REPORT

Boston Alternative Energy Facility - Preliminary Environmental Information Report

Chapter 5 Project Description

Client: Alternative Use Boston Projects Ltd

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5.1 Site Location

5.1.1 The Application Site for the Boston Alternative Energy Facility (hereafter referenced to as 'the Facility') is located approximately 2 km to the south east of Boston town centre (NGR TF339424) as shown on **Figure 1.1**. The Application Site is neighboured to the east by the Riverside Industrial Estate and to the west by The Haven, a tidal waterway of the River Witham between The Wash and the town of Boston. The A16 public highway is approximately 1.3 km to the west.

5.1.2 By road, the Application Site is accessed via the Riverside Industrial Estate's existing road network from Nursery Road. Access to the site from the west to Marsh Lane is gained from Bittern Way.

5.1.3 The Boston Biomass UK No.3 Ltd gasification plant, presently constructed but undergoing commissioning, is located on the eastern boundary of the Application Site, and a waste management facility (operated by Mick George) which processes construction and demolition waste is located to the east of Nursery Road and west of the Application Site.

5.1.4 A Household Waste Recycling Centre (HWRC) (built in 2018) is located to the west of the Application Site, south of the junction with Nursery Road/Callen Road. Public access to the HWRC is from Bittern Way.

5.1.5 A Waste Transfer Station (WTS) operated by Lincolnshire County Council (LCC)[1] is located to the south of the Application Site, off Slippery Gowt Lane.

5.2 Site Description

5.2.1 The Application Site comprises undeveloped and previously developed land enclosed by a network of drainage ditches and forms part of a wider emerging industrial/commercial area.

5.2.2 The eastern site margins are defined in part by a flood defence bank along The Haven. Large and small industrial business units are located to the north, west and south of the site. A 132 kV overhead powerline on pylons traverses the site from north to south and bisects the Application Site.

[1] The WTS receives all of the residual household waste from Boston Borough Council (BBC) and South Holland District Council (SHDC) areas, and some residual household waste from East Lindsey Council area. This waste is bulked and transferred to the North Hykeham energy from waste incineration facility (Lincoln).

5.2.3 There are several public rights of way that cross the Facility area. The Boston Public Footpath No.14 starts in Boston and follows the A16 (London Road) south over The Haven and merges with the existing footpaths along The Haven (BOST/14/12, BOST/14/2, BOST/14/4, BOST/14/5 and BOST/14/7). Footpaths BOST14/4 and BOST14/5 follow the crest of the primary flood bank that routes in parallel to The Haven. Footpath BOST/14/11 and BOST/14/9, follow the route of Roman Bank (also known as 'Sea Bank'), which continues south from the Application Site.

5.2.4 The part of the Application Site which will accommodate the wharf is approximately 750 m downstream from the existing Port of Boston (measured from the entrance to the impounded basin, the Wet Dock, to the approximate centre of the site).

5.2.5 The Haven is contained within flood banks (in good condition) within the site boundary at approximately 6.3 m Above Ordnance Datum (AOD). Typical dimensions across the River directly to the east of the site, are as below and illustrated in **Plate 5.1**:

- From the edge of the flood defence to the centre of the channel – 80 m
- Width of base of channel – 20 m
- From edge of flood defence to Mean High Water Spring (MHWS) – 30 m

5.2.6 The navigation channel is not dredged at this point. The bed level changes over time. Under normal conditions it gradually silts up, but erodes when large water volumes are discharged from the sluices upstream. This will not occur at high tides, so will not affect vessel manoeuvring.

5.2.7 A water main runs across the Application site from Bittern Way to the north-eastern corner of the Application Site where it then crosses the river. This will be avoided by the proposed marine facilities. The water main will be diverted. This is subject to a separate application to Anglian Water on behalf of the landowner. The route of the diversion will be determined in accordance with advice provided by Anglian Water. The diversion will be completed before construction of the Facility.

5.2.8 There are no existing buildings within the site that will require demolition.

5.2.9 The site is located within National Character Area 46: The Fens (Natural England, 2013), the Reclaimed Saltmarsh Landscape Character Type and Welland to Haven Reclaimed Saltmarsh Landscape Character Area (LCA) (ECUS Ltd, 2009). However, the area is significantly influenced by urban/industrial features including electricity pylons, industrial units, cranes and gantries at the Port of Boston.

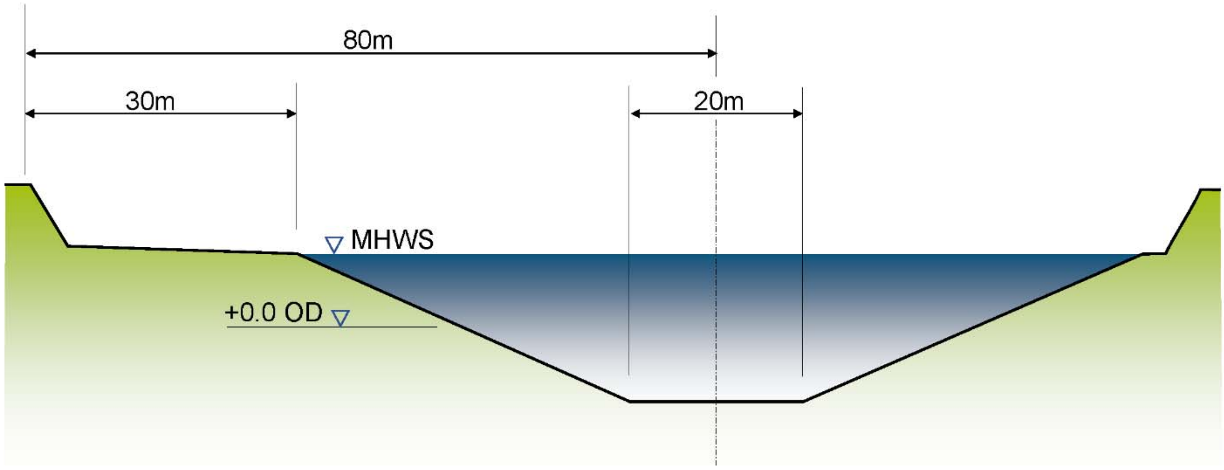

Plate 5.1 Indicative cross section through river to the east of the site. Note that vertical scale is different to horizontal.

Local Plan Allocation

5.2.10 Policy SL3, of the Lincolnshire Minerals and Waste Local Plan (Site Locations) December 2017, identifies the 119 ha Riverside Industrial Estate as an allocated area, referenced as WA22-BO. The allocated area has been identified as a suitable location for waste management related development (Resource Recovery Park, Treatment Facility, Waste Transfer, Materials Recycling Facility, Household Waste Recycling Centre, Metal Recycling/End of Life Vehicles, Re-Use Facility, C&D Recycling, Energy Recovery).

5.2.11 The Application Site is located within the allocated area.

5.2.12 Further detail on the allocation of the land is addressed in **Chapter 3 Policy and Legislative Context**.

5.3 Overview of the Development

5.3.1 The proposed Facility will deliver approximately 80 MWe of renewable energy to the National Grid using Refuse Derived Fuel (RDF) as a feedstock into a gasification facility generating power via steam turbine engines. This technology provides significant environmental benefits compared to landfilling residual waste and contributes to Government sustainable energy targets to achieve an 80% reduction in carbon emissions by 2050.

5.3.2 The Facility comprises the following main elements:

- A wharf and associated infrastructure (including re-baling facility, workshop, transformer pen and welfare facilities);

- A RDF bale storage areas, including sealed drainage, with mobile plant for transferring bales;
- Conveyor system between the RDF storage area and the RDF feedstock processing plant part of which is open and part of which is under cover (including thermal cameras);
- RDF feedstock processing building and associated infrastructure (including photo-voltaic roof panels, conveyor system to storage silos, fines de-stoning plant, water tanks and transformer pen);
- Processed RDF storage silos and ‘metered’ conveyor system into the gasification plant and liquid nitrogen silos;
- Gasification plant comprising three 34 MW_e gasification lines and associated ductwork and piping, transformer pens, diesel generators, stack, ash silos and ash transfer network; and air pollution control residues (APCr) silo and transfer network);
- Turbine plant comprising three steam turbine engines, make-up water facility and associated piping and ductwork;
- Air-cooled condenser structure, transformer pen and associated piping and ductwork;
- Lightweight Aggregate (LWA) manufacturing plant comprising four kiln lines, two filter banks with stacks, storage silos for incoming ash, APCr, and binder material (clay and silt), a dedicated berthing point at the wharf, silt storage and drainage facility, clay storage and drainage facility, LWA workshop, interceptor tank, LWA control room, aggregate storage facility and plant for loading aggregate / offloading clay or silt;
- Electrical export infrastructure;
- Carbon dioxide (CO_2) recovery plant and associated infrastructure, including chiller unit; and
- Associated site infrastructure, including site roads, pedestrian routes, car parking, site workshop and storage, security gate, control room with visitor centre and site weighbridge.

5.3.3 Details of additional supporting infrastructure are provided in the descriptions of each element provided in subsequent sections of this chapter. A schematic drawing of the Facility is provided in **Plate 5.2**.

5.3.4 The construction period for the whole development is anticipated to be between 42 to 48 months.

5.3.5 The Facility will be designed to operate for an expected period of at least 25 years, after which ongoing operation will be reviewed and if it is not appropriate to continue operation the plant will be decommissioned. The wharf structure will replace a section of the current primary flood defence bank (without impacting on the integrity of the bank) and will form a permanent structure that is not anticipated to be decommissioned.

5.3.6 The Facility will comprise a range of buildings and structures, shown on the site layout plan (**Figure 5.1**[2]), the tallest of which are the gasification plant exhaust stack and the two proposed LWA plant stacks which are each anticipated to be approximately 70m. The approximate maximum heights of the main buildings are as follows:

- RDF feedstock processing plant: 25 m;
- Processed RDF storage silos: 31 m;
- Gasifiers: 36 m;
- Turbine Hall: 20 m;
- Air-cooled condensers: 30 m;
- Lightweight Aggregate (LWA) manufacturing plant: 45 m; and
- Carbon dioxide (CO_2) recovery plant: 13 m.

[2] *The stack height of the gasifier and the lightweight aggregate plant is not available for this site layout plan.*

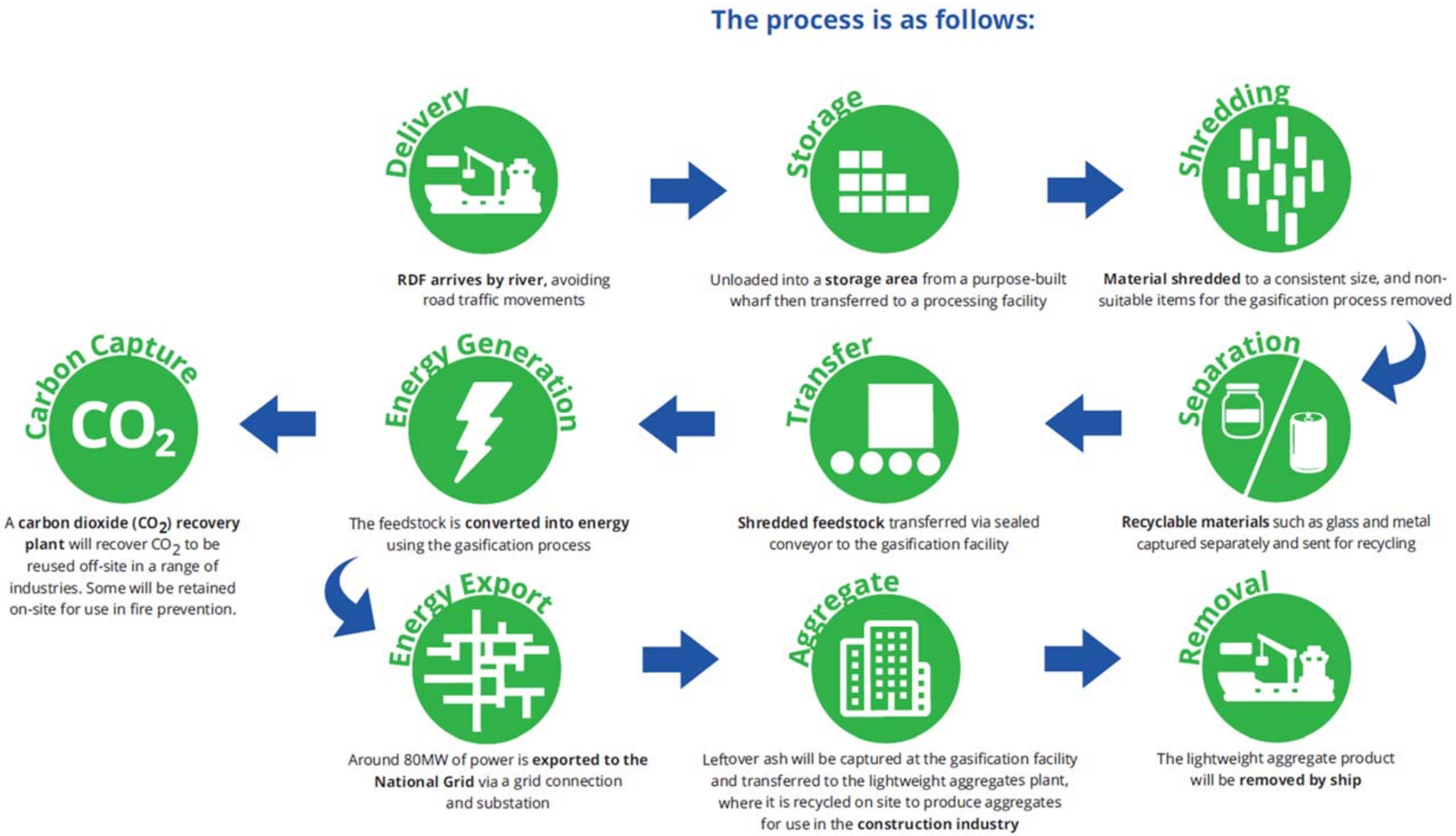

Plate 5.2: Schematic of the Facility

5.4 Construction of the Proposed Development

Introduction

5.4.1 The overall construction period is assessed as being no greater than 48 months, from 2021 to 2025. It is expected that there will be between 250-300 construction workers at peak construction. Construction activities would take place six days a week (Monday to Saturday) between 8am and 8pm (with an option of 7am to 7pm), with no bank holiday or public holiday working.

5.4.2 An outline of the construction traffic programme is discussed in **Chapter 19 Traffic and Transport** and shown in **Appendix 19.2**.

5.4.3 The ES will provide further details of the proposed construction activities and their anticipated duration, along with an indicative programme of the works.

5.4.4 Details of construction phasing and proposed construction methods are being finalised. An outline Construction Environmental Management Plan (CEMP) will be prepared and submitted with the DCO application. This will set out principles, controls and management measures to be implemented during the construction phase to manage potential significant effects.

5.4.5 Contracts with companies involved in the construction works will incorporate environmental control measures, health and safety regulations and current guidance with the intention that all contractors involved are committed to agreed best practice and meet relevant environmental legislation.

5.4.6 It is anticipated that temporary construction laydown areas will be required for the construction of the Facility. These areas are shown on **Figure 5.1**.

5.4.7 All construction works will adhere to the Construction (Design and Management) (CDM) Regulations 2015 (HMSO, 2015).

5.4.8 A brief overview of the construction of the Facility is outlined below.

Site Preparation

5.4.9 There is a water main which goes through the middle of the proposed site. A current and separate application has been submitted to the relevant water company (Anglian Water) to divert the main.

5.4.10 To provide a sewerage system for use in both construction and operation, it is proposed that foul drainage would be collected through a new mains connection to the existing sewer system which serves the industrial estate on the northern boundary. To facilitate this, there will be a spur constructed from the main sewerage line to the site, the proposed route of this will follow advice given by Anglian Water.

5.4.11 Top soil will be removed across the site and the site will be graded using imported stone. The proposed cut and fill balance for the site is to be determined.

5.4.12 Laydown areas will be prepared for the storage of plant components and equipment and office use (portacabins) in construction. Fencing will be erected around the site (an estimated fence distance of 4 km).

Wharf

5.4.13 The wharf would be built, replacing sections of the current flood defence bank and will comprise the quay wall, the main area of the wharf (which will provide the flood defence line), and an area behind the wharf for associated infrastructure, such as the re-baling facility, workshop, transformer pen and welfare facilities.

5.4.14 The wharf facility would include a berthing pocket to allow ships to safely dock at the wharf without restricting the navigable channel of The Haven. The berthing pocket would be constructed by dredging and excavation of the mud flats and land to the edge of the proposed wharf. Most of these construction works would be carried out by land-based equipment, although some floating plant may be required to complete the excavation of the berthing pocket towards the edge of the main channel, due to the distance from the wharf edge (up to 50 m).

5.4.15 The deck structure would be constructed by first driving the piles and then constructing the deck. The Contractor would work from the shore outwards, using the installed piles as part of the temporary works for construction of the structure further offshore.

5.4.16 The deck would be constructed of concrete precast beams and deck slabs, tied together with *in-situ* concrete. Slope protection would be provided.

5.4.17 The area behind the wharf would be consolidated with a suitable specification of fill material. If necessary, it would be surcharged to reduce post construction settlements. Prefabricated vertical drains (PVDs), if required, would be installed in the first stage.

5.4.18 Once the ground improvement is complete, the surcharge would be removed and the retaining wall constructed.

5.4.19 The construction of the wharf is anticipated to take approximately 15 to 18 months.

5.4.20 The estimated quantities associated with construction of the wharf are provided in **Table 5.1** below:

Table 5.1 Wharf Estimated Quantities

Item	Indicative Quantity
Dredging of channel	150,000 m^3
Fill required	7,000 m^3
Piles for suspended deck	300 no.
Concrete for suspended deck	7,000 m^3
Slope protection	10,000 m^2

RDF Storage Area

5.4.21 The RDF storage area would be constructed as a sealed concrete pad with a sealed drainage system.

Fuel Conveyors

5.4.22 The fuel conveyors will be constructed in two phases. During Phase 1 the turntable house (shown at the right angle of the conveyors in **Figure 5.1**) will be piled and erected. Following this the east to west conveyor will be erected, then the inclined conveyors will be erected to +6 m. Steelwork and the roof of the covered conveyor would then be erected. Conveyor units and turntables will be installed following this. During Phase 2 the south to north steelwork, conveyor units and conveyor modules would then be installed.

Silos and RDF feedstock processing plant

5.4.23 The silo bases will be piled and concrete poured for the base and then the silos will be constructed via slip forming concrete. Slip forming is a continuous process and 24 hour working is required for this. Roofs will be constructed and lifted onto the silos. The six silos will be constructed in pairs taking approximately 35 days per pair.

5.4.24 Following construction of the silos the RDF feedstock processing plant will begin construction. Foundations would be piled and concrete poured to form the hall base. Once lines one and two of the processing plant have been delivered to site it will take approximately 120 days to erect and install. Following this, lines three and four will be erected and wired (around 80 days). Lines five to eight will follow the same process. The building will be completed with an internal ventilation and fire systems. Following delivery of the conveyor this will be wired which will take approximately 5 months. Commissioning would take around 100 days. Overall from piling to commissioning will take approximately 28 months.

Gasifiers

5.4.25 The three gasifiers are proposed to have staggered construction start dates. Line 1 (western most gasifier), would begin first, followed by line 3 (eastern most gasifier) approximately 2 months later and line 2 approximately 1 month after that. The main parts of each gasifier will be constructed in the following order:

- Gasifier installation;
- Boiler installation;
- Scrubber installation;
- Bag filter installation;
- Flue gas installation;
- Piping installation; and
- Wiring and insulation installation.

5.4.26 Following installation there will be cold commissioning for around four months, after which there will be a stage of de-snagging before hot commissioning for another four months (approximately) with another period of de-snagging for each line after this.

5.4.27 Overall from the beginning of line one to the end of commissioning and de-snagging, construction of the three lines of gasification plant would take approximately 43 months.

Lightweight Aggregate Facility

5.4.28 Foundations for the lightweight aggregate facility building will be piled before the base slab is cast. The four kilns will be produced off-site and then transferred. The lightweight aggregate forming equipment will then be procured and transferred to site. The four lines would then be erected on individual steel structures over approximately four months. Finally, there would be installation of wiring. Overall, the LWA facility would take approximately 19 months to be constructed.

Power Export Island

5.4.29 The infrastructure for the power export island would be designed, procured, manufactured and the transformer factory acceptance tested off site before being transferred to site. The power export island will then be installed at site and an additional pylon erected. There would be a period of testing on site before connection to the grid after approximately 20 months.

Construction Phase Lighting

5.4.30 Construction phase lighting shall be designed, installed and controlled to limit any potential impact upon the surrounding area by minimising sky glow, glare and light spillage. Lighting would be installed to comply with the following regulations, standards and guidance documents, including:

- Lighting at Work, HSG 38, Health and Safety Executives Books Publication;
- Lighting Guides, LG1 and LG6 published by the Chartered Institution of Building Services Engineers; and
- Light and lighting – lighting of work places. Outdoor work places, BS 12464-2.

5.4.31 Luminaires to be mounted on any lighting columns would be of flat glass construction with 0-degree tilt to minimise any potential glare, sky glow and obtrusive light to the surrounding areas.

5.4.32 The use of mobile lighting taller than the fixed lighting columns shall be minimised and not be operated outside of normal construction hours.

5.5 Detailed Description of the Operation of the Proposed Development and Facility Processes

Introduction

5.5.1 This section describes each element of the Facility in terms of operation, ordered following RDF flow through the Facility.

5.5.2 The Facility is proposed to operate 24 hours a day, seven days a week, and expected to commence operation in 2025. There would be approximately 80 permanent workers employed at the Facility.

Refuse Derived Fuel Supply

5.5.3 The Facility would receive approximately 1,300,000 tonnes of RDF per year.

5.5.4 The RDF feedstock would be delivered by ship to the Facility sealed in plastic-wrapped bales. The bales will be wrapped by the supplier who will pre-screen the feedstock prior to baling to ensure that no unacceptable material (for example hazardous waste or gas cannisters) is baled.

5.5.5 The RDF will be sourced from UK suppliers and comprise ‘black bag’ waste collections from householders. The Facility will not divert any source-segregated or co-mingled recyclate from being recycled.

5.5.6 The material would be dispatched to the Facility from ports most likely located on the East coast of the UK. The source ports are likely to be one from Scotland (for example Leith); one from the northern or central area of England (for example Grimsby); and one from the south-east of England (for example Tilbury). The specific departure locations will be dictated by market conditions at the time of supply. No RDF feedstock would be imported to the Facility from overseas.

5.5.7 The bales will be labelled to identify the source of the RDF and the location and date of baling. The label will be clearly displayed on each bale.

5.5.8 The bales will be loaded onto ships at the departure points using grab-cranes. If a bale is damaged during loading, it will be removed prior to departure and re-baled and wrapped. No damaged bales will be dispatched to the Facility.

5.5.9 The bales will be brick-shaped and have an approximate volume of 1.85 m^3, weighing approximately 1.3 to 1.5 tonnes. Dimensions will vary according to the composition of the RDF and source location, but typical dimensions are presented in **Table 5.2**.

Table 5.2 Typical Dimensions for the RDF Bales

Size of RDF bales (m^3)	1.85
Length of RDF bales (m)	1.4
Width of RDF bales (m)	1.2
Height of RDF bales (m)	1.1
Minimum weight of RDF bales (tonnes)	1.3
Maximum weight of RDF bales (tonnes)	1.5
Design weight (tonnes)	1.4

5.5.10 There will be up to nine RDF deliveries by ship per week. The vessels are anticipated to have typical dimensions as detailed in **Table 5.3**, however, this will be directed by the market forces and the shipping fleet operator.

Table 5.3 Proposed Vessel Size and Capacity

Minimum Draught (m)	3.5
Maximum Draught (m)	4
Minimum Length (m)	90
Maximum Length (m)	100
Minimum Beam (m)	13
Maximum Beam (m)	15
Capacity of RDF bales (tonnes)	2,500

Wharf

5.5.11 The proposed new wharf (set out in **Figure 5.2**) would provide accessibility between the Facility and incoming and outgoing ships via The Haven and The Wash, enabling delivery of RDF feedstock and sediment and clay (both of which can be used as binder material in the manufacture of the lightweight aggregate plant); and the dispatch of lightweight aggregate. Using ships to transport materials would significantly reduce the operational impact of the Facility on the local road network.

5.5.12 The proposed wharf comprises a 400 m long docking facility, loading and offloading equipment and access / egress ramp. The wharf would have two berths for receiving RDF feedstock, and one berth for loading aggregate and receiving sediment and clay (which are required by the LWA plant).

5.5.13 Arriving vessels must navigate up The Haven to the proposed berth over high tide and leave over the next high tide. A Navigation Risk Assessment will be provided in the ES following consultation with relevant stakeholders, including Port of Boston (a preliminary assessment has been provided in this PEIR, see **Chapter 18 Navigational Issues**).

5.5.14 It is anticipated that vessels will be turned at the Port of Boston, either at the ‘Knuckle’ point turning circle outside of the Wet Dock, or within the Wet Dock. The vessels could be turned on arrival or departure, taking account of advice from the Port of Boston Harbour Master.

5.5.15 The berths at the proposed wharf will allow vessels to sit on the bed of the river at low tide whilst waiting for the next high tide because there is insufficient water depth at low tide to float (NAABSA, ‘Not Always Afloat But Safe Aground’, berths).

5.5.16 The berth points for the proposed wharf would be set parallel to the waterway, but set back in the berthing pocket to maintain a safe distance from passing vessels.

5.5.17 Bales would be removed from the ships by hydraulic cranes equipped with clamps. The bales will be transferred to stockpiles by forklift or trailer to the temporary storage area pending processing.

5.5.18 If a bale is observed to be damaged in the hold of the ship, it would not be brought to shore and would be left in the hold and returned with the ship. This is to prevent litter from a damaged bale potentially falling or being blown into the river during unloading.

5.5.19 The LWA plant will require a binder material as part of the process. This material would be clay (likely to be sourced from south-east England) and maintenance dredged material from the river.

5.5.20 The outbound quantity of aggregate is dependent upon the efficiency of the gasification process and is dictated by the quantity of ash and Air Pollution Control (APC) residues produced, and is likely to fluctuate. For a design reference point, it is anticipated that approximately 248,000 tonnes of LWA would be produced from ash residues, and 63,500 tonnes from APC residues. Therefore, 104 ships bearing approximately 3,000 tonnes of aggregate per load would be required to export this material from the Facility. This is equivalent to approximately two ships per week.

5.5.21 In total approximately 624 ships per year, or 12 per week, would be required by the fully operational Facility.

Temporary RDF Storage Area

5.5.22 The RDF bales will be transferred to a temporary storage area and stacked in stockpiles pending transfer to the feedstock processing facility.

5.5.23 The storage area would be surfaced with hardstanding and include a sealed drainage system. The surface would be graded to flow to the sealed drainage. Water collected from the sealed drainage system would be used in the LWA.

5.5.24 The temporary RDF storage area will be in the open and accommodate approximately four days of feedstock (approximately 12,600 tonnes).

5.5.25 If a bale is damaged when the bale is loaded onto the wharf, it will be immediately transferred to a covered damaged bale storage area (30 m long, 15 m wide and 4 m to eaves). The damaged bale would then be re-baled in the covered baler shed (24 m long, 8 m wide and 4 m to eaves) then replaced to the appropriate stockpile in the temporary RDF storage area.

5.5.26 There are not anticipated to be significant odour issues when the RDF is temporarily stored because the bales are tightly wrapped in plastic and are only stored for a short period. Any bales that are damaged whilst in storage would be immediately removed to the baler shed as described above.

5.5.27 The RDF stockpiles will be managed so that they are compliant with the Environment Agency's guidance on Fire Prevention Plans (FPP). An outline of the draft FPP will be submitted with the final Environmental Statement (ES). For the feedstock piles, the maximum height allowed is 4 m and the maximum length or width allowed is 20 m. The maximum stockpile volume will be 450 m^3. A minimum separation of 6 m must be in place between stockpiles, the site perimeter, buildings and any other combustible materials.

5.5.28 The bale stockpiles will also be monitored for temperature using probes. Any bales that are found to be hot would be removed to the quarantine area. This process will be described in detail in the FPP and is summarised below.

5.5.29 A quarantine area will be provided in the damaged bale store. This is required as a temporary storage area for any prohibited waste that has been detected at the Facility. It will also be used for temporary storage for any bale that has been detected to be 'hot'. In such cases, the bale will be carefully split open and allowed to cool. Quarantined material would be inspected and a decision taken regarding appropriate off-site disposal. The quarantine area will be large enough to hold at least 50% of the volume of the largest stockpile and there will be a separation distance of at least 6 m around the quarantine area from any other material, the site perimeter and buildings.

5.5.30 The temporary storage area will accommodate approximately 42 stockpiles to allow for four days of RDF supply being available. The RDF would be transferred for processing on a 'first in first out' basis. All bales will be processed in the feedstock processing facility within three months of first being baled and wrapped.

5.5.31 The bales would be removed from stockpiles by forklift or mobile crane with grab clamps that are able to manage two bales at once. The bales would be transferred onto a trailer for loading by crane onto the conveyor lines, which transport the bales to the RDF feedstock processing facility.

5.5.32 Thermal imaging cameras will be provided at the loading points on the conveyor to also monitor for 'hot' bales.

5.5.33 There would be ancillary infrastructure provided in the storage area, including welfare facilities for site workers and fuelling facilities for mobile equipment.

RDF Bale Conveyors

5.5.34 Two proposed parallel RDF conveyors approximately 600 m long will transport sealed bales from the temporary storage area to the RDF feedstock processing building.

5.5.35 The initial 190 m of the conveyor in the temporary storage area will be an open conveyor, which will then become covered and will follow an L-shaped route via a 90° turning point, running at approximately 2 m above ground level. Thermal cameras will be provided at the bale turning point.

5.5.36 The conveyor line will then ramp up over Roman Bank using a belt-conveyor to feed the RDF bales into the RDF feedstock processing building at a height of 6 m.

5.5.37 Thermal cameras will also be provided at the point of entry for the bales into the feedstock processing facility.

RDF Feedstock Processing

5.5.38 It is anticipated that approximately 20% of the composition of the RDF would be unsuitable for gasification (including metals, stones, glass, fines etc.). This would be segregated out in the RDF feedstock processing plant. Therefore, approximately 1,000,000 tonnes of processed RDF would be supplied into the gasifier each year.

5.5.39 The RDF feedstock processing building would measure approximately 130 m x 90 m x 20 m which will comprise of a two-span building with an apex roof containing photo-voltaic panels for additional energy use within the Facility.

5.5.40 The building will be able to accommodate and process approximately one day's worth of RDF feedstock pending transfer into the gasification plant. The feedstock processing lines are assumed to run for 8,000 hours per annum each, to allow for scheduled maintenance.

5.5.41 There will be eight processing lines within the feedstock processing building, with six lines in operation and two lines on standby to accommodate maintenance requirements.

5.5.42 The unit will operate in an enclosed environment using odour control measures to ensure no unacceptable odour is released. The building is kept under negative pressure to avoid odour escaping from it and is connected to the controlled air supply to the gasification unit (see below).

5.5.43 Four fast acting roller shutter doors would allow access into the unit for vehicles and maintenance.

5.5.44 The building will be suitably insulated to ensure no unacceptable noise levels are experienced outside the building (for operating plant noise assessment, see **Chapter 10 Noise and Vibration**).

5.5.45 The feedstock bales will be loaded into a primary shredder from the conveyor lines inside the building. The shredder will chop and shred the plastic wrap and the contents of the bale to a reduced maximum particle size of less than 100 mm in two dimensions with 90% less than 75 mm in two dimensions.

5.5.46 The shredded material will be passed through a fines screen to remove 'fine' material defined as less than 6 mm in any dimension. The fines will be removed to the fines de-stoning plant for sorting.

5.5.47 Each feedstock processing line employs a 'massive impact protection system', which removes material that is too bulky to be shredded, or material that may damage the shredding equipment. These are collected separately and removed from the feedstock processing building for assessment in accordance with the waste hierarchy to identify the most appropriate option for them.

5.5.48 Ferrous and non-ferrous metals would be removed from the feedstock by magnets and eddy-current separation respectively. These will be collected in separate skips at each processing line for recycling off-site.

5.5.49 Medium and heavy three-dimensional inert materials will also be removed to ensure a consistent feedstock specification that does not contain more than a total 2% by weight of non-combustible materials such as stones and glass.

5.5.50 The estimated quantities of segregated materials are:

- 33,000 tonnes of ferrous metals;
- 9,000 tonnes of non-ferrous metals (e.g. aluminium);
- Up to 120,000 tonnes of fines and lightweight inert material, e.g. glass, and approximately 90,000 tonnes of inert stones and other medium / heavy materials.

5.5.51 The fines are likely to contain some biogenic material that could be reprocessed as fuel – potentially up to 50%. This will be sorted in the fines de-stoning plant.

5.5.52 The segregated metal will be collected separately for removal by road to an off-site recycling facility in accordance with the waste hierarchy. There are several local options for metal recycling within the Riverside Industrial Estate.

5.5.53 The segregated fines and medium / heavy fraction will be sent to the fines de-stoning facility for further segregation into material that is suitable for recovery in the LWA plant and material that is not (for example hard stone and other dense material). Material that is suitable for the LWA plant will be transferred via sealed conveyor to storage silos at the LWA plant. Material that is not suitable will be assessed for potential off-site recycling opportunities in accordance with the waste hierarchy. There are several local options for recycling or recovery of inert material (see **Chapter 23 Waste).**

RDF Storage Silos

5.5.54 The processed RDF will be transferred via sealed conveyor to the storage silos.

5.5.55 There are six storage silos, each capable of storing approximately 48,000 m^3 processed RDF. The silos have an internal diameter of 25 m and are approximately 31 m tall.

5.5.56 The six silos are arranged in three pairs. Each pair will supply one gasification line.

5.5.57 The feedstock is transferred from the silos into the gasification plant via metered distribution using a first in first out process with a screw reclaimer.

Gasification Plant

5.5.58 Gasification is a process which converts a solid feedstock into a gaseous form for a more efficient power generation process. It does not involve direct combustion of the processed RDF feedstock; the Facility is not a traditional incinerator.

5.5.59 The proposed gasification plant is a three-line fluidised bed staged gasification (FBSG) plant with associated power station. The gasifier consists of a fluidised bubbling bed gasification area, bed recirculation and cleaning equipment.

5.5.60 The gasification plant would receive approximately one million tonnes of processed RDF, to generate approximately 102 MWe of renewable electricity. Some of the energy generated will be used to power the various elements of the Facility (‘parasitic load’). Approximately 80 MWe will be exported to the National Grid for distribution via a 132 kV grid connection point on-site.

5.5.61 Each gasifier would operate for 8,000 hours per year, with scheduled maintenance planned in for the gasifiers. Two lines would always be running when one is undergoing maintenance.

5.5.62 An indicative conceptual image of a gasification plant is shown in **Plate 5.3**.

Plate 5.3 Indicative Image of a Gasification Plant

Feeding System

5.5.63 The processed RDF feedstock would be transferred from the silos via metered bins. At each of the three gasifier units, four metering bins will feed to opposite sides of the gasifier (two on each side) which accurately measure the feed material and evenly distribute it across the fluidised bed to create good gasification conditions.

Fluidised Bed Gasification

5.5.64 In the fluidised bed gasification zone, the feedstock is broken down by the constantly moving sand. This hot (approximately 800°C) environment has limited oxygen so the solid fuel is not combusted and instead the volatile components of the solid fuel are converted into a synthesis gas (syngas), containing various hydrocarbons and carbon monoxide.

5.5.65 A gas monitoring system will adjust the feeding of limestone to the bed to control acidic components in the fuel, mainly sulphur, as well as injecting aqueous urea to suppress emissions of oxides of nitrogen (NO_x).

5.5.66 The bed sand grinds fuel particles until all the feedstock is vaporised. Ash from the feedstock is then carried by the fluidising air towards the flue gas cleaning section of the system (the cyclone). Incombustible solid particles like glass and metal are removed from the bed using an external vibrating screen.

5.5.67 All the extracted bed material can be recirculated; large inert particles are directed to the ash recovery system.

5.5.68 The size and heights of the gasification unit are detailed in **Table 5.4**. A concept image of the internal elements of the gasifier unit is provided in **Plate 5.4.**

Table 5.1 Gasification Unit Dimensions

Number of units	3
Power generation (MW per unit/hour)	34
Overall height of FBSG (m)	26
Height of gasifier (m)	30
Height of economiser (m)	29
Height of scrubber (m)	30

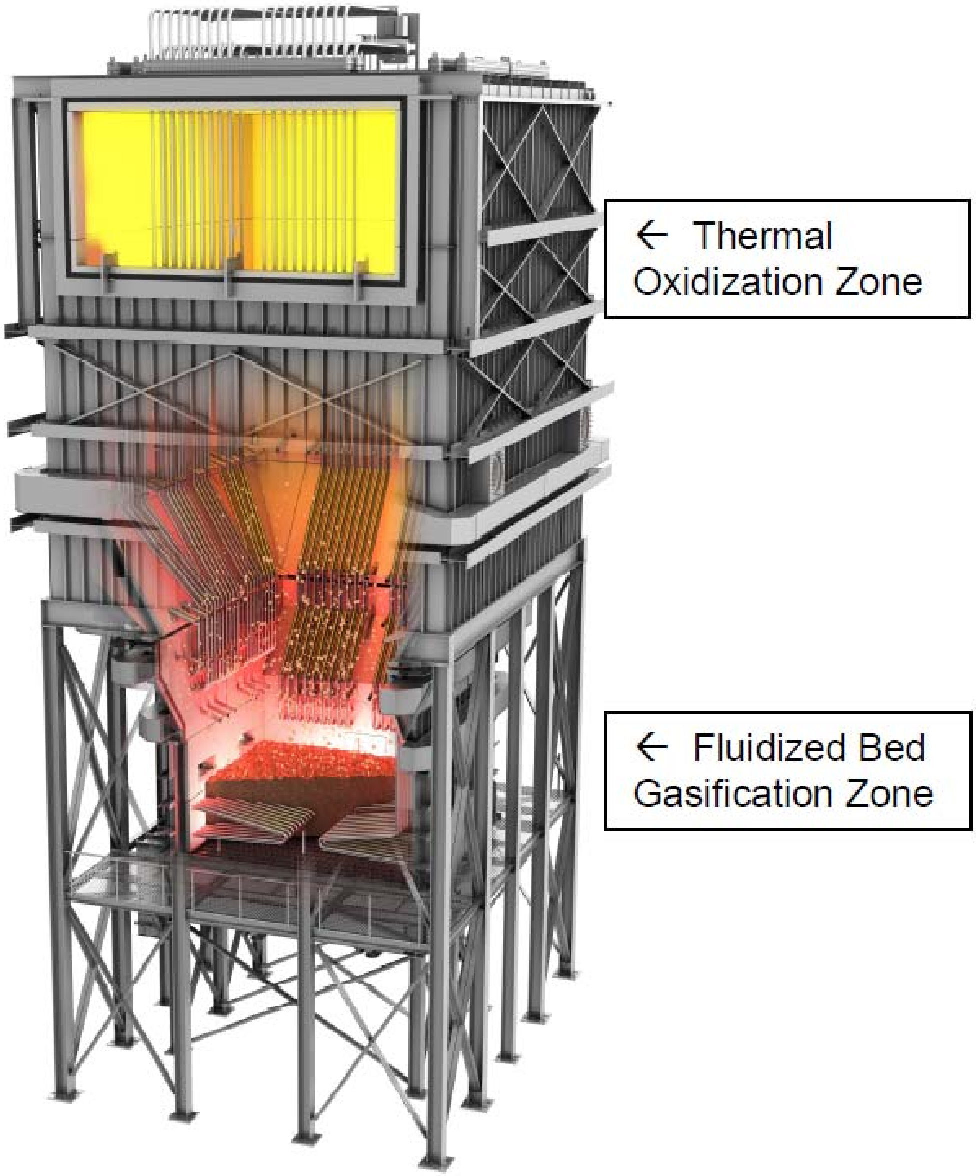

Plate 5.4 Concept Image of Internal Elements of the Gasifier

Heat Generation with Syngas

5.5.69 The syngas would flow to the thermal oxidation zone of the gasifier where a dedicated two-stage fan system injects air to the system, causing the gas to ignite. In the thermal oxidation zone, the oxidation reaction of the syngas increases the temperature of the gases to over 950°C, thermally breaking down potential contaminants. The hot combusted flue gas (comprising water vapour, air, carbon dioxide, and non-hazardous ash residue) would be routed to the boiler section of the plant for heat recovery.

5.5.70 A Selective Non-Catalytic Reduction (SNCR) system would be located in the upper vessel vapour space to provide further reduction of NO_x. Aqueous urea will be injected through multiple injection nozzles into the vapour space of the vessel, and air will be drawn into the system to provide additional cooling around the injection nozzles.

Steam Generation

5.5.71 Hot flue gases from the gasifier pass over multiple bundles of tubes that form a heat transfer surface to enable the release of heat to the water within, which turns into steam inside the tubes. The tube material, arrangement in the boiler and all other aspects of the boiler are purpose-designed to efficiently collect the heat from the syngas.

5.5.72 Steam generated in the boiler is superheated up to 400°C at 45-bar.

5.5.73 After the cyclone stage, the gases (approximately 350°C) pass through the economiser section of the boiler, releasing more heat to a recycling water section and increasing the efficiency of the system. Flue gas would flow downward so ash is captured and removed at the bottom of the unit; feedwater would flow upward to prevent steam bubbles from being trapped.

Flue Gas Treatment

5.5.74 The cooled gases leaving the economiser section of the boiler pass to the pollution control system in a spray tower where chemicals, typically hydrated lime and activated carbon, are injected into the gas flow to capture any residual emissions (heavy metals, sulphur dioxide, hydrogen chloride, particulates, etc.). The final treatment stage is a bag filter, which will filter the last ash / dust emissions from the combusted waste gas.

5.5.75 Air pollution control residues (APCr) would be collected in a hopper.

5.5.76 Induced draft fans will draw the cleaned gases to the stack, where an on-line Continuous Emission Monitoring System (CEMS) would provide continual monitoring of the exhaust gases to ensure the overall system is running well within the Industrial Emissions Directive (IED) emission limits. The height of the stack has been provisionally determined to be 70 m to ensure effective dispersion (see **Chapter 14 Air Quality**).

Electricity Generation

Turbines

5.5.77 There would be three steam turbines located in a single building, 53 m long, 40 m wide and 20 m high.

5.5.78 The generated steam would be routed to turbines where the hot high-pressure steam (approximately 400°C / 45bar) rotates the turbine shafts. These shafts will rotate electrical generators, delivering power to the 'power export zone'.

Air-Cooled Condenser

5.5.79 After the energy in the steam turbine is released for electricity production, the cooled steam would be routed to the air-cooled condenser. Condensed water is then pumped to the feed water tank, from where it is pumped back to the boiler via the economiser, closing the steam – water circuit.

5.5.80 The air-cooled condenser footprint would be 45 m x 65 m x 30 m high.

Ash Management

5.5.81 To remove ash from the gasification process some is carried away along with the combusted syngas. Some ash is collected in the boiler and a multiclone system removes ash particles from the gas stream before the economiser sections. Finally, ash is removed by centrifugal cyclones.

5.5.82 Ash cleaned from the tubes falls into hoppers and is continuously removed.

5.5.83 It is anticipated that less than 20% (estimated to be approximately 177,000 tonnes) of the annual input processed feedstock will become residual material to be removed from the gasifier. This will comprise two main types: the residual ash, which forms approximately 80% of the residual mass; and APCr, which form approximately 20% of the residual mass. The residual ash is classified as non-hazardous waste and APCr are likely to be classified as hazardous. Operational proportions will vary according to the nature of the feedstock.

5.5.84 Ash and APCr would be transferred separately from the gasifier to the LWA facility, as described below.

Lightweight Aggregate Plant

5.5.85 Residual ash and APCr would be processed on site to produce a marketable lightweight construction aggregate product. This would be exported via ship at a dedicated berth at the wharf. The ships that deliver clay as binder to the wharf can also be used to remove the aggregate. These ships would not be used for the incoming RDF supply.

5.5.86 The LWA plant is a high temperature kiln that will use the residues from the gasifier to produce a usable LWA product and additional heat, which will be used in the LWA process and also in the drying process in the fines de-stoning building. There will be one dedicated line in the LWA plant to produce aggregate using APC residues alone; and two dedicated lines to produce aggregate from the ash. One line would be held as redundancy to be used in the event of maintenance.

5.5.87 The LWA plant would have four lines, with a footprint of approximately 75 m by 40 m, and a dedicated berth on the wharf for loading the LWA product for export by ship to UK markets (location dictated by market forces). This berth will also be used for receiving binder material.

5.5.88 LWA has been manufactured since the 1930s utilising mainly bloatable clays, low carbon Pulverised Fuel Ash (PFA) (ash from coal fired power stations) and selected shales. The basic process is to form pellets and then sinter (melt) the material using a rotary kiln.

5.5.89 Traditional aggregate manufacturing processes are selective of the materials used. The LWA would incorporate a trefoil process. This process uses a triple-lobed (trefoil – see schematic in **Plate 5.5**) rotary kiln which enables a much wider range of materials to be used.

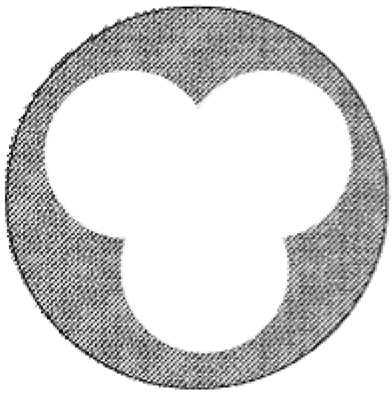

Plate 5.5 Schematic Image of Trefoil Kiln Shape

<u>Ash</u>

5.5.90 The main source material would be the residual ash from the gasification plant and the APC residues (processed in a different line to avoid mixing the two). These would be transferred from the respective ash and APC residue hoppers at the gasification plant in blown tubes to convey each residual stream separately to their individual silos on each LWA process line. Both streams would be separately mixed with a binder material in the trefoil process to form the aggregate.

5.5.91 Processing of the APC residues on site will remove the need for off-site disposal and associated vehicle movements, promoting both the waste hierarchy and the proximity principle (see **Chapter 23 Waste)**.

Binder Material and Mixing Water

5.5.92 Clay and / or silt would be used in the process primarily as a binder to give strength to the pellet, but it also sinters (i.e. compacts and forms the solid mass of material by heat or pressure without melting) to become part of the filler material in the fired aggregate.

5.5.93 Clay sourced from the south-east of England would be the primary binder source, delivered by ship.

5.5.94 Where silt is used, this will be from dredged material obtained from The Haven from maintenance dredging of the wharf berthing pocket, or from other maintenance dredging on The Haven (subject to the relevant permissions). The Port of Boston carries out maintenance dredging of The Haven (See **Chapter 18 Navigational Issues**).

5.5.95 Silt from dredging can be used as binder material for the LWA. The dredgings will be free drained prior to landing and are assumed to have no free water to drain under self-load. No more than 5% free draining water will be contained in acceptable silt on landing.

5.5.96 A free draining area would be constructed for freshly landed silt piles with integrated sumps with automatic pumps which will take all run-off water to collection tanks. This will be re-used within the LWA process for formulation mixing prior to formation of pellets and will minimise any fresh water requirements.

5.5.97 Sediment would also be dredged as part of the maintenance of the Facility's berth pocket. This would be carried out by crane from land. All run-off water would free drain under its own weight into an enclosed sump and be pumped into the holding tank before use in the LWA mixing process.

Pelletisation Process

5.5.98 The ash would be thoroughly mixed with binder material in accurately metered quantities. This mix is formed into pellets, with controllable variation in size between 4 mm and 20 mm.

5.5.99 The formed pellet will be dried before entering the kiln to prevent it from bursting. The rolling of an outer "egg shell" skin is an important part of the process. When pellets are dried they will usually shrink proportionally to the moisture content lost. With a successful "egg shell" rolled onto the pellet in a polishing drum (closing the outer pores of the green pellet) there will be virtually no loss in size when dried. This is important for both the looseness of compaction within the pellet (allowing easy access of combustion air) and it is the start of the formation of a lighter aggregate. The pellet will be dried from approximately 20% moisture to less than

3% moisture. This drying process will use heat energy recovered from the LWA process.

5.5.100 The dried pellets will be transferred to a pellet buffer prior to firing. The purpose of the storage is to enable immediate control over feed rate.

Firing

5.5.101 When entering the kiln zone, volatiles in the pellet mix are released. It is important to ensure that there is sufficient excess oxygen at this stage to allow the volatiles to combust in the kiln zone where the energy release will assist in the heating of the pellet rather than in the kiln ductwork. The incoming combustion air would be pre-heated using energy from the plant (i.e. from aggregate cooling and pellet dryer air).

5.5.102 The plant will operate in accordance with Best Available Techniques (BAT) and will be required to meet the standards of the IED. The exhaust emissions from the kiln will be held at a temperature of >850°C for a minimum of two seconds to ensure complete burn out. Following this, the exhaust gas would be rapidly cooled to prevent the formation of dioxins. Exhaust gases would be treated via an APC system to remove contaminants and will discharge to atmosphere via two stacks, following filtration in baghouses. Residues from the baghouse system would be recirculated back into the process, and the LWA Plant would operate in accordance with an Environmental Permit.

5.5.103 The aggregate product would be stored outside in bays pending transfer to ships via a dedicated berth at the wharf. A conveyor system would be used to move the product from the storage area to the vessel. The conveyor will be fed by a forward loading shovel via a hopper. The conveyor will move along the vessels and will be able to move vertically to reduce noise, dust and damage to the pellets.

Grid Connection

5.5.104 A grid connection point would be located within the Application Site to facilitate the net export of 80 MWe (and also an import of 5 MW) of electricity. The connection point and substation will be located in the south-east corner of the site. The grid connection infrastructure would include a primary substation to convert the site-produced power into the local 132 kV line. An additional overhead tower located in the south-east corner of the site may need to be constructed (by Western Power Distribution) to manage the connection to the grid system.

5.5.105 The electrification power output zone footprint is approximately 92 m x 30 m. There are two zones as described below.

5.5.106 The customer compound includes a transformer, high-level disconnector, marshalling kiosk (this provides the connection points for the various control, protection and instrumentation wires which go to, and come from, all the different substation plants), lighting and CCTV. The compound footprint is proposed at 500 m².

5.5.107 The Western Power Distribution Compound includes a pylon, high-level disconnector, low-level disconnector, circuit breaker, cable trench to switchroom, surge arrestors, anchor blocks and lighting/CCTV. The Compound footprint is proposed at 700 m².

Carbon Dioxide (CO_2) Recovery Plant

5.5.108 The Facility will include the connection of the flue-gas system from the westernmost gasification line to a carbon dioxide (CO_2) recovery plant, which will recover CO_2 (to food-grade) for off-site reuse in various industries. Some of the CO_2 will also be retained on-site for use in fire prevention.

5.5.109 The CO_2 plant will be a fully automatic system designed for constant operation (24 hours per day, 7 days per week).

Flue Gas Cleaning and Cooling

5.5.110 The CO_2 facility will draw the exhaust flue gas from one gasification line.

5.5.111 The incoming flue gas is cooled using a flue gas scrubber to ensure proper operating parameters and remove water-soluble impurities, e.g. sulphur dioxide. Cooling and sulphur dioxide removal will take place by recirculation of pH controlled water over a mass transfer packing. The resulting lower pH and warm water will be pH adjusted through soda ash or caustic dosing, and the water will then be cooled via a plate heat exchanger.

CO_2 Absorption

5.5.112 From the scrubber, the flue gas would be received by a variable speed-controlled extraction fan. The treated flue gas exhaust from the fan will be introduced to the sump section of the stainless-steel absorption column.

5.5.113 The flue gas will flow upward within the stainless-steel absorption column, making contact with the mass transfer packing sections counter-current to the properly-distributed absorption solvent.

5.5.114 The solvents chemically react with the CO_2 present in the flue gas, absorbing up to 90% of the CO_2 present in the incoming flue gas. The remaining products of combustion in the flue, namely N_2, O_2, CO etc. are vented at the top of the absorber column after treatment, to ensure IED limits are met.

5.5.115 The residual vent gas leaving the absorber column would be further treated in the wash section of the absorber column, where low concentration solvent is washed, condensed and returned to the absorption column, limiting solvent losses.

5.5.116 The CO_2-saturated solvent is pumped from the absorption column sump via a rich/lean solvent heat exchanger to the top of the solvent CO_2 gas stripping column. The stainless-steel stripping column complete with mass transfer packing allows the CO_2 gas to be released (desorbed) from the rich solvent.

5.5.117 The now lean solvent in the sump of the stripper column is pumped again via the lean/rich heat exchanger to return to the top section of the absorption column to maximise CO_2 recovery.

5.5.118 The liberated CO_2 gas exiting the stripping column requires cooling, which results in the condensate being separated from the CO_2 gas and automatically recycled back to the absorption column, thus ensuring solvent losses or carry-over are kept to an absolute minimum.

5.5.119 The CO_2 gas is then compressed from approximately atmospheric conditions to ± 18 to 20 bar(g). Once compressed, the CO_2 gas will be purified by means of potassium permanganate, dried by absorption using specially designed molecular sieve packed bed columns to a dew point adequate for liquefying the CO_2. On completion of drying, the gas is finally treated by activated carbon before liquefaction.

5.5.120 Once compressed, purified, and dried, the pure, odour-free, colour-free CO_2 gas will then be converted from gaseous to liquid product (condensed) by low temperature refrigeration. This would be completed in the CO_2 gas condenser by use of a self-contained refrigeration system. At this point, the liquid CO_2 would be stored for further use or distribution.

5.5.121 The CO_2 storage tanks will include a high-quality perlite vacuum insulation complete with all pipework, valves, safety devices, liquid level indicator, pressure gauge, automatic pressure build up and pressure reducing systems.

5.5.122 The final product quality will meet standards prescribed by the International Society of Beverage Technologists (ISBT) 2001 quality guidelines for liquid carbon dioxide (CO_2). This ensures the final liquid CO_2 quality is acceptable to international markets.

On-Site Lighting

5.5.123 The Facility would operate 24 hours a day. Lighting would therefore be required during the hours of darkness to fulfil health and safety requirements.

5.5.124 Operational phase lighting will be provided to the lighting design standards and guidance documents relevant to permanent lighting installations, including the following:

- UK Parliament, 1990: The Environmental Protection Act 1990 (as amended by the Clean Neighbourhoods and Environmental Act 2005), specifically 79 and 80;
- BS-EN 12464-2:2014: Lighting of Work Places - Outdoor Work Places;
- Chartered Institute of Building Services Engineers (CIBSE) Lighting Guide 6:2016; Outdoor Environment;
- Institution of Lighting Professionals (ILP (formerly ILE)); Guidance Notes for the Reduction of Light Pollution;
- ILP Guidance Note 08/18 Bats and Artificial Lighting in the UK;
- Health and Safety Executive: HSG 38, 1997 - Health and Safety Guide 38 – Lighting at Work.

Additional Information

5.5.125 The DCO application for the proposed Boston project will include the elements described above. In addition, temporary works and associated infrastructure necessary for the construction and operation of the project will be included.

5.5.126 The DCO application will also detail the proposed stopping up of public rights of way. During construction and continuing into operation, the following footpath sections would be permanently closed: BOST/14/4, BOST/14/10 and BOST/14/5. The closure would also affect the England Coast Path route which follows these footpaths, as does Macmillan Way. The diversion for these route closures would follow the route of an existing footpath, which follows the route of Roman Bank (also known as 'Sea Bank') along footpath sections BOST/14/11 and BOST/14/9. See **Figure 5.3** which shows the footpath network and identifies the footpath sections to be closed.

5.5.127 It is anticipated that surface water drainage systems will be sealed and water will predominantly be used to supply the LWA facility. Any surplus water will be managed with a minor amount discharged (under an Environmental Permit) into the drainage network (not directly into The Haven).

Decommissioning

5.5.128 To facilitate assessment in the PEIR, an assumption has been made that the Facility will have an operational lifetime of 25 years, which is a typical assumption for such facilities. In the case of the Facility, a decision would be made at the appropriate time as to whether it would be 're-powered' after 25 years based upon an investment decision considering the market conditions prevailing at that time.

If the operating life were to be extended the Facility would be upgraded and re-permitted in line with the legislative requirements at that time.

5.5.129 At the end of its working life, the Facility would be decommissioned and removed and the site reinstated to an agreed condition.

5.5.130 For the purposes of the PEIR, any decommissioning phase is assumed to be of a similar duration to the construction phase.

References

ECUS Ltd (2009). Landscape Character Assessment of Boston Borough. Available at: http://www.southeastlincslocalplan.org/wp-content/uploads/2017/06/Landscape-Character-Assessment-of-Boston-Borough-July-2009.pdf [Accessed: 04/02/2019].

Her Majesty's Stationary Office (HMSO) (2015). Statutory Instruments 2015 No. 51 Health and Safety. The Construction (Design and Management) Regulations 2015. London: HMSO.

Natural England (2013). NCA Profile: 46. The Fens (NE424). Available at: http://publications.naturalengland.org.uk/publication/6229624?category=587130 [Accessed: 04/02/2019].

South East Lincolnshire Joint Strategic Planning Committee (2019). Available at: http://www.southeastlincslocalplan.org/ [Accessed: 04/02/2019].