Sure Partners Limited

ARKLOW BANK WIND PARK PHASE 2
ONSHORE GRID INFRASTRUCTURE

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

VOLUME II

Chapter 8 Climate

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Contents

8 Climate

8.1 Introduction

The Arklow Bank Wind Park Phase 2 (the Project) is an offshore wind farm, located off the coast of County Wicklow, on the east coast of Ireland.

The proposed development will comprise the onshore grid infrastructure for the Project, including 220kV onshore export cable circuits and fibre optic cables, from the landfall of the offshore export cable circuits at Johnstown North, to a proposed onshore 220kV substation at Shelton Abbey and connection from the new substation to the National Electricity Transmission Network (NETN).

This chapter presents an assessment of the likely significant effects of the proposed development on climate including a quantitative assessment of construction carbon emissions.

The impact on flooding and natural disasters, which are effects of climate change on the proposed development, is addressed in **Chapter 10** *Water*, the Flood Risk Assessment **Appendix 10.1** of **Volume 3** and **Chapter 19** *Major Accidents and Disasters*.

The potential effects on air quality due to the proposed development are considered in **Chapter 7** *Air Quality*.

Chapter 5 *Description of Development* provides a description of the proposed development and **Chapter 6** *Construction Strategy* describes the construction strategy for the proposed development. The following aspects are particularly relevant to the climate assessment:

- Construction and Decommissioning:
  - Aspects relating particularly to the construction of the proposed development, including mitigation measures to reduce carbon emissions.
- Operation:
  - Aspects relating particularly to the operation and maintenance of the proposed development.

8.2 Assessment Methodology

8.2.1 General

The potential effects of emissions of carbon due to the construction, operation and decommissioning of the proposed development are considered in the context of Ireland's national climate change obligations. The climate assessment for the construction phase estimates the potential for greenhouse gas (GHG) emissions, i.e. carbon dioxide equivalence (CO_2 eq.), for the proposed development.

EU greenhouse gas emission reduction targets and reduction obligations for Ireland are split into two broad categories. The first category covers the large energy and power (i.e. energy intensive) industry which have their emissions controlled under the EU Emissions Trading Scheme (ETS). The second category deals with the non-Emissions Trading Scheme (non-ETS) sectors such as agriculture, transport, residential, commercial, waste and non-energy intensive industry.

As construction materials (primarily concrete and steel) are manufactured using energy intensive practices, the carbon impact is assessed against the ETS category.

The results of this assessment have been compared with the EPA's projected GHG emissions for the Emission Trading Scheme (ETS) sector and Ireland's total projected emissions for 2024, as this is expected to be the final year of construction.

There will be occasional maintenance works required during the operational phase which will require trips by road to the site, resulting in very minor increases in road traffic. However, it is not predicted that this will result in any significant carbon emissions.

As stated in the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5) Synthesis Report – Climate Change 2014, mitigation (i.e. reducing carbon emissions) and adaptation (i.e. responding to climate change impacts) are complementary approaches to reducing risks of climate change impacts over different timescales.

8.2.2 Sulphur Hexafluoride (SF_6)

The transmission and connection substations will use electrical equipment insulated with Sulphur Hexafluoride (SF_6) gas. The handling and maintenance of the equipment will lead to very low-level losses of SF_6.

SF_6 is listed under Section 3 of Annex 1 of the European F-Gas Regulations 2015. SF_6 is also listed as a GHG and, according to the Intergovernmental Panel on Climate Change (IPPC), it is the most potent GHG that has been tested, with a greenhouse gas potential 23,000 times higher than that of carbon dioxide. Table 4.3 page 133 of the EPA Ireland's National Inventory Report 2020 shows that Ireland's total SF_6 emissions from emission source category *2.G.1 Electrical Equipment* in 2018, the latest year for which the information is provided, was 16.13 kt CO_2 eq. This represented 0.026% of Ireland's total calculated emissions in 2018.

On page 140, the report explains this emission source category as follows:

"Section 4.8.1 Electrical Equipment (2.G.1)
4.8.1.1 Category Description
SF_6 is used for electrical insulation, arc quenching, and for current interruption in equipment used in the transmission and distribution of electricity.

The Electricity Supply Board (ESB) is the owner of both the high and low voltage distribution systems and the owner and operator of the medium and lower voltage distribution systems in Ireland. SF_6 is used in equipment across all voltage ranges on both the Distribution and Transmission systems owned by ESB Networks. Electrical equipment containing SF_6 is imported into Ireland and at time of purchase, is added to the SF_6 installed inventory database. Quantities of SF_6 are needed for servicing and repair of existing equipment. There are no manufacturing emissions. As of 2019 ESB Networks requested equipment manufacturers of non-hermetically sealed switchgear to only supply a low level of SF_6 for safe transport to Ireland. Once installed on site the remaining amount of SF_6 required is used from ESB Networks internal stock. Significant reduction in emissions in the years 2008 to 2010 are attributed to the network operator's investment in staff training, leak detection equipment and closed cycle SF_6 handling equipment. The increase in 2011 is due the highest installed inventory stock levels occurring in the period 2009 to 2011, but losses remain low around 0.5 per cent."

The design and manufacture of the gas insulated electrical equipment in the transmission and connection substations will follow industry best practice to reduce losses to a practical minimum. The switchgear will be equipped with pressure or density monitoring devices. Staff and any sub-contractors involved in equipment installation, servicing or disposal will also be trained to ensure they understand the techniques required to minimise the generation of fugitive emissions.

The emission of SF_6 from the transmission and connection substations are not expected to have a significant effect on climate, and thus is not considered further in this assessment.

A substantial leak of SF_6 is assessed in **Chapter 19** *Major Accidents and Disasters*.

8.2.3 Guidance and Legislation

European

Under the current EU Effort-Sharing Regulation, the national targets will collectively deliver a reduction of around 10% in total EU emissions from the sectors covered by 2020 and of 30% by 2030, compared with 2005 levels.

The European Green Deal, published by the European Commission in December 2019, provides an action plan which aims for the EU to be climate neutral by 2050. The EU Green Deal highlights that further decarbonisation of the energy sector is critical to reach climate objectives in 2030 and 2050.

The European Green Deal will increase the GHG emissions reduction 2030 target to at least 55% in comparison to 1990 levels. Targets for renewable energy and energy efficiency are also likely to be increased.

The 2021 EU Strategy on Adaptation to Climate Change sets out the pathway to prepare for the unavoidable impacts of climate change.

The aim is that "*by 2050, when we aim to have reached climate neutrality, we will have reinforced adaptive capacity and minimised vulnerability to climate impacts…"*

The EU has adopted integrated monitoring and reporting rules to ensure progress towards its 2030 climate and energy targets and its international commitments under the *2015 Paris Agreement*.

The EU ETS is implemented in Ireland under the *European Communities (Greenhouse Gas Emissions Trading) Regulations, SI 490 of 2012*, and amendments and *European Communities (Greenhouse Gas Emissions Trading) (Aviation) Regulations SI 261 of 2010* and amendments. The legislative framework of the EU ETS was revised in 2018 to enable it to achieve the EU's 2030 emission reduction targets in line with the *2030 Climate and Energy Policy Framework* and as part of the EU's contribution to the *2015 Paris Agreement*.

National

The Energy White Paper: Ireland's Transition to a Low Carbon Energy Future 2015-2030 was launched in 2015. This policy set out a framework to guide policy and actions that the government needed to take in the energy sector up to 2030.

The Government of Ireland's *Climate Action Plan* was published in 2019. It commits to achieving the objective of net zero carbon energy systems for Ireland. The plan sets out a detailed sectoral roadmap to deliver a cumulative reduction in emissions.

The new Programme for Government Our Shared Future, agreed in June 2020, has accelerated the decarbonisation agenda even further, committing to a 7% average yearly reduction in overall greenhouse gases over the next decade, and to achieving net zero emissions by 2050.

The National Energy and Climate Plan 2021-2030 (NECP), required under the EU Clean Energy Package, will see the production of a climate strategy with a statutory basis in EU law. The NECP incorporates all planned energy and climate policies and measures (up to the end of 2019) and if implemented will collectively deliver a 30% reduction by 2030 in non-ETS greenhouse gas emissions (from 2005 levels). The objectives in the NECP are regarded as a baseline, as opposed to the limit, of Ireland's ambition.

The *Climate Action and Low Carbon Development (Amendment) Bill* was introduced in October 2020. The Bill, if enacted will commit Ireland, in law, to move to a climate resilient and climate neutral economy by 2050. It also brings in a system of five-yearly economy-wide carbon budgets, starting in 2021, requires the annual revision of the Climate Action Plan and the preparation of a National Long Term Climate Action Strategy every ten years.

Regional

The *Wicklow County Council Climate Change Adaptation Strategy* was adopted in September 2019. The aim of Wicklow's first climate change adaption strategy is to identify the risks, challenges and opportunities that need to be considered and to take coherent coordinated action. The Strategy is based on six main themes:

1. Local Adaptation Governance and Business Operations
2. Infrastructure and Built Environment
3. Land use and Development
4. Drainage and Flood Management
5. Natural Resources and Cultural Infrastructure
6. Community Health and Wellbeing

It provides for many actions that will be developed and implemented over the next five years.

8.2.4 Categorisation of the Baseline Environment

A desk-based study of the baseline environment of the proposed development area was undertaken in order to inform this assessment. The EPA's *Ireland's Greenhouse Gas Emissions Projections 2018-2040* was referred to.

8.2.5 Impact Assessment Methodology

Construction is planned to take place from 2023 to 2024, with the development operational in 2025. The assessment of carbon emissions was carried out in order to determine the likely greenhouse gas emissions (CO_2 eq) predicted due to the construction phase of the proposed development, relative to Ireland's projected baseline for 2024, as reported by the EPA. This assessment focuses on the embodied carbon of the material used during the construction phase and compares this to the EPA's projected GHG emissions for both the Emission Trading Scheme (ETS) sector and total emissions for 2024.

The assessment considers the material manufacture, the transport of construction materials to site, the construction processes and the construction compounds.

The assessment excludes maintenance, repairs, electrical equipment within the substation, cables and water use. The assessment evaluates a worst-case for the construction phase which includes horizontal directional drilling (HDD) at the M11, the location of the HDD compound at landfall option 1 (for earthworks – southern field at landfall), sheet piling at the landfall and flood defences. The decommissioning phase is considered qualitatively in **Section 8.5.4**.

The University of Bath's (via Circular Ecology) carbon calculator (Version 1.1 November 2019) has been used to calculate the embodied carbon of cement and concrete mixtures in terms of carbon dioxide equivalency (CO_2 eq). The calculator uses data from the *Inventory of Carbon and Energy (ICE) Database - Embodied Carbon Model of Cement, Mortar and Concrete.*

For materials that are not covered by the Circular Ecology carbon calculator, namely, ceramics, hardcore and wastes, the UK Environment Agency's (UKEA) Carbon Calculator has been used to estimate carbon emissions due to construction activities in terms of carbon dioxide equivalency (CO_2 eq).

Both the Circular Ecology and the Environment Agency's Carbon Calculator considered the transport of material to the site. The varying, relevant transport distances have been included in both calculators for the transportation of materials to site.

For materials not covered by the Circular Ecology calculator or the UKEA calculator, including carbon sinks, the Transport Infrastructure Ireland (TII) *Carbon Assessment Tool for Road and Light Rail projects* (2018) is used to estimate carbon emissions.

8.3 Baseline Conditions

8.3.1 Climate

Chapter 19 *Major Accidents and Disasters* provides an overview of current climate and extreme weather events experienced in County Wicklow. The current climate and extreme weather events experienced in the County primarily relate to flooding but also drought, high temperatures, storms and cold spells, particularly in recent years.

The EPA (2019) *Irish Climate Futures: Data for Decision Making* report states that it is expected that such weather extremes will become more likely and more frequent with future climate change.

The EPA's Climate Change Research Programme carries out relevant and up to date studies on climate change in Ireland (available at www.epa.ie). Analysis of the meteorological records shows that Ireland's climate is changing in line with global patterns. The clearest trend is evident in the temperature records which show a mean temperature increase of 0.7º C between 1890 and 2008, i.e. an increase of 0.06 º C per decade. The increase was 0.4 º C during the period 1980-2008, i.e. equivalent to 0.14 º C per decade.

According to the EPA (www.epa.ie) climate change is expected to lead to the following adverse effects:

- sea level rise;
- more intense storms and rainfall events;
- increased likelihood and magnitude of river and coastal flooding;
- water shortages in summer in the east;
- adverse impacts on water quality;
- changes in distribution of plant and animal species; and
- effects on fisheries sensitive to changes in temperature.

A flood risk assessment (FRA) was prepared for the proposed development. The flood risk assessment is presented in **Appendix 10.1 of Volume 3**. The FRA had regard to sea level rise, intense rainfall events and the risk of river and coastal flooding.

Carbon Emissions

In July 2020, the EPA released the report *Ireland's Greenhouse Gas Emissions Projections 2019-2040*. This report stated that total national greenhouse gas emissions in 2018 were estimated to be 60.9 million tonnes carbon dioxide equivalent (Mt CO_2 eq). This is 1.1% lower than emissions in 2017. Ireland's greenhouse gas emissions for the energy intensive industries (known as the ETS sectors) were recorded to be 15.5 Mt CO_2 eq. in 2018.

There will be a minimal adverse impact to climate during the operational phase as there is no significant operational traffic and no significant operational emission sources. Therefore, only the impact of the construction phase of the proposed development is considered with reference to the ETS sector.

Table 8.1 presents the EPA projected emissions for the ETS sector *With Existing Measures* and *With Additional Measures* scenarios for 2020 and 2024 (assumed to be the worst-case construction year for the generation of carbon).

Table 8.1: Projected Emissions for the ETS Sector and Total Emissions (EPA, 2020)

Projections	Year	ETS Sector Only (Mt CO_2 eq.)	Total (Mt CO_2eq)
Projections (with existing measures)	2020	20.61	63.15
	2024	20.22	62.66
Projections (with additional measures)	2020	20.75	62.64
	2024	18.21	56.48

8.4 Description of the Proposed Development

8.4.1 Carbon Emissions

The aspects of the proposed development which might give rise to carbon emissions include the earthworks, the transport of materials, and the use of carbon intensive construction materials during the construction phase. This is assessed further in **Section 8.5.2.**

There is potential for disturbance or permanent loss of carbon sinks (e.g. soil and trees) brought about by land use change and vegetation clearance during the construction phase. For the M11 horizontal directional drilling option there will be a loss of immature woodland area approximately 4,000m^2 in size. There will be a loss of approximately 8,460m^2 of woodland to the north and west of the substation site. The woodland lost will be replaced with shallow rooted plants. There will be an additional 16,000m^2 of planting for biodviersity ehancement as outlined in **Chapter 12** *Biodiversity*. The carbon associated with the vegetation waste and loss of carbon sinks at the M11 and substation site and carbon sequestration from re-planting is assessed further in **Section 8.5.2.**

The sustainable earthworks design, incorporates re-use of materials to reduce the imports and exports from the site during the construction phase, thus reducing carbon emissions associated with the earthworks. The carbon effect of the earthworks is calculated in **Section 8.5.2.**

8.4.2 Resilience

The proposed development is resilient to climate change in that it will not be vulnerable to the effects of future climate change, in compliance with the 2021 EU Strategy on Adaptation to Climate Change.

The proposed development has been designed to be resilient to impacts arising from current weather events and climatic conditions, as described in **Section 8.3.1**, and in accordance with technical requirements that are built upon good industry practice, as per EirGrid functional specifications and adapted to consider climate change where appropriate.

The proposed substation is designed to allow for additional protection for future flood events with sensitivity for climate change. The proposed development incorporates improvements to the existing flood defences in the Avoca River Business Park. The surface water drainage network has been designed to ensure that no flooding or surcharging of the system will occur for all storm events up to and including the 1 in 30-year return period storm event. The proposed development is appropriately protected to the 0.1% AEP 1 in 1000 years plus Mid-Range Future Scenario allowance for climate change as detailed in the Flood Risk Assessment (**Appendix 10.1** of **Volume 3**). This includes protection for climate change peak rainfall event.

The Mid-Range Future Scenario accounting for climate change includes a 20% increased rainfall, 20% increased flood flow, 500mm sea level rise, -0.5mm/year land movement event with an allowance for climate change taking consideration of all flooding sources and mechanisms.

No significant climate change resilience risks have been found. No further climate change resilience measures are required.

8.5 Likely Significant Effects

8.5.1 ‘Do-Nothing’ Scenario

In the scenario where the proposed development did not proceed as planned, none of the construction or operational effects as set out in this chapter would occur. However, the indirect positive effects of the overall Project on GHG of a significant reduction of emissions for power generation would also not occur.

8.5.2 Construction Phase

The carbon footprint of the proposed development during the construction phase is estimated, based on an assessment of worst-case carbon equivalents, outlined in **Table 8.2.** The carbon assessment assumes no improvement in the carbon intensity of the production of cement and steel is achieved through time.

The predicted results are compared to the EPA's Projected ETS Sector CO_2 eq. emissions in 2024 assuming additional measures, as a worst-case projection, in **Table 8.3**.

Table 8.2: Estimated carbon footprint of the proposed development

Element	Embodied Carbon Contribution tonnes CO_2e /tonnes	Quantity of material (tonnes)	Comment / Assumptions	Tonnes CO_2e	Sources (Circular Ecology (CE) / UKEA / TII)
Landfall					
Concrete	0.15	370	15% Portland cement, 15% water 70% aggregate. Density of 2.4t/m^3 Includes 20km transport	60	CE
Bentonite clay	0.24	86	Total drilling fluid 900m^3 with 5% bentonite clay. Density of 1.9t/m^3. Additional 0.18t for 20km transport	21	UKEA
2 x High Density Polyethylene (HDPE) Ducts	1.93	600	Volume of each duct 285m^3. Density of 1050kg/m^3. Additional 5t for 70km transport	1,160	UKEA
Crushed stone (structural fill)	0.079	27,000	Density of 2t/m^3. Additional 58t for 20km transport	2,191	UKEA
Steel (sheet piling option)	1.99	20	World average steel. Steel reinforcing bar. Additional 0.15t for 70km transport	40	CE
Landfall Earthworks Option 1 (worst-case)					
Crushed stone (to be disposed)	0.02	27,000	Density of 2t/m^3	540	UKEA
HDD bore (to be disposed)	0.02	1,870	Density of 1.7t/m^3	37.4	UKEA
Medium size construction site, 751 kgCO_2e per week, 32-week duration				24	UKEA
Cable Route					
Weak Mix Concrete	0.079	12,000	Cement-bound sand (CBS), typically14:1 sand/cement mix (assuming 15% water,	948	CE

Element	Embodied Carbon Contribution tonnes CO_2e /tonnes	Quantity of material (tonnes)	Comment / Assumptions	Tonnes CO_2e	Sources (Circular Ecology (CE) / UKEA / TII)
			79% sand, 6% Portland cement). Density of 2.4t/m^3 Includes 20km transport		
Concrete	0.15	960	15% Portland cement, 15% water 70% aggregate. Density of 2.4t/m^3 Includes 20km transport	144	CE
12 x HDPE Ducts	1.93	4,473	Volume of each duct 355m^3. Density of 1050kg/m^3. Additional 26t for 70km transport	8659	UKEA
2 x HDPE Ducts (for HDD works)	1.93	598.5	Volume of each duct 285m^3. Density of 1050kg/m^3. Additional 4.5t for 70km transport	603	UKEA
Bentonite Clay R772 HDD	0.24	38	Total drilling fluid 400m^3 at HDD location with 5% bentonite clay. Density of 1.9t/m^3 Additional 0.08t for 20km transport	9.2	UKEA
Structural fill Temporary Construction Compounds (worst-case)	0.079	16,600	Density of 2t/m^3	1,311.4	UKEA
80 x Earth Rods	0.27	35.6	4 metal earth rods (40m long) per joint bay, 20 joint bays. Assuming copper. Density of copper 8.9t/m^3 Additional 0.3t for 70km transport	10.3	UKEA
Granular Material	0.05	34,000	Road surfacing. Density 2t/m^3	1,700	UKEA
Asphalt	0.081	3,400	Density 1.7t/m^3	275.4	UKEA
Organic Waste Disposed (treeline/hedgerow)	0.213	15.6	Assuming 195m treeline/hedgerows. Assuming *0.08t/m	3.3	UKEA
Organic Waste Disposed (Shrub)	0.213	113	Assuming 1,610m^2 shrub. Assuming *0.07t/m^2	24	UKEA
Pavement and haul routes build up (to be disposed)	0.02	20,230	Density 1.7t/m3	404.6	UKEA

Element	**Embodied Carbon Contribution tonnes CO_2e /tonnes**	**Quantity of material (tonnes)**	**Comment / Assumptions**	**Tonnes CO_2e**	**Sources (Circular Ecology (CE) / UKEA / TII)**
R772 HDD crushed stone (to be disposed)	0.02	8,000	Density of 2t/m^3	160	UKEA
R772 HDD bore (to be disposed)	0.02	340	Density of 1.7t/m^3	6.8	UKEA
Carbon Sink (removing woodland)	74.07**t/ha**	0.85**ha**	Assuming replacement with grassland/shrub includes net difference	62.95	TII
M11 HDD Option (worst case)					
Carbon Sink (removing woodland by M11 4000m^2)	74.07**t/ha**	0.4**ha**	Assuming replacement with grassland/shrub includes net difference	29.63	TII
Crushed stone (to be disposed)	0.02	9,200	Density of 2t/m^3	184	UKEA
HDD bore (to be disposed)	0.02	850	Density of 1.7t/m^3	17	UKEA
2 x HDPE Ducts (for HDD works)	1.93	598.5	Volume of each duct 285m^3. Density of 1050kg/m^3. Additional 4.5t for 70km transport	603	UKEA
Bentonite clay	0.24	86	Total drilling fluid 900m^3 with 5% bentonite clay. Density of 1.9t/m^3. Additional 0.18t for 20km transport	21	UKEA
Sheet piling	1.99	380	World average steel. Steel reinforcing bar. Additional 2.8t for 70km transport	759	CE
Large size construction site, 1252 kgCO_2e per week, 60-week duration				75	UKEA
Substation					
Concrete (with steel reinforcement)	0.258	6,340	15% Portland cement, 15% water 70% aggregate. Density of 2.4t/m^3 Includes 20km transport	1,635	CE
Structural Steel	1.99	484	World average steel. Steel reinforcing bar. Additional 4t for 70km transport	968	CE
Steel Cladding	3.06	5.2	World average steel. Assumption 1mm thickness. Additional 0.04t for 70km transport	15.94	CE

Element	Embodied Carbon Contribution tonnes CO_2e /tonnes	Quantity of material (tonnes)	Comment / Assumptions	Tonnes CO_2e	Sources (Circular Ecology (CE) / UKEA / TII)
Crushed stone (structural fill)	0.079	3,000	Density of 2t/m^3 Additional 6t for 20km transport	243	UKEA
Granular fill	0.005	140,000	Density of 2t/m^3 Additional 300t for 20km transport	1000	UKEA
Bituminous Material	0.49	5,280	Density of 2.4t/m^3 Additional 11t for 20km transport	2599	UKEA
Steel sheet piling (flood defences worst-case)	1.99	125	World average steel. Steel reinforcing bar. Additional 1t for 70km transport	250	CE
Made ground, pavement, embankment (to be disposed)	0.02	21,250	Density of 1.7t/m^3	425	UKEA
Flood defences embankment (to be disposed)	0.02	510	Density of 1.7t/m^3	10.2	UKEA
Crushed stone (to be disposed)	0.02	1,400	Density of 2t/m^3	28	UKEA
Medium size construction site, 751 kgCO_2e per week, 52-week duration				39	UKEA
NETN Connection					
Concrete (with reinforced steel)	0.225	535	15% Portland cement, 15% water 70% aggregate. Density of 2.4t/m^3 Includes 20km transport	121	CE
Crushed stone (structural fill)	0.079	3,400	Density of 2t/m^3 Additional 7t for 20km transport	276	UKEA
Structural Steel	1.99	60	World average steel. Steel reinforcing bar. Additional 0.5t for 70km transport	120	CE
Tower foundation (to be disposed of)	0.02	340	Density of 1.7t/m^3	6.8	UKEA
Crushed stone (to be disposed of)	0.02	3,400	Density of 2t/m^3	68	UKEA
			Total (Tonnes CO_2 eq.)	**27,909**	

*Density based on U.S. Environmental Protection Agency (April 2016) Volume-to-Weight Conversion Factors Office of Resource Conservation and Recovery

The replanting of 16,000m^2 (1.6ha) of biodiversity enhancement, mentioned in **Section 8.4.1**, is expected to sequester approximately 80.5 tonnes of CO_2 eq. (based on the TII tool, assuming mixture of grassland, scrub and woodland with an embodied carbon contribution of 50.3t/ha).

Table 8.3: Estimated carbon output during the construction phase

Estimated CO_2 eq during Construction Phase (Mtonnes)	Projected ETS Sector CO_2 eq emissions in 2024 with additional measures (Mtonnes)	As a percentage of 2024 ETS Sector CO_2 eq emissions with additional measures	Projected Total Irish CO_2 eq emissions in 2024 with additional measures (Mtonnes)	As a percentage of 2024 Total CO_2 eq emissions with additional measures
0.03	18.21	0.15%	56.48	0.05%

The carbon emissions from the construction of the proposed project are estimated to be 0.15% of the projected ETS Sector CO_2 eq. emissions (with additional measures) in 2024.

The carbon emissions from the construction of the proposed project are estimated to be 0.05% of Ireland's projected total CO_2 eq. emissions (with additional measures) in 2024.

As ETS carbon allowances for energy intensive industries are regulated by the EPA under the GHG permitting regime, the CO_2 eq. calculated, and shown in **Table 8.3**, are assumed to be incorporated within the projected ETS allowances. ETS allowances are reduced annually, forcing industry to minimise emissions. On this basis, the effects to climate are considered **slight, negative, long-term**.

As improvements in sustainability and recycling measures are progressed throughout the construction industry it is expected that the embodied carbon calculated as part of this assessment can be taken as a worst case, as with time this figure will improve. In addition, the embodied carbon is calculated on the basis that all emissions occur over one year, a worst-case consideration.

8.5.3 Operational Phase

Two stand-by diesel generators, approximately 500kVA in capacity, will be provided on the substation site. These generators would be expected to be used once every 5 years for up to 3 days. Therefore, the greenhouse gas emissions from the generators will be negligible and will result in a **long term, imperceptible** effect on climate.

As outlined in **Chapter 2** *Policy Context*, the proposed development as part of the overall Project, will support an increased capacity of 520MW of additional clean energy which is enough to offset 530,225 tonnes of carbon emissions annually, representing a significant contribution towards Ireland's 2030 targets for carbon emission reduction. It is anticipated that this will have an **indirect, significant positive** effect on climate and will offset the slight negative effect predicted during the construction phase.

The cumulative positive effect of the operation of the proposed development has the potential to have a long-term beneficial effect on biodiversity as climate change is one of the key drivers of biodiversity loss. The operation of the overall Project will generate renewable energy, which is expected to displace fossil fuel power generation.

The reduced emissions of pollutants and greenhouse gases will have a beneficial effect on biodiversity, at a wider scale. **Chapter 12** *Biodiversity* considers the potential effects to local biodiversity.

8.5.4 Decommissioning

As mentioned in **Chapter 5** *Description of Development*, the design life of the substation is c. 50 years but it may be extended beyond this, as a part of the national grid infrastructure. When the proposed development reaches the end of its useful life, it may be either refurbished and replaced, or it will be decommissioned.

If decommissioned, all buildings and above ground structures on the substation site will be removed. All above ground structures along the cable route will be removed. It is likely that the ducts and cables will be left in place, as to remove them would be likely to cause a more substantial environmental impact than leaving them in-situ.

The proposed substation decommissioning activities have the potential to generate carbon emissions particularly if refurbishment or replacement is undertaken, but the intensity and duration of the activities will be less than that associated with the construction phase. i.e. slight, negative, long-term effects are predicted. The SF_6 gas will be recycled if the substation were to be decommissioned. The negative effects predicted during the decommissioning phase will be offset during the operational phase of the proposed development.

8.5.5 Conclusion

The carbon emissions produced during the construction and decommissioning of the proposed development will be offset by the indirect effects of the operational phase. It is estimated that total construction phase carbon emissions comprise approximately 5% of the annual carbon savings during the operational phase of the overall Project. It is estimated that carbon emissions associated with the construction phase of the proposed development would be offset within 20 days of operation. Therefore, it is expected that the overall Project will have a significant long-term, positive effect on climate.

8.6 Mitigation Measures and Monitoring

8.6.1 Mitigation Measures

8.6.1.1 Construction Phase

There will be mitigation embedded through the design of the proposed development including the use of low carbon construction materials. This includes the use of less carbon intensive concrete blends (weak-mix concrete) for the cable route, as shown in **Table 8.2**. This low carbon approach has been incorporated as a design measure to reduce carbon.

8.6.1.2 Operational Phase

There is an indirect significant positive effect on climate predicted during the operational phase of the proposed development therefore no mitigation measures are proposed.

8.6.1.3 Decommissioning Phase

The mitigation measures, described for the construction phase, updated to reflect best practice at the time, will be implemented for the decommissioning phase.

8.6.2 Monitoring

8.6.2.1 Construction Phase

No likely significant effects are predicted to occur during the construction of the proposed development therefore, no monitoring measures are required.

8.6.2.2 Operational Phase

The proposed development will have an overall positive effect on climate during the operational phase therefore, no monitoring is required.

8.7 Cumulative Effects

This section considers the potential for cumulative effects arising from the proposed development in association with other developments. Specifically, it considers a worst-case scenario, where both the proposed development and other developments for which construction timelines are not known are under construction and/or operation at the same time.

A two-tiered approach to the cumulative assessment has been undertaken, in which the proposed development is considered cumulatively with other projects as follows:

Tier 1 -

- ABWP Phase 2 Offshore Infrastructure;
- ABWP Phase 2 Operations and Maintenance Facility (OMF);
- EirGrid Grid Upgrade Works; and
- Irish Water Upgrade Works.

Tier 2 -

- Other relevant projects currently under construction;
- Other relevant projects with consent;
- Other relevant projects in the planning process; and
- Other existing projects that were not operational when baseline data were collected.

There are a number of developments identified that are currently permitted or proposed in Arklow that were not assessed in this chapter. The nature and scale of these developments are such that development of these projects in combination with the proposed development would not give rise to significant effects to climate.

Climate is affected by macro-scale carbon contribution rather than by local effects; therefore, projects need not necessarily be considered at a local level for the cumulative assessment.

The projects which are considered cumulatively are those which have a notable effect regarding government targets and the EU ETS obligations in combination with the proposed development.

A summary of the cumulative effects is provided in **Chapter 21** *Summary of Cumulative Effects*.

8.7.1 Tier 1

8.7.1.1 All Tier 1 Projects and the Proposed Development

The construction of the Tier 1 elements of the Project have the potential to have a negative cumulative effect on climate in combination with the proposed development during the construction phase due to the embodied carbon associated with the materials and construction traffic.

When operational, the Tier 1 elements of the overall Arklow Bank Wind Park Phase 2 Project in combination with the proposed development will facilitate the generation of 520MW of renewable energy. This will offset 530,225 tonnes of annual carbon emissions, reduce the reliance on fossil fuels, and help to meet national and international renewable energy targets including EU ETS obligations.

It will offset the potential negative cumulative effect during the construction phase and the operational emissions associated with the maintenance of the offshore infrastructure (outlined in the Arklow Bank Wind Park Phase 2 Offshore Infrastructure EIAR). Therefore, there will be a **significant positive** cumulative effect on climate.

8.7.2 Tier 2

Only the Tier 2 projects which were considered to have the potential for a cumulative effect on climate (in terms of government targets) in combination with the proposed development are considered. Given the nature and scale of the other Tier 2 projects, there are negligible carbon emissions associated with their development.

8.7.2.1 Solar Farm Developments in Arklow and the Proposed Development

There are a number of permitted solar farms in the Arklow area, including;

- BNRG Neon Holdings Limited Solar Farm Johnstown North (Planning Reference 171497)
- BNRG Neon Holdings Limited Solar Farm Ballymoney (Planning Reference 19627)
- Highfield Solar Limited Ballinclea, Lower (Planning Reference 171440)
- Highfield Solar Limited Templerainy East (Planning Reference 161285)

The construction of the solar farms will have embodied carbon associated with the materials and some construction traffic.

When operational, the solar farms in combination with the proposed development, will facilitate additional renewable energy sources in Arklow which will reduce the reliance on fossil fuels, and help to meet national and international renewable energy targets. This will offset the potential negative cumulative effect during the construction phase.

As outlined in **Chapter 2** *Policy Context*, the Wicklow County Development Plan 2016-2022 has a strategic goal "*to address the climate change challenge…directly in the areas of flooding and renewable energy."* The Arklow Local Area Plan 2018-2024 also supports this core strategy with regard to renewable energy development as well as containing a vision to improve the town infrastructure.

The solar farms in combination with the proposed development would contribute to significant renewable energy infrastructure development in Arklow, helping to meet the objectives of the County Development Plan and Local Area Plan, informed by national and international targets, which will contribute to a **significant positive** cumulative effect on climate.

8.7.2.2 Flood Defence Embankment Works in the Avoca River Business Park

As outlined in **Section 8.4.2**, the proposed development includes improvement works to the flood defence embankment in the Avoca River Business Park to allow for additional protection for future flood events with sensitivity for climate change.

There will also be possible maintenance and repair works to the existing flood embankment around the Avoca River Business Park as part of a regular inspection, maintenance and repair programme, to manage residual risk of flooding from a potential breach of the embankment. Investigations are to be undertaken which will determine the nature and extent of the works required. Any required maintenance or reinforcement works, will be undertaken in advance of the substation construction, with ongoing maintenance and repair thereafter, subject to regular inspection and monitoring.

The cumulative effect of any additional maintenance and repair works to the additional flood defence embankment works in combination with the proposed development will ensure that the Avoca River Business Park (including the proposed development) remain resilient to climate change, with protection to the 0.1% AEP 1 in 1000 years plus Mid-Range Future Scenario allowance for climate change as detailed in the Flood Risk Assessment (**Appendix 10.1** of **Volume 3**). This will help to meet the objectives of the Wicklow County Development Plan 2016-2022 and the Arklow Local Area Plan 2018-2024, contributing to a **significant positive** effect to climate in terms of climate resilience.

8.8 Residual Effects

In relation to climate, over the lifespan of the proposed development, a long-term positive effect to climate is expected.

8.9 References

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