9 Climate

9.1 Introduction

This chapter presents an assessment of the likely impacts of the proposed site suitability project on climate. There are a number of elements involved in the proposed development which are detailed in full in **Chapter 4** ***Description of the Proposed Development***.

Climate represents long term weather patterns and considers environmental aspects such as climate change resulting from greenhouse gas emissions. Potential emissions of greenhouse gases that can contribute to climate change include carbon dioxide (CO_2) and nitrous oxide (N_2O). This chapter considers the GHG emissions from the facility for the existing "Do Nothing" scenario and the proposed "Do Something" scenario which involves a change in the fuel mix due to the proposed increase in hazardous waste accepted to the facility.

9.2 Assessment Methodology

Due to the changes in waste characteristics as part of the proposed development the potential greenhouse gas (GHG) emissions from the facility have been quantified. Predictions of greenhouse gas emissions from the facility were prepared using the emission factors derived from the European Commission (2001), UK DEFRA (2006), IPCC (2006), using the latest national waste statistics from the EPA (2018) and from information supplied by Indaver.

The waste-to-energy process would be expected to be the dominant source of CO_2 and N_2O emissions from the proposed development. Detailed waste throughput information was obtained from Indaver and this information was used to estimate GHG emissions.

In order to calculate the net contribution to greenhouse gas emissions of the proposed development and its effect on Ireland's annual GHG targets, the total forecasted anthropogenic ('man-made') emissions due to the proposed development have been calculated. In order to quantify the significance of emissions, the calculated GHG emissions as a result of the proposed development have been compared against Ireland's EU 2020 target for GHG emissions (Decision No 406/2009/EC of the European Parliament and Council (2009)). During the incineration of waste at the facility the thermal energy generated can be recovered and converted into electrical output, this can be available to the national grid. In addition, as part of the proposed development it is proposed to build a hydrogen plant which will allow for the electricity generated through the incineration of waste to generate hydrogen during times when the electricity cannot be fed to the grid.

The renewable energy when exported to the National Grid will be used to displace energy currently generated by fossil fuels. In 2018, the primary energy mix within the national generation system was gas (53.9%), coal (10.7%), renewables and waste (24.3%), peat (10.3%), fuel oil (0.8%) and others (SEAI, Energy in Ireland, 2019). The energy mix represents the relative contribution of different types of fuels or means of electricity generation supplying the national electricity distribution system.

Ireland has a binding renewable energy EU target of 16% by 2020. According to SEAI's *Renewable Energy in Ireland (2019 report)*, in 2018 renewable energy supply was 11% of gross final consumption (SEAI, *Renewable Energy in Ireland*, 2019). Looking to 2030, Member States of the EU agreed renewable energy targets of at least 32% by 2030 (European Commission, 2014). Non-ETS emission reduction targets for 2030 have been set at the Member State level. Ireland has a target reduction of 30% compared to 2005 levels (European Parliament & Council, 2018).

Ireland has made good progress towards meeting these renewable electricity targets. The use of renewables in electricity generation in 2018 reduced CO_2 emissions by 4 Mt and avoided €430 million in fossil fuel imports. (SEAI, Energy in Ireland, 2019). The profile of fuel type by 2030 will be significantly different from the current one due to greater penetration of renewable fuels. In order to calculate the emissions displacement, an average grid intensity of 0.37 tonnes CO_2 /MWh (SEAI, 2020) which is similar to that of natural gas which is what would alternatively be used to generate electricity and so allows for comparable results.

The renewable target set in Council Directive 2009/28/EC (Renewable Directive) for 2020 is set at 16% of the total final energy consumption. This target will be made up of contributions from renewable energy in electricity (RES-E), renewable energy in transport (RES-T) and renewable energy for heat and cooling (RES-H). The target for RES-E is 40% of renewables to contribute to gross electricity consumption by 2020. The target for RES-T is that biofuels and the renewable portion of electricity will account for 10% of transport energy by 2020. The RES-H target is that the renewable contribution to heat will reach 12% by 2020. As of 2018, the 11% of the total final energy consumption comes from renewable energy (SEAI, *Renewable Energy in Ireland*, 2019).

9.3 Receiving Environment

9.3.1 Climate Agreements

Ireland ratified the United Nations Framework Convention on Climate Change (UNFCCC) in April 1994 and the Kyoto Protocol in principle in 1997 and formally in May 2002 (UNFCC, 1997; 1999). For the purposes of the EU burden sharing agreement under Article 4 of the Doha Amendment to the Kyoto Protocol, in December 2012, Ireland agreed to limit the net growth of the six Greenhouse Gases (GHGs) under the Kyoto Protocol to 20% below the 2005 level over the period 2013 to 2020 (UNFCCC, 2012).

In order to meet the ultimate objective of the Convention to prevent dangerous anthropogenic interference in the climate system, cuts of up to 70% in this century are expected to be required (European Commission, 2009). The UNFCCC is continuing detailed negotiations in relation to GHG reductions and in relation to technical issues such as Emission Trading and burden sharing. The most recent Conference of the Parties to the Convention (COP25) was in Madrid, Spain in December 2019. COP21, held in December 2015, was an important milestone in terms of international climate change agreements. The "Paris Agreement" was agreed at COP21 by over 200 nations and has a stated aim of limiting global temperature increases to no more than 2°C above pre-industrial levels with efforts to limit this rise to 1.5°C. The aim is to limit global GHG emissions to 40 gigatonnes as soon as possible whilst acknowledging that peaking of GHG emissions will take longer for developing countries.

Contributions to GHG emissions will be based on Intended Nationally Determined Contributions (INDCs) that will form the foundation for climate action post 2020. Significant progress was also made on elevating adaption onto the same level as action to cut and curb emissions. The EU Effort Sharing Decision 406/2009/EC on GHG emissions (European Commission, 2009), requires Ireland to achieve a 20% reduction, relative to 2005 levels, by 2020 in GHG emissions for sectors of the economy not covered by the EU Emissions Trading Directive (European Council, 2003) (i.e. non-ETS GHG emissions).

In 2014, the EU agreed the "2030 Climate and Energy Policy Framework" (European Council, 2014). The European Council endorsed a binding EU target of at least a 40% domestic reduction in greenhouse gas emissions by 2030 compared to 1990. The EU will collectively deliver the target in the most cost-effective manner possible, with the reductions in the Emission Trading Scheme (ETS) and non-ETS sectors amounting to 43% and 30% by 2030 compared to 2005, respectively. Following on from political agreement, EU Member States legislated for emissions reduction targets at the national level while the renewable target is set at the EU level. As mentioned in **Section 9.2**, Ireland has a target reduction of 30% compared to 2005 levels. An EU level binding target of at least 32% for the share of renewable energy consumed in the EU was agreed for 2030.

In March 2020 the European Commission unveiled its proposal for a legally-binding commitment to reach net-zero greenhouse gas emissions by 2050. While the European Climate Law contains no concrete proposals for an enhanced mid-term target, the proposal suggests the European Commission is looking at a September deadline for finalising its "impact assessed plan" to raise the 2030 target to 50-55%. (European Commission, 2020).

The "Draft National Energy and Climate Plan (NECP) 2021-2030" (Government of Ireland, 2018) was published in December 2018. The NECP was due to be submitted by the government, as a final version, to the EU by the end of 2019. The plan, when finalised, will outline the roadmap for meeting the legal energy and climate obligations including a 30% reduction target in greenhouse gas emissions from the non-ETS sectors including transport, buildings, agriculture and waste management.

9.3.2 Baseline Conditions

The Government has also published the Climate Action Plan 2019 (Government of Ireland, 2019). This Plan is "committed to achieving a net zero carbon energy systems objective for Irish society and in the process, create a resilient, vibrant and sustainable country". This will be led by the Government who will outline a set of policies to achieve the targets of the Plan. In order to meet the EU 2030 targets established for Ireland and the overall aim of decarbonisation by 2050 several plans and policies in the key sectors of electricity, built environment, transport, enterprise, agriculture and waste are outlined within the Climate Action Plan. In addition, the "Draft General Scheme of the Climate Action (Amendment) Bill 2019" was published in January 2020 (Government of Ireland, 2020). This is a key action of the Government's Climate Action Plan 2019 and aims to enshrine in law the approach outlined in the Climate Action Plan.

An important part of the approach to reducing GHG emissions, engrained in the Doha Amendment to the Kyoto Agreement (dated 2012), is that emission reductions should reflect the most economically efficient cost of achieving the set target. As part of this approach, three "flexible mechanisms" facilitate the cost-effective implementation of the Protocol. These mechanisms are Emission Trading (ET), Joint Implementation (JT) and the Clean Development Mechanism (CDM). Emission trading is a mechanism whereby polluting entities are allocated allowances for their emissions which can subsequently be traded with each other. Emitters for whom it is very expensive to effect emission reductions are likely to buy permits from emitters for whom emissions reduction is more cost-effective thus ensuring that a pre-determined environmental outcome will take place where the cost of reduction is lowest. Due to significant economic growth in Ireland since 1990, emissions trading is of benefit to Ireland in meeting its commitments to limit the growth of GHG emissions (EPA, 2019). Both Joint Implementation and the Clean Development Mechanisms allow states to share reduction credits by investing in another territory with the aim of reducing emissions. However, the Clean Development Mechanism differs in that the projects are specific to assisting developing countries that are particularly vulnerable to the adverse effects of climate change to meet the cost of adaptation.

GHGs have different efficiencies in retaining solar energy in the atmosphere and different lifetimes in the atmosphere. In order to compare different GHGs, emissions are calculated on the basis of their Global Warming Potential (GWPs) over a 100-year period, giving a measure of their relative heating effect in the atmosphere. The GWP100 for CO_2 is the basic unit (GWP = 1) whereas CH_4 has a global warming potential equivalent to 28 units of CO_2 and N_2O has a GWP100 of 265. Greenhouse gases other than CO_2 (i.e. methane, nitrous oxide and so-called F-gases) may be converted to CO_2 equivalent using their global warming potentials, providing a CO_2 equivalent or CO_{2eq} value (IPCC, 2013).

Anthropogenic emissions of GHGs in Ireland included in the EU 2020 strategy are given in **Table 9.1** and **Table 9.2** based on data from the EPA. Agriculture is the greatest source of emissions at 33.6% of CO_{2eq} (2020 projection) (EPA, 2019). The next largest share of energy emissions projected for 2020 is from fuel combustion for power generation (19.7% of total emissions) and road transport (21.0%). Waste represents 1.0% of total emissions in 2020 (EPA, 2019).

2013 was the first year where the European Union's Effort Sharing Decision "EU 2020 Strategy" (Decision 406/2009/EC) was assessed for effectiveness in meeting the objectives outlined in the strategy. Ireland had non-ETS sectors emissions of 43.8 Mtonne CO_{2eq} in 2017, when emissions covered by the EU's Emissions Trading Scheme for stationary and aviation operators were removed. Recent data from the EU (EEA, 2019) indicates that Ireland is unlikely to meet the 2020 targets, based on current projections, in terms of GHG emissions and in terms of the renewable energy targets. It also reports a significant gap of -23.5% to the 2030 Effort Sharing target with existing measures (in percentage points of ESD 2005 base-year emissions). The most recent data (EPA, 2019) suggests that based on the "With Additional Measures" scenario, Ireland's non-Emission Trading Scheme emissions will be 6% below 2005 levels in 2020 compared to a target of 20% below 2005 levels in 2020.

Table 9.1 GHG Emissions in Ireland (ktonnes CO_2 equivalent) (2018) Source: EPA (2019) Ireland's Greenhouse Gas Projections 2018 - 2040

Sector	**Emissions (ktonnes CO_2 equivalent)**
Energy	12,764
Industrial Processes / Commercial / Manufacturing	7,810
Agriculture	20,296
Transport	12,471
Residential	6,639
Waste	712
Total	**61,850.6**

Table 9.2 GHG Emissions (ktonnes CO_2 equivalent) Source: EPA (2019) Ireland's Greenhouse Gas Projections 2018 - 2040

Year	**Emissions by National Climate Change Strategy Sectors (ktonnes CO_{2eq})**						
	Energy	**Residential**	**Industry & Commercial**	**Agriculture**	**Transport**	**Waste**	**Total**
2013	11,487	6,395	7,631	19.129	11,068	671	57,410
2014	11,272	5,746	7,894	18,901	11,347	853	57,098
2015	11,891	6,041	8,288	19,128	11,813	949	59,212
2016	12,608	6,047	8,528	19,945	12,294	957	61,270

Year	Emissions by National Climate Change Strategy Sectors (ktonnes CO_{2eq})						
	Energy	Residential	Industry & Commercial	Agriculture	Transport	Waste	Total
2017	11,744	5,742	8,879	20,213	12,003	933	60,744
2018	12,764	6,639	7,810	20,296	12,471	712	61,851

9.3.3 IPCC Guidelines for National GHG Inventories

The Intergovernmental Panel on Climate Change (IPCC) has outlined detailed guidelines on compiling national GHG inventories. The guidelines are designed to estimate and report on national inventories of anthropogenic GHG emissions and removals in order to ensure compliance with the Kyoto Protocol.

Anthropogenic refers to GHG emissions and removals that are a direct result of human activities or are a result of natural processes that have been affected by human activities (IPCC, 2006). The quantity of carbon from natural cycles through the earth's atmosphere, waters, soils and biota is much greater than the quantity added by anthropogenic GHG sources. However, the focus of the UNFCCC and the IPCC is on anthropogenic emissions because these emissions have the potential to alter the climate by disrupting the natural balances in carbon's biogeochemical cycle, and by altering the atmosphere's heat-trapping ability. The carbon from biogenic sources such as paper waste and food waste were originally removed from the atmosphere by photosynthesis, and under natural conditions, it would eventually cycle back to the atmosphere as CO_2 due to degradation processes. Thus, these sources of carbon are not considered anthropogenic sources and do not contribute to emission totals considered in the EU 2020 Strategy (IPCC, 2006).

In relation to solid waste disposal sites (SWDSs) including municipal waste landfills, detailed guidelines have been published for the calculation of GHG emissions (IPCC, 2006; USEPA, 2002). The main GHG emission from SWDSs is methane (CH_4). Even though the source of carbon is primarily biogenic, CH_4 would not be emitted were it not for the human activity of landfilling waste, which creates anaerobic conditions conducive to CH_4 formation. Although CO_2 is also produced in substantial amounts from landfills, the primary source of CO_2 is from the decomposition of organic material derived from biomass sources (crops, forests) and which are re-grown on an annual basis. Hence, these CO_2 emissions are not treated as net emissions from waste in the IPCC Methodology (IPCC, 2006).

Similarly, in relation to the proposed development, a large fraction of the carbon in waste combusted (paper, food waste) is derived from biomass raw materials which are replaced by re-growth on an annual basis. Thus, these emissions should not be considered as net anthropogenic CO_2 emissions in the IPCC Methodology (2006).

On the other hand, some carbon in waste is in the form of plastics or other products based on fossil fuel. Combustion of these products, like fossil fuel combustion, releases net CO_2 emissions. Thus, in estimating emissions from waste for the current facility, the desired approach is to separate carbon in the waste to be incinerated into biomass and fossil fuel-based fractions and thereafter to use only the fossil fuel fraction in calculating net carbon emissions (IPCC, 2006; USEPA, 2002). This approach follows the methodology outlined in the IPCC Guidelines For National GHG Inventories (2006). Other relevant gases released from combustion are net GHG emissions including CH_4 and N_2O.

9.4 Characteristics of the Proposed Development

A detailed description of the proposed development is included in **Chapter 4 *Description of the Proposed Development*** of this EIAR. In relation to potential climate impacts associated with the proposed development, the potential impacts are considered for both the construction and operational phases.

In relation to potential climate impacts the main elements are listed below:

- Construction and operational stage traffic emissions;
- Increase in the amount of hazardous waste accepted at the facility from the currently permitted 10,000 tonnes per annum up to a maximum of 25,000 tonnes per annum;
- It is also proposed to increase the annual total waste accepted at the site for treatment in the waste to energy facility from the currently permitted 235,000 tpa to 250,000 tpa;
- Development of a $10MW_e$ hydrogen generation unit for connection to the natural gas distribution network and for mobile transport applications.

There is the potential for impacts to climate during both construction and operational activities on site.

9.4.1 Construction Phase

There is the potential for a number of emissions to atmosphere during the construction of the facility. Construction vehicles, generators etc., may give rise to CO_2 and N_2O emissions. However, the Institute of Air Quality Management guidance (IAQM, 2014) states that emissions from site plant and vehicles is unlikely to be a significant source of pollutants and does not require a qualitative assessment.

During the construction phase of the development there is likely to be a minor increase in the number of vehicles required. The proposed development will be developed over two construction phases, Phase 1 and Phase 2. During the peak construction period for Phase 1, it is predicted that there will be an additional 186 construction vehicle movements per day.

During the peak Phase 2 construction period (which includes operational traffic for Phase 1), it is predicted that there will be an additional 222 construction

vehicle movements per day. Greenhouse gas emissions during the construction phase will not be significant in the context of Ireland's total GHG emissions.

9.4.2 Operational Phase

The incineration activities at the existing waste-to-energy facility would be expected to be the dominant source of CO_2 and N_2O emissions. Due to the proposed increase in the annual tonnage of material processed through the increase in the tonnage of hazardous waste accepted to the facility, the GHG emissions have the potential to increase. Volume flow rates and emission concentrations will be unchanged and remain in compliance with the licensed limits under Licence No. W0167-03. The composition of wastes received will change due to the proposed increase in hazardous wastes accepted to the facility for processing. Waste throughput information was obtained from Indaver and this information has been used to estimate GHG emissions from the facility. The net GHG contribution from the waste was derived using the procedure recommended by the European Commission (2001), UK DEFRA (2006) and IPCC (2006). See **Section 9.5.3** below for details on this exercise.

The future operation of the hydrogen generation unit (HGU) will have a positive effect to off-set GHG emissions as the existing facility is experiencing high levels of curtailment on the electricity grid (circa 1,000 hours in 2019) and during these times that energy is currently destroyed by diverting the high pressure and temperature steam to the air-cooled condenser on site. By utilising the HGU at these times, the steam can be converted to electricity and used to generate an emission-free fuel, replacing natural gas in the local network, as a transport fuel for vehicles or other purposes. This off-setting exercise is outlined in **Section 9.5.3** below.

9.4.2.1 Road Traffic

There is also the potential for increased traffic volumes to impact climate. During the future operational years in 2027 and 2037, the proposed site suitability project will increase traffic levels by a maximum of 76 AADT on the R152 north of the Indaver site. The change in AADT values is not of the magnitude to require a detailed climate assessment as per the DMRB screening criteria (UK DEFRA, 2018). It can therefore be determined that traffic related CO_2 and N_2O emissions during the operational phase are long-term, negative and imperceptible.

The proposed development will provide additional capacity for up to an additional 15,000 tpa of hazardous waste. This will avoid the need for transport of this waste to mainland Europe for treatment. By providing capacity for the treatment of this hazardous waste within Ireland there is an overall reduction in transport-related GHG emissions due to the reduced distance for travel required. This reduction in transport-related GHG emissions is considered minimal but will result in a long-term, positive, imperceptible impact on climate.

9.4.2.2 Climate Change Adaptation Measures

Effects of climate change on the proposed development must also be considered. The following items have been factored into the assessment:

- Rising sea levels;
- Increased in frequency and intensity of rainfall/storm events;
- The climate action plan will drive further de-carbonisation and carbon taxes likely to increase.

Rising sea levels have been ruled out as the site is sitting at approximately 30m OD at its lowest point and the site is located approximately 10km inland from the sea.

The site is currently not prone to flooding and the FRA prepared outlines this in detail, refer to **Appendix 15.1** ***Flood Risk Assessment*** in **Volume 3** of this EIAR. The increased risk of flooding associated with changing climate factors at the site is not considered to be significant.

The objectives of the climate action plan and aiming to achieve decarbonisation by 2050 will require additional measures to be implemented on a national scale. The proposed hydrogen generation unit (HGU) on site will aid in off-setting emissions which would otherwise be produced by fossil fuels. This will aid in achieving the goal of decarbonisation by 2050 and will reduce the impact on climate change on a national level.

9.5 Likely Significant Effects

9.5.1 "Do Nothing" Scenario

In relation to climate, the "Do Nothing" scenario will involve the facility operating as it currently does with a worst-case maximum annual throughput of 235,000 tonnes of waste consisting of all non-recyclable household and commercial and a maximum of 10,000 tonnes per annum of hazardous waste. The breakdown of waste has been based on the most recent national waste breakdown of residual waste (EPA/RPS, 2018) for the purposes of this assessment (see **Appendix 9.1** in **Volume 3**, Tables A9.1.1 – A9.1.2 of this EIAR).

Table 9.3 details the annual greenhouse gas emission from the site for the "Do Nothing" scenario. Annual GHG emissions from the facility account for 0.17% of Ireland's predicted total GHG emissions in 2018 as detailed in **Table 9.2**. The emissions have been compared with the EU 2020 target for Ireland of 37,942,682 tonnes CO_{2eq} (EC, 2017). The contribution to the total greenhouse gas emissions is 0.28% of the EU 2020 Target for the "Do Nothing" scenario.

According to the EPA's emission projections for 2018-2040, a range of measures will be required to tackle transport emissions. In the absence of biofuels such as hydrogen or an increase in the uptake of battery electric vehicles, transport emissions will continue to grow.

Table 9.3 Greenhouse Gas Emissions At Indaver Ireland's Waste Management Facility, Carranstown, Based On 235,000 Tonnes/Annum (Do Nothing Scenario)

	CO_2	N_2O[(2)]	CH_4[(3)]	% Of Ireland's Total 2018 Emissions	% Of Ireland's 2020 Target
Total / Annum (tonnes)[(1)]	103,487	4.3	32.6	-	-
Total / Annum (tonnes CO_2 Equivalent)[(4)]	103,487	1152	913	-	-
Total / Annum (tonnes CO_2 Equivalent)	105,552			0.17%	0.28%

(1) Based on average of the UK (2006a, 2006b) and EU (2001) default emission rates

(2) N_2O Emission Factor of 4 kg/TJ taken from Volume 2 Table 2.2 of IPCC Guidelines (2006)

(3) CH_4 Emission Factor of 30 kg/TJ taken from Volume 2 Table 2.2 of IPCC Guidelines (2006)

(4) Conversion of N_2O and CH_4 to carbon equivalents taken from IPCC guidance (2013)

9.5.2 Construction Phase

Impacts to climate during the construction phase are deemed short-term and imperceptible.

9.5.3 Operational Phase

As part of the proposed development it is proposed to increase the annual waste throughput to 250,000 tonnes consisting of all non-recyclable household, commercial and/or industrial waste. For the purpose of this study the maximum annual throughput of 250,000 tonnes was used including 25,000 tonnes of hazardous waste. The breakdown of waste has been based on the most recent national waste breakdown of residual waste (EPA/RPS, 2018) for the purposes of this assessment (see **Appendix 9.1** in **Volume 3**, Tables A9.1.3 – A9.1.4 of this EIAR).

Table 9.4 details the annual greenhouse gas emission from the site for the "Do Something" scenario. Annual GHG emissions from the facility account for 0.19% of Ireland's predicted total GHG emissions in 2018 as detailed in **Table 9.2**. The emissions have also been compared with the EU 2020 target for Ireland of 37,942,682 tonnes CO_{2eq} (EC, 2017). The contribution to the total greenhouse gas emissions is 0.30% of the EU 2020 Target for the "Do Something" scenario. Therefore, the proposed increase in waste throughput will result in a maximum increase of 0.03% of Ireland's EU 2020 target. This is considered a long-term, negative, imperceptible impact on climate.

Table 9.4 Greenhouse Gas Emissions At Indaver Ireland's Waste Management Facility, Carranstown, Based On 250,000 Tonnes/Annum (Do Something Scenario)

	CO_2	N_2O[(2)]	CH_4[(3)]	% Of Ireland's Total 2018 Emissions	% Of Ireland's 2020 Target
Total / Annum (tonnes)[(1)]	113,370	4.8	35.7	-	-
Total / Annum (tonnes CO_2 Equivalent)[(4)]	113,370	1262	1000	-	-
Total / Annum (tonnes CO_2 Equivalent)	115,631			0.19%	0.30%

(1) Based on average of the UK (2006a, 2006b) and EU (2001) default emission rates

(2) N_2O Emission Factor of 4 kg/TJ taken from Volume 2 Table 2.2 of IPCC Guidelines (2006)

(3) CH_4 Emission Factor of 30 kg/TJ taken from Volume 2 Table 2.2 of IPCC Guidelines (2006)

(4) Conversion of N_2O and CH_4 to carbon equivalents taken from IPCC guidance (2013)

The development of the HGU will result in the generation of approximately 160 tonnes of Hydrogen gas for use as a clean fuel each year. This is generated from 10 GWh of electricity which would otherwise be lost as waste heat to the atmosphere over the air-cooled condenser on site. Hydrogen has a calorific value of 130 MJ/kg which translates into 5.744 GWh of energy based on the HGU running for 1,000 hours per annum and producing 160 tonnes of Hydrogen.

If the equivalent energy (5.744 GWh) was to be supplied by natural gas this would produce 1175.8 tCO_{2eq} per year, based on an emission factor of 204.7 gCO_2/kWh for natural gas (SEAI, 2020). This is equivalent to 0.003% of Ireland's EU 2020 target. Therefore, the proposed HGU is offsetting emissions (albeit by a small amount on a National scale) and has a positive impact on climate.

9.6 Mitigation Measures and Monitoring

9.6.1 Construction Phase

As impacts to climate are imperceptible no mitigation is proposed.

9.6.2 Operational Phase

There are no significant impacts to climate predicted as part of the operational phase of the proposed development therefore no mitigation is proposed.

9.7 Cumulative Effects

There are a number of planned or permitted developments in the vicinity of the existing facility which have the potential to cumulatively impact climate. Each project has been reviewed in turn below for the potential cumulative impact to climate. Proposed projects are in the following sections.

9.7.1 Irish Cement Flue Dust Portland Cement Silo

There are no climate related impacts predicted as part of this development and therefore there is no potential for any significant negative direct nor indirect cumulative impacts to arise from the Indaver Site Sustainability Project in combination with the project above.

9.7.2 Irish Cement fossil fuel replacement and alternative raw materials project

This development is predicted to have a positive impact on climate due to the CO_2 savings through the use of alternative fuels relative to fossil fuels. As outlined in the EIA Report (Brady Shipman Martin, 2017) it is estimated that a saving of approximately 314,340 tonnes CO_2 per annum will be achieved as a result of the project. Cumulative impacts are considered neutral.

Impacts to climate are not predicted during the construction phase of this development.

Therefore, there is no potential for any significant negative direct nor indirect cumulative impacts to arise from the Indaver Site Sustainability Project in combination with the project above.

9.7.3 SSE Generation 110kV Transmission Substation

Significant impacts to climate are not predicted as a result of the substation development as there are no direct emissions to atmosphere during operation. Construction vehicles and machinery may give rise to some GHG emissions during construction, however, due to the small scale of the development and the predicted low volume of machinery required GHG emissions are considered imperceptible. The cumulative impact to climate is overall imperceptible and therefore there is no potential for any significant negative direct nor indirect cumulative impacts to arise from the Indaver Site Sustainability Project in combination with the project above.

9.7.4 Garballagh Lower Solar Farm

The solar farm development will have a positive impact on climate by reducing the reliance on fossil fuels and increasing the capacity of renewable energy available on the national grid. Cumulative impacts are considered neutral and therefore there is no potential for any significant negative direct nor indirect cumulative impacts to arise from the Indaver Site Sustainability Project in combination with the project above.

9.7.5 Solar Farm Electrical Substation (110kV)

The electrical substation development will allow for the renewable electricity generated by the solar farm development to be transported to the national grid. This will have a positive impact on climate by reducing the reliance on fossil fuels and increasing the capacity of renewable energy available on the national grid. Cumulative impacts are considered neutral and therefore there is no potential for any significant negative direct nor indirect cumulative impacts to arise from the Indaver Site Sustainability Project in combination with the project above.

9.7.6 Cumulative Effects Summary

Cumulative impacts are considered neutral in terms of climate.

9.8 Residual Effects

9.8.1 Operational Phase

The assessment has shown that the operational phase will not cause a significant impact on climate. Residual emissions from the operational phase will be 0.31% of Ireland's national emissions target in 2020 and thus is not considered to be significant in the context of aggregated national emission sources.

Climate change can cause flooding related impacts as a result of altered weather events. A flood risk assessment prepared for the proposed development found no risk of flooding on site and therefore impacts related to climate change are considered imperceptible.

9.8.2 Construction Phase

Impacts to climate during the construction phase are considered short-term and imperceptible.

9.9 References

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