14. Climate

14.1 Introduction

This chapter will describe and assess the impact of the proposed road development in terms of climate. Attention will be focused both on Ireland's obligations under the Kyoto Protocol and the effect of the scheme on the total national anthropogenic emissions of carbon dioxide and other greenhouse gases (GHGs) and also in the context of overall climatic impact in the presence and absence of the proposed road development.

14.2 Climatic Baseline

14.2.1 Microclimatic Baseline

The climate of along the proposed route is characterised by the passage of Atlantic low pressure weather systems and associated frontal rain belts from the west during much of the winter period. Over the summer months the influence of anticyclonic weather conditions will result in drier continental air over this part of Ireland, in particular when winds are from the east, interspersed by the Atlantic frontal systems.

Occasionally, the establishment of a high pressure area over Ireland and Britain will result in calm conditions and during the winter months. These are characterised by clear skies and the formation of low-level temperature inversions with slack wind conditions at nighttime. If anticyclonic conditions become established for a few days or more during the summer months then high daytime temperatures may be recorded, especially at inland locations in the region. Prolonged dry weather conditions are relatively infrequent but should continental air masses dominate over Ireland a period of drought conditions may occur which could last up to 2 or 3 weeks.

14.2.2 Wind

Long-term hourly observations at Kilkenny Meteorological station provide an indication of the prevailing wind conditions for the region (see Table 14.1). Results indicate that the main wind direction is from south to westerly in direction with an annual incidence of 40%. The mean wind speed is about 3.4m/s, with approximately 1-2 days per month of gales (see Table 14.1).

14.2.3 Rainfall

Precipitation data for the nearest long-term climatological stations at Kilkenny indicates an average annual rainfall of 822mm in the locality of the proposed road development, see Table 14.1. Slightly higher levels are recorded during the winter period compared to the summer period. Historically highest rainfall occurs in December with an average of 89mm and the lowest in April with an average of 51mm. The precipitation occurring in the winter periods tends to be associated with more pro-longed Atlantic frontal weather depressions passing over the region compared to the summer when rainfall is more likely to be associated with showery conditions.

14.2.4 Effects of Climate Change in Ireland

The potential effects of climate change on a global scale have been investigated by the Intergovernmental Panel on Climate Change (IPCC)[(1)]. The resulting impacts in Ireland are outlined in the National Climate Change Strategy[(2)] and include the following:

- Significant increases in winter rainfall, with a corresponding increase in the water levels in rivers, lakes and soils. Serious flooding more frequent than at present.
- Lower summer rainfall, especially in the midlands, east and north. Less recharge of reservoirs in the summer leading to more regular and prolonged water shortages than at present. Loss of bogland due to regular water deficits.
- Rising sea levels with more storm events and storm surges. Storms of greater severity; within a lifetime, an extreme weather event which in 1990 might be expected to occur every 100 years, might be expected to occur every 5 years.
- Increased agricultural production, with new crops becoming more viable and potentially reduced agricultural costs. Grass growth could enjoy beneficial effects with an increase in 20% possible with higher temperatures and changes in rainfall patterns.

It is recognised that Ireland cannot, on its own, prevent or ameliorate the impacts of climate change. However, the National Climate Change Strategy states that Ireland must meet its responsibilities with regard to reducing CO2 emissions in partnership with the EU and the global community.

14.2.5 Baseline Conditions

Emissions of greenhouse gases included in the Kyoto Protocol are given in Table 14.2 and Table 14.3. Combustion of fossil fuels for energy purposes is the greatest source of emissions at 95% of CO2 and 57% of total emissions (1995 data). The largest share of energy emissions in 1998 is from fuel combustion for power generation (25% of total emissions) and residential energy combustion (18%). Transport is likely to contribute around 18.9% of GHG emissions by 2010 without measures to reduce GHG emissions.

14.2.6 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[3,4]. For the purposes of the EU burden sharing agreement under Article 4 of the Kyoto Protocol, in June 1998, Ireland agreed to limit the net growth of the six GHGs[5] (see Table 14.2 and Table 14.3) under the Kyoto Protocol to 13% above the 1990 level over the period 2008 to 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 [5,6].

Further details regarding both the Kyoto Protocol and the National Climate Change Strategy (introduced below) are detailed in Section 2.3.4 of this EIS.

14.2.7 National Climate Change Strategy

The National Climate Change Strategy (NCCS)[2], published in October 2000, is based on sectoral equity, in relation to meeting the targets set down in the Kyoto Protocol. Whilst GHG emissions are currently running at 24% above 1990 levels (2000 data)[7], full implementation of the NCCS will lead to compliance with the Kyoto Protocol[2,7].

The strategy also acknowledges the need to bring the road network up to an acceptable standard. In terms of meeting the Kyoto targets, as outlined in the NCCS, the key transportation measure will be fuel measures to displace bunkering which lead to a saving of 0.9Mt CO2 by 2010. Currently, HGV's engaged in international transport are bunkering in Ireland to take advantage of the relatively low cost of fuel. This practice will be phased out by 2008 by setting excise duty on transport fuel at appropriate levels[2].

In the transport sector, a range of measures has already been implemented. The introduction of fuel economy labelling since August 2001 will lead to savings of 380,000 tonnes CO2 per annum by 2010. In relation to public transport, substantial increases in Dublin Bus and Irish Rail's capacity and improvements in the Greater Dublin Area as outlined in the DTO's A Platform for Change[8] will lead to a reduction in emissions of over 1,000,000 tonnes of CO2 per annum by 2016, a 41% reduction on projected emissions[7].

14.3 Characteristics of the Proposed Road Development

14.3.1 Forecasting Methods

The impact on climate as a result of the proposed road development has been determined using the procedures given in Annex 2 in the UK Department of Transport Design Manual for Roads and Bridges (Revised February 2003), Volume 11, Section 3, Part 1, Air Quality[9]. The Annex provides a method for the prediction of the regional impact of CO2 emissions from road developments.

CO2 emissions in the region of the scheme over the period 2010-2025 were calculated, in the presence and absence of the scheme, using traffic data and vehicle CO2 emissions factors. CO2 emission rates from HGVs, petrol cars and diesel cars used in the assessment were those provided by the UK National Atmospheric Emissions Inventory (NAEI) emission factor database[10].

14.3.2 Construction

There is the potential for a number of emissions to the atmosphere during the construction of the road development. Construction vehicles and generators, for example, may give rise to CO2 and N2O emissions.

14.3.3 Road Traffic

Road traffic would be expected to be the dominant source of greenhouse gas emissions as a result of the road development. Vehicles will give rise to CO2 and N2O emissions along the proposed route.

14.4 Impact of Road Development on Climate

14.4.1 Construction

The effect of construction on climate will not be significant.

14.4.2 Road Traffic

In relation to the proposed road development, the impact of the scheme on greenhouse gas emissions has been assessed. The existing baseline conditions have been assessed over the course of fifteen years from the baseline year (Year 2010) to the design year (Year 2025). In addition, the proposed scheme has been assessed over the course of fifteen years from the baseline year (Year 2010) to the design year (2025).

The predictions for GHG emissions from the proposed road development indicate that there will be an insignificant decrease in the levels of CO2 emissions as a result of the scheme (see Table 14.4), with the decrease of the order of 0.0001% of total emissions in Ireland over the period 2010-2025. For the "do minimum" scenario, the emissions of GHG in the region of the scheme will amount to 0.0015%%, whilst the “do something” scenario will amount to 0.0014% of the total emissions in Ireland over the period 2010-2025. With reference to the relevant evaluation criteria such as the Kyoto Protocol(3,4), which has set objectives to be achieved by 2008-12, GHG emissions, as a result of this road development, will be insignificant.

14.5 Description of Mitigation Measures

14.5.1 Construction

No mitigation measures will be necessary.

14.5.2 Road Traffic

The EU has reached a voluntary agreement with car manufacturing associations to achieve an average CO2 emission for new passenger cars of 140 gCO2/km by the year 2008/09. This measure will reduce CO2 emissions from new cars by an average of 25% in the period 1995 to 2008/2009. It is estimated that 15% of the necessary effort towards the overall climate change target of the EU will be met by this measure alone(2). Additional fuel efficiency measures include VRT and Motor Tax rebalancing to favour the purchases of more fuel-efficient vehicles, the National Car Test and Fuel Economy Labelling.

14.6 Residual Impacts

The residual impact on climate from the operation of the road development will be insignificant.

14.7 Limitations, Assumptions and Difficulties Encountered

There were no limitations, assumptions or difficulties encountered to undertake this assessment.

14.8 References

(1) IPCC Climate Change - The IPCC Scientific Assessment (1990)

(2) Department of Environment & Local Government National Climate Change Strategy (2000)

(3) Framework Convention On Climate Change Ireland - Report On The In-Depth Review Of The Second National Communication Of Ireland (1999)

(4) Framework Convention On Climate Change Kyoto Protocol To The United Nations Framework Convention On Climate Change (1997)

(5) EPA Environment In Focus (2002)

(6) ERM Limitation and Reduction of CO2 and Other Greenhouse Gas Emissions in Ireland (1998)

(7) Department of Environment & Local Government Progress Report On The Implementation of The National Climate Change Strategy (2002)

(8) Dublin Transportation Office A Platform For Change (2000)

(9) UK DETR DMRB, Volume 11 Section 3 Environmental Assessment Techniques (1999)

(10) UK NAEI UK Emission Factor Database www.naei.org.uk/emissions/index.php

Table 14.1 Kilkenny Meteorological Station – 30 Year Averages

1961 - 1990	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Temperature (c)													
Mean Daily Max.	7.7	7.9	10	12.4	15.1	18.1	19.9	19.6	17.2	13.9	10.1	8.4	**13.4**
Mean Daily Min.	1.4	1.6	2.3	3.4	5.6	8.4	10.4	9.9	7.9	6.1	2.8	2.1	**5.2**
Mean	4.6	4.8	6.1	7.9	10.3	13.3	15.2	14.7	12.6	10	6.4	5.3	**9.3**
Relative Humidity (%)													
Mean at 0900UTC	88	87	85	79	79	79	78	82	85	88	89	89	**84**
Mean at 1500UTC	80	74	68	64	64	65	65	66	69	76	78	82	**71**
Sunshine (hours)													
Mean daily duration	1.71	2.29	3.32	4.85	4.47	5.15	4.65	4.5	3.82	2.71	2.22	1.48	**3.51**
Rainfall (mm)													
Mean Monthly Total	86.3	66.1	63.9	51.4	61.9	50.5	52.5	69.4	73.5	84.9	73.8	88.6	**822.8**
Mean No. of days >=0.2mm	19	15	17	15	17	14	13	15	15	18	17	18	**192**
Wind (knots)													
Mean Monthly Speed	7.4	7.4	7.7	6.7	6.4	5.8	5.6	5.6	5.9	6.4	6.4	7.1	**6.5**

Table 14.2 Greenhouse Gas Emissions (1995 ("000 tonnes)[4]

	CO_2	CH_4[2]	N_2O[2]	HFC	PFC	SF^6
Energy	32105	14.99	3.52			
Industrial Processes	1772		2.62			
Solvents & Other Product Use						
Agriculture		636.86	19.11			
Land Use Change & Forestry	-6230	24.36	0.79			
Waste	54	136.03	0			
TOTAL	33931[1]	812.24	26.04	111	103	84

[1] Excluding land use change & forestry

[2] The global warming potential of CH_4 is 21 times that of CO_2 whilst N_2O is 310 times that of CO_2

Data for HFC, PFCs and SF_6 are estimated and are presented as CO_2 equivalents

Table 14.3 Greenhouse Gas Emissions ("000 tonnes CO_2 equivalent)[7]

Year	CO_2	CH_4	N_2O	HFC, PFC, SF_6	Total Emissions	Emission Index	Sinks (Kyoto Basis)	Net Total	Net Index
Base Year (1990)	31,575	12,836	9,085	256	53,752	100.0	0	**53,752**	**100.0**
1998	40,028	13,631	10,069	256	63,984	119.0	-745	**63,239**	**117.6**
2000	42,675	13,139	9,630	799	66,243	123.2	-991	**65,252**	**121.4**
2005	47,210	12,940	9,692	1,342	71,184	132.4	-1,523	**69,660**	**129.6**
2010 Low	51,373	12,185	9,720	672	73,950	137.6	-2,056	**71,894**	**133.8**
2010 High	51,373	12,185	9,720	1,885	75,163	139.8	-1,369	**73,794**	**137.3**

Table 14.4 Greenhouse Gas Emissions As A Result of the Proposed Scheme

Year	Do Minimum	Do Something	Average CO_2 Emissions[2]	CO_2 Emissions for Ireland[3]	CO_2 Emissions – Do Minimum		CO_2 Emissions – Do Something		
	Vehicle x Km[1]	Vehicle x Km[1]	(g/km)	(Tonnes)	(Tonnes)	% of CO_2 for Ireland	(Tonnes)	% of CO_2 for Ireland	Impact as a % of national CO_2 emissions
2010	2.58E+06	2.51E+06	275	59,000,000	710	0.0012	689	0.0012	-0.00003
2011	2.64E+06	2.56E+06	272	58,000,000	717	0.0012	696	0.0012	-0.00004
2012	2.69E+06	2.61E+06	269	57,000,000	724	0.0013	702	0.0012	-0.00004
2013	2.75E+06	2.66E+06	266	56,000,000	731	0.0013	708	0.0013	-0.00004
2014	2.80E+06	2.71E+06	263	55,000,000	737	0.0013	713	0.0013	-0.00004
2015	2.86E+06	2.76E+06	260	54,000,000	743	0.0014	718	0.0013	-0.00005
2016	2.92E+06	2.82E+06	257	53,000,000	749	0.0014	723	0.0014	-0.00005
2017	2.97E+06	2.87E+06	254	52,000,000	754	0.0014	727	0.0014	-0.00005
2018	3.03E+06	2.92E+06	251	51,000,000	759	0.0015	732	0.0014	-0.00005
2019	3.08E+06	2.97E+06	248	50,000,000	764	0.0015	735	0.0015	-0.00006
2020	3.14E+06	3.02E+06	244	49,000,000	768	0.0016	739	0.0015	-0.00006
2021	3.20E+06	3.07E+06	241	48,000,000	772	0.0016	742	0.0015	-0.00006
2022	3.25E+06	3.13E+06	238	47,000,000	775	0.0016	745	0.0016	-0.00006
2023	3.31E+06	3.18E+06	235	46,000,000	778	0.0017	748	0.0016	-0.00007
2024	3.36E+06	3.23E+06	232	45,000,000	781	0.0017	750	0.0017	-0.00007
2025	3.42E+06	3.28E+06	229		784	0.0018	752	0.0017	-0.00007
Total	**4.80E+07**	**4.63E+07**		**780,000,000**	**1.20E+04**		**1.16E+04**		
% Total				**4.80E+07**	**0.0015**		**0.0014**		**-0.0001**

(1) Based on 2010 and 2025 data for do minimum and do something scenarios (provide by traffic consultant for scheme) and assuming a linear annual increase

(2) Data provided by theUK Emission Factors Database (UK NAEI)

(3) Based on the likely reductions in GHG emissions on the National climate Change Strategy