitigation measures have been incorporated into the assessment. On this basis the emissions resulting from the construction stage of the Proposed Development may impede progress towards net zero.

9.5.2.3.2 Operational Phase

The largest component for GHG emissions during the operational phase is from the consumption of grid energy for heating and running equipment, followed by transport for the supply of feedstock.

With reference to Section 9.3.2.5 the magnitude and significance of effect from GHG emissions resulting from the operational phase has been determined to be of a **direct** impact due the use of grid energy and fossil-fuelled powered transport, that is **long-term** as a result of the estimated operational lifetime of the proposed development and **beneficial** due to the avoided emissions of GHG to the global climate as a result of the production of biogas replacing the requirement for fossil gas. Discounting any potential mitigation measures and on the assumption that without mitigation the development may impede the trajectory towards net zero, the impact on the climate is considered to be **beneficial**.

9.5.3 Climate Risk Assessment

9.5.3.1 Construction Phase

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

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

- Flood Risk due to increased precipitation, and intense periods of rainfall. This includes pluvial flooding affecting unfinished structures or access roads/pavement.
- Increased temperatures potentially causing drought, wildfires and prolonged periods of hot weather potentially affecting setting concrete or cement, dust suppression and construction worker health and safety.
- Reduced temperatures resulting in ice or snow potentially affecting setting concrete or cement, landscaping and construction worker health and safety.
- Major storm damage including wind damage potentially affecting landscaping, stored materials, vertical infrastructure and construction worker health and safety.

9.5.3.2 Operational Phase

9.5.3.2.1 Sensitivity Analysis

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. Table 9-13 presents the initial qualitative Sensitivity Analysis relevant to the proposed development. The aim of the sensitivity analysis is to identify which climate hazards are relevant to the specific type of project, irrespective of its location.



Table 9-13: Climate Hazard Screening

Climate-related Hazard	Hazard Screening Rationale	Screening
Extreme Heat temperatures	High temperatures are a key consideration for both construction and long-term operation of the proposed project. Heat can affect the performance of materials, road surfaces, electrical systems while also affecting the lifecycle of assets. Extreme heat should therefore be further considered and screened in.	Screen in
Extreme Cold Temperature	Snow and ice events pose significant risks to health, safety, and site operations. Road access may be disrupted, and low temperatures can affect water mains. Freeze-thaw cycles may cause cracking in concrete and road surfaces, with snow clearance and ice management the responsibility of the local authority. Cold temperatures are therefore screened in.	Screen in
High precipitation and pluvial flooding	Surface water remains a key vulnerability for any proposed development during both construction and operational phases. The FRA concluded the proposed development was subject to a low risk of flooding from any source, however increases in precipitation deserve consideration.	Screen in
Fluvial flooding	The FRA concluded that the Site is therefore in Flood Zone C, where the probability of flooding from rivers is low.	Screen out
Drought	Droughts have occurred across Ireland, previously impacting water supply. Water supply is not expected to directly affect the proposed development due to the presence of a private borehole, therefore drought is screened out.	Screen out
Wildfire	The area surrounding the site is a mix of agricultural land, woodland, mineral extraction and transport infrastructure. The GFDRR Think Hazard dataset records a medium risk of wildfire for Co. Carlow which means there is between a 10% and 50% change of experiencing weather that could support a hazardous wildfire that could result in a risk to property or life. The surrounding land is judged to include uses that may precipitate wildfires and contain sufficient fuel to maintain a fire should it occur.	Screen in
High winds and storms	High winds may cause localised disturbance such flying small debris or downed trees. Carlow in the east of Ireland is generally less vulnerable to high winds and storms than comparable locations in the west of Ireland. Damage would be expected to be minor and easily repairable and so is screened out.	Screen out
Fog	Fog is not considered a significant hazard for this development as it is not expected to have a long residency period before clearing. There is also ample street lighting.	Screen out
Lightning	Lightning can strike low-rise structures if there are few or no other features in the landscape, therefore vulnerable structures are anticipated to be well earthed. Vulnerable structures tend to have earthing rods embedded into design however the storage of gas presents an explosion risk. Therefore lightning is screened in.	Screen in



Climate-related Hazard	Hazard Screening Rationale	Screening
Landslides and Subsidence	The Geological Society of Ireland (GSI) landslide susceptibility mapping database (GSI, 2026) was reviewed to determine a low risk from landslides at the proposed development location, with no landslides recorded within the vicinity, therefore no further analysis is required.	Screen out
Sea level rise and coastal flooding	The site is over 50 km from the coast and therefore no further analysis is required, and this aspect is screened out.	Screen out

The sensitivity and exposure of the area was determined with input from the various discipline specialists on the project team. It was concluded that the proposed development does not have any significant vulnerabilities to the identified climate hazards as described in the below sections. All vulnerabilities are classified as low.

It was concluded that, with design and management mitigation in place, the proposed project does not have any significant vulnerabilities to the identified climate hazards as described in the below sections and Table 9-14.

Table 9-14: Climate Vulnerability Assessment

Climate Hazard	Sensitivity	Exposure	Vulnerability
Extreme heat	1 (Low)	2 (Medium)	2 (Low)
Extreme cold	1 (Low)	1 (Low)	1 (Low)
High precipitation and pluvial flooding	1 (Low)	2 (Medium)	2 (Low)
Wildfire	1 (Low)	2 (Medium)	2 (Low)
Lightning	1 (Low)	1 (Low)	1 (Low)

9.5.3.2.1.1 Extreme Temperatures (Heat & Cold)

Extreme temperatures, both hot and cold, can affect building materials and infrastructure; however, the development has been designed as outlined in Part L 2022 (Buildings other than dwellings). The buildings will be designed to achieve the Part L maximum U-values and achieve the defined standards for thermal bridging and air permeability.

Landscaping design will consider elevated temperatures such as those projected and extreme temperatures +30°C should be accommodated by the design through selection of species that will not demand excessive water input.

Utilities are expected to be buried or not exposed for thermal protection, and any cooling systems will be designed for RCP4.5 and RCP8.5 scenarios with capacity for future upgrades. Overall, extreme temperatures are not considered a significant risk.



9.5.3.2.1.2 High Precipitation, Fluvial and Pluvial Flooding

Future increases in rainfall due to climate change may elevate the risk of pluvial flooding, particularly if local drainage is overwhelmed or blocked. The site specific FRA showed that there is no pluvial flooding vulnerability at the site.

The FRA identified that the proposed development is located in Flood Zone C. Site drainage is to be designed with an attenuation pond capacity able to accommodate a 1-in-30 year storm event.

9.5.3.2.1.3 Wildfire

County Carlow is subject to a medium risk of wildfire. This is corroborated by the increased risk of longer, warmer dry periods or heatwaves that may lead to a higher fuel loading for wildfires.

The surrounding land uses include transport and industrial uses that may precipitate the conditions to allow a wildfire to start, e.g. disposal of sources of ignition from moving traffic.

The proposed layout of the development includes a substantial buffer between the site boundary and development infrastructure that will provide protection from any wildfires outside of the site boundary until they can be extinguished or have used up their fuel source. Therefore, this is not considered a significant risk to the development.

9.5.3.2.1.4 Lightning

Whilst the infrastructure at the site does not extend vertically in the same way as other infrastructure that is vulnerable to lightning and electrical storms, the nature of the gas storage on site necessarily presents a risk should any of the infrastructure be struck. With the increasing unpredictability of storms from one year to the next and the potential for such storms to be stronger when they do occur due in part to increasing atmospheric temperatures, the possibility of lightning strikes may also increase. As stated above, storms under both RCP4.5 and RCP8.5 are projected to be more severe and Ireland is susceptible to Atlantic storms due to its location. The risk is assessed as 'low'.

9.5.3.2.2 Summary

Overall, the proposed development has at most low vulnerabilities to the identified climate hazards. Therefore, no detailed risk assessment is required.

9.5.3.2.3 Climate Change Risk Assessment Significance of Effects

With design mitigation in place, there are no significant risks to the proposed development as a result of climate change. In accordance with the EPA Guidelines (EPA, 2022), the significance of effect of the impacts to both the construction phase and the operational phase as a result of climate change are **direct** as climate extremes have a direct physical effect on buildings and infrastructure, **long-term** due to the response times of the climate in relation to changes in anthropogenic emissions, **negative** as climate extremes can cause significant damage to infrastructure and **slight** due to the overall low climate risk to the development, which is overall **not significant** in EIA terms.



9.5.4 Cumulative Impacts

In accordance with guidance from the ISEP (2022& 2026) and TII (2022) the climate is not constrained by project, regional or national boundaries and therefore the GHG assessment has been presented in the context of the national and sectoral carbon budgets for the whole of Ireland and the ability of the proposed development to assist or impede the national relevant targets. Given the contribution of such targets to the global efforts to reduce the impact of society upon the climate the assessment is considered to be inherently cumulative.

In light of these statements:

- The residual cumulative impact of the proposed development in relation to construction phase GHG emissions is considered **direct** due to the production of greenhouse gases from materials and during construction, **long-term** due to the quantity of carbon required for the lifetime of the materials, negative as production of greenhouse gases has been conclusively shown to have a **negative** effect on the climate, and **moderate** as without mitigation the development will contribute negatively towards Ireland's trajectory to net zero. This is considered to be a **significant** effect.
- The residual cumulative impact of the proposed development in relation to operational phase GHG emissions is considered **direct** due to the production of greenhouse gases emissions from CH₄ sources, **long-term** due to the quantity of emissions during the lifetime of the materials, but **beneficial** due to the production of biogas that offsets the use of fossil gas, thus contributing positively towards Ireland's trajectory to net zero. This is considered to be a **beneficial** effect.

9.5.5 Summary of Potential Impacts

Table 9-15: Summary of Potential Impacts

Activity/Source of Impact	Potential Impact	Description of Effects.
Construction phase	Emissions of GHG	Direct, long-term, negative, moderate, significant
Operational phase	Emissions of GHG	Direct, long-term, beneficial
Construction phase	Climate Risk	Direct, long-term, negative, slight, not significant
Operational phase	Climate Risk	Direct, long-term, negative, slight, not significant

9.6 Mitigation Measures

9.6.1 Mitigation by Avoidance and Design

A series of mitigation measures are proposed for the project that will both reduce embedded carbon within the construction phase and reduce GHG emissions during the operational phase. These are outlined in Table 9-16.



Table 9-16: Mitigation Measures

Unmitigated	Mitigated
Use Electricity to heat the anime and pasteurisation units	Use of biomass boiler to heat the amine and pasteurisation units
No Solar panels	Solar panels (640,000 kWh)
6F1 and cl804 Used	Geogrid used in yard area to reduce volume of virgin aggregate
Potable water used on site	Harvested rainwater and groundwater water from site used
Standard cladding used	Lower carbon cladding used
Standard concrete used	Lower carbon concrete used
Steel Rebar not sized, new rebar used	Steel rebar sized, recycled rebar used
Normal Portal Frames	Low carbon steel (electric arc furnace)
Hot rolled asphalt	Mastic Asphalt
New 6F1 used	Recycled 6F1 used
HGV's not backloaded	HGV's backloaded
Grid electricity uses non renewable energy	Grid electricity uses renewable energy
Concrete piles used	Vibro stone columns used

In addition to the measures outlined in Table 9-16:

- reclamation of bare ground
 - enhancement Planting of 10,665 m² of existing hedgerow (native and local species)
 - new planting 395 m² hedgerow (native and local species)
 - planting 27,705 m² of new grassland
 - use of an on-site borehole for the water supply

Where the use of the biomass boiler is specified, this will be supplied with biomass from sustainably managed resources such that removal of biomass will be replaced in a manner that represents compliance with the Government of Ireland's commitment to net zero emissions.

9.6.2 Construction Phase Mitigation

Mitigation during the construction phase involves a change in the use of materials as detailed in Table 9-16 .



It has been calculated that the total construction phase embodied carbon for the proposed development will be 11,191 tCO₂e as shown in Table 9-17. Compared to unmitigated, this is a saving of 10,846 tCO₂e.

Table 9-17: Construction Phase Greenhouse Gas Emissions (Mitigated)

Stage	GHG Assessment Category	Predicted GHG Emissions (tCO ₂ e)	Predicted GHG Emissions as % of Project Total	Relevant Sector for Carbon Budget Comparison
A1-A3	Materials	6,395	57.1	Industry
A4	Material Transport	729	6.5	Transport
A5	A5.1 Site Clearance	4	<0.1	Industry
	A5.1 Excavation	104	0.9	Industry
	A5.1 Reclamation/replanting	-98	-0.9	LULUCF
	A5.2 Construction energy	3,834	34.3	Electricity
	A5.2 Construction water	3	<0.1	Industry
	A5.3 Construction Waste Disposal	0	0.0	Waste
	A5.3 Construction site material waste transport	<1	<0.1	Transport
	A5.4 Construction Worker Travel to Site	219	2.0	Transport
Total		11,191		

9.6.3 Operational Phase Mitigation

Mitigated operational impacts have been quantified based on engineering information provided using the methodology set out in Section 9.3.2.3 and are shown in Table 9-18. This is a saving of 18,182 tCO₂e compared to unmitigated.

Table 9-18: Annual Operational Phase Greenhouse Gas Emissions (Mitigated)

Stage	GHG Assessment Category	Predicted GHG Emissions (tCO ₂ e)	Predicted GHG Emissions as % of Project Total	Relevant Sector for Carbon Budget Comparison
B1	Operational Transport	2,609	99.9	Transport
	Operational Waste Disposal	0	0	Waste
	Operational Waste Transport	2	<0.1	Transport
B2	Maintenance	-	-	Industry
B3	Repair	-	-	Industry
B4	Replacement	-	-	Industry
B5	Refurbishment	-	-	Industry
B6	Operational energy use	0	0	Electricity



Stage	GHG Assessment Category	Predicted GHG Emissions (tCO ₂ e)	Predicted GHG Emissions as % of Project Total	Relevant Sector for Carbon Budget Comparison
B7	Operational water use	0	0	Industry
Total		2,610		

9.7 Residual Impacts

With reference to Section 9.3.2.5 and taking into account the mitigation measures detailed in Section 9.6 the magnitude and significance of effect from GHG emissions resulting from the construction stage has been determined to be of a **direct** impact due the use of material and emissions from plant and equipment, that is **long-term** as a result of the estimated lifetime of the buildings and **negative** due to the emission of GHG to the global climate. The impact on the climate is considered to be **minor adverse**. It is considered that the mitigation measures suggested constitute a level that is above and beyond the minimum required and therefore the impact is considered to be **not significant** and in line with Irelands trajectory towards net zero.

As with the construction phase, the magnitude and significance of effect from GHG emissions resulting from the operational phase takes into account the mitigation measures detailed in Section 9.6 and has been determined to be of a **direct** impact due the use of grid energy and fossil-fuelled powered transport, that is **long-term** as a result of the estimated operational lifetime of the proposed development and **beneficial** due to the avoided emissions of GHG to the global climate as a result of the production of biogas replacing the requirement for fossil gas. Discounting any potential mitigation measures and on the assumption that without mitigation the development may impede the trajectory towards net zero, the impact on the climate is considered to be **beneficial**. The proposed development is considered to operate in line with the trajectory towards net zero.

The primary function of the proposed development is the production of biogas that is classified as a renewable energy source under the EU Renewable Energy Directive 2001/2018 and its subsequent amendments. A substantial amount of CO₂e will be saved in emissions as a result of the addition of the biogas to the fuel mix in Ireland.

9.7.1 Summary of Residual Impacts

Table 9-19: Summary of Residual Impacts

Activity/Source of Impact	Potential Impact	Description of Effects (Pre Mitigation)	Description of Effects (Post Mitigation)
Construction phase	Emissions of GHG	Direct, long-term, negative, moderate, significant	Direct, long-term, negative, minor, not significant
Operational phase	Emissions of GHG	Direct, long-term, beneficial	Direct, long-term, beneficial
Construction phase	Climate Risk	Direct, long-term, negative, slight, not significant	Direct, long-term, negative, slight, not significant



Activity/Source of Impact	Potential Impact	Description of Effects (Pre Mitigation)	Description of Effects (Post Mitigation)
Operational phase	Climate Risk	Direct, long-term, negative, slight, not significant	Direct, long-term, negative, slight, not significant

9.8 Conclusions

This assessment has examined the effect of the proposed development on climate the effect of a changing climate upon the proposed development.

The effects of greenhouse gas emissions from the construction phase were found to have a direct, long-term, negative and minor impact that is considered to be not significant due to the levels of mitigation proposed in terms of the measures detailed in Section 9.6.2.

Similarly the operation of the facility was found to be a source of emissions, however the primary function of the proposed development is the production of biogas to replace the use of fossil gas. Therefore, the operational impact of the proposed development was found to be positive due to the production of biogas and levels of mitigation proposed in terms of the measures detailed in Section 9.6.2.

In the provision of mitigation measures at the construction and operational phases the proposed development seeks to further reduce any creation of GHGs emphasising the overall beneficial impact of the project.

9.8.1 Section 15 Compliance

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

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

- the most recent approved climate action plan,
- the most recent approved national long term climate action strategy,
- the most recent approved national adaptation framework and approved sectoral adaptation plans,
- the furtherance of the national climate objective, and
- the objective of mitigating greenhouse gas emissions and adapting to the effects of climate change in the State.”.

This chapter demonstrates how the proposed development is consistent with the objectives of Section 15 of the 2015 Act (as amended). The EIAR has carried out a greenhouse gas emissions assessment and assessed the proposed development’s resilience/adaptation to climate change.

- Greenhouse Gas Emissions Assessment – This assessment considers the proposed developments GHG emissions over its lifetime. The assessment analyses these emissions in the context of the relevant carbon budgets, targets and policies to ensure consistency with the most recent approved climate action plan and the most recent approved national long term climate action strategy, and with measures in furtherance of the national climate objective. This complies with subsections 15 (1) (a), (b), and (d) of the Act.



- Climate Change Vulnerability Assessment – This assessment identifies the impact of a changing climate on the proposed development and receiving environment in the context of the most recent approved national adaptation framework and approved sectoral adaptation plans. The assessment considers the proposed development’s vulnerability and adaption to climate change and identifies adaptation measures to increase resilience, as discussed in Section 8.4.3.2.1. This covers sections 15(1)(c) and (e) of the Act.

The above measures pursue the furtherance of the national climate objective and the objective of mitigating greenhouse gas emissions and adapting to the effects of climate change in the State as far as practicable as required by section 15(1)(d) and (e) of the Acts.

9.8.2 Policy Compliance

The reduction in GHG emissions as a result of the production of biogas to reduce reliance on fossil gas assists Ireland in the emissions reductions required under the EU Green Deal (European Commission, 2019) for a reduction in emissions of 55% in comparison to 1990 levels by 2030 and 90% by 2040. As part of the Government of Ireland CAP24 and CAP25 there is a requirement to reach carbon neutrality by 2050, and the proposed development also assists in positive actions towards this goal.

Locally, the County Carlow Climate Action Plan 2024-2029 looks to reduce emissions through a transition to a climate-resilient, environmentally sustainable, and climate-neutral economy. Through reducing reliance on fossil gas and the re-use of agricultural waste products in the production of biogas the project will assist the local actions aimed at meeting the requirements of CAP24 and CAP25.

The proposed development also contributes to the targets within the National Biomethane Strategy for 5.7 TWh of production by 2030. The proposed development contributes 0.05% towards this target.



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