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EIA Report for Proposed Increase to Waste Tonnage Throughput of the Lostock Sustainable Energy Plant

Appendix 9.2 – Climate Change Baseline

ENGINEERING CONSULTING

Document approval

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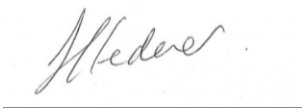
Prepared by:	Hannah Lederer		Environmental Scientist	05/07/2021
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Contents

1 Introduction

This appendix has been written is in support of Chapter 10 – Climate Change of the Environmental Impact Assessment (EIA) Report to support the section 36 (s.36) variation application for the Lostock Sustainable Energy Plant (LSEP) at Lostock Works, Northwich.

This appendix provides detail of the current climate baseline in the vicinity of the Site, based on historical climate averages and Met Office regional profile description for North West England and Isle of Man. This appendix also provides detail of the future climate baseline for the Site.

2 Baseline

The current climate baseline at the Site is based on Met Office historical climate averages data from the period 1981-2010, from the closest meteorological station with this historical data, Woodford (approximately 17 km to the north-east of the Site) and Met Office UK regional climate summary from the same time period for North West England and Isle of Man[1]. The Woodford site was based at the Woodford Aerodrome which is a former private airfield and manufacturing site. This site was closed on 28th May 2012.

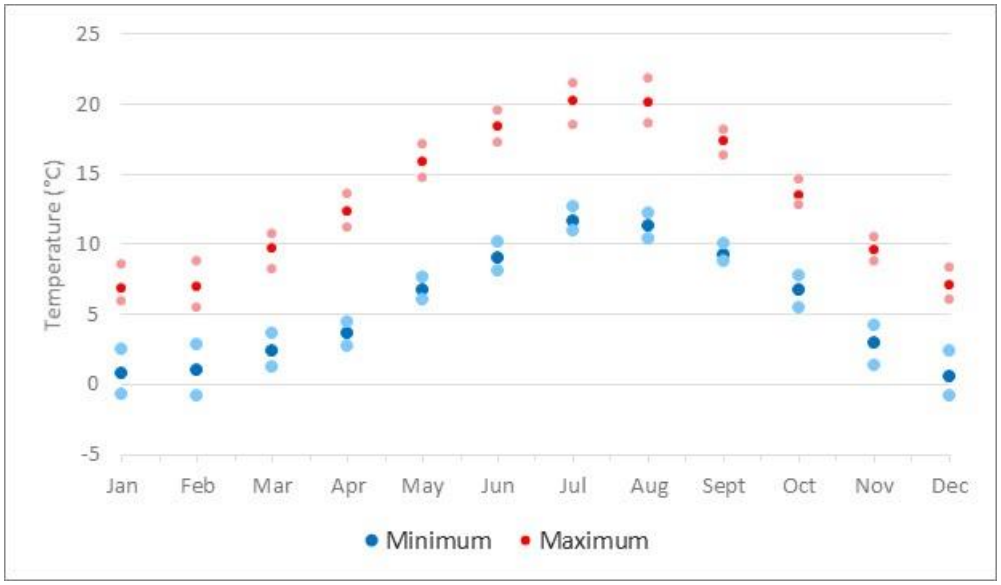
Winter refers to the months of December, January and February, and summer refers to the months of June, July and August.

2.1 Temperature

Mean annual temperatures over the North West England region depend very much on altitude and, to some extent, proximity to the coast. Over the lower lying areas of Cheshire, in which the Site is situated, the long term average mean temperature is around 10.5°C, which compares to the 9.4°C long term annual mean temperature recorded at Woodford. Temperature shows both a seasonal and a diurnal variation, with January being the coldest month and July being the warmest month.

The mean winter temperatures recorded at Woodford 3.9°C and mean summer temperatures are 15.1°C. The mean maximum temperature in winter is 7.0 °C and the mean maximum temperature in summer is 19.5°C. Note that these are means, and that there are individual days which will be greater than this each year. Figure 1 graphically shows the temperature trend for Woodford.

Figure 1: Long term temperature trend recorded at Woodford 1981-2010



Source: data from www.metoffice.gov.uk/research/climate/maps-and-data/uk-climate-averages/gcqrqyr80

[1] Met office (xx) North West England & Isle of Man: climate

2.2 Precipitation

Rainfall tends to be associated with Atlantic depressions or with convection. The Atlantic lows are more vigorous in autumn and winter and bring most of the rain that falls in these seasons. In summer, convection caused by solar surface heating sometimes forms shower clouds and a large proportion of rain falls from showers and thunderstorms then. A further factor that greatly affects the rainfall distribution is altitude. Moist air that is forced to ascend hills may be cooled below the dew point to produce cloud and rain.

The exposure of North West England to westerly maritime air masses and the presence of extensive areas of high ground mean that the region has some of the wettest places in the UK. Compared to the rest of the region, Cheshire is more sheltered and benefits from the 'rain shadow effect' of the high ground of North Wales. The mean annual precipitation at Woodford is 867 mm. Averages between seasons do not differ hugely, with an average summer month having 70.4 mm of precipitation and an average winter month having 74.3 mm of precipitation.

Figure 2: Long term precipitation trend recorded at Woodford 1981-2010

Source: data from www.metoffice.gov.uk/research/climate/maps-and-data/uk-climate-averages/gcqrqyr80

Periods of prolonged rainfall can lead to widespread flooding, especially in winter and early spring when soils are usually near saturation. North West England has been subject to a number of flooding events. Thunderstorms are most likely to occur from May to September, and occur on average between 8 to 12 days a year. The associated high intensity rainfall can also result in flooding, but this is usually short-lived.

The occurrence of snow is linked closely with temperature, with falls rarely occurring if the temperature is higher than 4 °C. For snow to lie for any length of time, the temperature normally has to be lower than this. Over most of North West England, snowfall is normally confined to the months from November to April, excluding the higher altitude areas.

Snowfall is not included within the data from Woodford, but the regional profile for North West England states that the number of days with snow falling is about 20 days in lower-lying parts of the mainland like Cheshire.

2.3 Wind

North West England is one of the more exposed parts of the UK, being relatively close to the Atlantic and containing large upland areas. The strongest winds are associated with the passage of deep areas of low pressure close to or across the UK. The frequency and strength of these depressions is greatest in the winter half of the year, especially from December to February, and this is when mean speeds and gusts (short duration peak values) are strongest.

The climatic data for Woodford from the Met Office shows the monthly mean wind speeds at 10 m, but this does not capture the days at which gale force winds (if wind reaches a mean speed of 34 knots or more over 10 consecutive minutes) are experienced. The regional profile for North West England suggests that inland areas of the region experience less than 5 gales per year.

Wind direction tends to blow from the south or south-west, as Atlantic depressions pass the UK, and later comes from the west or north-west as the depression moves away. The range of directions between south and north-west accounts for the majority of occasions and the strongest winds nearly always blow from this range of directions. Springtime tends to have a maximum frequency of winds from the north-east and summer can have a greater incidence of north-west or west winds associated with sea breezes.

2.4 Summary

A summary of the baseline is included in Table 1.

Table 1: Existing baseline climate conditions

Item	Units	Baseline (Woodford 1981-2010)
Mean annual temperatures	°C	9.4
Mean winter temperatures	°C	3.9
Mean summer temperatures	°C	15.1
Mean in winter precipitation	mm	74.3
Mean summer precipitation	mm	70.4

3 Future Baseline

The future climate baseline at the Site has been defined using latest UK Climate Projections (UKCP) which provide the most up-to-date assessment of how the UK climate may change in the future.. The latest version is UKCP18.

UKCP18 has predictions based on different emissions scenarios. These are determined by the Representative Concentration Pathways (RCPs), which specify concentrations of greenhouse gases that will result in total radiative forcing (the difference between the incoming and outgoing radiation at the top of the atmosphere). Radiative forcing targets for 2100 have been set at 2.6, 4.5, 6.0 and 8.5 watts per square metre (w/m^2) to span a wide range of plausible future emissions scenarios. Each scenario includes many assumptions regarding population growth, economic development, technological innovation and attitudes to social and environmental sustainability. This assessment has used the data produced by using the high emissions scenario (RCP8.5). This is the worst-case scenario but is plausible and realistic should the societal behaviour reflect the assumptions up to 2100 as set out in RCP8.5. In UKCP18, the probabilistic projections provide local low, central, and high changes across the UK, corresponding to 10%, 50% and 90% probability levels. This assessment has used the central estimate, which is considered to be the level at which as much evidence points to a lower outcome as a higher one. The 10^{th} and 90^{th} percentiles reflect the lowest and highest 10% of the model runs – the value at which 10% of the model runs fall at or below (10^{th} percentile) or at and above (90^{th} percentile) fall at or above. These have been considered where the direction of change is predicted to vary at each level. The predictions also cover a range of spatial resolutions. The data scenario from which the future baseline is calculated in summarised in Table 2.

Table 2: Future climate change data scenario summary

Projection	Emissions scenario	Percentile	Area	Baseline time period	Time horizon
UKCP18	RCP8.5	50^{th}, 10^{th} and 90^{th} (where appropriate)	North West England	1981-2000	2040-2059

The identified changes have then been incorporated to the current baseline from Woodford to give a local prediction of future climatic conditions.

It is noted that the baseline from which the predicted changes are based is not the same as the baseline climate data from Woodford. Therefore, some of the results may be slight over or under estimations. Nevertheless, they offer an estimate sufficient for this assessment in order to determine likely significant effects.

3.1 Temperature

Climate change is projected to lead to hotter summers and warmer winters. Probabilistic projections show that there is more warming in summer than winter, and a more pronounced north-south contrast in summer. This trend is projected in the low, central and high estimates. The projected changes in mean temperature as a central estimate are an overall annual increase of 1.7 °C, an increase of 0.5°C in winter and an increase of 0.6 °C in summer.

3.2 Precipitation

Over land, projections show a move towards wetter winters and drier summers as a central estimate. However, there is some variation in the projections. The change in winter precipitation for the low estimate is projected to decrease, but, for the central and high estimate this is projected to increase. The change in summer precipitation for the low and central estimate is projected to decrease, but for the high estimate no change is predicted. Projections also show that it is likely that more rain will fall during intense or extreme events.

The projected change in mean winter precipitation is an increase of 7% as a central estimate. Projected change in mean summer precipitation is a decrease of 15% as a central estimate, and no change as a high estimate.

3.3 Wind

There is large uncertainty in projected changes in wind and air circulation across the UK and it is difficult to represent regional extreme winds for the future. However, projections indicate there will be an increase in near surface wind speeds over the UK and more significant impacts of wind will be experienced in the winter months, including an increase in frequency of winter storms. However, projections have not been quantified and so shall be assessed qualitatively within Chapter 10 of the EIA Report.

3.4 Summary

3.4.1 Projections

Table 3 shows the variations in projections at the low, medium and high estimates. Those which are a projected increase have been highlighted in bold.

Table 3: Future baseline climate conditions variables

Item	Units	Low estimate – 10th %ile	Central estimate – 50th %ile	High estimate – 90th %ile
Mean annual temperatures	°C	**+0.8**	**+1.7**	**+2.6**
Mean winter temperatures	°C	**+0.5**	**+1.6**	**+2.8**
Mean summer temperatures	°C	**+0.6**	**+1.8**	**+3.2**
Mean in winter precipitation	mm	-5.0	**+7.0**	**+21.0**
Mean summer precipitation	mm	-32.0	-15.0	0.0

It should be noted that predictions are a general trend. Due to natural variations there will still be cold winters, dry winters, cooler summers and wetter summers.

3.4.2 Summary

Table 4: Future baseline climate conditions

Item	Units	Baseline (Woodford 1981-2010)	Predicted change (UKCP18)	Future baseline (At Woodford 2040-2059)
Central (50th percentile) estimate				
Mean annual temperatures	°C	9.4	**1.7%**	9.4
Mean winter temperatures	°C	3.9	**1.6%**	3.9
Mean summer temperatures	°C	15.1	**1.8%**	15.1
Mean in winter precipitation	mm	74.3	**7.0%**	79.5
Mean summer precipitation	mm	70.4	-15.0%	59.8
High 90th percentile) estimate				
Mean summer precipitation	mm	70.4	0.0%	70.4

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