Thurrock Flexible Generation Plant

Environmental Statement Volume 6
Appendix 14.2: Climate Change Risk

Date: January 2020

Environmental Impact Assessment

Environmental Statement

Volume 6

Appendix 14.2

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Prepared by: Hugo Forster

Contributors: Tom Dearing

Checked by: Senuri Mahamithawa, Tom Dearing

Thurrock Power Ltd

1st Floor

145 Kensington Church Street

London W8 7LP

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Summary

This document provides a report of the Met Office Hadley Centre's UKCP18 climate change projections and a high level climate risk assessment for the proposed assessment.

Qualifications

This document has been prepared by Hugo Forster BA (Hons), a Consultant who has experience in environmental impact assessment, with respect to climate change and GHG emissions.

It has been checked by Tom Dearing, a Chartered Environmentalist and full Member of the Institute of Environmental Management and Assessment, who has nine years' experience of environmental impact assessment.

1. Introduction and Climate Change Data

1.1 Introduction

1.1.1 This appendix to Volume 3, Chapter 14: Climate Change summarises projected changes in climatic parameters at the proposed development location and considers whether there is potential for likely significant environmental effects.

1.1.2 Besides climate risks to the proposed development itself, there are potential inter-relationships between climate change and several other environmental topic areas reported in other chapters of the Environmental Statement (ES), most notably flood risk. The climate projections summarised in this appendix have been provided to all ES chapter authors in order that any changes in the future baseline or sensitive receptors due to climate change can be evaluated if relevant to the respective impact assessments.

1.2 Climate Change Projections

1.2.1 The Met Office Hadley Centre (MOHC) publishes both probabilistic climate change projections and downscaled global circulation model outputs for the UK at various spatial scales. This is called the UKCP18 dataset, first published in November 2018 and at v1.1.2 at the time of writing. The projections are based on representative concentration pathway (RCP) scenarios used by the Intergovernmental Panel on Climate Change, thereby giving a low-high range in potential global GHG reduction initiatives and resulting rate of climatic effects over a given time period.

1.2.2 The probabilistic projections published at 25 km grid cell scale are considered the most useful for this assessment, being designed to show a range of projection values that reflect uncertainty in modelled outcomes. Additional data from 2.2 km scale grid cells for wind speed has also been used. The CP18 Overview Report and supporting factsheets for the wider regional and UK context have also been drawn from.

1.2.3 The proposed development has a 35-year initial design operating life, but depending on market conditions could continue to operate beyond that time. Climate change projections for two periods in the mid- and late century have therefore been considered: average conditions during 2040-2059 and 2080-2099.

1.2.4 The CP18 Overview Report and factsheets indicate that in general, warmer, wetter winters and hotter, drier summers are predicted, though of course still with natural variations in that pattern from year to year.

1.2.5 Within the last two decades, annual average temperature and precipitation records have been consistently set in the UK relative to the preceding baseline period, although generally wetter rather than drier summers have been seen in this period. In the near future, perhaps over the course of a decade, these natural variations will likely continue to be the most visible year-to-year changes in climate but in subsequent decades, within the proposed development's operating lifetime, the anthropogenic climatic changes are expected to become more apparent.

1.2.6 Table 1.1 and Table 1.2 show potential climatic changes from the UKCP18 probabilistic dataset averaged over the 2050-2069 and 2080-2099 time periods relative to the 1981-2000 baseline for the 25 km grid square in which the proposed development site is located. The data presented here is for the emissions pathway RCP8.5, which is a high-emissions scenario assuming 'business as usual' growth globally with little additional mitigation. This is a conservative (worst-case) approach for the assessment.

Table 1.1: Climate Parameter Projections 2050–2069

Parameter†	Units	10th percentile	Median value	90th percentile
Precipitation – annual average	%	-10.9	-3.5	4.7
Precipitation – driest season	%	-53.4	-24.5	4.8
Precipitation – wettest season	%	-13.7	-1.3	11.6
Precipitation – driest month	%	-15.3	11.9	41.3
Precipitation – wettest month	%	-24.7	-4.5	18.6
Temperature – annual average	ºC	1.1	2.4	3.7
Temperature – hottest season average	ºC	1.1	3.0	5.0
Temperature – coldest season average	ºC	0.6	2.1	3.7
Temperature – hottest month maximum	ºC	0.3	3.1	6.4
Temperature – hottest month average	ºC	1.1	3.4	6.0
Temperature – coldest month minimum	ºC	0.3	2.0	4.0
Temperature – coldest month average	ºC	0.4	1.9	3.5
Humidity – annual average	%	4.2	12.7	22.4
Humidity – winter	%	1.6	13.9	26.8
Humidity – summer	%	-0.2	12.5	26.1

† daily mean, maximum or minimum, as applicable, averaged over time period specified. n.b. 10th and 90th percentile and median values for the RCP8.5 scenario.

Table 1.2: Climate Parameter Projections 2080–2099

Parameter†	Units	10th percentile	Median value	90th percentile
Precipitation – annual average	%	-9.7	-2.3	5.3
Precipitation – driest season	%	-71.2	-38.9	-0.7
Precipitation – wettest season	%	-4.2	6.2	17.3
Precipitation – driest month	%	-16.3	19.0	54.9
Precipitation – wettest month	%	-15.0	0.1	19.4
Temperature – annual average	ºC	2.3	4.2	6.4
Temperature – hottest season average	ºC	2.6	5.5	8.7
Temperature – coldest season average	ºC	1.4	3.6	5.9
Temperature – hottest month maximum	ºC	1.6	6.0	11.0
Temperature – hottest month average	ºC	2.5	6.3	10.4
Temperature – coldest month minimum	ºC	0.7	3.5	6.7
Temperature – clodest month average	ºC	1.0	3.3	5.5
Humidity – annual average	%	10.5	23.6	38.3
Humidity – winter	%	8.0	25.9	45.6
Humidity – summer	%	3.0	21.5	41.1

† daily mean, maximum or minimum, as applicable, averaged over time period specified. n.b. 10th and 90th percentile and median values for the RCP8.5 scenario.

1.2.7 With regard to change in wind speed and wind storms, maximum gust speed anomalies over a 2.2km grid scale, compared to the baseline time period of 1981-2000, for the time period of 2061-2080 have been reviewed. Whilst there is no clear prediction for significant change in maximum gust speed over time, the change in maximum gust speeds between 2061-2080 at the site of the proposed location are expected to be between -1.09 $m.s^{-1}$ and 0.69 $m.s^{-1}$ in the summer and between -1.78 $m.s^{-1}$ and 1.48 $m.s^{-1}$ in the winter. In summary, no clear trend in storminess is predicted, and local anomalistic data published at 2.2km grid cell scale suggests no significant changes in wind speed and max gust speed over time period of 2061-2080.

2. Assessment

2.1 Climate Risk and Resilience Screening

2.1.1 Based on the information available for the proposed development, a high level risk assessment has been undertaken, considering the hazard, potential severity of effect on the development and its users, probability of that effect, and level of influence the development design can have on the risk. The severity of effect score considers the potential consequences of the hazard and the sensitivity of the receptor(s) affected. Each element of the risk assessment has been scored on a scale of one to three, representing low, medium or high; the sum of the individual scores gives a total risk score. Table 2.1 defines each of these terms.

2.1.2 A risk score of four or more has been defined as a risk that could lead to a significant effect of or on the development, prior to mitigation, as this is the minimum score where more than one element of the risk assessment is above 'low'.

Table 2.1 Severity, probability and influence factor definitions

Factor	Score definitions
Severity: the magnitude and likely consequences of the impact should it occur.	**1 =** unknown or low impact: for example, low-cost and easily repaired property damage; small changes in occupiers' or workers' behaviour.
	2 = moderate impacts with greater disruption and/or costs
	3 = severe impact, e.g. risk to individual life or public health, widespread property damage or disruption to business
Probability: reflects both the range of possibility of climatic parameter changes illustrated in CP18 projections and the probability that the possible changes would cause the impact being considered	**1 =** unknown or low probability of impact; impact would occur only at the extremes of possible change illustrated in projections
	2 = moderate probability of impact, plausible in the central range of possible change illustrated in projections
	3 = high probability of impact, likely even with the smaller changes illustrated as possible in the projections
Influence: the degree to which design of the proposed development can affect the severity or probability of impacts	**1 =** no or minimal potential to influence, outside control of developer, e.g. reliance on national measures or individuals' attitudes/actions; or hypothetical measures would be impracticable
	2 = moderate potential to influence, e.g. a mixture of design and user behaviour or local and national factors; measures may have higher costs or practicability challenges
	3 = strong potential to influence through measures that are within the control of the developer and straightforward to implement

2.1.3 Table 2.2 shows the climate change risks to the proposed development that have been identified and the risk scores assigned, following the approach set out in paragraph 2.1.2 and Table 2.1.

Table 2.2: Risk screening scores for the proposed development

Risk	Severity	Probability	Influence	Total score	Potentially significant?	Embedded mitigation
Surface water flooding of site						
Flooding of access routes to site			Flood risk is assessed in Volume 3, Chapter 15: Hydrology and Flood Risk of the Environmental Statement.			
Storm surges, overtopping of tidal defences flooding site						
High temperatures affecting engine or battery cooling	2	2	3	7	Y	Engine and battery control systems will include real-time temperature monitoring and automatic shut-down if overheat conditions for equipment develop
High temperatures affect operational and maintenance staff	1	2	3	6	Y	Facility will be controlled remotely with small on-site staff presence; staff welfare building included in design
Structural damage from extreme weather	3	1	2	6	Y	Development structures are outside the footprint over overhead power lines on site Topple distance with safety factor allowed for in siting gas engine exhaust stacks away from overhead power lines
De-rating of transmission lines/transformers due to extreme high temperatures	1	1	1	3	N	Underground cables used for connection to Tilbury Substation; ground temperatures are less susceptible to short-term extremes than air temperatures
Damage to gas pipeline due to subsidence as a result of increasaed rainfall or drought conditions	2	1	2	5	Y	-

2.2 Assessment of effects

2.2.1 The Climate Change Risk & Adaptation Response for UK Electricity Generation (Energy UK, 2015) concluded that risks to energy infrastructure from climate change remain relatively low. Climate change does not introduce any significant new risks which energy infrastructure developments do not already manage. It does however increase the likelihood and severity of such risks.

2.2.2 Short-term weather events may present more of a risk to the proposed development than long-term climate trends. Furthermore, the industry identifies engineering-related faults as more of a risk to losses in generation than changing weather patterns.

2.2.3 The most significant risk from climate change to the proposed development arises from flooding. This is assessed in Volume 3, Chapter 15: Hydrology and Flood Risk and appropriate flood management and resilience measures have been provided.

2.2.4 With the exception of flood risks, the greatest risks to the proposed development due to climate change have been identified as those arising from high temperatures affecting operation of the development and storms affecting power transmission. A possible risk to the gas pipeline from changing soil conditions was also suggested.

2.2.5 Network operators have a statutory requirement to keep overhead powerlines clear of vegetation that is a risk in storms and since 2006, operators have also been required to undertake a risk-based programme of resilience vegetation management. The proposed development itself has been designed with a 1.5x stack height topple distance to the nearest overhead power lines for safety.

2.2.6 High temperatures that reduce the cooling capacity of the radiators and air conditioning systems for the proposed development's gas engines and batteries could reduce the overall system efficiency, and possibly incur equipment damage if overheating occurred. However, engine and battery control systems will include real-time temperature monitoring and automatic shut-down if overheat conditions for equipment develop. It is recommended that in detailed design, consideration to higher average and peak temperatures is given when sizing the cooling systems for normal operation.

2.2.7 Stringent safety standards apply to the design and operation of a high-pressure gas pipeline, as set out in the Gas Connection Concept Design Report (application document A7.4). The connection facility to the national gas transmission network includes equipment for monitoring and inspection of the pipeline's structural integrity.

2.2.8 Overall, it is considered that the potentially-significant risks screened in Table 2.2 do not represent new or unexpected issues, and that good practice for the safe operation of electricity generation facilities will mitigate against the likelihood of significant adverse effects.

3. References

MOHC (2018) UK Climate Projections User Interface v1.1.2, available https://ukclimateprojections-ui.metoffice.gov.uk/ui/home, accessed 24 December 2019

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