



Aggregate Recycling Plant,
Asphalt Production Plant and
Gully Waste Recycling Plant,
Bulls Bridge, Hayes

Energy Statement

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Executive Summary

ENVIRON UK Ltd was appointed by FM Conway Ltd (hereinafter referred to as 'the Applicant') to prepare an Energy Statement that will accompany a detailed planning application for the development of an Aggregates Recycling, Asphalt Production Plant and Gully Waste Recycling Plant (hereinafter referred to as 'the Proposed Development') at the former Powergen site (hereinafter referred to as 'the Site'), Bulls Bridge, Hayes, London Borough of Hillingdon (LBH).

The Proposed Development relates to bespoke industrial and waste recycling plant and equipment that will enable construction material to be recycled rather than landfilled. In doing so, it will deliver materials that substitute virgin, primary aggregate, underpinning the aspirations of London Plan Policy 5.2 B. In addition, by replicating its existing facilities in Dartford and Erith (East London) at Bulls Bridge (West London), the Applicant is able to significantly reduce carbon emitting vehicle movements across the region.

Although the Proposed Development is for a bespoke facility, which has very specific process, energy, access and layout requirements, the proposals have been assessed against prevailing regional climate change and energy policy. As such, the Energy Strategy and Statement has been prepared by reference to London Plan policy requirements and in particular the Mayor of London's Climate Change Mitigation and Energy Strategy.

In presenting the Energy Strategy for the Proposed Development, the document:

- reports on the baseline energy demand of the Proposed Development, including the Non-Part L energy use;
- outlines the options considered for reducing CO₂ emissions through energy efficiency measures, energy supply and renewable energy technologies having regard to the unique characteristics of the Proposed Development and the local environment;
- describes the energy efficiency, low carbon and best practice initiatives which form part of the development proposals; and
- quantifies the residual carbon emissions from the Proposed Development's energy consumption in terms of tonnes (t) CO₂/year.

It concludes that:

- The overall carbon impact of the Proposed Development is predicted to be 9,145 tCO₂/year, of which:
 - 85% will be associated with the Asphalt Production Plant;
 - 14% will be associated with the Aggregate Recycling Plant; and
 - less than 1% will be associated with the Offices, Gully Waste Recycling Plant and other ancillary activities.
- The most appropriate strategy to improve energy efficiency and reduce carbon emissions from the Proposed Development is the application of Best Practice standards of design and operation for the Asphalt and Aggregate Recycling Plants. This comprises Electrical Efficiency features and Optimum insulation standards which have the potential to deliver 26% reduction in carbon impact. This is equivalent to 2,153 tCO₂/year.
- Renewable energy options are not considered appropriate for technical reasons and due to space restrictions. However, there is the opportunity to incorporate a Photovoltaic (PV) array on the roof areas of the Proposed Development's weighbridge building and three storey administration offices, which could deliver 15% reduction in the buildings' carbon impact. This is equivalent to 5 tCO₂/year.

- The Proposed Development will have no demand for medium grade heat and the technologies applied at the Site, would render CHP technology in compatible. In addition there is no option for specifying a micro-CHP unit for the buildings as there is no thermal loads for most of the year, and micro-CHP technology has not been effectively demonstrated to be practical for the two buildings.
- An additional reduction in carbon impact may be achieved by using Recycled Fuel Oil for the Asphalt Plant's rotary dryer, but this opportunity is restricted by issues associated with meeting air quality standards (referred to in London Plan Policy 5.7 D), Local Authority Pollution Prevention & Control (LAPPC) Permit criteria and the Site's location within an Air Quality Management Area.
- The Proposed Development complies with London Plan Policies 5.2, 5.7, 5.17, and 5.20 in regards to Energy Efficiency, Carbon Impact and the Aggregates Strategy for London.

The overall carbon footprint of the Proposed Development is shown in Figure A.

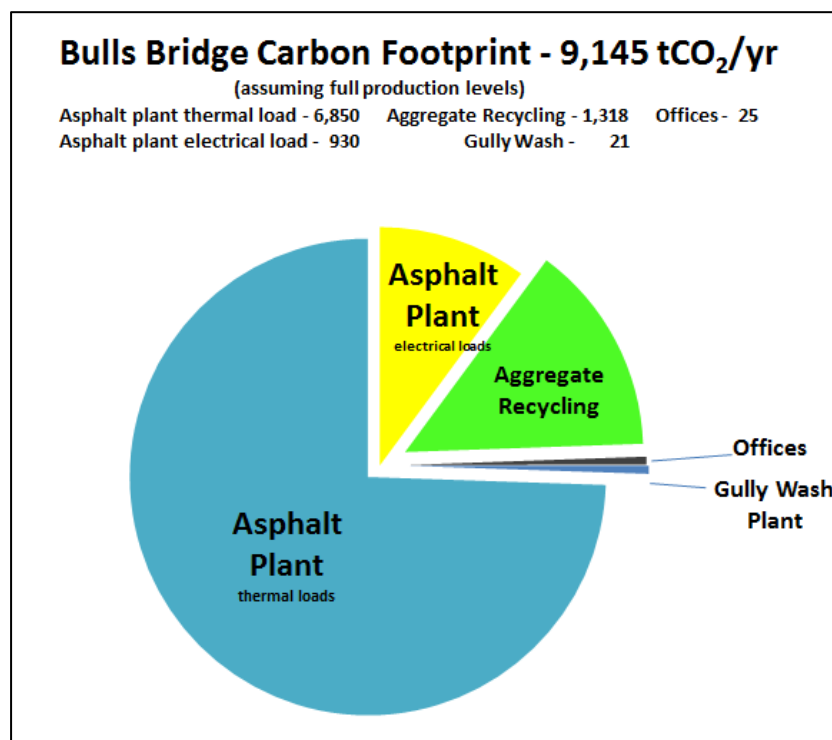


Figure A: Proposed Development Carbon Footprint

The key technologies that will be used at the Site for all the power elements of the processing activities to achieve Best Practice performance levels are:-

- High Insulation standards for the aggregate dryers;
- Controlling of moisture content of aggregate;
- Variable Speed Drives for motors;
- Best Practice Lighting design and control;
- Power Factor Correction;
- Energy Metering;
- EF1 High efficiency motors and drives; and
- Rotation censor fitted conveyors to eliminate any possibility of spillage due to stoppage out of sequence.

In line with industry best practice, the baseline energy demands of the Proposed Development have been calculated to include unregulated energy for the process loads and recycling facilities. These are based on metered data of similar sites within the same sector and industry published benchmarks.

The Applicant's strategy and approach is to employ the same, or improved, design and energy efficiency standards that have proven successful and effective for Asphalt production at their Erith Facility and the Aggregate Processing at their Dartford Facility. The design team has been retained so the key design details will be redeployed for the Proposed Development. The energy performance for the Proposed Development will match or further improve upon Erith's and Dartford's performance.

Asphalt Production Plant

The baseline CO₂ emissions for the Asphalt Production Plant are predicted to be 7,780 tCO₂/year assuming maximum capacity production of 300,000t/year. This represents a 20% reduction in carbon emissions compared to other industry sector benchmarks.

Aggregate Recycling Plant

The baseline CO₂ emissions for the Aggregate Recycling Plant are predicted to be 1,318 tCO₂/year assuming maximum capacity production of 300,000t/year. This represents a 20% reduction in carbon emissions compared to other industry sector benchmarks.

Gully Waste Recycling Plant

The CO₂ emissions associated with the Gully Waste Recycling Plant are predicted to be 21 tCO₂/year. This is a relatively new process that will facilitate an additional 20,000 tonnes of aggregate material to be recycled. There is limited energy performance data associated with this process, and it has been assumed the impact will be 2 kWh_{elec}/tonne processed.

Process Component Carbon Savings

The Processing component of the Proposed Development will achieve a 20% reduction in CO₂ emissions by adopting energy efficient design measures. There remains a potential for further reduction in CO₂ emissions by switching to RFO (Recycled Fuel Oil) for the rotary burner of the Asphalt Plant. However, there are air quality issues that make this option incompatible with local air quality and the requirements of London Plan Policy 5.7 D.

The total reduction of CO₂ emissions for the Processing component is predicted to be 2,332 tCO₂/yr as shown in Figure B.

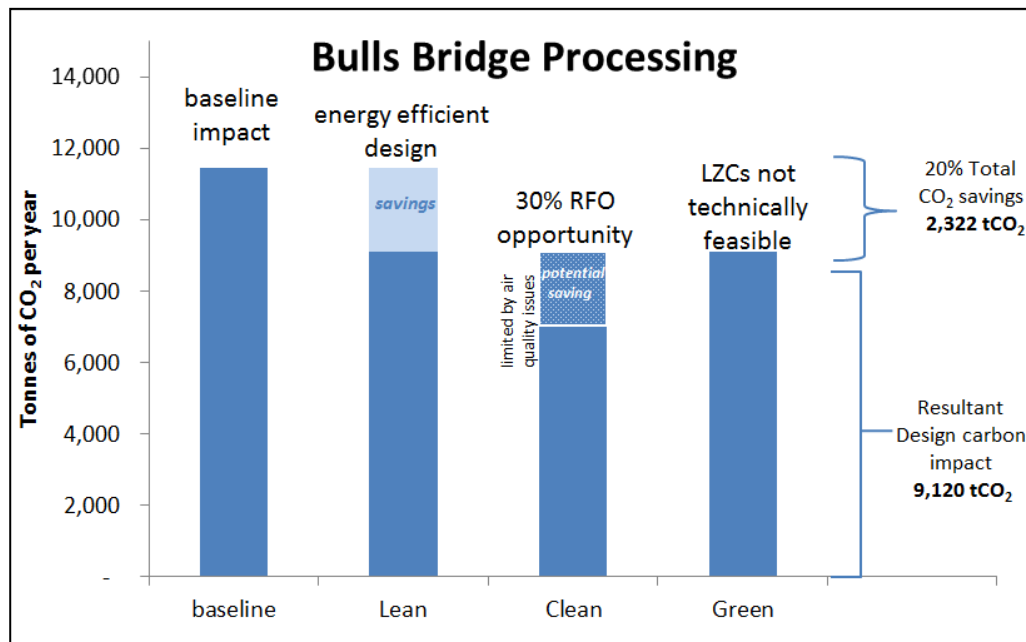


Figure B: Proposed Development Process Performance

Building Component Carbon Savings

The Proposed Development's Administration and Weighbridge Buildings (total area of 792 m²) will only contribute 25 tCO₂/yr (0.3%) towards the overall carbon impact of the scheme. This will be achieved by exceeding the energy efficiency design standards of the "baseline Building Regulations compliance specification" (33.7 tCO₂/yr) by 10%, and by installing up to 118 m² area of Photovoltaic, as shown in Figure C.

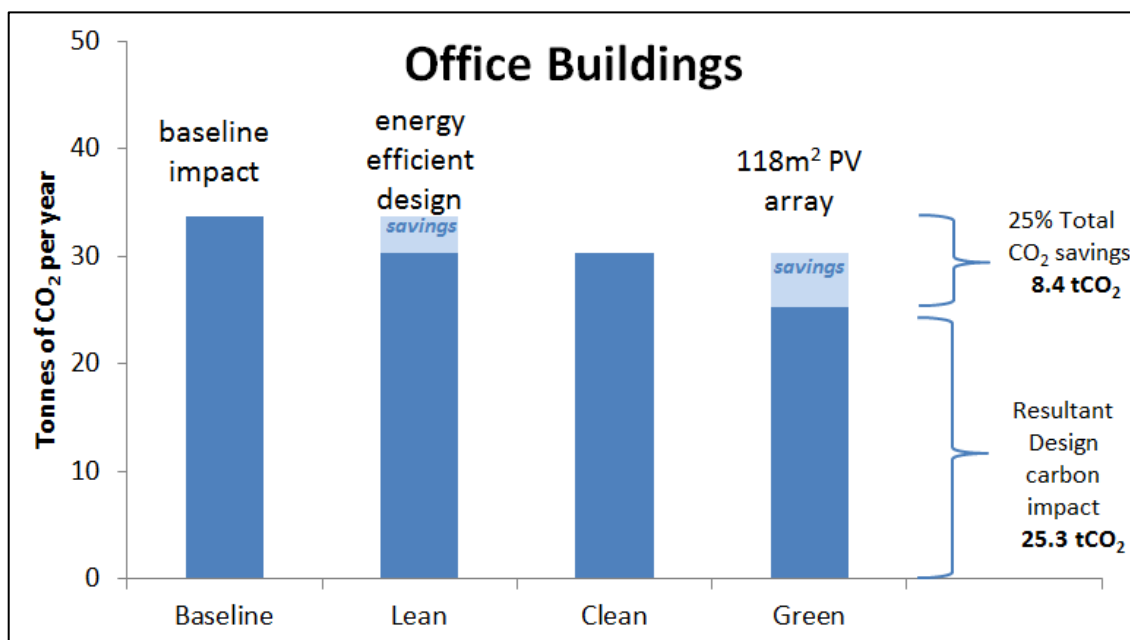


Figure C: Proposed Development Building Performance

1 Introduction

1.1 Background

ENVIRON UK Limited (ENVIRON) was commissioned by FM Conway Ltd. (hereinafter referred to as 'the Applicant'), to prepare an Energy Statement that will accompany a detailed planning application for the development of an Aggregates Recycling Plant, Asphalt Production Plant and Gully Waste Recycling Plant (hereinafter referred to as 'the Proposed Development') at the former Powergen site (hereinafter referred to as 'the Site') in Bulls Bridge, Hayes, London Borough of Hillingdon (LBH).

Following the receipt of an Environmental Impact Assessment (EIA) Screening Request compiled by ENVIRON, on behalf of the Applicant, in May 2011, LBH confirmed that the development proposals do not fall within Schedule 2 of the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations (as amended) (the EIA Regulations); however, discreet technical assessment reports would be required to accompany the planning application for the Proposed Development.

This report demonstrates how the Proposed Development has taken on board local and regional climate change and energy policy.

1.2 Purpose and Scope of Report

The purpose of the Energy Statement is to present the Energy Strategy for the Proposed Development. As such, it:

- reports on the baseline energy demand of the Proposed Development, including the Non-Part L¹ energy use;
- outlines the options considered for reducing CO₂ emissions through energy efficiency measures, energy supply and renewable energy technologies having regard to the unique characteristics of the Proposed Development and the local environment;
- describes the energy efficiency, low carbon and best practice initiatives which form part of the development proposals; and
- quantifies the residual carbon emissions from the Proposed Development's energy consumption in terms of tonnes CO₂/year.

The Energy Statement has been prepared by reference to London Plan² policy requirements and in particular the Mayor of London's Climate Change Mitigation and Energy Strategy³, as well as LBH policy, where relevant.

In addition, the following documents/guidance have informed the approach adopted in designing the most appropriate energy strategy for the Proposed Development:

- The Building Regulations⁴;
- CIBSE⁵ Guide F⁶;

¹ Her Majesty's Government, 2010. The Building Regulations. L1A Conservation of Fuel and Power in New Dwellings. Part L energy use is related to new buildings Regulations. Non Part L energy use is related to the Process Loads.

² Greater London Authority, 2011. London Plan; Spatial Development Strategy for London.

³ Greater London Authority, 2011. Delivering London's Energy Future. The Mayor's Climate Change and Mitigation and Energy Strategy.

⁴ Building Regulations apply in England & Wales and promote standards for most aspects of a building's construction, energy efficiency in buildings, the needs of all people, including those with disabilities, in accessing and moving around buildings.

- London Renewables Toolkit⁷;
- Data from the Carbon Trust Low Carbon Buildings Programme.

It is noted that the primary focus of prevailing policy and guidance is on delivering more energy efficient building stock, with very little, if any, focus on promoting process energy efficiency which will comprise the majority of the Proposed Development's carbon impact.

The approach that was therefore been adopted in this report to quantify the overall carbon impact of the Proposed Development has been to:

- consider the Proposed Development's two key process components (asphalt production and aggregate recycling) and use real performance data collected from a number of sources to benchmark the Proposed Development's process performance. These sources have included:
 - 2010 data from the Applicant's existing facilities at Dartford and Erith;
 - 2006 Asphalt PEER Group data from a competitor in the same sector undertaking similar mix of asphalt production and recycling over a portfolio of 30 sites;
 - Energy Consumption Guide (ECG)70 data, which contains sector performance benchmarks published by the Department of the Environment, Transport and the Regions (DETR)⁸; and
 - data from the Mineral Products Association (MPA) 2010 annual report⁹ for the combined CO₂ impact for the Asphalt sector.
- consider the energy performance of the Proposed Development's building components by reference to:
 - The London Plan Energy Hierarchy;
 - CIBSE Guide F;
 - BRE Energy Consumption Guide (ECG)19 - Energy Use in Offices¹⁰;
 - Building Regulation LA2 (Non-residential); and
 - Undertake a renewables options appraisal for both the process and building components.

⁵ Chartered Institute of Building Service Engineers, 2004. Energy Efficiency in Buildings. CIBSE. London.

⁶ Guide F deals with the building as a whole. The technical content is guidance from an energy perspective and extra information is available elsewhere in the CIBSE Guides

⁷ Secretary for Trade and Industry, London Energy Partnership and Faber Maunsell, 2004. London Renewables - Integrating renewable energy into new developments: Toolkit for planners, developers and consultants. Greater London Authority.

⁸ Department of the Environment, Transport and the Regions, Energy Consumption Guide 70 – Energy Use in the Minerals Industries of Great Britain. DETR.

⁹ Mineral Products Association, 2010. Summary Sustainability Report 2010.MPA

¹⁰ Building Research Establishment 2000. Energy Consumption Guide 19 – Energy Use in Offices. HMSO.

2 The Site

2.1 Site Context and Location

Hillingdon comprises the most western London borough. It borders Hertfordshire to the north; the London Boroughs of Harrow, Ealing and Hounslow to the east; Surrey to the south; and Buckinghamshire to the west. Approximately half of the borough is covered by open land, which is primarily used for agriculture and recreational activities. However, it also contains legacies of past mineral extraction in the form of poorly restored land, particularly in the south.

The Grand Union Canal runs for about 20kms through the borough and is an important spatial feature linking the urban area with open land and countryside. Another key feature of the borough is Heathrow International Airport.

The London Borough of Hillingdon has four regionally important Strategic Industrial Locations totaling approximately 270ha. These include three Preferred Industrial Locations (PIL) namely Uxbridge Industrial Estate, Victoria Road/Stonefield Way (in South Ruislip) and Hayes Industrial Area. The latter is the largest industrial area in the borough and benefits from easy access to the motorway system and Heathrow Airport, improved by the completion of the A312 Hayes By-Pass (the Parkway) in 1992.

The Site of the Proposed Development Site is located at Bulls Bridge within the Hayes Industrial Area and centered at national grid reference NGR TQ 107 792 as shown in Figure 2.1.

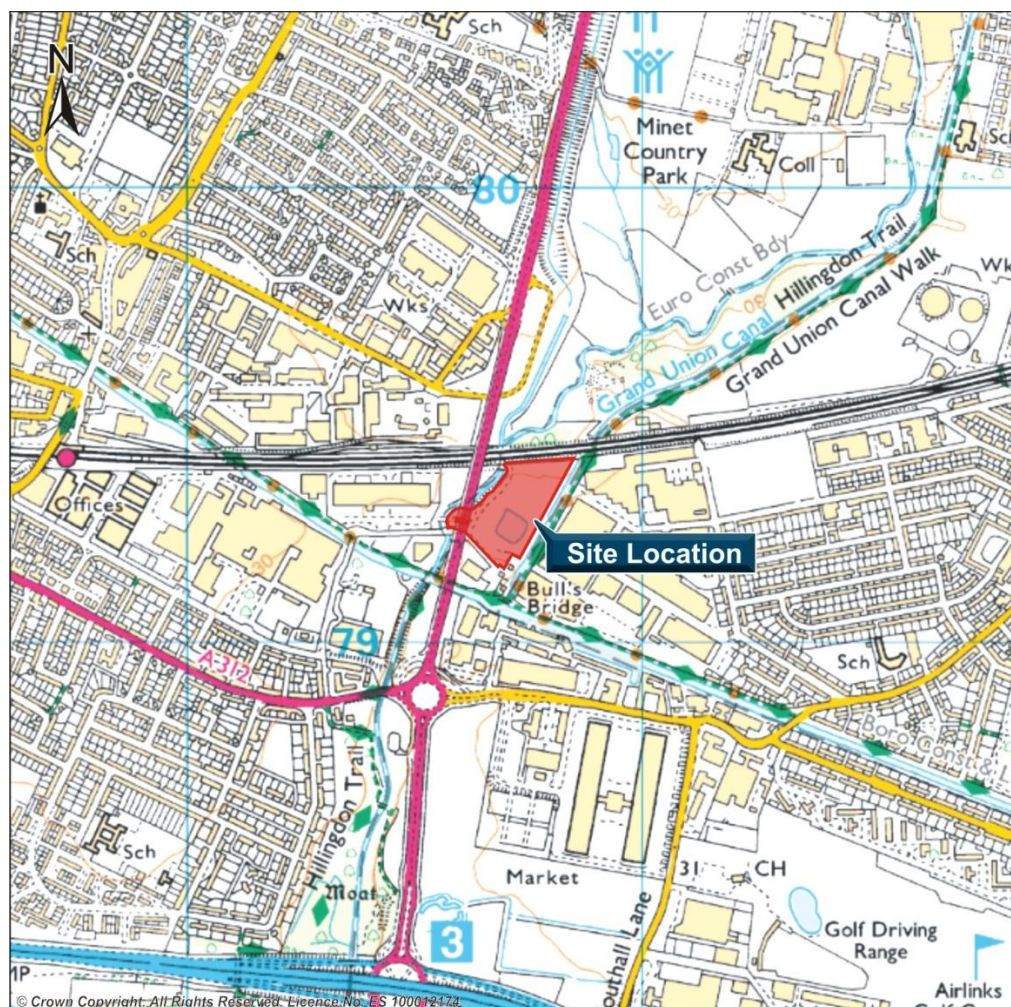


Figure 2.1: Site Location

Access to the Site is off North Hyde Gardens Road, which connects to the A312 (the Parkway) via North Hyde Road. The A312 southbound provides access to Junction 3 of the M4 motorway, approximately 1.3 km south of the Site.

The Site is bounded to the north by the Paddington to Bristol railway line, to the east by the Paddington Branch of the Grand Union Canal, to the south by North Hyde Gardens Road and to the west by the Yeading Brook and Parkway flyover. North Hyde Gardens Road passes under the Parkway flyover to terminate at the Grand Union Canal. An access road off North Hyde Gardens Road to the DHL Lorry Park cuts north-south through the western extent of the Site.

Bull's Bridge marks the junction where the Paddington Branch re-joins the main canal. It is from this point, where the Paddington Branch is shared for some distance between the London Boroughs of Ealing and Hillingdon. The Ealing side of the canal includes the towpath which adjoins the former site of the Southall Gas Works and the industrial land at the junction with the Grand Union Canal mainline. The area south of the Grand Union Canal, including the Tesco Superstore, falls within the London Borough of Hounslow.

2.2 Site Description

The Site is roughly rectangular in shape and occupies an area of approximately 3 hectares. It is brownfield having been previously operational as a Powergen site, a fuel storage facility for the nearby Bulls Bridge Power Station and a creosote works.

All previous structures have been demolished and the Site is now characterised by a perimeter earth and rubble bund and colonized regeneration vegetation. The boundary is defined by hoarding and steel palisade fencing.

Apart from the perimeter bund (approximately 3 m high), the Site is generally flat. Vegetation predominantly comprises tall ruderal and scrub species, a strip of broadleaved woodland along the Site's eastern boundary, most of which are typical of derelict and wasteland sites. The woodland has been subject to an Arboricultural Survey which has confirmed the majority of trees as Category C Norway Maple trees, with only two Category B English Oak trees.

The western boundary slopes down to the Yeading Brook which is approximately 4.5 m below the Site's ground level.

The A312 flyover crosses the south-west corner of the Site, with one of the flyover supports located on the Site.

3 Proposed Development

3.1 Proposed Development Scope

The development proposals are for the construction and operation of an Aggregate Recycling Plant; Asphalt Production Plant; Gully Waste Recycling Plant; together with associated ancillary structures and facilities, car and HGV parking, regrading and landscaping.

The redevelopment proposals provide for:

- clearance and spreading of the existing bund material across the Site (as outlined in the Proposed Development's Land Contamination Strategy Report);
- capping of the Site with concrete and/or asphalt as appropriate for circulation and parking;
- construction of administration office;
- construction of an Aggregate Recycling Plant;
- construction of a Gully Waste Recycling Plant;
- construction of an Asphalt Production and Storage Plant; and
- implementation of landscaping.

Upon completion the Aggregate Recycling Plant will have a maximum process and recycle capacity of approximately 300,000 tonnes per annum (tpa) of waste material extracted from pavements that will otherwise have been landfilled. Some of this material will be used within the Asphalt Production Plant which will at completion, have a production capacity of 300,000 tpa. In addition, the Gully Waste Recycling Plant, will accept material from road sweepers and gully suckers (that will otherwise have been sent to landfill) to recycle up to 20,000 tpa. The recycled water and the recovered solid materials from this process will be redirected back into the Aggregate Recycling Plant.

The Proposed Development's key objective will be to recycle all the waste materials that arise from the delivery of the Applicant's wide ranging services. These include asphalt; road and pavement sub base, paving, concrete and wet wastes such as gully waste and road sweepings.

The Proposed Development will also serve as an operating centre for the Applicant's Term Maintenance Division by providing parking for vehicles and storage for equipment and materials.

A maximum of 79 workers will be catered for at the Site upon completion of the full development. This will include HGV drivers and Term Maintenance operatives based at the Site, but often working away from the Site during the working day.

3.2 Proposed Development Layout

Figure 3.1 illustrates the layout of the Proposed Development, which has been informed by a number of limitations, considerations and requirements, including:

- the constrained area of the Site, especially following the set back of the eastern Site boundary to safeguard existing woodland trees on-site and immediately to the east of the Site;
- environmental issues including the location of sensitive receptors, the visibility of the Site, the setting of the Site; the past uses at the Site;

- the Applicant's operational experience based on their existing facilities at Dartford and Erith;
- site logistical arrangements including internal circulation and swept path analyses; and
- design criteria, including the desire to ensure uniformity in building presentation and to 'contain' industrial features to least visible areas of the Site.

In light of the re-spread of existing bund material across the Site and capping layers on top, the current site levels are likely to be raised by up to a maximum of 1.2 m. These materials will be retained by means of a 1.2 m high retaining wall along the entire site perimeter. The following boundary treatment will be implemented on top of this retaining wall:

- north-west: 2.4 m palisade fence;
- north-east :6 m acoustic boundary wall;
- east: 7 m acoustic boundary wall;
- south-east: 3-5 m acoustic boundary wall with 1.2 m high landscaping planters;
- south: 2 m acoustic boundary wall with 1.2 m high landscaping planters; and
- west: 2.4 m palisade fence.

In all instances the walls, and their respective heights, are provided for acoustic attenuation purposes.

Road access will be provided from two points along the existing road - one access point to the main facility and one access point to the staff car parking located beneath the A312 Parkway.

The development layout will comprise the following:

Northern and North-Eastern Site Area:

- Aggregate Recycling Plant including Washing Plant and Inbound Material Stockpile up to 5 m high
- Low level cement silo
- Water storage tank
- Staff welfare and storage facilities

Eastern Site Area:

- Inbound storage bays
- Covered aggregate storage bays
- Site storage and/or parking (comprising hardstanding areas, enclosed as necessary)
- Water storage tank

Southern Site Area:

- Asphalt Plant
- Asphalt HGV tracking lanes and parking spaces
- Site storage

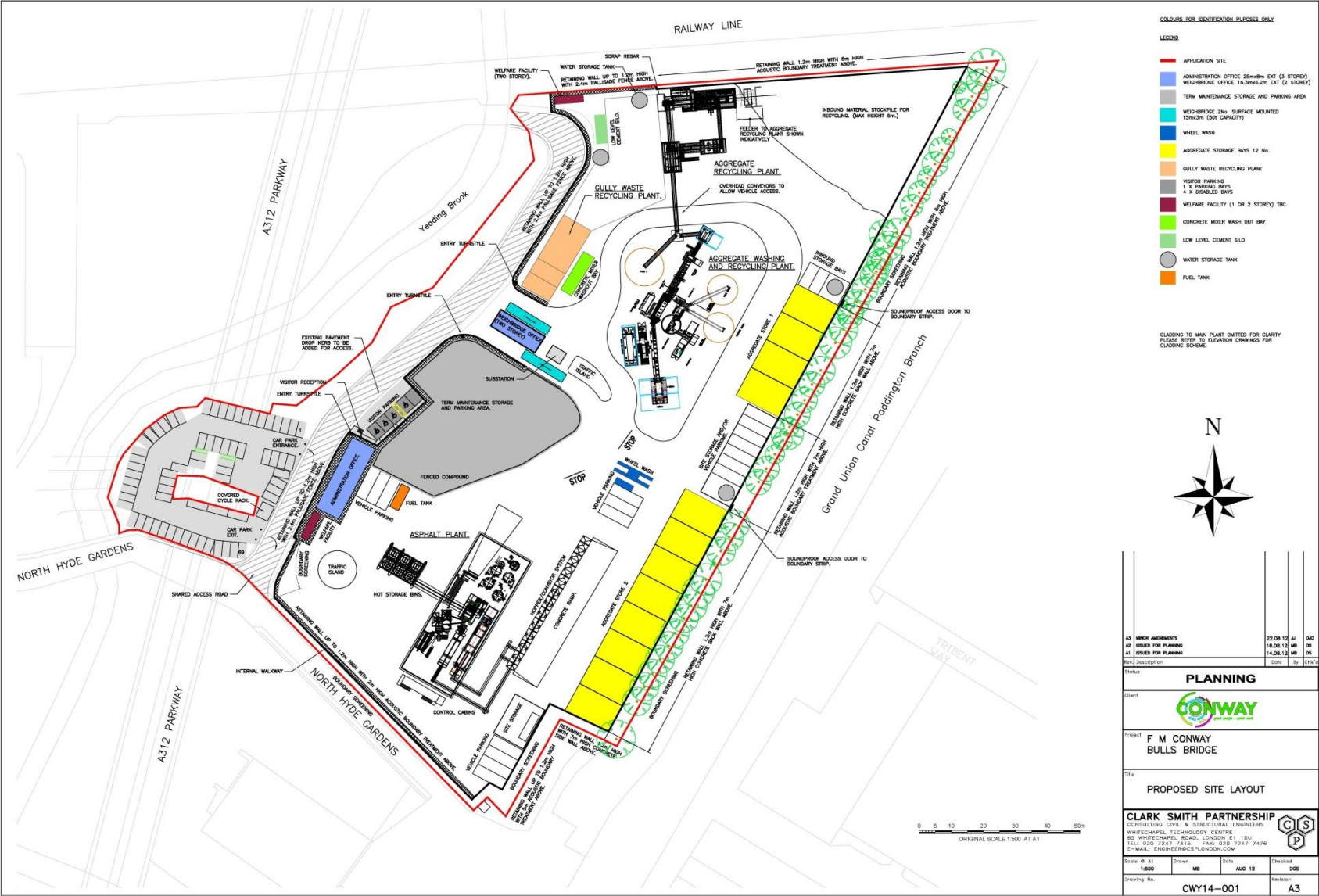


Figure 3.1: Proposed Development Layout

Western Site Area:

- Landscaped car park with 70 car parking spaces, five cycle and five motorcycle spaces
- Staff welfare facilities
- Office building and visitor car parking spaces
- Term Maintenance Yard (enclosed as necessary) and fuel storage areas
- Main site entrance point with entry and exit roads, incorporating weighbridges, on either side of the weighbridge office including the plant control room
- Gully Waste Recycling Plant
- Concrete washout bay
- Water storage tank
- Diesel fuel tank with 60,000 litre capacity and bunded containment of 110%.

Central Site Area:

- Hardstanding and circulation routes
- Drive-through wheel wash

3.3 Proposed Development Components and Processes

This section discusses in more detail the component parts and processes of the Proposed Development, as well as ancillary components.

3.3.1 Aggregate Recycling Plant**Component Parts**

The Aggregate Recycling Plant will comprise a processing plant, screens, washing plant, hoppers, conveyors, fines treatment equipment, control cabins, inbound storage bays (of block wall or sleeper construction) and other ancillary plant, equipment and structures.

The processing plant will be fully housed/enclosed as necessary to accord with the Proposed Development's noise and vibration impact assessment. Dry product conveyors will be enclosed whilst wet product conveyors will be open; dust suppression will be fitted as appropriate (water sprays).

Recovered materials delivered to the Site for recycling will be from the Applicant's existing contracts and will be stored in the inbound storage bays. Materials will typically include the following:

- road and pavement infrastructure materials including asphalt, sub-base, concrete, kerbs, slabs and drainage media (all inert);
- construction and demolition waste – inert only;
- road planings;
- waste asphalt;
- waste concrete;
- solid materials recovered from Gully Waste Recycling Plant; and
- primary aggregate for blending with recycled products.

The combined volume of the above components will reach up to 300,000 tpa.

Processes

The processing of material will be carried out through any combination of processing, re-grading, screening, washing, blending or simply re-handling. The process can be summarised as follows:

- Recovered materials will be delivered to Site in HGVs and unloaded into the inbound storage bays or stockpile in the north-eastern corner of the Site, not to exceed 5 m in height. Potential dust from these stock piles would be attenuated by means of perimeter installed dust suppression sprays.
- The processing plant will be fed material by a hydraulic excavator.
- All Materials will initially pass through the enclosed processing plant and be screened to produce either 0-25 mm product or 0-45 mm material stream. Both these activities will take place within high performance noise attenuation.
- The 0-25 mm material will be further washed and screened by transporting the material, via a semi covered conveyor, directly to the washing plant with a high pressure washing system. The material will be screened to 0-4 mm, producing recovered 4 mm sand and 4-20 mm recovered stone. These products will then be blended to produce fully recycled ballast. The recycled ballast is the principal raw material used by the Applicant's fleet of volumetric concrete mixers. The recycled ballast, together with cement, water and any required additives are mixed at the delivery point to produce fresh concrete. Only the exact quantity of concrete required is therefore mixed to avoid any wastage via the volumetric concrete mixers.
- The processing and washing plant are designed to allow for different size products to be produced including drainage media. The 0-45 mm material will be used for Type 1 sub base, and sold to the Applicant's own contracts or any third party customers. Stockpiles of recycled aggregates will not exceed 6 m in height and will be regularly dampened down to ensure that dust and visual impacts are minimised.
- A loading shovel will be used for moving materials and loading lorries.

The above processes will produce the following products:

- sub-bases;
- capping materials;
- Type 1;
- Type 4;
- drainage media;
- graded aggregate;
- sand;
- ballast; and
- recycled asphalt products (('RAP') a screened blend of road planings) and waste asphalt.

These products will be re-used on-site or loaded for off-site sale or re-use. Any unusable arisings, including fines and filter cake from the washing process, that cannot be re-used will be disposed of off-site. Any scrap metal, wood, plastic or litter will be separated as part of the process and recycled as appropriate. This would be less than 1% of all inbound material.

The above processes will be subject to the conditions of any waste management license as appropriate, issued by the Environment Agency, as is the case with the Applicant's existing Dartford Facility.

Operating Hours

The Aggregate Recycling Plant will operate as follows:

Plant Activity	Weekday Operating Hours	Weekend Operating Hours
Inbound material delivery	24/7, although principally from 07.00-18.00	24/7, although principally from 07.00 - 14.00
Aggregate processing and washing	07.00-18.00	07.00-14.00 Saturday
Loading out of recycled materials for off-site sale or collection by customers	06.00-18.00	06.00-14.00 Saturday

3.3.2 Asphalt Plant

Component Parts

The Asphalt Plant will comprise the production unit, an asphalt hot storage facility (with six 80 tonne capacity bins), twelve covered aggregate storage bays and ancillary plant, equipment and structures, including three sea-container style units for the storage of spare parts and equipment.

It will have a rated capacity of 160 tpa incorporating a parallel dryer drum for the use of hot RAP, which will significantly increase the proportion of RAP that can be used in different product mixes.

The hot storage facility would be fed by an enclosed conveyor from a ground level unloading facility. These component parts will all be fully contained and clad as show in Figure 5.2.

The fleet of vehicles serving the Asphalt Plant will be parked in the south-western corner of the Site. All vehicles would be fitted with air brake silencers, rubber tailgate buffers and white-noise proximity beepers (as per the loading shovel).

Processes

The Asphalt Plant will manufacture coated road-stone (asphalt) from a mix of primary and secondary aggregates, as well as RAP which will be combined with bitumen and fillers depending upon the required asphalt mix. . RAP will be sourced from the adjoining Aggregate Recycling Plant, and could in some instances comprise 70% of product mixes. At full capacity, maximum output will be up to 300,000 tpa.

The process comprises five main stages:-

(1) Site Storage of Raw Materials.

The majority of aggregates, sand, fillers, bitumen, fuel and various additives necessary for production of asphalt will be brought to Site by sheeted HGVs. Bitumen will be delivered to the Site by delivery tanker and will be drawn directly from the delivery tanker into one of five dedicated bitumen tanks (located within the Asphalt Production Plant) to minimise any risk of spillages.

On-site storage arrangements will be as follows:

- Aggregates, sand and RAP will be stored in 12 box profile clad and covered storage bays each capable of holding up to 1,200 tonnes, of material. Reclaimed and imported fillers including hydrated lime will be stored within three sealed silos located inside the main enclosure of the Asphalt Plant;

- Pigment will be stored within the main plant enclosure in a small 3 m³ hopper with closable lid;
- Bitumen will be stored within five electrically heated vertical tanks, three will hold 80 m³ and the fourth will be split into 2 x 40 m³ held at approximately 160 °C;
- Emulsion will be stored in a 30,000 litre heated tank holding the emulsion at approximately 80 °C. All binder tanks will comply with the refined bitumen association (RBA) safe storage regulations.
- Fuel oil will be stored within a 80,000 litre tank within the main plant enclosure with bunded containment of 110%.
- Diesel fuel will be stored in a 60,000 litre tank with bunded containment of 110%.

(2) Aggregate Feed and Proportioning

Aggregates and sands will be fed independently via a wheeled loading shovel from the storage bays into one of the thirteen three sided and roofed 14 m³ capacity “cold feed” steel storage hoppers; each providing a variable feed onto the transfer conveyor belts feeding the rotary dryer drum. RAP will be similarly fed by loading shovel into the plant but will proceed via an inclined slinger conveyor and elevator to the parallel dryer drum. The walls of the hoppers will be insulated and heated to keep the material at the required temperature.

(3) Heating and Drying

During the production process, the bitumen will be heated by a “high efficiency” automated system. Binder heating will be controlled using a P100 sensor with electric temperature regulator and analogue output for remote readouts. Additional safety thermostats will be installed to monitor the products.

The aggregate will be dried and heated in a sealed steel contra flow rotary dryer which will be 10 m in length by 2.8 m in diameter. This step is required to ensure the aggregate is free from moisture prior to mixing with bitumen and filler. The dryer has a 23,720 kW burner which will be fired on gas oil. Water vapour and exhaust air will pass through the bag filtration plant to be discharged via a 30 m stack and trapped particulates fed back as filler into the process.

A second parallel flow drum dryer, will receive and dry the RAP via a recycle elevator.

(4) Screening, Weighing and Mixing

Heated and dried aggregates discharged from the dryer will be passed via a bucket elevator to the top of the mixing tower to the vibrating screen deck and separated by size, in terms of the recipe mix required and pass into six hot stone bins. The required proportions of aggregate and RAP will be mixed with the bitumen and fillers and transferred to the paddle mixer. The plant will be able to mix up to 3 tonnes per batch. The mixing time is typically no more than 45 seconds per batch.

(5) Mixed Material Storage

The final asphalt product will either be directly loaded out into a waiting HGV below or stored in one of six 80 tonne capacity electrically heated mixed material storage hoppers. From these the asphalt is directly discharged via overhead doors into an insulated HGV for final dispatch from the plant. HGVs tippers will drive under the plant to a pre-notified hopper. The hopper would then discharge the required amount into the tipping body of the vehicle. The operation is controlled by computer via the plant control room, which will be located in the weighbridge office. All asphalt carrying HGVs will leave the Site sheeted.

Asphalt can be stored in the hot storage bins for up to twelve hours but this depends upon a number of factors including the amount and individual product mix. Any asphalt unused or, returned from site will be recycled on-site at the Aggregate Recycling Plant.

Process Requirements

The Asphalt Plant will be subject to the conditions of a Local Authority Pollution Prevention Control (LAPPC) Permit, issued by LBH.

The Permit will control all aspects of the operation through a series of enforceable conditions that will specify the acceptable levels of any emission including smoke, moisture, odour or airborne dust. Any breach of these conditions could potentially lead to revocation of the Permit by the Local Authority.

Operating Hours

The Asphalt Plant will operate on a 24/7 basis to meet the needs of service contracts with different London Boroughs and other public and private sector clients.

3.3.3 Gully Waste Recycling Plant

Component Parts

The Gully Waste Treatment and Recycling Plant comprises a shallow sloping concrete pad (10 x 24 m), filters and two below ground tanks for the treatment and recycling of gully sucker waste and road sweeper waste arising from street cleansing activities. At maximum output, up to 20,000 tpa of waste will be treated and recycled.

Processes

Gully waste treatment is a passive process. As the gully sucker tips up, water will drain through a series of filters, whilst trapping any hydrocarbons, and recovering any solid residue. These residues will be moved from the plant by loading shovel or hydraulic excavator, and processed at the Aggregate Recycling Plant. All water used in the process, will be re-circulated and used again (either by gully suckers or elsewhere on-site).

Any residue that cannot be recycled will be collected and disposed of off-site.

The above process will be subject to the conditions of any waste management license as appropriate, issued by the Environment Agency.

Operating Hours

There will be a requirement for 24/7 availability; however, the gully suckers typically only operate between 06.00-18.00 Monday to Friday and 06.00-14.00 on Saturday.

3.3.4 Cement Silo

The low level cement silo will comprise a 100 tonne capacity, prefabricated steel constructed silo. Cement from the silo will be taken by the Applicant's fleet of volumetric concrete mixer trucks as required, to facilitate the mixing of concrete at the point of use. No concrete will be produced on-site. The operation and maintenance of the cement silo will be governed by the terms of an LAPPC issued by LBH.

3.3.5 Concrete Washout Bay

The proposed Concrete Washout Bay, or settlement bay, will be used to wash down volumetric concrete mixers at the end of each working day. Through a system of weirs, the water will be

recycled for re-use and residues will be removed for re-processing in the Aggregate Recycling Plant. The use of the Concrete Washout Bay will be subject to the conditions of a LAPPC Permit or Discharge License as may be deemed appropriate, by the Local Authority or Environment Agency.

3.3.6 Term Maintenance Yard

The Term Maintenance Yard will comprise the following:

- Open storage of plant, equipment and materials such as paving slabs, setts, lighting, street furniture etc.;
- Low-level enclosed storage of plant equipment and material items such as power tools, PPE, high value items and items requiring inside storage;
- Vehicle parking; and
- Security fencing.

3.3.7 Welfare Facilities

Up to six Portacabin style units will be provided along the perimeter of the Site to provide changing, washing, toilet, drying and seating areas.

3.3.8 Office Buildings

Two buildings will be provided on-site:

- Two storey weighbridge office from where site access and plant control will take place.
- Three storey administrative office that will provide for general site and contract management and control.

3.3.9 Ancillary Components

The following ancillary components will be provided within the Proposed Development:

- Service supply cabins/buildings including brick constructed substations;
- Two surface mounted 50 tonne capacity weighbridges (15 x 3 m) located on either side of the Weighbridge Office;
- Up to 70 car parking spaces for employees/visitors beneath the A312 Parkway flyover;
- Up to 50 HGV parking spaces;
- Fuel storage tanks;
- Up to four water tanks, each with 60,000 litre capacity;
- Recycling skips and waste bins;
- CCTV;
- Site lighting (in accordance with lighting strategy to be developed post consent); and
- Landscaping.

3.4 Proposed Development Appearance

3.4.1 Massing and Scale

The scale and massing of proposed buildings and structures are dictated by standard plant and process requirements, although a reduction in the height of the Asphalt Plant has been

achieved during the design process by separating the proposed storage facility from the main production plant. This will limit visual impact considerably.

The principal elements of the proposal will range from 7.55 to 27.8 m as shown in Figure 3.2 and outlined in Table 3.1.

Table 3.1: Proposed Development Built Heights	
Plant Component	Height above Finished Site Level
Aggregate Recycling Plant	9.5 and 10.4 m
Asphalt Plant	27.8 m
Asphalt Stack	30.0 m
Asphalt Storage Facility	20.0m
Aggregate Storage Bays	9.5 m
Office Buildings	Weighbridge Office 7.55m Admin Office 11.4m
Cement Silo	6 m
Welfare Facilities	Single storey 3m, stacked two storey 6 m
Water Storage Tanks	Up to 6 m and 4 m diameter
Acoustic Boundary Treatment	Up to 7 m

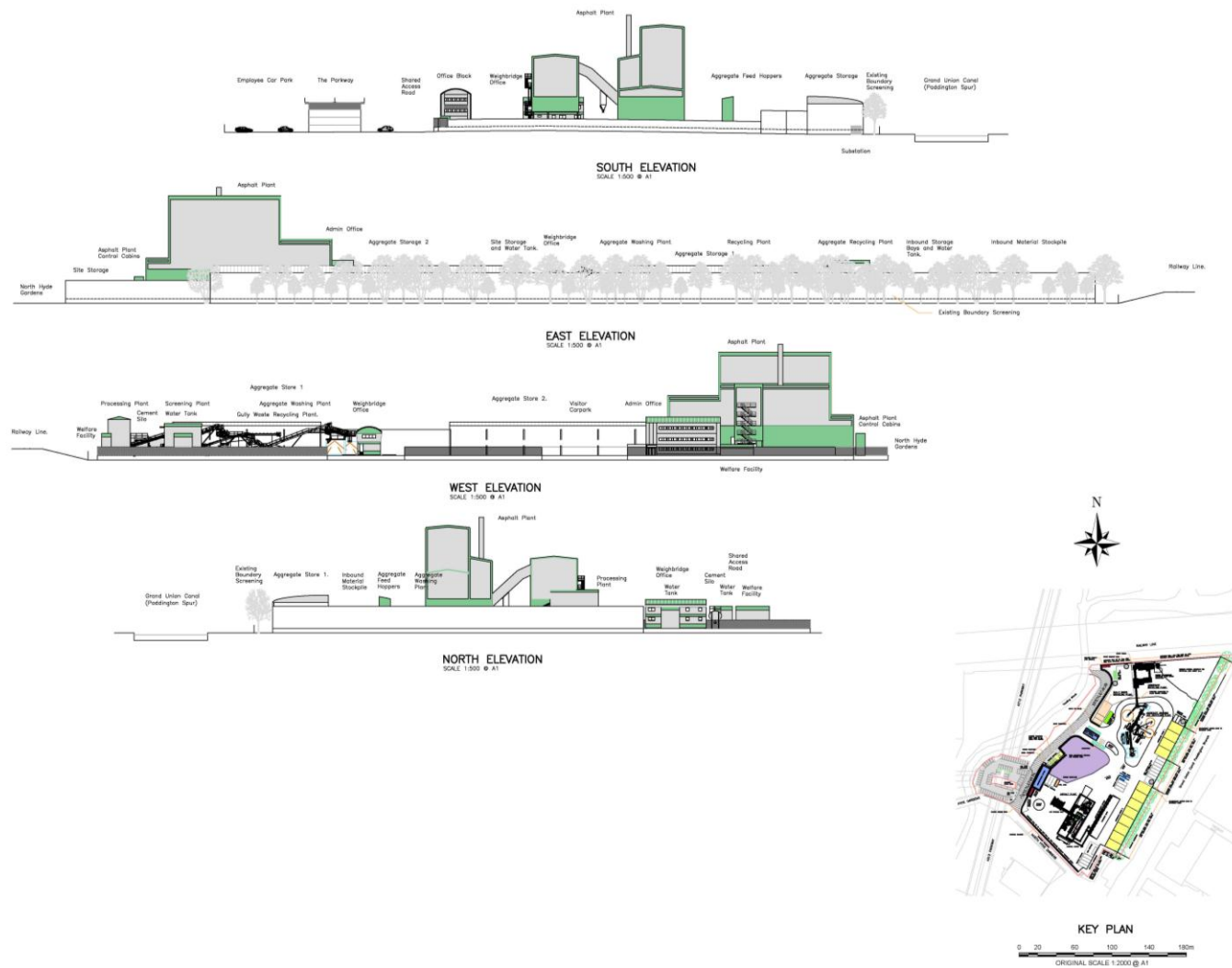


Figure 3.2: Proposed Development Elevations

4 Planning Context

This Energy Statement is presented to address local, regional and national planning requirements which encourage the effective application of energy efficiency measures, low carbon and renewable energy technologies for all new developments and major refurbishments. The relevant policies for the Proposed Development are discussed in the following paragraphs:

4.1 National Policy

National Planning Policy Framework, 2012

The National Planning Policy Framework (NPPF) was published on 27th March 2012, with its policies effective immediately. The NPPF supersedes all previous national planning policies; however with regards to the energy consumption of new developments the basic presumptions of previous government policies remains unchanged. For example to support the move to a low carbon future, the NPPF states that local planning authorities should:

- *“plan for new development in locations and ways which reduce greenhouse gas emissions;*
- *actively support energy efficiency improvements to existing buildings; and*
- *when setting any local requirements for a building’s sustainability, do so in a way consistent with the Government’s zero carbon buildings policy and adopt nationally described standards.”*

Local planning authorities (LPAs) are furthermore required to:

- have a positive strategy to promote energy from renewable and low carbon sources; and
- design policies to maximise renewable and low carbon energy development.

In determining planning applications, LPAs should require new development to:

- *“comply with adopted local plan policies for decentralised energy supply, unless it can be demonstrated unfeasible or unviable; and*
- *take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.”*

4.2 Regional Policy

Applicable regional policy is contained within the London Plan¹¹, the Mayor’s Supplementary Planning Guidance (SPG) on Sustainable Design and Construction¹² and the Mayor’s Climate Change Mitigation and Energy Strategy¹³, which are discussed in the following paragraphs.

The London Plan, 2011

The policies of the London Plan listed in Table 4.1 are relevant to this energy statement, but only in so far as the building components of the Proposed Development.

¹¹ Greater London Authority, 2011. London Plan; Spatial Development Strategy for London.

¹² Greater London Authority, 2006. Mayor’s Supplementary Planning Guidance (SPG) on Sustainable Design and Construction.

¹³ Greater London Authority, 2011. Delivering London’s Energy Future. The Mayor’s Climate Change and Mitigation and Energy Strategy.

Table 4.1: Relevant London Plan Policies

Policy	Policy Wording								
Policy 5.2 - Minimising carbon dioxide emissions	<i>“Planning decisions</i> A. <i>Development proposals should make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy:</i> <i>1 Be lean: use less energy</i> <i>2 Be clean: supply energy efficiently</i> <i>3 Be green: use renewable energy</i> B. <i>The Mayor will work with boroughs and developers to ensure that major developments meet the following targets for carbon dioxide emissions reduction in buildings. These targets are expressed as minimum improvements over the Target Emission Rate (TER) outlined in the national Building Regulations leading to zero carbon residential buildings from 2016 and zero carbon non-domestic buildings from 2019.</i> <i>Non-domestic buildings: Year Improvement on 2010 Building Regulations</i> <table border="0"> <tr> <td><i>2010 - 2013</i></td><td><i>25 per cent</i></td></tr> <tr> <td><i>2013 - 2016</i></td><td><i>40 per cent</i></td></tr> <tr> <td><i>2016-2109</i></td><td><i>As per building regulations requirements</i></td></tr> <tr> <td><i>2109 - 2013</i></td><td><i>Zero carbon</i></td></tr> </table> C. <i>Major development proposals should include a detailed energy assessment to demonstrate how the targets for carbon dioxide emissions reduction outlined above are to be met within the framework of the energy hierarchy.</i> D. <i>As a minimum, energy assessments should include the following details:</i> <i>a calculation of the energy demand and carbon dioxide emissions covered by the Building Regulations and, separately, the energy demand and carbon dioxide emissions from any other part of the development, including plant or equipment, that are not covered by the Building Regulations (see paragraph 5.22) at each stage of the energy hierarchy</i> <i>b proposals to reduce carbon dioxide emissions through the energy efficient design of the site, buildings and services</i> <i>c proposals to further reduce carbon dioxide emissions through the use of decentralised energy where feasible, such as district heating and cooling and combined heat and power (CHP)</i> <i>d proposals to further reduce carbon dioxide emissions through the use of on-site renewable energy technologies.</i> E. <i>The carbon dioxide reduction targets should be met on-site. Where it is clearly demonstrated that the specific targets cannot be fully achieved on-site, any shortfall may be provided off-site or through a cash in lieu contribution to the relevant borough to be ring fenced to secure delivery of carbon dioxide savings elsewhere.”</i>	<i>2010 - 2013</i>	<i>25 per cent</i>	<i>2013 - 2016</i>	<i>40 per cent</i>	<i>2016-2109</i>	<i>As per building regulations requirements</i>	<i>2109 - 2013</i>	<i>Zero carbon</i>
<i>2010 - 2013</i>	<i>25 per cent</i>								
<i>2013 - 2016</i>	<i>40 per cent</i>								
<i>2016-2109</i>	<i>As per building regulations requirements</i>								
<i>2109 - 2013</i>	<i>Zero carbon</i>								
Policy 5.3 – Sustainable design and construction	<i>“Strategic</i> A. <i>The highest standards of sustainable design and construction should be achieved in London to improve the environmental performance of new developments and to adapt to the effects of climate change of their lifetime.</i> <i>Planning decisions</i> B. <i>Development proposals should demonstrate that sustainable design standards are integral to the proposal, including its construction and</i>								

Table 4.1: Relevant London Plan Policies

Policy	Policy Wording
	operation, and ensure that they are considered at the beginning of the design process. C. Major development proposals should meet the minimum standards outline in the Mayor's supplementary planning guidance and this should be clearly demonstrated within a design and access statement. The standards include measures to achieve other policies in the Plan and the following sustainable design principles: - a minimising carbon dioxide emissions across the site, including the building and services (such as heating and cooling systems) - b - c efficient use natural resources (including water), including making the most of natural systems both within and around buildings - d minimising pollution (including noise, air and urban run-off) - e minimising the generation of waste and maximising reuse of recycling - f avoiding impacts from natural hazards (including flooding) - g - h securing sustainable procurement of materials, using local supplies where feasible, and - i promoting and protecting biodiversity and green infrastructure"
Policy 5.7 - Renewable energy	"Strategic A. The Mayor seeks to increase the proportion of energy generated from renewable sources, and expects that the projections for installed renewable energy capacity outlined in the Climate Change Mitigation and Energy Strategy and in supplementary planning guidance will be achieved in London. Planning decisions B. Within the framework of the energy hierarchy (see Policy 5.2), major development proposals should provide a reduction in expected carbon dioxide emissions through the use of on-site renewable energy generation, where feasible. LDF preparation C. Within LDFs boroughs should, and other agencies may wish to, development more detailed policies and proposals to support the development of renewable energy in London – in particular, to identify broad areas where specific renewable energy technologies, including large scale systems and the large scale deployment of small scale systems, are appropriate. The identification of areas should be consistent with any guidelines and criteria outline by the Mayor" D. All renewable energy systems should be located and designed to minimise any potential adverse impacts on biodiversity, the natural environment and historical assets and to avoid any adverse impacts on air quality."
Policy 5.18 - Construction, excavation and demolition waste	Planning decisions A. New construction, excavation and demolition (CE&D) waste management facilities should be encouraged at existing waste sites, including safeguarded wharves, and supported by: a using mineral extraction sites for CE&D recycling

Table 4.1: Relevant London Plan Policies

Policy	Policy Wording
	<i>b ensuring that major development sites are required to recycle CE&D waste onsite, wherever practicable, supported through planning conditions.</i> <i>B. Waste should be removed from construction sites, and materials brought to the site, by water or rail transport wherever that is practicable.</i> <i>LDF preparation</i> <i>C. LDFs should require developers to produce site waste management plans to arrange for the efficient handling of CE&D waste and materials.”</i>
Policy 5.20 - Aggregates	<i>“Strategic</i> <i>A. The Mayor will work with all relevant partners to ensure an adequate supply of aggregates to support construction in London. This will be achieved by:</i> <i>1 encouraging re-use and recycling of construction, demolition and excavation waste within London</i> <i>2 extraction of land-won aggregates within London</i> <i>3 importing aggregates to London by sustainable transport modes.</i> <i>B. The Mayor will work with strategic partners to achieve targets of:</i> <i>a 95 per cent recycling/re-use of construction, demolition and excavation waste by 2020</i> <i>b 80 per cent recycling of that waste as aggregates by 2020.</i> <i>C. London should make provision for the maintenance of a landbank (i.e. seven years’ supply) of at least 5 million tonnes of land won aggregates throughout the plan period until 2031.</i> <i>D. Maintenance of a landbank of specific tonnage</i> <i>E. identify, Support and Safeguard aggregate resources</i> <i>F. To reduce the environmental impact of aggregates, LDFs should:</i> <i>a ensure that appropriate use is made of planning conditions dealing with aftercare, restoration and re-use of minerals sites following extraction</i> <i>b safeguard wharves and/or railheads with existing or potential capacity for aggregate distribution</i> <i>c minimise the movement of aggregates by road and maximise the movement of aggregates via the Blue Ribbon Network</i> <i>d develop policies that support the protection and enhancement of aggregates recycling facilities.”</i>

As can be seen from the above,

- Policy 5.2 provides an indication of the level of energy consumption improvements required to comply with the London Plan.
- Policy 5.7D has specific relevance to minimising the impact to the environment and in particular on air quality.

Chapter 5 of the London Plan (London’s Response to Climate Change), provides guidance on the appropriate order or hierarchy in which to consider measures to reduce carbon emissions. This hierarchy has been adopted for the Proposed Development’s Energy Strategy as follow:

1. **Be Lean:** Using less energy, in particular by adopting sustainable design and construction measures;

2. **Be Clean:** Supplying energy efficiently in particular by prioritising decentralised energy generation; and
3. **Be Green:** Using renewable energy.

The hierarchy is graphically illustrated in Figure 4.1.

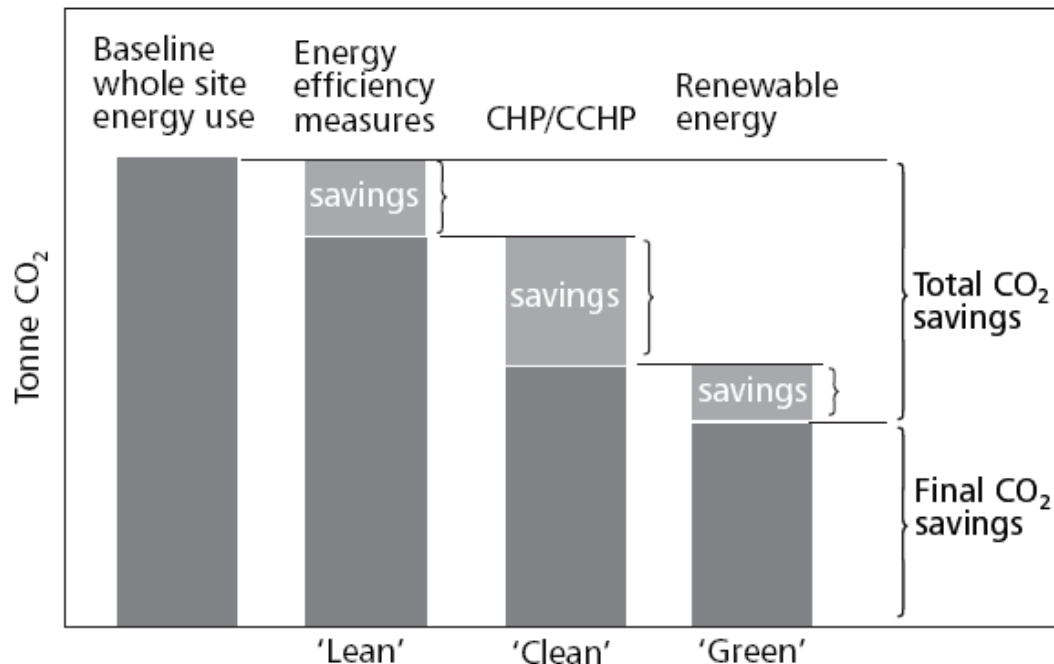


Figure 4.1: Energy Hierarchy (source CIBSE Guide F)

Mayor's Climate Change Mitigation and Energy Strategy, 2011

The Mayor's Climate Change Mitigation and Energy Strategy is one of eight environmental strategies setting out the action the Mayor is taking, and encouraging others to take, to green London, retrofit London, and provide cleaner air for London. This strategy focuses on reducing CO₂ emissions to mitigate climate change, securing a low carbon energy supply for London, and moving London to a thriving low carbon capital. It forms a central part of the Mayor's goal of retrofitting London.

The Mayor has set four objectives for this strategy:

1. To reduce London's CO₂ emissions to mitigate climate change;
2. To maximise economic opportunities from the transition to a low carbon capital;
3. To ensure a secure and reliable energy supply for London; and
4. To meet, and where possible exceed, national climate change and energy objectives.

Annex B of the Strategy Implantation Plan sets out the role of planners have upon the carbon reduction process, and action 4.1 of the report states that the Mayor will require new developments to incorporate on-site low carbon and renewable energy generation where appropriate and not contradictory to wider strategic energy objectives, and to support the implementation of decentralised energy systems and networks, making use of the Community Infrastructure Levy and carbon offset mechanisms where appropriate.

Action 9.1 of the plan states that the Mayor will set ambitious new CO₂ emissions reduction targets for major new development to be achieved via the Mayor's energy hierarchy: Be lean

(use less energy); be clean (supply energy efficiently); and be green (use renewable energy). This is based on a trajectory for all new residential developments to be zero carbon from 2016 and for new non-domestic developments to be zero carbon from 2019.

Sustainable Design and Construction Supplementary Planning Guidance, 2006

The Mayor of London's Sustainable Design and Construction Supplementary Planning Guidance (SPG) provides a framework for assessing sustainable development against a number of sustainability principles and therefore provides more detailed guidance for LPAs within London on how to implement the London Plan policies. The framework sets various essential standards that must apply to all London's buildings and are a minima based on current Building Regulations, the targets set out in the Mayor's strategies, local policy and current good practice. The SPG also has a second tier of Mayor's preferred standards which indicate more exemplary approaches that can be followed but are not yet policy requirements.

4.3 Local Policy

London Borough of Hillingdon Unitary Development Plan (adopted 1998)

The London Borough of Hillingdon Unitary Development Plan (UDP) and the saved policies of 27th September 2007 form the current planning policy framework for the Proposed Development.

Section 13.35 of the UDP reviews the importance of minerals and aggregate material within the region and places emphasis upon the need to encourage the recycling of waste aggregate products.

The only reference to Energy Conservation within the UDP is with the Index of Policies, and states (on page 325) that "The London Plan" should be referred to.

Draft London Borough of Hillingdon Local Development Framework, 2012

The LBH LDF comprises a suite of development planning documents including the Core Strategy and Development Management Plan Policies. The Core Strategy was submitted to the Secretary of State on 31st October 2011 and an independent Inspector has been appointed to conduct the EiP which commenced on 13th March 2012. The Core Strategy is expected to be adopted later in 2012.

The Core Strategy Pre-Submission version (Feb 2011) and proposed changes (Oct 2011) is not currently adopted policy but it provides an indication of the Council's current expectations with regards to the sustainability performance of new development.

The Core Strategy sets out the vision, strategic objectives, spatial strategy and policies for the spatial development of the borough over the next 15 years. The strategic objective most relevant to the Proposed Development's energy strategy is:

- SO11: Address the impacts of climate change, and minimise emissions of carbon and local air quality pollutants from new development and transport.

Core Policies of relevance to the Proposed Development are:

- 'Policy BE1: Built Environment' which states that LBH "...will require all new development to improve and maintain the quality of the built environment in order to create successful and sustainable neighbourhoods, where people enjoy living and working and that serve the long-term needs of all residents." It goes on to state that in respect of the Proposed Development, it should:

- achieve a high quality of design in all new buildings and new public realm to enhance the local distinctiveness of the area, to contribute to community cohesion and to a 'sense of place';
 - seek to protect the amenity of surrounding land and buildings;
 - improve areas of poorer environmental quality;
 - improve the quality of the public realm with proposals that respect the local character and landscape, enhance and protect biodiversity through the inclusion of living walls, roofs and areas for wildlife;
 - create safe and secure environments that reduce crime and fear of crime, anti-social behaviour and risks from fire and arson having regard to Secure by Design standards and address resilience to terrorism in major development proposals.
 - be able to demonstrate compliance with the prevailing energy reduction requirements set out in the London Plan. Where the required reduction from on-site renewable energy is not feasible within major developments, contributions off-site will be sought.
- 'Policy EM1: Climate Change Adaptation and Mitigation' which encourages sustainable techniques to land remediation to reduce the need to transport waste to landfill and encourages the installation of renewable energy for all new development in meeting the carbon reduction targets savings set out in the London Plan. The policy also seeks adaptation measures including locating and designing development to minimise the probability and impacts of flooding, consideration of the whole water cycle impact, giving preference to development of previously developed land, promoting the use of living walls and roofs, alongside sustainable forms of drainage to manage surface water run-off and increase the amount of carbon sinks and promoting the inclusion of passive design measures to reduce the impacts of urban heat effects.

Until the Core Strategy is adopted, the UDP saved policies still apply and take precedence over the draft Core Strategy policies.

5 Predicted Proposed Development Energy and Carbon Performance

5.1 Background

The Proposed Development will replicate the best practice design, construction and operations management approach that the Applicant has adopted for buildings and existing processes at their Erith and Dartford Facilities.

The Erith Facility in Kent was developed in 2009-2010 and incorporates a state of the art asphalt plant supplied by Benninghoven who are recognized as one of the world leaders in this field.

The Dartford Facility comprises an aggregate recycling plant and a gully waste plant.

The Applicant has retained the design team of these facilities given their expert understanding of operational requirements and to ensure the high standard of design and construction established to date will be retained and/or improved upon for the Proposed Development at Bulls Bridge.

The Applicant's existing facilities have been used as one of the benchmarks to compare the likely energy performance of the Proposed Development.

5.2 Proposed Development Energy Prediction

The predicted carbon emissions from the Proposed Development are graphically shown in Figure 5.1 and the associated carbon impact outlined in Table 5.1. It should be noted that the predicted emissions are based on fixed plant only and have not accounted for mobile plant that will be required to operate all of fixed plant and equipment, when the Proposed Development has reached full capacity.

Mobile plant will comprise a tracked excavator and two wheeled loading shovels. There are currently no practical or cost-effective, renewable energy alternatives to these. However the Applicant's policy is to ensure that all mobile plant meet the latest environmental standards, all operators are suitably trained and fuel consumption and running performance are continuously critically reviewed, to optimize performance and minimise fuel consumption.

The total carbon emissions of the Proposed Development are likely to be 9,145 tCO₂/year, of which:

- 85% (7,780 tCO₂/year) will be associated with the Asphalt Production Plant;
- 14% (1,318 tCO₂/year) will be associated with the Aggregate Recycling Plant; and
- less than 1% (46 tCO₂/year) will be associated with the Offices, Gully Waste Recycling Plant and other ancillary activities.

Bulls Bridge Carbon Footprint - 9,145 tCO₂/yr

(assuming full production levels)

Asphalt plant thermal load - 6,850

Aggregate Recycling - 1,318

Offices - 25

Asphalt plant electrical load - 930

Gully Wash - 21

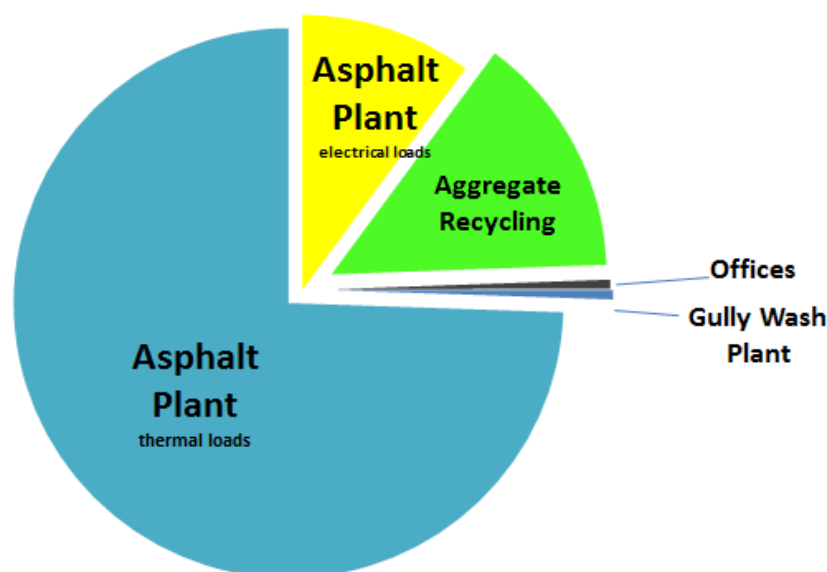


Figure 5.1: Proposed Development Carbon Emissions

Table 5.1: Proposed Development Carbon Impact Calculation

Operational Component	Carbon Impact tCO ₂ /year	%	Energy Consumption Calculation	Carbon Impact Calculation
Asphalt Thermal Loads (operating with gas-oil)	6,850	74.9%	300,000 tonnes/year at 90 kWh/t = 27,000,000 kWh _{g-oil}	27,000,000 kWh _{g-oil} × 0.2537 kgCO ₂ /kWh = 4,957 tCO ₂ /yr
Asphalt Electrical Loads	930	10.2%	300,000 tonnes/year at 6 kWh/t = 1,800,000 kWh _{elec}	1,800,000 kWh _{elec} × 0.5169 kgCO ₂ /kWh = 974 tCO ₂ /yr
Aggregate Recycling Plant	1,318	14.4%	300,000 tonnes/year at 1.98 kWh/t = 594,000 kWh _{elec}	594,000 kWh _{elec} × 0.5169 kgCO ₂ /kWh = 321 tCO ₂ /yr
Gully Waste Recycling Plant	21	0.2%	20,000 tonnes/year at 2 kWh/t = 40,000 kWh _{elec}	40,000 kWh _{elec} × 0.5169 kgCO ₂ /kWh = 22 tCO ₂ /yr
Offices	25	0.3%	792 m ² at 133 kWh/m ² = 105,334 kWh/yr _{combined}	105,334 kWh _{combined} × 0.3191 kgCO ₂ /kWh = 25 tCO ₂ /yr
TOTAL	9,145	100%		

The conversion factors used to determine the carbon impact of the Proposed Development's process plant have been derived from the DEFRA data base¹⁴ and are provide in Table 5.2.

Table 5.2: CO₂ Conversion Factors	
Fuel Type	kg CO₂ per kWh
Electricity	0.51694
Mains Gas	0.18483
Gas Oil	0.25372

Asphalt Production Process Component and Benchmarks

Figure 5.2 and Table 5.2 show the carbon impact of the Applicant's Erith Asphalt Facility when compared with baseline benchmark data from ECG70 and from the asphalt sector PEER Group.

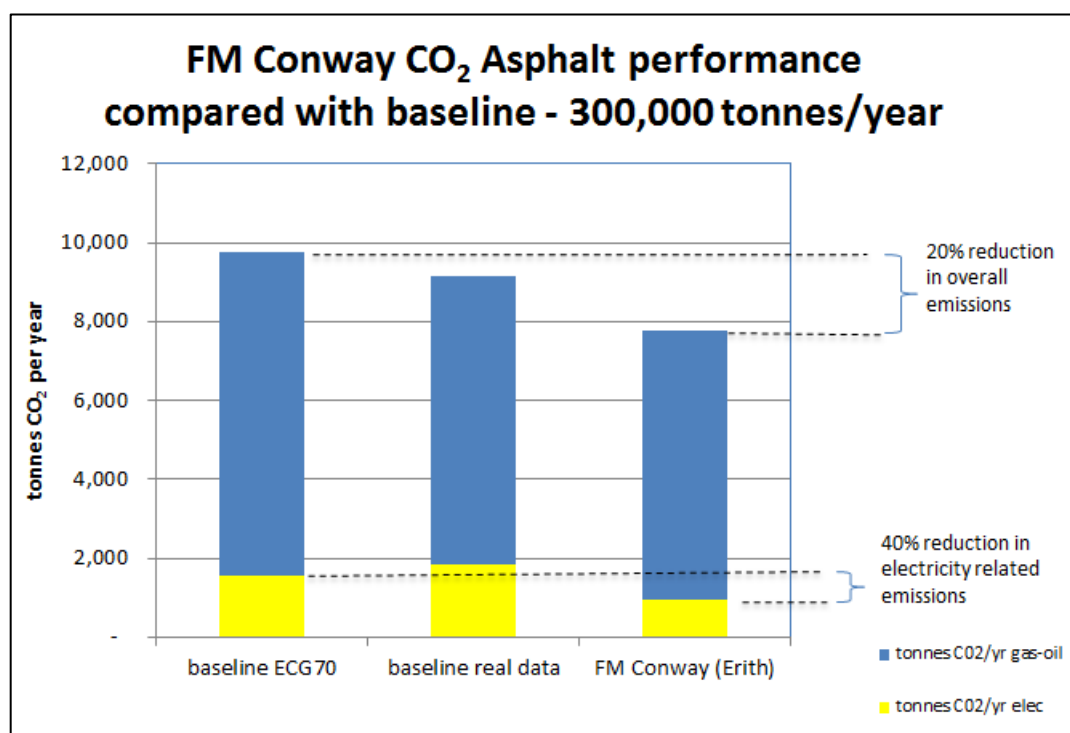


Figure 5.2: FM Conway Existing Energy and Carbon Performance vs Asphalt Benchmark Data

As can be seen, the Erith Facility outperforms relevant sector benchmarks by:

- 17% in thermal load emissions; and
- 40% in electrical load emissions
- 20% in overall emissions (thermal and electricity related emissions combined)

The Applicant is able to operate their Erith Asphalt Facility efficiently and achieve Carbon emissions 20% below the baseline performance published in ECG70. This represents carbon savings of 1,990 tCO₂ per year when full production is achieved of 300,000 tons of asphalt production per year.

¹⁴ Available at the following website: www.defra.gov.uk/publications/2012/05/30/pb13773-2012-ghg-conversion/

The carbon impact of the asphalt production process for the Proposed Development will replicate or better, the level of efficiency the Applicant is currently achieving at their Erith Facility.

Table 5.2: FM Conway Existing Energy and Carbon Performance vs Asphalt Benchmark Data

Data Source	Fuel Type	Category	kWh/ Tonne	t/year	kWh/yr	kgCO ₂ /kWh	tCO ₂ /yr
FM Conway Erith	Electric	Asphalt	6	300,000	1,800,000	0.5169	930
	Gas oil	Asphalt	90	300,000	27,000,000	0.2537	6,850
							7,781
ECG70	Electric	Asphalt	10	300,000	3,000,000	0.5169	1,551
	Gas oil	Asphalt	108	300,000	32,400,000	0.2537	8,221
							9,771
PEER Group	Electric	Asphalt	12	300,000	3,600,000	0.5169	1,861
	Gas oil	Asphalt	96	300,000	28,800,000	0.2537	7,307

Aggregate Recycling Process Component and Benchmarks

Figure 5.3 and Table 5.3 show the carbon impact of the Applicant's Dartford Aggregate Recycling Facility when compared with a baseline benchmark from ECG70 and the MPA carbon benchmark for processed rock.

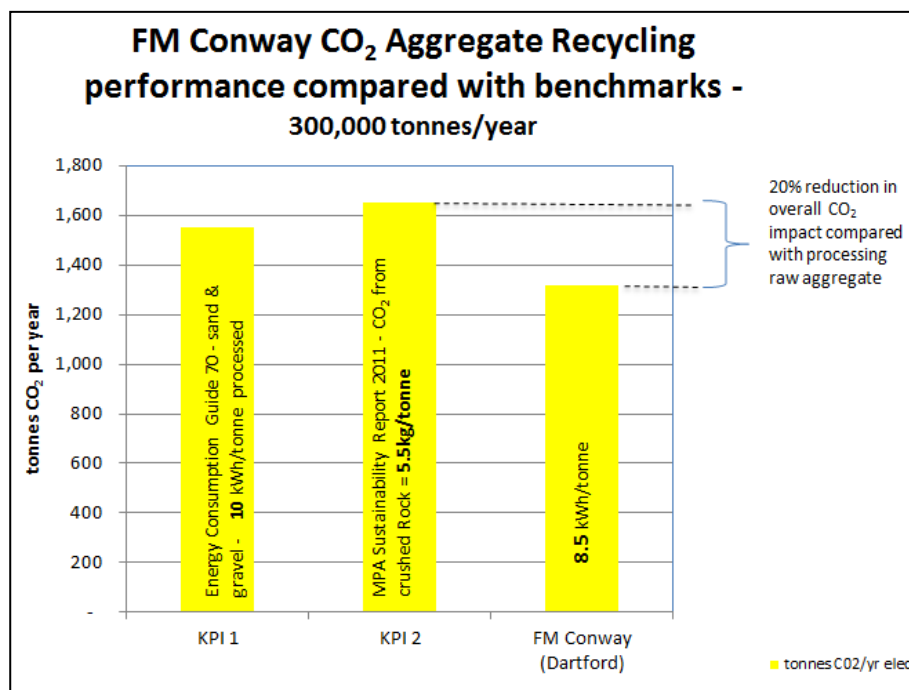


Figure 5.3: FM Conway Energy and Carbon Performance vs Aggregate Industry Benchmarks Data

The Applicant is able to operate their Dartford Aggregate Recycling site efficiently and achieve Carbon emissions 20% below the performance benchmark published in the MPA Sustainability

Report (2011). This represents carbon savings of 332 tCO₂ per year when full production is achieved of 300,000 tons of aggregate handling per year.

The carbon impact of the aggregate recycling process for the Proposed Development will replicate or better, the level of efficiency the Applicant is currently achieving at their Dartford Facility.

Table 5.3: FM Conway Existing Energy and Carbon Performance vs Aggregate Benchmark Data

Data Source	Fuel Type	Category	kWh/Tonne	t/year	kWh/yr	kgCO ₂ /kWh	tCO ₂ /yr
FM Conway Dartford	Electric	Recycling	8.5	300,000	2,550,000	0.5169	1,318
KPI1: ECG70 Raw Aggregate	Electric	Recycling	10	300,000	3,000,000	0.5169	1,551
KPI2: MPA Sustainability Report 2011	Electric	Recycling 5.5 kg CO ₂ /tonne	10.17	300,000	3,050,000	0.5169	1,650

6 “Be Lean”- Low Carbon Technologies for Proposed Development

This section considers the carbon savings that could be achieved within the Proposed Development by means of good design. The systems and technologies that will be adopted by the Proposed Development represent best practice installation for an aggregates sector recycling and asphalt site, as outlined within the Quarry Products Association (QPA) Good Practice Guide¹⁵.

6.1 Electrical Design

The Applicant will be able to achieve energy and carbon performance levels 25% better than the MPA benchmarks by specifying the following within the Proposed Development:-

- Variable Speed Drive (VSD) Motor control for mixing and product transportation;
- High Efficiency HF1/IE2 motors which are generally 2 – 8 % more efficient than standard motors;
- Power Factor Correction Equipment to achieve a power factor (PF)¹⁶ of 0.95 or better;
- Energy Efficient Lighting Control and Energy Efficient Lamps;
- Appropriately designed air compressors specified with VSD;
- Covered bays to ensure products are keep dry and moisture content low;
- Voltage Optimization to ensure design standards are achieved at commissioning stage;
- Best Practice buildings standards – better than Building Regulation standards; and
- Appropriate level of energy metering to encourage on-going operational monitoring.

6.2 Thermal Insulation

The Proposed Development's processing plant (rotary dryer and asphalt plant) will be insulated to “Best Practice” standards to minimise heat loss in the process. This standard includes:-

- Rotary drum drying plant – 70mm thick insulation with aluminium cladding;
- Screen – 60mm thick mineral wool;
- Hot Stone Bins – 150mm thick mineral wool;
- Bitumen storage tanks – 300mm thick mineral wool with foil backing;
- Bitumen weigh hopper – 60mm thick mineral wool;
- Bitumen delivery pipework – 50mm insulation with aluminium cladding;
- Paddle mixer – 70mm thick mineral wool;
- Mixed materials silos – 100mm thick mineral wool on side walls and top, cone section 140mm thick mineral wool; and
- Recycling drum dryer – 80mm thick mineral wool with zinc plate cladding.

6.3 Burner Control

The heat output of the Proposed Development's burner will be automatically controlled by sensing the temperature of the material at the dryer discharge using a programmable controller.

¹⁵ Quarry Products Association, 2008. Carbon Management Good Practice Guide. June 2008. Quarry Products Association.

¹⁶ Power Factor is a measure of optimum loading and balance between current and reactive power

Programmable Memory Control will be employed to maintain the optimum air/fuel ratio throughout the operating range, giving maximum fuel efficiency and minimum emissions of combustion products.

6.4 Variable Speed Drives

The use of variable speed drives (VSDs) will optimise the energy efficiency of industrial drives. The flexibility of a VSD means that the motor speed can be varied to suit load conditions, thereby saving energy and eliminating unnecessary over speed. The proposed Aggregate Recycling Plant will employ up to 18 VSDs to a total of 339 kW which amounts to 32% of the total connected plant load.

6.5 Belt Feeders

The belt feeders will be fitted with material flow sensors to warn the operator that the hopper is empty. Energy can be saved by eliminating unnecessary conveyor idling under no-load conditions.

6.6 Process Heaters

Bitumen will be stored in insulated tanks and maintained at optimum temperature by means of temperature sensor and control instrumentation, thereby preventing overheating of the material.

7 “Be Clean” - Alternative Fuel Sources for Proposed Development

The London Plan encourages new developments to adopt a hierarchy of energy and carbon efficient principles as part of the design process to achieve optimum carbon efficiency. This section reports on the use of alternative fuel and energy sources for the Proposed Development.

7.1 Recycled Oil

“Recycled” or “Recovered” fuel oil (RFO) is derived from the recovery and treatment of waste lubricants which enables combustion, as a fuel. Following a High Court Ruling in 2007, waste lubricants can now be recovered to a non-waste status prior to being used as a fuel.

The Applicant proposes to configure the Proposed Development to be able to operate with dual fuel capacity. This would enable either gas or oil to be used as a fuel, and this could therefore include RFO.

Figure 7.1 shows the relative carbon significance of the thermal load of the asphalt production process that could be reduced if RFO were introduced.

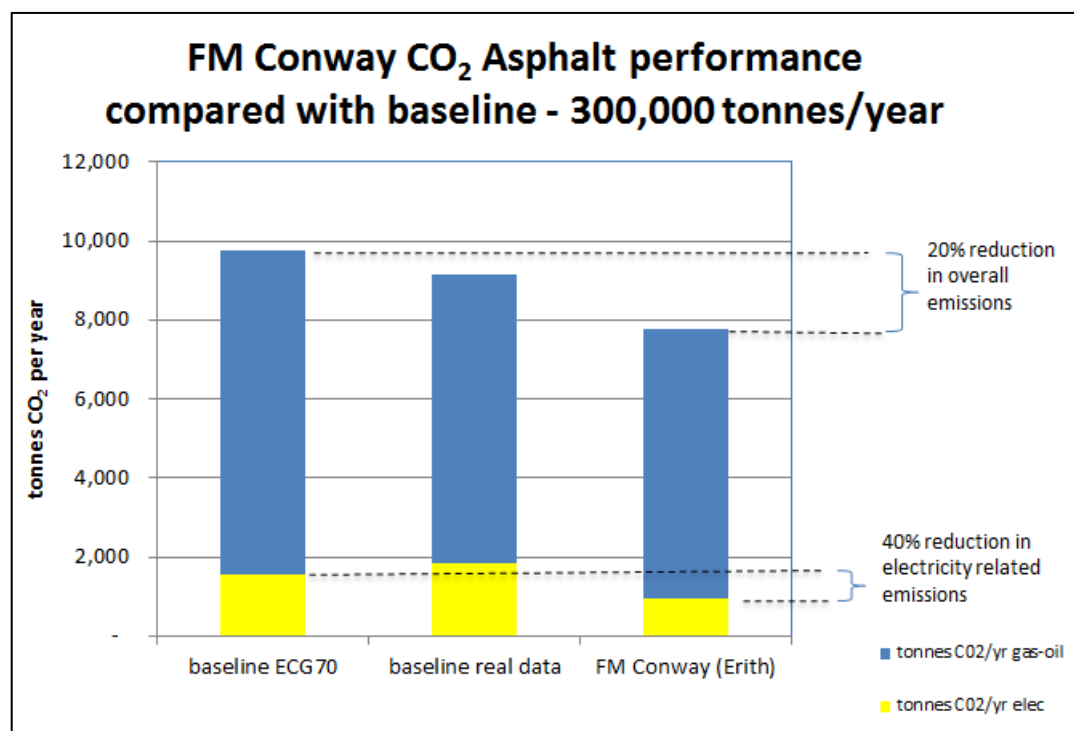


Figure 7.1: Relative Carbon Significance of Asphalt Production Process Thermal Load

The most significant portion of the Proposed Development’s CO₂ emissions is calculated to be the thermal load. This is currently planned to be provided by 27,000,000 kWh of gas-oil, with carbon content of 0.2537 kgCO₂/kWh, equating to 6,850 tonnes of CO₂ per year.

RFO - Zero Carbon Fuel

RFO can be deemed to be a zero-carbon rated fuel as the carbon impact has been addressed by the technology sector associated with the primary use of the oil. RFO is therefore treated as a waste product which would otherwise be incinerated at high temperature (associated additional carbon impact of gas assisted waste incineration).

RFO - Environmental Considerations

Air Emissions

The Proposed Development is located within an Air Quality Management Area (AQMA). Given that there would be higher levels of NO_x emissions from a RFO combustion process within a rotary dryer, and the fact that permitting requirements would be more onerous, RFO is not currently considered based on air quality impact grounds.

Availability

The Proposed Development is likely to be fully operational in 2016.

The state of the RFO market is difficult to predict following the market disruption that occurred when RFO was classified as a waste product in 2006 (subsequently reversed in 2007) by the Environment Agency. The cost and general availability of the fuel may be variable and difficult to predict over a three year horizon.

Potential RFO Impact at Proposed Development

Providing the rotary drum dryer with the option of operating with dual fuel capability would enable the overall carbon impact of the Proposed Development to be reduced significantly.

The Applicant is able to specify the rotary dryer with the capability to operate with either Natural Gas, Oil, RFO, or an Oil/RFO blend.

Depending upon the final design and commissioning results, RFO could be used as the primary fuel source for the dryer, or as a secondary fuel once the dual fuel burner has achieved temperature within the dryer using gas-oil. Conservatively, 30% carbon impact reduction is likely to be deliverable based on the assumption that 36% of the dryer operation could be fuelled by RFO.

7.2 Combined Heat and Power

The greatest advantage of a Combined Heat and Power (CHP) system is the fact that it is inherently more energy efficient than central power generation. A typical CHP system consists of an engine or turbine driving a generator, but with heat recovery features. The recovered heat is typically used in the heating system and/or domestic hot water for commercial and industrial premises, or for process heat in industrial premises.

Decentralised CHP allows heat that is normally wasted in central power generation to be used directly in the building or process, substituting for heat raised by boilers or burners.

CHP is not a renewable technology as defined by the London Toolkit¹⁷, but rather a means to improve energy efficiency and reduce overall demand.

Figure 7.2 illustrates the inherent efficiency of CHP as compared against mains electricity.

¹⁷ London Renewables Toolkit published by the London Energy Partnership advise on Low Carbon Developments

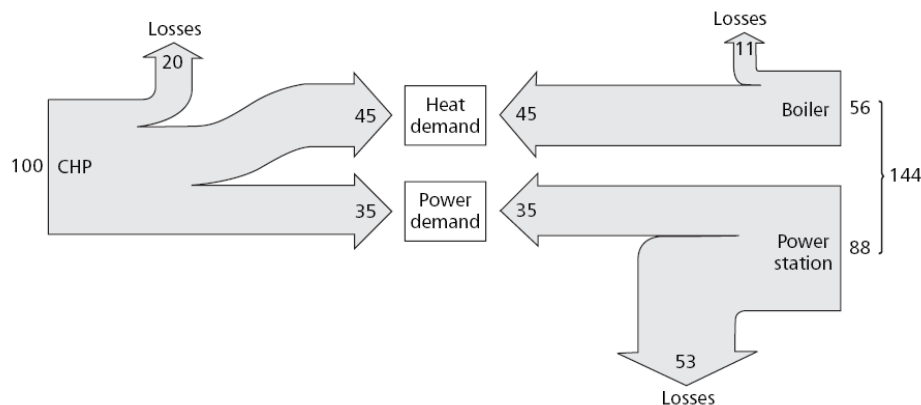


Figure 7.2: Schematic Explanation of CHP

CHP systems are sized on the amount of heat they can usefully supply, rather than the electricity demand for the facility (as excess electricity can easily be exported to the grid or local property). Generally CHP systems supply 1.6 times as much heat as electricity. This means that a significant year-round purpose for waste heat needs to be found, or else it is rejected and the energy advantages for CHP disappear and may even become negative.

The Proposed Development will have no demand for medium grade heat. The asphalt process is undertaken by direct fired tunnel dryers. This is the technology used to rapidly heat aggregate material to 200-220°C to dry off all free moisture as part of a continuous production process prior to mixing with bitumen. CHP heat output is provided by water at 80-100°C within a secondary medium that does not facilitate direct contact with the aggregate product. Accordingly, CHP technology is not considered compatible with rapid/continuous aggregate drying.

7.3 Waste Heat

The nature of the Asphalt production process makes the use of waste heat impracticable. The rotary burner generates significant quantities of hot exhaust gas within the flue with exhaust gas being recirculated to pre-heat materials and aid combustion as part of the regenerative heat design. There is potential to install a heat exchanger (air-to-water) within the flue to recover approximately 30% of the heat. However, currently there is no requirement for hot water in the locality and on the Site.

There is currently no district heating system in the borough to enable a useful design or technical review of potential integration, and the speculative installation of a heat exchanger in the flue at this stage would reduce efficiency of the process as the flue gas would be restricted. The heat exchanger would likely overheat in the medium term if not used (i.e. a process connected to it to remove heat), and hence the provision of a heat exchanger is currently not recommended on technical grounds.

The provision of a heat exchange to heat the buildings would necessitate a bespoke design and the small thermal load of the buildings does not justify the significant cost and technical risk of a bespoke installation.

It is recommended that the installation of a heat exchanger be technically reviewed in collaboration with a borough district heating scheme if this option is developed. The feasibility of the rotary dryer contributing a thermal booster station for a local district scheme may be appropriate if the operational times of the asphalt process could be coordinated and balanced

with a main thermal boiler house configuration when these features are developed as part of a system feasibility review.

8 “Be Green” - Renewable Energy Technology Options Review for Proposed Development Processing Component

8.1 Background

The proposed Asphalt Plant will have a capacity of up to 160 tonnes per hour at 4% moisture. Aggregates will be delivered by road and stored in covered collection bays, where it will be transferred by loading shovel into cold feed hoppers. Aggregate feed will be conveyed from the cold feed hoppers to direct-fired rotary drum dryers, whereafter the dried aggregate is screened and stored in thermally insulated hot bins.

Bitumen will be stored in temperature controlled conditions within insulated bulk storage tanks. Aggregate, bitumen, additives and reclaimed materials will be conveyed in controlled quantities to a paddle mixer where finished products will be blended.

Based on Benninghoven data (suppliers of the plant infrastructure), the principal heat consumers will be the rotary drum dryers which will be direct fired, heated by a gas-fired burner which has nominal heat output of 16.6 MW and 9.5 MW, giving a total installed burner capacity of 26.1 MW. The plant electric load is rated at 1.1 MW

In general, the nature of the plant make the application of renewable thermal energy technology (e.g. solar hot water, ground source heating/cooling, biomass) and thermal efficiency measures (CHP and heat recovery) unviable.

Therefore, only renewable technologies that produce electricity were considered in more detail within the following paragraphs.

8.2 Wind

Wind energy is one of the more effective methods of renewable power generation. The most common design is for three blades mounted on a horizontal axis which is free to rotate into the wind on the tall tower. Smaller turbines (5-10 kW_{output}) may be mounted on buildings, usually on the rooftop. Examples of wind turbines are shown in Figure 8.1

While wind can be an attractive renewable option, turbines in urban areas can suffer from low and intermittent wind speeds and turbulence / disturbance in wind flows from other buildings or structures. There are also issues of visibility and space / access to consider in urban areas, as well as interference with telecommunications fixed links.

As a rule of thumb, the greater the wind speed, the more energy is generated. In urban areas, mast (hub) height on which the turbines are mounted range between 15 and 40m, with higher hub heights generally able to capture higher and more consistent wind speeds.

At the Bulls Bridge Site, wind turbines would need to be in the order of 50m-100m in height to achieve wind speeds in the region of 4-6m/s.

A 15kW turbine (see photograph left) on a 15m hub could generate 60 MWh per year (using manufactures quoted data – often based on ideal conditions – i.e., 6.5 m/s wind speed unlikely in an urban location).

This represents 0.5% reduction in the associated carbon emissions of the Site (at full capacity).



Figure 8.1: Wind Turbines

The table below provides an extract from CIBSE Guide L that predicts the output from wind turbines.

Table 4.5 Indicative characteristics for a range of wind turbines (source: CIBSE Guide L ⁽¹⁷⁾)								
Item	Units	Value for stated wind turbine rating						
		0.6–1.0 kW	1.2–3.0 kW	5.0–6.0 kW	15–25 kW	50–18 kW	150–250 kW	0.6–2.0 MW
Rated wind speed	m/s	10–17	10–16	10–17	11–14	11–12	12	12–16
Cut-in wind speed	m/s	2.5–3.5	2.5–3.5	2.5–4	2.6–4	2.5–4.6	3	2.5–3.5
Turbine diameter	m	1.7–2.7	2–5	3.1–6	10–11	15–18	26–32	44–82
Hub height	m	5–18	6.5–18	9–24	13–32	25–41	>36	55–138
Manufacturer's quoted annual energy (electricity) generation	MW·h/year	0.9–1.896	2.5–9.534	5.0–12.0	60.0	155–225	656	1900–4000
Average wind speed corresponding to quoted annual energy generation	m/s	5–6	5–6	5–5.8	6.5	7	7	N/A

The use of wind as a renewable energy resource at the Proposed Development would be constraint/unviable on account of the following reasons:

- **Intermittent power provision** – The inconsistent availability of wind power requires provision of parallel generator and mains power supply facilities necessary without any reduction in their full capacity rating in order to ensure there is no disruption to production.
- **Space Requirements** – The Site area is constrained by the fact that a strip of land along the full length of its eastern boundary has been 'sacrificed' to safeguard woodland in the adjacent Bulls Bridge Conservation Area. The arrangement of the different development components have therefore already been designed as efficiently as possible to ensure

day-to-day operational ability. The footprint of a wind turbine and the access requirements for turbine servicing is such that there would not be sufficient space available on-site.

- **Wind speed** – The Site is wedged within a number of spatial features and located within an industrial context, which is highly likely to limit wind speed and cause turbulence. This will be exacerbated by the height of the buildings on-site (27.8 m high asphalt production building) and the woodland along and adjacent to the Site's eastern boundary. These contextual constraints will compromise the effectiveness of the turbine to generate power.
- **Visual Impact** – If considered at the Site, a wind turbine would be located in close proximity to the Bulls Bridge Conservation Area and would be visible from a number of other sensitive receptors including Minet Country Park and the Grand Union Canal. In addition, users of the busy A312 may be affected by flicker issues.
- **Proximity to Heathrow** – The Site is located near the flight path and visibility of the Heathrow approach would require consideration, potential disruption to air traffic control communications and radar interference.
- **Landscape Character and Conservation** – A wind turbine would impact on the landscape character of the Bulls Bridge Conservation Area and Minet Country Park, with additional ecological impacts associated with potential bird and bat kill, as well as noise.
- **Telecoms Network** – The Site's location raise the potential for interference with mobile phone and telecommunications networks.
- **Financial Payback** – The payback of a wind turbine is likely to be in excess of 20 years. This makes the option less attractive than the energy and carbon efficiency measures and practices proposed for the Applicant.

8.3 Photovoltaics

Photovoltaic (PV) systems convert energy from the sun into electricity through semiconductor cells. These are connected together to form flat plate modules which are connected into building electricity supply as shown in Figure 8.2. PV systems require only daylight, not sunlight to generate electricity (although more electricity is generated with sunlight), so energy can still be produced in overcast or cloudy conditions.

The electricity generated can be used directly to offset electricity demand at the facility where the system is installed, and excess electricity can be exported to the National Grid.

The PV panels could be roof mounted, set on framing system on a building roof or aggregate bay storage area. Ground mounted systems negate industrial activity or residential development opportunity in urban areas where floor area / space is of a premium.

PV cells have traditionally been made using crystalline silicon, known as monocrystalline or polycrystalline systems.

Alternatively, thin-film systems rely on non-silicon semiconductors, which can adsorb the same amount of sunlight as crystalline silicon but in layers that are at least two orders of magnitude thinner. This type of PV tends to be less costly to install but has a lower efficiency for converting sunlight to electricity (6-8%) than compared to crystalline PV (12 – 16%). 1 m² of monocrystalline or polycrystalline array will produce a useful output of 90–110 kWh per year (assuming a reasonable tilt, orientation and system efficiency).



Figure 8.2: Photovoltaics 30kW_{peak} PV Installation

The use of PV technology as a renewable energy resource at the Proposed Development would be constraint/unviable on account of the following reasons:

- **Process Compatibility** - The crusher motors within the Proposed Development's aggregate recycling plant have a power output of 150kW (with total site availability of 2,000 kVA) and therefore the required level of PV array necessary for an effective design would not be feasible.
- **Intermittent Power Provision** – The inconsistent availability of solar energy makes the provision of parallel generator and mains power supply facilities necessary without any reduction in their full capacity rating in order to ensure there is no disruption to production.
- **Space Requirements** – The footprint of the PV array makes the installation and specific location on-site difficult and likely to hinder aggregate handling and vehicle movement on-site. The Proposed Development is compact and space efficient with no opportunity to provide the significant area required by PV arrays without compromising the capacity of the Proposed Development and its ability to meet the London Plans Aggregate Recycling targets (policies 5.18 & 5.20).
- **Maintenance** - The impact of the aggregate movement and handling would necessitate regular cleaning of PV arrays to maintain effective performance.

8.4 Solar Thermal

This technology provides small scale hot water generation most often suitable for residential dwellings to supplement conventional boilers to meet domestic hot water loads for washing purposes. The heat collected by the solar gain is in the form a hot water at 50-90°C and not in a useful quantity or grade of heat to meet the requirements of the aggregate drying or washing processes. An example solar thermal installation is shown in Figure 8.3.

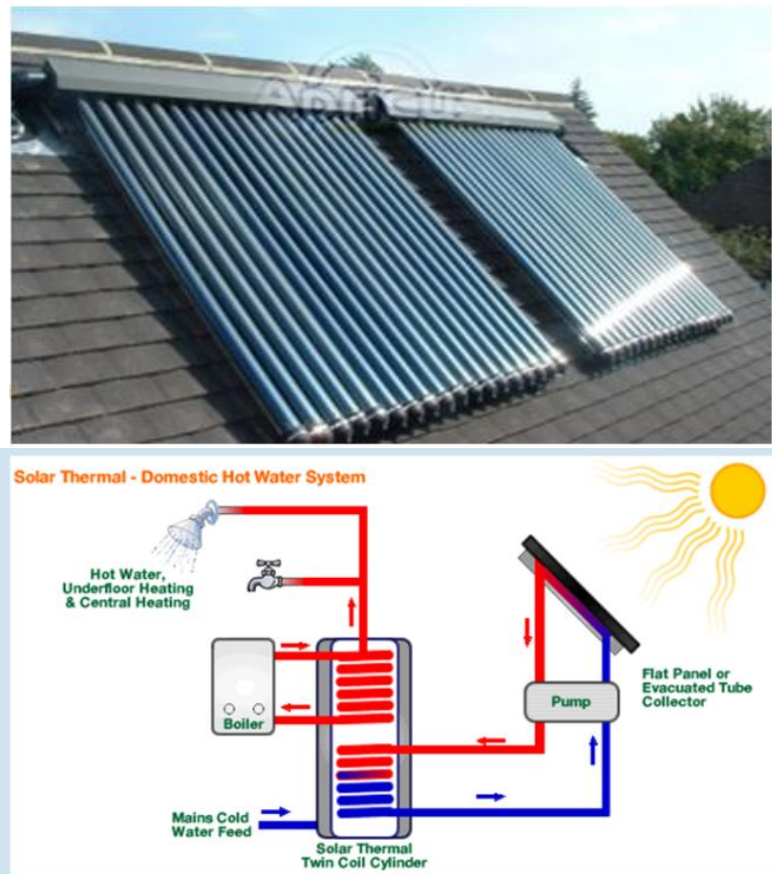


Figure 8.3: Solar Thermal Installation

The use of solar thermal as a renewable energy resource at the Proposed Development would be constraint/unviable on account of the following reasons:

- **No demand for medium grade heat** – The asphalt process is undertaken by direct gas oil fired tunnel dryers, and there is no significant demand for low-medium grade heat from solar thermal technology.
- **Limited opportunity to locate solar collectors** - There is no roof space for the installation of solar collectors. The aggregate storage areas are remote from the drying process, and the building roof space would be more effectively used to provide PV for the buildings.
- Even assuming the low grade heat could be used, and an effectiveness of 500 kWh/m² annual yield for the solar array, the Proposed Development would need over 5,000m² of solar thermal panels to achieve a 10% reduction in thermal load, which is unrealistic.

8.5 Biomass Thermal Heating

Biomass can be burnt directly to provide heat in buildings via biomass boilers, where biomass substitutes fossil fuels to generate hot water. Hence biomass can be used for medium to large scale residential housing scheme where medium grade heat (60-80°C) is useful for heating buildings, but the technology is not appropriate for industrial processes where rapid delivery of high grade heat (100-500°C) is required for the continuous process operation.

An example of a biomass boiler with an integral fuel-delivery system is shown in Figure 8.4.



Figure 8.4: Biomass Boiler Example

Wood (virgin and waste) is the most common fuel and nowadays is used commercially in the form of wood chips and pellets, though fuel other than wood, such as straw can also be used. Boilers are fed automatically by screw drives from fuel hoppers.

Biomass is considered a carbon neutral fuel in the London Renewables toolkit, as the carbon dioxide emitted on burning has been (relatively) recently adsorbed from the atmosphere by the photosynthesis and no fossil fuel is involved. The wood is seen as by-product of other industries and the small quantity of energy for drying, sawing, pelleting and delivery are discounted.

The use of biomass thermal as a renewable energy resource at the Proposed Development would be constrained/unviable on account of the following reasons:

- **No demand for medium grade heat** – The asphalt process is undertaken by direct gas-fired tunnel dryers, and there is no significant demand for low-medium grade heat from biomass boilers. Biomass systems are “boilers” – i.e.: generate hot water, and this is not appropriate for the aggregate drying process.
- **Requirement for fuel storage** – There is very limited space within the Proposed Development to provide a storage area for biomass fuel.
- **Biomass air quality issues** – The site is located within an air quality management area and the biomass combustion would result in adverse particulate emissions.

8.6 Ground Source Heating and Cooling

Ground Source Heating and Cooling exploits the large thermal mass of the ground. The ground is at a constant temperature of around 12°C, so energy from the earth can be used to control the temperature treated or introduced into occupied buildings. This is assisted by a heat pump for space heating or by direct use of water as a coolant.

Figure 8.5 shows the three types of Ground Source systems available in the market.

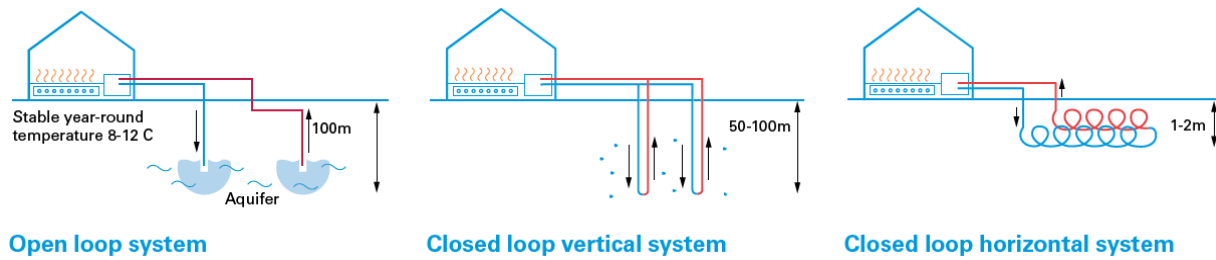


Figure 8.5: Ground Source Systems Examples

The ground source can be either an open loop system, where groundwater is pumped from one borehole and returned via a second borehole; or a closed loop system where coils of pipework are run underground or in structural piles to heat or cool the water in the coils to ground temperature

Ground Source Heat Pumps (GSHPs) are efficient throughout the year and in many climates. They can typically provide 3 – 4 kW of heating or cooling for every 1 kW of electricity input. However, many operate with a Coefficient of Performance (CoP) of 2 – 3, and hence may not be as carbon efficient as gas heating.

The use of GSHP technology as a renewable energy resource at the Proposed Development would be constraint/unviable on account of the following reasons:

- **No demand for medium grade heat** – The asphalt process is undertaken by direct gas-fired tunnel dryers, and there is no significant demand for low grade heat from GSHP systems that typically provide hot water at 40 - 60 °C.
- **Contaminated Status of the Site** - The Site has formerly been used for industrial purposes including a creosote works. As there will be no active remediation, this may render ground bore-holes inappropriate.

9 Energy Strategy for Process Component of Proposed Development

9.1 Introduction

The Proposed Development is subject to the planning guidelines and policies of the London Plan and the London Borough of Hillingdon, and this report presents the options for the scheme design to comply specifically with Policy 5.2 (employ the “Energy Hierarchy”) and Policy 5.7 (use Renewable employ where feasible) with an overall target of achieving up to 25% reduction in carbon impact compared to the 2010 Building Regulations.

However, as the Building Regulations do not apply to the industrial installations, Policy 5.7 has been interpreted as intending the Proposed Development to be an improvement of 26% compared to current good practice in the sector.

The Asphalt process contributes 85% of the carbon impact of the entire Site. This report presents the performance that the Applicant is achieving at their Erith Facility for asphalt production which is the most appropriate energy performance indicator for the development. The level of performance is compared to three similar benchmarks:

- Mineral Products Association current benchmark;
- DEFRA Good Practice Data; and
- Peer Group Performance Data.

The Aggregate Recycling process is calculated to contribute 14% of the carbon impact of the whole site, and the performance has been calculated to be that of the Best Practice Levels of performance that the Applicant is achieving at their Dartford Facility. This is 20% better than the comparable performance benchmarks presented from published benchmarks.

Figure 9.1 shows the Proposed Development's predicted performance against benchmark levels.

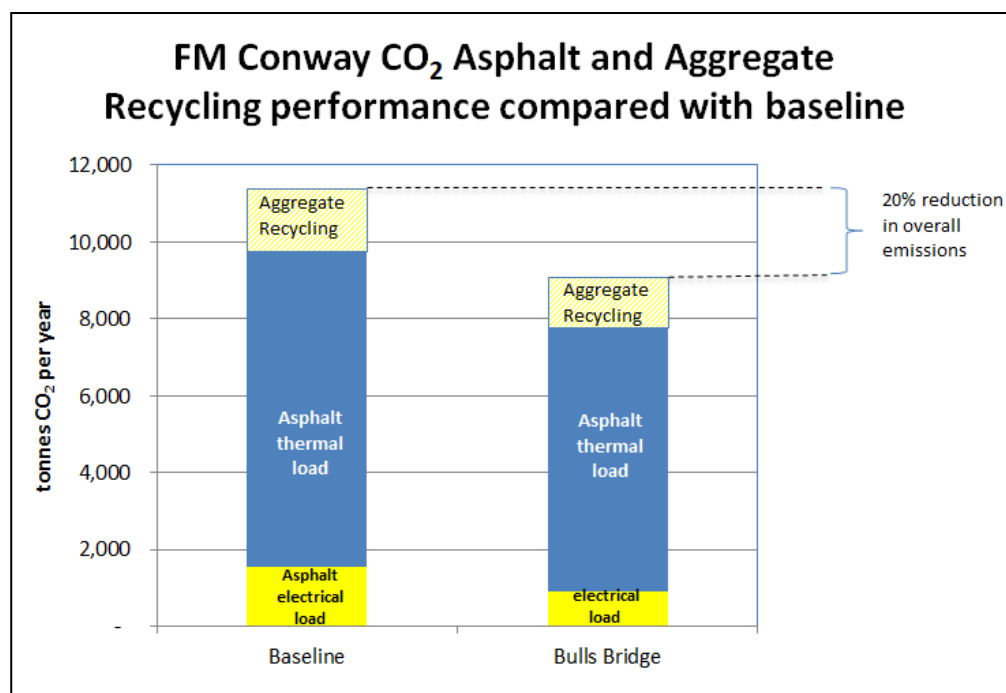


Figure 9.1: Proposed Development Performance against Benchmark Levels

9.2 Lean Performance

The combined performance being achieved at Erith and Dartford represents a 26% improvement in overall carbon emissions compared to available industry benchmarks for energy performance.

The Proposed Development will match this level of excellent energy and carbon performance by adopting best practice technical design features (listed in section 4) and ensuring the Applicant operates the Proposed Development to the same high standards employed at Erith and Dartford.

9.3 Clean Performance

The Proposed Development will include the specification of a rotary aggregate dryer that will have the dual-fuel capability to operate with either gas or oil (including RFO – Recycled Fuel Oil). The opportunity to reduce the carbon impact by using RFO needs to be balanced against the air quality issues associated with the associated NO_x emissions and the requirement to meet LAPPC Permit criteria. The Proposed Development is located within an Air Quality Management Area (AQMA) designated because of existing exceedances in NO_x emissions.

9.4 Green Performance

This report has reviewed the opportunity of applying Low Carbon Technology for the industrial drying process but concludes that thermal LZCs (Low to Zero Carbon) technologies are not appropriate. The two significant LZC technologies that generate electrical power are PV and large scale wind turbines. These are deemed to be technically unviable due to the necessary area of PV causing disruption to the Proposed Development activities. The installation of a large scale wind turbine is technically compromised by the intermittent power provision offered by wind, the turbulence of wind speed and direction in urban locals, and the associated ground footprint necessary of a large turbine.

Figure 9.2 shows illustrates the improvements that can be achieved by being “lean”, and the potential savings by using “clean” energy sources (RFO).

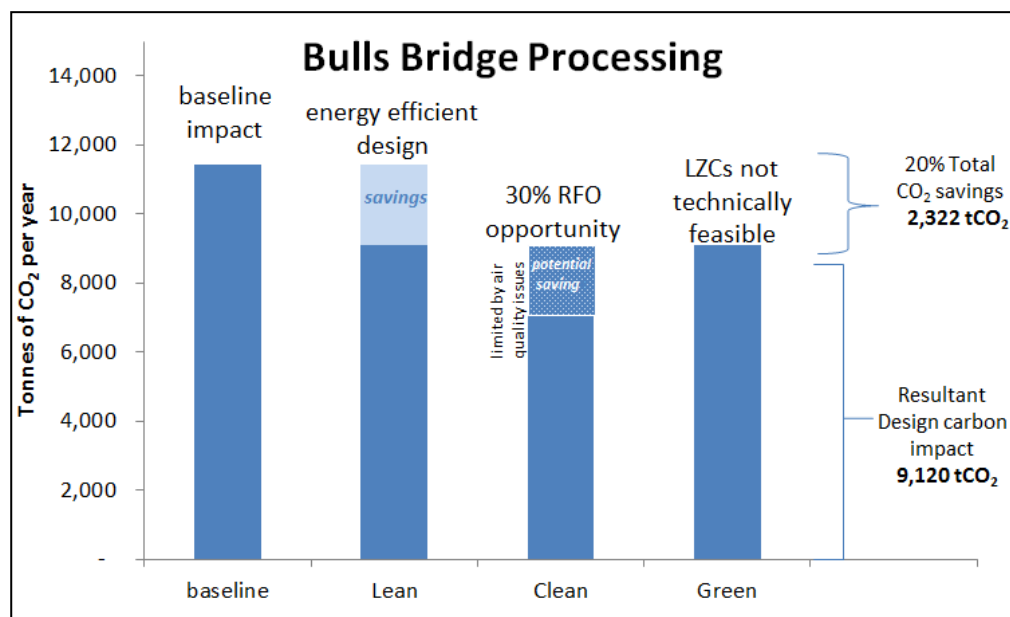


Figure 9.2: Proposed Development Process Performance against Energy Hierarchy

10 Energy Strategy for Building Component of Proposed Development

10.1 Introduction

The Proposed Development incorporates two buildings that will serve as office accommodation, plant control centre and weighbridge facility. These will comply with Building Regulations and their energy and carbon impact, despite only representing 0.5% of the overall Proposed Development, will be subject to the London Plan and the associated carbon efficiency requirements.

The Administration Office will have three floors of 25 x 8m (total area of 600 m²), whilst the Weighbridge Office will have two floors of 16 x 6m (total area of 192 m²).

Both buildings would be of similar construction to the Erith Plant Weighbridge Office as shown in Figure 10.1.



Figure 10.1: Erith Weighbridge Office

The energy demand of the 792 m² office footprint has been calculated to be 133 kWh/m² per year based on the assumption that the following specifications will be implemented in the design to meet 2010 Building Regulations:

- T5 Energy Efficient Lighting;
- Movement sensors on all lighting in toilets, open plan offices and meeting rooms;
- U-values for walls, roof and floors of 0.25, 0.20, 0.15 W/m².K (better than Building Regulations minimum standard);
- Natural ventilation with openable windows
- Secondary glazed windows with U-value of 1.6W/m².K
- Built envelope Air Tightness of 5 m³/h.m² @ 50PA;
- Electric Heating from split units specified with a CoP of 4.1; and

- Electric point-of-use hot water units.

Based on this, the Carbon impact of the two buildings has been calculated to be 33.7 tonnes CO₂/year.

10.2 Relative Energy Consumption Impact of the Building Component

The baseline annual energy use for the building components of the Proposed Development, prior to energy and carbon saving measures, has been calculated to be 133kWh/m², which equates to 33.7 tonnes CO₂/year. This represents 0.3% of the total carbon impact of the entire Proposed Development.

10.3 Approach to Optimising the Carbon Impact of the Building Component

The London Plan Hierarchy has been considered to optimise the potential energy and carbon impact of the Proposed Development's building component:-

1. Be lean: use less energy
2. Be clean: supply energy efficiently
3. Be green: use renewable energy

The results of this process are reported in the sections below.

“Be Lean”

The construction standard of the building component will exceed the current Building Regulation criteria. This approach will be adopted as energy efficient design is often the most cost effective strategy to achieving life time operational cost and carbon savings.

The key design features that will be incorporated in both buildings to further reduce the operational energy consumption and associated carbon impact include:-

- Split units with movement sensor control to prevent operation during unoccupied periods
- External LED lighting with time control and daylight sensors
- Push button taps to limit water use and associated hot water consumption
- Sub-metered for electricity use to enable and encourage energy management initiatives

The package of energy efficiency design features is calculated to reduce the overall energy and carbon use by 10% and equivalent to 3.3 tCO₂/yr.

“Be Clean”

The options for alternative fuel supply are limited for the Proposed Development's building component. The adoption of “better than Building Regulation” fabric standards will ensure the heating load is significantly reduced and the benefits of specifying electric heating (significantly more reliable and interactive control, low installation cost and minimal maintenance risks, costs and issues) make the choice financially and sustainably advantageous.

There is no option for specifying a micro-CHP unit for the buildings as there is no thermal loads for most of the year, and micro-CHP technology has not been effectively demonstrated to be practical for the two buildings.

There is no local communal or district heating system (currently) to consider the issues of connectivity.

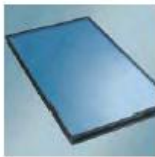
“Be Green”

The Renewable Energy technologies considered for the Proposed Development are described in Section 6.2. The technical feasibility for the building component is considered in Table 10.1:

Table 10.1: Building Component Renewable Options Appraisal		
Technology	Issues	Technically Appropriate
PV	Significant cost but technically feasible if array is facing south	✓
Solar Thermal Hot Water	There will be very little hot water load requirement in the offices	✗
Wind Turbine	The technology has not been shown to be effective for building mounted turbines in urban areas	✗
Ground Source Heat Pumps	The technology is not appropriate for small buildings as the significant investment cost (and associated “embedded” carbon impact of installation) is not recouped for sites with low heating load	✗
Biomass Heating	The technology is not appropriate for small industrial office buildings	✗

10.4 Photovoltaics

The box below provides an extract from CIBSE Guide F- Energy Efficiency in Buildings to demonstrate the potential carbon saving impact of PV.

Table 4.4 Properties and efficiencies of common types of PV cells (source: CIBSE KS15: <i>Capturing solar energy</i>⁽²²⁾)			
Property	PV cell type		
	Monocrystalline silicon	Polycrystalline silicon	Thin film amorphous silicon
Appearance			
Cell efficiency at standard test conditions ^[1]	15–17%	14–15%	8–12%
Module efficiency	13–15%	12–14%	5–7%
Area of modules required per kWp ^[2]	7 m ²	8 m ²	16 m ²
Area per kWp of building materials incorporating PV cells	Glass–glass laminates: 8–30 m ² (depends on cell spacing)	Glass–glass laminates: 10–30 m ² (depends on cell spacing)	Solar metal roofing: 23.5 m ² Glass–glass laminates: 25 m ²
Advantages/disadvantages	Most efficient but highest cost	Cheaper than monocrystalline but slightly less efficient	Considerably cheaper but about half the efficiency of monocrystalline Offers the widest range of options for integration into building elements

In order to reduce the carbon impact of the office component by 25% compared to 2010 Building Regulations, and provide a reduction in expected carbon dioxide emissions through the use of on-site renewable energy generation, where feasible, the development will need to employ a combination of energy efficiency features and a PV array.

As the energy efficiency improvements achieve 10% carbon reduction, the PV array needs to provide a 15% reduction, equivalent to 5 tCO₂/year.

The roof area of the Administrative Office building is 25 x 8m and the Weighbridge Office building has a roof area of 16 x 6m. Both are proposed to have a curved roof profile which is less appropriate for PV. Assuming an effective coverage of 40% of roof space (both buildings), it is recommended that a total PV array of 118m² be installed.

Assuming a yield of 655 kWh/kW_{peak} installed, and an installed array of 118m² (i.e. 14.8 kW), the annual energy yield would be approximately 9,688 kWh_{electricity} per year. This equates to 5.01 tCO₂/year.

Carbon Impact

The carbon impact of the building component has been calculated to be 25.3 tCO₂/year. This is the “baseline Building Regulation Compliance (33.7 tCO₂/yr) less 10% achieved by additional optimum design features (savings of 3.37 tCO₂/yr achieved by PIR sensors on splits etc), and a further 15% reduction (5.01 tCO₂/yr) in energy and carbon impact can be achieved by installing a 118 m² array of PV on the roofs. This is the maximum feasible available space, and the overall impact of both approaches will achieve a 25% reduction in the carbon emissions from the buildings which complies with Policy 5.2 and 5.7 of the London Plan.

Figure 10.2 uses the standard energy hierarchy approach to demonstrate the improvements that can be achieved by being “lean”, and the potential savings by using “green” renewable energy technology.

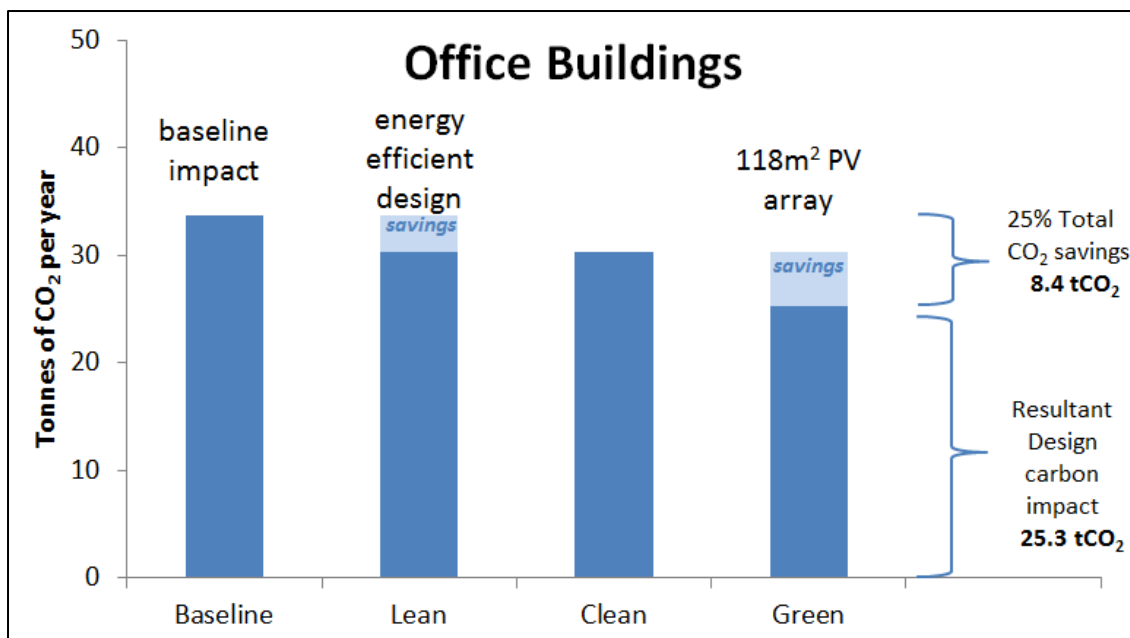


Figure 10.2: Proposed Development Building Component Performance against Energy Hierarchy

11 Conclusion

ENVIRON UK Ltd was appointed by FM Conway Ltd to prepare an Energy Statement that will accompany a detailed planning application for the development of an Aggregates Recycling Plant, Asphalt Production Plant and Gully Waste Recycling Plant at the former Powergen site, Bulls Bridge, Hayes, LBH.

The Proposed Development will comprise the following:

- clearance and leveling of the Site;
- capping of the Site with concrete and/or asphalt as appropriate for circulation and parking;
- construction of administration offices;
- construction of a satellite Asphalt Storage Plant;
- construction of an Aggregate Recycling Plant;
- construction of a Gully Waste Treatment and Recycling Plant;
- construction of an Asphalt Production Plant; and
- implementation of landscaping.

The Proposed Development relates to bespoke industrial and waste recycling plant and equipment that will enable construction material to be recycled rather than landfilled. In doing so, it will deliver materials that substitute virgin, primary aggregate, underpinning the aspirations of London Plan Policy 5.2 B. In addition, by replicating its existing facilities in Dartford and Erith (East London) at Bulls Bridge (West London), the Applicant is able to significantly reduce carbon emitting vehicle movements across the region.

The development proposals draw upon the Applicant's experience and best practice at their existing facilities. The new facility at Bulls Bridge will play a key role in the Applicant's company-wide aim of achieving a 'Zero to Landfill' target.

Although the Proposed Development is for a bespoke facility, which has very specific process, energy, access and layout requirements, the proposals have been assessed against prevailing regional climate change and energy policy. As such, the Energy Strategy and Statement has been prepared by reference to London Plan policy requirements and in particular the Mayor of London's Climate Change Mitigation and Energy Strategy.

In presenting the Energy Strategy for the Proposed Development, the document:

- reports on the baseline energy demand of the Proposed Development, including the Non-Part L energy use;
- outlines the options considered for reducing CO₂ emissions through energy efficiency measures, energy supply and renewable energy technologies having regard to the unique characteristics of the Proposed Development and the local environment;
- describes the energy efficiency, low carbon and best practice initiatives which form part of the development proposals; and
- quantifies the residual carbon emissions from the Proposed Development's energy consumption in terms of tonnes CO₂/year.

It concludes that:

- the overall carbon impact of the Proposed Development is likely to be 9,145 tCO₂/year, of which:
 - 85% will be associated with the Asphalt Production Plant;

- 14% will be associated with the Aggregate Recycling Plant; and
- less than 1% will be associated with the Offices, Gully Waste Recycling Plant and other ancillary activities.
- The most appropriate strategy to improve energy efficiency and reduce carbon emissions from the Proposed Development is the application of Best Practice standards of design and operation for the Asphalt and Aggregate Recycling Plants. This comprises Electrical Efficiency features and Optimum insulation standards which have the potential to deliver 26% reduction in carbon impact. This is equivalent to 2,153 tCO₂/year.
- Renewable energy options are not considered appropriate for technical reasons and due to space restrictions. However, there is the opportunity to incorporate a Photovoltaic (PV) array on the roof areas of the Proposed Development's weighbridge building and three storey administration offices, which could deliver 15% reduction in the buildings' carbon impact. This is equivalent to 5 tCO₂/year.
- The Proposed Development will have no demand for medium grade heat and the technologies applied at the Site, would render CHP technology in compatible. In addition there is no option for specifying a micro-CHP unit for the buildings as there is no thermal loads for most of the year, and micro-CHP technology has not been effectively demonstrated to be practical for the two buildings.
- An additional reduction in carbon impact may be achieved by using Recycled Fuel Oil for the Asphalt Plant's rotary dryer, but this opportunity is restricted by issues associated with meeting air quality standards (referred to in London Plan Policy 5.7 D), Local Authority Pollution Prevention & Control (LAPPC) Permit criteria and the Site's location within an Air Quality Management Area.
- The Proposed Development complies with London Plan Policies 5.2, 5.7, 5.17, and 5.20 in regards to Energy Efficiency, Carbon Impact and the Aggregates Strategy for London.

The overall carbon footprint of the Proposed Development is shown in Figure 11.1.

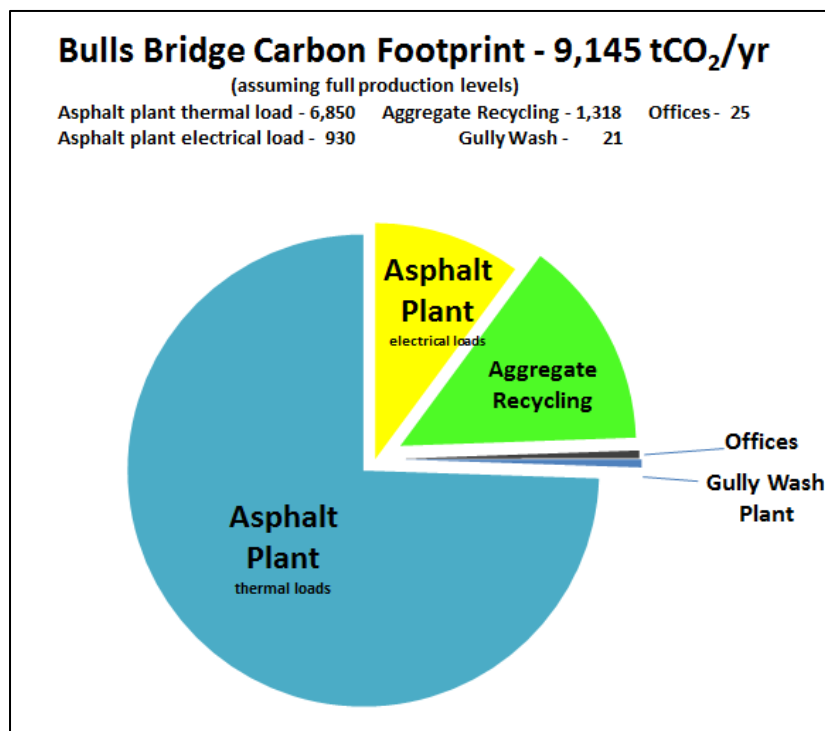


Figure 11.1: Proposed Development Carbon Footprint

Table 11.1 summarises the energy reduction opportunities and low carbon technology options explored.

Table 11.1: Proposed Development Carbon Mitigation Opportunities

Development Component	Carbon Impact tCO ₂ /year	%	Energy Reduction opportunities	Low Carbon Technology Options
Asphalt Thermal Loads	6,850	74.9%	Best Practice thermal efficiency measures and operational performance to Erith Standards – 20% better than current industry benchmarks. Optimum insulation of plant and high efficiency dryer and burners Controlling of moisture content of aggregate	Renewable technology options considered: • Wind • Photovoltaics • Solar Thermal • Biomass Thermal Heating • Ground Source Heating and Cooling Options limited in industrial sector due to specific thermal requirements of process. Potential for use of alternative fuel source - Recycled Fuel Oil - with zero carbon impact. However needs to be balanced against air quality issues as stated in London Policy 5.7 D and location within AGMA.
Asphalt Plant electrical Loads	930	10.2%	Best Practice standards of technical design includes	Renewable technology options considered:
Aggregate Recycling	1,318	14.4%	• VSD drive • High efficiency motors • Power Factor Correction • Conveyor sensors	Renewable technology options considered:
Gully Waste Plant	21	0.2%		• Wind • Photovoltaics • Solar Thermal • Biomass Thermal Heating • Ground Source Heating and Cooling Options are limited by technical issues of load matching in the industrial sector, and physical constraints of required ground footprint of Renewable systems

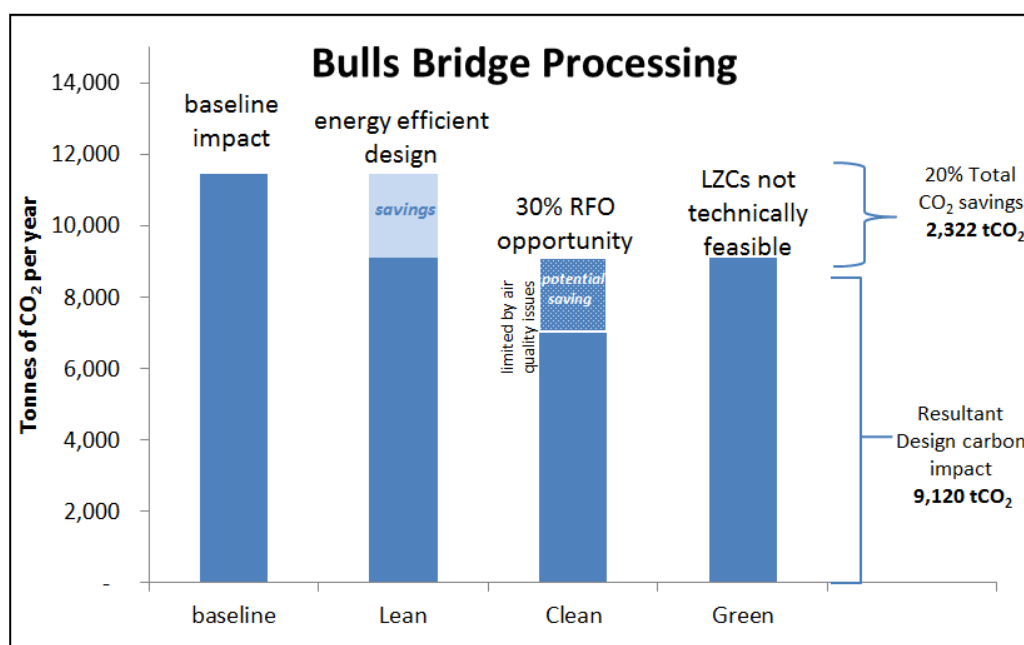
Table 11.1: Proposed Development Carbon Mitigation Opportunities

Development Component	Carbon Impact tCO ₂ /year	%	Energy Reduction opportunities	Low Carbon Technology Options
Offices	25	0.3%	Build standards better than current Building Regulations, high efficiency lighting, natural ventilation, good fabric standards, low air infiltration	118m ² of PV to achieve 15% carbon impact reduction
TOTAL	9,145			

Process Component Carbon Savings

The Processing component of the Proposed Development will achieve a 20% reduction in CO₂ emissions by adopting energy efficient design measures. There remains a potential for further reduction in CO₂ emissions by switching to RFO (Recycled Fuel Oil) for the rotary burner of the Asphalt Plant. However, there are air quality issues that make this option incompatible with local air quality and the requirements of London Plan Policy 5.7 D.

The total reduction of CO₂ emissions for the Processing component is predicted to be 2,332 tCO₂/yr as shown in Figure 11.2.

**Figure 11.2: Proposed Development Process Performance**

Building Component Carbon Savings

The Proposed Development's Administration and Weighbridge Buildings (total area of 792 m²) will only contribute 25 tCO₂/yr (0.3%) towards the overall carbon impact of the scheme. This impact will be reduced by 25% if the design exceeds the Building Regulation standards by 10%, and a 118 m² area of Photovoltaic array is installed. On this basis, the total CO₂ savings predicted are 8.4 tCO₂/yr, as shown in Figure 11.3.

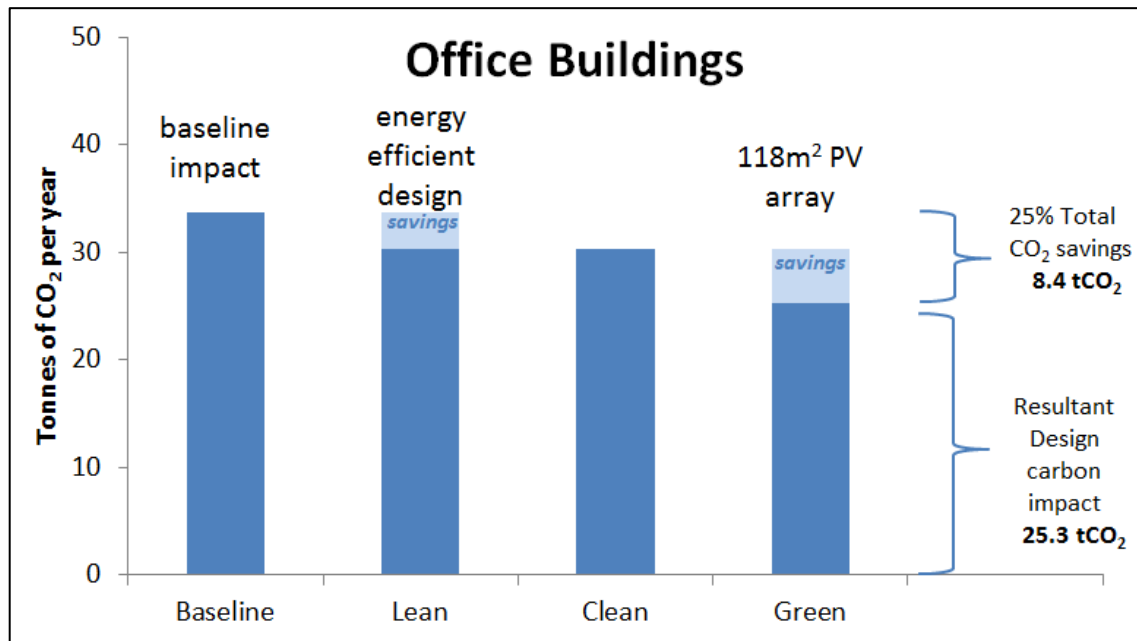


Figure 11.3: Proposed Development Building Performance