30. CLIMATE

30.1 Introduction

This chapter identifies, describes, and assesses the potential significant direct and indirect effects on climate arising from the construction, operation and maintenance, and decommissioning of the Project and has been completed in accordance with the EIA Directive and the guidance listed in Section 1.8.2 of Chapter 1: Introduction and Chapter 4: Environmental Impact Assessment Methodology. The full description of the Project is detailed in Chapter 5 of this Environmental Impact Assessment Report (EIAR).

This chapter provides an overarching assessment of all climate and carbon-related impacts relevant to the Project, including an assessment of the potential effects that the Project may have on climate and also the vulnerability of the Project over the construction phase, operation and maintenance phase, and decommissioning phase to climate change. This chapter also sets out proposed mitigation measures to avoid or reduce any potential significant effects that are identified.

The aim of the Project when in operation is to reduce the input of carbon intensive energy into the national grid and reduce the amount of greenhouse gas emissions being released to the atmosphere that are associated with electricity generation. Harnessing more energy by means of renewable sources will reduce dependency on fossil fuels, thereby resulting in a reduction in harmful emissions that can be damaging to human health and the environment. The Project will assist in delivering Irelands national climate targets, a 51% reduction in greenhouse gas emissions by 2030 as compared to 2018 levels.

As detailed in Section 1.1.1 in Chapter 1 Introduction, for the purposes of this EIAR, the various project components are described and assessed using the following reference: ‘the Project’. The ‘Offshore Site’ refers to all offshore Project elements, while the ‘Onshore Site’ refers to all onshore Project elements.

30.1.1 Background

The Project site is located within the Atlantic marine area adjacent to the Connemara and Co. Clare coast. The Offshore Array Area (OAA) is located between 5 kilometres (km) and 11.5km off the coast of Connemara, Co. Galway, between Slyne Head and Inishmore (Aran Islands). The closest settlement is Carna, Co. Galway. Land in the area of Carna is primarily pastural agricultural lands, as well as one-off rural housing. It is proposed to connect the Project to the national electricity grid via approximately 70km of cabling to be buried within or on the seabed. The Offshore Export Cable (OEC) runs to the west of the Aran Islands to a landfall location close to Doonbeg, Co. Clare, before going ashore.

Once ashore, approximately 3.5km northwest of Doonbeg, Co. Clare, it is proposed that the Onshore Grid Connection (OGC) will run underground, mostly in the existing road network but also through some private lands. The OGC will connect to the 220kV Onshore Compensation Compound (OCC) at Ballymacrinnan near Moneypoint, Co. Clare. The OGC will continue from the OCC to connect to the national grid at the existing Moneypoint 220kV Substation (hereafter referred to as Moneypoint), Co. Clare.

The full description of the Project is provided in Chapter 5 of this EIAR

30.1.2 Chapter Structure and Climate Study Areas

This chapter of the EIAR aims to provide an assessment of the potential significant direct and indirect effects on climate arising from the construction phase, operation and maintenance phase, and decommissioning phase of the Project, as well as the vulnerability of the Project to changes in climate.

An overview of the chapter structure is provided in Figure 30-1, with further details on the content of each section below.

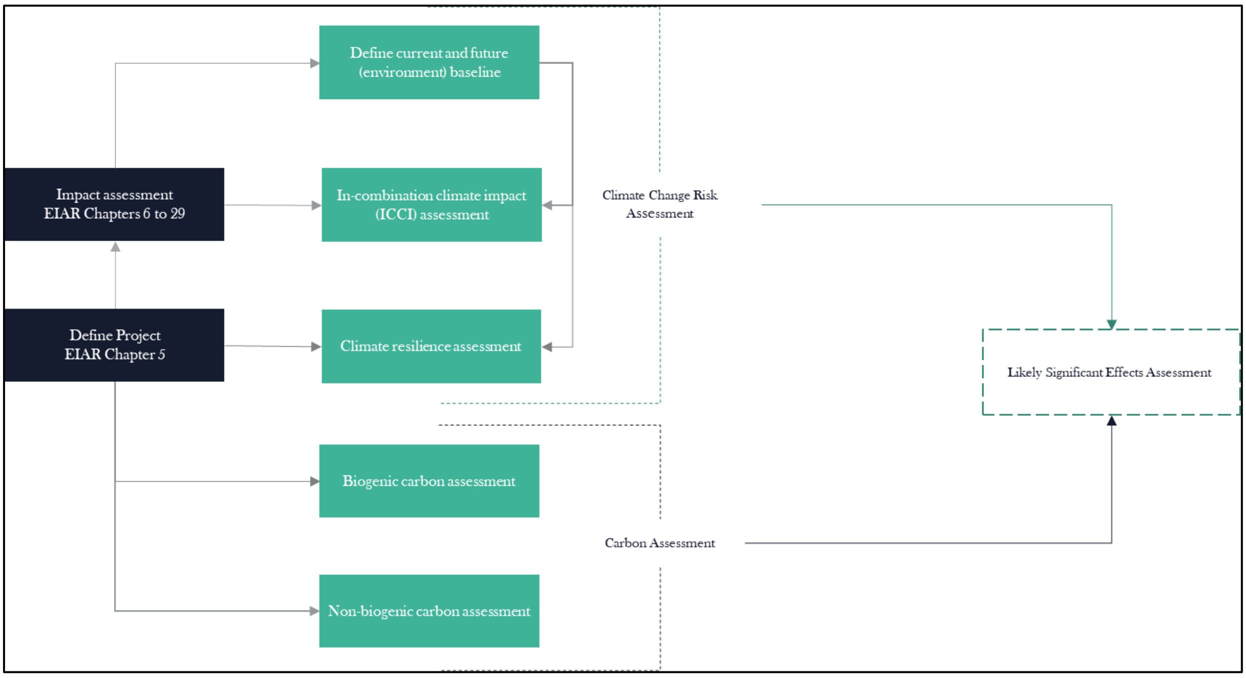


Figure 30-1 Climate chapter structure

The chapter structure is as follows:

- A review of all relevant climate change legislation policy and guidance applicable to the Project (Section 30.2)
- Presentation of the baseline environment (Section 30.3 below), including:
  - A description of the current baseline environment established from desk study, utilising relevant datasets and data provided within other sections of the EIAR (Section 30.3.1 below)
  - A description of the future baseline environment, established from desk study, utilising relevant datasets and data provided within other sections of the EIAR (Section 30.3.2 below)
- A detailed carbon assessment (Section 30.4 below), including:
  - A Biogenic Carbon Assessment which considers how the Project could affect carbon stored in the marine environment and in the terrestrial environment (Section 30.4.1 below)
  - A Non-Biogenic Carbon Assessment which considers how the Project will affect the climate as a result of carbon emissions associated with (for example) machinery, vessels and embodied carbon of Project components (Section 30.4.2 below)
  - A carbon savings assessment which establishes the carbon savings attributable to the Project in the context of the Irish Sectoral Emission Ceilings (Section 30.4.2.4 below). Carbon savings derive from the displacement of fossil fuel generated electricity with that generated by the Project
- A Climate Change Risk Assessment (Section 30.5) which comprises:
  - A Climate Resilience Assessment which reviews the ability of the Project to withstand, respond to and recover from the projected changes in climate, in both an Offshore and Onshore context (Section 30.5.1 below)
  - An In-Combination Climate Impact Assessment which considers how any impacts from the Offshore Site and Onshore Site (from all relevant EIAR sections) could be exacerbated or reduced as a result of climate induced changes (Section 30.5.2 below)

- Presents an assessment of the potential likely significant effects on climate arising from the Project during the construction phase (Section 30.6.2) operation and maintenance phase (Section 30.6.3), and decommissioning phase (Section 30.6.4) based on the information gathered and the analysis and assessments undertaken. All required mitigation measures to prevent, minimise, reduce or offset the likely significant environmental effects identified in the construction phase, operation and maintenance phase, and decommissioning phase is provided in this section.
- An assessment of potential cumulative impacts is provided in Section 30.7 and details any potential cumulative effects on climate between the Project and other permitted or proposed projects and plans in the area, (wind energy or otherwise) for the construction phase (Section 30.7.1), operation and maintenance phase (Section 30.7.2), and decommissioning phase (Section 30.7.3)

As stated in the IEMA 2022 Guidance (2022)[2], by their very nature, the impacts and resulting effects of greenhouse gas emissions are global rather than affecting one localised area. For the purposes of the EIAR, the overall Climate Study Area for the Project is defined as the national environment (Ireland), where the receptor is the climate and the global atmosphere. Therefore, effects arising from the potential impacts on climate are considered to impact on a national level. National, regional and local data has been considered where relevant and available. For the purposes of defining the current and future baseline within the Climate Study Area, and the assessment boundaries for the Carbon Assessment, and Climate Change Risk Assessments, their respective study areas within the overall Climate Study Area are defined below. The study areas considered across the different assessments provided within this report include:

30.1.2.1 Baseline Environment of the Project

- Current Baseline Study Area
  - Current Baseline Study Area: defined as the EIAR Site Boundary, as defined in Section 1.1.1 of Chapter 1 of this EIAR. Relevant information taken from EIAR Chapters for inclusion in the current baseline assessment is within the relevant discipline's specific assessment boundary, as identified in each cited EIAR Chapter.
- Future Baseline Climate Study Area
  - Future Baseline Study Area: defined as the EIAR Site Boundary, i.e., the primary study area for the EIAR as defined in Section 1.1.1 of Chapter 1 of this EIAR. Relevant information taken from relevant EIAR Chapters for inclusion in the future baseline assessment will be within the relevant discipline's specific assessment boundary, as identified in each cited EIAR Chapter.

30.1.2.2 Carbon Assessment

- Biogenic Carbon Assessment Study Area
  - Offshore Biogenic Carbon Assessment Study Area: defined as the OAA and Onshore Export Cable Corridor (OECC) (i.e. EIAR Site Boundary) and a 15km marine area around the Offshore Site that may be affected by indirect effects such as sediment suspension and deposition, which are not anticipated to extend beyond the 15km buffer; and
  - Onshore Biogenic Carbon Assessment Study Area: defined as the Onshore Landfall Location (OLL), OGC, and the OCC (i.e. EIAR Site Boundary)
- Non-Biogenic Carbon Assessment Study Area
  - Offshore Non-Biogenic Carbon Assessment Study Area: defined as the OAA and OECC (i.e. EIAR Site Boundary); and

[2] *IEMA (2022). Assessing Greenhouse Gas Emissions and Evaluating their Significant, 2nd Edition. Available online at:* https://www.iema.net/resources/blog/2022/02/28/launch-of-the-updated-eia-guidance-on-assessing-ghg-emissions

- Onshore Non-Biogenic Carbon Assessment Study Area: defined as the OLL, OGC, and OCC (i.e. EIAR Site Boundary).

30.1.2.3 Climate Change Risk Assessment

- Climate Resilience Assessment Study Area: defined as the national environment of Ireland relating to the marine habitat and terrestrial habitat and atmosphere surrounding the west of coast of Ireland during the operational and maintenance, and decommissioning phase of the Project[3]; and
- In-Combination Climate Impact Assessment Study Area: defined as the study area for each EIA topic (as defined in each topic chapter), as well as the national environment of Ireland during the operational and maintenance, and decommissioning phase of the Project[4].

30.1.3 Statement of Authority

The onshore section of this assessment on Climate has been prepared by Catherine Johnson and reviewed by Ellen Costello and Órla Murphy, all of MKO.

Catherine is an Environmental Scientist and Climate Practitioner at MKO with over two years of consultancy experience in climate and sustainability. Prior to joining MKO in 2022, Catherine worked as an Environmental Social Governance (ESG) analyst for Acasta in Edinburgh. Catherine has expertise in international climate law and policy, earth science, and sustainability/ESG processes. Catherine has a BSc in Earth and Ocean Science and an LLM in Global Environment and Climate Change Law.

Ellen is a Senior Environmental Scientist and Climate Practitioner with over five years of consultancy experience with MKO and has been involved in a range of projects including climate and sustainability context reports for masterplans and commercial developments, renewable energy infrastructure projects, and the compilation of numerous chapters including the preparation of air and climate assessments for Environmental Impact Assessment Reports. Ellen holds a BSc. in Earth Science and a MSc. in Climate Change: Integrated Environmental and Social Science Aspects where she focused her studies on climate adaptation and mitigation, and its implications on environment and society.

Órla Murphy is a Senior Environmental Scientist with MKO with 8 years of experience in private consultancy. Órla holds a BSc (Hons) in Geography from Queens University Belfast and an MSc in Environmental Protection and Management from the University of Edinburgh. Prior to taking up her position with McCarthy Keville O'Sullivan in January 2018, Órla worked as an Environmental Project Assistant with ITPEnergised in Scotland. Órla's key strengths and areas of expertise are in Environmental Protection and Management, EIA, Project Management, Renewable Energy and Peatland Management, where she has carried out research projects and site work relating to restoration and management of peatland sites in both Scotland and Northern Ireland. On joining MKO Órla has been involved on a range of renewable energy infrastructure projects. In her role as a project manager, Órla works with and co-ordinates large multidisciplinary teams including members from MKO's Environmental, Planning, Ecological and Ornithological departments as well as sub-contractors from various fields in the preparation and production of EIARs. Within MKO, Órla plays a role in the management of and sharing of knowledge with junior members of staff and works as part of a large multi-disciplinary team to produce EIA Reports.

---

[3] As noted in Section 30.5.1, Project construction is planned to commence in the near-term, and therefore climate variables are expected to be consistent with current conditions during the construction phase. The climate resilience review focusses on the Project's vulnerability to climate change in the long-term, i.e., during the operational and maintenance phase and decommissioning phase.

[4] As noted in Section 30.5.2.1, only impacts associated with the operational and decommissioning phase are considered within the ICCI assessment, as the current environmental conditions are considered to be applicable for the construction phase.

The offshore section of this assessment on Climate has been prepared by Jane Gordon and Craig Stenton, and reviewed by Mairi Dorward, all of Xodus Group Ltd (Xodus).

Jane is a Lead Environmental Consultant with over 5 years' experience in marine consenting and EIA. Jane has authored several environmental appraisals, EIA chapters and Scoping chapters for marine renewables, subsea cables and oil and gas assets. Jane has supported with the development of the methodology for the offshore biogenic carbon assessment, assessment of climate resilience and in-combination climate impact assessment within Xodus Group and has a strong understanding of the potential implications of climate change on the marine environment through this work. Jane has supported in leading on climate change risk assessments for the Pentland Floating Offshore Wind Farm and the West of Orkney Windfarm. Jane holds a BSc (Hons) in Zoology from the University of St Andrews and an MSc in Environmental Science from the University of Aberdeen.

Craig is a Lead Environmental Consultant with over a decade of marine research experience developed across government, academia and industry. He has a varied, multidisciplinary background, and specialises in untangling effects on multiple co-occurring marine stressors – including those related to climate change. Craig has a very strong quantitative analytical and modelling skillset and has previously supported quantitative Carbon Assessments within Xodus, developing the tools and approaches used. Craig holds a BSc (Hons) in Marine Biology & Oceanography from the University of Plymouth, and a PhD in Multiple Stressor Impacts from Edinburgh Napier University.

Dr Mairi Dorward is a Chartered Environmentalist and Full Member of the Institute of Environmental Management and Assessment (IEMA). She has 20 years' experience in marine science, engineering and environmental management from working across oil, gas, energy transition, and renewables sectors. Prior to joining Xodus she worked for 10 years with bp where she led on atmospheric emission assessment throughout major project delivery and into operations. This included emission quantification and assessment, emission reduction programmes, carbon management, policy development and the systematic identification, management and mitigation of environmental risk. She has brought her experience from multiple sectors and projects to lead the development of Xodus' internal process for climate (incorporating carbon) assessments and is delivering these assessments for multiple offshore energy projects and environmental impact assessments. Utilising knowledge and experience gained throughout her career, Mairi provides carbon and sustainability consultancy support for complex and novel energy transition scopes.

30.1.4 Scoping and Consultation

The scope for this chapter of the EIAR has also been informed by consultation with statutory consultees, bodies with environmental responsibility and other interested parties. This consultation process and the List of Consultees is outlined in Section 2.7 of this EIAR. Matters raised by consultees in their responses with respect to climate are summarised in Table 30-1 below.

Table 30-1 Summary of Climate Related Scoping Response

Consultee	Description of Scoping Response	Addressed in Section
Irish Peatland Conservation Council	The offshore windfarm is being built to reduce carbon emissions and to move the national electricity network to sustainable energy generation but if the onshore component of the proposed project damages peatlands it will have the opposite effect, reducing the carbon sequestration power of natural habitats, causing carbon emissions, reducing water quality and directly losing habitat for internationally rare species.	Section 30.4.1.2.3

Consultee	Description of Scoping Response	Addressed in Section
School of Natural Sciences, Physics, the Ryan Institute Centre for Climate & Air Pollution Studies, University of Galway, Galway, Ireland	The School of Natural Sciences, Physics, and the Ryan Institute Centre for Climate & Air Pollution Studies, University of Galway highlights the importance of the Mace Head Atmospheric Research Station for air quality and climate research in Ireland, as well as the potential perturbations in the natural baseline that is currently being evaluated at the station as a result of the various phases of the Project's development. Due to the increase in maritime activity during the construction and support of the Project, there is potential for increased air pollutants and greenhouse gases to be emitted.	Section 30.4.1 and Section 30.4.2 Due to the interrelationship between air quality and climate, consideration has also been given to this in Chapter 25 Onshore Air Quality.

30.2 Climate Legislation, Policy, and Guidance

Although variation in climate is thought to be a natural process, the rate at which the climate is changing has been accelerated rapidly by human activities. Climate change is one of the most challenging global issues facing the world today and is primarily the result of increased levels of greenhouse gases in the atmosphere. Increasing human emissions of carbon dioxide and other greenhouse gases cause a positive radiative imbalance at the top of the atmosphere, meaning energy is being trapped within the global climate system. The imbalance leads to an accumulation of energy in the Earth system in the form of heat that is driving global warming.[5,6] Greenhouse gases come primarily from the combustion of fossil fuels in energy use.

In March 2024 the European Environment Agency (EEA) published the European Climate Risk Assessment.[7] This assessment states that Europe is the fastest warming continent on the planet and is warming at about the twice the global rate. The average global temperature in the 12-month period between February 2023 and January 2024 exceeded pre-industrial levels by 1.5°C. 2023 was the warmest year on record over more than 100,000 years globally, at 1.48°C above pre-industrial levels, with the world's ocean temperature also reaching new heights.

The Intergovernmental Panel on Climate Change (IPCC), in their AR6 Synthesis Report: Climate Change 2023[8], state that widespread and rapid changes in the atmosphere, ocean, cryosphere and biosphere have occurred. This has led to widespread adverse impacts and related losses and damages to people and nature due to the pressures of climate change and the inability to adapt to a rapidly changing environment. Moving away from our reliance on coal, oil and other fossil fuel-driven power plants is essential to reduce emissions of greenhouse gases and combat climate change.

Relevant legislation, policy, and guidance in an international (Section 30.2.1), national (Section 30.2.2), and local (Section 30.2.3) context are detailed below.

---

[5] *Hansen, J.; Sato, M.; Kharecha, P. et al. Earth's Energy Imbalance and Implications. Atmospheric Chemistry and Physics 2011, 11 (24), 13421–13449.* https://doi.org/10.5194/acp-11-13421-2011
[6] *von Schuckmann, K.; Palmer, M. D.; Trenberth, K. E. et al. An Imperative to Monitor Earth's Energy Imbalance. Nature Clim Change 2016, 6 (2), 138–144.* https://doi.org/10.1038/nclimate2876.
[7] *European Environment Agency (2024) European Climate Risk Assessment* <https://www.eea.europa.eu/publications/european-climate-risk-assessment>
[8] *IPCC AR6 Synthesis Report: Climate Change 2023.* https://www.ipcc.ch/report/sixth-assessment-report-cycle/

30.2.1 International Greenhouse Gas Emission and Climate Targets

Globally, governance relating to climate change has changed significantly since 1994 when the United Nations Framework Convention on Climate Change (UNFCCC) entered into force. Greenhouse Gas emissions have been a primary focus of climate related international agreements for almost two decades.

Table 30-2 below identifies international instruments relating to greenhouse gas emissions and climate targets. Table 30-2 provides an overview of the international agreements that have played key roles in establishing climate governance; please refer to Appendix 30-1 for a detailed summary on each of the below international instruments.

Table 30-2 International Instruments Relating to Greenhouse Gases and Climate Change

<table>
<tr><th>International Instrument</th><th>Description</th></tr>
<tr><td>Kyoto Protocol</td><td>The Kyoto Protocol was adopted on 11 December 1997; this Protocol operationalised the UNFCCC and was the first international agreement that committed countries to reduce their greenhouse gas emissions. The Kyoto Protocol came into effect in 2005, as a result of which, emission reduction targets agreed by developed countries, including Ireland, became binding for the first time.</td></tr>
<tr><td>Doha Amendment to the Kyoto Protocol</td><td>In Doha, Qatar, on 8th December 2012, the "Doha Amendment to the Kyoto Protocol" was adopted. The amendment includes:

› New commitments for Annex I Parties to the Kyoto Protocol who agreed to take on commitments in a second commitment period starting in 2013 and lasting until 2020.
› A revised list of greenhouse gases to be reported on by Parties in the second commitment period; and</td></tr>
<tr><td rowspan="4">Conference of the Parties (COP):

Every year since 1995, the Conference of the Parties (COP) has gathered the 196 Parties (195 countries and the European Union) that have ratified the Convention in a different country, to evaluate its implementation and negotiate new commitments, and is the supreme decision-making body of the UNFCCC.</td><td>COP21 – Paris (30th November to 12th December 2015)

COP21 closed with the adoption of the first international climate agreement (concluded by 195 countries and applicable to all). The twelve-page text, made up of a preamble and 29 articles, provides for a limitation of the temperature rise to below 2°C above pre-industrial levels and even to tend towards 1.5°C.</td></tr>
<tr><td>COP25 – Madrid (December 2nd to December 13th, 2019)

At COP25 the European Union launched its most ambitious plan, 'The European Green Deal' which aims to lower CO_2 emissions to zero by 2050.</td></tr>
<tr><td>COP28 – Dubai (30th of November 2023 to the 13th of December 2023)

COP28 resulted in a landmark deal to 'transition away' from fossil fuels, the United Arab Emirates (UAE) Consensus. The agreement calls for 'transitioning away from fossil fuels in energy systems, in a just, orderly, and equitable manner.'

COP28 concluded the first ever Global Stocktake under the Paris Agreement. The Global Stocktake recognises that the world is not on track to meet 1.5°C and will require Parties to align their national targets and measures with the Paris Agreement.</td></tr>
<tr><td>COP29 – Azerbaijan (11th November 2024 to 22nd November 2024)

COP29 focused on accelerating global efforts to address climate change, in particular global efforts related to climate finance. The New Collective Quantified Goal on Climate Finance (NCQG) was agreed in the final days of COP with developed nations agreeing to triples finance to developing countries, with commitments increasing from USD 100 billion annually to USD 300 billion annually by 2035.

Significant progress was made in the discussions surrounding carbon markets, with nearly 200 nations agreeing on critical rules under Article 6 of the Paris Agreement. The adoption of these rules is seen as a crucial step towards operationalising a robust and credible carbon market. Despite the advances, concerns were expressed about the potential for weak governance and risks of exploitation in the system; these issues must be addressed to ensure the market's full functionality.</td></tr>
<tr><td>United Nations Sustainable</td><td>The Sustainable Development Goals Report 2024 was published in September 2024. The 2024 Report goes on to highlight the current standing of each SDG and its</td></tr>
</table>

Development Goals Report	relevant indicators; flagging that only about 16% of the SDG targets are on track to be achieved. The remaining 84% either show limited progress (insufficient to achieve the target by 2030) or even a reversal of progress. The majority of the targets that are particularly off-track are related to food systems, biodiversity, sustainable land use, or peace and strong institutions.
Climate Change Performance Index	Established in 2005, the Climate Change Performance Index (CCPI)[9] is an independent monitoring tool which tracks individual countries climate protection performance. Ireland, ranked 43rd in 2024, has risen 14 places to 29th for 2024, and is now considered a 'medium' performer in international performance. The CCPI states that Ireland's policies are missing a long-term strategy for phasing out fossil fuel infrastructure and shifting investments from natural gas towards an emissions-neutral energy supply. The CCPI flag an urgent need for port infrastructure and grid strengthening to ensure medium-to-long-term offshore wind expansion and heating and transport electrification can be achieved in Ireland.
State of the Global Climate 2024	In November 2024, the World Meteorological Organisation (WMO) published a report entitled the 'State of the Global Climate 2024. This report provided a summary on the state of the climate indicators in 2023 with sections on key climate indicators, extreme events and impacts. The key messages in the report include: › Greenhouse gases reached record observed levels in 2023. Real time data indicate that they continued to rise in 2024. › January – September 2024 global mean surface air temperature was 1.54 ± 0.13°C above the pre-industrial average.
Renewable Energy Directive	The first Renewable Energy Directive (RED)[10] is legislation that influenced the growth of renewable energy in the EU and Ireland for the decade ending in 2020. From 2021, RED was replaced by the second Renewable Energy Directive (REDII),[11] which continues to promote the growth of renewable energy out to 2030. REDII introduced a binding EU-wide target for overall RES of 32% in 2030 and requires Member States to set their national contributions to the EU-wide target. As per the National Energy and Climate Plan (NECP) 2021-2030, Ireland's overall RES target is 34.1% in 2030. Under REDII, Ireland's National Energy and Climate Plan 2021-2030 included a planned RES-E of 70% in 2030, which has been replaced by the 80% by 2030 RES-E target as detailed in the more recent Climate Action Plan (2024). Given the need to ratchet up the EUs clean energy transition, RED was revised in 2023, and the amending Directive EU/2023/2413 (REDIII)[12] entered into force on 20 November 2023. REDIII amended the EU-wide overall 2030 RES target from 32% to at least 42.5%, and it is assumed that Irelands 2030 RES target will increase accordingly.
European Green Deal	The European Green Deal is a comprehensive package of policy initiatives aimed at achieving climate neutrality across the EU by 2050.

[9] *Climate Change Performance Index 2024 <https://ccpi.org/>*
[10] *Directive 2009/28/EC on the promotion of the use of energy from renewable sources. Available from: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:en:PDF*
[11] *Directive (EU) 2018/2001 on the promotion of the use of energy from renewable resources (recast). Available from: https://eurlex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32018L2001*
[12] *Directive (EU) 2023/2413 amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources and repealing Council Directive (EU) 2015/652. Available from: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L_202302413*

	It features a wide range of actions and targets in different sectors such as energy, transport, industry, environment and agriculture. The goal is to transform the EU into a resource-efficient, competitive circular economy that is fair and inclusive for every individual and region. In its approach to decarbonisation, the EU has split greenhouse gas emissions into two categories, the Emissions Trading System (ETS) and the non-ETS. Under the EU Green Deal, the targets for the ETS and non-ETS sectors will be revised upwards in order to achieve the commitment, at EU level, to reach an economy-wide 2030 reduction in emissions of at least 55%, compared to 1990 levels.
Council Regulation (EU) 2022/2577 and 2024/223	Council Regulation (EU) 2022/2577 and 2024/223 lay down a framework to accelerate the deployment of renewable energy. Regulation 2022/2577 and 2024/223 recognises the relative importance of renewable energy deployment in the current difficult energy context and provides significant policy and legislative support to enabling renewable energy projects. Article 2(2) of Regulation EU 2022/2577 requires priority to be given to projects that are recognised as being of overriding public interest whenever the balancing of legal interests is required in individual cases and where those projects introduce additional compensation requirements for species protection. <u>The first sentence of Article 3(2) of Regulation (EU) 2022/2577 has the potential, in the current urgent and still unstable energy situation on the energy market which the Union is facing, to further accelerate renewable energy projects since it requires Member States to promote those renewable energy projects by giving them priority when dealing with different conflicting interests beyond environmental matters in the context of Member States' planning and the permit-granting process</u> (emphasis added). Further detail is provided in Section 1.1.8 of Appendix 30-1 and in Section 2.3.1 in Chapter 2 of this EIAR.
EU Effort Sharing Regulation	Emissions from all other sectors, including agriculture, transport, buildings, and light industry are covered by the EU Effort Sharing Regulation (ESR). This established binding annual greenhouse gas emission targets for Member States for the period 2021–2030. Ireland is required to reduce its emissions from these sectors by 30% by 2030, relative to 2005 levels.

30.2.2 National Greenhouse Gas Emission and Climate Targets

Ireland has reached a crucial point in addressing climate change with a goal to becoming climate neutral by 2050 and to significantly cut greenhouse gases by 2030. National greenhouse gas emission and climate targets are critical for achieving Irelands climate ambitions.

Table 30-3 below provides an overview of the national legislation, policy, and guidance that have played key roles in establishing climate governance; please refer to Appendix 30-1 for a detailed summary on each of the below national legislation measures.

Table 30-3 National Legislation and Reports relating to Greenhouse Gas Emission and Climate Targets

National Instrument	Description
Programme for the Government	The Programme for Government – Our Shared Future was published in October 2020 and last updated July 2021. The programme notes that the government is committed to reducing greenhouse gas emissions by an average 7% per annum over the next decade in a push to achieve net zero emissions by the year 2050. The programme also recognises the severity of the climate challenge as it clarifies that: "*Climate change is the single greatest threat facing humanity*".

Climate Action and Low Carbon Development (Amendment) Act 2021	The Climate Action and Low Carbon Development (Amendment) Act 2021 is a piece of legislation which commits the country to move to a climate resilient and climate neutral economy by 2050. This was passed into law in July 2021. The Programme for Government has committed to a 7% average yearly reduction in overall greenhouse gas emissions over the next decade, and to achieve net zero emissions by 2050. This Act will manage the implementation of a suite of policies to assist in achieving these annual targets.
Climate Change Advisory Council 2023	The Climate Change Advisory Council (CCAC) was established on 18th January 2016 under the Climate Action and Low Carbon Development Act 2015. The Annual Review 2024: Electricity report has been released by the CCAC and focuses specifically on key findings and recommendations for the Electricity sector. In 2023, emissions from the sector reduced by approximately 21% from 2022 to the lowest level since records began in 1990. This was driven by a considerable decline in the use of coal for electricity generation, coupled with a notable rise in imported electricity.
Carbon Budgets	The first national carbon budget programme proposed by the CCAC, approved by Government and adopted by both Houses of the Oireachtas in April 2022 comprises three successive 5-year carbon budgets. The total emissions allowed under each budget are shown in Section 1.2.4 of Appendix 30-1.
Sectoral Emission Ceilings	The Sectoral Emissions Ceilings were launched in September 2022. The Sectoral Emissions Ceilings alongside the annual published Climate Action Plan provide a detailed plan for taking decisive action to achieve a 51% reduction in overall greenhouse gas emissions by 2030. The Sectoral Emission Ceilings for each 5-year carbon budget period was approved by the government on the 28th of July 2022 and is shown in Section 1.2.5 of Appendix 30-1.
Climate Action Plan 2024	The National Climate Action Plan (CAP) 2024 was launched in December 2023. CAP 2024 sets out the roadmap to deliver on Ireland's climate ambition. It builds on CAP 2023 and aligns with the legally binding economy-wide carbon budgets and sectoral ceilings that were agreed by Government in July 2022 following the Climate Action and Low Carbon Development (Amendment) Act 2021, which commits Ireland to a legally binding target of net-zero greenhouse gas emissions no later than 2050, and a reduction of 51% by 2030. CAP 2024 highlights the firm commitment that has been made by Ireland in relation to the clean energy transition and provides an outline of precise goals for renewable energy, focusing on solar, onshore wind and offshore wind.
Irelands Climate Change Assessment	In 2023 the Environmental Protection Agency (EPA) published Irelands Climate Change Assessment (ICCA). This assessment provides a comprehensive overview and breakdown of the state of knowledge around key aspects of climate change with a focus on Ireland. The ICCA report is presented in four volumes. - Volume 1: Climate Science – Ireland in a Changing World - Volume 2: Achieving Climate Neutrality in 2050 - Volume 3: Being Prepared for Irelands Future - Volume 4: Realising the Benefits of Transition and Transformation

30.2.3 Local Greenhouse Gas Emission and Climate Targets

Under the Climate Action and Low Carbon Development (Amendment) Act 2021, each local authority in Ireland is required to prepare a local authority climate action plan for its respective administrative area. Local authorities are key drivers in advancing climate policy at the local level, the local authority climate action plan will help local authorities to address in an integrated way, the mitigation of greenhouse gas emissions and climate change adaptation and strengthen the alignment between national climate policy and the delivery of effective local climate action.

Galway Local Authority Climate Action Plan 2024-2029

The Galway County Council Local Authority Climate Action Plan 2024-2029 (Galway LACAP)[13] was adopted on 19th February 2024. The Galway LACAP highlights the current state of climate action in Ireland, and how Galway County Council intends to deliver and enable climate action for a just transition to a low carbon and climate resilient future within County Galway.

Overall, the greenhouse gas emissions generated from County Galway equated to 1,905,000 tCO_2eq in the baseline year, 2018.[14] The top emitting sectors within County Galway in terms of total greenhouse gas emissions in the baseline year were Agriculture, Transport, Land use, Land Use Change and Forestry (LULUCF) and Residential producing 44%, 16%, 16% and 15% respectively of the total greenhouse gas emissions in the county. In 2019, Irelands national emissions totalled 65,152,000tCO_2eq, with County Galway being responsible for approximately 5% of this (i.e., 3,009,000 tCO_2eq). During the operation and maintenance phase, the Project will assist in reducing emission by enabling renewable energy to be fed into the grid and the subsequent decarbonisation of other sectors. Please see Section 30.4.2.4 below for further information on carbon savings associated with the Project.

Further information on the Galway Local Authority Climate Action Plan 2024-2029 is provided in Appendix 30-1.

Clare Local Authority Climate Action Plan 2024-2029

The Clare County Council Local Authority Climate Action Plan 2024-2029 (Clare LACAP)[15] was adopted in March 2024. The Clare LACAP highlights the current state of climate action in Ireland, and how Clare County Council intends to deliver and enable climate action for a just transition to a low carbon and climate resilient future within County Clare.

Overall, the greenhouse gas emissions generated from County Clare equated to 1,905,730 tCO_2eq in the baseline year, 2018. The top emitting sectors within County Clare in terms of total greenhouse gas emissions in the baseline year were Agriculture, Transport, and Residential producing 45%, 20%, and 16% of the total greenhouse gas emissions in the county. This is broadly in line with National greenhouse gas emissions data. During the operation and maintenance phase the Project will assist in reducing emission by increasing the share of renewable energy on the national electricity grid and the subsequent decarbonisation of other sectors, including some of the main emitting sectors in County Clare as identified above. Please see Section 30.4.2.4 below for further information on carbon savings associated with the Project.

Further information on the Clare Local Authority Climate Action Plan 2024-2029 is provided in Appendix 30-1.

---

[13] *Galway County Council (2024) Local Authority Climate Action Plan <https://consult.galway.ie/en/consultation/galway-county-council-local-authority-climate-action-plan-2024-2029>*
[14] *Galway County Council (2023) Baseline Emissions Inventory <https://consult.galway.ie/en/system/files/materials/7736/Baseline%20Emissions%20Inventory_Galway.pdf>*
[15] *Clare County Council (2024) Local Authority Climate Action Plan <https://www.clarecoco.ie/services/climate/publications/clare-climate-action-plan-2024-2029-55368.pdf> >*

30.2.4 Relevant Guidance

This chapter of this EIAR is carried out in accordance with guidance contained in the following:

- *'Guidance on integrating climate change and biodiversity into environmental impact assessment'* (European Commission, 2013);
- *'Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation*' (Institute of Environment Management and Assessment (IEMA), 2020);
- 'Guidelines on the information to be contained in Environmental Impact Assessment Reports' (EPA, 2022)*Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance – 2nd Edition'* (IEMA 2022)
- *'Technical guidance on the climate proofing of infrastructure in the period 2021 – 2027 which summarises the step-by-step process for conducting a climate vulnerability and risk assessment'* (European Commission, 2021);

This chapter identifies, describes, and assesses the potential significant direct and indirect effects on climate arising from the construction, operation and maintenance, and decommissioning of the Project and has been completed in accordance with the EIA Directive and the guidance listed in Section 1.8.2 of Chapter 1: Introduction and Chapter 4: Environmental Impact Assessment Methodology.

30.3 Baseline Environment

30.3.1 Current Baseline Environment

30.3.1.1 Data Sources

A review of literature and data relating to climate change in Ireland was undertaken and utilised to provide an overview of the current baseline environment. The following key data sources were reviewed:

- Met Éireann 30-Year Averages[16]
  - *In accordance with WMO guidelines, Met Éireann has compiled a set of climate averages for the period 1991-2020 for a range of parameters including air temperature, precipitation, sunshine and wind. Annual, seasonal, and monthly average values for the period 1991-2020 were compiled using high quality data obtained from Met Éireann's observation network.*
- Irelands Climate Averages 1991-2020 Summary Report[17]
  - Utilising Met Eireann 30-Year Averages data, this report is '*a summary of the latest set of climate averages for Ireland as well as an assessment of trends between the two 30-year averaging periods, 1961-1990 and 1991-2020.'*
- Ireland's National Inventory Report 2024[18]
  - *The estimates presented in the National Inventory Report were estimated in accordance with the guidelines in Annex I of the decision using methodologies provided in the 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories (IPCC 2006) and GWPs as listed in the Column 'GWP 100-year' in Table 8.A.1 of Appendix 8.A of the report 'Climate Change 2013: The Physical Science Basis. Contribution of*

[16] *https://www.met.ie/climate/30-year-averages*
[17] *Department of Housing, Local Government and Heritage (2024) Irelands Climate Averages 1991-2020 Summary Report <https://edepositireland.ie/bitstream/handle/2262/108695/Ireland%27s_climate_averages_1991-2020_rev2.pdf?sequence=1&isAllowed=y>*
[18] *EPA (March 2024) Ireland's National Inventory Report <https://www.epa.ie/publications/monitoring–assessment/climate-change/air-emissions/Ireland's-NIR-2024_cov.pdf>*

Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change'.

- Met Éireann Provision State of the Irish Climate Report 2023[19]
  - *This webpage summarises the climate conditions experienced in Ireland in 2023.*
- Climate Status Report for Ireland 2020[20]
  - *This document presents the current state of Ireland's climate. This assessment is based on the collation and analysis of data from almost 50 internationally defined essential climate variables observed in the atmospheric, oceanic and terrestrial environments. It also documents the status of Ireland's climate-observing infrastructure, noting where it is robust, where gaps exist and where observing programmes need to be enhanced.*
- Annual Review 2024 – Preparing for Irelands Changing Climate[21]
  - *In this sixth part of the 2024 Annual Review, the Climate Change Advisory Council emphasises the urgent need for climate adaptation and increased resilience in Ireland. Climate adaptation refers to taking action to prepare for and adjust to both the current and future impacts of climate change*

30.3.1.2 Physical Environment

Ireland has a temperate, oceanic climate, resulting in mild winters and cool summers. The World Meteorological Organisation (WMO) defines climate as the average weather over an extended period of 30 years. This period is used as it is considered long enough to account for year-to-year variations. Therefore, the existing climate for the environs around the Current Baseline Study Area (as defined in Section 30.1.2 above) is estimated using 30-year (1990-2020) average meteorological data from Met Éireann.

The Met Éireann weather station at Shannon Airport is the nearest weather and climate monitoring station to the Current Baseline Climate Environment Study Area that has meteorological data recorded for the 30-year period from 1991-2020. The monitoring station was located approximately 91.6km southeast of the OAA and approximately 36.8km northeast of the OGC and OCC. The 30-year average Meteorological Data from the station at Shannon Airport is presented in Table 30-4 below.

Table 30-4 30-year Average Meteorological Data from Shannon Airport (annual values from 1991-2020) source: www.met.ie

Parameter	30-Year Average
Mean temperature (˚C)	10.7
Mean Relative Humidity at 0900 UTC (%)	83.9
Mean Daily Sunshine Duration (hours)	3.7
Mean Monthly Rainfall (mm)	1,019.7
Mean Monthly Wind Speed (knots)	9.1

Recent monthly meteorological data recorded at Mace Head, Co. Galway, located approximately 6.3km northeast of the OAA, from January 2021 to January 2024 is available at: https://www.met.ie/climate/available-data/monthly-data. October 2022 was the wettest month in this time period, with 209mm of rainfall recorded, while April 2021 was the driest month with 28.8mm of rainfall.

[19] *Met Éireann (2023). Provisional State of the Irish Climate Report 2024 < https://www.met.ie/state-of-the-irish-climate-report-2023>*
[20] *EPA (2021) Climate Status Report for Ireland 2020 <https://www.epa.ie/publications/research/climate-change/research-386-the-status-of-irelands-climate-2020.php>*
[21] *Climate Change Advisory Council (2024) Annual Review 2024 – Preparing for Irelands Changing Climate <https://www.climatecouncil.ie/councilpublications/annualreviewandreport/#d.en.128095>*

July 2021 was the warmest month in this time period, with a mean monthly temperature of 16.5° Celsius. January 2021 was the coldest month in this time period with a mean monthly temperature of 5.7° Celsius.

Recent monthly meteorological data recorded at Shannon Airport, Co Clare, located approximately 36.8km northeast of the OCC and OGC, from January 2021 to January 2024 is available at: https://www.met.ie/climate/available-data/monthly-data. July 2023 was the wettest month in this time period, with 155mm of rainfall recorded, while April 2021 was the driest month with 15.4mm of rainfall. July 2021 was the warmest month in this time period, with a mean monthly temperature of 17.8° Celsius. January 2021 and December 2022 were the coldest months in this time period with a mean monthly temperature of 4.5° Celsius.

Table 30-5 provides a summary of the current physical baseline environment with reference to relevant chapters within this EIAR where further information is available.

Table 30-5 Summary of current physical baseline environment

Climate variable	Summary of current baseline environment	Relevant EIAR chapter where further information is available (if applicable)
Air Temperature	Climate change is impacting air temperatures in the Northern European region, with a range of observable effects including rising temperature, increased frequency of heatwaves, changes in seasonal temperature patterns and milder winters[22]. Irelands Climate Averages 1991-2020 Summary Report identifies that the annual mean air temperature for Ireland over the period 1991-2020 is 9.8°C. The annual mean air temperature ranges from approximately 8.5°C to 10.8°C. Comparing the 1991-2020 annual mean air temperature for Ireland with that of the 1961-1990 period, there has been an increase of approximately 0.7°C. The Climate Status Report for Ireland 2020[23] states that air temperatures in Ireland have '*been increasing at an average rate of 0.078°C per decade since 1900 and that the annual average temperature is now approximately 0.9°C higher than it was in the early 1900s'.* Temperatures in Ireland are increasing, with sixteen of the top 20 warmest years on record occurring since 1990[24]. On 10th July 2024 Met Éireann confirmed that 2023 was Irelands wettest and warmest year on record (records going back to 1900).[25] Due to the moderating influence of the North Atlantic, Ireland has, and will continue to, experience much milder air temperatures as compared to mainland Europe and other continental countries.[26] However, this moderating influence could be in jeopardy if the Atlantic Meridional Overturning	n/a

[22] *IPCC (2021) Climate Change 2021: The Physical Science Basis <https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_FullReport.pdf>*
[23] *Government of Ireland (2020) Climate Status Report for Ireland 2020 <https://www.epa.ie/publications/research/climate-change/Research_Report_386.pdf>*
[24] *Irelands Climate Change Assessment (2023) Volume 1 Climate Science – Ireland in a Changing World <https://www.epa.ie/publications/monitoring--assessment/climate-change/irelands-climate-change-assessment-volume-1.php>*
[25] *https://www.met.ie/2023-confirmed-as-irelands-wettest-year-on-record*
[26] *https://www.met.ie/climate/what-we-measure/temperature#:~:text=The%20moderating%20influence%20of%20the,mild%20winters%20and%20cool%20summers.*

	Circulation (AMOC) continues to weaken[27]. The AMOC is a large system of ocean currents responsible for carrying warm water from the tropics into the North Atlantic and the strength of this current is a function of global mean temperature. The weakening of this current would counterbalance the warming effects of climate change creating instability for local ecosystems, agriculture, and fisheries.	
Precipitation	Climate change is impacting precipitation patterns in the Northern European region, with a range of observable effects including increased precipitation, more extreme precipitation events, seasonal variations and impacts on hydrological regimes[28]. Precipitation has been measured systematically in Ireland since the late 19th century and is a key indicator of changes in the climate; measurements and analysis of rainfall are essential for assessing the effects of climate change on the water cycle, water balance and for flood mitigation. Met Éireann highlights that it is already observing these trends, with the national annual average rainfall over the period 1991-2020 being approximately 1,288mm, which represents an increase of 7% from the previous 30-year monitoring period (1961-1990)[29]. Irelands Climate Averages 1991-2020 Summary Report obtained averages for the annual, seasonal and monthly number of rain days (number of days with rainfall ≥ 0.2 mm), wet days (number of days with rainfall ≥ 1 mm) and very wet days (number of days with rainfall ≥ 10 mm). Over the period 1991-2020, on an annual basis, the average number of rain days ranges from 201 days to 272 days; the average number of wet days ranges from 147 days to 226 days; and the average number of very wet days ranges from 22 days to 68 days.	Further detail on rainfall and evaporation data is provided in Section 23.3.2 in Chapter 23 Water.
Wind, Storms and Waves	Climate change is impacting wind patterns in the Northern European region with a range of observable effects including increased wind speeds, changes in wind direction and seasonal variations[30].	Please refer to Section 7.5.2.8.1 of Chapter 7 Marine Physical and Coastal Processes for further

[27] *IPCC (2019) IPCC Special Report on the Ocean and Cryosphere in a Changing Climate Chapter 6. Extremes, Abrupt Changes, and Managing Risk* <https://www.ipcc.ch/site/assets/uploads/sites/3/2022/03/08_SROCC_Ch06_FINAL.pdf>
[28] *IPCC (2021) Climate Change 2021: The Physical Science Basis* <https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_FullReport.pdf>
[29] *Department of Housing, Local Government and Heritage (2024) Irelands Climate Averages 1991-2020 Summary Report* <https://edepositireland.ie/handle/2262/108695>
[30] *IPCC (2021) Climate Change 2021: The Physical Science Basis* <https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_FullReport.pdf>

	Irelands Climate Averages 1991-2020 Summary Report identifies that the annual mean hourly wind speed ranges from 9 knots at Shannon Airport to 15 knots at Malin Head. Winds are generally strongest in the northwest of the country. The strongest winds are observed during the winter months and range from 10 knots at Shannon Airport to 18 knots at Malin Head. The lightest winds are observed during the summer months and range from 8 knots at Valentia Observatory to 13 knots at Malin Head. Analysis of observed and modelled wind and wave data can be used to identify long-term trends in weather patterns. In Ireland specifically, due to the limited wind measurements to date, no long-term trends for windspeeds have been identified and no comprehensive analyses of wave heights have been performed[31]. Nevertheless, Ireland possesses one of the largest and most energetic wave energy climates in the world due its location in the Northeast Atlantic with winter wave heights reaching up to 4 m – 5 and is highly dependent on the North Atlantic Oscillation (NAO). The frequency and intensity of storms within the north of the Atlantic Ocean is increasing and measurements of wave height over the last 70 years indicate a 20 cm decadal increase in winter wave heights and also a northward displacement of storm tracks[32]. It is important to note that there is a low confidence in attributing historical changes in weather patterns to climate change and the high degree of variability in the data also creates difficulties in identifying historic trends over time. In late 2023 and early 2024, Ireland and the UK experienced a very active storm season; the countries were affected by 13-14 severe storms[33]. The increased frequency and intensity of storm events will lead to associated increases in precipitation (see above). As stated in 'Air Temperature' above, the AMOC has a moderating influence on Europe, however as identified by the IPCC, the strength of the AMOC	information on current Irish wave regimes.

[31] https://www.climateireland.ie/impact-on-ireland/future-climate-of-ireland/windspeed/
[32] https://www.epa.ie/publications/research/climate-change/Research_Report_386.pdf
[33] Met Éireann (2024) Human-caused Climate Change Brings Increased Storm Rainfall <https://www.met.ie/human-caused-climate-change-brings-increased-storm-rainfall>

	is directly correlated to global mean temperature, and as global mean temperature increases, the AMOC will weaken[34]. The weakening of this current would result in increased storms in Europe and	
Sea Level Rise and Coastal Erosion	Climate change is impacting sea levels and costal erosion in the Northern European region, with a range of observable effects including loss of low-lying land areas, coastal flooding, and loss of coastal habitats[35]. Sea level rise occurs as sea ice continues to decline and as seawater expands as it warms. A long-term increase in the rate of sea level rise in the 20th century is well-documented and the average rate of global sea level rise was recorded as 3.2 mm per year between 1993 and 2010[36]. Along the Irish coastline, the sea level has risen by approximately 2 – 3 mm per year since the 1990s[37]. It is estimated that 19.9% of the Irish coastline is undergoing erosion and only 7.6% of the coastline is protected via defence works or artificial beaches[38]. Sea level rise and coastal erosion from storm events are becoming increasingly critical. Severe continued coastal erosion was reported in Wexford[39] and in Portrane in County Dublin[40] during storm events in 2023 and 2024, resulting in the loss of coastline and damage to access roads and properties. Further information on storms is presented above.	Please see Section 7.5.2.5.1 and Section 7.5.2.6.1 of Chapter 7 Marine Physical and Coastal Processes for further information on current levels of sea level rise and coastal erosion.
Sea surface and near-bottom temperatures	Climate change is impacting sea surface and near bottom ocean temperatures in the Northern European region, with a range of observable effects including loss of marine and coastal habitats, sea level rise, reduced ocean circulation [41].	Please see Section 7.5.2.10.1 of Chapter 7 Marine Physical and Coastal Processes for

[34] *IPCC (2019) IPCC Special Report on the Ocean and Cryosphere in a Changing Climate Chapter 6. Extremes, Abrupt Changes, and Managing Risk <https://www.ipcc.ch/site/assets/uploads/sites/3/2022/03/08_SROCC_Ch06_FINAL.pdf>*
[35] *IPCC (2021) Climate Change 2021: The Physical Science Basis <https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_FullReport.pdf>*
[36] *Horsburgh, K., Rennie, A. and Palmer, M. (2020). Impacts of climate change on sea-level rise relevant to the coastal and marine environment around the UK. Marine Climate Change Impacts Partnership Science Review 2020, 116–131.*
[37] *https://www.climateireland.ie/impact-on-ireland/future-climate-of-ireland/sea-level-rise/*
[38] *Masselink, G., Russell, P., Rennie, A., Brooks, S. and Spencer, T. (2020) Impacts of climate change on coastal geomorphology and coastal erosion relevant to the coastal and marine environment around the UK. MCCIP Science Review 2020, 158–189.*
[39] *https://wexfordlocal.com/2024/04/10/wexford-faces-serious-coastal-erosion-issues/*
[40] *https://www.rte.ie/news/dublin/2024/0416/1443757-dublin-coastal-erosion/*
[41] *IPCC (2021) Climate Change 2021: The Physical Science Basis <https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_FullReport.pdf>*

	Globally, sea surface temperatures have increased by 0.7°C over the last 175 years, with an increased rate of warming in the last 30 years. Temperature measurements at Malin Head in the north of Ireland show a mean annual increase in sea surface temperature of 0.47°C for the 2009 – 2018 period compared with the 1981 – 2010 average[42]. However, generally, across the 1982 – 2021 period, the increases in sea surface temperature in Ireland and on the west coast of the UK have been lower than those observed elsewhere, for example, in the southern North Sea[43]. Additionally, the frequency of marine heatwaves has also increased around the UK and Ireland by up to 3.8 events per year. However, this trend is more pronounced in northerly latitudes, with a weaker trend observed on the south west coast of Ireland. As stated in Section 7.5.2.10.1 of Chapter 7 Marine Physical and Coastal Processes, the M1 weather buoy, located west and further offshore of the Irish continental shelf, recorded average sea surface temperature of approximately 10°C to 16°C over a 7-year period from 2000 to 2007, with the warmest temperatures occurring in the months of July to August. Congruently, 2023 sea surface temperature records of annual average temperatures in Galway Bay itself were approximately 9.3ºC during the early spring (i.e. March and April), then gradually increasing to 16.4ºC in August, before gradually decreasing again over the winter months[44,45]. Measurements of near-bottom temperatures were recorded by the Marine Institute off the west coast of Ireland and also at the Rockall Trough. Data collected between 1975 and 2018 at depths between 1,500 m and 2,000 m show no significant trend in near-bottom temperatures[46]. This contradicts trends observed in the southern North Sea which has seen an increase in autumn near-bottom temperatures over the last thirty years[42].	further information on current sea surface temperatures.

[42] https://www.climateireland.ie/impact-on-ireland/future-climate-of-ireland/sea-temperatures/
[43] Cornes, R.C., Tinker, J., Hermanson, L., Oltmanns, M., Hunter, W.R., Lloyd Hartley, H., Kent, E.C., Rabe, B. and Renshaw, R. Climate change impacts on temperature around the UK and Ireland. MCCIP Science Review 2023, 18pp.
[44] Irish Data Buoy Network (2023). http://vis.marine.ie/dashboards/#/dashboards/weather?buoy=M1&=&measurement=SeaTemperature
[45] https://seatemperature.net/current/ireland/galway-sea-temperature#:~:text=Average%20annual%20water%20temperature%20on,in%20autumn%2056%C2%B0F
[46] Cámaro García, W.C.D. and Dwyer. N. 2020. Status of Ireland's Climate2020., Available online at: https://www.epa.ie/publications/research/climate-change/research-386-the-status-of-irelands-climate-2020.php [Accessed 02/10/2024].

Dissolved Oxygen, Salinity and Stratification	Climate change is impacting dissolved oxygen levels, salinity, and ocean stratification in the Northern European region, with a range of observable effects including loss of marine ecosystems, reduction in ocean circulation, and oxygen depletion in bottom waters[47]. Dissolved oxygen (DO) depletion is a factor of biological activity in the water column and is exacerbated by limited mixing and exchange of water bodies. As such, oxygen deficiency is particularly prevalent in shallower, stratified waters such as those likely to occur in the North Sea in the late summer months. DO was recorded throughout the water column for the 33 locations across the Offshore Site (see Section 8.5.2.2 of Chapter 8 Water and Sediment Quality). As a result, measured DO concentrations are available as profiles through the water column. DO is essential for all marine life with oxygen being more soluble in colder water and less soluble in warmer water. Since the 1960s, the global oceanic oxygen content has declined by more than 2%, resulting from eutrophication and climate change effects, such as increased ocean temperatures[48]. Salinity in the north eastern Atlantic Ocean is principally governed by global current circulation, but is locally and temporally affected by precipitation, particularly in the shelf seas regions where influences of terrestrial run-off are prevalent. However, large interannual and decadal variation make salinity predictions difficult. Historic salinity measurements between 1975 and 2018 show that deep water salinity (1500-2000m) measurements off the west coast of Ireland, including the Rockall Trough, are seemingly stable, having shown very little variation. During the same period, salinity in the upper 800m of the water column has shown a general trend towards increased salinity, however 2018 salinity levels were broadly equivalent to the long-term mean of this timeframe[49]. Both the temperature and salinity measurements across the Offshore Site, demonstrate the presence of stratification through the water column, despite the energetic wave environment, that occurs across the OAA and surrounding area. However, it is observed that there is a spatial variation in the presence /	Please see Section 7.5.2.10.1 of Chapter 7 Marine Physical and Coastal Processes for further information on current salinity levels and water column stratification. Please refer to Section 8.5.5.1.3 of Chapter 8 Water and Sediment Quality for further information on DO.

[47] IPCC (2021) Climate Change 2021: The Physical Science Basis <https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_FullReport.pdf>
[48] Mahaffey, C., Hull, T., Hunter, W., Greenwood, N., Palmer, M., Sharples, J., Wakelin, S. and Williams, C. Climate change impacts on dissolved oxygen concentration in marine and coastal waters around the UK and Ireland. MCCIP Science Review 2023, 31pp.
[49] Cámaro García, W.C.D. and Dwyer. N. 2020. Status of Ireland's Climate2020., Available online at: https://www.epa.ie/publications/research/climate-change/research-386-the-status-of-irelands-climate-2020.php [Accessed 02/10/2024].

	absence of stratification across this region, with respect to depth and spatial location of the sampling points, and the outcropping Sceirde Rocks.	
Ocean Acidification	Ocean acidification is a consequence of climate change, in which the physical properties of the ocean are altered, with resulting impacts on marine biota. Ocean acidification occurs as increases in anthropogenic CO_2 absorbed by the ocean cause a decline in pH. Climate change is impacting ocean acidification in the Northern European region, with a range of observable effects including loss of marine ecosystems and species and a decrease in coastal storm protection[50]. The global ocean absorbs approximately a quarter of anthropogenic carbon dioxide equivalent (CO_2e) emissions annually. The North Atlantic Ocean contains more anthropogenic CO_2e than any other ocean basin and is experiencing an ongoing decline in pH (increasing acidity)[51]. Rates of acidification in bottom waters are occurring faster at some locations than in surface waters; measurements of pH in the west of Ireland correspond to global trends, with an increase in ocean acidity observed between 1991 and 2013[52]. Measurements taken in offshore Irish waters at the southern Rockall Trough (taken annually since 2009) indicate an overall reduction in pH of 0.02 units per decade[53]).	n/a

[50] *IPCC (2021) Climate Change 2021: The Physical Science Basis <https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_FullReport.pdf>*
[51] *Findlay, H.S., Artoli, Y., Birchenough, S.N.R., Hartman, S., León, P. and Stiasny, M. (2022) Climate change impacts on ocean acidification relevant to the UK and Ireland. Marine Climate Change Impacts Partnership Science Review, 2022 24pp.*
[52] *Cámaro García, W.C.D. and Dwyer. N. 2020. Status of Ireland's Climate2020., Available online at: https://www.epa.ie/publications/research/climate-change/research-386-the-status-of-irelands-climate-2020.php [Accessed 02/10/2024].*
[53] *Nolan, G., Cusack, C., & Fitzhenry, D. (Eds.) (2023). Irish Ocean Climate & Ecosystem Status Report. Marine Institute, Galway, Ireland.*

30.3.1.3 Biological and Socio-Economic Environment

The biological and socio-environment may be affected by changes in the physical environment related to climate change. Table 30-6 summarises the current available evidence of the impacts of climate change on relevant biological and socio-economic receptors.

Table 30-6 Summary of current evidence of climate change impacts on biological and socio-economic receptors

Receptor	Summary of Current Evidence of Climate Change Impacts	Relevant EIAR Chapter
Offshore		
Coastal, intertidal, and subtidal habitats	Coastal, intertidal, and subtidal habitats may be directly affected by changes in the physical environment. Coastal habitats may be affected by changes in weather patterns (e.g. changes in rainfall, temperature and storminess), sea level rise and coastal erosion. Changes in the physical environment driven by climate change may result in habitat loss or degradation or make habitats less or more favourable for certain species, ultimately changing species composition. For example, recent surveys indicate that dune slacks are 'drying out' in England, with 30% of this habitat being lost between 1990 and 2012[54]. The predicted rise in sea temperatures, further detailed in Section 30.3.2.2.5 below, may result in an increased abundance of warm-water subtidal habitats and species and a decline in cold-water habitats and species, with associated shifts in abundances and species composition[55]. The North Sea has experienced a change in the distribution of soft-sediment benthic communities linked to changes in sea temperatures and pelagic primary production. While there has been a range shift of many benthic infaunal species range, this has lagged behind changes in temperature. This delay in range shifts following temperature increases means individuals may be experiencing warmer, sub-optimal temperatures. On hard substrates, warm-water brown algae species (e.g. *Laminaria ochroleuca*) have generally increased.	Further information on the coastal, intertidal, and subtidal habitats relevant to the Offshore Site are included in Chapter 9 of this EIAR.
Fish and shellfish ecology	Increases in the abundance of warm-water fish species have been observed across the UK and Ireland. For example, the abundance of warm-water European anchovy (*Engraulis encrasicolus*) is increasing in the south of Ireland, and it is predicted that the presence of warm-water species in Irish waters will continue to rise[56]. Furthermore, increased temperatures have been linked to changes in growth, metabolic and maturation rates, which may result in shifts in the timing of fish spawning, hatching and migration[57].	Further information on fish and shellfish ecology receptors relevant to the Offshore Site are included in Chapter 10 of this EIAR.

[54] *Burden, A., Smeaton, C., Angus, S., Garbutt, A., Jones, L., Lewis H. D. and Rees. S.M. (2020) Impacts of climate change on coastal habitats relevant to the coastal and marine environment around the UK. MCCIP Science Review 2020, 228–255.*
[55] *Moore, P.J. and Smale, D.A. (2020) Impacts of climate change on shallow and shelf subtidal habitats relevant to the coastal and marine environment around the UK. MCCIP Science Review 2020, 272–292.*
[56] *Nolan, G., Cusack, C., & Fitzhenry, D. (Eds.) (2023). Irish Ocean Climate & Ecosystem Status Report. Marine Institute, Galway, Ireland.*
[57] *Fox, C.J., Marshall, C., Stiasny, M.H. & Trifonova, N. Climate Change Impacts on Fish of Relevance to the UK and Ireland. MCCIP Science Review 2023, 17pp.*

Marine mammals and megafauna	Geographical shifts in marine mammal distributions have also been observed with northward shifts of warm-water species such as the short-beaked common dolphin (*Delphinus delphis*). The main effects of climate change on marine mammals are expected to relate to changes in prey availability and distribution; however, physiological stress (e.g. from increased sea temperatures) may also exacerbate other effects, such as increased susceptibility to disease[58].	Further information on the marine mammals and megafauna receptors relevant to the Offshore Site are included in Chapter 12 of this EIAR.
Ornithology	Research on climate change impacts on seabirds in Ireland is limited, however, climate change is generally considered to be a significant threat to Irish seabird populations[59]. In addition to changes in prey species abundance, nesting seabirds may be affected by changes in extreme weather events and increased sea levels.	Further information on the ornithology receptors relevant to the Offshore Site are included in Chapter 11 of this EIAR.
Commercial fisheries	A recent study investigated the link between episodic climate events (e.g. cold spells and heatwaves) and fish stocks. Following cold spells, increased landings of cold-water species (e.g. sole and seabass) and decreased landings of warm-water species (e.g. red mullet and brown crab) were observed. Conversely, only a weak increasing trend for landings of warm-water species was observed for the years following marine heatwave events[60].	Further information on the commercial fisheries relevant to the Offshore Site are included in Chapter 13 of this EIAR.
Onshore		
Terrestrial habitats and species	Irelands 4th National Biodiversity Action Plan (NBAP)[61] states that biodiversity is in trouble across a range of species and habitats. Scientific assessments of the state of nature in Ireland have found that 85% of Irish EU protected habitats are in unfavourable status, with almost half (46%) demonstrating ongoing declines. In 2012 the Environmental Protection Agency (EPA) report '*Winners and Losers: Climate Change Impacts on Biodiversity in Ireland: Projecting Changes and Informing Adaptation Measures*'[62] highlighted the habitats	Detailed information on the habitats and species within the Current Baseline Study Area is provided in Section 20.4 of Chapter 20 Biodiversity – Flora

[58] Martin, E., Banga, R. and Taylor, N.L. Climate change impacts on marine mammals around the UK and Ireland. MCCIP Science Review 2023, 22pp.
[59] Nolan, G., Cusack, C., & Fitzhenry, D. (Eds.) (2023). Irish Ocean Climate & Ecosystem Status Report. Marine Institute, Galway, Ireland.
[60] Wakelin, S., Townhill, B., Engelhard, G., Holt, J. and Renshaw, R. (2021) Marine heatwaves and cold spells, and their impact on fisheries in the North Sea. Journal of Operational Oceanography (Copernicus Marine Service Ocean State Report, 5), s91
[61] Department of Housing, Local Government and Heritage (2024) Ireland's 4th National Biodiversity Action Plan 2023–2030 <https://www.gov.ie/en/publication/93973-irelands-4th-national-biodiversity-action-plan-20232030>
[62] EPA (2012) Winners and Losers: Climate Change Impacts on Biodiversity in Ireland Climate Change Impacts on Biodiversity in Ireland: Projecting Changes and Informing Adaptation Measures.

	most vulnerable to climate change impacts as being upland habitats (siliceous and calcareous scree, siliceous and calcareous rocky slopes, alpine and subalpine heath); peatlands (raised bog, blanket bog); and coastal habitats (such as fixed dunes and salt marshes). Increasing spring temperature in recent decades has been shown to impact the timing of key lifecycle events (phenology) in a range of plant, bird and insect species in Ireland. The NBAP provides detail on the numerous national schemes that are in place to deliver positive change for a range of habitats and species all across the country. Many of these actions are focused on accelerating the restoration agenda and promoting the sustainable use of biodiversity, thus increasing the resilience of biodiversity to climate change.	and Fauna of this EIAR, in Appendix 20-1 Bat Report of Chapter 20, and in Section 21.3 of the Chapter 21 Biodiversity – Terrestrial Ornithology of this EIAR. Further details on the mapped soils and subsoils at each of the individual onshore components of the Project are provided in Section 22.3.3 of Chapter 22 Land Soils and Geology.
Population and human health	Ireland is vulnerable to climate change as an island nation with a heavy reliance on agriculture and imports. The Irish population has been affected by climate change through increased storm activity (and resulting damage costs), more frequent flooding events, and effects on general health and wellbeing. Various sectors within Ireland are particularly vulnerable to climate change; particularly agriculture and tourism. The Irish tourism industry is highly exposed to physical climate change risks given the dependence on the natural environment and weather. Low-lying or geologically soft areas are particularly vulnerable to damage from sea surges, coastal flooding and coastal erosion[63]. The agriculture industry is one of the most sensitive to climate change due to its dependence on weather and other natural processes. Irish agriculture is primarily a grass-based industry with 4.2 million hectares, or 64%, of Irish land used in primary agricultural production. Approximately 80% of Irish agricultural land is used for grass (silage, hay and pasture), 11% is used for rough grazing with the remaining 9% allocated to crop production.[64]	Further information on tourism in Ireland is detailed in Section 6.6 of Chapter 6 of this EIAR: Population and Human Health.

[63] *EPA (2019) Climate Change Adaptation: Risks and Opportunities for Irish Businesses* <https://www.epa.ie/publications/research/climate-change/Research_Report_402.pdf>
[64] https://www.stopclimatechaos.ie/assets/files/pdf/projected_economic_impacts_of_climate_change_on_irish_agriculture_oct_2013.pdf

	Climate change has had observable effects on human health in a myriad of ways, including exposure to extreme weather events such as heatwaves, storms and floods; changes in the quality and safety of air, food, and water; and stresses to mental health and wellbeing[65]. Climate change is undermining many of the UN Sustainable Development Goals (detailed in Section 30.2.1 above and in Section 1.1.3 of Appendix 30-1) such as good health and wellbeing (SDG3), clean water and sanitation (SDG6), decent work and economic growth (SDG8), sustainable cities and communities (SDG11) and responsible consumption and production (SDG12). Climate-sensitive health risks are disproportionately felt by the most vulnerable and disadvantaged, including women, children, ethnic minorities, poor communities, migrants or displaced persons, older populations, and those with underlying health conditions[66].	

[65] *Department of Health (2019) Health Impact of Climate Change and the Health Benefits of Clime Change Actions: A Review of Literature* <https://assets.gov.ie/38323/8d78596ef0224d9a87eb83052ec2cbf7.pdf>
[66] https://www.who.int/news-room/fact-sheets/detail/climate-change-and-health

30.3.1.4 Existing Greenhouse Gas Emissions

Greenhouse gas emissions arise from a large majority of anthropogenic activities. The Irish Sectoral Emission Ceilings (detailed in Section 30.2.2 above and Section 1.2.5 of Appendix 30-1 detail the main sectors which release emissions in Ireland. These sectors include:

- Electricity
- Transport
- Built Environment
    - Residential
    - Commercial
- Industry
- Agriculture
- Land Use, Land Use Change, and Forestry (LULUCF)[1]
- Other (F-Gases, Waste, Petroleum refining)
- Unallocated savings

The most recent inventory report for Ireland (National Inventory Report 2024 (NIR 2024)[67] was published in March 2024 and refers to the greenhouse gas inventory timeseries for the years 1990-2022. Over this period, total emissions of greenhouse gases (excluding LULUCF) increased steadily from 55,231.5 ktCO_2e in 1990 to 71,476.9 ktCO_2e in 2001, which is the highest level of greenhouse gas emissions ever reported in Ireland. Emissions then plateaued until 2008 with estimates ranging from 69,032.5 ktCO_2e to 71,213.8 ktCO_2e. There was then a sharp decrease from 69,032.5 ktCO_2e in 2008 to 58,582.4 ktCO_2e in 2011. Emissions in 2022 at 60,604.9 ktCO_2e are 1.9% lower than 2021.

The Energy sector (comprising heat, transport and electricity) accounted for the bulk of the CO_2 emissions in 2022 (91.7%), Industrial and Agriculture sectors contributed further 6.1% and 2.0%, respectively and Waste contributed the remainder 0.1%. Emissions of CO_2 increased from 32,945.3kt in 1990 to 36,711.4kt in 2022, which equates to an increase of 11.4%[68].

30.3.2 Future Baseline Environment

Ireland is experiencing climate change in line with global trends, with current projections, detailed below, indicating that these effects will intensify in the coming decades. The baseline environment, detailed in the above sections, will undergo significant shifts, influencing Ireland's environment, economy, and society. Predicted changes include rising temperatures, altered precipitation patterns, and increased frequency of extreme weather events.

Visible changes in global climate are evident worldwide, with climate change projections suggesting further, more pronounced impacts in the future. These impacts will have wide-ranging effects on both natural and man-made environments across various sectors and regions, resulting in socio-economic repercussions. Referred to as the 'costs of inaction,' these economic impacts of climate change are increasingly influencing policy discussions[69]. It has become clear that even if greenhouse gas emissions were to cease immediately, climate alterations would persist for many decades. Therefore, alongside efforts for mitigation, it's imperative to develop effective adaptive strategies (adaptation) to mitigate damages or seize opportunities arising from climate change.

---

[67] *EPA (March 2024) National inventory Report 2024 <https://www.epa.ie/publications/monitoring–assessment/climate-change/air-emissions/Ireland's-NIR-2024_cov.pdf>*
[68] *Ibid.*
[69] *European Environment Agency (2007) Climate change: the cost of inaction and the cost of adaptation <https://www.eea.europa.eu/publications/technical_report_2007_13/download>*

The cost of inaction has already been felt in Ireland due to frequent and severe weather events resulting in damage to the built environment, loss of critical infrastructure, water and land contamination resulting from flooding, and more.

This section provides a description of the future predictions for marine, coastal and terrestrial climate change. Where possible, future predictions focus on changes over the 38-year operational period of the Project.

Please note, if the Project does not proceed, the opportunity to capture the available renewable energy resource and connect it to Ireland's electricity grid would be lost, as would the opportunity to contribute to meeting Government and EU targets for the production and consumption of electricity from renewable resources, in particular the 5GW of offshore wind energy generation target identified in Climate Action Plan 2024 (Section 30.2.2 above and Section 1.2.6 of Appendix 30-1), and the reduction of greenhouse gas emissions from all sectors with a total national reduction target of 51% reduction by 2030 as compared to 2018 levels. Further context is provided in Section 30.6.1 on the Do-Nothing scenario of the Project.

The future environmental baseline is used to inform the climate change risk assessment provided in Section 30.5 below.

30.3.2.1 Data sources

A review of literature and data relating to climate change in Ireland was undertaken and utilised to provide an overview of the future baseline environment. The following key data sources were reviewed:

- High-resolution Climate Projections for Ireland – A Multimodel Ensemble Approach (report No. 339)[70]*:*
    - *This report provides climate projections (temperature, humidity, precipitation, snow, wind, storm and sea level) for Ireland based on the latest findings in climate science. Regional climate model simulations were run for a reference period (1981 – 2000) and a future period (2041 – 2060). Future projections were based on Representative Concentration Pathway (RCP) 4.5 and RCP 8.5 scenarios. In each case, the report compares the future period with the reference period to predict potential climate change impacts.*
- Marine Climate Change Impacts Partnership (MCCIP)[71]:
    - *The MCCIP reports summarise the current evidence for climate change, based on observed and modelled trends in climate data and the physical, biological, and socio-economic environment. In addition, they also provide predictions for the physical, biological, and socio-economic environment, based on modelled climate projections. The emissions scenarios used for climate projections differ between the different modelling studies reviewed within the MCCIP report. Generally, the MCCIP predictions are provided for 2100.*
- Climate Status Report for Ireland 2020[72]
    - *The Climate Status Report for Ireland 2020 provides a comprehensive characterisation of Ireland's climate by presenting an analysis of historical measurements of atmospheric, oceanic and terrestrial climate variables. The aim of the report is to enable an understanding of climate change in Ireland.*
- Climate Ireland[73]:
    - *Climate Ireland was formed under the Environmental Protection Agency (EPA) as a national platform for the analysis, consolidation and dissemination of climate*

[70] *EPA Research (2020) High-resolution Climate Projections for Ireland – A Multimodel Ensemble Approach <https://www.epa.ie/publications/research/climate-change/Research_Report_339_Part1.pdf>*
[71] *https://www.mccip.org.uk/*
[72] *https://www.epa.ie/publications/research/climate-change/Research_Report_386.pdf*
[73] *https://www.climateireland.ie/*

change data. Future predictions are provided for air temperature, precipitation, hydrology, phenology, windspeed, sea level rise, storms and waves, sea surface temperatures and sea chemistry and salinity.

30.3.2.2 Physical environment

This section will describe the future baseline for the offshore and onshore physical environment under the Representative Concentration Pathways (RCP) 8.5 high emission scenario. RCPs represent climate change scenarios used in modelling the possible future climate evolution, and are based on a wide suite of assumptions, to specify the greenhouse gas concentrations that will result in defined radiative forcing by 2100. The RCP 8.5 combines assumptions about high population and relatively slow income growth with modest rates of technological change and energy intensity improvements, leading in the long term to high energy demand and greenhouse gas emissions in absence of climate change policies. Compared to the total set of RCPs, RCP 8.5 thus corresponds to the pathway with the highest greenhouse gas emissions[74]. The physical environment of the Onshore Site and Offshore Site under the RCP 8.5 scenario is discussed under the following headers:

- Onshore environment:
  - Air temperature
  - Precipitation and flood risk
  - Wind, storms and waves
  - Sea level rise and coastal erosion
- Offshore environment:
  - Sea surface and near bottom temperature;
  - Dissolved oxygen, salinity and stratification; and
  - Ocean acidification.

30.3.2.2.1 *Air Temperature*

Annual surface air temperatures[75] in Ireland are now approximately 1°C higher than they were in the early 1900's (2013 – 2022 period relative to 1903 - 1912).

The upward trend in air temperatures is predicted to continue for all seasons: annual air temperatures may increase by over 3°C by the end of the 21st century relative to a 1976 to 2005 reference period under an RCP 8.5 high emission scenario[76].

Met Éireann projections[77] indicate an increase of 1–1.6°C in mean annual temperatures in Ireland, with the largest increases seen in the east of the country. Warming is enhanced for the extremes (i.e. hot or cold days), with highest daytime temperatures projected to rise by 0.7–2.6°C in summer and lowest night-time temperatures to rise by 1.1–3°C in winter. Averaged over the whole country, the number of frost days (days when the minimum temperature is less than 0°C) is projected to decrease by 62% for the RCP 8.5 high emissions scenario[78,79].

30.3.2.2.2 *Precipitation and Flood Risk*

[74] *Climate Change (2011) A scenario of comparatively high greenhouse gas emissions* <https://link.springer.com/article/10.1007/s10584-011-0149-y>
[75] https://www.epa.ie/publications/monitoring--assessment/climate-change/irelands-climate-change-assessment-volume-1.php
[76] *Irelands Climate Change Assessment (2023) Volume 1 Climate Science – Ireland in a Changing World*
[77] https://www.met.ie/climate/climate-change#Reference3
[78] *Nolan, P. 2015. EPA Report: Ensemble of Regional Climate Model Projections for Ireland. EPA climate change research report no. 159. EPA: Wexford.*
[79] *O'Sullivan, J., Sweeney, C., Nolan, P. and Gleeson, E., 2015. A high-resolution, multi-model analysis of Irish temperatures for the mid-21st century. International Journal of Climatology. doi: 10.1002/joc.4419.*

Climate change is expected to have a significant impact on Ireland's precipitation patterns. Ireland is predicted to experience greater seasonality in precipitation, with more extreme fluctuations between wet and dry periods. Winter and autumn are anticipated to see increased rainfall, while spring and summer are projected to become drier, leading to more frequent droughts. The EPA's climate projections indicate that very wet days (i.e., days with more than 30mm of rainfall) will become more common, increasing by 31% under a high emissions scenario (RCP 8.5).

Due to Ireland's location in the west of Europe, exposure to Atlantic storms is of concern and this is particularly the case in the context of rising sea levels which will enhance the impacts of storm surges.[80]

Extreme rainfall events, such as those currently expected only once every 50 years, could become twice as frequent by the end of the century. This means more frequent flooding risks, particularly during the winter months[81]. Further information on flood risk is presented in the section below.

Flood Risk

Floods are defined as the inundation of normally dry land and are classified into types (e.g., pluvial floods, flash floods, river floods, groundwater floods, surge floods, coastal floods) depending on the space and time scales and the major factors and processes involved[82]. As identified in the *'The Planning System and Flood Risk Management Guidelines for Planning Authorities'*[83], the two major causes of flooding are inland flooding and coastal flooding. Inland flooding is caused by prolonged and/or intense rainfall, and so, changes in extreme precipitation and frequency of these events are the main proxy for inland flooding to occur. Coastal flooding is caused by higher sea levels than normal, largely as a result of storm surges, resulting in the sea overflowing onto the land. It is likely that climate change will have significant impacts on flooding and flood risk in Ireland due to rising sea levels, increased winter rainfall and more intense rainfall.

As stated in Appendix 23-1 Flood Risk Assessment (FRA), it is likely that climate change will have a significant impact on flooding and flood risk in Ireland due to rising sea levels, increased winter rainfall and more intense rainfall. The CFRAM Programme has modelled flooding associated with potential future climate change scenarios. These CFRAM flood zones have been modelled for 2 no. potential future climate change scenarios, with the Mid-Range and High-End Future Scenario flood extents generated using an increase in rainfall of 20% and 30% respectively. The FRA identifies that the main risk of flooding to the Onshore Site is via pluvial flooding, however the overall risk of flooding to the Onshore Site is low.

Further details on flood risk are provided in Section 23.3.6 in Chapter 23 Water and Section 7.5.2.5.2 and Section 7.5.2.6.1 in Chapter 7 Marine Physical and Coastal Processes. An FRA for the Onshore Site has been carried out and is included as Appendix 23-1 of this EIAR.

30.3.2.2.3 *Wind, Storms and Waves*

Future climate and weather predictions indicate a slight reduction in mid-century (2041 – 2060) average wind speeds around Ireland (-2.47% for RCP 8.5 high emissions scenario compared to the 1981 – 2000 baseline), with these decreases being more pronounced during the summer months[84]. Predictions also point towards less frequent, but more intense storm activity around Ireland. Correspondingly,

---

[80] *https://www.epa.ie/our-services/monitoring--assessment/climate-change/climate-ireland/impact-of-climate-change-on-ireland/climate-hazards/coastal-flooding.*
[81] *EPA (2005) Climate Change Regional Climate Model Predictions for Ireland <https://www.epa.ie/publications/research/climate-change/climate-change-regional-climate-model-predictions-for-ireland-.php>*
[82] *IPCC (2021). Weather and Climate Extreme Events in a Changing Climate. In Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.*
[83] *https://www.gov.ie/en/publication/7db50-the-planning-system-and-flood-risk-management-guidelines-for-planning-authorities-nov-09/*
[84] *https://www.climateireland.ie/impact-on-ireland/future-climate-of-ireland/windspeed/*

projections indicate a decrease in average and extreme wave heights towards the end of the century, but an increase in the frequency and severity of storm surges in coastal regions of western Ireland, particularly in winter months[85]. Storm surge levels over a 20-to-30-year return period are anticipated to increase by up to 9cm by 2100[86].

There is uncertainty with regard to future predictions for storms and waves, and it is expected that the trends observed in the frequency and intensity of waves and storms will continue to be influenced by natural variability. Additionally, future trends are difficult to predict due to a low confidence in attributing historic trends in storms and waves to climate change. However, ongoing changes in the climate may potentially affect storms with cumulative effects on wind and wave heights.

Please refer to Section 7.5.2.8.2 of Chapter 7 Marine Physical and Coastal Processes for further information on future Irish wave regimes.

30.3.2.2.4 Sea Level Rise and Coastal Erosion

Sea level rise and coastal erosion are further potential impacts of climate change as described in Section 30.3.1.2. Sea level rise, coastal erosion and coastal flooding are intrinsically linked. Sea level rise has the potential to result in coastal erosion and also coastal flooding during periods of high tides or during storms. It is predicted that sea level rise will continue globally in the next century. As explained in Chapter 7 Marine Physical and Coastal Processes, sea levels at the Offshore Site are predicted to be up to 0.34 m higher in 50 years and 0.8 m higher in 100 years[87].

It is expected that the rates of erosion at vulnerable areas of coastline will increase, with the largest increases in the southwest from Dingle Peninsula to Cape Clear (i.e. to the south of the Offshore Site)[88]. As outlined in Chapter 7 Marine Physical and Coastal Processes, the coastline of Galway Bay consists predominantly of rocky shores and cobbles and is generally erosion resistant rock / cliffs. There are sandy beaches present that could be affected by sea level rise in the future and any increase in storm surges that could result in coastal erosion.

The presence of erosion resistant rock nearest the OAA is indicative of the future state of coastline in that area. The coastlines of the areas adjacent to the OAA (Galway Bay and Aran Islands) are generally stable although the coast to east and northeast of the Landfall is experiencing erosion[89].

Please see Section 7.5.2.5.2 and Section 7.5.2.6.2 of Chapter 7 Marine Physical and Coastal Processes for further information on future sea level rise and coastal erosion.

30.3.2.2.5 Sea Surface and Near Bottom Temperatures

It is predicted that increases in sea surface temperature will continue; across the UK and Ireland, increases in sea surface temperature are predicted to range from 3.01 – 3.72°C, when considering the 2079 – 2098 time period compared to 2000 – 2019. Increases in near bottom temperature are also predicted to occur over the next century. Modelled predictions for near bottom temperatures for 2079 – 2098 indicate an increase of 2.19 – 3.65°C compared with 2000 – 2019[90]. In accordance with historic trends, increases in sea temperatures are predicted to be greater in the North Sea and English Channel compared with the Irish and Celtic Seas, potentially indicating a weaker trend for the Offshore Site[91]).

---

[85] *https://www.epa.ie/publications/research/climate-change/research-339-high-resolution-climate-projections-for-ireland-.php*
[86] *https://www.climateireland.ie/impact-on-ireland/future-climate-of-ireland/waves–surges/*
[87] *Deltares (2022). Skerd Rocks offshore wind farm metocean study.*
[88] *https://www.epa.ie/our-services/monitoring–assessment/climate-change/climate-ireland/impact-of-climate-change-on-ireland/climate-hazards/coastal-erosion/*
[89] *EMODnet (2021). EMODnet Geology Mapper. <https://www.emodnet-geology.eu/map-viewer/.>*
[90] *Cornes, R.C., Tinker, J., Hermanson, L., Oltmanns, M., Hunter, W.R., LloydHartley, H., Kent, E.C., Rabe, B. and Renshaw, R. Climate change impacts on temperature around the UK and Ireland. MCCIP Science Review 2023, 18pp.*
[91] *Ibid.*

Please see Section 7.5.2.10.2 of Chapter 7 Marine Physical and Coastal Processes for further information on future sea surface temperatures.

30.3.2.2.6 Dissolved Oxygen, Salinity and Stratification

The waters off western Ireland are considered more resilient to oxygen depletion due to their depth and greater exchange with the Atlantic Ocean, but annual mean oxygen concentrations are still expected to deplete by approximately 3% by 2100[92].

Predictions for Irish shelf sea suggest that by the end of the century, both sea surface salinity and near-bottom salinity will decrease as compared to the 1960–1989 average (Table 30-7). This is consistent with trends in the west of the United Kingdom Continental Shelf (UKCS) and North Sea, where it is predicted that waters will be less saline by 2100 due to ocean circulation changes driven by climate change, and a similar, albeit weaker, predicted trends for waters to the southwest of the UKCS in the Celtic Sea, Irish Sea and English Channel[93].

Table 30-7 Predicted changes in sea surface and near bottom salinity (comparing 1960 to 1989 with 2069 to 2098)[94].

Region	Surface Salinity (Change in PSU*)	Near Bottom Salinity (Change in PSU)
Irish and British shelf region (average)	-0.41 (±0.47)	-0.33 (±0.38)
**PSU = Practical Salinity Unit*		

Projections suggest that by 2100, an earlier onset of seasonal stratification will occur with tentative evidence of long-term trends in the strengthening of stratification. Projections suggest that by 2100, thermal stratification will extend in duration by around 2 weeks (with both earlier onset and later breakdown), and increase in strength, due to changes in air temperature[95].

Please refer to Section 8.5.5.1.3 of Chapter 8 Water and Sediment Quality for further information on DO and Section 7.5.2.10.2 of Chapter 7 Marine Physical and Coastal Processes for further information on future salinity levels and water column stratification.

30.3.2.2.7 Ocean Acidification

pH levels of the seas surrounding the UK and Ireland are predicted to continue to decrease under the RCP 8.5 high emissions scenario by an average of 0.003 per year from 2000 - 2050. There is a high degree of regional variability in this predicted decline, with the faster rates of decline expected in deeper shelf waters. Aragonite undersaturation events may occur as a result of ocean acidification as reductions in pH reduce carbonate ion concentration which control the saturation state of calcium carbonate minerals such as aragonite. Aragonite is an important calcium carbonate mineral that organisms use to produce shells and skeletons. At a lower saturation state, aragonite dissolves more easily which can result in difficulties for calcifying organisms[96]). Episodic aragonite undersaturation

---

[92] https://www.mccip.org.uk/sites/default/files/2023-02/Climate%20Change%20Impacts%20on%20Dissolved%20Oxygen%20Concentration%20in%20Marine%20and%20Coastal%20Waters%20around%20the%20UK%20and%20Ireland%20.pdf

[93] *Dye, S., Berx, B., Opher, J., Tinker, J.P. and Renshaw, R. (2020) Climate change and salinity of the coastal and marine environment around the UK. Marine Climate Change Impacts Partnership Science Review 2020, 76–102. Available online at: https://www.mccip.org.uk/sites/default/files/2021-07/04_salinity.pdf*

[94] *Tinker, J., Lowe, J., Pardaens, A., Holt, J. and Barciela, R. (2016). Uncertainty in climate projections for the 21st century northwest European shelf seas. Progress in Oceanography, 148, 56-73.*

[95] *Sharples, J., Holt, J., Wakelin, S. and Palmer, M.R. Climate change impacts on stratification relevant to the UK and Ireland. MCCIP Science Review 2022, 11pp.*

[96] *Nolan, G., Cusack, C., & Fitzhenry, D. (Eds.) (2023). Irish Ocean Climate & Ecosystem Status Report. Marine Institute, Galway, Ireland.*

events are projected to begin by 2030 and by 2100, up to 90% of the north-west European shelf seas may experience undersaturation for at least one month of each year.

30.3.2.3 Biological and Socio-Economic Environment

The biological environment may be directly or indirectly affected by changes in the physical environment caused by climate change. Geographical and phenological shifts, and changes in species composition, have already been observed as explained in Section 30.3.1.3 [97]. Further climate change may result in conditions that are at or close to the tolerable limits for species and/or habitats, which may reduce resilience to other drivers of change[98].

The following table (Table 30-8) summarises the predicted future effects of climate change on the biological and socio-economic environment. It has not been possible to undertake a detailed evaluation of potential climate-related effects, due to uncertainty in how the physical environment will respond to climate change and the complexity of differentiating between climate change effects and other factors that can influence the physical environment and subsequently biological receptors[99]. Please note, the below assessment provides a robust indication from current best available sources on the potential effects of climate change on the biological and socio-economic environment.

[97] https://www.mccip.org.uk/all-uk/uk-impacts/hub/ecosystem-change
[98] https://www.eea.europa.eu/publications/how-climate-change-impacts
[99] *Küpper, F.C. and Kamenos, N.A. (2017). The future of marine biodiversity and marine ecosystem functioning in UK coastal and territorial waters (including UK Overseas Territories. Foresight Future of the Sea project.*

Table 30-8 Summary of future predictions of climate change impacts on biological and socio-economic receptors

Receptor	Summary of Future Predictions of Climate Change Impacts	Relevant EIAR Chapter
Offshore		
Coastal, intertidal, and subtidal habitats	Sea level rise and coastal erosion will continue to threaten coastal habitats, although as described in Section 30.3.2.2.4, the coastline at the Offshore Site is mostly erosion resistant rock / cliffs. With increasing sea temperatures, the species composition of intertidal and subtidal habitats and species is expected to change, with a rise in warm water species and decline in cold-water species[100],[101]. Shell building organisms in the intertidal region may be vulnerable to ocean acidification, with an expected continued decline in pH as described in Section 30.3.2.2.7.	Further information on the coastal, intertidal, and subtidal habitats relevant to the Offshore Site are included in Chapter 9 of this EIAR.
Fish and shellfish ecology	With the continued expected rise in sea temperatures, species composition and abundances are expected to continue to change, with potential impacts on predator-prey relationships. Increased presence of warm-water species is anticipated, such as the Mediterranean horse mackerel and bogue. Physiological stress could also result from changes in sea chemistry (e.g. DO, salinity and stratification)[102]. Continued increases in sea temperatures may also negatively impact spawning success due to adverse effects on egg development. Therefore, species that are close to or at their thermal maximum may experience higher rates of reproductive failure. The effects will be species and region specific, with variations occurring across the UK and Ireland.	Further information on fish and shellfish ecology receptors relevant to the Offshore Site are included in Chapter 10 of this EIAR.
Marine mammals and megafauna	With the increases in sea temperature, range shifts are expected to continue. Cold-water species that have a high fidelity towards their breeding grounds are expected to be most affected. Physiological stressors may also occur as a result of an increase in thermal stress which increases the vulnerability to infectious disease[103].	Further information on the marine mammals and megafauna receptors relevant to the Offshore Site are included in Chapter 12 of this EIAR.

[100] *Mieszkowska, N., Burrows, M. and Sugden, H. (2020) Impacts of climate change on intertidal habitats relevant to the coastal and marine environment around the UK. MCCIP Science Review 2020, 256–271.*
[101] *Moore, P.J. and Smale, D.A. (2020) Impacts of climate change on shallow and shelf subtidal habitats relevant to the coastal and marine environment around the UK. MCCIP Science Review 2020, 272–292.*
[102] *Fox, C.J., Marshall, C., Stiasny, M.H. & Trifonova, N. Climate Change Impacts on Fish of Relevance to the UK and Ireland. MCCIP Science Review 2023, 17pp.*
[103] *Martin, E., Banga, R. and Taylor, N.L. Climate change impacts on marine mammals around the UK and Ireland. MCCIP Science Review 2023, 22pp.*

Ornithology	With increases in temperatures, seabirds in Ireland that are at the southern limit of their breeding range are expected to be most affected by climate change, and some species may not be able to shift their breeding locations north as a response to rising temperatures. Many seabirds in the UK and Ireland are at the southerly limit of their range and are therefore vulnerable to climatic changes which reduce their range[104]. The storm petrel (*Hydrobates pelagicus*) and little tern (*Sternula albifrons*) are considered to be the most vulnerable species to climate change in Ireland based on their feeding guild (i.e. surface feeder or water column feeder), reliance on sandeel and vulnerability to weather events[105].	Further information on the ornithology receptors relevant to the Offshore Site are included in Chapter 11 of this EIAR.
Commercial fisheries	Effects on fish stocks as a result of climate change are expected to negatively impact the fisheries industry, including those along the Co. Galway coastline and around the Aran Islands. Overall, in the recent climate risk assessment conducted by Payne *et al.* (2021)[106], Irish fleet and coastal fisheries were predicted to be at a 'moderate' risk from climate change, when the sensitivity of the catch composition to climate change is considered, and where climate risk refers to the potential for climate change to have adverse consequences on fishing fleets. Overall, the climate risk in Ireland was comparably lower compared to the UK, with the lowest climate risk predicted for the south of Ireland. Townhill *et al.* (2023)[107] projected the habitat suitability change in 2030 – 2070 compared with the 1997 – 2016 baseline for key commercial fish and shellfish species in UK waters under different emissions scenarios (RCP 4.5 and RCP 8.5). Approximately half of the species considered were predicted to have more suitable habitat in the future across all RCP scenarios, whereas a significant decline of cold-water species was predicted, including for megrim which are one of the key commercial species at the Offshore Site[108]. Additionally, ocean acidification may adversely affect commercially important shellfish species at the Offshore Site. It is expected that most species will be	Further information on the commercial fisheries relevant to the Offshore Site are included in Chapter 13 of this EIAR.

[104] *Burton, N.H.K., Daunt, F., Kober, K., Humphreys, E.M. and Frost, T.M. (2023) Impacts of Climate Change on Seabirds and Waterbirds in the UK and Ireland. MCCIP Science Review 2023, 26pp.*
[105] *Nolan, G., Cusack, C., & Fitzhenry, D. (Eds.) (2023). Irish Ocean Climate & Ecosystem Status Report. Marine Institute, Galway, Ireland.*
[106] *Payne, M.R., Kudahl, M., Engelhard, G.H., Peck, M.A. and Pinnegar, J.K. (2021). Climate-risk to European fisheries and coastal communities. PNAS, 118(40), e201808611.*
[107] *Townhill, B.L., Couce, E., Tinker, J., Kay, S. and Pinnegar, J.K. (2023). Climate change projections of commercial fish distribution and suitable habitat around north-western Europe. Fish and Fisheries.*
[108] *Ibid.*

	able to withstand the projected pH levels under the RCP 8.5 scenario, although some sub-lethal effects may occur. For example, the Dublin Bay Prawn (*Nephrops norvegicus*) experience reduced immune response when exposed to lower pH levels (7.47 – 8.11)[109].	
Onshore		
Terrestrial habitats and species	Biodiversity regulates the climate and plays a mitigating role against the worst of climate change effects. Climate change is a growing driver of biodiversity loss, with current projections indicating a significant shift in the distribution of species throughout Ireland[110]. Degraded habitats are less resilient to the impacts of climate change, and therefore are less able to provide the ecosystem services needed to be resilient to climate change. Habitat loss is one of the major contributing factors for decline in species population, and the direct correlation between climate change effects and habitat loss is blatant. Up to 20% of Ireland's total native flora is estimated to be vulnerable to climate change in the period up to 2050, with more than half of species on the Irish threatened plants list at risk of being adversely affected by climate change[111]. Observed impacts of climate change on Irish species and habitats include changes in species abundance and distribution, phenology (such as the timing of bird migration and plant flowering), community composition, habitat structure and ecosystem processes. Increases in spring temperatures in recent decades have been demonstrated to impact the timing of key life cycle events in a range of plant, bird and insect species in Ireland[112]. Shifts in weather patterns and climate changes are impacting mammals in Ireland. For instance, the habitat of the Irish hare (*Lepus timidus*) is projected to shrink by 75% over the next 50 years due to changes in precipitation and rising global temperatures[113]. Additionally, climate change in Ireland	Detailed information on the habitats and species within the Current Baseline Study Area is provided in Section 20.4 of Chapter 20 Biodiversity – Flora and Fauna of this EIAR, in Appendix 20-1 Bat Report of Chapter 20, and in Section 21.3 of the Chapter 21 Biodiversity – Terrestrial Ornithology of this EIAR.

[109] *Townhill, B.L., Artioli, Y., Pinnegar, J.K. and Birchenough, S.N.R. (2022). Exposure of commercially exploited shellfish to changing pH levels: how to scale-up experimental evidence to regional impacts. ICES Journal of Marine Science, 79, 2362–2372.*
[110] *Government of Ireland (2023) Irelands 4th National Biodiversity Action Plan* <https://www.npws.ie/sites/default/files/files/4th_National_Biodiversity_Action_Plan.pdf>
[111] *EPA (2024) Irelands Climate Change Assessment Volume 3* <https://www.epa.ie/publications/monitoring--assessment/climate-change/irelands-climate-change-assessment-volume-3.php>
[112] *Ibid.*
[113] *Queens University Belfast (2018) The Irish Har: From the Ice Age to Present* <https://pureadmin.qub.ac.uk/ws/portalfiles/portal/149454109/British_Wildlife_post_print.pdf>

	could create more favourable conditions for non-native mammal species, such as the Sitka deer (*Odocoileus hemionus sitkensis*), potentially leading to the loss of native Irish species. Actions to preserve and restore biodiversity centre around the implementation of the Biodiversity Climate Change Sectoral Adaptation Plan[114] with a particular focus on peatlands rehabilitation and restoration.	
Population and human health	Climate change is impacting health in a myriad of ways, including by the alteration of exposure level stressors such as extreme weather events such as heatwaves, storms and floods; vector-, food- and waterborne infectious diseases; changes in the quality and safety of air, food, and water; and stresses to mental health and wellbeing[115]. Furthermore, climate change is undermining many of the social determinants for good health, such as livelihoods, equality and access to health care and social support structures. These climate-sensitive health risks are disproportionately felt by the most vulnerable and disadvantaged, including women, children, ethnic minorities, poor communities, migrants or displaced persons, older populations, and those with underlying health conditions[116].	Detailed information on Population and Human Health in the Offshore and Onshore Population Study Areas is provided in Chapter 6 of this EIAR.

[114] *Department of Culture, Heritage and the Gaeltacht (2019) Biodiversity Climate Change Sectoral Adaptation Plan* <https://www.npws.ie/sites/default/files/publications/pdf/Biodiversity-Climate-Change-Sectoral-Adaptation-Plan.pdf>
[115] *Department of Health (2019) Health Impact of Climate Change and the Health Benefits of Clime Change Actions: A Review of Literature* <https://assets.gov.ie/38323/8d78596ef0224d9a87eb83052ec2cbf7.pdf>
[116] https://www.who.int/news-room/fact-sheets/detail/climate-change-and-health

30.3.2.4 Greenhouse Gas Emissions Projections

In its approach to decarbonisation, the EU has split greenhouse gas emissions into two categories, the Emissions Trading System (ETS) and the non-ETS. Emissions from electricity generation and large industry in the ETS are subject to EU-wide targets which require that emissions from these sectors be reduced by 43% by 2030, relative to 2005 levels. Within the ETS, participants are required to purchase allowances for every tonne of emissions, with the amount of these allowances declining over time to ensure the required reduction of 43% in greenhouse gas emissions is achieved at EU-level[117].

Emissions from all other sectors, including agriculture, transport, buildings, and light industry are covered by the EU Effort Sharing Regulation (ESR[118]). This established binding annual greenhouse gas emission targets for Member States for the period 2021–2030. Please see Section 30.2.1 above and Section 1.1.9 of Appendix 30-1 for further details on the EU ESR.

Considerable progress has been made in the decarbonisation of the electricity sector, with emissions falling by 45% between 2001 and 2022[119]. The decarbonisation of the Electricity Sector has been made possible through the deployment of renewables and their successful integration into the national grid, further facilitating the decarbonisation of other sectors, such as transport, heating and industry as they look towards electrification.

The Environmental Protection Agency (EPA) publish Ireland's greenhouse gas emission projections and at the time of writing, the most recent report, *'Ireland's Greenhouse Gas Emissions Projections 2023-2050* was published in May 2024. The report includes an assessment of Ireland's progress towards achieving its emission reduction targets out to 2030 set under the ESR.

The EPA has produced two scenarios in preparing these greenhouse gas emissions projections: a "With Existing Measures" (WEM) scenario and a "With Additional Measures" (WAM) scenario. These scenarios forecast Irelands greenhouse gas emissions in different ways. The WEM scenario assumes no additional policies and measures, beyond those already in place by the end of 2020. This is the cut off point for which the latest national greenhouse gas emission inventory data is available, known as the 'base year' for projections. The WAM scenario has a higher level of ambition and includes government policies and measures to reduce emissions such as those in Ireland's Climate Action Plan 2024 that are not yet implemented. As implementation of policies and measures occurs, they will be migrated into the WEM Scenario.

The EPA Emission Projections Update notes the following key trends:

- Ireland is not on track to meet the 51% emissions reduction target by 2030 (as compared to 2018 levels) based on most up to date EPA projections which include the majority of CAP 2024 measures
- The first two carbon budgets (2021-2030), which aim to support achievement of the 51% emissions reduction goal, are projected to be exceeded by a significant margin of between 17 and 27%.
- Sectoral emissions ceilings for 2025 and 2030 are projected to be exceeded in almost all cases, including Agriculture, Electricity, Industry and Transport.
    - Total emissions from the agriculture sector are projected to decrease by between 1 and 18% over the period 2022 to 2030

[117] *Department of the Environment, Climate and Communications (2023) - Climate Action Plan 2024 https://www.gov.ie/en/publication/79659-climate-action-plan-2024/*
[118] *Regulation (EU) 2018/842 of the European Parliament and of the Council of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No 525/2013 (Text with EEA relevance)*
[119] *Department of the Environment, Climate and Communications (2023) - Climate Action Plan 2024 https://www.gov.ie/en/publication/79659-climate-action-plan-2024/*

- Transport emissions are projected to decrease by 5 to 26% over the period 2022-2030
- Emissions from the LULUCF sector have been revised significantly to reflect new science. Total emissions from the LULUCF sector are projected to increase over the period 2022 to 2030

- Emissions from the Energy Industries sector are projected to decrease by between 57 and 62% over the period 2022 to 2030
  - Renewable energy generation at the end of the decade is projected to range from 69 to 80% of electricity generation as a result of a projected rapid expansion in wind energy and other renewables
- Ireland will not meet its non-ETS EU targets of a 42% emissions reduction by 2030 in WAM even with both the ETS and LULUCF flexibilities.
- Emissions in the WAM Scenario are projected to be 29% lower in 2030 (compared with 2018) whereas in the WEM Scenario the emissions reduction is projected to be 11%
  - There has been no improvement on these figures since EPA projections published in 2023

30.4 Carbon Assessment

A detailed carbon assessment of the Project is presented below under two main sections.

The biogenic carbon assessment addresses potential impacts on biogenically sequestered carbon e.g. disturbance to peat and forestry (onshore) and disturbance to carbon stores in marine habitats and seabed sediments (offshore). The non-biogenic carbon assessment details potential impacts associated with the materials and emissions associated with the construction, operation and maintenance, and decommissioning of the Project.

30.4.1 Biogenic Carbon Assessment

30.4.1.1 Offshore Site

30.4.1.1.1 *Introduction*

Carbon stored in the marine environment ('blue carbon') refers to carbon captured by biological metabolic processes, i.e. in the soft tissues, shells and skeletons of plants and animals[120]. Carbon is sequestered in the marine environment when carbon is removed from the atmosphere and accumulated in vegetated habitats or by calcifying organisms. Biologically derived blue carbon is stored in the marine environment mainly in marine sediments as inorganic carbon. The quantity of carbon held in a habitat at any specified time is the carbon stock or store, and the rate at which the carbon is stored is referred to as the carbon sequestration rate[121].

Cott *et al.* (2021)[122] outline the key blue carbon ecosystems as:

- Saltmarshes;
- Seagrass meadows;
- Mangrove forests; and
- Tidal freshwater forests.

---

[120] Porter, J, S., Austin, W, E, N., Burrows, M, T., Clarke, T., Davies, G., Kamenos, N., Riegel, S., Smeaton, C., Page, C., Want, A., (2020). Blue carbon audit of Orkney waters. Scottish Marine and Freshwater Science Vol 11 No 3, 96pp.
[121] European Environment Agency (2024) Greenhouse gas emission intensity of electricity generation in Europe. <https://www.eea.europa.eu/en/analysis/indicators/greenhouse-gas-emission-intensity-of-1?activeAccordion=546a7c35-9188-4d23-94ee-005d97c26f2b>
[122] Cott, G. M., Beca-Carretero, P. and Stengel, D. B. (2021). Blue Carbon and Marine Carbon Sequestration in Irish Waters and Coastal Habitats. Marine Institute, Ireland.

Mangrove forests are not found in Ireland and there are no significant areas of tidal freshwater forests in Ireland. Therefore, Ireland has two main blue carbon ecosystems; saltmarsh and seagrass beds. Other marine ecosystems, may also qualify as blue carbon ecosystems, such as macroalgae (including maerl), phytoplankton and cold-water corals[123], however, there is generally a paucity of data on the carbon stocks and carbon sequestration rates of these ecosystems. Due to the uncertainties around the density of organic and inorganic carbon present in marine sediments and habitats and also the uncertainties around the fate of disturbed carbon, a qualitative assessment is provided for the biogenic carbon assessment for the Offshore Site. This is consistent with Carbon Trust (2024) guidance[124]. Ireland's Exclusive Economic Zone (EEZ) covers an area of 880,000km^2. The marine habitats and ecosystems around Ireland have been estimated to absorb over 42 million tonnes of CO_2e per year, providing an ecosystem service estimated to have a value of €819 million[125].

According to Porter *et al.*, (2020)[126], there are multiple pressures on carbon in stored sediment that arises from the current practices of the marine environment, the main one of which is physical disturbance to the seabed (e.g. resulting from bottom trawling, dredging or other forms of sediment disturbance). If it is assumed that all organic carbon in remineralised, it is estimated that bottom trawling has resulting in damage equivalent to US$ 0.8 – 6 billion as a result of the carbon released in the UK[127]. Additionally, blue carbon habitats are subject to ongoing climate change impacts, such as acidification, deoxygenation and temperature changes of seawater[128]. The majority of this carbon is in the form of calcium carbonate, with a significantly lower proportion being held in the organic form.

Please note, the below assessment is based on current best available sources which have informed a robust and complete offshore biogenic carbon assessment. Where assumptions have been utilised, these are detailed in Appendix 30-1.

30.4.1.1.2 Methodology

The existing data sets and literature with relevant coverage to the Offshore Site, which have been used to inform the blue carbon assessment are outlined in Table 30-9. There is a paucity of data on the carbon sequestration rates and carbon stocks in Ireland, although there are research projects ongoing to improve this understanding (e.g. BlueC[129]). Where data is available from research conducted in other regions (e.g. Scotland), this has been used. However, as noted above, a qualitative assessment is conducted for the biogenic carbon assessment for the Offshore Site, in line with Carbon Trust (2024) guidance[130].

Table 30-9 Summary of key datasets and reports

Title	Source	Year	Author

[123] Cott, G. M., Beca-Carretero, P. and Stengel, D. B. (2021). Blue Carbon and Marine Carbon Sequestration in Irish Waters and Coastal Habitats. Marine Institute, Ireland.
[124] Carbon Trust (2024). Offshore wind industry product carbon footprinting guidance. Available online at: https://www.carbontrust.com/our-work-and-impact/guides-reports-and-tools/standardising-offshore-wind-carbon-footprinting
[125] Norton, D., Hynes, S., and Boyd, J. (2018). Valuing Ireland's Blue Ecosystem Services. Available online at: https://www.universityofgalway.ie/media/researchsites/semru/files/marine_ecosystem_service_non_technical_report_final.pdf [Accessed 04/10/2023].
[126] Porter, J, S., Austin, W, E, N., Burrows, M, T., Clarke, T., Davies, G., Kamenos, N., Riegel, S., Smeaton, C., Page, C., Want, A., (2020). Blue carbon audit of Orkney waters. Scottish Marine and Freshwater Science Vol 11 No 3, 96pp
[127] Luisetti, T., Turner, R.K., Andrews, J.E., Jickells, T.D., Kröger, S., Diesing, M., Paltriguera, L., Johnson, M.T., Parker, E.R., Bakker, D.C. and Weston, K (2019). Quantifying and valuing carbon flows and stores in coastal and shelf ecosystems in the UK. Ecosystem Services, 35, 67-76.
[128] Porter, J, S., Austin, W, E, N., Burrows, M, T., Clarke, T., Davies, G., Kamenos, N., Riegel, S., Smeaton, C., Page, C., Want, A., (2020). Blue carbon audit of Orkney waters. Scottish Marine and Freshwater Science Vol 11 No 3, 96pp
[129] https://www.bluec.ie/
[130] Carbon Trust (2024). Offshore wind industry product carbon footprinting guidance. Available online at: https://www.carbontrust.com/our-work-and-impact/guides-reports-and-tools/standardising-offshore-wind-carbon-footprinting

Blue carbon and marine carbon sequestration in Irish waters and coastal habitats	https://oar.marine.ie/bitstream/Blue_Carbon_in_Irish_Waters_and_Coastal_Habitats	2021	Cott *et al.,*[131]
Valuing Ireland's blue ecosystem services	https://ageconsearch.umn.edu/record/309535/?v=pdf	2018	Norton *et al.,*[132]
The United Kingdom's Blue Carbon Inventory: Assessment of Marine Carbon Storage and Sequestration Potential in UK Seas (Including Within Marine Protected Areas).	https://www.wildlifetrusts.org/sites/default/files/2024-09/UK%20assessment%20-%20scientific%20report.pdf	2024	Burrows *et al.,*[133]
Assessment of maerl beds in the OSPAR area and the development of a monitoring program	https://www.npws.ie/sites/default/files/publications/pdf/Hall-Spencer_et_al_2008_OSPAR_maerl.pdf	2008	Hall-Spencer *et al.,*[134]

The assessment for blue carbon is undertaken following the principles set out in the Chapters 7 to 19 of this EIAR, including Chapter 4: Environmental Impact Assessment Methodology. The sensitivity of receptor is combined with the magnitude to determine the impact significance. Topic-specific sensitivity and magnitude criteria are assigned based on professional judgement, as described in Table 30-10 and Table 30-11.

Table 30-10 Sensitivity criteria

Sensitivity of Receptor	Definition
High	The receptor has a very low capacity to accommodate a particular effect with a low ability to recover or adapt. The receptor is of very high carbon stock or sequestration rates.
Medium	The receptor has a low capacity to accommodate a particular effect with a low ability to recover or adapt. The receptor is of moderate carbon stock or sequestration rates.
Low	The receptor has some tolerance to accommodate a particular effect or will be able to recover or adapt. The receptor is of low carbon stock or sequestration rates.

[131] *Cott, G. M., Beca-Carretero, P. and Stengel, D. B. (2021). Blue Carbon and Marine Carbon Sequestration in Irish Waters and Coastal Habitats. Marine Institute, Ireland*
[132] *Norton, D., Hynes, S., and Boyd, J. (2018). Valuing Ireland's Blue Ecosystem Services. Available online at: https://www.universityofgalway.ie/media/researchsites/semru/files/marine_ecosystem_service_non_technical_report_final.pdf [Accessed 04/10/2023].*
[133] *Burrows, M.T., O'Dell, A., Tillin, H., Grundy, S., Sugden, H., Moore, P., Fitzsimmons, C., Austin, W., Smeaton, C. 2024. The United Kingdom's Blue Carbon Inventory: Assessment of Marine Carbon Storage and Sequestration Potential in UK Seas (Including Within Marine Protected Areas). A Report to The Wildlife Trusts, WWF and the RSPB. Scottish Association for Marine Science, Oban.*
[134] *Hall-Spencer, J.M. Kelly, J. and Maggs, C.A. (2008). Assessment of maerl beds in the OSPAR area and the development of a monitoring program. Available online at: https://www.npws.ie/sites/default/files/publications/pdf/Hall-Spencer_et_al_2008_OSPAR_maerl.pdf [Accessed 04/10/2024].*

Negligible	The receptor is generally tolerant and can accommodate a particular effect without the need to recover or adapt. The receptor is of negligible carbon stock or sequestration rates.

Table 30-11 Magnitude criteria

Magnitude Criteria	Definition
High	The impact occurs over a large spatial extent resulting in widespread, long-term, or permanent changes in baseline conditions. The impact is very likely to occur and/or will occur at a high frequency or intensity.
Medium	The impact occurs over a local to medium extent with a short- to medium-term change to baseline conditions. The impact is likely to occur and/or will occur at a moderate frequency or intensity.
Low	The impact is localised and temporary or short-term, leading to a detectable change in baseline conditions or a noticeable effect on a small proportion of a receptor population. The impact is unlikely to occur or may occur but at low frequency or intensity.
Negligible	The impact is highly localised and short-term, with full rapid recovery expected to result in very slight or imperceptible changes to baseline conditions or a receptor population. The impact is very unlikely to occur; if it does, it will occur at a very low frequency or intensity.

30.4.1.1.3 Results

There were no seagrass beds or saltmarsh recorded in the Offshore Site during the benthic survey (see Section 9.5.2.2.1 of Chapter 9: Benthic Ecology); however, maerl beds were identified in the Offshore Site.

A maerl assessment was undertaken following the identification of the Annex V listed species maerl within the Offshore Site. The results of the maerl assessment found that there were two locations that had potential for maerl beds (ST027 and T33). Based on figures by De Grave *et al.* (2000)[135] and Burrows *et al.* (2014)[136], Cott *et al.*, (2021)[137] estimated that the quantity of carbon in Irish maerl deposits is 1,143,120 tonnes. Primary productivity from maerl deposits can reach 407 g C m^{-2} yr^{-1} which then becomes locked within each deposit[138]. Any habitat loss or disturbance on maerl from the placement of infrastructure will be minimal, based on the localised spatial change and low frequency of disturbance / loss expected to occur through the life cycle of the Offshore Site, as the Project has taken measures to design around maerl to avoid direct disturbance. Further information on the extent of temporary loss of habitat/disturbance is detailed in Section 9.5.2.2.1 of Chapter 9: Benthic Ecology.

As discussed in Chapter 9: Benthic Ecology, the majority of the OAA consists of coarse sediments, followed by sand and muddy sand and areas of exposed rock whereas, within the OECC, sand,

135 De Grave, S., Fazakerley, H., Kelly, L., Guiry, M.D., Ryan, M. and Walshe, J., 2000. A study of selected maërl beds in Irish waters and their potential for sustainable extraction. Marine Resource Series, No. 10.Marine Institute, Dublin.
136 Burrows M.T., Kamenos N.A., Hughes D.J., Stahl H., Howe J.A. & Tett P. 2014. Assessment of carbon budgets and potential blue carbon stores in Scotland's coastal and marine environment. Scottish Natural Heritage Commissioned Report No. 761.
137 Cott, G. M., Beca-Carretero, P. and Stengel, D. B. (2021). Blue Carbon and Marine Carbon Sequestration in Irish Waters and Coastal Habitats. Marine Institute, Ireland
138 Burrows M.T., Kamenos N.A., Hughes D.J., Stahl H., Howe J.A. & Tett P. 2014. Assessment of carbon budgets and potential blue carbon stores in Scotland's coastal and marine environment. Scottish Natural Heritage Commissioned Report No. 761

muddy sand, mud and sandy mud are dominant. Smeaton *et al.* (2020)[139] used data collated by Diesing *et al.* (2017)[140] to estimate the organic and inorganic carbon content of different sediment types found in the OAA and OECC (i.e., sand, mud, gravel), as described in Table 30-12. Finer sediments generally have a higher organic carbon content. However, it is important to note that the organic carbon content in fine sediments will vary considerably depending on how quickly organic carbon is remineralised to carbon dioxide and with the rate at which carbonate containing phytoplankton are deposited as detritus[141]. Other factors such as bioturbation by marine organisms will influence the organic carbon content in sediments.

Table 30-12 Estimated average organic and inorganic carbon content for the sediment types identified at the Offshore Site

	Presence in Offshore Site	Organic carbon content (%)	Inorganic carbon content (%)
Gravelly sand	› 11 of the 30 sampling stations in the OAA; and › 3 of the 28 sampling stations in the OECC.	0.23	3.99
Sandy gravel	› 10 of the 30 sampling stations in the OAA; and › 2 of the 28 sampling stations in the OECC.	0.12	3.57
Slightly gravelly sand	› 4 of the 30 sampling stations in the OAA; and › 5 of the 28 sampling stations in the OECC.	0.22	1.67
Sand	› 2 of the 30 sampling stations in the OAA.	0.24	1.48
Muddy sand	› 2 of the 30 sampling stations in the OAA; and › 11 of the 28 sampling stations in the OECC.	0.54	1.26
Muddy sandy gravel	› 1 of the 30 sampling stations in the OAA.	0.16	2.22
Slightly gravelly muddy sand	› 5 of the 28 sampling stations in the OECC.	0.67	2.95
Gravel	› 1 of the 28 sampling stations in the OECC.	0.13	1.61

[139] *Smeaton, C., Austin, W. and Turrell, W.R. (2020). Re-Evaluating Scotland's Sedimentary Carbon Stocks. Scottish Marine and Freshwater Science Vol 11 No 2, 16pp.*
[140] *Diesing, M., Kröger, S., Parker, R., Jenkins, C., Mason, C. and Weston, K. (2017). Predicting the standing stock of organic carbon in surface sediments of the North–West European continental shelf. Biogeochemistry, 135, pp.183-200.*
[141] *Burrows, M.T., Hughes, D.J., Austin, W.E.N., Smeaton, C., Hicks, N., Howe, J.A., Allen, C.,Taylor, P. & Vare, L.L.(2017). Assessment of Blue Carbon Resources in Scotland's Inshore Marine Protected Area Network. Scottish Natural Heritage Commissioned Report No. 957.*

As presented in Section 8.5.2.2 of Chapter 8: Water and Sediment Quality, a total of 65 samples were analysed for Total Organic Carbon (TOC) during site-specific surveys in between September and October 2023. Within the OAA, TOC ranged from below level of detection (< LoD) to 1.47 mg/1. TOC at stations along the OECC was < LoD in 15 of the 32 samples analysed, with a maximum concentration of 1.24 mg/1.

Any habitat loss or disturbance from the placement of infrastructure will be minimal, based on the localised spatial change and low frequency of disturbance / loss expected to occur through the life-cycle of the Offshore Site. The footprint of temporary habitat loss / disturbance during the construction phase is 1.03km^2 and the footprint of long-term loss or damage during the operation and maintenance phase is 1.7km^2 (see Chapter 9: Benthic Ecology).

As explained above, and in Chapter 9 Benthic Ecology, no direct disturbance is expected to occur on maerl beds as the Project has been designed to avoid all known maerl beds.

Abrasion of the seabed has the potential to remineralise organic carbon into CO_2. However, any disturbance of the seabed that results in an increase in Suspended Sediment Concentrations (SSC) with subsequent deposition will be over a brief duration only. It is not possible to quantify the potential carbon lost due to sediment disturbance. However, it is noteworthy that the introduction of artificial structures has the potential to result in a source of carbon input, where organic material collects on structures, then dies and is assimilated into seabed sediments as carbon matter. The presence of structures in the marine environment may result in modified sediment dynamics. However, this was assessed as not significant in Chapter 7 Marine Physical and Coastal Processes.

The temporary habitat loss / disturbance footprint is inclusive of dredging and disposal of sediments (see Chapter 9 Benthic Ecology). As stated in Section 5.6.1.2.1, prior to commencing rock placement at the gravity-based structure fixed-bottom foundations (GBS) foundation locations, some locations may require removal of the soft superficial sediments around the stonebed placement areas. Dredging to excavate the seabed will be undertaken using a trailing suction hopper dredger (TSHD), which sucks mud, sand, clay and gravel from the seabed. The TSHD stores the dredged material in its own hopper. Dredged material will be disposed of at one of two identified disposal sites, please see Figure 5-3 of Chapter 5 of this EIAR for locations of dredged storage material (subject to approval by a Dumping at Sea Permit). The relevant Dumping at Sea permits, as required by the Dumping at Sea Act 1996, have been initiated and will be obtained prior to any dredging and discharging activity. The inorganic and organic carbon content of the sediment types at the Offshore Site is detailed in Table 30-12 above. As identified in Section 5.6.1.2.1, there will be approximately 150,000m^3 of dredged material generated as part of the construction phase of the Project, that will be subsequently disposed of at one of two identified disposal sites at the Offshore Site.

Overall, taking the localised nature of any seabed disturbance associated with the Project (including from dredging and disposal activities), and the absence of key blue carbon ecosystems at the Offshore Site, the Project is expected to result in a negligible loss of blue carbon stores or release of carbon due to any direct disturbance of marine ecosystems. Please refer to Section 30.4.2.3 below for further details on carbon losses associated with the Offshore Site.

30.4.1.2 Onshore Site

30.4.1.2.1 *Introduction*

Onshore biogenic carbon refers to the carbon stored in soil, wetlands, and vegetation such as peatlands, grasslands and forests. Biogenic carbon is absorbed from the atmosphere during photosynthesis and is either respired by plants or stored more permanently in the terrestrial biosphere. There is a myriad of factors that influence the rate of carbon sequestration in terrestrial ecosystem, including climate, soil type, and land-use.

Peatlands cover only 3% of the Earth's land surface but store about 15–30% of the world's soil carbon as peat[142,143]. In Ireland, peat soils cover approximately 1.46 million ha or 20% of the land surface and store approximately 2.3 billion tonnes of carbon[144]. The total sequestration capacity of Irish grassland soils has been shown to contain large stores or stocks of carbon, approximately 440 tCO_2/ha or an estimated 1,800 $MtCO_2$ across all Irish mineral soils. To put this into context, national greenhouse gas emissions are about 60 Mt per year, and so Irish mineral soils store approximately 30 years' worth of emissions.[145]

Peatlands are estimated to sequester carbon at a rate of 20 to 30 $gC/m^2\,yr$[146,147], making them crucial ecosystems for moderating atmospheric CO_2 concentrations. The estimated global average for the apparent carbon accumulation rate in peatlands ranges from 0.12 to 0.31 t C/ha yr.

The construction of infrastructure on bog and peat habitats may affect the natural hydrological regime, thus exposing and drying out the peat and allowing the decomposition of carbon. The carbon balance of wind farm developments and associated infrastructure in peatland habitats has attracted significant attention in recent years. When developments are proposed for peatland areas, there will be direct impacts and loss of peat in the area of the development footprint. There may also be indirect impacts where it is necessary to install drainage in certain areas to facilitate construction, or from the reinstatement of extracted peat. The works can either directly or indirectly allow the peat to dry out, locally, which permits the full decomposition of the stored organic material with the associated release of the stored carbon as CO_2. It is essential therefore that any development in a peatland area saves more CO_2 than is released.

30.4.1.2.2 Methodology

The existing data sets and literature with relevant coverage to the Onshore Site, which have been used to inform the Biogenic onshore carbon assessment are outlined in Table 30-13. Peatlands have been known to be an important habitat for thousands of years, with continued monitoring and restoration studies taking place at a variety of locations around Ireland.

Table 30-13 Summary of key datasets and reports

Title	Source	Year	Author
EPA Report No. 401 Peatland Properties Influencing Greenhouse Gas Emissions and Removal	https://www.epa.ie/publications/research/climate-change/Research_Report_401.pdf	2022	Florence Renou-Wilson, Kenneth A. Byrne, Raymond Flynn, Alina Premrov, Emily Riondato, Matthew Saunders, Killian Walz and David Wilson
EPA Report No. 422 Soil Organic Carbon and Land Use Mapping (SOLUM)	https://www.epa.ie/publications/research/climate-change/Research_Report_422.pdf	2022	Matthew Saunders, Gabriela Mihaela Afrasinei, Jesko Zimmerman, Alina Premrov, Kevin Black and Stuart Green

[142] *Biogeosciences, 5 (2008) Peatlands and the carbon cycle: from local processes to global implications – a synthesis.* <https://doi.org/10.5194/bg-5-1475-2008>
[143] *Water Resoure (2020) Centennial-scale shifts in hydrophysical properties of peat induced by drainage*
[144] *Opening Statement for the Public Session of the Joint Committee on Agriculture and the Marine on the Subject of Rewetting of Peatlands and the Impact on Drainage for Surrounding Farmland* <https://data.oireachtas.ie/ie/oireachtas/committee/dail/33/joint_committee_on_agriculture_and_th e_marine/submissions>
[145] https://www.teagasc.ie/environment/climate-change--air-quality/signpost-programme/research-updates/soil-carbon-sequestration/
[146] *Northern Peatlands: Role in the Carbon Cycle and Probable Responses to Climatic Warming*
[147] *Estimating carbon accumulation rates of undrained mires in Finland–application to boreal and subarctic regions.*

Extent & Utilisation of Irish Peatlands	https://www.ipcc.ie/a-to-z-peatlands/irelands-peatland-conservation-action-plan/peatland-action-plan/extent-utilisation-of-irish-peatlands/	2009	Malone, S. and O'Connell, C
SoilC-Measurement and modelling of soil carbon stocks and stock changes in Irish soils	https://www.epa.ie/publications/research/land-use-soils-and-transport/STRIVE_35_Kiely_SoilOrganicC_syn_web.pdf	2009	Kiely, Ger *et al.,*
Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories, Volume 4: Agriculture, Forestry and Other Land Use, Chapter 7 Wetlands	https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_07_Ch7_Wetlands.pdf	2006	Dominique Blain, Clark Row, Jukka Alm, Kenneth Byrne, and Faizal Parish

The assessment for onshore Biogenic carbon is undertaken following the principles set out in EIAR Chapters 20 to 31, and Chapter 4 Environmental Impact Assessment Methodology. The sensitivity of receptor is combined with the magnitude to determine the impact significance. Topic-specific sensitivity and magnitude criteria are assigned based on professional judgement, as described in Table 30-10 and 30-11 above.

30.4.1.2.3 Results

Peatlands have been known to be an important habitat for thousands of years, however 80% of Irish peatlands have been damaged or degraded to various extents as a direct result of anthropogenic activities, with current climate projections indicating that 40% of suitable climatic areas for peatlands in Ireland will be lost by 2075[148].

The Onshore Site is primarily situated on agriculture land, the public road network, with small areas of peatland, i.e., cutover bog and blanket bog, covering two sections of the OGC. Peat was encountered during site surveys by Hydro-Environmental Services (HES), MKO, and Irish Drilling Limited (IDL). Peat is a key carbon sequestering vegetation.

The OGC is partially situated on peat habitats, please note, the area covered by peat varies due to changes in peat depths, therefore, the loss of carbon stored in the peat is assessed in this section of the EIAR. The excavation of peat will be required in two sections in order to construct the OGC. In order to minimise the volume of peat excavations arising, sections of the grid connection route located in peatland will be Horizontal Directionally Drilled (HDD). As detailed in Section 5.3.2.5 of Chapter 5 of this EIAR, estimated peat volume to be excavated and subsequently reinstated is 1,392m^3.

Based on the above, the greenhouse gas emissions associated with the extraction and reinstatement of peat as part of the Project will be **580 tonnes CO_2eq**.

[148] *Jones, H.P., Hole, D.G. & Zavaleta, E.S. (2012) Harnessing nature to help people adapt to climate change*

30.4.2 Non-Biogenic Carbon Assessment

30.4.2.1 Background

All industries, including the renewable energy industry, emit greenhouse gases[149]. However, renewable energy projects can mitigate their greenhouse gas emissions by replacing other, more carbon-intensive forms of electricity generation.

This section contains assessment of:

- The carbon lifecycle emissions resulting from construction (including pre-construction activities), operation and maintenance, and decommissioning phases of the Project in terms of carbon dioxide equivalent (CO_2e) emissions (Section 30.4.2.4). These emissions result from:
  - Embodied carbon, i.e. emissions of CO_2e incurred from the production of materials (raw material acquisitions, material refinement, manufacturing); and
  - Direct emissions due to the combustion of fuel (e.g. component transportation; vessels, vehicles and equipment use across all phases of the Project);
- The estimated CO_2e emissions which the Project will avoid due to the displacement of other more carbon-intensive forms of electricity generation (Section 30.4.2.4);
- The carbon intensity of electricity generated by the Project (Section 30.4.2.4);
- The operational duration of the Project required to 'pay back' the emissions resulting from construction, operation and maintenance, and decommissioning phases (the 'payback period') (Section 30.4.2.4.1); and
- The impact of the Project on the global climate, using the Irish Carbon Budget as a proxy (Section 30.4.2.4).

This carbon assessment is based on best available information at time of conducting this assessment.

30.4.2.1.1 *Project Design Parameters*

The design for the Project is as described in EIAR Chapters 5 to 31. Emissions associated with each component were assessed across all relevant phases (i.e. construction (including pre-construction), operational and maintenance, and decommissioning) and collated to identify a representative scenario for assessment.

A summary of the inputs used in the assessment is presented in Table 30-14. Vessel and vehicle movements are also considered in the non-biogenic carbon assessment for the construction, operation and maintenance, and decommissioning phases (see Sections 30.4.2.3.3 to 30.4.2.3.5).

Table 30-14 Summary of the inputs used in the embodied carbon assessment

Parameter	Value
Offshore	
Maximum Export Capacity (MEC) (MW)	450
Wind Turbine Generator (WTG) tip height	324.9m
WTG rotor diameter	292m

[149] *"Greenhouse Gases are the gases in the atmosphere which trap heat. In this carbon assessment a focus is on anthropogenic greenhouse gas emissions, namely CO_2, N_2O and CH_4 (summed as CO_2e) which increase the natural greenhouse effect".*

WTG foundation	GBS
Number of WTG	30
OEC (total length)	63.5km
Inter-array cables (IAC) and inter-connector cables (total length)	73km
OSSs	One (containing 2.8 t SF_6)
OSS foundation	GBS
Cable protection	Cast iron shell: ○ IAC – 73km ○ OEC – 14.5km Rock berm: ○ IAC – 73km ○ OEC – 13.6km
Rock placement (Foundations and cable protection)	5,841,932 t
Onshore	
OGC (total length)	22.3km
EirGrid/ESB 220kV Gas Insulated Switchgear (GIS) building	One (containing 2.5 t SF_6)
Cable transition joint bays	43 (15 m^3 concrete bays)
Access roads	4km

30.4.2.2 Methodology

Assumptions, where made to supplement available Project information, are conservative and therefore, assessment results are also considered conservative. The assessment was undertaken using the Xodus inhouse Carbon Assessment Tool, which calculates and attributes emissions in line with the guidance and methods outlined by The Carbon Trust (2024)[150,151] for the construction and operation and maintenance phases of the Project.

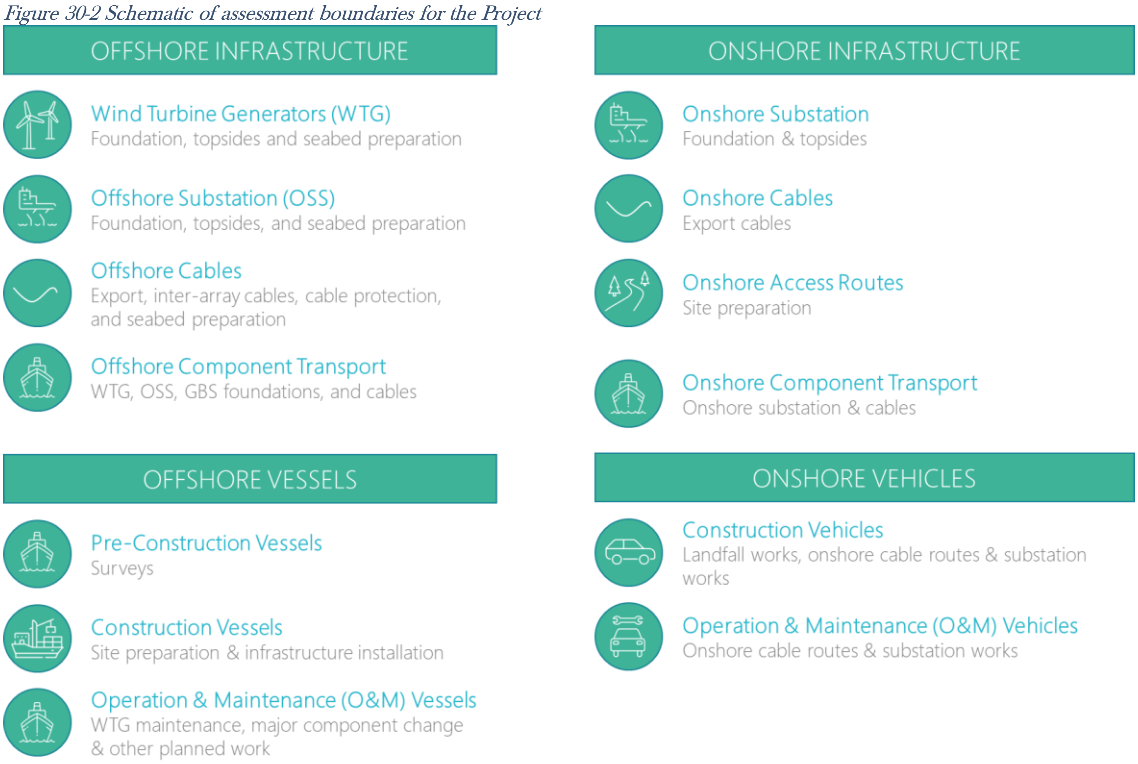
Given the phase of development of the Project, a precautionary approach has been applied to the materials used on the Project. Where known, source location of these components and estimates for shipping and installation durations have been used, otherwise assumptions have been made based upon the Project location. The assessment boundaries, which define the scope of the assessment, comprise the Project boundary (Figure 30-2) and all components therein, including both offshore and onshore activities.

[150] *Carbon Trust (2024). Offshore wind industry product carbon footprinting guidance. Available online at: https://www.carbontrust.com/our-work-and-impact/guides-reports-and-tools/standardising-offshore-wind-carbon-footprinting*
[151] *Norton, D., Hynes, S., and Boyd, J. (2018). Valuing Ireland's Blue Ecosystem Services. Available online at: https://www.universityofgalway.ie/media/researchsites/semru/files/marine_ecosystem_service_non_technical_report_final.pdf [Accessed 04/10/2023].*

Decommissioning is also considered. With regard to the decommissioning phase, for a typical offshore wind farm, up to 90% of the material may be recycled[152].

Further information on assumptions is provided in Appendix 30-1.

Figure 30-2 Schematic of assessment boundaries for the Project



An assessment of the impact from the results of the carbon assessment has been undertaken per the methodology outlined in Section 30.4.2.2.1 below.

[152] *Spyroudi, A. (2021). Carbon footprint of offshore wind farm components. Available online at:: https://ore.catapult.org.uk/wp-content/uploads/2021/04/Carbon-footprint-of-offshore-wind-farm-components_FINAL_AS-3.pdf*

30.4.2.2.1 Defining Magnitude and Sensitivity

The IEMA 2022 Guidance (2022)[153] states that:

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

In the absence of sector-based, or local emissions budgets, the Carbon Budgets (detailed in Section 30.2.2 above and in Appendix 30-1) can be used to contextualise the level of significance. As per IEMA (2022)[138] guidance, all greenhouse gas emissions are classed as having the potential to be significant as all emissions contribute to climate change. However, as per the IEMA 2022 Guidance, it is standard practice to exclude minor sources of emission as these can be considered immaterial in practice. Inventories that exclude these minor sources are still considered complete. The exclusion of emission sources that contribute less than 1% of a given emissions inventory is based on a '*de minimis*' (relatively minimal) contribution[154].

On this basis, where emissions from the Project are greater than 1% of the relevant Carbon Budgets the impact of the Project on the climate is considered to be major. This is summarised in Table 30-15, Table 30-16, and Table 30-17 below.

Currently, there is no published standard definition for receptor sensitivity of greenhouse gas emissions. The global climate has been identified as the receptor for this assessment. The sensitivity of the climate to greenhouse gas emissions is considered to be 'high'[155]. The rationale supporting this includes:

- Any additional greenhouse gas impacts could compromise Ireland's ability to reduce its greenhouse gas emissions, and therefore the ability to meet future carbon targets; and
- The importance of meeting the Paris Agreement goal of limiting global average temperature increase to well below 2°C above pre-industrial levels. Additionally, a recent report by the IPCC highlighted the importance of limiting global warming below 1.5°C[156].

Table 30-15 Magnitude criteria for impact assessment

Magnitude	Magnitude Criteria Description
Beneficial reduction	Estimated emissions equate to a reduction of >0.1% of total emissions across the relevant five-year Carbon Budget period in which they arise.
Negligible change	Estimated emissions equate to ± 0.1% of total emissions across the relevant five-year Carbon Budget period in which they arise.
Small increase	Estimated emissions equate to between 0.1 and 1% of total emissions across the relevant five-year Carbon Budget period in which they arise.
Large increase	Estimated emissions equate to >1% of total emissions across the relevant five-year Carbon Budget period in which they arise.

[153] *IEMA (2022). Assessing Greenhouse Gas Emissions and Evaluating their Significant, 2nd Edition. Available online at:* https://www.iema.net/resources/blog/2022/02/28/launch-of-the-updated-eia-guidance-on-assessing-ghg-emissions
[154] BS EN ISO 14064-1:2019. (2019) Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals.
[155] *IEMA (2022). Assessing Greenhouse Gas Emissions and Evaluating their Significant, 2nd Edition. Available online at:* https://www.iema.net/resources/blog/2022/02/28/launch-of-the-updated-eia-guidance-on-assessing-ghg-emissions
[156] *IPCC (2021). Weather and Climate Extreme Events in a Changing Climate. In Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.*

Table 30-16 Consequence matrix for impact assessment

Magnitude Of Emissions	Sensitivity Of Receptor: High
Beneficial reduction	Beneficial
Negligible change	Minor beneficial / adverse
Small increase	Moderate adverse
Large increase	Major adverse

Table 30-17 Carbon Budget[157] (Climate Change Advisory Council, 2021)

Budget	Carbon Budget (Million Tonnes Co_2e)	% Reduction Below Base Year (2018)
1st Carbon Budget (2021 to 2025)	295	4.8 % by 2025
2nd Carbon Budget (2026 to 2030)	200	35 % by 2030
3rd Carbon Budget (2031 to 2035)	151	51% by 2035

30.4.2.3 Carbon Losses – Emissions Inventory

The emissions inventory for the Project is divided into three phases: construction (including pre-construction activities), operation and maintenance, and decommissioning. Each of these phases is subdivided into a category, a component, and an activity or material. For example, CO_2e emissions associated with the steel used in the manufacture of the WTG would be captured as shown in Figure 30-3.

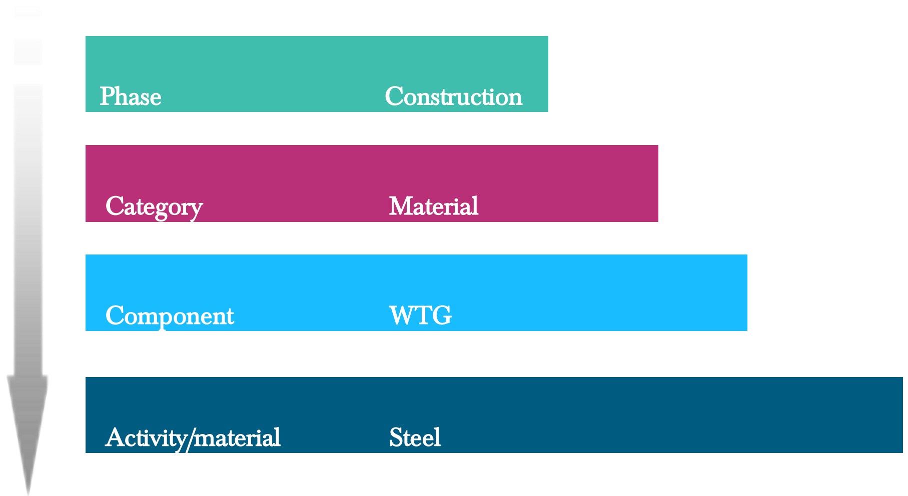


Figure 30-3 Process for identifying component materials

Each activity or material has an assigned unit of measurement and an associated emission factor. The primary data sources used to inform the assessment, in addition to those detailed in Section 30.2.4 above, include:

157 Climate Change Advisory Council (2023) Annual Review. <https://www.climatecouncil.ie/councilpublications/annualreviewandreport/>

- Bath Inventory of Carbon and Energy (ICE) [Embodied carbon for standard materials and processes][158];
- IP 2000 [Standardised vessel fuel use];
- Digest of UK Energy Statistics (DUKES) [Emission factors for generation sources; most recent version e.g. 2023]; and
- DEFRA Greenhouse Gas reporting: conversion factors 2024.

The details provided in the following sections set out the activities and materials accounted for with respects to each component and/or system within each phase of the Project.

The information upon which the assessment is based, with supplementary assumptions, calculations and results is presented in the following sections.

30.4.2.3.1 Consideration of Data Sources and Quality

To conduct the assessment, the information contained within the project design has been supplemented with conservative assumptions and industry standard references.

While the Sustainable Energy Authority of Ireland (SEAI) has only published a provisional value for the carbon intensity of the Irish national grid in 2023, this is the most robust information available in an Irish context to utilise for this assessment. This assessment makes no assumptions around future decarbonisation. It is expected that decarbonisation may occur, for example relating to vehicle use associated with the Project, or in manufacturing practices e.g. steel production[159]. Such initiatives would be expected to reduce emissions associated with the Project, and therefore the payback period.

30.4.2.3.2 Embodied Carbon Sources

Materials and masses were provided by Corio based on preliminary design information. Embodied carbon in the context of the Project relates to the emissions associated with procuring, mining, and harvesting raw materials, the transformation of those materials into construction products, transporting them to the site, installation of these materials during a construction phase, and the subsequent replacement, removal, and disposal of these materials upon decommissioning. Where specific manufacturing detail was unavailable, embodied carbon has been attributed to the same year in which shipping and/or installation is anticipated to occur.

Systems considered within the assessment align with the boundaries shown in Figure 30-2 above.

Sources of embodied carbon associated with Offshore Site infrastructure consist of:

- 30 WTG, including nacelle, tower, and blades:
  - Blades – 3 x 85 t (Corio)
  - Nacelle – 1,200 t (Corio)
  - Tower – assumed to be 1,674 t (NREL reference design).
  - Material composition (steel, plastic, copper, aluminium, and fibreglass) estimated based on a Vestas WTG of similar specification (Allekotte & Garrett, 2024).
- 31 GBS Foundations:
  - 30 WTG + 1 Offshore 220kV Electrical Substation (OSS);
  - Composition and weights;
    - Total concrete – 11,411 t
    - Steel – 982 t
    - Sand (ballast) – 8,650 t

[158] *This inventory predominantly pulls from international data sources. Given that the Project is expected to source many components from outside Ireland, the inventory data within this report are considered appropriate and fitting for calculations undertaken.*
[159] *Publications Office of the European Union, Luxembourg (2022).Technologies to decarbonise the EU steel industry,*

- OSS:
  - OSS topside (2,600 t) assumed to be composed entirely of carbon steel;
  - Contains 2.8 t SF_6
    - Assumes no leakage of SF_6;
- Offshore cables:
  - Cable types, total cable lengths, and estimates for cable weights were provided by Corio:
    - IAC – Aluminium core, 73.0km length, 80 kg/m;
    - OEC – Aluminium core, 63.5km length, 100 kg/m;
    - Assumed to be Cross-Linked Polyethylene (XPLE) submarine cables, with major materials of copper, steel and polyethylene (plastic).
- Rock placement and cable protection:
  - Details of rock placement (seabed preparation and cable protection) supplied by Corio:
    - Granite rock placement – 2,545,591m^3
      - Assumed granite density of 2,700kg/m^3
    - Cast iron cable protection – 21,850 t.
      - IAC – 73km
      - OEC – 14.5km
      - Assumed armour density of 250kg/m

Sources of embodied carbon associated with Onshore Site infrastructure consist of:

- Onshore components:
  - Cable types, total cable lengths, and estimates for cable weights, cable joint bay specifications, and the length of access roads required were provided by Corio:
    - OGC (from the OLL to Moneypoint) – Copper core, 22.4km length, 100 kg/m;
      - 19.3km from the transition joint bay (TJB) to the OCC
      - 3km from the OCC to Moneypoint
    - Assumed to be Cross-Linked Polyethylene (XPLE) onshore cables, with major materials of aluminium, copper, steel and polyethylene (plastic).
  - Cable joint bays – 43 no. x 15m^3 concrete bays
    - Assumed concrete density of 2.38 t/m^3
  - Gravel access roads – 4km
    - Assumed road width of 4 m, and a depth of 0.3m;
    - Roads will be of aggregate construction
- OCC main components:
  - Asphalt coverage – 3,500m^2
    - Assumes 0.5 m aggregate depth topped with 0.3m asphalt
  - Onshore GIS:
    - GIS assumed to be 10,000 t of carbon steel
    - Contains 2.5 t SF_6
    - Assumes no leakage of SF_6;

30.4.2.3.3 Construction Phase Carbon

Sources of CO_2e during the construction phase of the Offshore Site encompasses:

- The embodied carbon of the offshore components;
- The vessels used in offshore transport from the fabrication site to the offshore Project, with ports of origin and transit distances provided by Corio;
- Pre-construction vessel activity:
- Site preparation activity including surveys and seabed preparation;

- All offshore vessel construction activity;
- Vessel fuel consumption assumed present day values, without decarbonisation as construction activities will occur in the relative near term; and
- Vessel activity aligns with that presented in Section 5.4.1.1.1 of Chapter 5 Project Description of this EIAR.

Sources of CO_2e during the construction phase of the Onshore Site encompasses:

- The embodied carbon of the onshore components;
- All onshore construction vehicles;
  - Vehicle fuel consumption assumed present day values, without decarbonisation as construction activities will occur in the relative near term; and
  - Vehicle activity aligns with that presented in Section 29.4 of Chapter 29 Traffic and Transportation of this EIAR.

As stated in Section 14.5.2.2 and 14.6.2.1.1 of Chapter 14 Shipping and Navigation, activities associated with the construction phase of the Offshore Site may displace existing routes/activity of third-party vessels. The displacement of existing vessel traffic in the Offshore Site, e.g. through implementing advisory safe clearance distances from construction vessels, has the potential to increase exhaust emissions from third-party vessels, although any additional emissions will likely be negligible.

All carbon losses associated with the construction phase are detailed below in Table 30-19 in Section 30.4.2.3.6.

30.4.2.3.4 Operation and Maintenance phase Carbon

Vehicle/vessel assumptions for routine operation and maintenance phase activities for both the onshore and offshore aspects are detailed in Section 5.7 in Chapter 5: Project Description. It has been assumed that any operational phase activity will not begin until after the Project is fully operational.

Both planned and unplanned maintenance will be required during the operational lifespan of the Project. Planned maintenance may include activities such as routine inspection and upkeep of assets and component replacements, whereas unplanned maintenance covers fault rectification and unexpected repairs.

It is assumed that each year, on average, approximately 5% of major components would require replacement (with associated shipping to site). Major components include blades, transformers, generators, main bearings, blade bearings, converters and gearboxes.

Offshore vessel usage is considered a predominant source of emissions during the operation and maintenance phase of the Project. Table 30-18 compares two operational phase emission scenarios. These estimates respectively assume a no decarbonisation scenario, and a linear vessel decarbonisation rate from current emission levels to net zero close to 2050 in line with IMO ambitions[160]. This comparison is solely for illustrative purposes, with all calculations conservatively assuming no vessel decarbonisation during the Project's operational lifetime.

Table 30-18 Impact of offshore vessel decarbonisation assumptions during the operation and maintenance phase

Decarbonisation Scenario	Total Vessel CO_2e
No vessel decarbonisation (tCO_2e)	189,600
Vessel decarbonisation (tCO_2e)	74,856

[160] *2023 IMO Strategy on Reduction of Greenhouse Gas Emissions from Ships.*

As stated in Section 14.6.2.1.1 of Chapter 14 Shipping and Navigation, activities associated with the operation and maintenance phase of the Offshore Site may displace existing routes/activity of third-party vessels. During the operation and maintenance phase, the minimum spacing between WTGs (1,017 m) is sufficient for safe and easy passage throughout the OAA by all maintenance and monitoring vessels and all identified third party vessels. Therefore, there will be little to no displacement of vessel traffic in the Offshore Site during the operational phase to lead to increased greenhouse gas emissions from exhaust emissions; any additional emissions will likely be negligible.

Onshore vehicle emissions associated with the operation and maintenance phase of the Project are expected to be minimal in comparison to offshore vessel emissions.

SF_6 is a greenhouse gas which has been used for insulation in high voltage switchgears and in electricity substations. It is estimated that around 80% of the SF_6 used globally is used in electricity transmission[161]. SF_6, is an extremely potent fluorinated greenhouse gas with a GWP[162] of 22,800[163]. For this assessment and to align with the precautionary principle, it has been assumed that the OSS and GIS of the Project will use SF_6. However, the Project may substitute SF_6 with another insulating material, should suitable alternatives become available in future.

All carbon emissions associated with the operation and maintenance phase are detailed below in Table 30-19.

30.4.2.3.5 Decommissioning Phase Carbon

Decommissioning considers the decommissioning and removal of infrastructure at the end of the Project's lifetime. The details of the approach to decommissioning for the Offshore Site are provided in Section 5.8 of Chapter 5 Project Description of this EIAR and in Section 30.6.4 below.

Please note, as stated in Section 14.5.2.2 and 14.6.2.1.1 of Chapter 14 Shipping and Navigation, activities associated with the decommissioning phase of the Offshore Site may displace existing routes/activity of third-party vessels. The displacement of existing vessel traffic in the Offshore Site, e.g. through implementing advisory safe clearance distances from decommissioning vessels, has the potential to increase exhaust emissions from third-party vessels, although any additional emissions will likely be negligible.

Decommissioning will occur following a four-year construction phase, and 38-year operational life. A value of 1.2% of the total emissions associated with the constructions phase of the Project was used to estimate the emissions associated with decommissioning phase. This aligns with Thomson and Harrison (2015)[164].

30.4.2.3.6 Summary of Non-Biogenic Carbon Emissions

The final calculated non-biogenic CO_2e emissions from the Project are presented in Table 30-19 below and graphically in Figure 30-4 and Figure 30-5. The majority of CO_2e emissions are associated with embodied carbon and vessel activity of the construction phase, accounting for approximately 74.5% of all non-biogenic carbon emissions. Non-biogenic emissions during the operation and maintenance phase of the Project, in comparison, represent around 24.7% of emissions.

Table 30-19 Non-Biogenic CO_2e emissions from the Project

---

[161] https://www.nationalgrid.com/stories/energy-explained/what-is-sf6-sulphur-hexafluoride-explained
[162] GWP is a comparison of the ability of each greenhouse gas to trap heat in the atmosphere. The chosen reference gas is carbon dioxide for consistency with the IPCC guidelines. 1 kg of SF6 has the GWP of 22,800 kg of CO_2.
[163] Department for Environment, Food and Rural Affairs (DEFRA) (2023). Calculate the carbon dioxide equivalent quantity of an F gas. <https://www.gov.uk/guidance/calculate-the-carbon-dioxide-equivalent-quantity-of-an-f-gas>
[164] Thomson, R.C. and Harrison, G.P. (2015). Life Cycle Costs and Carbon Emissions of Offshore Wind Power <https://www.climatexchange.org.uk/media/1461/main_report_life_cycle_costs_and_carbon_emissions_of_offshore_wind_power.pdf>

Phase		Non-Biogenic $CO_{2}e$ (t)
Offshore		
Embodied carbon, shipping, & installation	Pre-construction vessel emissions	65,039
	GBS foundations	132,151
	WTG	396,811
	Offshore cables	61,074
	OSS	12,959
	Rock placement	731,569
	Component transport from fabrication sites	28,922
	Construction vessel emissions	244,207
Offshore operation and maintenance phase	Vessel emissions (excluding replacement shipping)	169,864
	Replacement components (embodied carbon and shipping) - total	371,576
Offshore Total		**2,214,172**
Onshore		
Embodied carbon, shipping, & installation	Cable grid	7,923
	Peat removal[165]	580
	Onshore compound	34,857
	Construction vehicle emissions	2,982
Onshore operation and maintenance phase	Vehicle emissions total	4,821
	O&M emissions (Scope 2) - total	2,009
Onshore Total		**53,172**
Overall Project		
Decommissioning		**20,629**
TOTAL PROJECT EMISSIONS		**2,287,973**

[165] *Although peat removal constitutes a biogenic carbon source, it was accounted for within the Non-Biogenic Carbon Assessment to more accurately inform the calculation of carbon intensity and payback period and provide additional context.*

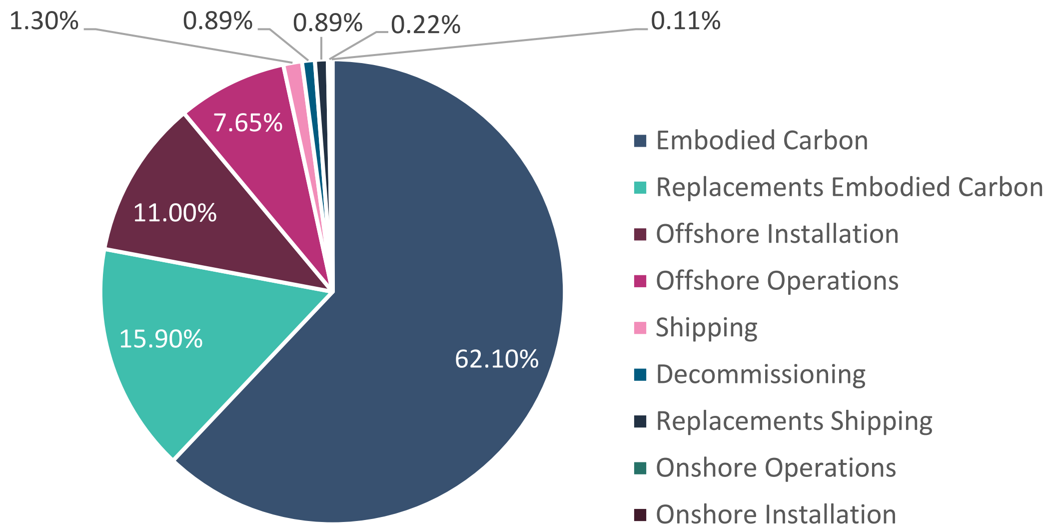


Figure 30-4: Breakdown of Non-Biogenic CO_2e emissions by Project phase

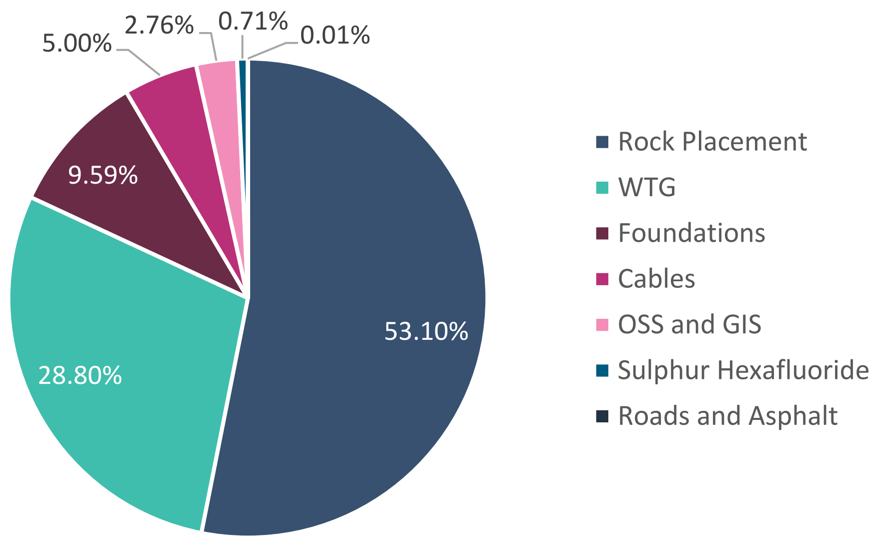


Figure 30-5 Breakdown of Non-Biogenic CO2e embodied carbon emissions

30.4.2.4 Carbon Savings

To establish the reduction in CO_2e emissions attributable to the Project, the potential carbon savings of the Project, i.e., the CO_2e avoided by the Project, have been estimated. This has been calculated by comparing the CO_2e emissions that would be generated from other forms of electricity generation, under the assumption that electricity generated by the Project will displace the requirement for generation from these other sources from the national grid.

Annual electricity production (MWh per annum) is calculated as the product of MEC (MW) multiplied by the capacity factor (%), multiplied by the number of hours in a year. To calculate total electricity production, annual electricity production is summed over the number of years of operations.

To calculate electricity production for the Project, the following assumptions were made:

- A capacity factor of 51%[166] i.e. a fractional correction accounting for the intermittent nature of the wind, and anticipated downtime of the WTGs such as required for maintenance, etc. has been used for the Project;
- A four-year offshore construction period, beginning in 2026, with the Project producing electricity upon completion of construction, with a one-year commissioning period planned for 2029 during which full-capacity generation will occur.

A summary of the annual generation and the total generation over the 38-year operational lifetime of the Project is shown in Table 30-20.

Table 30-20 Electricity production

Years Of Operation	Number Of Years	Electricity Production (MWh)
2029 – 2067	38	2,010,420 (annual)
Total MWh generation over the operation and maintenance phase		***76,395,960***

30.4.2.4.1 Carbon Intensity and Payback

The carbon intensity of the Project is a measure of the emissions generated per unit of electricity produced. This figure is influenced by the Project phases included within the calculation and the scope of the assessment. Carbon intensity is calculated as:

$$Carbon\ intensity\ (gCO_2e/kWh) = \frac{Emissions\ (gCO_2e)}{Electricity\ production\ (kWh)}$$

where:

- Emissions are calculated per phase and summed for the Project phase(s) under consideration; and
- Electricity production is calculated annually and summed for the operational lifetime of the Project (Table 30-20).

$$Carbon\ intensity\ \left(\frac{gCO2e}{kWh}\right) = \frac{(2.287973E+12)\ gCO2e}{76{,}395{,}960{,}000\ kWh}$$

[166] *Eirgrids Enduring Connection Policy for Offshore West* https://cms.eirgrid.ie/sites/default/files/publications/ECP-2.3-Solar-and-Wind-Constraints-Report-Assumptions-and-Methodology-v1.1.pdf

$$Carbon\ intensity = 29.9\ gCO2e/kWh$$

The total carbon intensity associated with the Project, including embodied carbon and the construction phase was calculated to be 29.9 gCO_2e/kWh. This accounts for the total Project emissions, over the entire lifecycle of the Project, equating to 2,287,973 tCO_2e (2.287973E+12 gCO_2e) stated in Table 30-19 and the total MWh generation over the operation and maintenance phase of 76,395,960 MWh (76,395,960,000 kWh) (Table 30-20).

If only the operational phase of the Project is considered[167], this is associated with 548,270 tCO_2e of emissions (Table 30-19). Utilising the total MWh generated over the operation and maintenance phase (Table 30-20 above), the carbon intensity of the electricity generated is calculated to be 7.18 gCO_2e/kWh.

As of 2023, the net marginal carbon intensity of electricity production for Ireland, including existing renewable energy sources, was 229.9g CO_2e/kWh[168]. For comparison, the carbon intensity associated with coal and gas was 340.6gCO_2e/kWh and 251.9gCO_2e/kWh respectively in 2023[169]. The calculated carbon intensity of the Project is consistent with assertions that renewable energies typically exhibiting lifecycle emissions that are an order of magnitude lower than fossil-fuel technologies[170]. Estimates of lifecycle offshore wind carbon intensities have produced interquartile ranges of 8 to 35 gCO_2e/kWh with a median of 12gCO_2e/kWh[171]. The calculated carbon intensity for the Project is conservatively estimated, resulting in a carbon intensity greater than the median, but nonetheless within these estimates.

The CO_2e emissions displaced from the national grid over the proposed 38-year lifetime of the development are calculated as follows:

$$CO_2e\ emissions\ displaced\ (tCO_2e) = electricity\ eneration\ over\ the\ operational\ phase\ (kWh) \times carbon\ intensity\ of\ the\ grid\ (tCO_2e/kWh)$$

$$CO_2e\ emissions\ displaced\ (tCO_2e) = 76{,}395{,}960{,}000\ kWh \times 0.0002299\ tCO_2e/kWh$$

$$CO_2e\ emissions\ displaced\ (tCO_2e) = 17{,}563{,}431$$

Therefore, **17.56 million tonnes** of CO_2e emissions will be displaced from the national grid over the entire lifecycle of the Project. This represents **767.6%** of the total amount of CO_2e emissions associated with the Project over its lifetime.

The payback period for the Project (a cumulative calculation of emissions and displaced emissions over time to identify the point in the Project operations phase when more CO_2e emissions have been displaced than produced) was calculated by comparing emissions associated with the Project's electricity generation with 2023 grid carbon intensity of 229.9g CO_2e/kWh[172].

---

[167] Published grid predictions of carbon intensity only include emissions associated with the operational phase of electricity generation and exclude any emissions associated with construction or decommissioning.
[168] SEAI Webpage <https://www.seai.ie/data-and-insights/seai-statistics/conversion-factors/>
[169] Ibid.
[170] UNECE (2021). Carbon Neutrality in the UNECE Region: Integrated Life-cycle Assessment of Electricity Sources. <https://unece.org/sites/default/files/2022-04/LCA_3_FINAL%20March%202022.pdf>
[171] Schlömer S., T. Bruckner, L. Fulton, E. Hertwich, A. McKinnon, D. Perczyk, J. Roy, R. Schaeffer, R. Sims, P. Smith, and R. Wiser (2014). Annex III: Technology-specific cost and performance parameters. In: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
[172] SEAI Webpage <https://www.seai.ie/data-and-insights/seai-statistics/conversion-factors/>

The Project payback period is approximately three years following full commissioning. However, the payback period assessment is highly sensitive to the assumptions made about the carbon intensity of the grid electricity displaced by the Project and it is suggested that the carbon intensity of the Project is a more meaningful comparator.

Within a local context, for both County Galway and County Clare, the Project provides an opportunity to displace emissions arising from both counties, The Project will displace approximately 462,196 tonnes of CO_2e emissions from traditional carbon-based electricity generation each year of operation, a value that makes up approximately 24% of County Galway's 2018 total baseline emissions (i.e., 1,905,000 tCO_2e), or 24% of County Clare's 2018 total baseline emissions (1,905,730 tCO_2eq).

Table 30-21 below presents net Project emissions per 5-year carbon budget (detailed in Section 30.2.2 above and in Section 1.2.4 of Appendix 30-1). Construction of both the Offshore Site and the Onshore Site is assumed to start in 2026. Full operations are assumed to commence in 2029 and continue beyond the 2050 net zero target date. As per the methodology outlined in Section 30.4.2.2, the magnitude of Project impact on the carbon budgets will constitute **negligible change** in the 2021-2025 period, consisting only of preconstruction surveys. In the 2026 to 2030 period – which will encompass the entirety of the construction phase of the Project – Project emissions will represent 0.34% of the Irish carbon budget. This represents a **small increase**. From 2031 to 2035, the impact magnitude will be - 1.44%, i.e. a **beneficial reduction**. As carbon budgets are not yet determined past 2035, it is not possible to quantify the percentage of the Project's CO_2e emissions beyond 2035, although assuming a reducing carbon budget, the percentage of avoided emissions will increase. Overall, the Project will assist the Irish Government's ability to meet carbon budgets post-.

Table 30-21 Project net CO_2e emissions against the Irish carbon budget

	Carbon Accounting Period		
	2021 to 2025	2026 to 2030	2031 to 2035
Amount per Carbon Budget Period (tCO_2e)	295,000,000	200,000,000	151,000,000
Project emissions for period (net tCO_2e)	65,039	692,293	-2,174,060
Project emissions as a % of Irish budget	0.002%	0.34%	-1.44%

30.4.3 Summary

The carbon equivalent emissions associated with the construction, operation and maintenance, and decommissioning phases of the Project have been quantified. During the construction phase it is anticipated that there will be net-positive emissions, but once commissioned, the Project will result in an overall reduction in emissions as the less carbon-intensive electricity generated by the Project will displace more carbon-intensive electricity from the national grid. After approximately three years of operations, the Project will have "paid back" the emissions associated with construction phase and initial operations.

It is not possible to quantify the carbon lost as a result of the disturbance / loss of biogenic carbon at the Offshore Site. However, considering the limited spatial extent of any blue carbon habitats present at the Offshore Site and the footprint associated with the Offshore Site, minimal loss of carbon sequestrating habitats and CO_2e release as a result of sediment disturbance is anticipated.

Biogenic carbon losses from the Onshore Site are associated with activities relating to peat removal and reinstatement, drainage, and habitat improvement. The habitat that will be impacted by the development footprint comprises agricultural land and smaller areas of peat bogs. Due to the carbon sequestration capabilities of peat bogs (as detailed in Section 30.4.1.2.1), there is expected loss of approximately 580 tCO_2e associated with the removal of carbon fixing vegetation and habitat due to the Project. However, the Landscape Management Plan (LMP) (Appendix 27-1) provides detail on proposed habitat enhancement activities to take place as part of the Project during the operation and maintenance phase. These activities will include native woodland planting and planting of hedgerows. These activities, over the lifetime of the Project have the potential to give rise to carbon savings.

30.5 Climate Change Risk Assessment

30.5.1 Climate Resilience

30.5.1.1 Introduction

This section reviews the ability of the Project to withstand, respond to and recover from the projected changes in climate, as described in Section 30.5. This assessment is in accordance with Directive 2011/92/EU which requires for an assessment of the vulnerability of a project to climate change to be considered. Please refer to Chapter 31 Major Accidents and Natural Disasters for further detail on the vulnerability of the Project to climate change.

The climate resilience assessment considers the potential effects (i.e. damage or interference) that result from the projected change in a climate variable (e.g. temperature and precipitation) on the Project infrastructure, facilities and activities.

Project construction is planned to be completed in the near-term, i.e., 2029. Therefore, climate variables are expected to be consistent with current conditions during the construction phase. This climate resilience review focusses on the Project's vulnerability to climate change in the long-term, i.e., during the operation and maintenance phase.

30.5.1.2 Assessment Methodology

This review has been conducted in accordance with the following guidance documents:

- IEMA (2020)[173] Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation, specifically Step 0: "Building Climate Resilience into the Project" and Appendix 1: "Climate Change Risk Assessment"; and
- European Commission (2021)[174] Technical guidance on the climate proofing of infrastructure in the period 2021 – 2027. Summarises the step-by-step process for conducting a climate vulnerability and risk assessment.

In line with European Commission (2021)[175], the climate resilience review is conducted in two-stages. The first stage (i.e. screening stage) identifies the climate variables with the potential to result in a significant hazard or risk to the Project (Section 30.5.1.2.1). The second stage (i.e. assessment stage) involves undertaking a more detailed assessment of the 'screened in' climate variables to assess the vulnerability of the Project to climate change (Section 30.5.1.3).

30.5.1.2.1 *Climate Change Impact Identification*

The climate variables, with the potential to affect the Project include:

- Extreme weather events (e.g. storm surges, flooding, and heat waves);
- Changes in average weather patterns (e.g. rising temperatures);
- Sea level rise; and
- Coastal erosion.

---

173 IEMA (2020). Environmental Impact Assessment Guide to Climate Change Resilience and Adaption. Available online at: https://www.iema.net/resources/reading-room/2020/06/26/iema-eia-guide-to-climate-change-resilience-and-adaptation-2020 [Accessed 22/03/2024].
174 European Commission (2021). EC Technical Guidance on Climate Proofing of Infrastructure. Available online at: https://ec.europa.eu/newsroom/cipr/items/722278/ [Accessed 25/03/2024].
175 Ibid.

For each of the climate variables listed above, a screening assessment has been conducted to identify the climate variables that have the potential to result in a significant impact on the Project, either as a result of economic costs, safety risks or environmental damage. In accordance with European Commission (2021), both the sensitivity and exposure of the Project to the climate variable have been considered as follows:

- Sensitivity – the vulnerability of the Project to a climate variable, irrespective of location; and
- Exposure – the overlap of the Project and the changing climate variable, based on the current and future climate projections at the Project location (see Section 30.3 for further details)

The significance of the stage 1 climate resilience screening, 'screened in' impacts is then assessed in detail in Section 30.5.1.3.

Table 30-22 lists the climate variables with the potential to impact the Project and the results of the screening assessment to ascertain if these impacts have the potential to result in a significant impact, either as a result of economic cost, safety risks, change in energy production or environmental impacts. The summary of climate variables is drawn from the current and future baselines outlined in Section 30.3.1 and 30.3.2.

Table 30-22 Potential impacts of changing climate variables on the Project

Climate variable		Climate Resilience Screening Assessment
Offshore		
Extreme weather events	Increased frequency of storms (i.e. high winds, thunderstorms, and extreme waves)	Overall, there is predicted to be a reduction in average and extreme wave heights but an increase in the frequency and severity of storm surges in coastal areas. An increased frequency of storm events may result in the following impacts on the Offshore Site: • Disruption to operation and maintenance phase activities (e.g. as a result of increased weather downtime for vessels); • Health and safety risks to personnel conducting operation and maintenance phase activities; • Damage or loss of WTG and OSS infrastructure; and • An increased frequency of WTG shutdown as a result of more frequent cut-out speed exceedances. Due to the potential financial cost and health and safety risks associated with an increased frequency of storms, this climate variable has been **screened into** the assessment of climate resilience.
	Increased frequency of heavy rainfall events	It is predicted that the frequency of heavy rainfall events in winter and autumn months will increase in Ireland by approximately 20%[176]. Although rainfall can

[176] https://www.epa.ie/environment-and-you/climate-change/what-impact-will-climate-change-have-for-ireland/#:~:text=Significant%20reductions%20are%20expected%20in,20%25).

Climate variable		Climate Resilience Screening Assessment
		be beneficial to help rid WTG blades of debris, heavy rainfall events may increase the risk of erosion of WTG blades[177]. It is possible that heavy rainfall may also disrupt operation and maintenance phase activities. Due to the potential financial cost and health and safety risks associated with an increased frequency of heavy rainfall events, this climate variable has been **screened into** the assessment of climate resilience.
	Increased frequency of marine heatwaves	Marine heatwaves have the potential to increase ocean temperatures, resulting in damage, loss or reduced structural integrity of the Offshore Site infrastructure (e.g. from thermal expansion). In addition, warmer sea temperatures may increase the potential for biofouling. The frequency of marine heatwave events is increasing[178]. However, the west coast of Ireland, where the Offshore Site is located, is an area with relatively cold sea temperatures. Therefore, it is anticipated that the Offshore Site infrastructure will be able to withstand any temporary periods of anomalously warm sea temperatures for the region, as these temperatures are still expected to be within the design limits of the Offshore Site infrastructure. Although the Offshore Site is potentially sensitive to this impact, due to the Offshore Site location, it is highly unlikely that it will be exposed to extreme marine heatwaves beyond the design limits of the Project infrastructure. Therefore, this climate variable has been **screened out** of the assessment of climate resilience.
	Increased frequency of air heatwaves	An increased frequency of heat waves may pose a health and safety risk to personnel. Due to the potential health and safety risks of this climate variable, increased frequency of air heatwaves has been **screened into** the assessment of climate resilience.
Changing weather patterns / sea conditions	Increased sea surface and near bed temperatures	Increased temperatures have the potential to cause damage, loss or reduced structural integrity of the Offshore Site infrastructure (e.g. from thermal expansion) or increase the potential for biofouling of infrastructure.

[177] *New York State Energy Research and Development Authority (2021) Offshore Wind Climate Adaptation and Resilience Study <https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Programs/Offshore-Wind/Offshore-Wind-Climate-Adaptation-and-Resilience-Study.pdf>*

[178] *Cornes, R.C., Tinker, J., Hermanson, L., Oltmanns, M., Hunter, W.R., Lloyd Hartley, H., Kent, E.C., Rabe, B. and Renshaw, R. Climate change impacts on temperature around the UK and Ireland. MCCIP Science Review 2023, 18pp.*

Climate variable		Climate Resilience Screening Assessment
		However, the west coast of Ireland, where the Offshore Site is located, is an area with relatively cold sea temperatures. Therefore, it is anticipated that the Offshore Site infrastructure will be able to withstand the projected increase in sea temperatures for the region, as these temperatures are still expected to be within the design limits of the Offshore Site infrastructure. Although the Offshore Site is potentially sensitive to this impact, due to the Offshore Site location, it is highly unlikely that it will be exposed to average sea temperatures beyond the design limits of the Offshore Site infrastructure. Therefore, this climate variable has been **screened out** of the assessment of climate resilience.
	Increased air temperature	An increase in air temperatures may pose a health and safety risk to personnel. In addition, changes in air temperature may result in an impact on wind turbine load. However, considering the Offshore Site location, it is expected that on average, the air temperatures will be well within safe working conditions for personnel. Furthermore, Hübler and Rolfes (2021)[179] concluded that air temperature had a negligible impact on WTG fatigue. Therefore, this climate variable has been **screened out** of the assessment of climate resilience.
	Changing wind resource	Change in wind resource may reduce energy production or result in a higher inter-annual variability in energy production[180,181]. It is predicted that wind power potential may decrease in Ireland by the end of the century, however, the west and southwest coasts were identified to have the greatest future wind potential[182]. Considering the Offshore Site location, which is in an area of strong wind potential, this climate variable has been **screened out** of the assessment of climate resilience.

[179] *Hübler, C. and Rolfes, R. (2021). Analysis of the influence of climate change on the fatigue lifetime of offshore wind turbines using imprecise probabilities. Wind Energy, 24(3), pp.275-289.*
[180] *Frontiers in Energy Research (2022) Climate Change Impact on the Offshore Wind Energy Over the North Sea and the Irish Sea <https://www.frontiersin.org/journals/energy-research/articles/10.3389/fenrg.2022.881146/full>*
[181] *Wind Energy Engineering (2023) Climate Change Effects on Offshore Wind Turbines <https://openresearch.surrey.ac.uk/esploro/outputs/bookChapter/Chapter-28--Climate-change-effects/99778742102346>*
[182] *Moradian, S., Olbert, A.I., Gharbia, S. and Iglesias, G. (2023). Copula-based projections of wind power: Ireland as a case study. Renewable and Sustainable Energy Reviews, 175, p.113147.*

Climate variable		Climate Resilience Screening Assessment
	Increased winter rainfall	Increased winter rainfall may be beneficial for WTGs as this can help rid blades of debris and increase performance. Therefore, this climate variable has been **screened out** of the assessment of climate resilience.
	Decreased summer rainfall	No potential impacts on the Offshore Site are expected from decreased summer rainfall and increased ocean acidification. Therefore, this climate variable has been **screened out** of the assessment of climate resilience
	Ocean acidification	
	Reduced mean wave height	It is expected that wave heights will decline towards the end of the century in Ireland (see Section 30.3.2.2.3 for further details). No potential adverse impacts are expected from reduced mean wave height as this variable is within current conditions. Reduced wave height can positively affect accessibility to the Offshore Site and reduce weather downtime throughout the year. Therefore, this projected climate variable has been **screened out** of the assessment of climate resilience.
Sea level rise		The WTGs and OSS are expected to largely be resilient to sea level rise due to the main components (topsides, nacelles, blades etc.) being above the sea surface and at a height that prevents any impact from sea level rise. The main impact of sea level rise on the Project is expected to occur at the Landfall. Rises in sea level may increase the potential for cable exposure at the OLL due to increased rates of coastal erosions, resulting in increased requirements for repair. Due to the potential economic costs associated with increased repair needs and the potential safety risk associated with cable exposure, this climate variable has been **screened into** the assessment of climate resilience.
Coastal erosion		Increased rate of coastal erosion, as a result of sea level rise and increased frequency of storms, may result in reduced structural integrity or increased risk of cable exposure for the OEC at the Landfall. Due to the potential economic costs associated with increased repair needs and the potential safety risk associated with cable exposure, this climate variable has been **screened into** the assessment of climate resilience.
Onshore		

Climate variable		Climate Resilience Screening Assessment
Extreme weather	Increased frequency of storms (i.e. high winds, thunderstorms, and extreme waves)	An increased frequency of storm events may result in the following impacts on the Onshore Site: - Disruption to operation and maintenance phase activities (e.g. collisions onsite and offsite with vehicles involved in operational phase activities of the Project) - Health and safety risks to personnel conducting operation and maintenance phase activities; - Damage to the OCC and associated infrastructure; Due to the potential financial cost and health and safety risks associated with an increased frequency of storms, this climate variable has been **screened into** the assessment of climate resilience.
	Increased frequency of heavy rainfall events	Heavy rainfall may disrupt operation and maintenance phase activities through flood events and increased risk of collision on roads. Due to the potential financial cost and health and safety risks associated with an increased frequency of heavy rainfall events, this climate variable has been **screened into** the assessment of climate resilience.
	Increased frequency of air heatwaves	An increased frequency of heat waves may pose a health and safety risk to personnel. Due to the potential health and safety risks of this climate variable, increased frequency of air heatwaves has been **screened into** the assessment of climate resilience.
Changing weather patterns	Increased air temperature	An increase in air temperatures may pose a health and safety risk to personnel. However, considering Ireland's temperate oceanic climate and the minimal onshore work required during the operation and maintenance phase, it is expected that on average, the air temperatures will be well within safe working conditions for personnel. Therefore, this climate variable has been **screened out** of the assessment of climate resilience.
	Increased frequency of heavy rainfall events	Heavy rainfall may disrupt operation and maintenance phase activities through flood events and increased risk of collision on roads. Due to the potential financial cost and health and safety risks associated with an increased frequency of heavy rainfall events, this climate variable has been **screened into** the assessment of climate resilience.

Climate variable		Climate Resilience Screening Assessment
	Increased winter rainfall	Increased winter rainfall may disrupt operation and maintenance phase activities through flood events and increased risk of collision on roads. Due to the potential financial cost and health and safety risks associated with an increased frequency of winter rainfall events, this climate variable has been **screened into** the assessment of climate resilience.
	Decreased summer rainfall	No potential impacts on the Onshore Site are expected from decreased summer rainfall. Therefore, this climate variable has been **screened out** of the assessment of climate resilience
Sea level rise		Sea levels are predicted to continue to rise in Ireland (please refer to Section 30.3.2.2.4 for further details). Rising sea levels would result in increased coastal erosion, flooding and damage to property and infrastructure. The main impact of sea level rise on the Project is expected to occur at the Landfall. Rises in sea level may increase the potential for cable exposure at the Landfall, resulting in increased repair needs. Due to the potential economic costs associated with increased repair needs and the potential safety risk, this climate variable has been **screened into** the assessment of climate resilience.
Coastal erosion		Increased rate of coastal erosion, as a result of sea level rise and increased frequency of storms, may result in reduced structural integrity at the Landfall. Due to the potential economic costs associated with increased repair needs and the potential safety risk, this climate variable has been **screened into** the assessment of climate resilience

30.5.1.2.2 Mitigation by Design

As part of the Project design process, a number of designed-in measures and management plans have been proposed. Mitigation incorporated in the design phase of the Project that increases the resilience of the offshore and onshore Project to climate change, are described in the sections below. As there is a commitment to implementing these measures, they are considered inherently part of the design of the Project and have therefore been considered in the assessment presented below (i.e., the determination of the magnitude of impact and therefore the significance of impacts assumes implementation of these measures). These measures are considered standard industry practise for this type of development.

The mitigation incorporated into the Project through its design relevant to Project are described in Table 30-23 below.

Table 30-23 Mitigation by design specific to climate resilience

Mitigation by Design Measures	Justification
Offshore mitigation by design	
Cut-Out / Shut-Down Speed	The WTGs will contain an anemometer to monitor wind speed and direction which will trigger the WTG to shut-down when a pre-determined shut-down / cut-out speed is reached. The shut-down / cut-out speed is typically designed to be lower than what the WTG can withstand to reduce any potential for damage.
Infrastructure Design and Third-Party Verification	All infrastructure will be designed in accordance with industry standards and design codes to account for future climate projections (including extreme weather events). The final design will be subject to third-party verification, where applicable.
Health and Safety Protocols	All offshore personnel will follow safety standards and codes of practice and undergo health and safety awareness and training, in line with risk assessment protocols.
Landfall Trenchless Technology	Use of trenchless technology will reduce the potential for cable exposure at the Landfall.
Onshore mitigation by design	
Flood Risk Assessment	The FRA (provided as Appendix 23-1 to Chapter 23 Water) identified the flooding risk associated with the Onshore Site based on flood modelling for 2 no. potential future climate change scenarios, with the Mid-Range and High-End Future Scenario flood extents generated using an increase in rainfall of 20% and 30% respectively. Due to the nature of the underground cabling, flooding will have no effect during the operation and maintenance phase of the Project. During the construction phase, works in these areas may have to be postponed following heavy rainfall events, or in the occurrence of high spring tides, which may cause flooding at these locations – the risk of which is classified as Low. All onshore personnel will follow safety standards and codes of practice and undergo health and safety awareness and training, in line with risk assessment protocols.

30.5.1.2.3 Defining the Climate Change Risk

In accordance with European Commission (2021)[183] and IEMA (2020)[184], the risk posed by climate change on the Project is determined by defining the likelihood and magnitude (i.e. severity) of the

[183] *European Commission (2021). EC Technical Guidance on Climate Proofing of Infrastructure. Available online at: https://ec.europa.eu/newsroom/cipr/items/722278/ [Accessed 25/03/2024].*
[184] *IEMA (2020). Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation. Available online at: https://www.iema.net/resources/reading-room/2020/06/26/iema-eia-guide-to-climate-change-resilience-and-adaptation-2020 [Accessed 22/03/2024].*

potential climate change impact. Existing or embedded mitigations identified within the EIA are accounted for when determining impact likelihood and magnitude.

The definitions for likelihood and magnitude are provided in Table 30-24 and Table 30-25, respectively. It should be noted that likelihood refers to the impact occurring under the worst-case assumption that the projected climate change does occur (i.e. that the confidence level for the projected change is high).

Table 30-24 Definitions for the likelihood

Likelihood	Definition
Certain	The event / impact will occur during the life cycle of the Project (i.e. it is inevitable), potentially many times during the operation and maintenance phase.
Likely	The event / impact is likely to occur at some point during the life cycle of the Project.
Possible	The event / impact is possible during the life cycle of the Project.
Unlikely	The event / impact is unlikely to occur during the life cycle of the Project.
Extremely Unlikely	The event / impact is extremely improbable during the life cycle of the Project.

Table 30-25 Definitions for magnitude

Magnitude	Definition
High	Permanent damage, loss or reduction in the structural integrity of the Project infrastructure and facilities (i.e. permanent loss of energy production); Serious health and safety risk (i.e. fatalities); and Irreversible and irrecoverable financial, reputational, or environmental impact.
Moderate	Major damage, loss or reduction in the structural integrity of the Project infrastructure and facilities (i.e. loss of energy production lasting up to a week); Major health and safety risk (i.e. multiple serious injuries); and Major financial, reputational, or environmental impact.
Low	Moderate damage, loss or reduction in the structural integrity of the Project infrastructure and facilities (i.e. moderate reduction in energy production lasting several hours or slight reduction in energy production lasting up to a week); Moderate health and safety risk (i.e. single serious injury); and Moderate financial, reputational, or environmental impact.

Magnitude	Definition
Negligible	Minimal damage, loss or reduction in the structural integrity of the Project infrastructure (i.e. slight reduction in energy production lasting several hours); Low health and safety risk (i.e. minor injury); and Minimal financial, reputational, or environmental impact.
No Change	No damage or loss of the Project infrastructure (i.e. no loss of energy production); No health and safety risks; and No financial, reputational, or environmental impact.

Having determined the likelihood and magnitude of the climate change impact, the risk level is determined, as either negligible, minor, moderate, or major, as shown in Table 30-26. Table 30-27 provides the correlation of the significance and risk rating to the '*Guidelines on the Information to be Contained in Environmental Impact Assessment Reports*'[185] published by the EPA in May 2022 (hereafter referred to as EPA Guidelines) to impact terminology classifications.

Table 30-26 Significance matrix

		Likelihood				
		Extremely Unlikely	Unlikely	Possible	Likely	Certain
Magnitude	No Change	Negligible	Negligible	Negligible	Negligible	Negligible
	Negligible	Negligible	Negligible	Minor	Minor	Minor
	Low	Negligible	Minor	Minor	Moderate	Major
	Moderate	Negligible	Minor	Moderate	Major	Major
	High	Minor	Moderate	Major	Major	Major

Table 30-27 Correlation of Impact Assessment Terminology

EPA Term	EPA Description	Risk Rating
Imperceptible	An effect capable of measurement but without significant consequences	Negligible
Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities	Minor

[185] *European Protection Agency (2022). Guidelines on the information to be contained in Environmental Impact Assessment Reports. Available online at: https://www.epa.ie/publications/monitoring--assessment/assessment/EIAR_Guidelines_2022_Web.pdf [Accessed 04/10/2024].*

EPA Term	EPA Description	Risk Rating
Moderate	An effect that alters the character of the environment in a manner consistent with existing and emerging baseline trends	Moderate
Significant	An effect, which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment	Major

30.5.1.2.4 *Consideration of Data Sources and Quality*

The evidence base for climate change assessments and the confidence in future climate projections is increasing. However, there are still some uncertainties present as this is a growing area of research[186]. Data sources, such as the MCCIP, aim to continue to review and publish evidence on climate change risks and impacts as and when they occur, and therefore, it is expected that the understanding of climate change projections and impacts presented within this assessment will continue to evolve in the coming years. The assessment has been carried out using the most comprehensive and up-to-date data sources, as described in Section 30.3.2.1. It is acknowledged that this climate change resilience review is limited by the data available in relation to climate change projections and associated effects in Ireland at the time of the assessment. Please note, the climate resilience assessment for the Project is based on the current best available scientific sources and therefore is as robust and complete as possible at the time of writing.

30.5.1.3 Assessment of Climate Resilience

This section presents the assessment of climate resilience for the offshore and onshore elements of the Project (Table 30-28 and Table 30-29, respectively). The assessment is provided for the 'screened in' impacts (see Section 30.5.1.2.1) using the methodology outlined in Section 30.5.1.2.3.

[186] *Küpper, F.C. and Kamenos, N.A. (2017). The future of marine biodiversity and marine ecosystem functioning in UK coastal and territorial waters (including UK Overseas Territories. Foresight Future of the Sea project.*

30.5.1.3.1 Offshore

Table 30-28 Assessment of the Offshore Site resilience to climate change

Climate Variable	Impact On the Offshore Site	Likelihood	Magnitude	Risk Level	Significance (Pre-Mitigation)	Mitigation / Adaptation Required	Residual Significance (Post-Mitigation)
Extreme weather event: Increased occurrence of high wind events and lightning strikes during storms.	Disruption to operation and maintenance phase activities (e.g. as a result of increased weather downtime for vessels)	**Likely** – This impact will only occur in extreme circumstances where high winds, lightning and extreme waves disrupt operation and maintenance phase activities and result in prolonged weather downtime. Contractors will monitor weather patterns to identify suitable weather windows to undertake operation and maintenance phase tasks. It is expected that this additional disruption as a result of climate change could occur at least once during the Project lifecycle.	**Negligible** – Operation and maintenance phase activities will be able to resume once the extreme weather event has passed. Costs may arise due to prolonged weather downtime; however, contingencies will be factored into Project programming and costs. Therefore, any disruption is considered to result in a minor financial, reputational or environmental impact and a minor reduction in energy production.	Minor	Slight, which is Not Significant	None required beyond mitigation by design measures stated in Section 30.5.1.2.2.	Slight, which is Not Significant
	Health and safety risks to personnel conducting operation and maintenance phase activities	**Unlikely** - This impact will only occur in extreme circumstances where high winds, lightning and extreme waves disrupt operation and maintenance phase activities and result in increased health and safety risks to personnel. Contractors will monitor weather patterns to identify suitable weather windows to undertake operation and maintenance phase tasks, and therefore, the likelihood of a health and safety incident is relatively low.	**Low** - Potential health and safety risks if personnel work during extreme weather or if there is a sudden change of weather conditions. However, there will be no personnel present on structures during storm events, and Contractors will monitor weather patterns, and take appropriate actions to avoid working in adverse weather conditions (e.g. standby the vessel away from offshore infrastructure).	Minor	Slight, which is Not Significant	None required beyond mitigation by design measures stated in Section 30.5.1.2.2.	Slight, which is Not Significant
	Damage or loss of WTG and OSS infrastructure	**Unlikely** – This impact will only occur in extreme circumstances where high winds, lightning and extreme waves damage Project infrastructure. However, the WTGs and OSS will be designed using the return period method to withstand a specific size of extreme event that has a set probability of occurring. The Project infrastructure will also align with the relevant design codes which have sufficient safety factors to account for extreme weather events. At high wind speeds that exceed the cut-out speed, the WTGs will shut down to avoid structural damage.	**Low** – As extreme weather events will be taken into account in the design of the Project infrastructure, severe damage from storms is highly unlikely to occur. Therefore, it is expected any damage will be non-critical, resulting in a moderate financial, reputational, environmental impact and a moderate reduction in energy production.	Minor	Slight, which is Not Significant	None required beyond mitigation by design measures stated in Section 30.5.1.2.2.	Slight, which is Not Significant
	An increased frequency of WTG shutdown as a result of more frequent cut-out speed exceedances during periods of high wind	**Certain** – this impact will only occur in extreme circumstances where high winds result in an exceedance of the cut-out speed. It is likely that shutdown as a result of climate change may happen at several points during the life cycle of the Project.	**Negligible** – Shutdown of the WTGs will only occur temporarily with the WTGs powering back-up once the wind speeds reduce. These shut-down periods are anticipated to occur and will be factored into energy yield assessments and forecasts. There are anticipated to be minimal financial, reputational or environmental impacts associated with WTG shutdown, and only a reduction in energy production lasting several hours.	Minor	Slight, which is Not Significant	None required beyond mitigation by design measures stated in Section 30.5.1.2.2.	Slight, which is Not Significant

Climate Variable	Impact On the Offshore Site	Likelihood	Magnitude	Risk Level	**Significance (Pre-Mitigation)**	Mitigation / Adaptation Required	**Residual Significance (Post-Mitigation)**
	Increased air temperatures increase safety risk (e.g. staff experiencing heat stress) during operation and maintenance phase activities	**Extremely unlikely** – Predicted air temperature increases are not expected to be significant enough to induce heat stress, except in extreme cases. Ahead of maintenance works, Contractors will monitor weather patterns and health, and safety protocols will be adhered to. Therefore, the likelihood of a health and safety incident is low.	**Low** – The magnitude of potential health and safety risks will be lowered by adherence to health and safety protocols. Operation and maintenance phase activities will be able to resume once the extreme weather event has passed	Negligible	Imperceptible, which is Not Significant	None required beyond mitigation by design measures stated in Section 30.5.1.2.2.	Imperceptible, which is Not Significant
Extreme weather events: Heavy rainfall	Damage of WTG and OSS infrastructure	**Extremely unlikely –** the greatest potential for damage to WTG blades and the OSS through erosion would be in periods of extended high humidity, fog or rain[187]. However, WTGs are designed for the offshore environment and to be resilient to blade erosion. Therefore, the potential for damage is relatively low.	**Negligible –** High levels of rainfall may reduce the reliability of WTG blades; however, the potential cost of damage and the reputational or environmental impact is considered to be minimal.	Negligible	Imperceptible, which is Not Significant	None required beyond mitigation by design measures stated in Section 30.5.1.2.2.	Imperceptible, which is Not Significant
Sea level rise	Changing sea conditions can result in potential damage, loss or reduced structural integrity of the Project components	**Extremely unlikely** – The WTGs and OSS will be situated at a height that will prevent any impacts from sea level rise upon the structural integrity of these assets. Erodible rocks and cliffs and sandy beaches around the Landfall could be impacted by sea level rise in the future. However, the Landfall will be installed using a trenchless technology and ducted conduit, surfacing in-land, thus reducing potential for vulnerabilities as a result of sea level rise.	**Low** - Exposure of cables could increase the risk of cable to external threats, increasing risk of damage or faults. However, sea level rise projections will be taken into account when determining burial depth at the Landfall. Furthermore, regular surveys will be undertaken to monitor the condition of the cables. Considering this, the financial, reputational, or environmental impact is expected to be minimal.	Negligible	Imperceptible, which is Not Significant	None required beyond mitigation by design measures stated in Section 30.5.1.2.2	Imperceptible, which is Not Significant
Coastal erosion	Changing sea conditions and coastal erosion can result in potential damage. Loss or reduced structural integrity of OECs.	**Extremely unlikely –**Erodible rocks and cliffs and sandy beaches around the Landfall could be impacted by sea level rise in the future. However, the OEC will be installed using a trenchless technology and ducted conduit, surfacing in-land, thus reducing potential for vulnerabilities as a result of sea level rise.	**Low**– Exposure of cables could increase the risk of cable to external threats, increasing risk of damage or faults. However, coastal erosion projections will be taken into account when determining burial depth at the Landfall. Furthermore, regular surveys will be undertaken to monitor the condition of the cables. Considering this, the financial, reputational, or environmental impact is expected to be minimal.	Negligible	Imperceptible, which is Not Significant	None required beyond mitigation by design measures stated in Section 30.5.1.2.2	Imperceptible, which is Not Significant

[187] https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Programs/Offshore-Wind/Offshore-Wind-Climate-Adaptation-and-Resilience-Study.pdf

30.5.1.3.2 Onshore

Table 30-29 Assessment of the Onshore Site resilience to climate change

Climate Variable	Impact On the Onshore Site	Likelihood	Magnitude	Risk Level	Significance (Pre-Mitigation)	Mitigation / Adaptation Required	Residual Significance (Post-Mitigation)
Extreme weather event: Increased occurrence of high wind events and lightning strikes during storms.	Disruption to operation and maintenance phase activities (e.g. collisions onsite and offsite with vehicles involved in operation and maintenance phase activities of the Project)	**Likely** –This impact will only occur in extreme circumstances where high winds, lightning and extreme waves disrupt operation and maintenance phase activities and result in prolonged weather downtime. Contractors will monitor weather patterns to identify suitable weather windows to undertake operation and maintenance phase tasks. It is expected that this additional disruption as a result of climate change could occur at least once during the Project lifecycle.	**Negligible** – Operation and maintenance phase activities will be able to resume once the extreme weather event has passed. Costs may arise due to prolonged weather downtime; however, contingencies will be factored into Project programming and costs. Therefore, any disruption is considered to result in a minor financial, reputational or environmental impact and a minor reduction in energy production.	Minor	Slight, which is Not Significant	None required beyond mitigation by design measures stated in Section 30.5.1.2.2	Slight, which is Not Significant
	Health and safety risks to personnel conducting operation and maintenance phase activities	**Unlikely** - This impact will only occur in extreme circumstances where high winds, lightning and extreme waves disrupt operation and maintenance phase activities and result in increased health and safety risks to personnel. Contractors will monitor weather patterns to identify suitable weather windows to undertake operation and maintenance phase tasks, and therefore, the likelihood of a health and safety incident is relatively low.	**Low** - Potential health and safety risks if personnel work during extreme weather or if there is a sudden change of weather conditions. However, contractors will monitor weather patterns and take appropriate actions to avoid working in adverse weather conditions.	Minor	Slight, which is Not Significant	None required beyond mitigation by design measures stated in Section 30.5.1.2.2	Slight, which is Not Significant
	Damage to the Onshore infrastructure;	**Unlikely** – This impact will only occur in extreme circumstances where high winds, lightning and extreme waves damage Project infrastructure. However, Onshore Site infrastructure will be designed using the return period method to withstand a specific size of extreme event that has a set probability of occurring. The Onshore Site infrastructure will also be designed in accordance with the relevant design codes which have sufficient safety factors to account for extreme weather events.	**Low** – As extreme weather events will be taken into account in the design of the Onshore Site infrastructure, severe damage from storms is highly unlikely to occur. Therefore, it is expected any damage will be non-critical, resulting in a moderate financial, reputational, environmental impact and a moderate reduction in energy production.	Minor	Slight, which is Not Significant	None required beyond mitigation by design measures stated in Section 30.5.1.2.2	Slight, which is Not Significant
	Heavy rainfall may disrupt operation and maintenance phase activities through flood events and increased risk of collision on roads.	**Possible** – this impact will occur in extreme circumstances where heavy rainfall periods will result in flooding. It is possible that this additional disruption as a result of climate change may happen at several points during the life cycle of the Project.	**Low** –As extreme weather events will be taken into account in the design of the Onshore Site infrastructure, severe damage from increased periods of heavy rainfall (and associated flooding events) is highly unlikely to occur. Therefore, it is expected any damage will be non-critical, resulting in a moderate financial, reputational, environmental impact and a moderate reduction in energy production. Furthermore, there will be a low risk to onsite personnel during such periods as adequate	Minor	Slight, which is Not Significant	None required beyond mitigation by design measures stated in Section 30.5.1.2.2	Slight, which is Not Significant

Climate Variable	Impact On the Onshore Site	Likelihood	Magnitude	Risk Level	**Significance (Pre-Mitigation)**	Mitigation / Adaptation Required	**Residual Significance (Post-Mitigation)**
			safety procedures will be established (laid out in Chapter 31 of this EIAR) resulting in a low health and safety risk.				
	Increased air temperatures increase safety risk (e.g. staff experiencing heat stress)	**Extremely unlikely** – Predicted air temperature increases are not expected to be significant enough to induce heat stress, except in extreme cases. Ahead of maintenance works, Contractors will monitor weather patterns and health, and safety protocols will be adhered to. Therefore, the likelihood of a health and safety incident is low.	**Low** – Potential health and safety risks will be lowered by adherence to health and safety protocols. Operation and maintenance phase activities will be able to resume once the extreme weather event has passed.	Negligible	Imperceptible, which is Not Significant	None required beyond mitigation by design measures stated in Section 30.5.1.2.2	Imperceptible, which is Not Significant
	Changing sea conditions can result in potential damage, loss or reduced structural integrity of Project components	**Extremely unlikely** – The main impact of sea level rise on the Project is expected to occur at the OLL. Increases in in sea level may increase the potential for cable exposure at the OLL due to the presence of erodible rocks and cliffs and sandy beaches. However, the OEC will be installed through trenchless technology and ducted conduit, surfacing in-land, thus reducing potential for vulnerabilities as a result of sea level rise.	**Low** - Exposure of cables could increase the risk of cable to external threats, increasing risk of damage or faults. However, sea level rise projections will be taken into account when determining burial depth at the OLL. Furthermore, regular surveys will be undertaken to monitor the condition of the cables. Considering this, the financial, reputational, or environmental impact is expected to be minimal.	Negligible	Imperceptible, which is Not Significant	None required beyond mitigation by design measures stated in Section 30.5.1.2.2	Imperceptible, which is Not Significant
Coastal erosion	Changing sea conditions and coastal erosion can result in potential damage. Loss or reduced structural integrity of OECs.	**Extremely unlikely –** Erodible rocks and cliffs and sandy beaches around the OLL could be impacted by sea level rise in the future. However, the OEC will be installed through trenchless technology and ducted conduit, surfacing in-land, thus reducing potential for vulnerabilities as a result of coastal erosion.	**Low**– Exposure of cables could increase the risk of cable to external threats, increasing risk of damage or faults. However, coastal erosion projections will be taken into account when determining burial depth at the OLL. Furthermore, regular surveys will be undertaken to monitor the condition of the cables. Considering this, the financial, reputational, or environmental impact is expected to be minimal.	Negligible	Imperceptible, which is Not Significant	None required beyond mitigation by design measures stated in Section 30.5.1.2.2	Imperceptible, which is Not Significant

30.5.2 In-Combination Climate Impact Assessment

The ICCI assessment considers how any of the predicted impacts from the Project alone could be exacerbated or reduced by any predicted future changes in the physical environment due to climate induced changes. The ICCI assessment has been conducted in accordance with IEMA (2020)[188] Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation. This is illustrated in Figure 30-6.

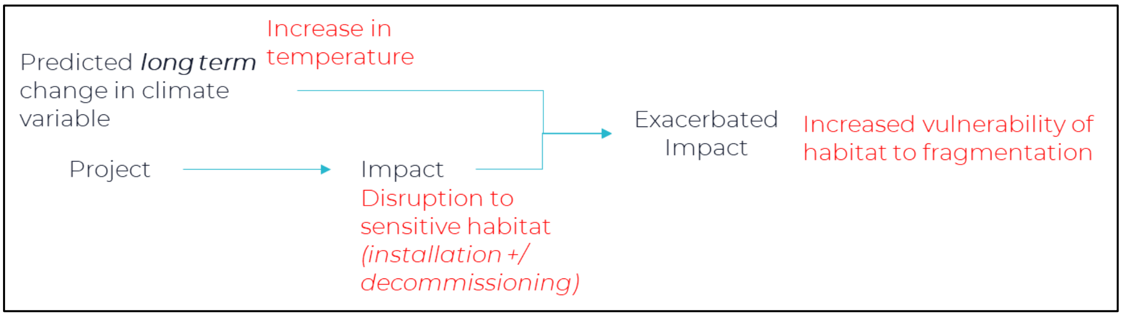


Figure 30-6 Illustration of ICCI assessment, red text provides examples

30.5.2.1 Assessment Methodology

The ICCI assessment considers all potential receptors which could be impacted by the Offshore Site and the Onshore Site, as outlined in EIAR Chapters 6 through 31. It places the impact of the Offshore Site and the Onshore Site on relevant EIA receptors in the context of future climate conditions, as outlined in Section 30.3.2.

30.5.2.1.1 *Receptor and Impact Identification*

Only impacts associated with the operation and maintenance, and decommissioning phase are considered within the ICCI assessment, as the current climate conditions are considered to be applicable for the construction phase. Please see Appendix 5-18, Rehabilitation Plan, for further details on the decommissioning phase of the Project.

The future climate projections are summarised in Section 30.3.2 and this information has been reviewed to identify the potential impacts of climate change on the EIA topics assessed within EIAR Chapters 6 through 31. The impacts of the Offshore Site and the Onshore Site are then considered alongside any impacts associated with future climate projections, to understand whether the impact, as assessed within the EIARs, is exacerbated or reduced.

30.5.2.1.2 *Defining Impact Likelihood and Magnitude*

The consequence of the ICCI is determined by defining the likelihood and magnitude of the impact. The definitions for likelihood and magnitude are provided in Table 30-30 and Table 30-31, respectively. The likelihood of the ICCI occurring considers the potential for the climate projection to occur alongside the sensitivity of the receptor and is based on expert judgement. The magnitude considers the change in significance of the effect from the Offshore Site and the Onshore Site when in-combination effects of climate change are considered.

[188] *IEMA (2020). Environmental Impact Assessment Guide to Climate Change Resilience and Adaption. Available online at: https://www.iema.net/resources/reading-room/2020/06/26/iema-eia-guide-to-climate-change-resilience-and-adaptation-2020 [Accessed 22/03/2024].*

Table 30-30 Definitions for likelihood

Likelihood	Definition
Certain	The event / impact will occur during the life cycle of the Project (i.e. it is inevitable), potentially many times during the operation and maintenance phase
Likely	The event / impact is likely to occur at some point during the life cycle of the Project.
Possible	The event / impact is possible during the life cycle of the Project.
Unlikely	The event / impact is unlikely to occur during the life cycle of the Project.
Extremely Unlikely	The event / impact is extremely improbable during the life cycle of the Project.

Table 30-31 Definitions for magnitude

Magnitude	Definition
High	The consequence of the effect increases to major when the in-combination effects from climate change are considered.
Moderate	The consequence of the effect increases to moderate when the in-combination effects from climate change are considered.
Low	The consequence of the effect increases to minor when the in-combination effects from climate change are considered.
Negligible / no change	There is no change in the effect in-combination with the projected change in the climate variable.

Having determined the likelihood and magnitude of the ICCI, the consequence is determined. The consequence categories in Table 30-32 provide a threshold to determine whether or not the ICCI is deemed 'significant' in EIA terms. Table 30-33 provides the correlation of the significance and risk rating to the EPA Guidelines[189] impact terminology classifications.

Where the assessment identifies a significant impact as a result of the combination of the Offshore Site or the Onshore Site impacts and climate change, mitigation measures or design changes have been proposed to avoid or reduce impacts to an acceptable level.

[189] *European Protection Agency (2022). Guidelines on the information to be contained in Environmental Impact Assessment Reports. Available online at: https://www.epa.ie/publications/monitoring–assessment/assessment/EIAR_Guidelines_2022_Web.pdf [Accessed 04/10/2024].*

Table 30-32 Significance matrix

		Likelihood				
		Extremely Unlikely	Unlikely	Possible	Likely	Certain
Magnitude	No Change	Negligible	Negligible	Negligible	Negligible	Negligible
	Negligible	Negligible	Negligible	Minor	Minor	Minor
	Low	Negligible	Minor	Minor	Moderate	Major
	Moderate	Negligible	Minor	Moderate	Major	Major
	High	Minor	Moderate	Major	Major	Major

Table 30-33 Correlation of Impact Assessment Terminology

EPA Term	EPA Description	Risk Rating
Imperceptible	An effect capable of measurement but without significant consequences	Negligible
Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities	Minor
Moderate	An effect that alters the character of the environment in a manner consistent with existing and emerging baseline trends	Moderate
Significant	An effect, which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment	Major

30.5.2.1.3 Consideration of Data Sources and Quality

The evidence base for climate change and the confidence in future climate projections is increasing. However, there are still some uncertainties present, and this is a growing area of research. The assessment has been carried out using the most comprehensive and up-to-date data sources, as described in Section 30.3.2.1. It is acknowledged that this ICCI assessment is limited by the data available at the time of the assessment in relation to climate projections and the effects on the physical, biological and social environment. Please note, the ICCI assessment for the Project is based on the current best available scientific sources and therefore is as robust and complete as possible at the time of writing.

30.5.2.2 ICCI assessment

30.5.2.2.1 Offshore

Table 30-34 summarises the ICCI assessment, which has been undertaken using the methodology described in Section 30.5.2.1 above.

Table 30-34 Summary of ICCI assessment: Offshore

EIA Topic	Potential Climate Change Projection and Impact	Likelihood of ICCI	Magnitude of ICCI	Significance (Pre-mitigation)	Additional Mitigation Required?	Significance of Residual Consequence (Post-mitigation)
Marine and Physical Processes	Increased sea temperatures, increased frequency of marine heatwaves and changes related to the Atlantic Meridional Overturning Circulation (AMOC) system could change the extent or presence of stratification at the Offshore Site, altering the predicted effect of the Offshore Site on water column structure.	Extremely unlikely – the influence of the Offshore Site on water column structure is predicted to be highly localised. The OAA may influence water column structure in the immediate vicinity of the OAA due to increased mixing, however, this will be most influenced by water depth, bathymetry, outcropping rocks and freshwater influx. It is predicted that regional scale patterns of stratification will be unaffected by the Offshore Site, and therefore, the influence of climate change is not predicted to significantly alter this effect within the lifetime of the Project.	Negligible – The predicted effect of climate change is not expected to exacerbate the impact of the Offshore Site.	Imperceptible, which is Not Significant	No	Imperceptible, which is Not Significant
	Increased frequency of storms and sea level rise could alter the predicted effects of the Offshore Site on tidal, wave and sediment transport regimes and also the potential introduction of scour.	Extremely unlikely – the Offshore Site is predicted to result in localised changes to tidal flows and wave height in the local vicinity of the OAA, which could affect sediment transport. However, there is a limited presence of sediment within the OAA which means that changes to sediment mobility will be limited. Therefore, the influence of climate change is not predicted to significantly alter this effect within the lifetime of the Project.	Negligible – The predicted effect of climate change is not expected to exacerbate the impact of the Offshore Site.	Imperceptible, which is Not Significant	No	Imperceptible, which is Not Significant
	Increased frequency of storms and sea level rise could accelerate coastal erosion at the Landfall, altering the predicted effect of the Offshore Site on offshore and coastal morphology.	Extremely unlikely – the influence of the Offshore Site on tidal flows and waves is not expected to extend beyond the local vicinity of the OAA with no effects on the adjacent coast. The effect of any protection on the seabed (e.g. at the trenchless duct exit) is only anticipated to result in effects in the short to medium term and coastal erosion at the OLL and the adjacent coast from the Offshore Site is expected to be minimal over the lifetime of the Project (see Section 30.3.2.2.4). As noted in Section 30.5.1, the Offshore Site is considered to be resilient to climate change. Therefore, the influence of climate change is not predicted to significantly alter this effect within the lifetime of the Project.	Negligible – The predicted effect of climate change is not expected to exacerbate the impact of the Offshore Site.	Imperceptible, which is Not Significant	No	Imperceptible, which is Not Significant
Water and sediment quality	Increased frequency of coastal flooding, caused by sea level rise, coastal erosion and increased storm surges could increase pollutant load and suspended sediment concentrations.	Extremely unlikely – as noted above, the Offshore Site will not result in any significant changes to coastal morphology at the OLL and the adjacent coast to the Offshore Site. The coastline adjacent to the OAA is generally erosion resistant and stable. Flood risk at the OLL is low, with the main risk of flooding being	Negligible – The predicted effect of climate change is not expected to exacerbate the impact of the Offshore Site.	Imperceptible, which is Not Significant	No	Imperceptible, which is Not Significant

EIA Topic	Potential Climate Change Projection and Impact	Likelihood of ICCI	Magnitude of ICCI	Significance (Pre-mitigation)	Additional Mitigation Required?	Significance of Residual Consequence (Post-mitigation)
		from pluvial sources. Surface water ponding/pluvial flooding may occur in some flat areas due to the presence of low permeability soils and subsoils. Therefore, it is likely that the long-term effects of sea level rise will not be observed during the lifetime of the Project. Therefore, this effect is not predicted to be significantly altered by climate change.				
Benthic Ecology	Predicted change in sea conditions (e.g. increased sea temperatures) at the limits of tolerance for benthic subtidal and intertidal ecology receptors may enhance other external effects, including those of the Offshore Site.	Unlikely – change in sea conditions may exacerbate the effects of habitat loss and disturbance and potentially facilitate the spread of Invasive Non-Native Species (INNS)[190]. However, the west coast of Ireland, where the Offshore Site is located is in an area of relatively cold sea temperatures with a weaker increase in sea temperatures expected compared with some other regions of Ireland and the UK. Therefore, the benthic subtidal and intertidal receptors within the Offshore Site area are expected to be relatively tolerant to the projected changes in sea conditions (see Section 30.4.1.1) within the lifetime of the Project. Furthermore, mitigations have been applied to reduce the potential for habitat loss and disturbance (e.g. avoiding areas of maerl).	Negligible – The predicted effect of climate change is not expected to exacerbate the effect of the Offshore Site on benthic subtidal and intertidal ecology receptors.	Imperceptible, which is Not Significant	No	Imperceptible, which is Not Significant
	Predicted effects of climate change on physical and coastal processes (described above) could exacerbate the predicted scour effects.	Extremely unlikely – the Offshore Site is predicted to have minimal extent of change in metocean conditions with little or no development of scour. Additionally, there is no change predicted in the sediment transport regime. Therefore, the influence of climate change is not predicted to significantly alter this effect within the lifetime of the Project.	Negligible – The predicted effect of climate change is not expected to exacerbate the impact of the Offshore Site.	Imperceptible, which is Not Significant	No	Imperceptible, which is Not Significant
Fish and Shellfish Ecology	Predicted change in sea conditions (e.g. increased sea temperatures) at the limits of tolerance for fish and shellfish ecology receptors may enhance other external impacts, including those of the Offshore Site.	Unlikely – change in sea conditions may exacerbate the effects of habitat loss and disturbance and alter the health and resilience of fish and shellfish ecology receptors present at the Offshore Site. However, the west coast of Ireland, where the Offshore Site is located, is in an area of relatively cold sea temperatures with a weaker increase in sea temperatures expected compared with some other regions of Ireland and the UK. Furthermore, as fish and shellfish	Negligible – The predicted effect of climate change is not expected to exacerbate the effect of the Offshore Site on fish and shellfish ecology receptors.	Imperceptible, which is Not Significant	No	Imperceptible, which is Not Significant

[190] *Cottier-Cook, E., Beveridge, C., Bishop, J.D., Brodie, J., Clark, P.F., Epstein, G., Jenkins, S.R., Johns, D.G., Loxton, J., Macleod, A. and Maggs, C., 2017. MCCIP Science Review 2017: Non-Native Species. In Marine Climate Change Impacts Partnership: Science Review (pp. 47-61).*

EIA Topic	Potential Climate Change Projection and Impact	Likelihood of ICCI	Magnitude of ICCI	Significance (Pre-mitigation)	Additional Mitigation Required?	Significance of Residual Consequence (Post-mitigation)
		receptors are mobile, they can adapt to changing sea conditions by changing their distribution. Therefore, the fish and shellfish ecology receptors within the Offshore Site area are expected to be relatively tolerant to the projected changes in sea conditions (see Section 30.4.1.1) within the lifetime of the Project. Therefore, this effect is not predicted to be significantly altered by climate change.				
	Indirect effects in relation to impacts on prey species (e.g. reduced availability and distribution) could enhance the predicted effects of Offshore Site.	Unlikely – changes in sea conditions (in particular sea temperature) may result in a change in the distribution and abundance of prey species. However, as noted above, the change in sea temperature in the west coast of Ireland is expected to be weaker than other regions of the UK. Furthermore, it is not expected that all prey species will decline (for example there may be an increase in the abundance of warm-water species). Therefore, this effect is not predicted to be significantly altered by climate change within the life of the Project.	Negligible – The predicted effect of climate change is not expected to exacerbate the effect of the Offshore Site on fish and shellfish ecology receptors.	Imperceptible, which is Not Significant	No	Imperceptible, which is Not Significant
	Increase in sea temperatures could result in change of spawning and/or migratory periods, altering the predicted effects of Offshore Site on spawning habitat and diadromous fish.	Unlikely – spawning and recruitment success may be hindered by rising sea temperatures, as the synchrony between hatching fish larvae and plankton prey is changing[191]. Furthermore, rising temperatures may also alter migratory cues for diadromous species. Nevertheless, the effects of the Offshore Site on spawning habitat and diadromous fish species are predicted to be highly localised in extent. Therefore, these effects are not predicted to be significantly altered by climate change within the life of the Project.	Negligible– the effect of climate change is not expected to exacerbate the effects of the Offshore Site	Imperceptible, which is Not Significant	No	Imperceptible, which is Not Significant
Marine mammals and megafauna	Predicted change in sea conditions (e.g. increased sea temperatures) at the limits of tolerance for marine mammal and megafauna receptors may enhance other external effects, including those of the Offshore Site.	Unlikely – changes in sea conditions and additional stresses may increase the vulnerability of marine mammals to external impacts. However, the effects of the Offshore Site on marine mammal species are considered to be highly localised in extent and are not predicted to result in population level effects. Furthermore, as marine mammal receptors are mobile, they can adapt to changing sea conditions by	Negligible – the effect of climate change is not expected to exacerbate the effects of the Offshore Site	Imperceptible, which is Not Significant	No	Imperceptible, which is Not Significant

[191] *Wright, P.J., Pinnegar, J.K. and Fox, C. (2020) Impacts of climate change on fish, relevant to the coastal and marine environment around the UK. MCCIP Science Review 2020, 354–381.*

EIA Topic	Potential Climate Change Projection and Impact	Likelihood of ICCI	Magnitude of ICCI	Significance (Pre-mitigation)	Additional Mitigation Required?	Significance of Residual Consequence (Post-mitigation)
		changing their distribution. Overall, the effects of the Offshore Site are not predicted to be significantly altered by climate change within the life of the Project.				
	Indirect effects in relation to impacts on prey species (e.g. reduced availability and distribution) could enhance the predicted effects of Offshore Site.	Unlikely – the availability of prey may be impacted by range shifts of prey species, potentially exacerbating any impact of displacement or barrier effects and long-term habitat change. However, this impact on marine mammals is highly uncertain and poorly understood. It is not expected that all prey species will decline (for example there may be an increase in the abundance of warm-water species). Additionally, any effect of the Offshore Site on prey species (e.g. resulting from habitat loss and disturbance impacts on key prey species such as sandeel) will be highly localised with no long-term change in abundance and distribution. Therefore, the effects of the Offshore Site are not predicted to be significantly altered by climate change within the life of the Project.	Negligible– the effect of climate change is not expected to exacerbate the effects of the Offshore Site	Imperceptible, which is Not Significant	No	Imperceptible, which is Not Significant
Offshore and intertidal ornithology	Increased occurrence of extreme weather events (e.g. storms) and sea level rise and erosion may impact breeding bird success or impact foraging success at-sea and enhance any other survival impairment.	Unlikely – the frequency of extreme weather events is expected to increase alongside continued increases in sea level and coastal erosion over the lifetime of the Project. Additional pressure on birds and reduced foraging success may occur as a result of these climate change impacts. The projected increase in frequencies of extreme weather are uncertain but are not anticipated to exacerbate the effects of the Project to an extent that would change the magnitude of the Offshore Site's impact. Therefore, the effects of the Offshore Site are not predicted to be significantly altered by climate change within the life of the Offshore Site.	Negligible– the effect of climate change is not expected to exacerbate the effects of the Offshore Site	Imperceptible, which is Not Significant	No	Imperceptible, which is Not Significant
	Indirect effects in relation to impacts on prey species (e.g. reduced availability and distribution) could enhance the predicted effects of Offshore Site.	Extremely unlikely - the potential effect on prey species is uncertain. The availability of prey may be impacted by range shifts of prey species, potentially exacerbating any impact of displacement or barrier effects and long-term habitat change. Additionally, any effect of the Offshore Site on prey species (e.g. resulting from habitat loss and disturbance impacts on key prey species such as sandeel) will be highly localised	Negligible – the effect of climate change is not expected to exacerbate the effects of the Offshore Site	Imperceptible, which is Not Significant	No	Imperceptible, which is Not Significant

EIA Topic	Potential Climate Change Projection and Impact	Likelihood of ICCI	Magnitude of ICCI	Significance (Pre-mitigation)	Additional Mitigation Required?	Significance of Residual Consequence (Post-mitigation)
		with no long-term change in abundance and distribution. Therefore, the effects of the Offshore Site are not predicted to be significantly altered by climate change within the life of the Project.				
Shipping and Navigation	Increased frequency of storms or adverse weather events could enhance the predicted effects of the Offshore Site.	Extremely unlikely – an increased frequency of storms or adverse weather events could result in changes to vessel routing, affecting the risk of vessel collision and allision, access to local ports and emergency response capability. It is considered unlikely that vessel routing will drastically change from the current baseline as a result of the predicted climate change effects over the lifetime of the Project. Adequate safety measures are already in place for periods of adverse weather and all vessels will adhere to mitigation measures to reduce the navigational risks, as outlined in Chapter 14 Shipping and Navigation, ensuring all risks are reduced to As Low As Reasonably Practicable (ALARP). Overall, the effects of the Offshore Site are not predicted to be significantly altered by climate change within the life of the Offshore Site.	Negligible– the effect of climate change is not expected to exacerbate the effects of the Offshore Site	Imperceptible, which is Not Significant	No	Imperceptible, which is Not Significant
Military and civil aviation	No pathway for an in-combination climate impact identified.					
Commercial fisheries	Climate change impacts on commercial fish and shellfish species (e.g. reduced availability and distribution) could enhance the predicted effects of the Offshore Site.	Unlikely – as explained above, the predicted effects of climate change are not expected to significantly alter the effects of the Offshore Site on fish and shellfish ecology receptors. Therefore, the effects of the Offshore Site on commercial fisheries receptors are also not predicted to be significantly altered within the lifetime of the Project	Negligible – the effect of climate change is not expected to exacerbate the effects of the Offshore Site	Imperceptible, which is Not Significant	No	Imperceptible, which is Not Significant
Seascape, landscape and visual	Changes in coastal morphology caused by climate change could exacerbate seascape, landscape and visual impacts.	Extremely unlikely - as explained above, the Offshore Site is not predicted to result in significant long-term changes to the coastal morphology at the OLL and the adjacent coast. Therefore, the influence of climate change is not predicted to significantly alter this effect within the lifetime of the Project.	Negligible – the effect of climate change is not expected to exacerbate the effects of the Offshore Site	Imperceptible, which is Not Significant	No	Imperceptible, which is Not Significant
Marine archaeology and cultural heritage	Predicted effects of climate change on physical and coastal processes could exacerbate the predicted scour effects and increase vulnerability of marine archaeology receptors.	Extremely unlikely – the Offshore Site is predicted to have minimal extent of change in metocean conditions with little or no development of scour. Additionally, there is no	Negligible – The predicted effect of climate change is not expected to exacerbate the impact of the Offshore Site.	Imperceptible, which is Not Significant	No	Imperceptible, which is Not Significant

EIA Topic	Potential Climate Change Projection and Impact	Likelihood of ICCI	Magnitude of ICCI	Significance (Pre-mitigation)	Additional Mitigation Required?	Significance of Residual Consequence (Post-mitigation)
		change predicted in the sediment transport regime. Therefore, the influence of climate change is not predicted to significantly alter this effect within the lifetime of the Project.				

30.5.2.2.2 Onshore

Table 30-35 summarises the ICCI assessment, which has been undertaken using the methodology described in Section 30.5.2.1.

Table 30-35 Summary of ICCI assessment: Onshore

EIA Topic	Potential Climate Change Projection and Impact	Likelihood of ICCI	Magnitude of ICCI	Significance (Pre-Mitigation)	Additional Mitigation Required?	Significance of Residual Consequence (Post-Mitigation)
Biodiversity – Flora and Fauna	Predicted changes in weather patterns (i.e., increased frequency of storm events and precipitation patterns) may enhance external effects of the Onshore Site	Extremely Unlikely – changes in weather patterns, including increased frequency of storm events and precipitation patterns may increase the vulnerability of flora and fauna to external impacts. However, the effects of the Onshore Site on flora and fauna are not predicted to result in habitat loss at any scale greater than local importance. Overall, the effects of the Onshore Site are not predicted to be significantly altered by climate change within the lifetime of the Project.	Negligible – the effect of climate change is not expected to exacerbate the effects of the Onshore Site	Imperceptible, which is Not Significant	No	which is
	Predicted increases in air temperature, at the limits of tolerance for flora and fauna may enhance other external effects, including those of the Onshore Site.	Unlikely – the predicted increases of air temperature may result in changes in distribution of plant and animal species and in the phenology (the timing of lifecycle events) of native species. Increased air temperatures may lead to native Irish plant population declines while promoting invasive species abundance. However, any effect of the Onshore Site on flora and fauna (e.g. resulting from habitat loss and disturbance impacts on key ecological receptors) will be highly localised. Therefore, the effects of the Onshore Site are not predicted to be significantly altered by climate change within the lifetime of the Project.	Negligible – the effect of climate change is not expected to exacerbate the effects of the Onshore Site	Imperceptible, which is Not Significant	No	Imperceptible, which is Not Significant
	Changes in vegetation as a result of climate change effects may impact soil erosion and sedimentation, affecting the predicted effect of the Onshore Site.	Extremely Unlikely – the predicted rates of soil erosion and sedimentation may result in changes in vegetation within and around the Onshore Site. However, any effect of the Onshore Site on vegetation will be highly localised and over a short-term duration as the majority of onshore infrastructure is underground and any removed peat or spoil will be reinstated and allowed to revegetate naturally. Therefore, the effects of the Onshore Site are not predicted to be significantly altered by climate change within the lifetime of the Project.	Negligible – the effect of climate change is not expected to exacerbate the effects of the Onshore Site	Imperceptible, which is Not Significant	No	Imperceptible, which is Not Significant
Biodiversity – Terrestrial Ornithology	Predicted increase in winter temperatures may result in a shift in bird ranges and may increase the overwinter survival rate for some species	Unlikely – routes of Irish migratory birds may alter to adjust to warmer winters which will reduce habitat and feeding grounds. However,	Negligible – the effect of climate change is not expected	Imperceptible, which is Not Significant	No	Imperceptible, which is Not Significant

EIA Topic	Potential Climate Change Projection and Impact	Likelihood of ICCI	Magnitude of ICCI	Significance (Pre-Mitigation)	Additional Mitigation Required?	Significance of Residual Consequence (Post-Mitigation)
	and their abundance in Ireland, altering the effects of the Onshore Site.	the majority of the key ornithological receptors were restricted to specific areas of the Onshore Site. Therefore, impacts, for the majority of species, are predicted to occur locally where a given species was recorded. Therefore, the effects of the Onshore Site are not predicted to be significantly altered by climate change within the lifetime of the Project	to exacerbate the effects of the Onshore Site			
	Increased winter rainfall could result in reduced overwinter survival for some small birds as a result of greater energy expenditure, increasing the susceptibility to impacts and altering the effects of the Onshore Site.	Unlikely – increases in winter rainfall frequency may increase the vulnerability of Irish birds to external impacts. However, the effects of the Onshore Site on ornithological receptors are not predicted to result in habitat loss at any scale greater than local importance. However, as stated above in Section 30.3.2.2.2 climate change is expected to have an impact on Ireland's precipitation patterns with EPA climate projections indicating that very wet days (i.e., days with more than 30mm of rainfall) will become more common, increasing by 31% under a high emissions scenario (RCP 8.5). Therefore, it is likely that the long-term effects of climate change on rainfall patterns will be observed during the lifetime of the Project. Therefore, impacts are predicted to occur locally on birds as a result of increased winter rainfall. Therefore, the influence of climate change is not predicted to significantly alter this effect during the lifetime of the Project.	Negligible – the effect of climate change is not expected to exacerbate the effects of the Onshore Site	Imperceptible, which is Not Significant	No	Imperceptible, which is Not Significant
Land Soils and Geology	Increase in precipitation patterns and extreme rainfall events may lead to increased erosion of soil and rock, as well as increased costal erosion, leading to potential landslide events or other natural disasters.	Extremely Unlikely – The Onshore Site is predicted to have a no significant impact on the peat, soils and subsoils as stated in Section 22.5.2.2 of Chapter 22 Land, Soils, and Geology. The majority of onshore infrastructure will be buried, with disturbed areas reinstated and monitored throughout the operation and maintenance phase. Furthermore, the OLL will be installed in rock using trenchless technology which will ensure robust protection throughout the lifetime of the Project. As noted in Section 30.5.1.3.2 above, the Onshore Site is considered to be resilient to climate change from a land, soils geology perspective. Therefore, the influence of climate change is not predicted to significantly alter this effect during the lifetime of the Project.	Negligible – the effect of climate change is not expected to exacerbate the effects of the Onshore Site.	Imperceptible, which is Not Significant	No	Imperceptible, which is Not Significant

EIA Topic	Potential Climate Change Projection and Impact	Likelihood of ICCI	Magnitude of ICCI	Significance (Pre-Mitigation)	Additional Mitigation Required?	Significance of Residual Consequence (Post-Mitigation)
	Increased air temperature may lead to changes in the rate of weathering of rocks and soils, altering erosion and sedimentation patterns, altering the predicted effect of the Onshore Site.	Unlikely – The Onshore Site is predicted to have a no significant of impact on the peat, subsoil and bedrock at the Onshore Site as stated in Section 22.5.2.2 of Chapter 22 of this EIAR. The majority of onshore infrastructure will be buried, with disturbed areas reinstated and monitored throughout the operation and maintenance phase. Furthermore, the OLL will be installed in rock using trenchless technology which will ensure robust protection throughout the lifetime of the Project. As noted in Section 30.5.1, the Onshore Site is considered to be resilient to climate change from a land, soils geology perspective. Therefore, the influence of climate change is not predicted to significantly alter this effect during the lifetime of the Project.	Negligible – the effect of climate change not expected to exacerbate the effects of the Onshore Site.	Imperceptible, which is Not Significant	No	Imperceptible, which is Not Significant
Water	Increased winter rainfall and decreased summer rainfall may alter water resources, surface water flow and groundwater recharge, as well as change the predicted flood risk. Therefore, altering the predicted effect of the Onshore Site.	Extremely Unlikely – the overall flood risk at the Onshore Site is considered to be low. All flood zone mapping has been modelled for 2 no. potential future climate change scenarios, with the Mid-Range and High-End Future Scenario flood extents generated using an increase in rainfall of 20% and 30% respectively. The FRA goes on to state that while it is likely that climate change will have significant impacts on flooding and flood risk in Ireland due to rising sea levels, increased winter rainfall and more intense rainfall, the OLL and OCC are not constrained by coastal, fluvial or groundwater flooding. The majority of the OGC is located in Flood Zone C. However, some sections of the route, in the vicinity of local watercourses are mapped in fluvial flood zones. Some sections of the route are also mapped in coastal flood zones. Due to the nature of the underground cabling, this will have no effect during the operation and maintenance phase of the Project. Therefore, the influence of climate change is not predicted to significantly alter this effect during the lifetime of the Project.	Negligible – the effect of climate change is not expected to exacerbate the effects of the Onshore Site.	Imperceptible, which is Not Significant	No	Imperceptible, which is Not Significant
	Sea level rise and increased occurrence of winter storms may increase the severity of coastal flooding, affecting the predicted effects on the Onshore Site.	Extremely Unlikely – flood risk at the OLL is low, and, as identified in Section 30.3.2.2.4 above sea levels in Ireland are predicted to be up to approximately 1.01m higher in 2100 compared	Negligible – the effect of climate change is not expected to exacerbate the effects of the Onshore Site.	Imperceptible, which is Not Significant	No	Imperceptible, which is Not Significant

EIA Topic	Potential Climate Change Projection and Impact	Likelihood of ICCI	Magnitude of ICCI	Significance (Pre-Mitigation)	Additional Mitigation Required?	Significance of Residual Consequence (Post-Mitigation)
		with the 1981 – 2000 average[192]. As explained in Chapter 7 Marine Physical and Coastal Processes, sea levels at the Offshore Site are predicted to be up to 0.34m higher in 50 years and 0.8m higher in 100 years[193]. Therefore, it is likely that the long-term effects of sea level rise will not be observed during the lifetime of the Project to the extent that they would affect the Project. Therefore, the influence of climate change is not predicted to significantly alter this effect during the lifetime of the Project.				
	Increased winter rainfall, and any associate flood risk, may result in changes in surface water runoff which could alter the interactions of the Onshore Site with contaminated land.	Extremely Unlikely – the overall flood risk at the Onshore Site is considered to be low. The OGC is connected to Moneypoint, which is regulated under the Control of Major Accident Hazards Involving Dangerous Substances Regulations as an Upper Tier SEVESO site. The Project itself is not a SEVESO Site and is not considered a modification to the SEVESO status of Moneypoint and is not connected to any of the SEVESO Sites identified in Chapter 31 Major Accidents and Natural Disasters. Therefore, the influence of climate change is not predicted to significantly alter this effect during the lifetime of the Project.	Negligible – the effect of climate change is not expected to exacerbate the effects of the Onshore Site.	Imperceptible, which is Not Significant	Not significant	Imperceptible, which is Not Significant
Cultural Heritage	Costal erosion resulting in destruction of coastal archaeological and historical sites	Extremely Unlikely –many of Irelands important archaeological and historical sites are located along coastlines, and as sea level rises and the rates of coastal erosion increase these sites are at risk. However, the Onshore Site will not contribute to further coastal erosion due to the nature of the underground cabling installation works and the design of the Onshore Site. Therefore, the influence of climate change is not predicted to significantly alter this effect during the lifetime of the Project.	Negligible – the effect of climate change is not expected to exacerbate the effects of the Onshore Site.	Imperceptible, which is, Not Significant	No	Imperceptible, which is Not Significant
Air Quality	Increased pollutants being emitted to the atmosphere may reduce air quality and have potential harmful effects on the biosphere	Extremely Unlikely – no impacts on air quality are predicted to occur as a result of the Onshore Site due to the nature of the underground cabling	Negligible – the effect of climate change is not expected	Imperceptible, which is Not Significant	No	Imperceptible, which is Not Significant

[192] https://www.climateireland.ie/impact-on-ireland/future-climate-of-ireland/sea-level-rise/
[193] Deltares (2022). Skerd Rocks offshore wind farm metocean study.

EIA Topic	Potential Climate Change Projection and Impact	Likelihood of ICCI	Magnitude of ICCI	Significance (Pre-Mitigation)	Additional Mitigation Required?	Significance of Residual Consequence (Post-Mitigation)
		installation works and the design of the Onshore Site. Therefore, the influence of climate change is not predicted to significantly alter this effect during the lifetime of the Project.	to exacerbate the effects of the Onshore Site.			
Noise and Vibration	Increased air temperature increasing exposure to noise as occupants of houses opened their windows	Extremely Unlikely – the predicted increases of air temperature may result in changes to anthropogenic behaviour associated with the outdoors. However, any effect of the Onshore Site on noise and vibration will be highly localised. Therefore, the effects of the Onshore Site are not predicted to be significantly altered by climate change within the lifetime of the Project.	Negligible – the effect of climate change is not expected to exacerbate the effects of the Onshore Site.	Imperceptible, which is Not Significant	No	Imperceptible, which is Not Significant
Landscape and Visual	Changes in landscape due to changes in weather patterns	Extremely Unlikely – an increase in precipitation events, droughts, storms, etc. will have an effect on the Irish landscape. As storms become more frequent and severe, Ireland's trees, cliffs, and rural structures will experience more wear and tear. More intense rainfall and rapid soil saturation can increase mudslides and erosion, particularly on Ireland's hills and coastal cliffs. However, due to the nature of the underground cabling installation works and the design of the Onshore Site it is not predicted to have any significant effect on landscape and visual. Therefore, the influence of climate change is not predicted to significantly alter this effect during the lifetime of the Project.	Negligible – the effect of climate change is not expected to exacerbate the effects of the Onshore Site.	Imperceptible, which is Not Significant	No	Imperceptible, which is Not Significant
Traffic and Transport	Changes in weather patterns causing a change in the use of transport and time spent outdoors	Extremely Unlikely – the predicted increases of air temperature may result in changes to anthropogenic behaviour associated with the outdoors. However, any effect of the Onshore Site on traffic and transport will be highly localised and limited to the duration of the construction phase. Therefore, the effects of the Onshore Site are not predicted to be significantly altered by climate change within the lifetime of the Project.	Negligible – the effect of climate change is not expected to exacerbate the effects of the Onshore Site.	Imperceptible, which is Not Significant	No	Imperceptible, which is Not Significant
Material Assets	Predicted changes in weather patterns (i.e., increased frequency of storm events and precipitation patterns) may enhance external effects of the Onshore Site.	Extremely Unlikely – no significant impacts on existing infrastructure, telecommunications, gas pipelines, or waste supply/wastewater infrastructure are predicted to occur as a result of the Onshore Site due to the nature of the underground cabling installation works and the design of the Onshore Site to avoid existing underground services and maintain appropriate	Negligible– the effect of climate change is not expected to exacerbate the effects of the Onshore Site.	Imperceptible, which is Not Significant	Not significant	Imperceptible, which is Not Significant

EIA Topic	Potential Climate Change Projection and Impact	Likelihood of ICCI	Magnitude of ICCI	Significance (Pre-Mitigation)	Additional Mitigation Required?	Significance of Residual Consequence (Post-Mitigation)
		set back distances. Therefore, the influence of climate change is not predicted to significantly alter this effect during the lifetime of the Project.				

30.5.2.2.2 Summary

Overall, for both the Onshore Site and the Offshore Site, there is low potential for in-combination and future climate impacts to adversely impact offshore or onshore receptors. The comprehensive assessment, based on the best-available data and the likelihood of these future occurrences has resulted in the overall risk of impacts on climate change being assessed as imperceptible and therefore there are no likely Significant effects.

30.6 Likely Significant Effects and Associated Mitigation Measures

30.6.1 'Do-Nothing' Scenario

If the Project doesn't proceed, the opportunity to capture the available renewable energy resource and connect it to Ireland's electricity grid would be lost, as would the opportunity to contribute to meeting Government and EU targets for the production and consumption of electricity from renewable resources, in particular the 5GW of offshore wind energy generation target identified in Climate Action Plan 2024 (Section 30.2.2. above and Section 1.2.6 of Appendix 30-1), and the reduction of greenhouse gas emissions from all sectors to achieve the goal of a 51% reduction in emissions by 2030 as compared to a 2018 baseline.

Ireland is experiencing climate change in line with global trends, with current projections indicating that these effects will intensify in the coming decades. Please refer to Section 30.3.2 above for further information on the future baseline; i.e., a description of the future predictions for marine, coastal and terrestrial climate change in Ireland. As detailed in the future baseline changes are projected to occur in the physical environment which will affect the biological and socio-economic environment. If the Project were not to proceed the identified effects in Section 30.3.2 will continue to progress and lead to intensifying climate change impacts and mounting socio-economic costs; please note, it is likely that the identified effects in Section 30.3.2 will continue to progress if the Project is granted development permission as well.

The opportunity to further significantly reduce emissions of greenhouse gas emissions, including carbon dioxide (CO_2), oxides of nitrogen (NO_x), and sulphur dioxide (SO_2) from fossil fuels to the atmosphere over the lifetime of the Project would be lost. The opportunity to contribute to Ireland's commitments under the Kyoto Protocol, the Paris Agreement, and EU law would also be lost. This would be a long-term moderate negative effect.

A comparison of the potential environmental effects of the 'Do-Nothing' Alternative when compared against the chosen option of developing a renewable energy development at the Project site are presented in Table 3-1 of Chapter 3: Site Selection and Alternatives of this EIAR.

30.6.2 Construction Phase

Within this section, the Project i.e. both the Offshore Site and the Onshore Site, will be considered as a whole. Where the Offshore Site and the Onshore Site are required to be considered separately, this is identified within the assessment.

30.6.2.1 Greenhouse Gas Emissions

30.6.2.1.1 *Pre-Mitigation Impact*

Project Infrastructure

The construction of the Offshore Site will require construction materials (such as cement), seabed disturbance (i.e., dredging, boulder clearance, rock placement, etc.), and the operation of marine vessels and plant. Greenhouse gas emissions, e.g., carbon dioxide, carbon monoxide and nitrogen oxides will arise as a result of the production of construction materials, seabed disturbance activities, and the operation of marine vessels and construction machinery as a result of construction activities. This impact will be short-term and moderate only, which is Not Significant, given the quantity of greenhouse gases that will be emitted to the atmosphere and will be restricted to the duration of the construction phase. Mitigation measures to reduce this effect are presented below.

The key blue carbon ecosystems of Ireland (seagrass beds and saltmarshes) have not been identified to be present within the Offshore Site. Maerl beds were identified within the OAA, which are a potential blue carbon habitat and the sediments across the Offshore Site are considered to have a moderate carbon value. Maerl beds are considered to have a moderate carbon stock and sequestration rate; however, it is important to note that the Project has adopted measures to design around maerl beds present at the Offshore Site such that no direct disturbance to maerl is expected (see Section 30.4.1.1). The construction activities associated with the Offshore Site are unlikely to result in significant loss or disturbance of carbon or affect the carbon sequestration potential of the immediate seabed and associated habitats, and as such, the magnitude of impact on blue carbon is assessed as negligible for the construction of the Offshore Site. Therefore, in the absence of mitigation, the overall effect on blue carbon from the Offshore Site is assessed as a short-term slight negative effect which is Not Significant.

The construction of the Onshore Site will require the excavation and reinstatement of approximately 1,392m^3 of peat habitat, the use of construction materials (such as cement), and the operation of vehicles and plant. Greenhouse gas emissions, e.g., CO_2, carbon monoxide and nitrogen oxides associated with the removal and reinstatement of peat habitat, production of construction materials, and operation of vehicles and plant will arise as a result of the construction activities. This impact will be short-term and imperceptible only, which is Not Significant, given the quantity of greenhouse gases that will be emitted to the atmosphere and will be restricted to the duration of the construction phase.

Transport to Site

Vessel movements associated with construction in the Offshore Site are likely to generate exhaust emissions, i.e., operation of construction vessels and plant and the displacement of third-party existing vessel traffic. This impact will be short-term and slight only, which is Not Significant, given the quantity of greenhouse gases that will be emitted and will be restricted to the duration of the construction phase. Mitigation measures to reduce this effect are presented below.

The transport of Onshore Site infrastructure and construction materials to the site, which will occur on specified routes only (see Section 5.4 in Chapter 5 of this EIAR), will also give rise to greenhouse gas emissions associated with the transport vehicles (terrestrial) and exhaust emissions. This impact will be short-term and slight only, which is Not Significant, given the quantity of greenhouse gases that will be emitted and will be restricted to the duration of the construction phase. Mitigation measures to reduce this effect are presented below.

Waste

Construction waste will arise from the Project, mainly from the excavation and unavoidable construction waste including material surpluses, damaged materials and packaging waste at the

Onshore Site. The Project will give rise to greenhouse gas emissions associated with the generation and management of these waste streams, however, this potential impact will be short-term and imperceptible only, which is Not Significant, given the quantity of greenhouse gases associated these waste streams which will be restricted to the duration of the construction phase. Waste management will be carried out in accordance with *Best Practice Guidelines on the Preparation of Resource and Waste Management Plans for Construction & Demolition Projects* (2021) produced by the EPA.

The Construction and Environmental Management Plan (CEMP) (Appendix 5-16 of this EIAR) provides a Waste Management Plan (WMP) which outlines the best practice procedures during the construction phase of the project. The WMP outlines the methods of waste prevention and minimisation by recycling, recovery and reuse at each phase of construction of the Project. Disposal of waste at appropriately licenced facilities will be a last resort. Please refer to Section 5.3.2.8.7 of Chapter 5 of this EIAR and Section 3.9 of the CEMP for detailed processes on waste management during the construction phase of the Project.

Project CO_2e Emissions Relative to National Carbon Budgets

As detailed in Section 30.4.2.4 the Project will displace carbon dioxide from fossil fuel-based electricity generation, over the proposed 38-year lifespan of the Project. Therefore, while there will be greenhouse gas emissions associated with the construction phase, this will take place under the Electricity sector emissions ceiling and, after approximately three years of operations, the Project will have “paid back” the emissions associated with construction phase.

Table 30-21 above (Section 30.4.2.4.1) presents net Project emissions per 5-year carbon budget (detailed in Section 30.2.2 above and in Section 1.2.4 of Appendix 30-1). As per the methodology outlined in Section 30.4.2.2, the magnitude of Project impact on the carbon budgets will constitute **negligible change** in the 2021-2025 period, consisting only of preconstruction surveys. This will represent **0.002%** of the first Irish carbon budget. This impact will be short-term and imperceptible only, which is Not Significant given the quantity of greenhouse gases that will be emitted to the atmosphere and will be restricted to the duration of the construction phase. Mitigation measures to reduce this effect are presented below.

In the 2026 to 2030 period – which will encompass the entirety of the construction phase of the Project – Project emissions will represent **0.34%** of the second Irish carbon budget. This represents a **small increase**. This impact will be short-term and moderate only, which is Not Significant, given the quantity of greenhouse gases that will be emitted to the atmosphere and will be restricted to the duration of the construction phase. Mitigation measures to reduce this effect are presented below.

30.6.2.1.2 *Mitigation and Monitoring Measures*

Please note, all mitigation and monitoring measures outlined below relate to the Project infrastructure, transport to site, and waste headers as identified above.

- Construction staff will be trained how to inspect and maintain construction vehicles and plant to ensure good operational order while onsite, thereby minimising any emissions that arise. The Site Supervisor/Construction Manager will produce and follow a site inspection and machinery checklist which will be followed and updated if/when required.
- All plant and vehicles (terrestrial and marine) shall be stored in dedicated areas. Machinery will be switched off when not in use.
- Construction materials will be transported to the Project site on specified routes only, unless otherwise agreed with the Planning Authority. Please see Chapter 29 Traffic and Transportation for details.
- Marine coordination will be implemented to manage Project vessel movements including the application of traffic management procedures such as the designation of entry and exit points to and from the OAA and routes to and from base ports as appropriate.

- Areas of excavation will be kept to a minimum, and stockpiling will be minimised by coordinating excavation, spreading and compaction.
- The expected waste volumes generated onsite are unlikely to be large enough to warrant source segregation at the Site. Therefore, all wastes streams generated onsite will be deposited into a single waste skip which will be covered.
    - This waste material will be transferred to a licensed /permitted Materials Recovery Facility (MRF) by a fully licensed waste contractor where the waste will be sorted into individual waste streams for recycling, recovery or disposal.
    - The MRF will be local to the Onshore Site to reduce the emissions associated with vehicle movements
- A CEMP will be in place throughout the construction phase (see Appendix 5-16).
- Where reasonably practicable, the majority of aggregate materials for the construction of the Onshore Site will be obtained locally. This will significantly reduce the number of delivery vehicles accessing the site, thereby reducing the amount of emissions associated with vehicle movements.
- Where applicable, low carbon intensive construction materials will be sourced and utilised onsite.

30.6.2.1.3 *Residual Effects*

Following implementation of the mitigation measures above, residual effects of greenhouse gas emissions arising from the construction phase of the Project will have a short-term slight negative effect which is Not Significant. However, once emitted to the atmosphere, the greenhouse gas emissions that will arise from construction phase activities will have a permanent slight negative effect on Climate, which is Not Significant.

30.6.2.1.4 *Significance of Effects*

Based on the assessment above there will be No Significant effects on climate arising from the construction phase of the Project.

30.6.3 Operation and Maintenance Phase

30.6.3.1 Greenhouse Gas Emissions

30.6.3.1.1 *Pre-Mitigation Impact*

Project Infrastructure

The Project will generate energy from a renewable source. As detailed in Section 30.4.2.4 above, the Project will displace carbon dioxide from fossil fuel-based electricity generation, over the proposed 38-year operational life. The MEC of the Project is 450MW, displacing approximately 462,196 tonnes of CO_2e emissions each year of operation, culminating to approximately **17.56 million** tonnes of CO_2e emissions over the proposed 38-year operational lifetime of the Project from traditional carbon-based electricity generation. This will have a long-term significant positive impact on climate.

The key blue carbon ecosystems of Ireland (seagrass beds and saltmarshes) have not been identified to be present within the Offshore Site. Maerl beds were identified within the OAA, which are a potential blue carbon habitat and the sediments across the Offshore Site are considered to have a moderate carbon value and sequestration rate. However, it is important to note that the Project has adopted measures to design around the maerl beds present in the Offshore Site such that no direct disturbance to maerl is expected (see Section 30.4.1.1). The long-term presence of infrastructure associated with the Offshore Site is unlikely to result in significant loss or disturbance of carbon or affect the carbon sequestration potential of the immediate seabed and associated habitats, and as such, the magnitude of impact on blue carbon is assessed as negligible for the operation and maintenance phase of the Offshore Site. Therefore, in the absence of mitigation, the overall effect on blue carbon from the Offshore Site is assessed as having a long-term imperceptible negative effect, which is Not Significant.

An assessment of the Project's climate resilience and in-combination impacts is provided in Section 30.5 above. During the operation and maintenance phase, for both the Onshore Site and the Offshore Site, the Project will be resilient to climate change and will have a low potential for in-combination and future climate impacts to adversely impact offshore or onshore receptors. The comprehensive assessment, based on the best-available data and the likelihood of future climate change has resulted in the overall risk of impacts on climate change being assessed as imperceptible to slight, which is Not Significant.

Transport to Site

Maintenance and monitoring activities for the Project will take place throughout the proposed 38-year operational life of the Project.

Maintenance of the Offshore Site will occur annually, with approximately 5% of major components requiring replacement (with associated shipping to site). Major components include blades, transformers, generators, main bearings, blade bearings, converters and gearboxes. Emissions associated with embodied carbon of replacement components and transport will result in a long-term slight negative effect on climate, which is Not Significant. Estimates are provided in Table 30-18 with all calculations conservatively assuming no vessel decarbonisation emission during the Project's operational lifetime.

Offshore vessel usage is considered a predominant source of emissions during the operation and maintenance phase of the Project. Some potential long-term slight negative impacts that may occur during the operation and maintenance phase of the Offshore Site is the release of CO_2e emissions to the atmosphere due to maintenance and monitoring activities, including turbine component replacement, associated with the offshore vessels listed in Section 30.4.2.3.2.

The operation and maintenance phase of the Onshore Site will generate additional traffic to the area in the form of light goods vehicles (LGVs) visiting the permanent OCC intermittently for inspections but on occasion, Heavy Goods Vehicle (HGVs) may be required over short periods during maintenance/substation component replacement activities. The OCC will be operated and maintained by EirGrid and ESB. On occasion, the removal of hydrocarbons (transformer oil) and waste from welfare facilities will be removed from the OCC by a licenced waste disposal company.

The addition of intermittent LGVs and, on occasion, HGVs to the area of the Onshore Site during the operational and maintenance phase will give rise to a long-term imperceptible negative impact on climate, which is Not Significant, as a result of greenhouse gas emissions arising from exhaust emissions.

Waste

Waste is not proposed to be generated on the Project site during the operation and maintenance phase, any waste that does arise will be minimal and any impact will be short-term and imperceptible, which is Not Significant. Waste management will be carried out in accordance with '*Best Practice Guidelines on the Preparation of Resource and Waste Management Plans for Construction & Demolition Projects*' (2021) produced by the EPA and will be managed in accordance with the Wast Manegement Plan outlined in Section 3.9 of Appendix 5-16 CEMP.

Project CO_2e Emissions and Displacement Relative to National Carbon Budgets

Table 30-21 above (Section 30.4.2.4.1) presents net Project emissions per 5-year carbon budget (detailed in Section 30.2.2 above and in Section 1.2.4 of Appendix 30-1). Full operations are assumed to commence in 2029 and continue beyond the 2050 net zero target date. When considering the greenhouse gas emissions associated with the operation and maintenance phase, the Project in the context of the Irish carbon budgets (and within the Electricity sectoral emission ceiling), Project emissions will represent **0.34%** of the second Irish carbon budget period (2026-2030) for both the end of the construction phase and commencement of the operation and maintenance phase, and approximately **-1.44%** in the third Irish carbon budget (2031-2035). In the third carbon budget period, the Project will displace greenhouse gas emissions from traditional carbon-based electricity. Over the proposed 38-year operational life time of the Project, it will displace approximately **17.56 million tonnes of CO2e** from traditional carbon-based electricity sources. As carbon budgets are not yet determined past 2035, it is not possible to quantify the percentage of the Project's CO_2e emissions beyond 2035 however, over the proposed 38-year operational lifetime of the Project, percentage reductions of Ireland's carbon budgets beyond 2035 will follow the trajectory of the percentage reduction of the third carbon budget.

As identified above, this will have a long-term Significant Positive impact on climate.

30.6.3.1.2 *Mitigation and Monitoring Measures*

Please note, all mitigation and monitoring measures outlined below relate to the Project infrastructure, transport to site, and waste headers as identified above.

- Ensure that all maintenance and monitoring vehicles (terrestrial) will be maintained in good operational order while onsite, and, when stationary, be required to turn off engines thereby minimising any emissions that arise.
- Ensure that all maintenance and monitoring vehicles (marine) will be maintained in good operational order while onsite, and, when stationary, adjust the idling rate to minimise fuel usage, thereby minimising any emissions that arise.

30.6.3.1.3 *Residual Effect*

Following implementation of the above mitigation, the Project will have a long-term imperceptible negative effect on climate. However, due to the nature of the Project, i.e., a renewable energy development, the Project will displace **17.56 million tonnes of CO2e** from fossil fuel-based electricity generation over its proposed 38-year operational lifetime. Therefore, while there will be greenhouse gas emissions associated with the Project, this will be 'paid back' after approximately three years of operation.

As demonstrated above the Project which will serve to assist the Irish Government's ability to meet any individual future national, regional and local level carbon budgets.

There will be a Long-term Significant Positive Effect on Climate as a result of reduced greenhouse gas emissions.

30.6.3.1.4 *Significance of Effects*

Based on the assessment above there will be a significant positive effect on climate arising from the operation and maintenance phase of the Project.

30.6.4 Decommissioning Phase

The Project is expected to operate for approximately 38 years. At the end of the operational life of the Project, prior to any works being undertaken on the Project infrastructure, it will be disconnected from the national grid by the site operator in conjunction with ESB Networks and EirGrid. As part of decommissioning of the Project, the WTGs will be disassembled in reverse order to how they were erected.

The works required during the decommissioning phase are described in Section 5.8 in Chapter 5: Project Description. A Rehabilitation Plan has been prepared for the Project (Appendix 5-18) and will be updated prior to the end of the operational period in line with decommissioning methodologies that may exist at the time and any proposed changes will be agreed with the competent authority at that time.

As stated in Section 30.4.2.3.5 above, a nominal value of 1.2% of the total emissions associated with the construction phase of the Project was used to estimate the emissions associated with decommissioning. Therefore, for the purposes of this assessment, the decommissioning phase for the Project will result in the emissions of 20,629 tCO_2e. This impact will be short-term and slight only, which is Not Significant, given the quantity of greenhouse gases that will be emitted to the atmosphere and will be restricted to the duration of the decommissioning phase. The budget for the Electricity sector beyond the third carbon budget period (2031-2035) has not yet been defined. Therefore, emissions associated with the decommissioning phase are not able to be quantified in relation to the Irish carbon budgets. Mitigation measures applied during decommissioning activities will be similar to those applied during construction where relevant.

The residual effects of greenhouse gas emissions arising from the decommissioning phase of the Project will have a short-term imperceptible negative effect which is Not Significant. However, once emitted to the atmosphere, the greenhouse gas emissions that will arise from decommissioning phase activities will have a permanent imperceptible negative effect on Climate, which is Not Significant.

Based on the assessment above there will be no significant effects on climate arising from the decommissioning phase of the Project.

30.7 Cumulative Assessment

Potential cumulative effects on climate between the Project and other permitted or proposed projects and plans in the area, as set out in Section 4.3.3.4 of Chapter 4: Environmental Impact Assessment Methodology of this EIAR, were also considered as part of this assessment. The developments considered as part of this cumulative effect assessment are presented in Appendix 4-1 of this EIAR, with relevant developments within 500m of the OGC presented below in Table 30-36 and all proposed offshore wind farms in Ireland detailed in Table 30-37 below. This is in line with the Transport Infrastructure Ireland (TII) Publication 'Air Quality Assessment of Proposed National Roads – Standard PE-ENV-01107, December 2022'. The cumulative project list was prepared following a review of planning files (An Bord Pleanála and Local Authority files), EPA search engines, development plans and National Roads Office/Transport Infrastructure Ireland road projects.

As outlined in Chapter 9 of this EIAR, no other projects, plans or activities were identified as having the capacity to contribute to cumulative effects on benthic ecology receptors. On this basis, there are no cumulative effects anticipated in relation to any loss or disturbance of blue carbon or disturbance or loss of blue carbon habitats that would affect carbon sequestration at the Offshore Site.

Table 30-36 Other Plans and Projects with the Potential to cause cumulative effects on climate alone and in-combination with the Project.

Planning Ref.	Description	Decision
ABP. Ref. 307798	Proposed 400kV electricity transmission cables, extension to the existing Kilpaddoge Electrical Substation and associated works, between the existing Moneypoint 400kV Electrical Substation in the townland of Carrowdotia South County Clare and existing Kilpaddoge 220/110kV Electrical Substation in the townland of Kilpaddoge County Kerry. The development includes work in the foreshore.	Conditional Permission
ABP. Ref. 319080-24	Proposed transition and conversion of the existing 900MW electricity generating station from coal to heavy fuel oil and associated ancillary development at Moneypoint Generating Station, Moneypoint, Co. Clare.	No decision issued by An Bord Pleanála yet
CCC. Ref. 19746	for development on a c. 1.8 ha site located within Moneypoint Generating Station, Carrowdotia North and Carrowdotia South, Kilimer, County Clare (Eircode V15 R963) which is licenced by the Environmental Protection Agency (EPA) under an Industrial Emissions (IE) Licence (Ref.P0605-04) and Upper Tier COMAH site and therefore falls under the requirements of the Control of Major Accident Hazard Regulations (COMAH) Regulations, 2015. The development, which will be located within a fenced compound c. 0.94 ha. will consist of a 300 to 400 MVA (electrical rating) synchronous condenser, including the following elements: a) a Generator and Flywheel building (c. 962 sq.m., c. 15m high) to house equipment including the generator, flywheel, lube oil skid, air compressor and pumps; b) supporting items of plant located within the compound including *cooling equipment (c. 690 sq.m., c. 3m high); *c. 7m high modular containers to house electrical and control equipment (total area of c. 384sq.m); *a generator step-up transformer (c.150 sq.m c. 8m high), auxilary transformer (c. 48 sq.m., 7m high) and electrical plant including an external circuit breaker (c 66 sq.m., c. 9m high); *firefighting water tank (c. 7m dia., c. 8m high, pump house (c. 21 sq.m., c. 3m high); and * an above-ground oil separator and collection pit (c. 72sq.m.) connections to existing site services networks including electrical, water and wastewater and an underground surface water attenuation tank connecting to existing surface water drains; c) all other ancillary and miscellaneous site works including site clearance; site access, internal roads and development of areas of hard standing including a maintenance lay-down area; and d) the development will be bounded by a c. 3m high chainlink fence. Site access will be by means of a new c. 2.7 m high palisade gate accessed from existing roads within the station site. Planning Permission is being sought for a duration of 10 years.	Conditional Permission
CCC. Ref. 2332	For development within the Moneypoint Generating Station, Carrowdotia North and Carrowdotia South, Kilimer, County Clare (Eircode V15 R963) which is licenced by the Environmental Protection Agency (EPA) under an Industrial Emissions (IE) Licence (Ref P0605-04) and Upper tier COMAH site and therefore falls under the requirements of the Control of Major	Conditional Permission

	Accident Hazard Regulations (COMAH) Regulations, 2015. The development, which will be located at various locations within the station complex, will consist of land-based site Investigation (SI) works comprising of boreholes and trial pits across the site	

Table 30-37 Offshore Wind Developments with the potential to cause cumulative effects on climate alone and in-combination with the Project

Proposed Offshore Wind Farm	Status	Description	Distance to the OAA (km)	Distance to the OEC (km)	Planning Reference (if available)
Arklow Bank Phase 2	Phase 1	Offshore wind farm with a MEC of 800MW and will consist of up to 56 WTGs with a maximum tip height of 287m and a rotor diameter of 250m.[194]	270.0482912	243.9986066	Bord Pleanála Case reference: OA27.319864
Dublin Array	Phase 1	Offshore wind farm with a MEC of 900MW and will consist of 61 WTGs with a maximum tip height of 308m and a rotor diameter of 285m.[195]	266.252928	250.9277427	Bord Pleanála Case reference: VC06D.308178
North Irish Sea Array (NISA)	Phase 1	Offshore wind farm with a MEC of 500MW and will consist of 36 WTGs with a maximum tip height of 320m and a rotor diameter of 290m.[196]	269.3916404	266.794745	Bord Pleanála Case reference: OA29N.319866
Codling Wind Park	Phase 1	Offshore wind farm with a MEC of 1500MW and will consist of 140 WTGs with a maximum tip height of 320m and a rotor diameter of 288m.[197]	276.0786677	257.5145436	Bord Pleanála Case reference: OA29N.320768

[194] *Arklow Bank Phase 2 <https://www.arklowbank2offshoreplanning.ie/>*
[195] *Dublin Array <https://dublinarray.com/>*
[196] *North Irish Sea Array <https://northirishseaarray.ie/>*
[197] *Codling Wind Park <https://codlingwindpark.ie/>*

Oriel Wind Farm	Phase 1	Offshore wind farm with a MEC of 375MW and will consist of 25 WTGs with a maximum tip height of 270m and a rotor diameter of 236m.[198]	264.3035514	266.1617067	Bord Pleanála Case reference: OA15.319799
Danu	Draft South Coast DMAP	Proposed offshore renewable energy development (OREDP) off the southeast coast of Ireland. When the wind farm design has been optimised and all environmental constraints fully considered and accommodated, it is expected the project will have a MEC of up to 1000MW. Based on the 14.7MW offshore wind turbines that are available in the market today, 1000 MW equates to approximately 67 turbines.[199]	272.8	216	N/A
Lí Ban	Draft South Coast DMAP	Proposed OREDP off the southeast coast of Ireland.	244	190.5	N/A
Manannán	Draft South Coast DMAP	Proposed OREDP off the southeast coast of Ireland.[200]	262.9	210	N/A
Tonn Nua	Draft South Coast DMAP	Proposed OREDP off the southeast coast of Ireland.	222.5	171.5	N/A

[198] Oriel Wind Farm <https://orielwindfarm-marineplanning.ie/>
[199] Danu Offshore Wind Farm <https://danuoffshorewind.ie/about-project>
[200] Manannán Offshore Wind Farm <https://www.manannanenergy.ie/faq>

30.7.1 Construction Phase

Table 30-21 above (Section 30.4.2.4.1) presents net Project emissions per 5-year carbon budget (detailed in Section 30.2.2 above and in Section 1.2.4 of Appendix 30-1). Construction of both the Offshore Site and the Onshore Site is assumed to start in 2027. As per the methodology outlined in Section 30.4.2.2, the magnitude of Project impact on the carbon budgets will constitute **negligible change** in the 2021-2025 period, consisting only of preconstruction surveys. This will represent **0.002%** of the first Irish carbon budget. This impact will be short-term and imperceptible only, which is Not Significant given the quantity of greenhouse gases that will be emitted to the atmosphere and will be restricted to the duration of the construction phase.

In the 2026 to 2030 period – which will encompass the entirety of the construction phase of the Project – Project emissions will represent **0.34%** of the second Irish carbon budget. This represents a **small increase**. This impact will be short-term and slight only, which is Not Significant, given the quantity of greenhouse gases that will be emitted to the atmosphere and will be restricted to the duration of the construction phase.

The construction of proposed and planned offshore wind farm projects, detailed in Table 30-37 above, have the potential overlap with the construction phase of the Project, if granted development permission. These works would have the potential to take place in the second carbon budget period (2026-2030). In this period, there is a potential for cumulative effects arising from the Project and other planned or proposed offshore wind energy development projects which will fall under the Electricity Sector carbon budget of 20MtCO_2e. However, once the mitigation proposals, as outlined in Section 30.6.2 are implemented, the Onshore Site will not result in any significant residual effects on climate. The construction phase of the Project and proposed and planned offshore wind farm projects listed in Table 30-37, has a potential for slight cumulative negative effects. This will be restricted to the duration of the construction phase and will therefore give rise over a short-term duration. However, once emitted to the atmosphere, the greenhouse gas emissions that will arise from construction phase activities will have a permanent slight negative effect on Climate which is Not Significant.

During the construction phase of the Onshore Site and other developments as described in Chapter 2 Background and Planning Policy, that are yet to be constructed, there will be minor emissions from construction plant and machinery and potential dust emissions associated with the construction activities. However, once the mitigation proposals, as outlined in Section 30.6.2 are implemented, the Onshore Site will not result in any significant residual effects on climate and will not contribute to any cumulative effect when considered in combination with other plans and projects. Exhaust emissions of carbon dioxide (CO_2), oxides of nitrogen (NO_x), sulphur dioxide (SO_2) or other greenhouse gases during the construction phase of the Onshore Site will be minimal. These will be restricted to the duration of the construction phase, and as such will give rise to emission over a short-term duration. However, once emitted to the atmosphere, the greenhouse gas emissions that will arise from construction phase activities will have a permanent slight negative effect on Climate which is Not Significant.

Mitigation proposed in Section 30.6.2 above will be deployed during the construction phase of the Project to ensure that effects associated with the Project remain not significant, these measures will also serve to ensure the cumulative effect of other permitted or proposed projects in the area, in tandem with the Project, will not result in significant effects on climate.

Once the mitigation proposals, as outlined in the above assessment in Section 30.6.2 are implemented during the construction phase of the Project, there will be potential for slight negative cumulative negative effect on climate owing to the Project and other proposed or consented plans and projects within the surrounding landscape be constructed in parallel with the Project. Therefore, there will be no significant cumulative effects associated with the construction phase of the Project.

30.7.2 Operation and Maintenance Phase

The nature of the Project is such that, once operational, it will have a long-term, moderate, positive effect on climate. All carbon losses associated with the Project will be ‘paid back’ by the operation and maintenance phase of the Project after approximately **three years** of operation.

Table 30-21 above (Section 30.4.2.4.1) presents net Project emissions per 5-year carbon budget (detailed in Section 30.2.2 above and in Section 1.2.4 of Appendix 30-1). Full operation of the Project is assumed to commence in 2029 and continue beyond the 2050 net zero target date. As per the methodology outlined in Section 30.4.2.2, the magnitude of Project impact on the carbon budgets will constitute **negligible change**, i.e., a **0.002%,** in the first carbon budget period (2021-2025) period. The Project will result in a **small increase** represent approximately **0.34%** of the second carbon budget period (2026-2030) period. From 2031 to 2035, the Project will result in a **beneficial reduction** of emissions of approximately **-1.44%** in the third Irish carbon budget as a result of the renewable energy being generated as part of the operation and maintenance phase. Over the proposed 38-year operational lifetime of the Project, percentage reductions of Ireland’s carbon budgets beyond 2035 will follow the trajectory of the percentage reduction of the third carbon budget. As carbon budgets are not yet determined past 2035, it is not possible to quantify the percentage of the Project’s CO_2e emissions between 2035 and 2067 (the estimated end date for the operation and maintenance phase of the Project). However, as stated above the Project will displace approximately **17.56 million tonnes** of CO2e emissions over the proposed 38-year operational lifetime of the Project from traditional carbon-based electricity which will serve to assist the Irish Government’s ability to meet any individual future carbon budget.

The operation and maintenance phase of proposed and planned offshore wind farm projects, detailed in Table 30-37 above, will overlap with the operation and maintenance phase of the Project. The operational phase of the Project and other permitted or planned offshore projects will take place in the third and any future carbon budget periods set forth by the Irish government. The Project alone will result in a beneficial reduction of -1.44% of the available carbon budget in the third carbon budget period. Therefore, it can be determined that cumulatively the Project and all other permitted or proposed offshore wind projects will have long-term significant positive cumulative effect on climate and will assist Ireland in meeting its national and international climate targets.

Mitigation proposed in Section 30.6.3 above will be deployed during the operation and maintenance phase to mitigate greenhouse gas emissions associated with maintenance and monitoring activities to ensure that effects associated with the Project remain not significant. As identified above emissions during the operation and maintenance phase will result in a long-term significant positive effect on Climate. The proposed mitigation measures identified in Section 30.6.3 will serve to mitigate this effect and ensure the cumulative effect of other permitted or proposed projects in the area, in tandem with the Project, will result in significant effects on climate.

30.7.3 Decommissioning Phase

The works required during the decommissioning phase are described in Section 5.8 in Chapter 5: Project Description. For the purposes of assessment, a nominal value of 1.2% of the total emissions for the Project was used to estimate the emissions associated with decommissioning. There is therefore potential for cumulative greenhouse gas emissions to result from the Project during the decommissioning phase as once greenhouse gases are emitted to the atmosphere, they are considered permanent.

The decommissioning of the proposed and planned offshore wind farm projects, detailed in Table 30-37 above, will overlap with the decommissioning phase of the Project. The operation and maintenance phase of the Project and other permitted or planned offshore projects will take place under any future carbon budget periods set forth by the Irish government. The budget for the Electricity beyond the third carbon budget period has not yet been defined. However, as identified above in Section 30.6.4

emissions during the decommissioning phase will have an imperceptible negative effect on climate and will be restricted to the duration of the decommissioning phase and will therefore give rise over a short-term duration. However, once emitted to the atmosphere, the greenhouse gas emissions that will arise from decommissioning phase activities will have a permanent imperceptible negative effect on Climate. Any cumulative impact and consequential effect that occurs during the potential decommissioning phase of the Project are similar to that which occur during the construction phase, be it of less impact. The mitigation measures prescribed for the construction phase, i.e., Section 30.6.2 above, will be implemented during the decommissioning phase thereby minimising any potential cumulative effects. Therefore, there will be no significant cumulative effects associated with the decommissioning phase of the Project.

A Rehabilitation Plan, including details on the decommissioning has been prepared for the Project (Appendix 5-18) and will be updated prior to the end of the operational period in line with decommissioning methodologies that may exist at the time and any proposed changes will be agreed with the competent authority at that time.

30.8 Summary

Following consideration of the residual effects (post-mitigation) it is noted that during the construction and decommissioning phase of the Project will not result in any significant effects on climate. During the operation and maintenance phase, the Project will result in a significant positive effect on climate.

Provided that the Project is constructed, operated and decommissioned in accordance with the design, best practice and mitigation that is described within this application, significant negative effects on climate through greenhouse gas emissions are not anticipated at international, national or county scale.

Furthermore, the Project is expected to have a long-term significant positive effect on climate due to the displacement of approximately **17.56 million tonnes** of CO2e emissions over the proposed 38-year operational lifetime of the Project from traditional carbon-based electricity which will serve to assist the Irish Government’s ability to meet any individual future carbon budget.

BIBLIOGRAPHY

Ahmad, S., Liu, H., Günther, A., Couwenberg, J., & Lennartz, B. (2020). Long-term rewetting of degraded peatlands restores hydrological buffer function. Science of the Total Environment, 749, 14157. https://doi.org/10.1016/j.scitotenv.2020.141571

Allekotte, L., & Garrett, P. (2024). Life Cycle Assessment of Electricity Production from an offshore V236-15 MW Wind Plant. Vestas Wind Systems A/S.

Bain, C., Bonn, A., Stoneman, R., Bruneau, P., Chapman, S., Coupar, A., Evans, M., Geary, B., Howat, M., Joosten, H., Keenleyside, C., Lindsay, R., Labadz, J., Littlewood, N., Lunt, P., Miller, C., Moxey, A., Orr, H., Reed, M . S, Shepherd, M., Smith, P., Swales, V., Thompson, D. B. A., Van de Noort, R., Wilson, J.D., Worrall, F. (2011) Commission of Inquiry on UK Peatlands. IUCN UK Peatland Programme, Edinburgh.

Bonn, Aletta & Allott, Tim & Evans, Martin & Joosten, Hans & Stoneman, Rob. (2016). Peatland restoration for ecosystem services. 10.1017/CBO9781139177788.002.

BSI (2019) BS EN ISO 14064-1:2019. Greenhouse gases. Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals.

Burden, A., Smeaton, C., Angus, S., Garbutt, A., Jones, L., Lewis H. D. and Rees. S.M. (2020) Impacts of climate change on coastal habitats relevant to the coastal and marine environment around the UK. MCCIP Science Review 2020, 228–255.

Burrows, M.T., Hughes, D.J., Austin, W.E.N., Smeaton, C., Hicks, N., Howe, J.A., Allen, C., Taylor, P. and Vare, L.L. (2017). Assessment of Blue Carbon Resources in Scotland's Inshore Marine Protected Area Network. Scottish Natural Heritage Commissioned Report No. 957.

Burrows, M.T., O'Dell, A., Tillin, H., Grundy, S., Sugden, H., Moore, P., Fitzsimmons, C., Austin, W., Smeaton, C. 2024. The United Kingdom's Blue Carbon Inventory: Assessment of Marine Carbon Storage and Sequestration Potential in UK Seas (Including Within Marine Protected Areas). A Report to The Wildlife Trusts, WWF and the RSPB. Scottish Association for Marine Science, Oban

Burton, N.H.K., Daunt, F., Kober, K., Humphreys, E.M. and Frost, T.M. (2023) Impacts of Climate Change on Seabirds and Waterbirds in the UK and Ireland. MCCIP Science Review 2023, 26pp.

Calculating carbon savings from wind farms on Scottish peat lands: a new approach. 27 June 2008 Directorate Environment and Forestry Directorate, Energy and Climate Change Directorate; Part of Environment and climate change. ISBN: 9780755971473.

Carbon Trust (2024). Offshore wind industry product carbon footprinting guidance. Available online at: https://www.carbontrust.com/our-work-and-impact/guides-reports-and-tools/standardising-offshore-wind-carbon-footprinting [Accessed 03/10/2024].

Cámaro García, W.C.D. and Dwyer. N. 2020. Status of Ireland's Climate2020., Available online at: https://www.epa.ie/publications/research/climate-change/research-386-the-status-of-irelands-climate-2020.php [Accessed 02/10/2024].

Clare County Council (2024) Clare Climate Action Plan 2024-2029

Clare Noone, Deirdre McClean, Danielle Gallagher, Jennifer McElwain and Peter Thorne, 2023, IRELAND'S CLIMATE CHANGE ASSESSMENT Volume 1: Climate Science – Ireland in a Changing World, Environmental Protection Agency, Ireland, 228 pp, Climate Change Advisory Council (2021) Carbon Budget Technical Report https://www.climatecouncil.ie/media/climatechangeadvisorycouncil/Technical%20report%20on%20carbon%20budgets%2025.10.2021.pdf

Climate Change Advisory Council (2023) Annual Review <https://www.climatecouncil.ie/councilpublications/annualreviewandreport/CCAC-AR-2023-FINAL%20Compressed%20web.pdf>

Climate Change Performance Index (CCPI) (2023) Climate Change Performance Index 2024. https://ccpi.org/download/climate-change-performance-index-2024/

Climate Change Performance Index (CCPI) (2022) 2023 Results: Climate Mitigation Efforts of 57 Countries plus the EU. Covering 90% of the Global Greenhouse Gas Emissions. www.ccpi.org

Collins M., M. Sutherland, L. Bouwer, S.-M. Cheong, T. Frölicher, H. Jacot Des Combes, M. Koll Roxy, I. Losada, K. McInnes, B. Ratter, E. Rivera-Arriaga, R.D. Susanto, D. Swingedouw, and L. Tibig, 2019: Extremes, Abrupt Changes and Managing Risk. In: IPCC Special Report on the Ocean and Cryosphere in a Changing Climate [H.-O. Pörtner, D.C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, A. Alegría, M. Nicolai, A. Okem, J. Petzold, B. Rama, N.M. Weyer (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA, pp. 589–655. https://doi.org/10.1017/9781009157964.008.

Community Climate Change Consortium for Ireland (June 2008) Ireland in a Warmer World <https://maths.ucd.ie/~plynch/Publications/Ireland_in_a_Warmer_World.pdf>

Cornes, R.C., Tinker, J., Hermanson, L., Oltmanns, M., Hunter, W.R., Lloyd Hartley, H., Kent, E.C., Rabe, B. and Renshaw, R. Climate change impacts on temperature around the UK and Ireland. MCCIP Science Review 2023, 18pp.

Cott, G. M., Beca-Carretero, P. and Stengel, D. B. (2021). Blue Carbon and Marine Carbon Sequestration in Irish Waters and Coastal Habitats. Marine Institute, Ireland.

Cottier-Cook, E., Beveridge, C., Bishop, J.D., Brodie, J., Clark, P.F., Epstein, G., Jenkins, S.R., Johns, D.G., Loxton, J., Macleod, A. and Maggs, C. (2017). MCCIP Science Review 2017: Non-Native Species. In Marine Climate Change Impacts Partnership: Science Review (pp. 47-61).

Curley, M., Coonan, B., Ruth, C.E. and Ryan, C. 2024. Ireland's Climate Averages 1991-2020. Summary Report. Met Éireann, Ireland.

Cunningham, C. and Hunt, C. (2023). Scottish Blue Carbon - a literature review of the current evidence for Scotland's blue carbon habitats. NatureScot Research Report 1326.

Deltares (2022). Skerd Rocks offshore wind farm metocean study.

Department of Communications, Climate Action and Environment (2021). Climate Action and Low Carbon Development (Amendment) Act 2021.

Department of Communications, Climate Action and Environment (2021) Climate Action Plan (CAP).

Department of Communications, Climate Action and Environment (2018). Sustainable Development Goals National Implementation Plan 2018-2020.

Department of Communications, Climate Action and Environment (2015). Climate Action and Low Carbon Development Act 2015.

Department of Environment, Climate and Communications (2023) Climate Action Plan 2024.

Department of Environment, Climate and Communications (2022). Climate Action Plan 2023.

Department of Environment, Climate and Communications (May 2022). Draft of the Second National Implementation Plan for the SDG Goals 2022-2024.

Department for Environment, Food and Rural Affairs (DEFRA) (2023). Calculate the carbon dioxide equivalent quantity of an F gas. Available online at: https://www.gov.uk/guidance/calculate-the-carbon-dioxide-equivalent-quantity-of-an-f-gas. [Accessed 28/07/2023].

Department of the Environment, Heritage and Local Government (2007) National Climate Change Strategy 2007 – 2012. Stationery Office, Dublin.

Department of the Environment, Heritage and Local Government (2006). Wind Energy Development Guidelines for Planning Authorities (Revised). Stationery Office, Dublin.

Department of Climate Change, Action & Environment. Renewable Energy Action Plan (NREA) Submitted under Article 4 of Directive 2009/28/EC.

Department of Climate Change, Action & Environment National Energy Efficiency Action Plan (NEEAP).

Department of the Taoiseach (2020). Programme for Government: Our Shared Future.

De Grave, S., Fazakerley, H., Kelly, L., Guiry, M.D., Ryan, M. and Walshe, J. (2000). A study of selected maërl beds in Irish waters and their potential for sustainable extraction. Marine Resource Series, No. 10. Marine Institute, Dublin.

Diesing, M., Kröger, S., Parker, R., Jenkins, C., Mason, C. and Weston, K. (2017). Predicting the standing stock of organic carbon in surface sediments of the North–West European continental shelf. Biogeochemistry, 135, pp.183-200.

Doddy Clarke, E, Sweeney, C, McDermott, F, et al. Climate change impacts on wind energy generation in Ireland. Wind Energy. 2021; 1- 13. DOI: 10.1002/we.2673.

Dye, S., Berx, B., Opher, J., Tinker, J.P. and Renshaw, R. (2020) Climate change and salinity of the coastal and marine environment around the UK. Marine Climate Change Impacts Partnership Science Review 2020, 76–102. Available online at: https://www.mccip.org.uk/sites/default/files/2021-07/04_salinity.pdf.

Eaton, J.M., McGoff, N.M., Byrne, K.A., Leahy, P. and Kiely, G. 2008 Land cover change and soil organic carbon stocks in the Republic of Ireland 1851-2000. *Clim Change*. **91**, 917-334

EirGrid, Enduring Connection Policy 2.3 Constraints Report for Area H2 Solar and Wind (December 2022). Available at: <https://cms.eirgrid.ie/sites/default/files/publications/ECP-2.3-Solar-and-Wind-Constraints-Report-Results-for-Area-H2-v1.0.pdf>

EirGrid, Enduring Connection Policy 2.3 Constraints Report for Offshore West (April 2024) Available at: https://cms.eirgrid.ie/sites/default/files/publications/ECP-2.3-Solar-and-Wind-Constraints-Report-Assumptions-and-Methodology-v1.1.pdf

EMODnet (2021). EMODnet Geology Mapper. Available online at: https://www.emodnet-geology.eu/map-viewer/

Environmental Protection Agency (2005) Climate Change Regional Climate Model Predictions for Ireland. https://www.epa.ie/publications/research/climate-change/climate-change-regional-climate-model-predictions-for-ireland-.php

Environmental Protection Agency (2009) SoilC – Measuring and Modelling of Soil Carbon Stocks and Stock Changes in Irish Soil <https://www.epa.ie/publications/research/land-use-soils-and-transport/STRIVE_35_Kiely_SoilOrganicC_syn_web.pdf>

Environmental Protection Agency (2012) Winners and Losers: Climate Change Impacts on Biodiversity in Ireland Climate Change Impacts on Biodiversity in Ireland: Projecting Changes and Informing Adaptation Measures. EPA Climate Change Research Programme 2007–2013 Report Series No. 19. Environmental Protection Agency. https://www.epa.ie/pubs/reports/research/climate/CCRP_19.pdf

European Protection Agency (2022). Guidelines on the information to be contained in Environmental Impact Assessment Reports. Available online at: https://www.epa.ie/publications/monitoring–assessment/assessment/EIAR_Guidelines_2022_Web.pdf [Accessed 04/10/2024].

Environmental Protection Agency (2022) Ireland's Greenhouse Gas Emissions Projections 2022-2040.

Environmental Protection Agency (2022) Soil Organic Carbon and Land-Use Mapping <https://www.epa.ie/publications/research/climate-change/Research_Report_422.pdf>

Environmental Protection Agency (2022) Peatland Properties Influencing Greenhouse Gas Emissions and Removal <https://www.epa.ie/publications/research/climate-change/Research_Report_401.pdf>

Environmental Protection Agency (2024) Ireland's National Inventory Report 2023 - Greenhouse Gas Emissions 1990-2021

Environmental Protection Agency (2024) Ireland's Greenhouse Gas Emissions Projections 2023-2050. EPA, Ireland.

EPA Research (2020) High-resolution Climate Projections for Ireland – A Multimodel Ensemble Approach https://www.epa.ie/publications/research/climate-change/Research_Report_339_Part1.pdf /

European Commission (2023) COP28 Climate Change Conference. Available at: https://www.cop28.com/en/

European Commission (2022) COP27 Climate Change Conference. Available at: https://cop27.eg/#/

European Commission (2021). EC Technical Guidance on Climate Proofing of Infrastructure. Available online at: https://ec.europa.eu/newsroom/cipr/items/722278/ [Accessed 25/03/2024].

European Commission (2019) COP25 Climate Change Conference. Available at: https://ec.europa.eu/clima/events/cop25-climate-change-conference_en

European Commission (2019) European Green Deal – European Climate Law, 2021.

European Commission (2015). COP21 Paris Agreement. Available at: https://ec.europa.eu/clima/policies/international/negotiations/paris_en

European Commission, Directorate-General for Environment, *Guidance on integrating climate change and biodiversity into environmental impact assessment –*, Publications Office, 2013, https://data.europa.eu/doi/10.2779/11735

European Commission (2010) Europe 2020 Strategy A European strategy for smart, sustainable and inclusive growth. Brussels.

European Environment Agency (EEA) (2024) Greenhouse gas emission intensity of electricity generation in Europe. Available online: https://www.eea.europa.eu/en/analysis/indicators/greenhouse-gas-emission-intensity-of-1?activeAccordion=546a7c35-9188-4d23-94ee-005d97c26f2b

European Union (2014). Directive 2014/52/EU of 16 April 2014 on the assessment of the effects of certain public and private projects on the environment.

European Union (2014) 2030 Climate and Energy Policy Framework.

Findlay, H.S., Artoli, Y., Birchenough, S.N.R., Hartman, S., León, P. and Stiasny, M. (2022) Climate change impacts on ocean acidification relevant to the UK and Ireland. Marine Climate Change Impacts Partnership Science Review, 2022 24pp.

Fox, C.J., Marshall, C., Stiasny, M.H. & Trifonova, N. Climate Change Impacts on Fish of Relevance to the UK and Ireland. MCCIP Science Review 2023, 17pp.

Frolking, Steve & Talbot, Julie & Jones, Miriam & Treat, Claire & Kauffman, John & Tuittila, Eeva-Stiina & Roulet, Nigel. (2011). Peatlands in the Earth's 21st century climate system. Environmental Reviews. 19. 371-396. 10.1139/a11-014.

Frontiers in Energy Research (2022) Climate Change Impact on the Offshore Wind Energy Over the North Sea and the Irish Sea. https://www.frontiersin.org/journals/energy-research/articles/10.3389/fenrg.2022.881146/full.

Gorham, Eville. "Northern Peatlands: Role in the Carbon Cycle and Probable Responses to Climatic Warming." Ecological Applications, vol. 1, no. 2, 1991, pp. 182–95. JSTOR, https://doi.org/10.2307/1941811

Government of Ireland (2019) Irelands Biodiversity Sectoral Climate Change Adaptation Plan Available online: https://www.npws.ie/sites/default/files/files/32631_NPWS_Climate%20Change%20Reirish%20flora%20port_15Feb(1).pdf.

Hall-Spencer, J.M. Kelly, J. and Maggs, C.A. (2008). Assessment of maerl beds in the OSPAR area and the development of a monitoring program. Available online at: https://www.npws.ie/sites/default/files/publications/pdf/Hall-Spencer_et_al_2008_OSPAR_maerl.pdf [Accessed 04/10/2024].

Horsburgh, K., Rennie, A. and Palmer, M. (2020). Impacts of climate change on sea-level rise relevant to the coastal and marine environment around the UK. Marine Climate Change Impacts Partnership Science Review 2020, 116–131.

Hübler, C. and Rolfes, R. (2021). Analysis of the influence of climate change on the fatigue lifetime of offshore wind turbines using imprecise probabilities. Wind Energy, 24(3), pp.275-289.

IEA (2024), Renewables 2023, IEA, Paris

IEMA (2020). Environmental Impact Assessment Guide to Climate Change Resilience and Adaption. Available online at: https://www.iema.net/resources/reading-room/2020/06/26/iema-eia-guide-to-climate-change-resilience-and-adaptation-2020 [Accessed 22/03/2024].

IEMA (2022). Assessing Greenhouse Gas Emissions and Evaluating their Significant, 2nd Edition. Available online at: https://www.iema.net/resources/blog/2022/02/28/launch-of-the-updated-eia-guidance-on-assessing-ghg-emissions [Accessed 19/04/2023].

Irish Data Buoy Network (2023). Available at: http://vis.marine.ie/dashboards/#/dashboards/weather?buoy=M1&=&measurement=SeaTemperature [Accessed August 2023].

Irish Peatland Conservation Council. Extent & Utilisation of Irish Peatlands <https://www.ipcc.ie/a-to-z-peatlands/irelands-peatland-conservation-action-plan/peatland-action-plan/extent-utilisation-of-irish-peatlands/> [Accessed on 28/08/2024]

International Maritime Organisation (IMO) (2023). 2023 IMO (2023) 2023 IMO Strategy on Reduction of Greenhouse Gas Emissions from Ships. Accessed July 23, 2024.

IPCC (2006) chapter 7 Wetlands, Volume 4 <https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_07_Ch7_Wetlands.pdf>

IPCC, 2010. Guidance Note for Lead Authors of the IPCC Fifth Assessment Report on Consistent Treatment of Uncertainties, <https://www.ipcc.ch/site/assets/uploads/2017/08/AR5_Uncertainty_Guidance_Note.pdf – Accessed April 2021>

IPCC (2021). Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Pêan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press. In Press.

IPCC (2021). Weather and Climate Extreme Events in a Changing Climate. In Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change.

IRENA (2023), IRENA's energy transition support to strengthen climate action: Insight to impact 2023, International Renewable Energy Agency, Abu Dhabi.

James, M., Haldar, S., Varghese, R., Bhattacharya, S. and Pakrashi, V. (2023). Climate change effects on offshore wind turbines. In Wind Energy Engineering (pp. 413-422). Academic Press.

Jones, H.P., Hole, D.G. & Zavaleta, E.S. (2012) Harnessing nature to help people adapt to climate change Nature Climate Change 2, 504–509 doi:10.1038/nclimate1463

Küpper, F.C. and Kamenos, N.A. (2017). The future of marine biodiversity and marine ecosystem functioning in UK coastal and territorial waters (including UK Overseas Territories. Foresight Future of the Sea project. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/663897/Future_of_the_Sea_-_Marine_Biodiversity_Final.pdf [Accessed 23/01/2023]

Limpens, J., Berendse, F., Blodau, C., Canadell, J. G., Freeman, C., Holden, J., Roulet, N., Rydin, H., and Schaepman-Strub, G.: Peatlands and the carbon cycle: from local processes to global implications – a synthesis, Biogeosciences, 5, 1475–1491, https://doi.org/10.5194/bg-5-1475-2008, 2008.

Liu, H., Price, J., Rezanezhad, F., Lennartz, B., 2020a. Centennial-scale shifts in hydrophysical properties of peat induced by drainage. Water Resour. Res. 56 (10), e2020WR027538.

Luisetti, T., Turner, R.K., Andrews, J.E., Jickells, T.D., Kröger, S., Diesing, M., Paltriguera, L., Johnson, M.T., Parker, E.R., Bakker, D.C. and Weston, K (2019). Quantifying and valuing carbon flows and stores in coastal and shelf ecosystems in the UK. *Ecosystem Services*, 35, 67-76.

Martin, E., Banga, R. and Taylor, N.L. Climate change impacts on marine mammals around the UK and Ireland. MCCIP Science Review 2023, 22pp.

Met Éireann www.met.ie

Moore, P.J. and Smale, D.A. (2020) Impacts of climate change on shallow and shelf subtidal habitats relevant to the coastal and marine environment around the UK. MCCIP Science Review 2020, 272–292.

Moradian, S., Olbert, A.I., Gharbia, S. and Iglesias, G. (2023). Copula-based projections of wind power: Ireland as a case study. Renewable and Sustainable Energy Reviews, 175, p.113147.

Masselink, G., Russell, P., Rennie, A., Brooks, S. and Spencer, T. (2020) Impacts of climate change on coastal geomorphology and coastal erosion relevant to the coastal and marine environment around the UK. MCCIP Science Review 2020, 158–189.

Mieszkowska, N., Burrows, M. and Sugden, H. (2020) Impacts of climate change on intertidal habitats relevant to the coastal and marine environment around the UK. MCCIP Science Review 2020, 256–271.

Nolan, P., and J. Flanagan, 2020: High-Resolution Climate Projections for Ireland – a Multi-model Ensemble Approach. Environmental Protection Agency. <https://www.epa.ie/publications/research/climate-change/Research_Report_339_Part1.pdf>

Nolan, P. 2015. EPA Report: Ensemble of Regional Climate Model Projections for Ireland. EPA climate change research report no. 159. EPA: Wexford.

Nolan, G., Cusack, C., & Fitzhenry, D. (Eds.) (2023). Irish Ocean Climate & Ecosystem Status Report. Marine Institute, Galway, Ireland.

Norton, D., Hynes, S., and Boyd, J. (2018). Valuing Ireland's Blue Ecosystem Services. Available online at: https://www.universityofgalway.ie/media/researchsites/semru/files/marine_ecosystem_service_non_technical_report_final.pdf [Accessed 04/10/2023].

New York State Energy Research and Development Authority (2021) Offshore Wind Climate Adaptation and Resilience Study. https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Programs/Offshore-Wind/Offshore-Wind-Climate-Adaptation-and-Resilience-Study.pdf.

O'Sullivan, J., Sweeney, C., Nolan, P. and Gleeson, E., 2015. A high-resolution, multi-model analysis of Irish temperatures for the mid-21st century. International Journal of Climatology. doi: 10.1002/joc.4419.

Riahi, K., Rao, S., Krey, V. et al. RCP 8.5—A scenario of comparatively high greenhouse gas emissions. Climatic Change 109, 33 (2011). https://doi.org/10.1007/s10584-011-0149-y

Payne, M.R., Kudahl, M., Engelhard, G.H., Peck, M.A. and Pinnegar, J.K. (2021). Climate-risk to European fisheries and coastal communities. PNAS, 118(40), e201808611.

Porter, J, S., Austin, W, E, N., Burrows, M, T., Clarke, T., Davies, G., Kamenos, N., Riegel, S., Smeaton, C., Page, C., Want, A., (2020). Blue carbon audit of Orkney waters. Scottish Marine and Freshwater Science Vol 11 No 3, 96pp.

Schlömer S., T. Bruckner, L. Fulton, E. Hertwich, A. McKinnon, D. Perczyk, J. Roy, R. Schaeffer, R. Sims, P. Smith, and R. Wiser (2014). Annex III: Technology-specific cost and performance parameters. In: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B.

Sharples, J., Holt, J., Wakelin, S. and Palmer, M.R. Climate change impacts on stratification relevant to the UK and Ireland. MCCIP Science Review 2022, 11pp.

Smeaton, C., Austin, W. and Turrell, W.R. (2020). Re-Evaluating Scotland's Sedimentary Carbon Stocks. Scottish Marine and Freshwater Science Vol 11 No 2, 16pp.

Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Scottish Government (2008). Calculating Carbon Savings from Wind Farms on Scottish Peat Lands

Somers, J. (2022). Technologies to decarbonise the EU steel industry, EUR 30982 EN, Publications Office of the European Union, Luxembourg, ISBN 978-92-76-47147-9.

Spyroudi, A. (2021). Carbon footprint of offshore wind farm components. Available online at:: https://ore.catapult.org.uk/wp-content/uploads/2021/04/Carbon-footprint-of-offshore-wind-farm-components_FINAL_AS-3.pdf [Accessed 19/04/2023].

Susini, S., Menendez, M., Eguia, P. and Blanco, J.M. (2022). Climate change impact on the offshore wind energy over the North Sea and the Irish Sea. Frontiers in Energy Research, 10.

Sustainable Energy Authority Ireland (SEAI) Energy in Ireland 2022 Report. December 2022. <https://www.seai.ie/publications/Energy-in-Ireland-2022.pdf>

Thomson, R.C. and Harrison, G.P. (2015). Life Cycle Costs and Carbon Emissions of Offshore Wind Power. Available online at: https://www.climatexchange.org.uk/media/1461/main_report_-_life_cycle_costs_and_carbon_emissions_of_offshore_wind_power.pdf [Accessed 19/04/2023].

TII Air Quality Assessment of Proposed National Roads – Standard PE-ENV-01107. December 2022. (TII 2022a) <https://www.tiipublications.ie/library/PE-ENV-01107-01.pdf>

TII Climate Assessment of Proposed National Roads – Standard PE-ENV-01105. December 2022 (TII 2022b) <https://www.tiipublications.ie/library/PE-ENV-01105-01.pdf>

TII Climate Guidance for National Roads, Light Rail, and Rural Cycleways (Offline & Greenways) - Overarching Technical Document – Overarching Technical Document PE-ENV-01104. December 2022 (TII 2022c) <https://www.tiipublications.ie/library/PE-ENV-01104-01.pdf>

TII Carbon Tool for Road and Light Rail Projects: User Guidance Document. GE-ENV-01106. December 2022. (TII, 2022d) <https://www.tiipublications.ie/library/GE-ENV-01106-01.pdf>

TII Carbon Tool for Road and Light Rail Projects: User Guidance Document. GE-ENV-01106. December 2022. <https://www.tiipublications.ie/library/GE-ENV-01106-01.pdf>

TII (2020) TII Carbon Assessment Tool (Version 2).

Tinker, J., Lowe, J., Pardaens, A., Holt, J. and Barciela, R. (2016). Uncertainty in climate projections for the 21st century northwest European shelf seas. Progress in Oceanography, 148, 56-73.

Tomlison, R. 2005 Soil carbon stacks and changes in the Republic of Ireland. *J. Environ. Manage.* **76**, 77-93

Townhill, B.L., Couce, E., Tinker, J., Kay, S. and Pinnegar, J.K. (2023). Climate change projections of commercial fish distribution and suitable habitat around north-western Europe. Fish and Fisheries.

Townhill, B.L., Artioli, Y., Pinnegar, J.K. and Birchenough, S.N.R. (2022). Exposure of commercially exploited shellfish to changing pH levels: how to scale-up experimental evidence to regional impacts. ICES Journal of Marine Science, 79, 2362–2372.

Turunen, J., Tomppo, E., Tolonen, K., & Reinikainen, A. (2002). Estimating carbon accumulation rates of undrained mires in Finland–application to boreal and subarctic regions. The Holocene, 12(1), 69–80. https://doi.org/10.1191/0959683602hl522rp

Turunen, Jukka & Roulet, Nigel & Moore, Tim & Richard, Pierre. (2004). Nitrogen deposition and increased carbon accumulation in ombrotrophic peatlands in Eastern Canada. Global Biogeochemical Cycles. 18. 10.1029/2003GB002154.

UNECE (2021). Carbon Neutrality in the UNECE Region: Integrated Life-cycle Assessment of Electricity Sources. Available online at: https://unece.org/sites/default/files/2022-04/LCA_3_FINAL%20March%202022.pdf [Accessed 19/04/2023].

UNFCCC (1997) Kyoto Protocol to the United Nations Framework Convention on Climate Change adopted at COP3 in Kyoto, Japan, on 11 December 1997

UNFCCC (2012) Doha Climate Change Conference United Nations Framework Convention on Climate Change

United Nations (2023). The Sustainable Development Goals Report 20223

United Nations (2015) Transforming our World: the 2030 Agenda for Sustainable Development. Available at: https://sustainabledevelopment.un.org/sdgs

United Nations (2012). Doha Amendment to the Kyoto Protocol. United Nations Framework Convention on Climate Change.

United Nations (1998). Kyoto Protocol to the United Nations Framework Convention on Climate Change. United Nations Framework Convention on Climate Change, Bonn.

Wakelin, S., Townhill, B., Engelhard, G., Holt, J. and Renshaw, R. (2021) Marine heatwaves and cold spells, and their impact on fisheries in the North Sea. Journal of Operational Oceanography (Copernicus Marine Service Ocean State Report, 5), s91

Weisenfeld, N., Bix, B., Fried, M., Moran, G., Phillips, C., and Whiting, M. (2021). NYSERDA: Offshore Wind Climate Adaptation and Resiliency Study.

Wilson, D., 2021. Opening Statement for the Public Session of the Joint Committee on Agriculture and the Marine on the Subject of Rewetting of Peatlands and the Impact on Drainage for Surrounding Farmland. accessed February, 2023. https://data.oireachtas.ie/ie/oireachtas/committee/dail/33/joint_committee_on_agriculture_and_the_marine/submissions/2021/2021-03-02_opening-statement-dr-david-wilson-earth y-matters-environmental-consultants_en.pdf.

Wind Energy Engineering (2023) Climate Change Effects on Offshore Wind Turbines. https://openresearch.surrey.ac.uk/esploro/outputs/bookChapter/Chapter-28—Climate-change-effects/99778742102346.

Wiser, R., Z. Yang, M. Hand, O. Hohmeyer, D. Infi eld, P. H. Jensen, V. Nikolaev, M. O'Malley, G. Sinden, A. Zervos, 2011: Wind Energy. In IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation [O. Edenhofer, R. Pichs-Madruga, Y. Sokona, K. Seyboth, P. Matschoss, S. Kadner, T. Zwickel, P. Eickemeier, G. Hansen, S. Schlömer, C. von Stechow (eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

World Meteorological Organisation (2024) State of the Global Climate 2023

APPENDIX 30-1

CLIMATE LEGISLATION, POLICY, AND GUIDANCE

APPENDIX 30-2

CARBON CALCULATIONS

GLOSSARY

Term	Definition
Blue Carbon	Carbon captured by biological metabolic processes, i.e. in the soft tissues, shells, and skeletons of plants and animals, and buried in the marine environment in marine sediment.
Carbon Budget	Cap on the total amount of greenhouse gases which can be emitted over a specified time period. Means of setting emissions reduction targets.
Climate Change	Long-term change in average climate patterns.
Coastal Erosion	Breakdown or loss of land at the coastline due to wave, currents, tides, wind or other storm impacts.
Greenhouse Gas Emissions	A gas that contributes to the natural greenhouse effect via absorption of infrared radiation, including carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride.
Ocean Acidification	Decrease in the ocean's pH over time as a result of carbon dioxide (CO_2) absorption.
Representative Concentration Pathway (RCP)	Climate change scenarios used in modelling possible future climate evolution. Based on a wide suite of assumptions, RCP pathways specify greenhouse gas concentrations that will result in defined radiative forcing by 2100[1].
Stratification	The horizontal separation of water in layers based on their differing density as a result of differences in ocean chemistry (i.e., temperature, salinity, etc.)

ACRONYMS AND ABBREVIATIONS

Acronym	Definition
AMOC	Atlantic Meridional Overturning Circulation
AQG	Air Quality Guideline
CAP	Climate Action Plan
CCAC	Climate Change Advisory Council
CCPI	Climate Change Performance Index
CEMP	Construction and Environmental Management Plan

[1] *See here: https://www.ipcc.ch/report/ar5/syr/*

Acronym	Definition
CFRAM	Irelands Catchment Flood Risk Assessment and Management programme
COMAH	Control of Major Accident Hazard Regulations
COP	Conference of the Parties
CSR	Corporate Social Responsibility
DECC	Department of the Environment, Climate and Communications
DEFRA	Department for Environment, Food and Rural Affairs
DUKES	Digest of UK Energy Statistics
EC	European Commission
EEA	European Environment Agency
EIAR	Environmental Impact Assessment Report
EPA	Environmental Protection Agency
ESG	Environmental Social Governance
ESR	Effort Sharing Regulation
ETS	Emissions Trading System
EU	European Union
FRA	Flood Risk Assessment
GBS	Gravity Base Structure Fixed-Bottom Foundations
GIS	EirGrid/ESB 220kV Gas Insulated Switchgear building
GW	Gigawatt
HDD	Horizontal Directional Drilling
HES	Hydro-Environmental Services
HMR	Helicopter Main Route
IAA	Irish Aviation Authority
IAC	Inter-Array Cables

Acronym	Definition
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
ICCA	Irelands Climate Change Assessment
ICCI	In-Combination Climate Impact
ICE	Inventory of Carbon and Energy
IDL	Irish Drilling Limited
IEMA	Institute of Environment Management and Assessment
IMO	International Maritime Organisation
INNS	Invasive Non-Native Species
IPCC	Intergovernmental Panel on Climate Change
IUU	Illegal, Unreported and Unregulated
LACAP	Local Authority Climate Action Plan
MCCIP	Marine Climate Change Impacts Partnership
MGN	Marine Guidance Notice
MPA	Marine Protected Area
MRF	Materials Recovery Facility
MW	Megawatt
NAO	North Atlantic Oscillation
NBAP	National Biodiversity Action Plan
NEEAP	National Energy Efficiency Action Plan
NIR	National Inventory Report
OAA	Offshore Array Area
OCC	220kV Onshore Compensation Compound
OEC	Offshore Export Cable
OECC	Offshore Export Cable Corridor
OGC	Onshore Grid Connection
OLL	Onshore Landfall Location

Acronym	Definition
OSS	Offshore 220kV Electrical Substation
PSU	Practical Salinity Unit
RCP	Representative Concentration Pathway
SAR	Search and Rescue
SDG	Sustainable Development Goals
SSC	Suspended Sediment Concentrations
TII	Transport Infrastructure Ireland
TJB	Transition Joint Bay
TOC	Total Organic Carbon
UAE	United Arab Emirates
UKCS	United Kingdom Continental Shelf
UNFCCC	United Nations Framework Convention on Climate Change
UTC	Coordinated Universal Time
WAM	With Additional Measures
WEM	With Existing Measures
WHO	World Health Organisation
WMO	World Meteorological Organisation
WMP	Waste Management Plan
WTG	Wind Turbine Generator
XPLE	Cross-Linked Polyethylene