REPORT

Boston Alternative Energy Facility – Preliminary Environmental Information Report

Chapter 21 Climate Change

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Table of Contents

Table of Tables

Non-Technical Summary

This chapter of the Preliminary Environmental Information Report (PEIR) considers Greenhouse Gas (GHG) emissions and the resilience of the Boston Alternative Energy Facility ('the Facility') to the projected effects of climate change. As part of the assessment, a description of the current baseline GHG emissions within the Boston region is provided, along with current climate in the region. Potential impacts during construction and operation of the Facility are considered.

A GHG assessment of construction phase emissions will be carried out at the Environmental Statement (ES) stage. The operational phase assessment considered two 'existing' pathways for the treatment of waste that would be processed at the Facility, compared to the anticipated GHG emissions arising from the operation of the Facility. GHG emissions were quantified from the gasification process, marine vessels and road vehicles going to and from the Application Site, and consumption of fuel by on-site equipment. The results of the assessment show that the Facility will increase GHG emissions from the existing 'Do Nothing' scenarios, but this will be offset by GHG savings elsewhere in the UK energy generation sector. The impact of the Facility was therefore considered not to have a significant impact on regional and national GHG emissions.

The climate resilience assessment identified that the Facility would be most vulnerable to an increase in flooding from increased heavy rainfall events due to the projected effects of climate change. There are ongoing improvements to the flood defences near the site through the Boston Combined Strategy, which will reduce the flood risk to the Application Site (see **Chapter 13 Surface Water, Flood Risk and Drainage Strategy**). Additional flood defences will be included as part of the design of the Facility. The risks of the design of the Facility from the potential for an increase in flood events as a result of climate change will be considered at the ES stage.

21 Climate Change

21.1 Introduction

21.1.1 This chapter of the Preliminary Environmental Information Report (PEIR) describes the existing environment in relation to climate change and details the assessment of the potential impacts during the construction and operational phases of the Boston Alternative Energy Facility ('the Facility'). Mitigation measures are described, and a discussion of the residual impacts provided where significant impacts were identified.

21.1.2 This chapter comprises two assessments: a greenhouse gas (GHG) assessment; and a climate change resilience (CCR) assessment. The GHG assessment considered the contribution of the Facility to national and regional GHG emissions. The CCR assessment will consider the resilience of the design and infrastructure associated with the Facility to the projected effects of climate change over the lifespan of the project.

21.1.3 At the PEIR stage, not all information was available to carry out the GHG and CCR assessment. Where information was not available at the PEIR stage, the approach that will be undertaken at the Environmental Statement (ES) stage is described.

21.2 Legislation, Policy and Guidance

Legislation

United Nations Framework Convention on Climate Change

21.2.1 The United National Framework Convention on Climate Change (UNFCCC) is an intergovernmental environmental treaty and entered into force on 21 March 1994. The main objective is the *"stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system."*

21.2.2 A regular series of international meetings of the UNFCCC have taken place since 1997 resulting in several important and binding agreements: the Copenhagen Accord (2009); the Doha Amendment (2012); and the Paris Agreement (2015). At the 22nd Climate Change Conference of the Parties (COP22) in November 2016, the UK ratified the Paris Agreement to enable the UK to *"help to accelerate global action on climate change and deliver on our commitments to create a safer, more prosperous future"* (BEIS, 2016).

21.2.3 The Doha Amendment included a commitment by parties to reduce greenhouse gas emissions by at least 18% below 1990 levels in the eight-year period from 2013 to 2020. The UK Climate Change Act 2008 has an interim 34% reduction target for 2020, which if achieved will allow the UK to meet and exceed its Kyoto agreement target.

21.2.4 During the United Nations Climate Change Conference in Paris in 2015 (known as 'COP21') the following were key areas of agreement (UNFCCC, 2016):

- Limit global temperature increase to below 2ºC, while pursuing efforts to limit the increase to 1.5ºC above the pre-industrial average temperature;
- Parties aim to reach global peaking of GHG emissions as soon as possible to achieve the temperature goal;
- Commitments by all Parties to prepare, communicate and maintain a Nationally Determined Contribution;
- Contribute to the mitigation of GHG emissions and support sustainable development;
- Enhance adaptive capacity, strengthen resilience and reduce vulnerability to climate change;
- Transparent reporting of information on mitigation, adaptation and support which undergoes international review; and
- In 2023 and every five years thereafter, a global stocktake will assess collective progress toward meeting the purpose of the Agreement.

21.2.5 The UK ratified the Paris Agreement in November 2016. At the recent COP24, held in Katowice, Poland in December 2018, a set of rules for the Paris climate process were agreed.

Kyoto Protocol

21.2.6 The Kyoto Protocol is an international agreement adopted in 1997 and was enacted in 2005. The Protocol is linked to the UNFCCC objective to reduce atmospheric concentrations of GHG to reduce the rate and extent of global warming. The Protocol applies to the reduction of six greenhouse gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6).

21.2.7 The Protocol acknowledges that the economic development of a country is an important factor in the country's ability to combat climate change. Therefore, countries have an obligation to reduce their current emissions, as they are historically responsible for the current concentrations of atmospheric GHGs.

The Climate Change Act 2008

21.2.8 The Climate Change Act 2008 provides a framework for the UK to meet its long-term goals of reducing GHG emissions by 34%, relative to a 1990 baseline by 2020 and by 80% in 2050 ("climate mitigation"). The Climate Change Act was enacted as part of the UK's responsibility and obligations as a signatory of the Kyoto Protocol 1997 (which did not become binding until 2005). The UK target covers the six main GHGs referenced in the Kyoto Protocol.

21.2.9 The Climate Change Act requires the government to set legally-binding 'carbon budgets' to provide a constraint of GHG emissions in a given time period. Carbon budgets are caps on the quantity of GHG emissions emitted in the UK over a five-year period. The first five carbon budgets have been placed into legislation and will run up to 2032.

21.2.10 The Climate Change Act requires the UK Government to produce a Climate Change Risk Assessment (CCRA) every five years. The CCRA assesses current and future risks to, and opportunities for, the UK from climate change (to inform "climate adaptation" actions). In response to the CCRA, the Climate Change Act also requires the UK Government to produce a National Adaptation Programme (NAP) (both discussed further below).

UK Climate Change Risk Assessment 2017

21.2.11 The Government produced its latest CCRA in 2017, the second assessment to be produced for the UK following the first release in 2012. The report concludes that among the most urgent risks for the UK are flooding and coastal change risks to communities, businesses and infrastructure. It identifies suggestions for reducing these risks, including the consideration of climate change in developing new infrastructure.

National Adaptation Programme

21.2.12 The National Adaptation Programme (NAP) sets the actions that the UK government will undertake to adapt to the challenges of climate change in the UK as identified in the CCRA. The NAP details the range of climate risks which may affect the natural environment, infrastructure, communities, buildings and services. Key actions are set out in the NAP which aim to address the identified high-risk areas, which include:

- flooding and coastal change risks to communities, businesses and infrastructure;
- risks to health, well-being and productivity from high temperatures;

- risks in shortages in the public water supply for agriculture, energy generation and industry;
- risks to natural capital; and,
- risks to domestic and international food production and trade.

National Planning Policy

National Planning Policy Framework (NPPF)

21.2.13 The revised NPPF (Ministry of Housing, Communities and Local Government, 2019) was adopted in February 2019, which advises that the planning system should support the transition to a low carbon future. With respect to planning for climate change, the NPPF states:

"Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures"

21.2.14 The NPPF also states:

"New development should be planned for in ways that:

a) avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure; and,

b) can help to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards."

National Policy Statements for Energy

21.2.15 The National Policy Statement (NPS) for Energy sets out in national policy for energy infrastructure in the UK.

21.2.16 The NPS advises that applicants and the IPC (now the Planning Inspectorate) should consider the effects of climate change when developing and consenting infrastructure. It also advises that new energy infrastructure needs to be resilient against the possible impacts of climate change to meet the UK's future energy needs. The NPS also advises that new energy infrastructure needs to consider the potential impacts of climate change when considering the location, design, build and operation of new energy infrastructure (DECC 2011a).

21.2.17 The NPS also states:

> *"The IPC should be satisfied that applicants for new energy infrastructure have taken into account the potential impacts of climate change using the latest UK Climate Projections available at the time the ES was prepared to ensure they have identified appropriate mitigation or adaptation measures. This should cover the estimated lifetime of the new infrastructure."*
>
> *"Applicants should apply as a minimum, the emissions scenario that the Independent Committee on Climate Change suggests the world is currently most closely following – and the 10%, 50% and 90% estimate ranges. These results should be considered alongside relevant research which is based on the climate change projections."*

21.2.18 The National Policy Statement for Renewable Energy Infrastructure (EN-3) (DECC, 2011b) advises that the proposals for new development should consider how they will be resilient to an increase in the risk of flood and drought affecting river flows.

Local Planning Policy

South-East Lincolnshire Local Plan

21.2.19 The South-East Lincolnshire Local Plan was adopted on 8 March 2019 (South East Lincolnshire Joint Strategic Planning Committee, 2019) and is the new Local Plan for Boston Borough Council (BBC), as well as South Holland District and Lincolnshire County Councils. The following policies are of relevance to climate change.

> *"**Policy 4: Approach to Flood Risk***
>
> *Development proposed within an area at risk of flooding (Flood Zones 2 and 3 of the Environment Agency's flood map or at risk during a breach or overtopping scenario as shown on the flood hazard and depths maps in the Strategic Flood Risk Assessment) will be permitted, where:*
>
> *[…]*
>
> *3. The application is supported with a site-specific flood risk assessment, covering risk from all sources of flooding including the impacts of climate change…"*
>
> *"**Policy 28: The Natural Environment***
>
> *A high quality, comprehensive ecological network of interconnected designated*

sites, sites of nature conservation importance and wildlife-friendly greenspace will be achieved by protecting, enhancing and managing natural assets:

[…]

3. Addressing gaps in the ecological network:

[…]

iv. conserving or enhancing biodiversity or geodiversity conservation features that will provide new habitat and help wildlife to adapt to climate change, and if the development is within a Nature Improvement Area (NIA), contributing to the aims and objectives of the NIA."

*"**Policy 31: Climate Change and Renewable and Low Carbon Energy***

A. Climate Change

All development proposals will be required to demonstrate that the consequences of current climate change has been addressed, minimised and mitigated by:

1. *employing a high-quality design;*
2. *the adoption of the sequential approach and Exception Test to flood-risk and the incorporation of flood-mitigation measures in design and construction to reduce the effects of flooding, including SuDS schemes for all 'Major' applications;*
3. *the protection of the quality, quantity and availability of water resources, including for residential developments, complying with the Building Regulation water efficiency standard of 110 litres per person per day;*
4. *reducing the need to travel through locational decisions and, where appropriate, providing a mix of uses;*
5. *incorporating measures which promote and enhance green infrastructure and provide an overall net gain in biodiversity as required by Policy 28 to improve the resilience of ecosystems within and beyond the site.*

B. Renewable Energy

With the exception of Wind Energy the development of renewable energy facilities, associated infrastructure and the integration of decentralised technologies on existing or proposed structures will be permitted provided,

individually, or cumulatively, there would be no significant harm to:

1. *visual amenity, landscape character or quality, or skyscape considerations;*
2. *residential amenity in respect of: noise, fumes, odour, vibration, shadow flicker, sunlight reflection, broadcast interference, traffic;*
3. *highway safety (including public rights of way);*
4. *agricultural land take;*
5. *aviation and radar safety;*
6. *heritage assets including their setting; and*
7. *the natural environment.*

Provision should be made for post-construction monitoring and the removal of the facility and reinstatement of the site if the development ceases to be operational. Proposals by a local community for the development of renewable and low-carbon sources of energy, in scale with their community's requirements, including supporting infrastructure for renewable energy projects, will be supported and considered in the context of contributing to the achievement of sustainable development and meeting the challenge of climate change and against criteria B1-7."

Guidance

Institute for Environmental Management and Assessment (IEMA) 2017– Environmental Impact Assessment Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance

21.2.20 The Institute for Environmental Management and Assessment (IEMA) has published guidance to inform the consideration of GHG emissions within an EIA (IEMA, 2017). The guidance sets out the areas for consideration at all stages of the assessment, and provides guidelines for, and requirements of, an assessment.

IEMA 2015 – Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation

21.2.21 IEMA has also published a framework for the consideration of climate change resilience and adaptation in the EIA process. The guidance advises that the future climate at the development site should be identified, and how adaptation and resilience measures have been built into the design of a development. (IEMA,

2015).

21.3 Consultation

21.3.1 Consultation was undertaken with the Planning Inspectorate, and through them wider stakeholders, through submission of the Scoping Report. Comments made in the Scoping Opinion for the Facility are considered in this assessment and will inform the final ES chapter.

21.3.2 A summary of the consultation of relevant to climate change is detailed in **Table 21.1**.

Table 21.1 Consultation and Responses

Consultee and Date	Response	Chapter Section Where Consultation Comment is Addressed
Planning Inspectorate, July 2018	The Scoping Report refers to guidance applicable to the assessment. The Applicant should ensure that the guidance applied to the assessment and the methodology that is adopted are fully explained within the ES.	Guidance applied to the assessment is detailed in **Section 21.2**.
	The ES should clearly state within the GHG assessment the lifecycles of the Proposed Development that will be included within the assessment.	Scenarios considered in the GHG assessment are set out in **Section 21.4**.
	The ES should state any assumptions made in calculating the predictive GHG emission; any limitations to the calculations; and any uncertainties this presents for the assessment of GHG emissions.	Assumptions and limitations in the calculated of GHG emissions are set out in **Section 21.4**.

21.3.3 One representation to the Scoping Opinion submitted by Natural England referred to climate change, and specifically requested Alternative Use Boston Projects Ltd ('the Applicant') provide provisions for maintaining ecological networks in the face of climate change. The representation states:

"The NPPF requires that the planning system should contribute to the enhancement of the natural environment 'by establishing coherent ecological networks that are more resilient to current and future pressures' (NPPF Para 109), which should be demonstrated through the ES."

21.3.4 The impact of climate change on ecological networks is considered in **Chapter 12 Terrestrial Ecology** and **Chapter 17 Marine and Coastal Ecology**.

21.4 Assessment Methodology

21.4.1 The climate change assessment comprises two separate assessments. A GHG assessment was undertaken to predict emissions arising from activities associated with the Facility. The assessment considered emissions associated with two 'Do Nothing' scenarios, to calculate 'baseline' GHG emissions from the existing pathways for the refuse derived fuel (RDF) which would be used at the Facility. In addition, a 'Do Something' scenario was considered, which calculated the GHG emissions associated with the delivery of RDF to the Facility, and process emissions.

21.4.2 Initial findings are presented in this PEIR, but a more detailed assessment considering projected net contribution to UK / global CO_2 emissions, rather than gross, point-source emissions associated with the proposed Facility, will be presented in the ES. As the effects of carbon dioxide are realised at a global, rather than local, level, this net overall effect is a key factor in determining the effect of a proposed scheme.

21.4.3 A CCR assessment was undertaken to evaluate the resilience and vulnerability of the design and infrastructure associated with the Facility to the projected effects of climate change. The methodologies for both assessments are detailed below.

21.4.4 Where information was not available that the PEIR stage, the approach that will be undertaken at the ES stage is outlined.

Study Area

Greenhouse Gas Assessment

21.4.5 At the PEIR stage, information was not available to determine GHG emissions from the construction phase. GHG emissions arising from construction activities will be calculated at the ES stage.

21.4.6 GHG emissions arising from the operational phase of the Facility were predicted within a defined 'project boundary', in accordance with the GHG Protocol[1]. The 'project boundary' was defined as the Application Site boundary of the Facility, and the routes that marine vessels and road vehicles travel to and from the Application Site. In addition, existing waste disposal routes were included in the project boundary for the 'Do Nothing' scenarios, which included landfill sites in the UK, and Energy from Waste (EfW) facilities in Europe.

Climate Change Resilience Assessment

[1] *https://ghgprotocol.org/*

21.4.7 The Study Area for the CCR assessment is defined as the Application Site boundary and associated transport networks, including access for vessels at the Haven and road transport links.

21.4.8 The construction phase is anticipated to be up to 48 months, between 2021 and 2025. Effects of climate change, as distinct from weather, are not considered to be significant during construction and are therefore excluded from consideration.

Data Sources

21.4.9 The assessment was undertaken with reference to several sources, as detailed in **Table 21.1.**

Table 21.2 Key Information Sources

Data Source	Reference
UK Climate Projections (UKCP) Database	Met Office, 2018, https://www.metoffice.gov.uk/research/collaboration/ukcp
Met Office Holbeach Meteorological Station	Met Office, 2019, https://www.metoffice.gov.uk/public/weather/climate/u12h2kdgz
Emissions of Carbon Dioxide for Local Authority Areas	BEIS, 2018a, https://data.gov.uk/dataset/723c243d-2f1a-4d27-8b61-cdb93e5b10ff/emissions-of-carbon-dioxide-for-local-authority-areas
Greenhouse Gas Reporting, Conversion Factors 2018	BEIS, 2018b, https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2018

Impact Assessment Methodology

Greenhouse Gas Assessment

Approach

21.4.10 The GHG assessment was undertaken in accordance with the methodology defined in the GHG Protocol, developed by the World Resources Institute and World Business Council on Sustainable Development (2015). The GHG Protocol defines three emission scopes, which are detailed below:

- Scope 1 emissions: “direct” GHG emissions arising from a project, such as those associated with fossil fuel consumption by vehicles and plant under the control of the Applicant (or construction contractor) at the Application Site;
- Scope 2 emissions: account for “indirect” GHG emissions from the production of electricity and gas (i.e. off-site and usually by third parties) consumed by plant and equipment; and,

- Scope 3 emissions: “indirect emissions arising from supporting activities” (e.g. work upstream and / or downstream, the activities of sub-contractors and ancillary travel) associated with a project. This includes third party marine vessel and road traffic vehicles, which are not under the direct control of the Applicant.

21.4.11 The term ‘GHG’ in this assessment encompasses three gases, namely CO_2, CH_4 and N_2O. Emissions of other ‘Kyoto’ gases are not considered significant in the context of the Facility and they are excluded from consideration. Where practicable, the results in this assessment were expressed in carbon dioxide equivalent (CO_2eq) which recognises that different gases have notably different global warming potential[2].

Construction Phase

21.4.12 There is not sufficient detailed development information available at the PEIR stage to determine GHG emissions from the construction phase of the Facility. More information will be available at the ES stage, where a more complete calculation of GHG emissions arising from construction activities will be undertaken.

21.4.13 The construction phase GHG assessment will quantify GHG emissions, considered to be net contributions to the global system, from the following sources:

- the use of dredgers within The Haven;
- the use of construction plant and equipment;
- construction and staff traffic movements to and from the Application Site;
- the use of generators to provide power to construction activities on the Application Site;
- road traffic and vessel movements associated with deliveries of construction material to the Application Site; and
- embodied carbon within materials used in construction.

21.4.14 As most of the construction plant and equipment are likely to be diesel powered, Scope 2 GHG emissions associated with the consumption of electricity during the construction phase are anticipated to be minimal and will not be considered in the assessment.

[2] *Global Warming Potential of a GHG is a measure of how much heat is trapped by a certain amount of gas in the atmosphere relative to carbon dioxide.*

Operational Phase

21.4.15 The Facility is anticipated to process 1,300,000 tonnes of RDF per year. The current disposal routes for the RDF waste that will be used at the Facility is unknown, but it is likely that most of the waste is either landfilled in the UK or exported to energy recovery (EfW) facilities in Europe. Three scenarios were therefore considered to calculate gross annual GHG emissions associated with the existing baseline, and proposed development options:

- Scenario 1: 'Do Nothing 1', where it was assumed that 100% of the RDF waste is landfilled within the UK;
- Scenario 2: 'Do Nothing 2', where it was assumed that 50% of the RDF waste is landfilled in the UK, and 50% is transported to the Europe and processed within energy recovery facilities (thermal treatment / EfW); and
- Scenario 3: 'Do Something', where the RDF waste is transported to the Facility and electricity is produced following the gasification process.

21.4.16 The Facility will generate 102 MWe (gross) of renewable electricity. A proportion of this will supply the Facility (parasitic load), including the feedstock management and lightweight aggregate (LWA) facilities. 80 MWe is planned to be exported to the National Grid. Due to the nature of the Facility, generating renewable power, there are not anticipated to be any notable Scope 2 GHG emissions during the operational phase.

21.4.17 The GHG emission sources considered for each Scenario are provided in **Table 21.3**. Further information for the calculation of each source of GHGs for each scenario is provided below

Table 21.3 GHG Emissions Sources Considered for Each Scenario

Scenario	Parameter
Scenario 1 - (Do Nothing, 100% UK Landfill)	Landfilled UK Waste
Scenario 2 - (Do Nothing, 50% UK Landfill, 50% Exported to Waste to Energy Facilities	Landfilled UK Waste
	EfW Generation
	Marine Vessel Movements (UK to Europe)
Scenario 3 – (Do Something, Operational Emissions Associated with the Facility)	EfW Generation
	Marine Vessel Movements (UK to UK)
	Road Transport Movements
	Combustion of Fuel from On-site Plant

21.4.18 At this PEIR stage, all emissions calculated are gross and make no allowance for emissions avoided from an alternative baseline scenario or elsewhere in the wider system. The ES will seek to calculate net CO_2 emissions.

Scenario 1: Do Nothing 1 (100% Landfilled UK)

21.4.19 Under Scenario 1, all of the 1,300,000 tonnes of RDF waste that would be processed each year at the Facility is disposed at landfill sites within the UK. It has been assumed that 64% of the RDF is domestic, and 36% is industrial and commercial waste, as detailed in **Plate 2.1** in **Chapter 2 Project Need**. Emission factors for landfilled waste in the UK were obtained from the Department for Business, Energy and Industrial Strategy (BEIS, 2018a). The emission factor encompasses 'gate to grave' emissions, which includes collection, transportation and landfill emissions.

Scenario 2: Do Nothing 2 (50% Landfilled UK, 50% Exported to EfW Facilities in Europe)

21.4.20 For Scenario 2, it was assumed 650,000 tonnes (50%) of the RDF waste is landfilled in the UK, where the same methodology as Scenario 1 was used. In addition, it was assumed that the remaining RDF waste would be exported to Europe to be used in EfW facilities. GHG emissions (gross) were therefore considered from the transport of the waste by marine vessel, and from the gasification process to generate electricity.

Marine Vessels

21.4.21 It was assumed that the RDF is transported by cargo vessels, from the east coast of the UK to Europe. As the destination of the waste is unknown, it was assumed that the average trip length was 600 km[3], which represents a reasonable approximation of emissions associated with travelling the equivalent distance between Grimsby, UK, and Esjbert, Denmark. The RDF is likely to be exported via cargo vessels (less than 10,000 DWT (dead weight tonne)).

21.4.22 Emission factors were obtained from guidance provided by the GloMEEP Project Coordination Unit and the International Association of Ports and Harbors (GloMEEP & IAPH, 2018). The cargo vessels were assumed to travel at an average speed of 28.2 km/hr (GloMEEP & IAPH, 2018). Emission parameters for the cargo vessels are provided in **Table 21.6**.

European Energy from Waste Process

21.4.23 The specific operating parameters of the European facilities that receive the

[3] 600km is the approximate distance between Grimsby in the UK, to Esjberg in Denmark

exported RDF are unknown, so, emission factors were obtained from the existing Cory Riverside Energy Facility in the UK, which currently processes UK waste (Carbon Trust, 2017). CO_2 emissions from the Cory Riverside Energy Facility align with measurements of CO_2 emissions from EfW facilities in Europe (Christensen et al, 2015), and is therefore considered likely to be representative of GHG emissions arising from the use of the typical UK waste mix in EfW processes.

Scenario 3 – Do Something

21.4.24 Scenario 3 accounted for GHG emissions that would be released during operation of the Facility. The assessment considered emissions from the gasification process, movement of marine vessels and road traffic vehicles, and from the use of on-site plant and equipment.

Gasification Process

21.4.25 It is anticipated that a proportion of the RDF will be unsuitable for gasification and this will be segregated in the RDF Feedstock processing facility (see **Chapter 5 Project Description**). Therefore, it was assumed that 1,000,000 tonnes of processed RDF will be supplied into the gasification each year.

21.4.26 The Facility will also include the connection of one of the three fluidised bed staged gasification (FBSG) lines to a CO_2 recovery plant. Full details of the CO_2 facility are provided in **Chapter 5 Project Description**.

21.4.27 The information used to calculate GHG emissions associated with the gasification process are provided in **Table 21.4**. It was assumed that the gasifiers would be in operation for 8,000 hours of the year.

Table 21.4 Parameters Used to Calculate GHG Emissions per Train

Parameter	Value
Gas Flow Rate per Train (kg/hour)	352,025
Volume of CO_2 in Exhaust Gas (%)	9.9
CO_2 Released per Hour (tonnes)	34.9

Vessel Movements

21.4.28 RDF will be delivered to the site via cargo vessels, with an average load of 2,500 tonnes. In addition, LWA material will be exported from the Application Site via bulk carriers. GHG emissions associated with the movement of cargo vessels and bulk carriers were therefore calculated.

21.4.29 It was assumed that the RDF waste would be supplied equally from three UK ports: Leith; Grimsby; and Tilbury. The travel time and distance to each port is provided in **Table 21.5**. The destination for the LWA export is currently unknown, but it is likely to be to a port on the east coast of the UK. Therefore, an average distance of 200 km was assumed. Such assumptions will be subject to sensitivity testing through the final ES assessment stages.

Table 21.5 Distance and Duration of Vessel Movements Delivering RDF from Port to Application Site

Port	Number of Vessel Movements	Distance to Application Site (km)	Average Speed (km/hour)	Hours per Trip	Total Annual Activity Hours
Leith	153	480	28.2	17.0	5,220
Grimsby	153	105	28.2	3.7	1,142
Tilbury	154	345	28.2	12.2	3,769

21.4.30 Vessel parameters and emission factors were obtained from GloMEEP and IAPH guidance (2018). Emissions were calculated from propulsion and auxiliary engines whilst the vessels are cruising, and in a Reduced Speed Zone (RSZ). The RSZ was assumed to be whilst the vessels are travelling on The Haven, where each vessel would require one hour to travel each way. Emission parameters for the marine vessels delivering RDF waste and removing LWA are provided in **Table 21.6**.

Table 21.6 Vessel Parameters for Vessels Delivering RDF and Removing LWA

Product	Vessel Type	Average Vessel Load (tonnes)	Propulsion Engine Capacity (kW)	Auxiliary Engine Capacity (kW)
RDF	Cargo Vessel (> 10,000 DWT)	2,500	1,008	193
LWA	Bulk Carrier (> 5,000 DWT)	2,500	1,879	193

Road Transport Movements

21.4.31 Road transport movements during the operational phase will be associated with workers travelling to the site via car, and HGV movements. An average trip length of 50 km (each way) for HGV movements, and 10 km (each way) for cars was assumed. Emission factors were obtained from the Department for Business, Energy and Industrial Strategy (BEIS) (BEIS, 2018a).

21.4.32 Traffic movements during operation of the Facility were obtained from the Transport Consultants for the project. Assumptions made for this assessment correspond to those made for the transport and air quality assessments

undertaken in **Chapter 19 Traffic and Transport** and **Chapter 14 Air Quality** respectively. The operational phase traffic movements used to calculate GHG emissions are provided in **Table 21.7**.

Table 21.7 Operational Phase Traffic Movements

Vehicle	Daily Trips	Annual Trips	Average Trip Length (km)	Annual Distance (km)
Cars	178	15,600	10	780,000
HGVs	50	55,536*	50	555,360
*Assumed 6 working days per week				

On-Site Plant Vehicles

21.4.33 The operational phase GHG assessment also considered emissions associated with fuel consumption from on-site vehicles, which included those listed in **Table 21.8**. The engine power for each vehicle were obtained from manufacturer specifications.

Table 21.8 Site Vehicles to be Used During the Operational Phase (Indicative of Market Equipment)

Vehicle	Number of Vehicles	Assumed Engine Power (kW)
Liebherr LH 110 Port Litronic	4	300
Forklifts	4	55
>30 Te Tractor Unit	2	403
Operations Vans	2	127
Multi Seat Crew Bus	1	209

21.4.34 The engines for each of the vehicles were assumed to operate at 80% load for the full duration of the working day (21 hours a day) to present a conservative scenario.

Emission Factors

21.4.35 Emission factors used in the assessment for the sources detailed above are detailed in **Table 21.9**. Where possible, emission factors in units of CO_2eq were obtained. Where emission factors were not available for CO_2eq, a calculation was undertaken which used the functionally-equivalent amount or concentration of CO_2 as the 'reference'.

Table 21.9 Emission Factors for Fuel Oil On-Site Vehicles during the Operational Phase

Parameter	CO_2eq emission factor	CO_2 emission factor	CH_4 emission factor*	N_2O emission factor*	Emission Factor Unit	Source
Landfilled Municipal Waste (UK)	586.53	N/A	N/A	N/A	kg per tonne of waste	BEIS, 2018
Landfilled Commercial and Industrial Waste (UK)	99.8	N/A	N/A	N/A	kg per tonne of waste	BEIS, 2018
Marine Vessel Propulsion Engines	N/A	683	0.03	0.01	g per kWh	GloMEEP & IABH, 2018
Marine Vessel Auxiliary Engines	N/A	722	0.03	0.01	g per kWh	GloMEEP & IABH, 2018
Fuel Oil Consumption by On-site Plant	0.285	N/A	N/A	N/A	kg per kWh	BEIS, 2018
Existing Energy from Waste Facility	N/A	454	N/A	N/A	kg per tonne of waste	Carbon Trust, 2017

Climate Change Resilience (CCR) Assessment

21.4.36 An assessment of the resilience and vulnerability of the design and infrastructure to the projected effects of climate change was undertaken over the operational lifespan of the Facility. This assessment will identify the likelihood of climate hazards occurring within the Study Area, and the consequences of the impact will be highlighted.

Approach

21.4.37 A four-step methodology has been applied for the CCR assessment. The initial stages of the assessment aim to identify the climate variables to which the Facility is vulnerable to during its lifetime. A more detailed risk assessment is then undertaken following the identified of influencing climate variables, which aims to assess the level of risk associated with the hazards posed by the predicted changes in climate variables.

21.4.38 Within this PEIR the initial steps (Stages 1 and 2, as outlined below) comprising

the identification of climate variables was undertaken. Stages 3 and 4 will be finalised for the ES production, when further details have been confirmed on the design of the Facility and associated infrastructure.

Step 1: Identifying climate variables

21.4.39 The first step of the CCR assessment is to identify the receptors which may potentially be impacted by climate change hazards. Those receptors identified should include both known receptors (such as receptors reported / known to have already experienced a climate-related event (i.e. flooding)) and unknown receptors which are yet to be impacted according to available data and literature.

Step 2: Climate vulnerability assessment

21.4.40 Stage 2 consists of a qualitative assessment (informed by professional judgement and supporting literature) of the Facility to changes in the climate variables. Vulnerability is considered to be a function of:

- The sensitivity of the Facility and any associated infrastructure to climate variables; and
- The exposure (both spatially and temporally) of the Facility and its associated infrastructure to climate variables.

21.4.41 Both the sensitivity and the exposure of the Facility and its associated infrastructure to climate variables are considered in the vulnerability assessment. This approach attributes either a high, moderate or low sensitivity / exposure categorisation to each vulnerability.

21.4.42 Overall vulnerability is determined by considering the interrelationship between the exposure and the receptor sensitivity, as set out in **Table 21.10** below.

Table 21.10 Sensitivity / Exposure Matrix for Determining Vulnerability Rating

Sensitivity	Exposure		
	Low	Moderate	High
Low	Low vulnerability	Low vulnerability	Low vulnerability
Moderate	Low vulnerability	Medium vulnerability	Medium vulnerability
High	Low vulnerability	Medium vulnerability	High vulnerability

21.4.43 Climate change projection data was obtained from the UKCP18 database, which was used to identify the climate variables within the Study Area for three

representative concentration pathways (RCP) (RCP 2.6, RCP 4.5 and RCP 8.5). Data were obtained for the 10th, 50th and 90th percentiles for each RCP.

21.4.44 Further information related to the vulnerability of the Facility to the projected effects of climate change were obtained from the other topic chapters such as **Chapter 13 Surface Water, Flood Risk and Drainage Strategy** and **Appendix 13.2 Flood Risk Assessment**.

21.4.45 The risk of climate change to the design and infrastructure of the Facility, and consequently on its operation and whether there are any risks to others associated with any vulnerabilities identified, is then determined through Steps 3-4 of the assessment process. At the time of the PEIR this exercise has not been undertaken, as the more detailed design of the Facility and infrastructure is being refined.

21.4.46 For information only, the final steps of the CCR assessment process to be completed and presented within the ES are detailed below.

Stage 3: Risk assessment

21.4.47 For those vulnerabilities categorised as medium or high, climate-related hazards will be identified through professional judgement, engagement with the Applicant and literature. The risks of the Facility and its associated infrastructure to the occurrence of a hazard event will be qualitatively identified by considering the hazard likelihood and consequence, as per **Table 21.11**.

Table 21.11 Likelihood / Consequence Matrix for Determining Risk Rating

Likelihood	Consequence				
	Insignificant	Minor	Moderate	Major	Catastrophic
Almost certain	Low	Medium	High	Extreme	Extreme
Likely	Low	Medium	Medium	High	Extreme
Moderate	Low	Low	Medium	High	Extreme
Unlikely	Low	Low	Medium	Medium	High
Very unlikely	Low	Low	Low	Medium	Medium

Stage 4: Mitigation

21.4.48 For climate risks to the Facility or its associated infrastructure identified as 'medium' or higher, mitigation measures will be identified by professional

judgement, and in consultation with the Applicant. The design team will be influenced to implement greater climate resilience into the developing design. With the proposed mitigation measures taken into consideration, a residual risk rating will be assessed.

21.4.49 For each hazard, a resilience rating is identified as one of the following:

- **High** – strong degree of climate resilience. Remedial action or adaptation may be required but is not a priority.
- **Moderate** – a moderate degree of climate resilience. Remedial action or adaptation is recommended.
- **Low** – a low level of climate resilience. Remedial action or adaptation is required as a priority.

Impact Significance

GHG Assessment

21.4.50 There is no single preferred method to evaluate the significance of GHG emissions arising from a 'project'. IEMA guidance advises that all releases of GHGs might be considered to be significant, but professional judgement should be used to contextualise a project's GHG budget (IEMA, 2017). The approach adopted to determine the significance of GHG emissions arising from the Facility compared predicted emissions to the two 'Do Nothing' scenarios and evaluates contributions to the regional and national climate change GHG emissions.

CCR Assessment

21.4.51 The significance of the CCR assessment will be determined through consideration of the residual risk and resilience rating applied to each hazard identified. **Table 21.12** presents the matrix used to identify the overall significance of climate change resilience. This stage of the assessment will be completed at the ES.

Table 21.12 Significance Criteria

Risk Rating	Resilience Rating		
	High	Medium	Low
Extreme	**Significant**	**Significant**	**Significant**
High	**Not significant**	**Significant**	**Significant**
Medium	**Not significant**	**Not significant**	**Significant**
Low	**Not significant**	**Not significant**	**Not significant**

Embedded Mitigation

21.4.52 As part of the project design, several embedded mitigation measures have been

proposed to reduce potential impacts on climate change. These measures are considered standard industry practice for this type of the development.

GHG Assessment

21.4.53 The Facility will also include the connection of one gasification line to a CO_2 recovery plant, producing CO_2 to be re-used in various industries. Full details of the CO_2 recovery system are provided in the **Chapter 5 Project Description**. Other measures include the use of heat exchangers, heat reuse within the plant, and the positioning of the proposed Facility to enable material transport by river.

CCR Assessment

21.4.54 As described in **Appendix 13.2 Flood Risk Assessment**, there are ongoing improvements to the flood defences near the Application Site. Embedded mitigation for the Facility includes both primary and secondary flood defence lines. The primary flood defence line would be formed by the wharf and would replace the existing Environment Agency flood defences at the Application Site.

21.4.55 Improvements to the tidal defences around the Application Site are being carried out through the Boston Combined Strategy, which will provide Boston town with a 1 in 300 year standard of protection against tidal flooding. The Boston Combined Strategy will be carried out over five phases, with Phase 3 due to be completed by late 2019. In addition, the Boston Tidal Barrier is programmed for completion by the end of 2020. The Boston Tidal Barrier is to be constructed with a crest height of 7.55 mAOD which includes a freeboard allowance for wave action due to wash from ships

21.4.56 The Application Site is located within the area that will be subject to improvement and upgrade works as part of the Haven Banks Project, which forms Phase 5 of the Boston Combined Project. This is an adaptive defence scheme that will implemented to enable the Haven Banks to address increasing risk associated with climate change. The Haven Banks project is programmed for construction between Summer 2019 and Winter 2020. This phase of Haven Banks Project works will comprise a minimum crest height of 6.5 mAOD, suitable to provide protection for projected flood levels associated with 50 years of climate change.

21.4.57 The proposed primary defence line for the Facility would tie in with the Environment Agency's Havens Banks Project; therefore, the crest height for the proposed wharf is 6.8 mAOD.

21.4.58 A flood action plan for the Facility will be implemented, which will include procedures to receive flood warnings, and closure or evacuation of the Application

Site with sufficient time before a flood event.

21.4.59 There will be an increase in impermeable areas and associated surface water run-off during the construction and operational phases of the Facility. A surface water drainage system would be built as part of the enabling works to manage the increase in surface water run-off. Much of the surface water collected would be retained for use in the LWA facility, with any surplus discharged into the site drainage system in accordance with an environmental permit.

21.4.60 Embedded mitigation related to surface water drainage matters is also detailed in **Chapter 13 Surface Water, Flood Risk and Drainage Strategy**.

Assumptions and Limitations

21.4.61 The GHG assessment is scenario-based, since RDF feedstock supply is not identified as coming from a specific source. Whilst the assumptions underpinning the CO_2 emissions calculations have been identified, assessments in the ES will be subject to sensitivity testing to ensure clarity.

21.4.62 The final ES will also include consider the effect of avoided emissions elsewhere in the system in a net CO_2 emission calculation. This will account for the fact that development of the Facility would avoid emissions associated with fossil fuelled power production (through contributing to renewable energy generation), and transport of feedstocks overseas and/or landfilling of waste (depending on the baseline scenario considered), as well as avoiding emissions associated with primary aggregate extraction (through development of the LWA facility).

21.4.63 A key assumption of the climate change projection data from the UKCP18 is that the model is strongly dependent on future global GHG emissions. The RCP scenarios cover a recent set of assumptions based upon future population dynamics, economic development and account for international targets on reducing GHG emissions. Each RCP scenario has a different climate outcome, given they are based upon different set of assumptions. The three RCP scenarios presented within this chapter (RCP 2.6, RCP 4.5 and RCP 8.5) are considered the most likely to occur over the lifespan of the Facility. However, the UKCP18 guidance cautions that the scientific community cannot reliably place probabilities on which scenario of GHG emissions is most likely.

21.4.64 Due to the intrinsic uncertainty within climate projections, the UKCP18 data is based upon probabilistic projections generating a normally-distributed model per output. The projections give values for the 10^{th}, 50^{th} and 90^{th} percentiles, which covers the range of uncertainty.

21.5 Existing Environment

Regional GHG Emissions

21.5.1 The Department for Business, Energy and Industrial Strategy's (BEIS) *Emissions of carbon dioxide for Local Authority areas* online database discloses the UK's CO_2 net emissions in 2016 were estimated at 357,470 kt CO_2 (BEIS, 2018). CO_2 emissions from the BBC region were 334.6 kt which contributed approximately 0.1% towards the UK's total. **Table 21.13** presents annual CO_2 emissions in the BBC region from 2005 to 2016.

Table 21.13 Boston Region CO_2 Emission Estimates 2005-2016 (kt CO_2) (BEIS, 2018).

Year	Industry and Commercial	Domestic	Transport	Total
Annual kt CO_2				
2005	185.4	157.1	137.1	481.8
2006	183.6	157.9	138.9	482.5
2007	178.1	154.8	135.6	469.3
2008	179.5	153.1	129.3	463.1
2009	162.0	139.8	124.8	428.7
2010	167.5	150.8	125.1	444.6
2011	144.6	131.6	123.9	401.0
2012	161.2	140.0	121.6	423.7
2013	150.9	135.4	121.2	408.1
2014	149.5	112.8	123.1	384.7
2015	123.4	109.2	126.0	358.3
2016	104.0	103.7	127.3	334.6

21.5.2 Transport was the largest contributing sector to GHG emissions within the Boston region in 2016, responsible for emissions estimated at 127.3 kt CO_2.The industry and commercial, and domestic sectors contributed 104.0 kt and 103.7 kt of CO_2 respectively during 2016.

21.5.3 The data in **Table 21.13** shows that annual CO_2 emissions within the Boston region have decreased by 31% from 2005 to 2016, with reductions in industrial and domestic emissions driving this change.

Existing Climate

21.5.4 The Facility is located on the east coast of England, and currently experiences an 'maritime' climate which is typical of the UK. As it is located on the east coast of

England, Boston is situated in a 'rain shadow' and has a drier climate than the UK average.

21.5.5 Existing climate data for the period 1981 – 2010 were obtained from the Holbeach meteorological station, which is the most representative station to the Application Site. Climate data for Holbeach and the UK average are provided in **Table 21.14**.

Table 21.14 Existing Climate at the Holbeach Meteorological Station for the Period 1981 – 2010 (Met Office, 2019)

Climate Variable	Units	Holbeach Annual Average	UK Average
Maximum Temperature (average over 12 months)	^{0}C	13.8	12.4
Minimum Temperature (average over 12 months)	^{0}C	6.3	5.3
Days of Air Frost	Days	33.8	54.6
Rainfall	mm	610.1	1154.0
Days of Rainfall ≥ 1 mm	Days	115.8	156.2
Mean Wind Speed 10 m	Knots	11.0	N/A

21.5.6 **Table 21.14** displays the influence of the maritime setting of the Application Site, compared to the average climate in the UK. Maximum and minimum temperatures are both higher than the UK average, and there are fewer days of air frost. In addition, annual precipitation is 47% less than the UK average.

Projected Climate Change

21.5.7 Climate change projections were used to identify future risk to existing climatic variability within the Study Area. It is anticipated that the Facility will have a lifespan of at least 25 years. This is the expected operational period and is considered typical of a development of its kind. On reaching 25 years of operation, ongoing operation would be reviewed and if not deemed appropriate to continue then the Facility will be decommissioned. As such, climate forecasts and impacts to the baseline conditions arising from the construction and operation of the Facility have been based on a 25-year lifespan.

21.5.8 Climate change projections for 2050 (average weather from 2040 – 2069) in the 25 km^2 grid square where the Application Site is located were obtained from the UKCP18 database (Met Office, 2018). Data were obtained for three RCPs scenarios, which are defined in **Table 21.15**. For each of these RCPs, three probabilities were considered, 10% (unlikely), 50% (central estimate of projections) and 90% (projections unlikely to be less than).

Table 21.15 Summary of the RCP Emission Scenarios

RCP	Atmospheric CO_2 equivalent (parts per million) in 2100	Parameters
2.6	421	GHG emissions stay at present levels until 2020, and then start to decline.
4.5	670	Decline of global GHG emissions begins around 2040
8.5	936	Increasing global GHG emissions throughout 21st century

21.5.9 Data from the RCP emission scenarios presented within **Table 21.15** were based obtained from the 500000, 325000 25 km land-based grid square which encompasses the Application Site. Changes in climate variables were compared to a baseline period of 1981-2000, and are displayed in **Table 21.16**.

Table 21.16 Projected Climate Change within the Study Area in 2050 (from the 1981-2000 baseline), at the 10th, 50th and 90th Percentile for Three Climate Scenarios (Met Office, 2018)

Climate Variable	Climate Scenario								
	RCP 2.6			RCP 4.5			RCP 8.5		
	10%	50%	90%	10%	50%	90%	10%	50%	90%
Change in precipitation (%)	-19	-1	19	-19	-1	19	-19	-1	19
Change in mean daily maximum temperature (ºC)	0.1	1.4	2.8	0.1	1.5	2.8	0.5	1.9	3.4
Change in mean daily minimum temperature (ºC)	0.2	1.3	2.4	0.2	1.3	2.5	0.5	1.7	3.0
Change in mean temperature (ºC)	0.2	1.3	2.5	0.2	1.4	2.6	0.6	1.8	3.1

21.5.10 The data contained within **Table 21.16** demonstrates that under all scenarios, the maximum, minimum and mean daily temperatures are projected to increase within the Study Area. Mean daily temperatures are anticipated to rise between 0.1 ºC to 3.4 ºC at the Application Site over the lifespan of the project, dependent on the RCP and probability scenario. Changes in precipitation are predicted to be the same for each RCP but vary according to each probability scenario showing the potential for increased or decreased annual precipitation levels. Changes in precipitation patterns may result in an increase of surface water flooding or drought at the site.

21.5.11 It is anticipated that climate change will result in an increase intensive preciptation events in the UK. Environment Agency guidance (2017) suggests a 10% and 20% allowance should be applied to the development of the surface water

drainage design for the Facility (see **Appendix 13.2 Flood Risk Assessment**).

Table 21.17 Peak Rainfall Intensity Allowance in Small and Urban Catchments (1961-90 Baseline)

Applies across all of England	Total Potential Change Anticipated for the '2020s' (2015-2039)	Total Potential Change Anticipated for the '2050s' (2040-2069)	Total Potential Change Anticipated for the '2070s' (2070-2115)
Upper End	10%	20%	40%
Central	5%	10%	20%

Flood Risk

21.5.12 The baseline flood risk information is detailed in **Appendix 13.2 Flood Risk Assessment** and is summarised below.

21.5.13 Flood risk mapping from the Environment Agency confirms that the site is in a Flood Zone 3. This is associated with tidal flood risk rather than fluvial flood risk, and therefore it would be affected by tidal flooding during the 1 in 200 year event, without the presence of any flood defences. There was a tidal flood event on the 5th December 2013, which affected the southern half of the Application Site, where maximum tidal water level was recorded as 5.2 m AOD.

21.5.14 Surface water flood risk on the Application Site is primarily very low, with small areas of increased surface water flood risk across the site associated with existing drains / watercourses and localised low-lying points.

21.5.15 The Application Site would be at high risk of tidal flooding if it did not benefit from existing tidal flood defences, through earth embankments which provide a 1 in 150 year standard of protection. Effective crest levels for the defences are understood to be 6.1 m AOD. The Site also benefits from a secondary flood defence, known as Sea Bank (or 'Roman Bank'), which has a crest level approximately 2.5 m AOD.

21.5.16 The flood defences near the Application Site are currently being improved by a series of schemes, as described in **Section 21.6**.

21.5.17 The projected sea level anomaly data, compared to the 1981 – 2000 baseline, off the Boston Coastline were obtained from the UKCP18 database, and displayed in **Table 21.18** (Met Office, 2018).

Table 21.18 UKCP18 Sea Level Anomaly Data at the Site for 2050

RCP	Sea Level Anomaly (m)		
	5% Probability Scenario	50% Probability Scenario	95% Probability Scenario
2.6	0.161	0.231	0.325
4.5	0.176	0.247	0.345
8.5	0.205	0.289	0.392

21.5.18 The data in **Table 21.18** highlights that the Sea Level Anomaly off the Boston coastline would increase by 0.161 – 0.392 m, depending on the RCP and probability scenario.

Summary of Projected Climate Change Hazards

21.5.19 The UKCP18 data shows that the main climate hazards over the operational lifespan of the Facility are likely to be:

- An increase in temperature at the Application Site;
- An increase in drought conditions; and
- An increase in flood risk through a higher risk of hazardous precipitation events causing surface water flooding events and storm surges resulting in tidal flooding.

21.6 Potential Impacts

Potential Impacts during Construction

GHG Assessment

21.6.1 As detailed in **Section 21.4**, a calculation of construction phase GHG emissions will be carried out at the ES stage, which will account for the following activities:

- the use of dredgers within the Haven;
- operation of construction plant and equipment; and
- the use of generators to provide power to the construction site.

21.6.2 Emission factors will be derived from the most relevant sources, including the BEIS database (BEIS, 2018b). GHG emissions arising from the movement of dredgers will be carried out in accordance with GloMEEP and IAPH guidance GloMEEP & IAPH, 2018).

CCR Assessment

21.6.3 **Section 21.5** identified the main climate hazards with the potential to impact upon

the Facility are likely to be an increase in temperature, flood risk and drought conditions at the Application Site. The construction phase is anticipated to be 36 months, commencing in 2021. Given the timescales over which the climate changes, there is not anticipated to be any significant effects of projected climate change of the site to construction activities.

21.6.4 Following implementation of the surface water drainage scheme in the enabling works, there is anticipated to be a negligible effect on the risk of surface water flooding, as detailed in **Appendix 13.2 Flood Risk Assessment**.

Potential Impacts during Operation

GHG Assessment

21.6.5 Predicted (gross) GHG emissions from each assessment scenario, in accordance with the methodology in **Section 21.4** are provided in **Table 21.19**.

Table 21.19 Predicted Annual GHG from Each Scenario

Scenario	GHG Emission Source	Annual CO_2eq Emissions (Tonnes)
Scenario 1	Landfilled Waste	534,685
Total for Scenario 1		**534,685**
Scenario 2	Landfilled Waste	267,343
	Marine Vessel Movements	5,902
	European Energy from Waste Facility	227,000 (as CO_2)
Total for Scenario 2		**500,245**
Scenario 3	Marine Vessel Movements	8,003
	Road Traffic Movements	821
	On-Site Construction Plant	4,699
	Gasification Process	585,488 (as CO_2)
Total for Scenario 3		**594,311**

21.6.6 Scenario 2 has the lowest overall GHG emissions, but does not include GHG emissions from road traffic, on-site plant or any energy consumption at the Facility where it is processed.

21.6.7 Predicted gross GHG emissions associated with operation of the Facility are anticipated to be 594,311 tonnes per year. The Facility is anticipated to provide 80 MW to the National Grid, which will displace energy generated from other sources within the UK. Based on the current carbon intensity of the UK's energy market, this has the potential to displace over 175,000 tonnes of CO_2eq from

elsewhere within the UKs energy generation sector. Emissions will be avoided from elsewhere in the supply chain and wider waste management and aggregate systems, and a more complete assessment of this will be presented in the ES.

21.6.8 Based on professional judgement at this stage, the GHG contribution from the operation of the Facility is not considered to be a significant increase in terms of national emissions.

CCR Assessment

21.6.9 As detailed in **Section 21.5**, the main climate hazards over the anticipated operational lifespan of the Facility are likely to be an increase in temperature, flood risk and drought conditions at the Application Site. These climate parameters are considered further below.

Temperature

21.6.10 The Facility is considered to have a high exposure to ambient temperature increases, although a **low** sensitivity to any such climatic change. Overall the Facility is assessed to have a **low** vulnerability to air temperature changes over its lifetime.

21.6.11 Given the vulnerability rating of the Facility is **below medium**, an assessment of the predicted effects and associated risks of an increase in temperatures at the Facility was not carried out.

Drought Conditions

21.6.12 RDF will be delivered to the Application Site via cargo vessels to the new wharf which will be constructed as part of the Facility. As The Haven is tidal, there are not anticipated to be any significant effects associated with an increase in drought conditions disrupting the supply of RDF to the Facility. As such, the exposure to drought conditions of the Facility is considered to be **low**, and the sensitivity **moderate**. It was therefore determined that the Facility has a **low** vulnerability to drought conditions.

21.6.13 The impacts and associated risks of an increase in drought conditions were not carried out and are considered to be scoped out of assessment at the ES stage, since the vulnerability rating was identified as **lower than medium**.

Flood Risk

21.6.14 Climate change may exacerbate the risk of flooding in the Application Site by an increase in tidal water levels and an increase in the duration and intensity of rainfall events likely to affect surface or tidal water flooding.

21.6.15 As discussed in **Appendix 13.2 Flood Risk Assessment** and **Section 21.5**, the highest source of flooding to the Application Site is likely to be tidal flooding from The Haven. The Application Site is located along part of the frontage included within the Haven Banks flood defence improvement works and the Boston Combined Strategy, which will ultimately provide Boston with a 1 in 300 year standard of protection. Improvement works associated with the Haven Banks project are likely to be constructed along the frontage in front of the Application Site prior to the commencement of operations at the Facility.

21.6.16 Given the geographic location and proximity of the Facility to a tidal waterbody, it is considered that the exposure of the Facility to increased flood risk is **high**, and has a sensitivity of **moderate** to increasing flood risk. The overall vulnerability rating for the Facility in terms of flood risk is therefore considered to be **medium**.

21.6.17 As a result of the **medium** vulnerability rating identified, flood risk hazards and the risk this poses to the Facility will be progressed to Stages 3 and 4 of the CCR assessment. However, as the design of the Facility and the mitigation measures to be implemented are still being developed, an assessment of the predicted effects and associated risks of an increase in flood risk at the Facility has not been carried out. This will be presented at the ES stage.

Mitigation

Additional Mitigation

GHG Assessment

21.6.18 No additional mitigation measures beyond the embedded mitigation set out within the above section are considered necessary, as the Facility is considered not to have a significant net impact upon the UK's climate change emissions or ability to meet currently-identified carbon budgets.

CCR Assessment

21.6.19 With the implementation of a surface water drainage strategy, the risk of surface water flooding over the lifespan of the Facility is considered to be **low**. Should there be a storm surge forecast or flood warning issued, an emergency flood warning and evacuation plan will be implemented, which identifies area of safe refuge.

21.6.20 With inclusion of the measures detailed above, the effects of projected climate change to flood risk at the site is considered to be lower than without implementing such mitigation measures. It is recommended that, despite the anticipated lower impacts from increased risk of flooding, an assessment of risk and overall significance of impacts from increase flood risk upon the Facility is undertaken at

the ES stage.

21.7 Cumulative Impacts

21.7.1 The global atmosphere is the receptor for the GHG assessment, therefore there are no common receptors between this assessment and other disciplines considered in the PEIR. GHG emissions have the potential to contribute to climate change, and therefore the effects are global and cumulative in nature. The GHG assessment is therefore considered to be inherently cumulative.

21.8 Inter-Relationships with Other Topics

21.8.1 This chapter has inter-relationships with the following chapters:

- **Chapter 12 Terrestrial Ecology**;
- **Chapter 13 Surface Water, Flood Risk and Drainage Strategy** (and **Appendix 13.2 Flood Risk Assessment**);
- **Chapter 14 Air Quality**;
- **Chapter 17 Marine and Coastal Ecology**; and
- **Chapter 19 Traffic and Transport**.

21.9 Summary

21.9.1 A preliminary GHG assessment was undertaken to consider gross GHG emissions from the Facility, compared with potential existing waste disposal routes (two alternative baseline scenarios were considered). The results of the assessment highlighted that the operation of the Facility would have an increase in local GHG emissions, but the net contribution to regional and national emissions will be presented in the final ES.

21.9.2 The impacts of the assessment are summarised in **Table 21.20** below.

Table 21.20 Impact Summary

Potential Impact	Receptor	Value / Sensitivity	Magnitude	Significance	Mitigation	Residual Impact
Operation						
GHG emissions from the Facility	Global atmosphere	The assessment approach does not consider the sensitivity of the receptor, which is the global atmosphere.	N/A	Not likely to represent a significant net CO_2 emissions contribution	The Facility represents an opportunity to increase renewable energy generation and avoid emissions associated with current 'baseline' operations.	Not significant
Impact of climate change on the Facility	The vulnerability of the Facility and associated infrastructure to increased flood risk as a result of potential climate change.	The Application Site is considered to have a high sensitivity	Moderate risk	To be addressed at the ES stage		

21.10 References

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