ELEMENT POWER

ENVIRONMENTAL IMPACT STATEMENT FOR THE PROPOSED MAIGHNE WIND FARM

VOLUME 2 – MAIN EIS

CHAPTER 5 – AIR AND CLIMATE CHANGE

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5 AIR AND CLIMATE CHANGE

5.1 Introduction

This section describes the existing air and climate environment of the proposed wind farm development. It examines the various elements of the construction, operational and decommissioning phases of the proposed development which have the potential to impact on air quality and climate. Mitigation measures and the residual impacts after the proposed mitigation measures have been implemented are also described.

5.2 Methodology

As the operation of wind turbines does not give rise to emissions, in respect of air and climate, this chapter focusses on the potential emissions which may arise during the construction and decommissioning phases of the proposed Maighne Wind Farm.

5.2.1 Air Quality

A review of existing air quality monitoring data undertaken by the Environmental Protection Agency (EPA) was undertaken and used to characterise the existing environment.

The impact assessment methodology involved the review and assessment of the proposed wind farm and associated infrastructure to identify the potential for air emissions during construction, operation and decommissioning.

To assess the impacts of construction dust emissions, the NRA Assessment Criteria for the impact of dust emissions from construction activities with standard mitigation in place was used. This table is provided in Appendix 8 of the *National Roads Authority (NRA) Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes* (NRA, 2011).

The traffic figures for the construction phase of the project, outlined in Chapter 13 Traffic and Transportation, were used in a basic air quality prediction screening model. This prediction tool is provided in the Design Manual for Roads and Bridges (DMRB) (Volume 11, Section 3 Air Quality, May 2007) and published by the UK Highways Agency. The DMRB model predicts vehicle emissions for NO_x, NO_2 and PM_{10}, carbon monoxide, benzene and 1,3-butadiene.

The DMRB model requires a number of inputs such as traffic flow (AADT), speed and vehicle mix and annual background pollutant concentrations. The latter were sourced from representative EPA fixed monitoring stations. Predicted concentrations for the construction phase of the project were then compared with the Irish ambient air quality standard - S.I. No. 180 of 2011 – Air Quality Standards Regulations, 2011. These regulations set limit values and averaging periods, which are used to assess the impact of emissions on human health, vegetation and ecosystems. They specify limit values in ambient air for six pollutants (SO_2, NO_2 and NO_x, particulate matter, lead, benzene and CO).

5.2.2 Climate

A desk-top study assessment was undertaken of available climatic information to characterise the existing environment.

The impact assessment considered the positive impacts the proposed wind farm will have on contributing to national targets for the reduction of greenhouse gas emissions. The proposed development will result in the production of energy from a renewable source which, once fed into the National Grid, has the potential to avoid several thousand tonnes of carbon dioxide (CO_2) annually that would have been released had the energy been generated by the average Irish power generation mix. Recent figures from the Sustainable Energy Authority of Ireland indicate that the net CO_2 displacement intensity by wind generation was 0.46 tonnes CO_2/MWh in 2012.

The amount of CO_2 that could potentially be avoided on an annual basis due to the proposed wind farm is therefore estimated based on this figure. The net displacement value may increase or decrease somewhat, as the generation mix in Ireland develops, under different fuel prices scenarios and as demand changes over time, and as more storage, interconnection and demand side management (smart meters) comes online.

5.3 Existing Environment

5.3.1 Air Quality

European air quality legislation requires that each member state be defined in terms of Zones and Agglomerations for air quality, with Ireland divided into four zones. Dublin Conurbation is one zone – Zone A and Cork Conurbation is defined as Zone B. Zone C consists of 24 cities and towns (such as Galway, Limerick and Waterford cities and towns such as Naas, Newbridge, Celbridge, Leixlip) with a population of greater than 15,000 while Zone D covers the remainder of the country. The proposed wind farm is located in Zone D.

The air quality in each zone is monitored by the EPA and classified with respect to upper and lower assessment thresholds based on measurements over the previous five years. The number of monitoring locations required is dependent on population size and whether ambient air quality concentrations exceed the upper assessment threshold, are between the upper and lower assessment thresholds, or are below the lower assessment threshold. The Air Quality Report 2013 (EPA 2014) noted that Ireland's overall air quality was good and compares favorably with other member states.

5.3.2 Climate

The climatic conditions for the wider geographical area have been derived from historical meteorological measurements complied by Met Éireann at Casement Aerdrome synoptic station (94m OD) which is approximately 23km west of the proposed wind farm. These are presented in Table 5.1 hereunder.

Table 5.1: Historical Met Éireann Data for Casement Aerdrome (1981 – 2010)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Temperature (degrees Celsius)													
mean daily max	8.0	8.2	10.2	12.4	15.2	17.9	19.8	19.5	17.1	13.6	10.2	8.3	13.4
mean daily min	2.1	2.0	3.3	4.1	6.6	9.4	11.5	11.3	9.5	7.0	4.2	2.4	6.1
mean temperature	5.1	5.1	6.8	8.2	10.9	13.6	15.7	15.4	13.3	10.3	7.2	5.4	9.7
absolute max.	15.2	15.9	17.3	22.7	24.9	27.6	31.0	29.5	25.4	21.3	17.7	14.8	31.0
min. maximum	-3.0	-0.7	2.3	4.5	7.1	10.2	10.6	11.7	10.8	5.2	-3.1	-4.7	-4.7
max. minimum	11.3	13.0	11.5	12.6	13.8	17.2	18.1	18.3	17.8	16.4	13.8	12.7	18.3
absolute min.	-12.4	-8.0	-9.0	-5.5	-2.4	0.4	4.6	2.2	0.2	-4.1	-9.1	-15.7	-15.7
mean num. of days with air frost	7.5	7.7	4.6	3.4	0.8	0.0	0.0	0.0	0.0	1.3	4.3	7.6	37.2
mean num. of days with ground frost	14.0	14.0	11.0	11.0	4.0	0.0	0.0	0.0	1.0	4.0	9.0	14.0	82.0
mean 5cm soil	3.7	3.6	5.3	8.4	12.6	15.7	17.1	16.0	12.8	9.2	6.0	4.2	9.6
mean 10cm soil	3.9	3.8	5.2	7.6	11.4	14.6	16.2	15.3	12.6	9.2	6.2	4.4	9.2
mean 20cm soil	4.6	4.5	5.9	8.1	11.5	14.5	16.3	15.8	13.4	10.1	7.1	5.1	9.7
Relative Humidity (%)													
mean at 0900UTC	87.2	86.7	84.5	80.1	77.4	77.7	79.7	82.2	84.5	86.3	88.9	88.4	83.6

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Temperature (degrees Celsius)													
mean at 1500UTC	82.2	76.7	71.8	67.7	67.3	67.9	68.9	69.0	71.8	76.6	81.6	84.1	73.8
Sunshine (hours)													
mean daily duration	1.7	2.5	3.3	5.1	6.0	5.3	4.9	4.8	4.1	3.3	2.2	1.5	3.7
greatest daily duration	8.1	9.2	10.9	13.2	15.4	16.0	15.5	14.4	12.3	10.1	8.5	6.9	16.0
mean no. of days with no sun	8.9	5.8	4.4	2.5	1.8	2.1	1.6	1.1	2.4	4.5	7.0	9.9	52.0
Rainfall (mm)													
mean monthly total	63.8	48.5	50.7	51.9	59.1	62.5	54.2	72.3	60.3	81.6	73.7	75.7	754.2
greatest daily total	30.0	32.2	31.1	38.7	29.8	97.5	33.7	89.3	51.1	50.1	82.0	46.8	97.5
mean num. of days with >= 0.2mm	17	14	16	14	15	14	15	16	14	16	16	16	183
mean num. of days with >= 1.0mm	12	10	11	10	11	10	10	11	10	12	11	12	130
mean num. of days with >= 5.0mm	4	3	3	3	3	3	3	4	4	4	4	5	43
Wind (knots)													
mean monthly speed	13.6	12.9	12.4	9.8	9.1	8.6	8.8	9.0	9.6	11.1	11.6	12.3	10.7
max. gust	80	78	71	59	63	51	58	55	59	65	66	82	82
max. mean 10-minute speed	57	54	47	43	43	36	39	36	38	44	46	57	57
mean num. of days with gales	4.5	3.2	2.1	0.6	0.4	0.1	0.1	0.2	0.3	1.2	1.9	3.5	18.1
Weather (mean no. of days with..)													
snow or sleet	4.1	3.9	2.5	1.1	0.1	0.0	0.0	0.0	0.0	0.0	0.5	2.3	14.6
snow lying at 0900UTC	1.8	1.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.0	4.1
hail	1.0	1.5	2.7	2.4	1.5	0.2	0.2	0.1	0.2	0.2	0.7	0.6	11.3
thunder	0.1	0.1	0.3	0.4	1.1	1.0	1.0	1.2	0.6	0.4	0.1	0.1	6.3
fog	1.8	1.9	1.6	1.6	1.5	1.2	1.1	2.0	2.8	2.0	2.1	2.4	22.1

The data indicates that the annual mean rainfall (30 year average) was 754.2mm, mean air temperature 9.7°C and the mean wind speed 10.7m/s. Mean daily sunshine duration at Casement Aerodrome is approximately 3.7 hours per day.

5.4 Potential Impacts

5.4.1 Do-Nothing Impacts

If Maighne Wind Farm does not proceed local air quality and the micro climate will remain unchanged. On a national scale, there will be an increase in greenhouse gas emissions if future electricity needs are not met by alternative renewable sources which has the potential to contribute to air pollution and climate change.

5.4.2 Air Quality

Construction Phase

The principal source of potential air emissions during the construction of the proposed wind farm will be dust arising from earthworks, tree felling activities, trench excavation along cable routes, construction of the new access tracks, excavation and backfill of borrow pits, the temporary storage of excavated materials, the movement of construction vehicles, loading and unloading of aggregates and the movement of material around the site and the loading and unloading of materials.

Dust emissions arise when particulate matter becomes airborne making it available to be carried downwind from the source. Dust emissions can lead to elevated PM_{10} and $PM_{2.5}$ concentrations and may also cause dust soiling. The amount of dust generated and emitted from a working site and the potential impact on surrounding areas varies according to:

- The type and quantity of material and working methods
- Distance between site activities and sensitive receptors
- Climate/local meteorology and topography

Table 5.2 details the NRA assessment criteria used for assessing the impact of dust from construction activities sites or varying scale.

Table 5.2: NRA Assessment Criteria for the Impact of Dust Emissions from Construction Activities with Standard Mitigation in Place

Source		Potential Distance for Significant Effects (Distance from source)		
Scale	**Description**	**Soiling**	**PM_{10}**	**Vegetation Effects**
Major	Large construction sites, with high use of haul roads	100 m	25 m	25 m
Moderate	Moderate construction sites, with moderate use of haul roads	50 m	15 m	15 m
Minor	Minor construction sites, with limited use of haul roads	25 m	10 m	10 m

Source: National Roads Authority, 2011

Applying the criteria of Table 5.2, the overall construction of Maighne Wind Farm would be considered a major construction site. However given that the development will be constructed over a wide geographical area, for example the turbines will be constructed in clusters and the cables in a liner route, individual work sites could be classified as moderate using the NRA assessment criteria. This would result in soiling effects have the potential to occur up to 50m from the source, with PM_{10} deposition and vegetation effects occurring to 15m from the source.

Construction vehicles and plant emissions have the potential to increase concentrations of compounds such as NO_2, Benzene and PM_{10} in the receiving environment. The number and types of vehicles accessing Maighne Wind Farm during the 20 month construction period is described in Chapter 13 Traffic and Transportation.

To assess the potential impacts on local and regional air quality, a DMRB screening model was conducted to estimate the baseline for CO, Benzene, NO_x, NO_2 and PM_{10} traffic emissions using 2014 surveyed traffic data along the proposed haul routes as well as sections of the HV route cable options. Emission levels were calculated at receptors along the route.

An assessment was then conducted to calculate the predicted increase on base levels as a results of increased traffic movements along roads during the construction period.

This assessment was conservative in that the peak monthly traffic figure for the all of the clusters was selected; this peak figure construction figure was then applied to each road along the haul route, when in fact actual traffic figures will be significantly lower.

This conservative screening assessment indicated that the predicted traffic emissions during the construction period, although experience a slight increase are within the relevant air quality guideline limits. A summary of the assessment outputs is included in Appendix O.

Plant and machinery such as generators, excavators etc. will be required at various stages of the construction works. These will be relatively small units which will be operated on an intermittent basis. Although there will be an emission from these units, given their scale and the length of operation time, the impacts of emissions from these units will be negligible.

Operational Phase

Once the proposed wind farm development is constructed there will be no significant direct emissions to atmosphere. A diesel generator will be located at the substation, however this will only be operated as a back-up/emergency power supply.

Decommissioning Phase

Although there will be truck movements associated with the removal of turbine components from Maighne Wind Farm during decommissioning, the number of vehicles will be significantly lower than that estimated for the construction phase where the assessment has indicated that the increase in concentrations significantly below ambient air quality standards.

This phase may also give rise to potential dust emissions owing to increased vehicle movements and removal of access tracks (if required by Kildare County Council and/or Meath County Council).

5.4.3 Climate Impacts

Construction Phase

There is the potential for greenhouse gas emissions to the atmosphere during the construction phase such as those arising from construction vehicles, the use of on-site generators, pumps etc. The potential climatic impacts arising these emissions are assessed hereunder with respect to micro and macro climates

1. **Microclimate -** The significance of impacts associated with the conversion of vegetated surfaces to un-vegetated surfaces is assessed through the consideration of the area of the land experiencing such a change. The proposed wind farm is predominately a Greenfield site with the exception of existing public road ways and internal track ways. The total area of proposed permanent hardstanding surface is approximately 2% of the wind farm cluster development area, and therefore will not results in localised impacts on air temperature and microclimate.

2. **Macroclimate -** Carbon dioxide (CO_2) is a greenhouse gas which if released in excessive amounts can lead to increases in global temperatures known as 'global warming' or 'greenhouse effect' which can influence climate change. Once the proposed wind farm is constructed there will be no negative impacts on climate change and in fact it will have a long-term positive impact by providing a sustainable energy source. Should the wind farm not be developed, fossil fuel power stations will be the primary alternative to provide the required quantities of electricity. This will further contribute to greenhouse gas and other air pollutant emissions, as well as hindering Ireland in its commitment to meet its target to increase electricity production from renewable sources and to reduce greenhouse gas emissions.

   Ireland currently imports up to 85% of our energy. Maighne Wind Farm offers Ireland an indigenous form of sustainable electricity, and provides for security of supply against our dependence on imports.

Operational Phase

From an operational perspective, the proposed development will displace the emission of CO_2 from other less clean forms of energy generation and will assist Ireland in meetings its renewable energy targets and obligations. The burning of fossil fuels for energy creates greenhouse gases, which contributes significantly to climate change. These and other emissions also have the potential to give rise to acid rain, smog and ambient air quality reduction. It is estimated that a potential output of 125MW for Maighne Wind Farm will result in the net displacement of 190,000 tonnes of CO_2 per annum.

During operations, there will be no negative impacts on climate.

5.4.4 Cumulative Impacts

Cumulative impacts may arise during the construction phase of the development, particularly during periods of dry weather, in areas where existing activities may give rise to dust emissions. These includes active peat extraction and milling activities at Windmill and the Drehid-Hortland clusters.

5.5 Mitigation Measures

5.5.1 Air Quality

Construction Phase

An Outline Construction Environmental Management Plan (CEMP) has been prepared and is included in Appendix D. This includes for the following mitigation measures during the construction phase of the wind farm relevant to air quality:

- The internal access roads and internal haul roads will be constructed prior to the commencement of other major construction activities. These roads will be finished with graded aggregate
- A water bowser will be available to spray work areas and haul roads, especially during periods of excavations works coinciding with dry periods of weather, in order to suppress dust migration from the site
- In relation to the borrow pits, the following will be implemented:
    - Topsoil removed from each pit will be temporarily stored in designated areas adjacent to the pits. These stockpiles will be damped and covered
    - Access to each borrow pit will be controlled through one dedicated access/egress location which limit the movement of vehicles within each borrow pit. Speed limits will also be enforced along this access tracks
    - Excavation of each pit will be conducted in a phased manner with the actual working area from which material is being extracted minimised
    - Excavation activities will stop during periods of strong winds
    - Material will be loaded onto covered vehicles (sheeted) or damped for transport
    - Backfill/restoration of the pits will commence as soon as practicable and will be re-seeded immediately upon completion
- All loads which could cause a dust nuisance will be covered to minimise the potential for fugitive emissions during transport
- All other stockpiles will be kept damp and covered to prevent windblown dust emissions
- The access and egress of construction vehicles will be controlled to designated locations, along defined routes, with all vehicles required to comply with onsite speed limits
- Construction vehicles and machinery will be serviced and in good working order
- Wheel washing facilities will be provided at the entrance/exit point of each cluster
- The developer in association with the contractor will be required to develop and implement a dust control plan. This plan will address aspects such as excavations, haul roads and borrow pits, temporary stockpiling and restoration works. The plan will be prepared prior to any construction activities and will be established and maintained through the construction period. It will be submitted to Kildare and Meath County Councils for approval.

Operational Phase

As the proposed operation of the wind farm will have only have positive impacts on air quality, mitigation is unnecessary.

Decommissioning Phase

If KCC and/or MCC requires the removal of access tracks from Maighne Wind Farm as part of decommissioning, dust mitigation measures, similar to those outlined under 'construction mitigation measures' will be put in place to reduce dust nuisance.

5.5.2 Climate Change

It is considered that the proposed development will have an overall positive impact in terms of carbon reduction and climate change. It will assist Ireland in meeting its national mandatory target to supply 16% of its overall energy needs from renewable sources by 2020 which is driven by the requirements for a reduction in greenhouse gas emissions along with energy security and competiveness.

5.6 Residual Impacts

5.6.1 Air Quality

Following the implementation of the above mitigation measures, the proposed development may result in slight residual impacts arising from fugitive dust emissions during particular construction activities. These will be localised in nature and as they will be associated with particular elements of the construction phase, they will also be temporary and will not result in any permanent residual impacts.

5.6.2 Climate

There will be residual positive impacts from the operation of the proposed wind farm in terms of the displacement of fossil fuel energy generation with renewable energy. It is estimated that a potential output of 125MW for Maighne Wind Farm will result in the net displacement of 190,000 tonnes of CO_2 per annum which is a greenhouse gas.

5.7 References

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