12.0 CLIMATE

12.1 INTRODUCTION

The potential impacts of the proposed gas fired power plant at Lumcloon on climate are addressed in this section with specific reference to the generation of greenhouse gases from operational activities and from traffic associated with the construction and operational phases of the proposed development.

12.2 RECEIVING ENVIRONMENT

12.2.1 Microclimate

The climate of the area is best described by meteorological measurements collected by the National Meteorological Service from the meteorological stations at Birr, Co. Offaly and Mullingar, Co. Westmeath; the nearest met stations to the proposed development. To characterise the prevailing conditions at the site, historical meteorological data compiled by Met Eireann (www.meteireann.ie) is presented for Birr and Mullingar for the period 1981-1990. The most important meteorological parameters in relation to the proposed development are wind speed, rainfall and temperature.

Birr Station is located 1.5 Km ESE of Birr Town, Co. Offaly (53°5'25" N, 7°53'25"W) at 73M above mean sea level. Birr station is located approximately 15 km from the proposed site. Mullingar Synoptic Station is situated approximately 1.7 Km northwest of Mullingar, Co. Westmeath (53° 32' 14" N 07° 21' 44" W) at 104M above mean sea level. Mullingar station is located approximately 45 km from the proposed site.

The prevailing weather conditions at the site of the proposed development and that at Birr and Mullingar meteorological station is not expected to be significantly different.

12.2.1.1 Mullingar Wind Data

Outlined below is a windrose and tabulated data for wind direction and wind speeds in the area of the proposed development site. This data has been used for the purposes of the air dispersion modeling exercise carried out as part of the local air quality impact assessment. Figure 12.1 indicates the predominant wind direction is south-westerly. The wind speed is greater than 10 knots for approximately 3% of the measured met data from 2000 to 2004 (See Figure 12.2).

Figure 12.1 Mullingar Windrose Diagram detailing wind speed and direction (Blowing to) from 2000 to 2004

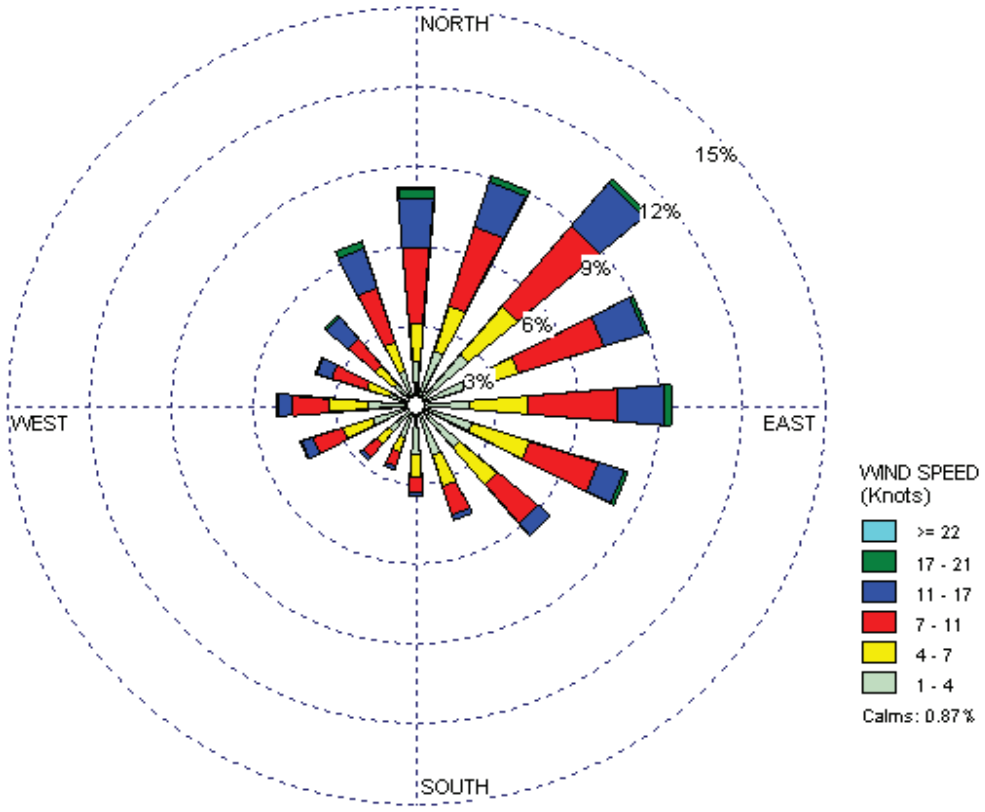
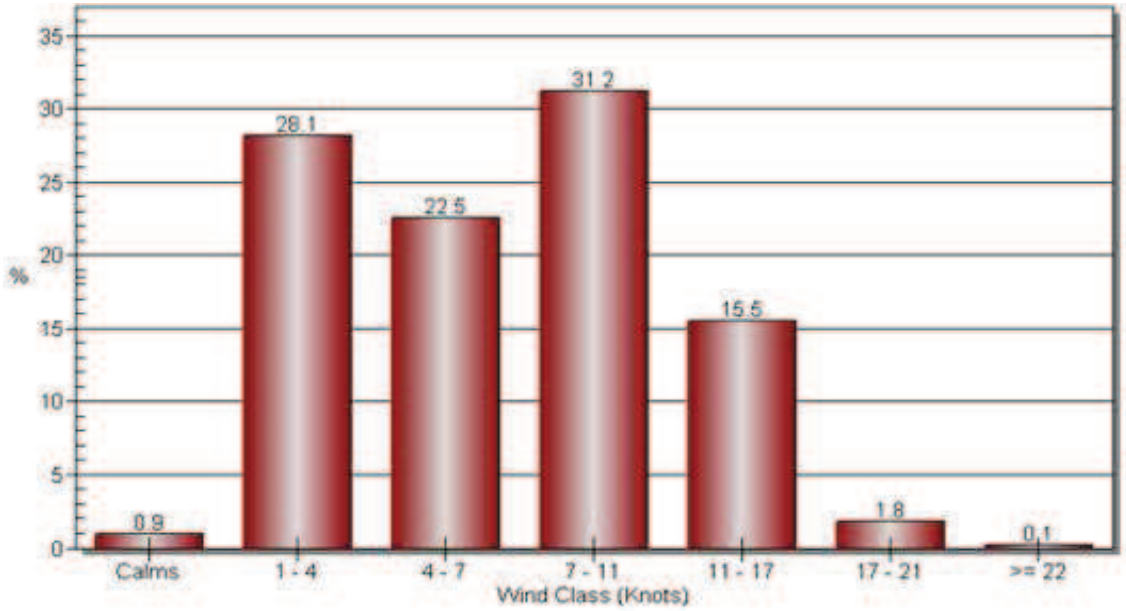


Figure 12.2 Mullingar wind speed frequency distribution (2000 – 2004)



Solar Radiation

Mean monthly Solar Radiation data from Birr for 2009, 2008 and mean value from 1981-1990 is presented in Table 12.1. No solar radiation data is available for Mullingar Met station.

Table 12.1 Solar Radiation Data for Birr Meteorological Station

Global Solar Radiation in Joules/cm^2 for Birr													
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
2009	7745	12237	27780	36039	51710	-	-	-	-	-	-	-	187463
2008	6849	13904	26502	41033	54000	48593	45087	33549	29031	17961	8511	5643	330663
Mean	7205	12563	24060	38647	50261	48440	49530	39060	29348	17288	9201	5522	331127

Note: Data for the most recent months are provisional. Solar radiation means are presented for 1981-1990.

Precipitation

Rainfall data for 2008 and 2009 to date along with average monthly and annual precipitation rates over the period 1961 – 1990 for Birr and Mullingar are presented in Table 12.2 (a) and Table 12.2 (b). The results show that the annual average rate of precipitation for 2008 in Birr and Mullingar is 1,017 mm and 1,065, respectively. The average monthly rainfall values in 2008 at Birr range from 30.7 mm in April to 181.5 mm in August. In the summer months, high rainfall amounts tend to be associated with intense thunder showers which may be localised in rainfall intensity.

Table 12.2(a) Mean Monthly Rainfall Data for Birr Meteorological Station

Total rainfall in millimetres for Birr													
Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
2009	124.8	15.6	49.3	106.1	69.8	-	-	-	-	-	-	-	381.4
2008	134.9	31.5	95.2	30.7	19.1	86.8	91.8	181.5	84.1	121.1	77	63.7	1017.4
Mean	76	53.9	60.7	52.8	61.2	55.6	58.7	78	70.6	84.1	74.2	78.3	804.2

Note Data for the most recent months are provisional. All means are for the period 1961-1990.

Table 12.2(b) Mean Monthly Rainfall Data for Mullingar Meteorological Station

Total rainfall in millimetres for Mullingar													
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2009	104.6	-	40.6	102.9	75	-	-	-	-	-	-	-	-
2008	138.5	54.6	91.6	59.1	19.4	84.7	98.6	154.5	104.7	124	78.2	57.1	1065
mean	92.4	66.3	72.6	59	70.9	67	61.2	82.9	85.1	94.1	87.9	92.2	931.5

Note Data for the most recent months are provisional. All means are for the period 1961-1990.

Air Temperature

Air temperature for 2008 and 2009 to date, along with average daily air temperatures over the period 1961 - 1990 for Birr and Mullingar are presented in Table 12.3 (a) and Table 12.3 (b). The 2008 average daily temperatures for Birr and Mullingar ranged from 4.5°C in December to 15.4°C in August and 4.1°C in December to 14.9°C in August, respectively.

Table 12.3(a) Mean Air Temperatures at Birr Meteorological Station

Mean temperature in degrees C. for Birr													
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2009	4.3	5.2	7.2	9	11.2	-	-	-	-	-	-	-	7.8
2008	6.4	5.9	5.9	7.7	13.3	13	15.2	15.4	12.3	8.9	7.2	4.5	9.6
mean	4.6	4.8	6.1	7.9	10.4	13.2	14.9	14.6	12.6	10.1	6.4	5.4	9.3

Note Data for the most recent months are provisional. All means are for the period 1961-1990.

Table 12.3(b) Mean Air Temperatures at Mullingar Meteorological Station

Mean temperature in degrees C. for Mullingar													
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2009	3.5	4.9	6.5	8.7	10.8	-	-	-	-	-	-	-	7.5
2008	5.6	5.4	5.5	7.5	12.5	12.5	14.5	14.9	12	8.1	6.7	4.1	9.1
mean	4	4.2	5.7	7.6	10.1	13	14.7	14.2	12.3	9.7	5.9	4.8	8.8

Note Data for the most recent months are provisional. All means are for the period 1961-1990.

12.2.2 Existing Energy Usage in Ireland

Sustainable Energy Ireland (SEI's) 'Energy in Ireland 1990 -2006' report found that overall energy use in Ireland increased by almost 1% in 2006 while CO_2 related energy emissions increased by 0.4%.

Renewable energy use in Ireland grew by 15% during 2006. Wind energy experienced the highest growth in 2006, up by 46%, contributing 5% (primary energy equivalent) to Ireland's total energy requirements for 2006. The CO_2 emissions offset from renewable energy production reached 2.2 million tonnes of CO_2 in 2006.

Emissions associated with electricity generation in 2006 decreased by 1.8% notwithstanding growth of 6.3% in final electricity consumption. Last year each kWh of electricity emitted 601 grams of carbon dioxide which was a reduction of 5.6% on 2005.

The use of natural gas in electricity generation increased by 373 ktonne between 2005 and 2006.

At present, Ireland emits 14.85 Mtonnes of CO_2e from the Energy Sector, with emissions projected to increase by 1% over the period 2007 – 2020 to 15.0 Mtonnes of CO_2e.

12.2.3 Ireland and Climate Change

The potential effects of climate change on a global scale have been investigated by the Intergovernmental Panel on Climate Change (IPPC). The predicted impacts in Ireland are outlined in the National Climate Change Strategy including the following:

- Significant increases in winter rainfall;
- Lower summer rainfall (10% reduction in the southern half of the country);
- Prolonged water shortages and CO_2 losses from peat land due to water deficit;
- Benefits will include increased temperatures and related increases in agricultural production.

12.3 IMPACT ASSESSMENT

Given the nature of the proposed development, it is anticipated that the proposed development will not have a significant adverse impact on the local climate. Potential release of GHG emissions will occur during both the construction and operational phases.

12.3.1 Construction Phase

The main potential impacts on climate will be those associated with site traffic (HGV's and cars) entering and leaving the site. This will result in minor emissions of the greenhouse gas, CO_2 and acid gases, NO_x and SO_2. Levels of the pollutants emitted to atmosphere will be low, significantly lower than any regulatory standards, and therefore impact on climate will not be of any significance. With reference to Kyoto Protocol, which has set objectives to be achieved by 2008 – 2012, GHG emissions during construction will be negligible. There will be no ozone depleting substances used or emitted during the construction phase of the project.

12.3.2 Operational Phase

The proposed plant will have the capability of producing up to 350MW of power. The proposed development will operate as essentially one power block and will be capable of running in either open cycle or combined cycle modes. The proposed power block will comprises four small scale (<50MW) gas turbines, four heat recovery steam generators (HRSGs) and two steam turbine generators producing a further 75MW. Each HRSG will be fitted with supplementary gas burners and capable of producing around 32.5MWs of power at the alternator terminals. The principal design feature of the Lumcloon plant design is its flexibility and the fact that it will be capable of accommodating a wind power loss in the range from 47 to 185 MWs in open cycle mode and up to 70MW in supplementary firing mode.

In the combined cycle mode, a conditioned gas is combusted in the gas turbine generator producing electricity and the waste heat from the gas turbine is used to make steam to generate additional electricity via a Heat Recovery Steam Generator (HRSG) and a steam turbine. Combined Cycle Power Plants far exceed conventional Thermal Power Plants with efficiencies in a range of 54% to 57%. Open cycle gas turbines (OCGTs) are less efficient than combined cycle gas turbines (CCGTs) with typical efficiencies of approximately 37.5%. However, the advantage of operation in open cycle mode is that the plant can supply electricity in a much shorter timeframe than in combined cycle. In open cycle mode, the plant will be capable of producing 188MW of power.

12.3.2.1 CCGT & OCGT CO_2 Emissions

A document by the Oxford Institute for Energy Studies (20:20 vision to reducing CO_2 emissions in the UK electricity market) states that a modern CCGT plant only produces 40% of the CO_2 that a conventional coal-fired power station produces, and 75% of that produced by a conventional oil-fired power station, for the same amount of electricity output. Within the constraints of existing technologies it therefore appears that the only way to achieve a 20% reduction in emissions from electricity generation nationally would be to replace all conventional fossil fuel generation with low GHG emission CCGT plants and supported by renewable energy, and constrain demand growth to 1% per annum. At present, Ireland emits 14.85 Mtonnes of CO_2e from the Energy Sector, with emissions projected to increase by 1% over the period 2007 – 2020 to 15.0 Mtonnes of CO_2e.

Gas fired power generation station, as proposed in the Lumcloon plant, in both the open cycle and combined cycle modes have relatively low emissions of CO_2, CO and NO_x. From information provided by the project engineers, CO_2 emissions for the Lumcloon plant will be 200kgs/ MWhr minimum to 350kgs/MWhr maximum for the OCGT and 145kgs/ MWhr minimum to 280 kgs/MWhr maximum for the CCGT as opposed to coal and oil-fired thermal power plants with a CO_2 emission of 300 kgs/MWhr minimum to 1,000kgs/MWhr maximum.

At a maximum proposed output of 350MW, the combined cycle unit operating at full capacity for a year (circa 6,000 hours) at an average output of 212.5 kgs/MWhr CO_2 emissions would amount to 446,250 tonnes/annum. If the 188MW open cycle unit (peaking) operated at an expected circa 500 hours/year, at an average output of 275 kgs/MWhr CO_2 emissions would amount to 25,850 tonnes/annum. Therefore, this would amount to an approximate annual CO_2 output of 472,100 tonnes/annum, which is approximately 0.68% of Ireland's total GHG emissions in 2007 of 69.205 million tonnes carbon dioxide equivalent (Mt CO_2eq), , of which energy accounted for 21.5%.

When compared to a 350MW coal fired plant with an average CO_2 emission output of 341 kgs/MWhr running at the same operating capacity and producing 774,865 tonnes/annum, the proposed Lumcloon CCGT and OCGT plant will result in a CO_2 emissions reduction of approximately 302,765 tonnes CO_2/annum. When compared to a sample 350MW oil fired plant with an average CO_2 emission output of 265 kgs/MWhr running at the same operating capacity and producing 602,875 tonnes/annum, the proposed Lumcloon CCGT and OCGT plant will result in a CO_2 emissions reduction of approximately 130,775 tonnes CO_2/annum (Ref.: http://www.sei.ie/Publications/Statistics_Publications/Emission_Factors). Therefore, this surmises that the proposed Lumcloon Power Plant only produces 60% of the CO_2 that a

conventional coal-fired power station produces, and 78% of that produced by a conventional oil-fired power station, for the same amount of electricity output.

It should also be noted that the January 2009 report entitled the '*Impacts of High Levels of Wind Penetration in 2020 on the Single Electricity Market'* published by CER and NIAUR concluded that a mixed portfolio of plant, i.e. CCGTs, OCGTs and wind, has a greater positive impact on CO_2 emissions than OCGTs and wind only.

The principal feature of the Lumcloon plant design is that it will be capable of supporting wind power generation plant by virtue of its design which lends itself to high efficiency, flexibility and availability. There are currently a number of wind farms in very close proximity to Lumcloon in Offaly and North Tipperary including the 2.55 MW Carrig wind farm, the 4.25 MW Skehanagh wind farm, the 2.55 MW Ballinleugh wind farm and the 2.55 MW Ballinveny wind farm. In their strategy document (*Grid 25)* for the Development of Ireland's Electricity Grid for a Sustainable and Competitive Future, Eirgrid predicts that the demand for electricity in the Midlands region will grow by over 40% by 2025 and the region is expected to have up to 160MW of wind energy capacity. As such, Eirgrid propose to invest an additional €310m in the midlands region upgrading the transmission network and new circuit build. Eirgrid state that this *'reinforcement is necessary to cater for the continued demand growth in the gateway towns of Athlone, Mullingar and Tullamore'.* Upgrading the network will also facilitate power flows from both conventional and renewable sources. The proposed plant at Lumcloon will provide a secure and reliable source of electricity and provide the necessary back up required for wind generation plants.

12.3.2.2 Traffic

Based on traffic figures detailed in the Traffic Impact Assessment report in Section 14.0, there will be an insignificant increase in greenhouse gases related to traffic on a local, regional or national scale.

12.4 MITIGATION MEASURES

In summary, the proposed development will adhere to the recommended mitigation measures as outlined in Section 11, Air Quality, and good site practices during the construction phase to ensure emissions of gases that may impact on the local, regional and global climate are minimised.

There will be no ozone depleting substances produced or emitted during the operational phase of the proposed development. Emissions of acidifying gases, such as nitrogen oxides

and sulphur dioxide from the development will not have any significant adverse impact on the receiving environment as outlined in Section 11, Air Quality.

The EU is committed to an average reduction of greenhouse gas emissions by 8% below 1990 levels. The EU Emissions Trading Scheme (EU ETS) through Directive 2003/87/EC is being implemented to achieve this. As this plant will replace traditional coal, oil and peat power plants and support wind energy, it will therefore help Ireland to adhere to the EU GHG targets. The EPA has been given the responsibility for implementing the Emissions Trading Directive in Ireland by Government under the European Communities (Greenhouse Gas Emissions Trading) Regulations 2004 (S.I. 437 of 2004). The Lumcloon plant will operate under the EU ETS and will require a Greenhouse Gas Emissions Permit from the EPA.

12.5 RESIDUAL IMPACTS

Minimal residual impact is expected from the operation of the proposed development due to the comparatively low GHG emissions associated with CCGT & OCGT gas power generation in conjunction with supply support from local wind energy.

12.6 REFERENCES

- Environmental Protection Agency, 2000, Climate Change, Scenarios and Impacts for Ireland;
- 'National Climate Change Strategy' (Department of the Environment, 2000);
- EPA Report, 2005 Air Quality and Emissions to Air, Report 2003;
- EPA, 2003, Advice Notes on Current Practice (in the preparation of Environmental Impact Statements);
- Environmental Protection Agency Air Quality in Ireland 2007;
- Met Éireann website (http://www.met.ie/climate/);
- Oxford Institute for Energy Studies (20:20 vision to reducing CO_2 emissions from the UK electricity market).
- Sustainable Energy Ireland - http://www.sei.ie/Publications/Statistics_Publications/Emission_Factors