Riverside Energy Park

Environmental Statement

Chapter 3: Project and Site Description

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RIVERSIDE ENERGY

Contents

3 Project and Site Description

3.1 Introduction

3.1.1 This chapter provides a description of Riverside Energy Park (REP) and its Electrical Connection together with a description of the Application Site and surroundings. This includes a description of the construction, operation and maintenance and an indication of the outline construction programme.

3.1.2 The Application Site comprises the following:

- the REP site, located to the north of Belvedere off Norman Road;
- the Main Temporary Construction Compound located to the south of the REP site and west of Norman Road;
- the Electrical Connection, running underground between the REP site and the Electrical Connection Point at Littlebrook substation connecting into an existing National Grid building in Dartford; and
- Cable Route Temporary Construction Compounds required to support the construction of the selected Electrical Connection route. These will be small discrete compounds, required for a period of time whilst works are undertaken along particular lengths of the Electrical Connection route.

3.1.3 The Application Site would be located within the administrative areas of the London Borough of Bexley (LBB) and Dartford Borough Council (DBC). The site extents are shown on **Figure 1.1** - Site Location Plan, **Figure 1.2** - Application Boundary and Location of Project Elements. Statutory and non-statutory designation plans of nature conservation for the area surrounding the Application Site are shown in **Figures 3.1 and 3.2**.

3.2 The Site and Surrounding Areas

REP Site & Main Temporary Construction Compound

3.2.1 The REP site is located in Belvedere, in the LBB, in an area bounded to the north by the River Thames and the adjacent Thames Path long distance trail. It is bounded to the east by a boundary fence onto a public footpath linking Norman Road with the Thames Path, and to the west by a boundary fence onto the adjacent undeveloped Crossness Nature Reserve, between the REP site and Thames Water's Crossness Sewage Treatment Works (STW) site, approximately 200 m away. Within this area a public footpath links the Crossness Local Nature Reserve (LNR) with the Thames Path. A number of ditches and small watercourses surround the REP Site.

3.2.2 The REP site includes the existing jetty extending out into the River Thames but excludes the existing Riverside Resource Recovery Facility (RRRF) main building itself. The majority of the REP site is currently used for private vehicle circulation areas, the jetty access ramp, staff and visitor parking, open container storage, contractor maintenance, an electrical substation and associated landscape/habitat areas.

3.2.3 The REP site is accessed by river via the existing jetty and by pedestrians and vehicles from Norman Road, a single carriageway road linking to the dual carriageway A2016 Picardy Manor Way.

3.2.4 To the immediate north of the REP site is the River Thames. Further north, on the opposite bank of the river is an area characterised by manufacturing, including the Ford Motor Company works, and associated car and lorry parking. To the east of the REP site and Norman Road is a large strategic industrial area, accessed via a junction at the southern end of Norman Road. This includes two distribution centres and a document storage facility. East of these are further warehouse, distribution and similar commercial developments.

3.2.5 West of the REP site is Crossness STW, which is approximately 1 km in width from east to west and approximately 200 m from the REP site boundary. This operational STW includes settlement and sludge tanks, as well as a sludge-powered generator where sludge is thermally treated and used to generate electricity. The Grade I listed Crossness Pumping Station, built by Sir Joseph Bazalgette, is located at the western end. Further to the west of the STW is the Thamesview Golf Centre, beyond which is the Thamesmead residential area.

3.2.6 To the south and west of the REP site and Norman Road is Crossness Nature Reserve, a 25.5 ha LNR which is part of the Erith Marshes Site of Metropolitan Importance for Nature Conservation (SMINC), containing a number of ditches, watercourses and ponds. The site is owned and managed by Thames Water. To the east of the Crossness LNR, adjacent to Norman Road, is a site owned by the Applicant, with planning permission for a data centre (Local Planning Authority reference: 15/02926/OUTM). Power for the data centre is expected to be provided via a connection along Norman Road from the RRRF and REP site. South of the data centre site is the area identified as the Main Temporary Construction Compound.

3.2.7 South of Norman Road is the A2016, formed by the dual carriageway Picardy Manor Way at its junction with Norman Road (North), and by the dual carriageway Eastern Way, south of Crossness LNR. South of Picardy Manor Way is a recent development consisting of The Morgan pub and a Travelodge hotel building, along with five residential blocks. South of this is a residential area centred on North Road and Norman Road (South). Further south is the main area of Belvedere comprising residential dwellings, Belvedere railway station and retail outlets. South of Eastern Way are areas of undeveloped marshland, containing a number of ponds and watercourses, interspersed with commercial storage and distribution and education development, and bounded to the south and southwest by Yarnton Way, a dual carriageway.

3.2.8 The proposed Main Temporary Construction Compound would be located in an area of previously developed land (a former National Grid substation site) adjacent to the west side of Norman Road, immediately north of its junction with A2016 Picardy Manor Way. The northern extent of this area most recently received planning permission for the erection of three industrial units for mixed-use within Class B1 (business), Class B2 (general industrial) and B8 (storage/distribution), with associated ancillary works (Local Planning Authority reference: 13/00918/FULM). Part of the southern portion comprises an existing joinery business. The Main Temporary Construction Compound, to be located off Norman Road, will serve a different purpose is different and a separate Works item to the Cable Route Temporary Construction Compounds, which may be required at different locations along the Electrical Connection route (see below). The timing of all temporary construction compounds is addressed in the relevant section later in this chapter.

Electrical Connection

3.2.9 The proposed Electrical Connection route would run southwards from the REP site towards the existing Littlebrook substation, in Dartford. A number of alternative route options were identified through studies undertaken by UK Power Networks (UKPN), the local distribution network operator, and are shown in **Figure 1.2.** A number of alternative routes have been identified and all have been assessed within the ES. However, only one overall route would be required to connect from the REP site to the Electrical Connection Point.

3.2.10 The preferred route is Route 1 but following variant 1A along Norman Road and 2B through The Bridge development. Selection of a final single Electrical Connection route will be confirmed in partnership with UKPN, after further detailed engineering investigation has been completed. The final route will take account of UKPN's statutory obligations under the Electricity Act (to develop an efficient, co-ordinated and economical system) as well as the responses received from statutory consultation. It is expected that a single Electrical Connection route option will be decided upon during the pre-examination and examination process, and that will allow the Development Consent Order to be granted on the basis of a single route.

3.2.11 The Electrical Connection routes are generally located on the highway (comprising highway, verges and railway/watercourse crossings on highway structures) and are predominantly through urban areas. Some route lengths run outside the public highway and include the Crossness LNR, adjacent areas of the River Cray and Dartford Creek valleys and through The Bridge development. In developed areas the site surroundings for the Electrical Connection are generally residential, but with significant industrial and commercial areas.

3.2.12 The Electrical Connection route would cross the River Darent, a tributary which feeds into the River Thames. The Dartford Marshes Local Wildlife Site (LWS) is a large area of marshland and wetland habitat along the River Darent and on the Darent floodplain. The Electrical Connection route would cross the River Darent using the existing highway or using trenchless installation techniques. Whilst a crossing in the existing highway is the preferred solution, trenchless installation is more likely. A deliverable solution is considered achievable using these installation options.

3.3 Description of Proposed Development

Riverside Energy Park

3.3.1 As set out in **Chapter 1**, the primary components of REP are:

- an Energy Recovery Facility (ERF);
- an Anaerobic Digestion facility;
- a Solar Photovoltaic installation;
- Battery Storage; and
- Enabling infrastructure for Combined Heat and Power to provide for a potential future local district heating (DH) pipe connection at the site boundary.

3.3.2 The REP site would also incorporate other infrastructure required to operate the facility including, but not limited to, ramps, parking, stores for supplies and office/welfare provision.

Energy Recovery Facility (ERF)

3.3.3 ERFs are industrial facilities which utilise thermal treatment technology (combustion) to process various types of waste. The treatment process is combined with boiler and steam turbine technology to enable the generation of electricity. The combined processes produce further outputs including heat, an ash from the combustion process known as Incinerator Bottom Ash (IBA), and residues from integral processing of emissions to control air pollution, known as Air Pollution Control Residues (APCR). Electricity generated is normally exported to either local distribution or national electricity networks, after utilising electricity that is used to run the plant itself.

3.3.4 The ERF at REP would normally treat Commercial and Industrial (C&I) waste, with the potential to accept Municipal Solid Waste (MSW). Both categories of waste would be non recyclable waste remaining after prior processing offsite. The facility would likely be ‘two stream’, meaning that two separate ‘lines’ of waste treatment would occur, allowing for maintenance to be undertaken on one line whilst the other continues to operate fully.

3.3.5 Each line would consist of separate waste combustion grates, boiler and steam systems, combustion air systems, flue gas treatment facilities and ancillary equipment. The two lines would share a waste reception ‘tipping’ hall, waste storage bunker, ash collection and storage system, emissions control system, steam turbine, electrical generator and transformer, air cooled condensers, as well as a common process control system. Each line requires a stack (note that

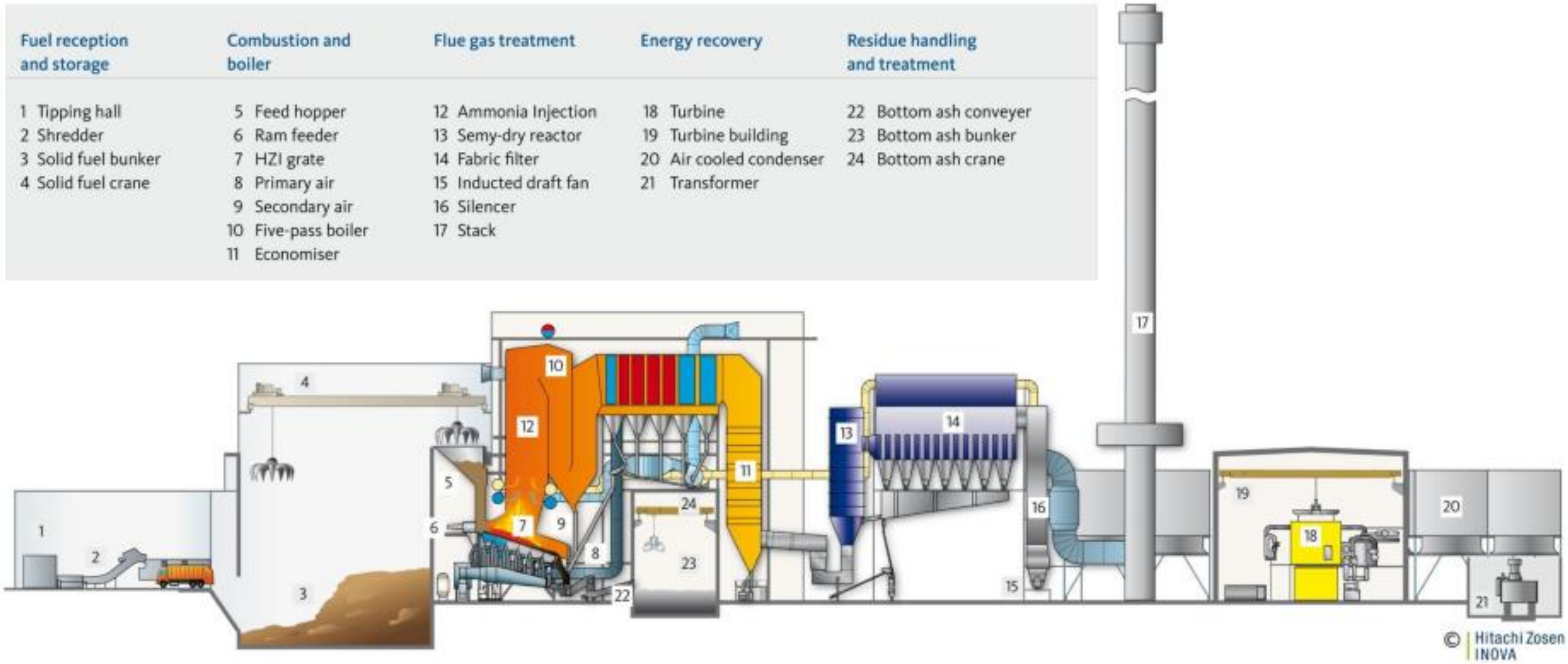
RRRF is a single outer enclosure with 3 inner flues, one for each of its lines). In total the ERF would be able to treat a likely upper throughput of waste up to 805,920 tpa, whilst the nominal design throughput is likely to be lower (c. 655,000 tpa). The likely higher throughput of 805,920 tpa has been assumed in the Environmental Impact Assessment (EIA) on a precautionary basis and represents the reasonable worst case.

3.3.6 The Main REP Building would house a significant proportion of the ERF, key components of the Anaerobic Digestion facility (however, to conform with technical and operational design requirements, the gas flare and gas storage would be located separately outside), the battery storage, and would also accommodate solar photovoltaic panels on the roof.

3.3.7 To facilitate optimum access for river and road deliveries and to offer the most advantageous logistics for the accommodation of the various components of REP, the Main REP Building would be orientated with the waste reception/tipping hall and bunker sited towards the southern boundary of the REP site and the stack towards the northern boundary. The REP site layout also presents the best option to minimise modifications to the existing site infrastructure thus ensuring the integrity of operations of RRRF during the construction of REP. Further information on how the general orientation was determined is provided in **Chapter 5** and the **Design and Access Statement (Document Reference 7.3)**. Illustrative Site Layouts and Elevations are provided in **Figure 1.3 a, b and c.**

3.3.8 **Plate 3.1** on the following page presents an indicative schematic through one line of an ERF showing the principal components of the treatment process. The numbers in the schematic are used in the description that follows.

Plate 3.1 Indicative Schematic of an ERF



(1 & 2) Tipping Hall and Shredder

3.3.9 A single waste reception area, comprising a tipping hall and shredder, with a ramp to access the tipping hall, would be a shared facility between the ERF and Anaerobic Digestion facility, integrated into the Main REP Building.

3.3.10 The tipping hall would be elevated to c. 3m Above Ordnance Datum (AOD) to meet the requirements of the Flood Risk Assessment (FRA) (**Document Reference 5.2**), which accompanies this application, and would be accessed by a purpose-built ramp. The tipping hall would be sized and designed to accommodate the range of manoeuvring expected of the delivery vehicles whilst maintaining a safe working environment.

3.3.11 The tipping hall would have a number of tipping bays to allow simultaneous tipping of waste and control over the location of deposition of waste into the bunker. The tipping hall would also facilitate the separate deposition of food and green waste into the Anaerobic Digestion facility bunker.

Plate 3.2: RRRF Waste Reception and Tipping Hall

3.3.12 Waste delivery trucks would reverse into an assigned tipping bay and unload their waste into the bunker. The tipping hall is ventilated by drawing air and supplying it into the ERF combustion process. The resulting negative pressure within the tipping hall ensures that dust and odour are prevented from leaving the interior. By integrating the Anaerobic Digestion and ERF waste tipping in the same facility, the negative pressure arrangement can be used to control and combust odours from both processes.

3.3.13 The tipping hall would be provided with sufficient safe areas for the inspection of waste deliveries and for the potential quarantine of any non-compliant waste.

3.3.14 Any non-compliant, or unacceptable waste (for example engine blocks, gas canisters) would be identified and removed wherever practicable. All bulk waste deliveries received on site would be managed in accordance with standard Tipping Hall operation procedures and safe working practices. Should any waste arrive that is not suitable for treatment at the ERF, this would be managed in accordance with standard Waste Auditing procedures to inspect and remove unacceptable waste from site. Example of procedures used within the operational RRRF are included with the Operational Waste Statement (**Appendix K.4**). Unacceptable waste represents a very small proportion of overall waste throughput and would normally be disposed of by a suitable licensed carrier to an offsite disposal facility, depending on the type of waste identified.

(3 & 4) Waste Bunker and Cranes

3.3.15 A single waste storage bunker would be used for both lines, and would be up to 8 m deep below OD. Overhead cranes (‘duty’ and ‘stand-by’ allowing for redundancy) feed the hoppers with waste ready for later stages of the process, keeping the area behind the tipping bay free of waste and able to receive new waste. The crane grab also mixes the waste in the bunker to achieve a uniform heating value and thus helps to support the efficient and smooth operation of the facility.

3.3.16 Two cranes would typically be installed at the same elevation inside the waste bunker. An opening to the side of the bunker building allows the grab of either crane to be lowered to the tipping hall ground level for repair or maintenance purposes.

Plate 3.3: RRRF Waste Bunker, Crane Gantry and Hopper

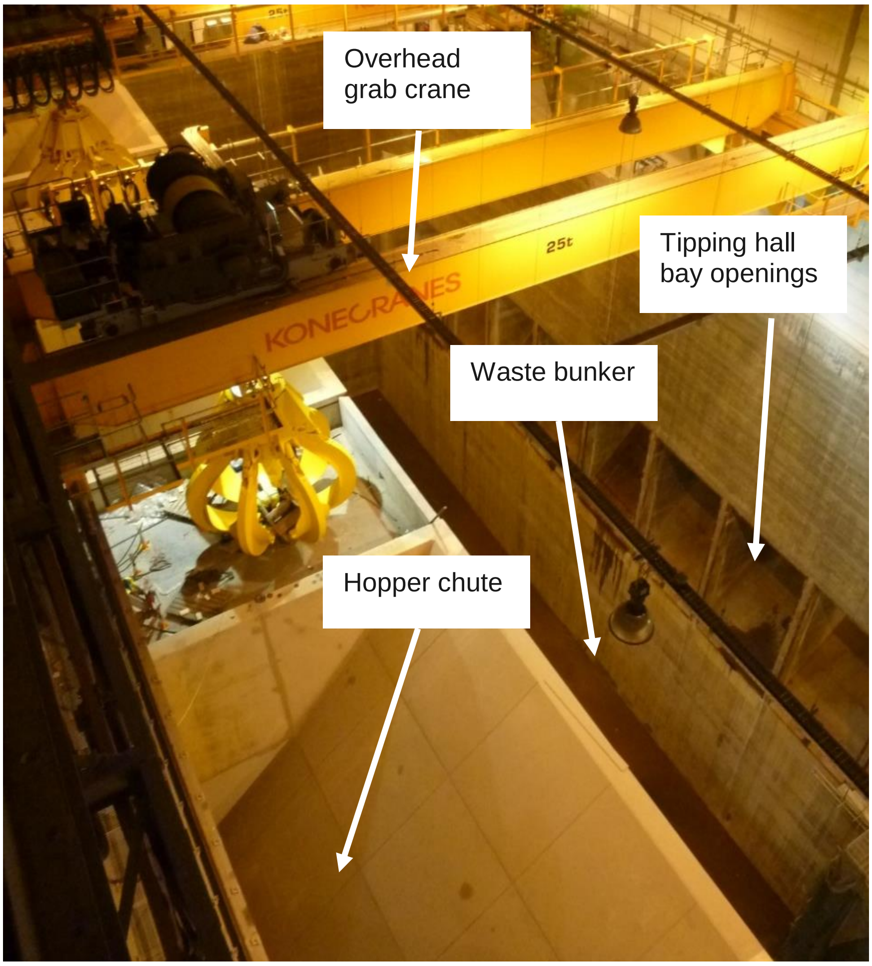


Plate 3.4: Typical Waste Grab

3.3.17 The cranes are equipped with a load measuring system to record waste feed rates and to automatically aggregate the weight of the waste fed to the hopper.

(5 & 6) Feed Hopper and Ram Feeder

3.3.18 Waste is deposited into the hopper to a vertical feed chute from which the ram feeder discharges waste onto the grate for combustion. The feed chute ensures that the waste is delivered continuously onto the grate. Waste is not introduced onto the grate until the minimum combustion temperature of 850 degrees Celsius (˚C) is achieved in the combustion chamber in accordance with the Industrial Emissions Directive (IED).

Plate 3.5: RRRF Waste Feeding Hopper

(7, 8 & 9) Grate and Primary/Secondary Air

3.3.19 An air cooled moving grate system facilitates thermal treatment of the waste through combustion. Combustion occurs at temperatures in excess of 850 °C. Air is taken from the waste bunker and tipping hall and used as Primary Air in the combustion process, which ensures that any odour is eliminated through combustion within the facility. The combustion process is controlled to ensure the combustion gases are within stringent emissions limits set by the IED. Waste heat treatment is managed by a Combustion Control System (CCS). The CCS allows for the operation to be fully controlled and a largely automatic and secure operation.

3.3.20 The grate incinerates the waste, ensures a continuous combustion and a good burnout rate. The grate sits on an incline towards the end at which the IBA leaves the combustion unit.

3.3.21 Within the upper part of the combustion chamber there are also auxiliary burners which are used: (1) to heat the combustion chamber before waste is introduced onto the grate; (2) for increasing the combustion chamber temperature should it drop towards the minimum temperature of 850°C; and (3) maintaining the minimum temperature in the combustion chamber until all waste is combusted when shutting down.

Plate 3.6: Typical Combustion Chamber and Grate

3.3.22 Primary air is drawn in from the waste bunker and delivered by a fan to the underside of the grate. A secondary air system delivers and regulates the secondary combustion air above the grate to the flue gases.

3.3.23 The angle of injection of the secondary air causes a swirling airflow in the combustion chamber. Due to this mixing the flow is homogenised with respect to temperature, velocity and concentrations.

(10, 11 & 12) Boiler, Economiser and Ammonia Injection

3.3.24 Hot combustion gases are passed through the boiler and economiser to produce steam. In the economiser system, the water supplied from the feed water tank is heated up to a temperature close to boiling. In the schematic in **Plate 3.1** the steam boiler consists of five passes, some vertical and some horizontal, each with a given purpose, including cooling down the combustion chamber. High pressure steam is produced in the boiler during normal thermal operation.

3.3.25 Intermediate and low pressure steam would also be available for export following partial expansion through the steam turbine, which increases thermal cycle efficiency. Uses would include internal consumption within the ERF, such as feed water preheating, and export to facilitate CHP including Anaerobic Digestion process heating and potentially DH.

3.3.26 A water system prepares and supplies water to the feed water tank of the boiler and covers the losses of boiler feed water due to steam, condensate and blow down losses. Typically, the only input to the boilers is on the first fill, as water remains in a closed loop. Ammonia (NH_3) is added, as required operationally at various positions in the first and second stage passes to work through a chemical reaction to ensure that the gases from the process are within environmental limits. Ammonia is provided only at an appropriate dose which is sufficient to support abatement of oxides of Nitrogen (NOx). It does not contribute ammonia entering the atmosphere at the discharge point of flue gases.

(13-16) Flue Gas Treatment (FGT)

3.3.27 To ensure that the combustion gases from the ERF meet the stringent requirements of the IED, they would be treated prior to emission to atmosphere via the stack. Combustion gases would first be maintained at a minimum temperature of 850°C for a residence time of at least two seconds in the combustion chamber to ensure that dioxins and furans are destroyed in accordance with the IED.

3.3.28 The furnace would be configured and designed for staged combustion to minimise the formation of NOx. Further flue gas treatment processes would achieve abatement of NOx and other emissions to meet the IED and the requirements of the Environmental Permit (EP), as described below.

3.3.29 After combustion, flue gases would be rapidly cooled in the boiler to minimise the risk of dioxin reformation. Flue gases would then be discharged to the flue gas treatment (FGT) facility for further treatment using lime and powered activated carbon (PAC), to reduce the levels of acid gases, dioxides, volatile organic compounds, mercury and other trace metals.

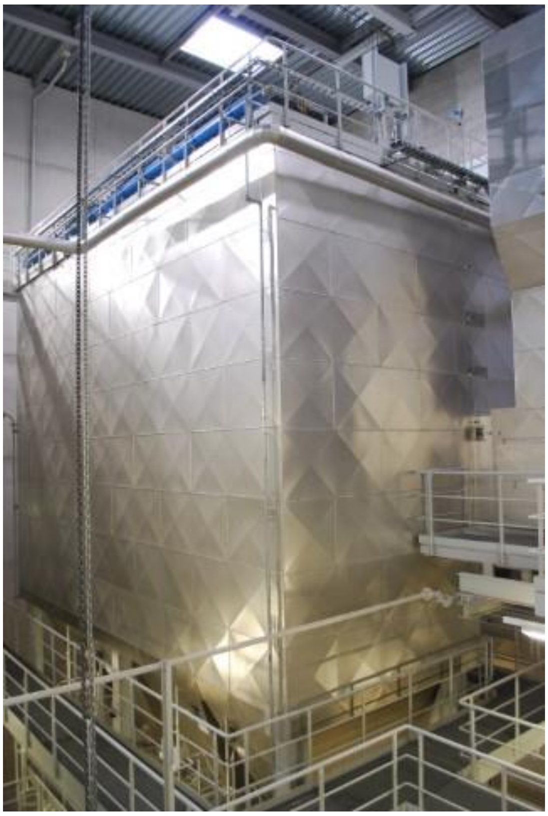
3.3.30 Bag filters would be used to remove particulate matter including fly ash and other residues from the FGT process. Solids from the process would be collected in filter hoppers and discharged to collecting silos. A small proportion of these solids are recirculated into the process but the remainder is collected as APCR and recycled.

3.3.31 The APCR would be transferred into sealed silos for storage ready for collection and removal. The APCR has a consistency of powdered cement. It is taken off-site in tankers for recycling at specialist treatment facilities. included with the **Operational Waste Statement (Appendix K.4)** Uses after processing included manufacture of construction ‘breeze blocks’.

3.3.32 The FGT process is continuously monitored and controlled automatically via the central control room. Any deviations from the environmental limits are immediately alarmed and automatically corrected.

Plate 3.7: Typical Bag Filter House

Plate 3.8: Typical bag filter penthouse



(17) Stack

3.3.33 One flue per line is used to discharge the cleaned flue gases to the atmosphere. Emissions are monitored continuously 24 hours per day, 365 days per year, to ensure that emissions are within permitted environmental limits. Emission levels would be regularly reported at a frequency determined by the EA, in line with an EP. Underneath the flue gas inlet to the stack, condensed water vapour and rain water is collected and discharged via a condensate pipe.

(18 & 19) Turbine & Turbine Building

3.3.34 The steam generated in the boiler is transferred to the turbine. The turbine transforms the thermal energy of the high pressure steam into a rotary motion, which drives a generator to produce electrical power.

Plate 3.9: Typical turbine

(20) Air Cooled Condensers

3.3.35 After generating electricity, the residual (turbine exhaust) steam would be condensed in air cooled condensers and collected as condensate for re-use within the facility. The turbine exhaust is maintained below atmospheric pressure to maximise efficiency and power generation. A quantity of intermediate and low pressure steam is extracted from the turbine for low grade heat uses (as described in the Boiler, Economiser and Ammonia Injection section above) to maximise thermal cycle efficiency.

Plate: 3.10 RRRF Air Cooled Condensers

(21) Transformer

3.3.36 The transformer would be located with the onsite substation and increases the electrical voltage for efficient distribution onwards within the local network.

(22-24) Bottom Ash Conveyor, Bunker and Crane

3.3.37 Ash created from the combustion of waste (IBA) is collected on a conveyor system and transferred to an ash bunker ready for collection and removal. IBA is temporarily stored in the ash bunker and loaded into purpose-built sealed ash containers. These would be transported to the existing jetty ready for loading onto barges for transport to the existing ash processing facility which is located at the Port of Tilbury. River-based movements are discussed in more detail in the ES **Chapter 6 Transport** and the Navigational Risk Assessment which is appended to it (**Appendix B.2**).

3.3.38 At the ash processing facility any metal present in the IBA is removed for recycling. The IBA is then screened by size and used as secondary (replacement for natural material) aggregates in the construction industry. Typical re-uses of IBA as secondary aggregate include road construction filling material.

3.3.39 Lime, aqueous ammonia and Powdered Activated Carbon (PAC) are three key consumables in the ERF process. They are stored in tanks or silos with new supplies delivered as required in lorries.

Plate 3.11: Typical Storage Silos

Anaerobic Digestion

3.3.40 Anaerobic Digestion processes food and green waste in the absence of oxygen. Through the degradation of waste by natural organisms, biogas is generated as a useful by-product, along with a digestate. The Anaerobic Digestion element of REP would be capable of processing up to a maximum 40,000 tpa of food and green waste.

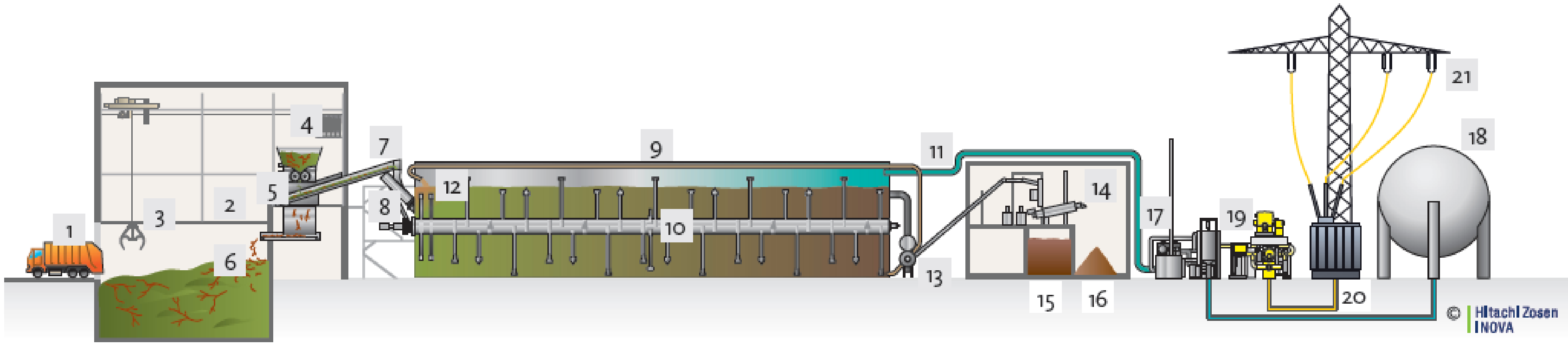
3.3.41 The biogas resulting from the Anaerobic Digestion process would be passed through a gas-upgrading system (biogas to biomethane) integrating a buffer gas storage tank based on membrane technology, suitable for Compressed Natural Gas (CNG) production and/or for injection into a local gas network. CNG can be used as a fuel for vehicles, including through conversion of onsite vehicles (which shuttle waste containers within the site). CNG would be the preferred option if feasible and viable. However a CNG option is not progressed then REP would incorporate a “CHP engine” which would use the biogas to generate electricity and heat, which could be used to support the Anaerobic Digestion process or added to energy export from the other aspects of REP.

3.3.42 The digestate (up to 17,200 tonnes per year), would be handled in line with the waste hierarchy, being firstly transported off-site for use in the agricultural sector for use as a fertiliser. Should this not be possible, it would be used as a fuel for REP to generate electricity. REP would incorporate a digestate drying, storage and loading room to process (through maturation) suitable solid digestate to meet the standards required for agricultural use. In the event that the composition of the feedstock (resulting in longer maturation time), or throughput required, exceed the processing capacity of the Main REP Building storage room, the semi-processed compost would be transported to a third party site to complete its maturation. The tipping hall and loading room would operate at negative air pressure to control odour, with all process air odour eventually being eliminated in the ERF combustion process.

3.3.43 Rejected material from the Anaerobic Digestion process (kitchen caddy liners etc.) would, where appropriate, be subject to energy recovery within the ERF.

3.3.44 A typical anaerobic digestion process consists of the following components shown on the schematic in **Plate 3.12**. References below relate to those in the Plate.

Plate 3.12 Indicative Schematic of an Anaerobic Digestion Facility



Waste Reception and Storage

1 Waste receiving
2 Waste bunker
3 Waste crane

Anaerobic Digestion

4 Shredder
5 Sieve
6 Sieve rejects
7 Conveying system
8 Feeding system
9 Digester
10 Agitator
11 Biogas pipe

Discharge

12 Inoculation pipe
13 Discharge system
14 KOM+Press
15 Liquid fertilizer
16 Compost

Energy Utilization

17 Biogas upgrading
18 Gas storage
19 Combined heat and power plant
20 Transformer
21 Electricity export

(1-3) Food/green waste reception, intermediate storage and handling by means of a waste bunker with a fully automated crane. The waste bunker would be integrated into the Main REP building and therefore operate with the benefit of negative air pressure to control odours, which would be combusted in the ERF:

(4-6) Waste pre-treatment with a shredder, sieve, and magnetic separator.

(7-8) Conveyor and feed system.

(9-13) The digester and input/output pipes etc, which is the component where anaerobic digestion occurs to create biogas and digestate.

(14) Drying the digestate by means of dryers, potentially utilising process steam from the integrated ERF to achieve a solid digestate fraction.

(15 & 16) Solid digestate aerobisation ("maturation") in aerated boxes and compost finishing (screening and sorting). This process would be used where a suitable end agricultural user has been identified to accept agricultural fertiliser.

(17 & 18) Gas-upgrading system (biogas to biomethane) integrating a buffer gas storage tank based on membrane technology, suitable for Compressed Natural Gas (CNG) production and/or for injection into a local gas network.

During unplanned outages of the gas upgrading system, the produced gas can be diverted to a gas flare, eliminating any possibility of gas accumulation.

(19) Where gas is not processed to produce CNG, the pre-treated biogas can be directed to CHP unit(s) to generate heat and/or electricity.

(20 & 21) Local control and low voltage distribution system in a control room/container for the Anaerobic Digestion plant.

3.3.45 A ventilation / air collection system would be present for all buildings used in the process. Due to the integrated nature of REP the waste air and odours from the Anaerobic Digestion process would be fed directly into the ERF waste bunker, where they would then be drawn in as primary air for the ERF combustion process, thus controlling and containing odours.

3.3.46 The digester would run continuously 24 hours per day, 365 days per year and would convert organic waste into a constant and high quality stream of biogas for subsequent gas upgrading to natural gas (CNG quality vehicle fuel or for utilisation in Combined Heat and Power (CHP) production). The digester process converts nearly 100% of the anaerobically degradable matter of the organic input material into biogas. Ordinarily, when subject to appropriate additional processing, the material discharged from the process is a high quality solid compost (e.g. PAS100 compliant). This is ideally suited for use as fertiliser.

3.3.47 The digester process would be able to accept mixed food and green waste. All organic materials, including related impurities which are fed into the digester, are discharged continuously, i.e. no planned stoppage and/or opening of the digesters is required for maintenance or sediment clean out. All components requiring maintenance (bearing, sealing, gearbox, etc.) are accessible from outside. All digester process steps are fully enclosed ensuring that, notwithstanding emergency biogas release via overpressure protection systems, all emissions of greenhouse gases and odours, as well as noise, are kept to an absolute minimum and are contained and eliminated.

Waste Reception and Handling

3.3.48 The organic material delivered would be directed to REP's shared tipping hall to a dedicated tipping bay for discharge into the organic waste bunker. The bunker would serve as intermediate storage for organic waste feedstock. An automated crane would feed the waste into the processing area where it would be shredded and screened to ensure that only small sized pieces are passed to the digester. The pre-treated material would then be transported to the digester via conveyor belts and screw conveyors. Any material from this process that is unsuitable for the anaerobic digestion process (remnant fragments of plastic bags for example), can be fed into the ERF.

The Digester

3.3.49 The pre-treated organic material is fed directly into the digester. If required, the waste is moistened to ensure a uniform and optimal water content. This can be achieved, for example, by collected rainwater and/or service water from a tank. In addition, inoculum (a live microorganism) recirculated from the digester outlet can, when required, be fed to the inlet in order to stabilise and kick start the digestion process of the fresh material.

Plate 3.13: Example digester

3.3.50 An integrated heating system would ensure that the process temperature is reached rapidly and is constantly maintained. Due to the integrated nature of REP, heating could be provided by low pressure steam supplied from the ERF turbine rather than generating heat by electricity or from imported fossil fuels. In order to minimise heat losses, the digester tank would be fully insulated and can be installed outdoors in a weatherproof housing.

3.3.51 The digestion process is based on anaerobic-thermophilic digestion above ambient temperature. Any unwanted seeds, germs and micro-organisms are eliminated inside the gas-tight digester. The temperature inside the digester, filling level, gas production and gas pressure are constantly monitored, resulting in consistent and constant high gas yields.

Digestate Drying and Storage

3.3.52 Liquid digestate from the digester is pumped to a belt dryer. The dryer would have the potential to utilise steam from the ERF process. The dried digestate would be taken from the discharge point of the dryers by shovel loader and filled into boxes. The mixed steam / hot air exiting the dryer would be returned into the combustion process of the ERF. The exhaust air of the boxes and storage area is collected and fed back to the dryer. This would ensure neutralisation of any potential odours.

3.3.53 The dried digestate would then be processed (through maturation) in the same storage and loading area until it achieves compliance to standards that would be required before use in agriculture or for onward transportation to a further maturation facility.

Biogas Storage, CHP Engine and Flare

3.3.54 Where gas is not processed to produce CNG, the pre-treated biogas would be fed to CHP unit(s). The generated electrical power is added into the site network while the excess heat can be used for digester heating and for drying of the digestate, or as additional heat available for local district heating.

3.3.55 An external gas flaring system would ensure that any excess biogas is combusted (e.g. when biogas utilisation is stopped or in case of an emergency). This is expected to occur approximately 10 times a year while the gas upgrading engine is out of service for maintenance and repairs. This ignition occurs automatically as part of a three-tier pressure protection system. The biogas engine would operate for up to approximately 8,000 hours per year. The flame of the flare is not visible outside the associated stack. This is a separate stack to that required for the ERF and would be no taller than 14m.

Solar Photovoltaic

3.3.56 Solar panels would be located on the Main REP Building roof areas. Initial studies demonstrate that high specification photovoltaics (PV) modules would be capable of generating up to c. 1.0 Megwawatts (MWe) for the selected stepped building form. Inclusion of solar PV generation would increase renewable energy generated from REP which can also be used to offset power required to run the facility as a whole.

3.3.57 Solar photovoltaic modules convert solar radiation directly into electricity in a silent and clean process that requires no moving parts. Solar radiation falling onto semiconductor cells generates electron movement, resulting in direct current (DC) power output. A mounting system would ensure that the photovoltaic modules are securely attached to the roof at a tilt angle optimised to maximise power generation over each calendar year.

3.3.58 Inverters are required to convert the DC output from the photovoltaic panels into alternating current (AC) for connection to the distribution network (to combine with other on-site generation or energy storage, via a step-up transformer). A step-up transformer would transform the output from the inverters to the required distribution voltage.

Battery Storage

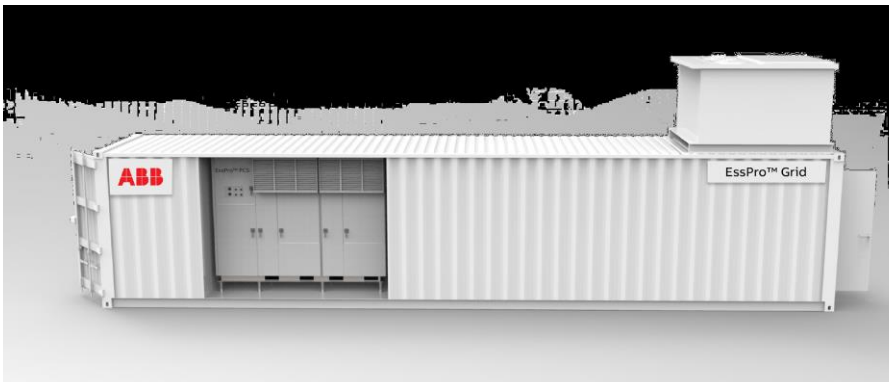
3.3.59 The battery storage facility of REP would supply additional power to the offsite distribution network at times of peak electrical demand. This facility would be integrated into the Main REP Building. The battery storage system would increase the operational performance and reliability of REP and provide an enhanced balance of supply and demand. Such energy storage benefits the entire power value chain through generation, transmission and distribution to all users.

3.3.60 The battery storage facility would also provide a stand-by generation capability during times when the ERF is not operating (e.g. during routine shut down periods).

3.3.61 The battery storage facility would be charged during low power demand periods directly from the energy produced from the ERF, solar photovoltaic panels and the Anaerobic Digestion CHP engine (if that option was selected) and stored for supply into the electricity distribution network.

3.3.62 The REP system would likely be a modular battery system consisting of a suitable number of (typically 1 MWe capacity) containers connected to AC/DC converters and electrical transformers. This approach would minimise the use of space and reduce installation time. Batteries, controls, protection cabinets and transformers would all be contained in a single module. The converters and transformers would be located at ground floor level, but above maximum flood risk level.

Plate 3.14: Typical Battery Storage Container



3.3.63 The batteries would be designed to allow for multiple cycles of charge and discharge per day. The charging, discharging and monitoring systems would be fully integrated into the overall REP control and management systems.

CHP Infrastructure

3.3.64 'CHP-Ready' is a recognised term under the EA's CHP-Ready Guidance and means a plant which is initially configured to generate electrical power only, but which is designed to be ready, with minimum modification, to supply heat in the future (i.e. to a DH network). REP would be constructed to a level of greater 'readiness' on-site where the plant is fully capable of exporting heat, with all required infrastructure in place, and is synonymous with being 'CHP from the outset', which the Applicant has referred to as being 'CHP-Enabled'. REP would include all the necessary infrastructure within the REP site (heat exchangers, pumps, pressurisation system). A dedicated and integrated heat supply system would also be provided to support the Anaerobic Digestion process. The heat supply system would be included to potentially export up to 30 MWt of heat to offsite consumers.

3.3.65 Typically, a DH network transfers steam heat to a closed hot water circuit via a series of heat exchangers. This would supply hot water to offsite consumers through a pre-insulated buried pipeline, before being returned to REP for reheating. This technology is well proven and highly efficient. The REP proposal would include the CHP-Enabling infrastructure and the export/return pipes to be installed to the site boundary so that the infrastructure is ready should a future end user be identified, such as the developer of a new housing development. The Applicant is in discussions with relevant local authorities and developers to explore opportunities for connecting to REP. A CHP Study **(Document Reference 5.4),** identifying potential end users, has been prepared and accompanies this Application.

Plate 3.15: Typical CHP Heat Exchanger

3.3.66 The DH pipes for REP would be approximately 500-600 mm in external diameter including high performance insulation to minimise heat losses. Subject to verifying offsite heat demands and location(s), one pipe would be for the export of water at a temperature of around 90ºC, and one would be for the return water at a temperature of around 60ºC, after heat has been extracted. The pipes would be buried below ground, with around 600 mm cover, and would be spaced close together.

Main REP Building

3.3.67 As a minimum, the shared tipping hall, the majority of the ERF, battery storage and solar photovoltaic installation would be contained within, or in the case of the solar photovoltaic panels supported upon, the same Main REP Building. The building would also accommodate all the key welfare, storage, admin and control facilities necessary to operate REP. Integration of the facilities in a single building brings significant benefits including in respect of energy efficiency and carbon footprint, control of odour and dust, and minimisation of development footprint.

3.3.68 The final design of the Main REP Building would be subject to a Design Principles process (to be secured pursuant to a Requirement in the DCO). As part of the Design Principles, the Applicant has determined that the Building would be a ‘stepped’ form. This form would minimise the massing and maximum height of the building, whilst providing the opportunity for significant and accessible solar photovoltaic generation. More information on the building forms considered, and how a stepped form was chosen, are given in **Chapter 5** of this ES and in the Consultation Report **(Document Reference 5.1)** submitted with this Application. The profile of the "stepped" form has not been determined at this stage, hence the need for the building height parameters.

REP Site Ground Levels and Site Clearance

3.3.69 Existing ground levels on the REP site vary in the order of 1.7 m to 2.5 m AOD and therefore the 'average' ground level is in the order of 2-2.2 m AOD. Ground levels would be modified where appropriate to accommodate the development. On the basis of the above, for the purposes of the assessment, it has been assumed that finished exterior ground levels on the REP site would be between 1 m and 3 m AOD.

3.3.70 No significant changes in ground level from existing would be expected on the REP site, other than as localised ramping to achieve the lower and upper limits set out above. The minimum level of flood sensitive and key components of REP would be set to at least 2.97 m AOD, including the Main REP Building finished floor level, as proposed and consulted upon with the EA.

3.3.71 Some minor structures and buildings currently exist on the REP site and on the Main Temporary Construction Compound area. Where necessary, these would be demolished/removed to facilitate construction or use as a temporary site compound.

Jetty

3.3.72 The import of waste and export of IBA from the ERF would predominantly be undertaken via the existing jetty that serves RRRF. The existing jetty has sufficient capacity without modification to support the proposed throughput to REP and continued use by RRRF. The parameters for consideration within this ES are a nominal case for imported waste by refuse collection vehicle of 75% by river and 25% by road as this is a reasonable worst case scenario under normal operating conditions. However, the assessment includes parameters for a sensitivity test of a river/road split of up to 100% of imported waste using road-based refuse collection vehicles or by river. These assessment scenarios are reflected in the Transport Assessment (**Appendix B.1**) and Navigational Risk Assessment (**Appendix B.2**) submitted with this Application.

3.3.73 Deliveries and exports from the jetty would be made using standard ISO containers lifted off/on barges by the existing cranes. Containers are sealed until they enter the tipping hall and on exiting the ash collection area so that no incoming waste or outgoing IBA would escape into the local surrounding environment. No river works would be required or proposed to facilitate the increased throughput of the jetty during the construction or operation of REP.

3.3.74 The jetty currently receives waste from four upriver Waste Transfer Stations (WTS) which are located in Central London. IBA is exported downstream to the Port of Tilbury. It is anticipated that future contracts will continue to use the same fundamental river network. Further details on transportation assumptions are provided in **Chapter 6 Transport** of the ES .

3.3.75 During construction the Applicant would seek to make use of the existing jetty and ISO containers to deliver construction materials, where practicable, to reduce the number of deliveries by road at peak times.

Electrical Connection

~~3.3.1~~3.3.76 REP would be connected to the existing electricity distribution network via a new 132 kilovolt (kV) distribution connection ('the Electrical Connection') provided by UKPN (or potentially an Independent Connection Provider (ICP) for contestable works). It is proposed that the Electrical Connection would be routed predominantly underground via the existing road network, except for the point of connection to the existing National Electricity Transmission System (NETS) at a new 132 kV substation located at REP and at Littlebrook National Grid substation. The connection at Littlebrook would be installed in an existing substation building with no external alteration required. UKPN concluded that Littlebrook would be the most suitable connection point for REP, as outlined in **Chapter 5 Alternatives Considered**. The Electrical Connection would comprise a new part of the electricity distribution network to be owned and operated by UKPN. A substation would also be required within the REP site into which the Electrical Connection would connect.

Plate 3.16: Littlebrook substation

~~3.3.2~~3.3.77 Selection of a final single Electrical Connection route will be confirmed in partnership with UKPN, after further detailed engineering investigation has been completed. The final route, as explained above, will take account of UKPN's statutory obligations under the Electricity Act (to develop an efficient, co-ordinated and economical system) as well as the responses received from previous statutory consultation.

~~3.3.3~~3.3.78 The Electrical Connection would comprise a trefoil of cables (3 cables laid together to comprise a single 3-phase circuit), buried in a cable trench typically 450mm wide and with 900mm cover (except where there is potential for trenchless installation or a localised deeper trench to be required to pass below a specific constraint) when laid under highway footways and carriageways, with jointing pits approximately every 500 m along the route. To provide 900mm typical cover, with c. 160mm diameter ducts and c. 50mm duct bedding, the excavation required would typically be 1.2m deep. The preferred cable route (and alternatives) generally follow existing carriageway routes.

~~3.3.4~~3.3.79 At Littlebrook substation the connection would be made to existing gas insulated switchgear (GIS) which has already been constructed. Works around the substation will consist of the installation and connection of 132kV cables, however it is not anticipated that external building works would be required.

3.4 Rochdale Envelope and Parameters for The Assessment

Rochdale Envelope

3.4.1 The detailed design of REP would be determined post-consent once the Applicant has appointed a contractor(s) (as is usual with infrastructure projects of this type and scale). The draft DCO submitted with this Application includes a Requirement for details of the final design to be submitted and approved by the relevant planning authorities prior to construction. The assessment of the Proposed Development is therefore based on a set of parameters, as what is commonly referred to in undertaking EIA as a 'Rochdale Envelope'.

3.4.2 PINS Advice Note Nine: Rochdale Envelope (July 2018) (Version 3) sets out advice for using the Rochdale Envelope approach for the assessment of Nationally Significant Infrastructure Project applications.

3.4.3 The ES sets out the findings of an assessment of the Rochdale Envelope and the key parameters as described further below.

3.4.4 In order to provide a robust assessment, each topic specific assessment presented in **Chapters 6 - 14** has been undertaken on a reasonable worst case scenario for that given topic. The reasonable worst case scenario for each topic differs depending upon the particular assessments being undertaken, and the chapters set out the scenario for that topic, however all assessments have been undertaken within the broadest reasonable parameters, to ensure the assessment is precautionary in its approach.

Parameters for the Assessment

3.4.5 Maximum heights have been assumed for particular key components of REP as set out below in Table 3.1.

Table 3.1: Size parameters for EIA

Building, structure, component	***Maximum height AOD***	***Parameter Colour on Figures 1.3 a & b***
Main REP Building	65m	Red
Anaerobic Digestion (where external to Main Process Building)	43m	Green
Other Integral Process Buildings/Structures	38m	Blue
ERF Stack(s)	113m	Magenta

3.4.6 Parameter plans are included in **Figure 1.3 a, b and c**. These show the location proposed for the primary above-ground visible infrastructure components that would comprise REP. These parameters have been used, where relevant, to inform the assessments in the topic specific chapters of this ES. No maximum/minimum length or width parameters have been proposed in the assessment since maximum sizes and positions of each Works are constrained by the Works Plan(s) (**Document Reference 2.3**) and therefore the maximum 'volume' of development within the parameters is assumed for assessment purposes where appropriate. Note that this would also allow a smaller 'volume' of development to be completed within the parameter constraints, but providing flexibility of location within parameters. As set out earlier in this chapter, each line of the ERF facility requires a discharge flue. REP would comprise two lines and therefore two flues. Whilst RRRF comprises three flues contained within a single stack, REP would likely comprise two separate flues and therefore up to two separate stacks. The proposed form of the stack(s) is discussed in the Design Principles (**Document Reference 7.4**)

3.4.7 The draft DCO (**Document Reference 3.1**) includes an article which restricts the authorised development to be carried out within the Application Boundary (or Order Limits) subject to the extent of the works shown in the Works Plans (**Document Reference 2.2**). An appropriate level of flexibility for the Proposed Development is included within the areas covered by each work however, given the physical constraints of the site, no limits of lateral deviation beyond the works shown are sought as part of the DCO application.

3.5 Construction and Commissioning

3.5.1 Should consent be granted in 2020, it is anticipated that construction and commissioning of REP would commence in 2021 and be fully completed in 2025 with a construction period of up to 36 months until 2024. Commissioning would include receiving waste for treatment for reliability testing (12-15 months) and electricity generation from 2024 to 2025, resulting in the commencement of normal operation thereafter. The Electrical Connection would take up to 24 months and would need to complete in advance of first export generation by any of the key components of REP.

Riverside Energy Park Site

3.5.2 All works within the REP site would be undertaken by the Applicant and their appointed contractors, except the export cable from the high voltage side of the onsite substation onwards to Littlebrook, which would be undertaken by UKPN or their appointed contractor (or an ICP for contestable works) as part of their overall Electrical Connection.

3.5.3 At the REP site the construction activities would include the deep foundations work, civil and structural works, installation of the process mechanical plant, installation of the electrical and control systems, and commissioning of the entire plant prior to a period of reliability testing. The construction activities would take approximately 36 months to complete. The number of operatives on site would average 300 over the complete construction duration with a peak of approximately 800 during a period of six months mid-way through the construction period.

3.5.4 In order to provide mitigation against potential odour and pests during commissioning of the anaerobic digester (in the event the ERF is not operating in parallel), the anaerobic digester would be fully enclosed to contain odour. Handling of organic materials (reception, pre-treatment, intermediate storage, digestate post-treatment, etc) would take place in closed and ventilated halls, thereby minimising odour emissions.

3.5.5 There is the potential, particularly during the commissioning phase, for uncombusted biogas (methane) created through the anaerobic digestion process to be released. This would occur through the activation of the standard overpressure protection procedures for the facility and only in the event that the biogas consumer was not available and flaring of surplus biogas could not be undertaken. This combination of events would represent an abnormal circumstance and would be covered within the associated Environmental Permit that is being sought for the Proposed Development.

3.5.6 It is anticipated that the core working hours for construction activities would be 7am to 7pm Monday - Friday and 7am to 1pm on Saturday, however specific activities, such as extended concrete pouring or trenchless techniques which require a one off continuous operation, would require 24/7 working for temporary periods. Anticipated extended activities are included within the relevant Requirement of the draft DCO (**Document Reference 3.1**).

3.5.7 Operations consisting of land clearance, environmental surveys and monitoring, investigations for the purpose of assessing ground conditions (including the making of trial boreholes), receipt and erection of construction plant and equipment, erection of construction welfare facilities, erection of any temporary means of enclosure, and the temporary display of site notices or advertisements are excluded from the DCO definition of material operations and are therefore able to commence prior to discharge of pre-commencement DCO Requirements. This has been considered as part of the EIA, as assessed in the ES, and is not considered to result in any likely significant adverse environmental effects that would require mitigation measures to be secured and implemented by way of requirements in the DCO.

3.5.8 Construction activities would commence with the erection of a temporary site fence and the stripping of any organic topsoil. Due to limited space available on site, any topsoil would likely be removed from site completely.

3.5.9 As the foundations for the Proposed Development would likely consist of deep piles, the first construction step after topsoil stripping would be to install a granular piling carpet which would be laid across the majority of the site. The piling carpet would be approximately 400 mm in thickness and would be constructed by importing new or recycled granular material.

3.5.10 Following the completion of part of the piling carpet the actual piling operation would commence. The piling would likely consist of Continuous Flight Auger (CFA) piling or percussion piling. The former is a cast in-situ process, suited to soft ground where deep casings or use of drilling support fluids might otherwise be needed. The latter relies on driving piles into the ground using a hammer. Three to five piling rigs would likely be deployed to construct the piles in an appropriate window in the overall programme.

3.5.11 The new ERF and Anaerobic Digestion facility would include a waste bunker, the majority of which would be located below ground, requiring a temporary embedded retaining wall to be constructed around the perimeter of the bunker. The embedded retaining wall would serve the dual purposes of supporting the adjacent soil when forming the deep excavation and to help to reduce the inflow of water into the excavation. During the construction of the deep excavation a temporary dewatering scheme would be implemented. The discharge of the temporary dewatering system would pass through a small settling pond/tank before discharging to the existing drainage system in the RRRF facility.

3.5.12 The waste bunker walls would be constructed using a slip form technique, which would require 24 hour construction 7 days per week for a period of approximately 2 months. The concrete would be continuously pumped into formwork which would be hydraulically jacked at a rate of approximately 25mm per hour. Plate 3.17 shows a typical bunker during a slip form operation.

Plate 3.17: Typical bunker during a slip form operation

3.5.13 Upon completion of piling activities the remaining concrete foundations of the new facility would be constructed. The foundations would consist of large concrete rafts bearing directly on the piles. At the same time as constructing the foundations, new underground drainage networks would be constructed, together with the new roads around the perimeter of the buildings. Underground works would also include other critical services such as fire mains, potable water, foul water and site electric cables (but not necessarily including the Electrical Connection at that point in time).

3.5.14 To construct the bunker and foundations, tower cranes would be utilised. The cranes would typically be approximately 60 m in height and have a swing radius of 65 m. For the stack installation, a larger crane (approximately 130 m) will be utilised. This would typically be for a limited period of approximately two weeks. The final dimensions and size of the crane would be determined once the detailed design of the plant is complete. At this stage, it is envisaged that 2 to 4 cranes would be required.

3.5.15 Upon completion of the main foundations and bunker, the mechanical equipment comprising the future operational plant would be installed. The mechanical equipment would be mainly delivered by normal road-going transport, however, a small number of abnormal loads would be required.

3.5.16 The mechanical installation would also be undertaken utilising tower cranes. It may be necessary to increase the capacity of the tower cranes for the mechanical installation phase by changing the upper part of the crane. The mechanical erection phase will require a significant amount of laydown area to be made available to store and pre-fabricate the equipment. The laydown/prefabrication areas will be located outside of the main REP site, at the Main Temporary Construction Compound.

3.5.17 Once the majority of mechanical equipment has been installed it would be possible to commence the erection of the Main REP Building steelwork. The building steelwork would be erected over the top of the mechanical equipment using the tower cranes. Metal cladding would be utilised to form the Main REP Building enclosure.

3.5.18 Electrical equipment and the control system would then be installed inside the water tight building. The majority of the electrical equipment would be delivered to site in prefabricated modular units.

3.5.19 Upon completion of the electrical installation the commissioning phase would start. The commissioning phase would consist of two distinct phases for the ERF and Anaerobic Digestion plant, namely cold and hot commissioning. The cold phase would be undertaken before energisation of that particular system, to ensure that all mechanical and electric items have been correctly installed and are ready to receive power.

3.5.20 The hot commissioning phase (including reliability testing) of the ERF would include the delivery of waste and the production of steam from the boiler, resulting in electricity via the steam turbine. During this phase the ERF will be fully tested to ensure compliance with the EP. The ERF plant will also be tested during this phase to ensure maximum efficiency, performance and reliability is achieved in the operation of the plant.

3.5.21 Commissioning of the Anaerobic Digestion plant is divided into the phases (a) cold commissioning (b) hot commissioning and (c) performance testing. In the various stages the following operations are performed:

a. Cold commissioning: functional testing and commissioning of components / equipment without organic materials. The cold commissioning phase is completed when all components have been checked for proper installation, and when all the measurement and control devices as well as all moving parts have been checked for proper function. All function tests are documented.

b. Hot commissioning: Filling of the digester with press water / inoculum and heating up thereof. Start up with organic material, increasing organic substrate input up to the designed throughput level.

c. Performance test: Proof of the guaranteed performance values. Following and during hot commissioning the contract guaranteed performance values are demonstrated through a series of established performance tests.

3.5.22 The solar and battery storage equipment would be switched on to test electrical connections as part of the overall Energy Park commissioning.

3.5.23 Upon completion of commissioning and reliability testing, any temporary facilities within the REP site would be demobilised from site and any permanent landscaping/habitat scheme would be completed.

Electrical Connection

3.5.24 The construction period for the Electrical Connection route is estimated to be up to 18 – 24 months, consisting of a rolling programme along the route. The works at Littlebrook 132kV substation are estimated to take approximately two weeks to install 132kV cables and connect the cables to the switchgear.

3.5.25 Where works are undertaken along footpaths and verges, a 3 m wide working corridor would be likely and generally be expected to cause some encroachment of the works area onto the highway, typically resulting in a lane closure. Where the proposals require works within the highway carriageway, a lane closure would be required. Depending on the width of the chosen highway route, a lane closure for the working area would typically require:

a. On dual carriageways - a reduction from two lanes to one along one of the carriageways; and

b. On single carriageways – traffic signals to control single lane traffic working.

3.5.26 Depending on specific local constraints, road closures may be required in certain circumstances. However, the Applicant and UKPN's decision making process to determine a preferred connection route sought to minimise or, where possible, eliminate potential temporary road closures and therefore formed a key consideration for selecting a predominantly dual carriageway route. More information regarding the alternatives considered is included in **Chapter 5.**

3.5.27 Due to the relatively limited working width required, public rights of way (PRoW) closures are considered unlikely, since temporary short diversions (approximately one week at a given location) would ordinarily be possible. Some highway footways may require temporary diversion or closure whilst works are being undertaken.

3.5.28 When trenching works are being undertaken it is expected that a length of up to 200 m would typically be excavated to facilitate duct laying. Longer lengths of excavation would be avoided by the commitment from UKPN to use a ducted cable system. This allows relatively short lengths of ducting to be installed and long cable lengths to be pulled through later between jointing pits.

3.5.29 The actual working area that would be fenced off could be up to c. 300 m to allow for safe clearances, including traffic management. Typical main mobile plant for open trenching would include an excavator with a breaker attachment, a dumper truck and a compactor. A specialist trenching machine may also be used. Where works are close to existing live services, precautionary digging may be undertaken locally by hand.

3.5.30 Methods to protect and reinstate soils excavated through the trenching works will be included within the final CoCP(s) and will include (where appropriate):

- stockpiling of any excavated materials in discreet horizons, in reverse order of excavation to test whether any can be re-used on site and also to ensure that proper reinstatement (where appropriate) can take place;
- Defra's general guidance on the 'Construction Code of Practice for the Sustainable Use of Soils on Construction' would be adhered to;
- methods to prevent compaction of soils, such as constructing access roads first, and ensuring traffic only uses designated access routes;
- ensuring any exposed soils are re-vegetated as soon as practical to prevent excess runoff or wind erosion. Land required temporarily during construction works would be reinstated to an agreed condition.

Plate 3.18: Example approach to cable working area

3.5.31 It is expected that a typical trench length would be open for around 7 days and that this would be on a rolling basis along the length of the route. The location of jointing pits would need to be determined by subsequent detailed design. Their location would depend on the maximum length the cables can be pulled, which will depend on the number of bends and cable drum lengths. Joint pits may need to be accessed, with an associated working area, to install and joint cables. The expected time for such an installation would be approximately 5 days.

3.5.32 UKPN have completed their non-intrusive studies of cable route options. Working closely with the Applicant they are aiming to identify a preferred route, taking into account engineering and construction constraints, consultation comments and environmental considerations. Some of this study has identified likely engineering constraints and, as a result, an additional period of consultation and engagement was undertaken in August 2018 to allow the inclusion of additional areas within the Application Boundary.

3.5.33 UKPN have now progressed to undertake more detailed engineering investigations at key locations to confirm locations of utilities, highway and ground conditions and to prove available ducting routes. A limited number of locations may require a solution other than open trenching. This would include trenchless installation techniques such as localised Horizontal Directional Drilling (HDD), boring or the installation of cables under or over an existing structure. This is most likely to occur at railway crossings, waterways or similar structures where trenching is not possible. These locations, such as at the crossing of the River Darent, have been considered in the ES. Wherever practicable, a trenched installation approach is preferable, however trenchless solutions provide an alternative that is, based on UKPN's engineering studies, considered achievable in all cases where trenched installation would not be undertaken. Other locations may arise generally along the route where a trenchless alternative to open trenching is required due to an unforeseen constraint however, given the extent of study undertaken so far, the likelihood of this occurring is considered low. The location of such potential works continues to be refined, however this Application has specifically excluded the potential to undertake trenchless installation within the extent of a former inert landfill immediately to the southwest of the highway crossing of the River Darent. Where trenchless installation is required, the works would be supported by a compound, approximately 30 m by 20 m, encompassing equipment and materials storage, and support facilities (see Plate 3.19 for a typical layout).

Plate 3.19: Example temporary trenchless installation compound (illustration is of a typical HDD setup)

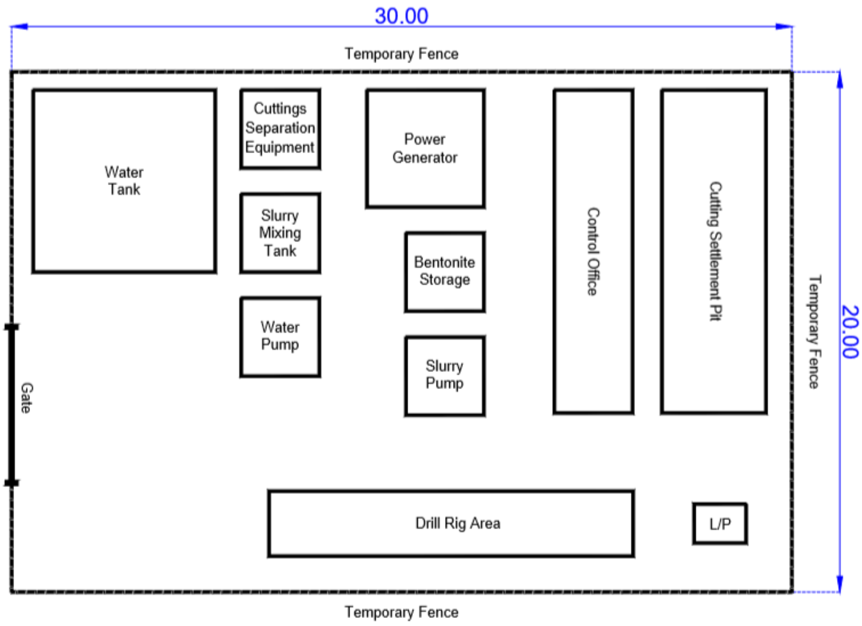


Table 3.2 Indicative construction and commissioning programme

Year	2021				2022				2023				2024				2025			
Quarter	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Main REP site construction																				
Main REP site commissioning (including cold and hot commissioning and reliability testing)															Reliability Testing commences				Commencement of Normal Ongoing Operation	
Electrical Connection construction																				
Electrical Connection commissioning																				

3.5.34 The period for construction of the Electrical Connection route would depend on the number of construction work areas installing ducting and cabling at the same time along the route. If multiple working areas were undertaken simultaneously, these would be sufficiently far apart to avoid accumulating any effects that might arise. It is expected that there would be no more than two working areas active at the same time.

Temporary Construction Compounds

3.5.35 Two forms of Temporary Construction Compound would be required, namely the Main Temporary Construction Compound to support the development of REP and the Cable Route Temporary Construction Compounds to support installation of the Electrical Connection.

3.5.36 The Main Temporary Construction Compound would be located on the western side of Norman Road, to the south of the REP site. The land there has been previously developed. The Main Temporary Construction Compound would be used as a laydown area, including as a delivery reception and consolidation point for construction materials, for equipment, for assembly/ fabrication and for associated welfare. They would also provide a site for satellite welfare facilities for the REP site. The use of the laydown area would potentially reach a peak towards the middle of the overall construction programme.

3.5.37 Part of the Main Temporary Construction Compound already has hard standing, however additional hard standing fill (i.e. a compacted imported fill) may be required to ensure the integrity of the site for laydown purposes. On completion of the construction phase, any compacted fill installed to provide a hardstanding would be removed.

3.5.38 The Main Temporary Construction Compound would likely be established at the same time as, or shortly before, piling works commence on the REP site.

3.5.39 Cable Route Temporary Construction Compounds would be required to provide small scale localised storage of materials and mobile welfare whilst the Electrical Connection route is being constructed. These would be required where materials cannot be delivered direct to the working area. Due to the potential route options, working arrangements (in terms of ducted lengths, joint pit location and number of operational gangs) and extent of direct-to-site deliveries, it is not possible at this stage to identify the specific location of each Cable Route Temporary Construction Compound, however the Application Boundary has been drawn with the expectation that the compounds can be encompassed within these limits.

Plate 3.20: Example of 132kV Cable Drum Storage in Cable Route Temporary Construction Compound

3.6 Operation

3.6.1 REP would become initially operational and enter a period of reliability testing from 2024 onwards, commencing normal ongoing operation in the mid to latter part of 2025 (subject to prior grant of DCO in early 2020).

Workforce

3.6.2 The operation of REP would generate a minimum of 75 full time equivalent (FTE) jobs comprising operations, jetty/site operations, engineers, technicians/fitters, stores operatives and financial/admin staff.

Access and On-site Vehicle Movements

3.6.3 The main and only highway access to REP would be via Norman Road from the existing highway network and would be shared with RRRF. Norman Road provides access directly to a dual-carriageway highway used by other industrial uses in the area, including significant road based logistical distribution facilities.

3.6.4 Access from the River Thames would be via the existing jetty which is currently used for RRRF. Onsite vehicles would transport sealed containers carrying construction materials (if used) and waste during operation from the jetty into the Main REP Building. IBA outputs would be transported in sealed containers back to the jetty for transporting via the River Thames.

3.6.5 Primary pedestrian access to REP would be via Norman Road and the PRoW network.

3.6.6 Indicative onsite access arrangements would predominantly utilise a one-way system with turning movements tested through swept path analysis. Some amendments would be made to the northern end of Norman Road to facilitate a revised arrangement on entering the REP site. An Illustrative Site Layout is provided in **Figure 1.3 a, b and c**.

3.6.7 To inform the assessments, waste delivery scenarios of 100% by road and 100% by river have been considered and are discussed in more detail in the relevant topic-specific chapters of this ES.

3.6.8 The Main Temporary Construction Compound would be accessed directly from Norman Road with one or more new access points required depending on the final subdivision and arrangement within the Application Boundary.

Maintenance, Start-up and Shutdown

3.6.9 The ERF would be designed to operate for approximately 8,000 hours per year. Typically, each boiler line would undergo one planned minor outage (approx. 7 days in duration) and one planned major outage (approx. 14 days in duration) per year, which can be conducted without taking the entire plant offline. Statutory inspections on common plant (necessitating a full shut down for approx. 3 days) are required at least every two years. Additionally, the turbine and generator would typically be taken out of service for up to 8 days per year for inspections and maintenance.

3.6.10 The waste bunker would be sized to accommodate c. 7 days storage capacity when operating at nominal throughput. This is sufficient to allow waste to be stockpiled in a controlled manner for anticipated maintenance periods. In the very rare event of an extended outage, waste volumes would be managed through the logistics network and, if required, diverted to other waste disposal/treatment facilities temporarily.

3.6.11 The Anaerobic Digestion facility would remain in operation for the entirety of its design life once commissioned. All components requiring maintenance would be accessible from outside of the digester. All ancillary systems (material handling, ventilation, gas upgrading etc) are designed to be capable of being maintained without disrupting the anaerobic digestion process.

3.6.12 Battery storage would remain in operation for the entirety of its design life, operating intermittently but frequently to suit generation output and peak demand.

3.6.13 The roof mounted photovoltaic panels would remain in operation for the entirety of their design life and would only require occasional cleaning and maintenance.

3.7 Decommissioning

3.7.1 At the end of the operational life of REP, the generating equipment would be removed once the plant had ceased operations permanently. Any decommissioning phase is assumed to be, at worst, of a similar duration to construction (minus the commissioning activities), and therefore environmental effects are considered to be of a similar level to those during the construction phase.

3.7.2 If the Electrical Connection route is decommissioned then ducting would be left in-situ. Cabling may be removed, or disconnected (made safe) and left in-situ.

3.8 Site Security

3.8.1 The REP site would be surrounded by a palisade fence which includes lighting to the perimeter at night and CCTV that covers the entire site. Gates and barriers would be controlled by an access control system, along with all of the outer building doors and strategic internal doors. Weighbridge barriers would be controlled by the weighbridge system and would communicate to the access control system to open gates when exiting.

3.9 Fire and Explosion Risk

3.9.1 Fire and explosion risks will be controlled at REP by adhering to the latest codes of practice and guidance. A full Hazard and Operational study will be undertaken throughout the design phase of the project and REP will be designed, constructed, and operated in compliance with the current issues of:

- BS9999: Code of practice for fire safety in the design, management and use of buildings;
- NFPA 850: Recommended Practice for Fire Protection for Electric Generating Plants and High Voltage Direct Current Converter Stations; and
- WASTE 28: Reducing fire risk at waste management sites.