# Kronospan Low Carbon CHP Facility

# Appendix 9A

# Climate Baseline

**Prepared for: Kronospan**

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**DNS5-4-037**

## 1.0 INTRODUCTION

1.1.1 This appendix has been written in support of Chapter 9 of the Environmental Statement (ES) to the planning application for the Proposed Development. This appendix provides detail of the current climatic conditions in the vicinity of the Proposed Development, based on UK Meteorological Office (Met Office) historical climate averages and regional profile descriptions. In addition, future climatic conditions for the area have been quantified based on the latest UK Climate Projections (UKCP).

## 2.0 CURRENT BASELINE CLIMATE

2.1.1 The current climatic conditions at the Site have been determined based on Met Office historical climate averages data from the period 1991-2020, from the closest meteorological station with this historical data, Hawarden[1] (approximately 26km to the north east of the Site in a straight line) and the Met Office UK regional climate summary from the same time period for Wales[2].

2.1.2 Within this analysis:

i) Winter refers to the months of December, January and February;
ii) Spring refers to March, April and May;
iii) Summer refers to the months of June, July and August; and
iv) Autumn refers to September, October and November.

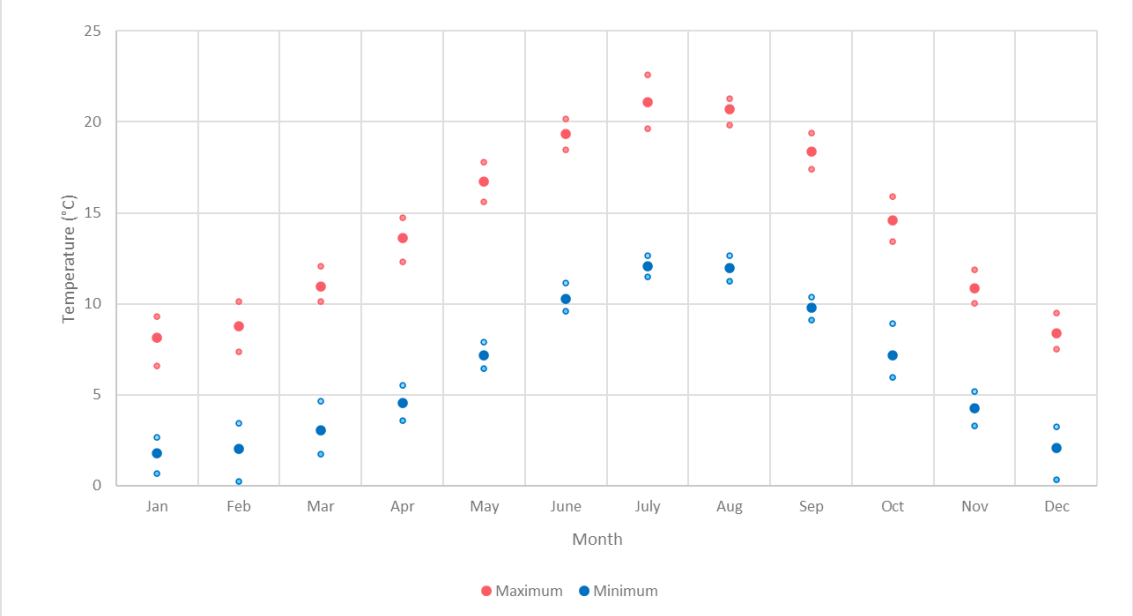
[1] Met Office. *UK Climate Averages Hawarden (Flintshire)*. Available at: https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-climate-averages/gcmys019j [Last Accessed 1 November 2024].
[2] Met Office (2016). *Wales: Climate*. Available at: https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/weather/regional-climates/wales_-climate-met-office.pdf [Last Accessed 1 November 2024].

## 2.2 Temperature

The long-term annual mean temperature at Hawarden is 10.3°C. Temperature shows both a seasonal and a diurnal variation, with January being the coldest month and July being the warmest month.

The long-term mean temperature during winter recorded at Hawarden is 5°C and the long-term mean temperature during summer is 16°C. The maximum mean temperature during Winter is 8°C and the maximum mean temperature during Summer is 20°C. It should be noted that temperatures presented are means, and there will be individual days where the temperature will be greater (or lower) than this each year. Image 1.1 graphically shows the temperature trend for Hawarden from 1991 to 2020.

**Image 1.1 – Long term mean temperature trend record at Hawarden 1991-2020.**



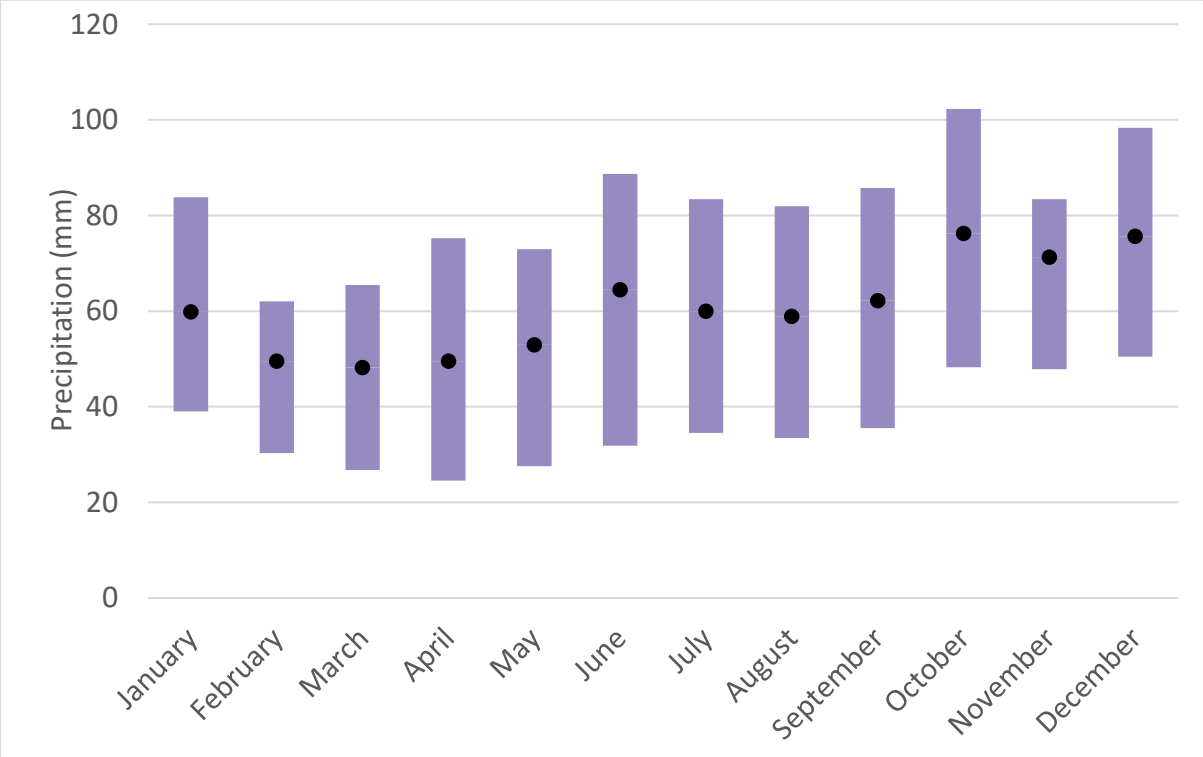

## 2.3 Precipitation

2.3.1 Across the UK, 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. A further factor that greatly affects the rainfall distribution is altitude. Moist air that is forced to ascend hills can be cooled below the dew point to produce clouds and rain.

2.3.2 Rainfall in Wales varies widely, with the highest average annual totals being recorded in the central upland spine from Snowdonia to the Brecon Beacons. Snowdonia is the wettest area with average annual totals exceeding 3,000mm, comparable to those in the English Lake District or the western Highlands of Scotland. In contrast, places along the coast and, particularly, close to the border with England, are drier, receiving less than 1,000mm a year.

2.3.3 The mean annual precipitation at Hawarden is 729 mm, reflecting the relatively low precipitation of the region. For context, the UK mean annual precipitation in 2023 was 1,290 mm[3]. Long-term data from Hawarden shows that there tends to be higher rainfall over Autumn and Winter than the Spring and Summer. Long term seasonal means recorded at Hawarden are 61mm in Summer and 62mm in Winter. Image 1.2 graphically shows the precipitation trend for Hawarden from 1991 to 2020.

**Image 1.2 – Long term precipitation trend record at Hawarden 1991-2020**




[3] Met Office (2024). *Annual Summary 2023*. Available at: https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/summaries/uk_climate_summary_calendar_year_2023.pdf [Last Accessed 5 April 2024].

2.3.4 Throughout Wales, the months from October to January are significantly wetter than those between February and September, unlike places in eastern England where July and August are often the wettest months of the year. This seasonal pattern is a reflection of the high frequency of winter Atlantic depressions and the relatively low frequency of summer thunderstorms. In west and north-west Wales, the frequency is around eight days per year.

2.3.5 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. Snowfall is not included within the historical climate average data from Hawarden. However, the Met Office regional climate profile for the region states the average number of days each year when sleet or snow falls varies from 10 or less in south-western coastal areas to over 30 in Snowdonia.

## 2.4 Wind

2.4.1 Wales is one of the windier parts of the UK, with the windiest areas being over the highest ground and along the coasts. 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 from November to February, and this is when mean speeds and gusts (short duration peak values) are strongest.

2.4.2 A day of gale is defined as a day on which the wind speed attains a mean value of 34 knots or more over any period of 10 minutes. The inland areas of the region, where the Proposed Development is located, experience less than five days of gale each year, with only exposed areas having more than this.

## 2.5 Summary

2.5.1 A summary of the current climatic conditions is included in Table 1.1.

**Table 1.1 – Existing baseline conditions**

| Item | Units | Current climate (Hawarden 1991-2020) |
|---|---|---|
| Mean annual temperatures | °C | 10 |
| Mean winter temperatures | °C | 5 |
| Mean summer temperatures | °C | 16 |
| Mean in winter precipitation | mm | 62 |
| Mean summer precipitation | mm | 62 |

## 3.0 FUTURE BASELINE CLIMATE

3.1.1 The future climatic conditions at the Proposed Development have been defined using the latest UK Climate Projections (UKCP) which provides the most up-to-date assessment of how the UK's climate may change in the future. The latest version is UKCP18[4].

3.1.2 UKCP18 has predictions based on different emissions scenarios. These are determined by the Representative Concentration Pathways (RCPs), which specify concentrations of greenhouse gases (GHGs) 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.

3.1.3 This assessment has used the data produced by using the high emissions scenario (RCP8.5). This is the worst-case scenario as this is based on a massive increase in coal use across the world but is recommended for use by the Institute of Sustainability and Environmental Professionals (ISEP) (formally the Institute of Environmental Management and Assessment (IEMA)) guidance titled: *"Environmental Impact Assessment Guide to: Climate Change Resilience & Adaption""*[5] (hereafter referred to as the 'ISEP Climate Change & Adaption Guidance') unless a case can be made for using a different, lower emission scenario.

3.1.4 In UKCP18, the probabilistic projections provide local low, central and high changes across the UK, corresponding to 10%, 50% and 90% probability levels.

[4] Met Office. (2022). *UKCP18 Key Results (2022 update).* Available at: https://www.metoffice.gov.uk/research/approach/collaboration/ukcp/summaries/headline-findings [Last Accessed: 1 November 2024].
[5] ISEP. (2020). *Environmental Impact Assessment Guide to: Climate Change Resilience & Adaption*. Available at: https://www.iema.net/media/mabhqino/iema-eia-climate-change-resilience-june-2020.pdf [Last Accessed: 16 July 2025].

3.1.5 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 10th and 90th percentiles reflect the lowest and highest 10% of the model runs – the value at which 10% of the model runs fall at or below (10th percentile) or at and above (90th 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 has been calculated and is summarised in Table 1.2.

3.1.6 The UKCP18 country profiles for Wales has been used for the future climate predictions.

**Table 1.2 – Climate projections scenarios**

| Projection | Emissions Scenario | Percentile | Country | Baseline time | Time horizon |
|---|---|---|---|---|---|
| UKCP18 | RCP8.5 | 50th, 10th and 90th (where appropriate) | Wales | 1981-2000 | 2010-2029 |
| UKCP18 | RCP8.5 | 50th, 10th and 90th (where appropriate) | Wales | 1981-2000 | 2030-2049 |
| UKCP18 | RCP8.5 | 50th, 10th and 90th (where appropriate) | Wales | 1981-2000 | 2050-2069 |

3.1.7 The identified changes have been incorporated into the current climatic conditions from Hawarden to give a local prediction of future climate.

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

## 3.2 Temperature

3.2.1 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.

3.2.2 The projected changes in mean temperature as a central estimate from the baseline of 1981-2000 are:

i) For the time horizon 2010-2029 an overall annual increase of 0.7°C, with an increase of 0.5°C in Winter and an increase of 0.9°C in Summer.
ii) For the time horizon 2030-2049 an overall annual increase of 1.2°C, with an increase of 1.1°C in Winter and an increase of 1.4°C in Summer.
iii) For the time horizon 2050-2069 an overall annual increase of 2.1°C, with an increase of 1.8°C in Winter and an increase of 2.6°C in Summer.

## 3.3 Precipitation

3.3.1 Over land, most projections indicate a move towards wetter Winters and drier Summers for the 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 is predicted to increase. Projections also show that it is likely that more rain will fall during intense or extreme events.

3.3.2 The projected changes in mean precipitation as a central estimate from the baseline of 1981-2000 are:

i) For the time horizon 2010-2029 during Winter is for an increase of 5% as a central estimate and the projected change in mean precipitation during Summer is for a decrease of 5% as a central estimate.
ii) For the time horizon 2030-2049 during Winter is for an increase of 6% as a central estimate and the projected change in mean precipitation during Summer is for a decrease of 9% as a central estimate.
iii) For the time horizon 2050-2069 during Winter is for an increase of 12% as a central estimate and the projected change in mean precipitation during Summer is for a decrease of 21% as a central estimate.

3.3.3 The low estimates and high estimates for mean winter precipitation show varying projections from the baseline of 1981-2000 in all time horizons:

i) For the time horizon 2010-2029, the high estimate is an increase by 16% but the low estimate for is a decrease of 7%.

ii) For the time horizon 2030-2049, the high estimate is an increase by 18% but the low estimate for is a decrease of 5%.

iii) For the time horizon 2050-2069, the high estimate is an increase by 30% but the low estimate for is a decrease of 4%.

3.3.4 The low estimates and high estimates for mean summer precipitation show varying projections from the baseline of 1981-2000 in all time horizons:

i) For the time horizon 2010-2029, the high estimate is an increase by 12% but the low estimate for is a decrease of 20%.

ii) For the time horizon 2030-2049, the high estimate is an increase by 11% but the low estimate for is a decrease of 29%.

iii) For the time horizon 2050-2069, the high estimate is an increase by 3% but the low estimate for is a decrease of 44%.

## 3.4 Wind

3.4.1 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.

## 3.5 Summary

3.5.1 Table 1.3 shows the variations in projections at the low, medium and high estimates for each climatic condition.

**Table 1.3 – Change in climate conditions variables from baseline time horizon**

| Projection | Emissions Scenario | Percentile | Country | Baseline time | Time horizon |
|---|---|---|---|---|---|
| UKCP18 | RCP8.5 | 50th, 10th and 90th (where appropriate) | Wales | 1981-2000 | 2010-2029 |
| UKCP18 | RCP8.5 | 50th, 10th and 90th (where appropriate) | Wales | 1981-2000 | 2030-2049 |
| UKCP18 | RCP8.5 | 50th, 10th and 90th (where appropriate) | Wales | 1981-2000 | 2050-2069 |

3.5.2 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.

3.5.3 Table 1.4 summarises the current and future climatic conditions at Hawarden which is considered representative of likely conditions at the Proposed Development. 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.

**Table 1.4 – Future baseline climate conditions variables**

| Item | Units | Current conditions (Hawarden 1981-2010 | 2010-2029 time horizon | | 2030-2049 time horizon | | 2050-2069 time horizon | |
|---|---|---|---|---|---|---|---|---|
| | | | **Predicted change from baseline (UKCP18)** | **Future conditions** | **Predicted change from baseline (UKCP18)** | **Future conditions** | **Predicted change from baseline (UKCP18)** | **Future conditions** |
| **Central (50th percentile) estimate** | | | | | | | | |
| Mean annual temperatures | °C | 10.3 | 0.7 | 11.0 | 1.2 | 11.5 | 2.1 | 12.4 |
| Mean Winter temperatures | °C | 5.2 | 0.5 | 5.7 | 1.1 | 6.3 | 1.8 | 7.0 |
| Mean Summer temperatures | °C | 15.9 | 0.9 | 16.8 | 1.4 | 17.3 | 2.6 | 18.5 |
| Mean in Winter precipitation | mm | 62.0 | 5.0% | 65.0 | 6.0% | 66.0 | 12.0% | 69.0 |
| Mean summer precipitation | mm | 61.0 | -5.0% | 58.0 | -9.0% | 56.0 | -21.0% | 48.0 |
| **High (90th percentile) estimate** | | | | | | | | |
| Mean Summer precipitation | mm | 61.0 | 12.0% | 68.0 | 11.0% | 68.0 | 3.0% | 63.0 |
| **Low (10th percentile) estimate** | | | | | | | | |
| Mean Winter precipitation | mm | 62.0 | -7.0% | 58.0 | -5.0% | 59.0 | -4.0% | 60.0 |