# 15 CLIMATE

## 15.1 INTRODUCTION

The climate assessment undertaken in 2009 comprehensively addressed the potential impacts of the emissions from the existing development on the climate of the site and its environs. The 2009 study has been updated to allow for an increase in waste accepted from 200,000 tonnes to 220,000 tonnes (including a possible maximum of between 10,000 – 15,000 tpa of suitable hazardous waste). A summary of the key findings of the updated climate assessment is presented below. The general principle of the assessment was to compare greenhouse gas emissions (GHG) from the proposed facility against GHG from an equivalent notional landfill facility.

## 15.2 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

### 15.2.1 Forecasting Methods

Predictions of greenhouse gas emissions from the waste management facility were prepared using the emission factors derived from the IPCC[1], UK[2,3] and EU[4] and from information supplied by Indaver Ireland. The prediction of GHG emissions from landfills was developed using the IPCC Landfill Model[5] and using emission factors derived from the IPCC[1].



### 15.2.2 Construction

There will be some minor construction activities associated with this application. Two existing buildings will be converted from temporary to permanent structures in addition to ancillary roads, additional parking spaces and the installation of a Puraflo effluent treatment system.

### 15.2.3 Incineration

Incineration would be expected to be the dominant source of greenhouse gas ($CO_2$, $CH_4$ and $N_2O$) emissions from the development. Detailed waste throughput information was obtained from Indaver Ireland and this information was used to estimate GHG emissions from the scheme. The annual waste throughput for the proposed Waste Management Facility will be a maximum of 220,000 tonnes consisting of all non-recyclable household, commercial and/or industrial waste. For the purpose of this study the maximum annual throughput of 220,000 tonnes was used including 20,000 tonnes of industrial hazardous and non-hazardous waste although in reality the maximum tonnage of industrial hazardous and non-hazardous waste will be 10,000 - 15,000 tonnes of suitable hazardous waste streams. The net greenhouse gas contribution from the waste was derived using the procedure recommended by the IPCC. The breakdown of waste for both the "Do Nothing" and "Do Something" scenario is shown in Appendix 15.1 which is based on the most recent national waste breakdown of residual waste[6]. For the

purposes of this assessment, the "Do Nothing" scenario is based on the facility in operation treating 200,000 tonnes of residual household and commercial waste whilst the "Do Something" scenario is based on the facility in operation treating 200,000 tonnes of residual household and commercial waste and 20,000 tonnes of industrial hazardous and non-hazardous waste as a worst-case (industrial hazardous and non-hazardous waste will have a greater GHG impact than MSW).

### 15.2.4 Road Traffic

Road traffic will be an additional source of greenhouse gas emissions as a result of the development. Waste will be transported from the source of the waste to the site for disposal whilst the ash will subsequently be removed from the facility to be landfilled. In the absence of a detailed breakdown of the sources of waste, a detailed comparison of GHG emissions between the current operation (Do Nothing) and the proposed operation (Do Something) is not possible. However, analysis by the USEPA has estimated that the traffic-derived GHG emissions from waste-to-energy is approximately equivalent at 0.01 MTCE (metric tonnes of carbon equivalent) of anthropogenic $CO_2$ emission per ton (US) of material incinerated with the resulting ash landfilled(7). In this context, the impact from the transport of the additional waste accounts for less than 2% of the impact from the incineration of waste (excluding energy recovery) and thus is a minor contributor to the overall GHG emission total.



### 15.2.5 Modelling Methodology – Waste-to-Energy Facility

In order to calculate the scheme's net contribution to greenhouse gas emissions and the effect of the scheme on Ireland's obligations under the Kyoto Protocol, the total forecasted anthropogenic emissions due to the proposed development have been calculated. The baseline year is assumed to be 2012. Given in Table 15.1 and Table 15.2 is the annual greenhouse gas emission from the site for both the "Do Nothing" and "Do Something" scenario. The emissions have been compared with the Kyoto Target for Ireland over the period 2008-2012(8). The contribution to the total greenhouse gas emissions, in the absence of power generation, is 0.11% of the Kyoto Target for the "Do Nothing" scenario and 0.16% of the Kyoto Target for the "Do Something" scenario. Thus, compared to the "Do Nothing" scenario, greenhouse gas emissions increase by no more than 0.05% of the Kyoto Target as a result of this proposal.

During the incineration of waste at the facility the thermal energy generated by the burning of waste will be recovered and when the plant is running at 100% load will give a maximum electrical output of about 18.2MW. The current data from the plant (prior to final optimisations etc) indicates 16.56 MW for both the "Do Nothing" scenario and the "Do Something" scenario. Although this figure will increase over time as the operation of the plant is optimised, the figure is conservative in the context of this assessment. As approximately 1.88 MW and 2.07 MW is required for electrical demand within the plant respectively, the net electrical output from the plant for export to the national grid will be 14.68 MW for the "Do Nothing" scenario and 14.49 MW for the "Do Something" scenario, which will be approximately equivalent to a net electrical output of 114,504 MWh and 113,022 MWh for the "Do Nothing" and "Do Something" scenarios

respectively. Thus, the export of 114,504 MWh / 113,022 MWh will give a direct benefit in terms of greenhouse gas emissions which would have been released in the production of 114,504 MWh / 113,022 MWh from power stations. In order to calculate the net benefit in terms of greenhouse gas emissions, the likely greenhouse gas emissions from a combined cylce gas turbine (CCGT) power station (the most GHG efficient power source) producing 114,504 MWh / 113,022 MWh of power have been calculated and subtracted from the site's greenhouse gas emissions (see Table 15.3 and Table 15.4). The dominant primary fuels, on which the generation system currently relies in terms of electricity generation output, are gas (62%), coal (14%), renewables (16%), peat (8%) and oil (2%)[9]. $CO_2$ emissions from coal are 77% higher per Joule, peat is 110% higher per joule whilst oil is 49% higher per Joule than natural gas[9]. Thus, the assumption that the displaced power generation is from a CCGT burning natural gas is a worst-case scenario and more pessimistic assumption than using the average fossil fuel profile.

The production of power for export to the national grid is equivalent to a net reduction of 65% in the amount of greenhouse gases emitted from the site for the "Do Nothing" scenario and a net reduction of 46% in the amount of greenhouse gases emitted from the site for the "Do Something" scenario. The actual contribution to the total greenhouse gas emissions is 0.04% of the Kyoto Target for Ireland in 2012 for the "Do Nothing" scenario and 0.09% of the Kyoto Target for Ireland in 2012 for the "Do Something" scenario. Thus, the overall impact of the "Do Something" scenario compared to the "Do Nothing" scenario is to increase Total Greenhouse Gas Emissions in Ireland by 0.05% of the Kyoto Target for Ireland in 2012 and thus the proposal has a negligible impact on Ireland's obligations under the Kyoto protocol.



## 15.3 PREDICTED IMPACT OF DEVELOPMENT ON CLIMATE

### 15.3.1 Construction

The effect of construction on climate will not be significant.

### 15.3.2 Incineration

The contribution of the Waste-to-Energy Facility to total greenhouse gas emissions in Ireland is equivalent to only 0.( of the Kyoto Target for Ireland in 2012, when energy recovery in taken into account. Moreover, compared to the Nothing" scenario, emissions will increase by only 0.05% of the Kyoto Target for Ireland in 2012, when energy reco in taken into account. Thus, the overall annual impact of the existing plant on climate is to increase greenhouse emissions by approximately 0.05% (See Table 15.5) of the total greenhouse gas emissions in Ireland in 2012 and will be imperceptible in terms of Ireland's obligations under the Kyoto Protocol.

## 15.4 DESCRIPTION OF MITIGATION MEASURES

### 15.4.1 Construction

As there will be no significant impact on climate, no mitigation measures are proposed.

### 15.4.2 Incineration

During the incineration of waste at the facility the thermal energy generated by the burning of waste will be recovered and will give an electrical output of about 16.56 MW with a net electrical output from the plant for export to the national grid will be 14.49 MW (equivalent to 113,022 MWh) (see Table 15.4). Thus, the export of 113,022 MWh will give a direct benefit in terms of greenhouse gas emissions which would have been released in the production of 113,022 MWh from power stations.

The Waste-to-Energy facility will also recover and recycle ferrous materials during the incineration process. The recycling of metals will require less energy than processes using virgin inputs and thus lead to a direct saving in energy and thus GHG emissions. A recent USEPA report has estimated that approximately 0.01 MTCE per ton (US) of mixed MSW is saved through recycling of metals[7].



## 15.5 REFERENCES

(1) IPCC 2006 IPCC Guidelines for National GHG Inventories (2006)
(2) UK DEFRA / ERM (2006) Impact of Energy from Waste and Recycling Policy on UK GHG Emissions
(3) UK DEFRA / ERM (2006) Carbon Balances & Energy Impacts of the Management of UK Wastes
(4) European Commission Waste Management Options and Climate Change (2001)
(5) IPCC (2006) IPCC Spreadsheet for Estimating Methane Emissions from Solid Waste Disposal Sites (IPCC Waste Model) 2006 Guidelines for National GHG Inventories
(6) EPA National Waste Database Report 2009 (2011)
(7) USEPA Greenhouse Gas Emissions From Management of Selected Materials in Municipal Solid Waste (2002)
(8) DEHLG National Climate Change Strategy 2007-2012
(9) SEAI Energy Forecast for Ireland to 2020 – 2011 Report

**Table 15.1: Greenhouse Gas Emissions At Indaver Ireland's Waste Management Facility, Carranstown, Based On 200,000 Tonnes/Annum (Do Nothing Scenario)**

| | $CO_2$ | $N_2O$[2] | $CH_4$[3] | % Of Ireland's Total Emissions |
|---|---|---|---|---|
| Total / Annum (tonnes)[1] | 70,481 | 2.1 | 15.4 | - |
| Total / Annum (tonnes $CO_2$ Equivalent)[4] | 70,481 | 592 | 354 | - |
| Total / Annum (tonnes $CO_2$ Equivalent) | 71,443 | | | 0.11 |

(1) Based on average of the UK[2,3] and EU[4] default emission rates
(2) $N_2O$ Emission Factor of 4 kg/TJ taken from Volume 2 Table 2.2 of IPCC Guidelines (2006)[1]
(3) $CH_4$ Emission Factor of 30 kg/TJ taken from Volume 2 Table 2.2 of IPCC Guidelines (2006)[1]
(4) Conversion of $N_2O$ and $CH_4$ to carbon equivalents taken from Council Directive 2009/28/EC



**Table 15.2: Greenhouse Gas Emissions At Indaver Ireland's Waste Management Facility, Carranstown, Based On 220,000 Tonnes/Annum (Do Something Scenario)**

| | $CO_2$ | $N_2O$[2] | $CH_4$[3] | % Of Ireland's Total Emissions |
|---|---|---|---|---|
| Total / Annum (tonnes)[1] | 98,641 | 2.9 | 21.7 | - |
| Total / Annum (tonnes $CO_2$ Equivalent)[4] | 98,641 | 899 | 456 | - |
| Total / Annum (tonnes $CO_2$ Equivalent) | 99,995 | | | 0.16 |

(1) Based on average of the UK[2,3] and EU[4] default emission rates
(2) $N_2O$ Emission Factor of 4 kg/TJ taken from Volume 2 Table 2.2 of IPCC Guidelines (2006)[3]
(3) $CH_4$ Emission Factor of 30 kg/TJ taken from Volume 2 Table 2.2 of IPCC Guidelines (2006)[3]
(4) Conversion of $N_2O$ and $CH_4$ to carbon equivalents taken from Council Directive 2009/28/EC

**Table 15.3: Greenhouse Gas Emissions At Indaver Ireland's Waste Management Facility, Carranstown As A Result of Exporting 14.68 MW (Do Nothing Scenario)**

| | $CO_2$ | $N_2O$[3] | $CH_4$[3] | % Of Irelands Total Emissions[1] |
|---|---|---|---|---|
| CCGT Producing 14.68 MW[2] (tonnes) | 45,802 | 1.2 | 0.41 | - |
| CCGT Producing 14.68 MW (tonnes $CO_2$ Equivalent) | 46,194 | | | - |
| Total / Annum (tonnes $CO_2$ Equivalent) After Subtraction Of Power (Do Nothing) | 25,249 | | | **0.04** |

(1) Based on a Kyoto Target of 62.8 million tonnes $CO_2$ equivalent in 2008-2012

(2) Based on an energy saving of 0.40t $CO_2$ / MWh CCGT for electricity generation[9] and assuming 114,504 MWh

(3) Based on 2006 IPCC Guidelines[1]



**Table 15.4: Greenhouse Gas Emissions At Indaver Ireland's Waste Management Facility, Carranstown As A Result of Exporting 14.49 MW (Do Something Scenario)**

| | $CO_2$ | $N_2O$[3] | $CH_4$[3] | % Of Irelands Total Emissions[1] |
|---|---|---|---|---|
| CCGT Producing 14.49 MW[2] (tonnes) | 45,209 | 1.2 | 0.41 | - |
| CCGT Producing 14.49 MW (tonnes $CO_2$ Equivalent) | 45,596 | | | - |
| Total / Annum (tonnes $CO_2$ Equivalent) After Subtraction Of Power (Do Something) | 54,400 | | | **0.09** |
| **Impact Of Proposal** | **29,151 Tonnes $CO_2$ Equivalent** | | | **0.04** |

(1) Based on a Kyoto Target of 62.8 million tonnes $CO_2$ equivalent in 2008-2012

(2) Based on an energy saving of 0.40t $CO_2$ / MWh CCGT for electricity generation[9] and assuming 113,022 MWh

(3) Based on 2006 IPCC Guidelines[1]

**APPENDIX 15.1**

In order to calculate the facility's net contribution to GHG emissions and the effect of the facility on Ireland's obligations under the Kyoto Protocol, the anthropogenic emissions have been calculated. Given in Tables A15.1 - 15.4 are the annual anthropogenic GHG emission from the facility based on UK and EU default emission factors for both the "Do Nothing" and "Do Something" scenarios. The average of the two default emission databases had been used in the calculations.

| Type | Waste Totals | Waste Fraction | Total Carbon Content (wet) | Fossil Carbon Fraction | $CO_2$ Emissions (Tonnes/Annum) |
|---|---|---|---|---|---|
| **Paper** | 42,319 | 21.2% | 31.9% | 0.0% | **0** |
| **Glass** | 5,392 | 2.7% | 0.3% | 0.0% | **0** |
| **Plastic** | 25,086 | 12.5% | **51.3%** | 100.0% | **47,186** |
| **Ferrous** | 5,445 | 2.7% | 0.0% | 100.0% | **0** |
| **Aluminium** | 10,457 | 5.2% | 24.0% | 10.0% | **920** |
| **Other Metals** | 12,788 | 6.4% | **39.9%** | 50.0% | **9,354** |
| **Textiles** | 69,986 | 35.0% | 13.5% | 0.2% | **69** |
| **Organics** | 524 | 0.3% | 0.0% | 100.0% | **0** |
| **WEEE** | 1,796 | 0.9% | 42.5% | 0.0% | **0** |
| **Wood** | 26,208 | 13.1% | **21.8%** | 50.0% | **10,474** |
| **Others** | 42,319 | 21.2% | 31.9% | 0.0% | **0** |
| **Total** | 200,000 | | | | **68,004** |

**Table A15.1 Anthropogenic $CO_2$ Emissions From The Incineration of 200,000 tonnes of MSW (tonnes $CO_2$ eq) Based On UK Guidance[2,3] (Do Nothing)**

| Type | Waste Totals | Waste Fraction | Total Carbon Content (wet) | Fossil Carbon Fraction | $CO_2$ Emissions (Tonnes/Annum) |
|---|---|---|---|---|---|
| **Paper** | 42,319 | 21.2% | 33.0% | 0.0% | **0** |
| **Glass** | 5,392 | 2.7% | 0.0% | 0.0% | **0** |
| **Plastic** | 25,086 | 12.5% | **61.0%** | 100.0% | **56,108** |
| **Ferrous** | 5,445 | 2.7% | 0.0% | 100.0% | **0** |
| **Aluminium** | 10,457 | 5.2% | 24.0% | 10.0% | **920** |
| **Other Metals** | 12,788 | 6.4% | **39.0%** | 50.0% | **9,143** |
| **Textiles** | 69,986 | 35.0% | 19.0% | 0.2% | **98** |
| **Organics** | 524 | 0.3% | 0.0% | 100.0% | **0** |
| **WEEE** | 1,796 | 0.9% | 42.5% | 0.0% | **0** |
| **Wood** | 26,208 | 13.1% | **24.0%** | 29.0% | **6,688** |
| **Others** | 42,319 | 21.2% | 33.0% | 0.0% | **0** |
| **Total** | 200,000 | 100.0% | | | **72,957** |

**Table A15.2 Anthropogenic $CO_2$ Emissions From The Incineration of 200,000 tonnes of MSW (tonnes $CO_2$ eq) Based On EU Guidance[4] (Do Nothing)**

| Type | Waste Totals | Waste Fraction | Total Carbon Content (wet) | Fossil Carbon Fraction | $CO_2$ Emissions (Tonnes/Annum) |
|---|---|---|---|---|---|
| **Paper** | 42,319 | 19.2% | 31.9% | 0.0% | **0** |
| **Glass** | 5,392 | 2.5% | 0.3% | 0.0% | **0** |
| **Plastic** | 25,086 | 11.4% | **51.3%** | 100.0% | **47,186** |
| **Haz Waste** | 20,000 | 9.1% | **38.4%** | 100.0% | **28,160** |
| **Metals** | 5,445 | 2.5% | 0.0% | 100.0% | **0** |
| **Nappies** | 10,457 | 4.8% | 24.0% | 10.0% | **920** |
| **Textiles** | 12,788 | 5.8% | **39.9%** | 50.0% | **9,354** |
| **Organics** | 69,986 | 31.8% | 13.5% | 0.2% | **69** |
| **WEEE** | 524 | 0.2% | 0.0% | 100.0% | **0** |
| **Wood** | 1,796 | 0.8% | 42.5% | 0.0% | **0** |
| **Others** | 26,208 | 11.9% | **21.8%** | 50.0% | **10,474** |
| **Total** | 220,000 | | | | **96,164** |

**Table A15.3 Anthropogenic $CO_2$ Emissions From The Incineration of 220,000 tonnes of MSW (tonnes $CO_2$ eq) Based On UK Guidance[2,3] (Do Something)**

| Type | Waste Totals | Waste Fraction | Total Carbon Content (wet) | Fossil Carbon Fraction | $CO_2$ Emissions (Tonnes/Annum) |
|---|---|---|---|---|---|
| **Paper** | 42,319 | 19.2% | 33.0% | 0.0% | **0** |
| **Glass** | 5,392 | 2.5% | 0.0% | 0.0% | **0** |
| **Plastic** | 25,086 | 11.4% | **61.0%** | 100.0% | **56,108** |
| **Haz / Non-Haz Waste** | 20,000 | 9.1% | **38.4%** | 100.0% | **28,160** |
| **Metals** | 5,445 | 2.5% | 0.0% | 100.0% | **0** |
| **Nappies** | 10,457 | 4.8% | 24.0% | 10.0% | **920** |
| **Textiles** | 12,788 | 5.8% | **39.0%** | 50.0% | **9,143** |
| **Organics** | 69,986 | 31.8% | 19.0% | 0.2% | **98** |
| **WEEE** | 524 | 0.2% | 0.0% | 100.0% | **0** |
| **Wood** | 1,796 | 0.8% | 42.5% | 0.0% | **0** |
| **Others** | 26,208 | 11.9% | **24.0%** | 29.0% | **6,688** |
| **Total** | 220,000 | 100.0% | | | **101,117** |

**Table A15.4 Anthropogenic $CO_2$ Emissions From The Incineration of 220,000 tonnes of MSW (tonnes $CO_2$ eq) Based On EU Guidance[4] (Do Something)**