
VOLUME 3 – ISLAND SITES BUILDING 3

ENERGY ASSESSMENT

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JULY 2018

SWECO UK LIMITED

Change list

VER.	DATE	STATUS	REVIEWED	APPROVED
01	JULY/2018	FINAL FOR PLANNING	GC	KA
02	APR 2020	AMENDED TO BLDG 3 SPECIFIC	PH	

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3 Volume 3 – Island Sites and the Pavilion

3.1 Introduction

Volume 3 was originally prepared by Sweco to assess the predicted energy performance of the Ferry Island and North Island plots, collectively known as the “Island Sites”, including the Pavilion (‘the Proposed Island Sites Development’) and explains how the development addresses the Energy Hierarchy: ‘Be Lean’, ‘Be Clean’ and ‘Be Green’ set out in the London Plan and Haringey Local Plan, and explained in Volume 1.

Version 2 of this report has been modified to specifically relate to Building 3 (B3) only to form part of the Employers Requirements for that project.

3.1.1 Plot Scheme and General Description

The Proposed Island Sites Development comprises four buildings; Building 1 (“B1”), Building 2 (“B2”) and the Pavilion at Ferry Island and Building 3 (“B3”) at North Island (see Figure 3-1A and 3-1B).

Ferry Island

Ferry Island comprises the land containing the Ferry Island Retail Park and bounded by The Hale/Ferry Lane to the west and south respectively and Tottenham Hale Bus Station to the east.

The existing site contains a retail park and associated car parking.

The proposed development comprises two mixed-use buildings (B1 and B2) each with non-residential uses at ground floor and residential above. B1 will also host a shared amenity use at mezzanine level. A shared basement serves both buildings. The Ferry Island plot includes the potential for part of the basement to be used as either ancillary residential/storage/plant floor space (Option A); or cinema/flexible retail floor space (Option B). In Option B the overall basement area is larger.

A low-rise Pavilion is proposed to the south of Ferry Square between B1 and B2, adjacent to Ferry Lane and will host retail areas and a restaurant.

The main constraints on both plots are underground utilities and tunnels. Where possible, the built form of the development is located away from the key utility infrastructure and London Underground tunnel assets.

Ferry Island has been identified as one of the plots where a basement is possible as the underground tunnels and services are located on the periphery of the plot. Providing a basement allows for back of house areas to be placed below ground, freeing up the ground floor for a range of town centre uses that activate the public realm.

The vision for a significant new public space on Ferry Island determined the rationale for the massing of the different buildings. The aim was to create a well-connected and well

orientated new public square (Ferry Square) that could actively engage with the surrounding buildings. As detailed in the Design and Access Statement ("DAS") Volume 5, two options of plot arrangement were explored, 'introvert' and 'extrovert'. The latter comprise a public square to the south perimeter of the plot which was further developed for concept design stage due to the good levels of daylight and sunlight. Moreover, this option provides a greater ability to engage and connect with the long term aspirations of the Tottenham Hale District Framework to redevelop the retail park to the south of Ferry Lane.

To serve as a buffer for the heavily trafficked Ferry Lane, a pavilion was added to the south of the plot. The location of the pavilion was carefully selected to provide a focal point and draw users into Ferry Square. Also, its footprint relates to underground utilities and addresses an underground tunnel easement to the south, which the building must avoid (see Volume 6 of the DAS).

North Island

North Island is located on the corner of Station Road and The Hale, comprising 49 and 51 The Hale, 1 Station Road as well as associated hardstanding to the north.

There are a number of existing uses on the North Island plot. These include office and residential uses within 51 The Hale (the 3 storey former White Hart public house on the corner of The Hale and Station Road). 49 The Hale comprises an existing car wash which includes a small built structure and hardstanding. B3 consists of non-residential use at ground floor with residential accommodation above.

The commercial areas face south and east of the plot on ground floor to activate Station Road, which is designed to be realigned to maximise the development opportunities either side of the road, thus creating a pedestrian friendly environment. B3 consists of ground plus 17-storeys of shared-ownership residential accommodation.

The plots will be well connected to a new road/pedestrian network, linked to routes north and south and the bus and rail interchange to the east. This, together with the introduction of a range of town centre uses at ground and first floor, will inject vibrancy in the area.

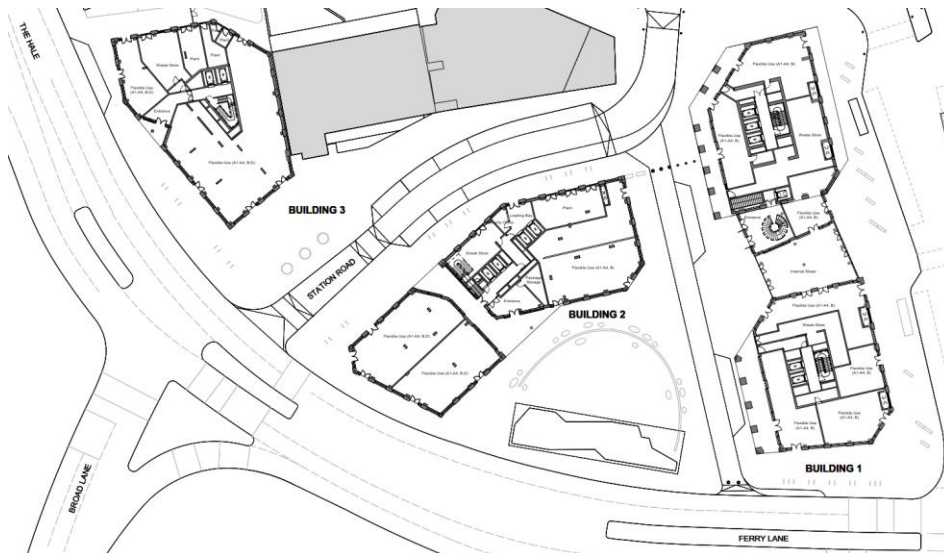


Figure 3-1A Tottenham Hale Island Sites and the Pavilion Option A, ground floor plan (extracted from AHMM Architects drawing)

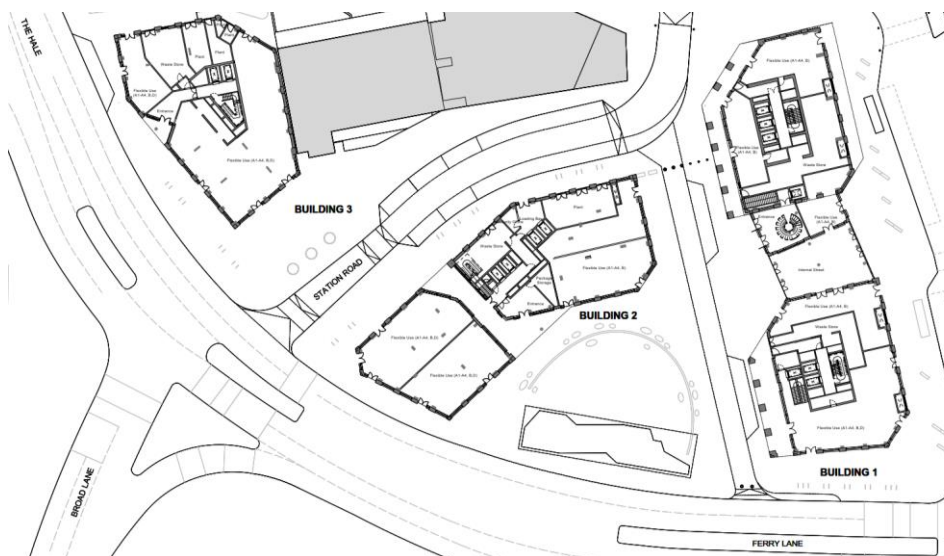


Figure 3-1B Tottenham Hale Island Sites and the Pavilion Option B, ground floor plan (extracted from AHMM Architects drawing)

Table 3-1 shows the uses and quantum development within the Proposed Island Sites Development.

Table 3-1 Plot Area Schedule

	Quantum of development
	North Island (B3)
Residential (no. units)	136
Flexible Retail / Leisure / Office uses GIA (m ²)	448

Note: please refer to detailed Area Schedule contained in Volumes 5 and 6 of the DAS prepared by AHMM Architects and Ruff Architects, respectively.

3.1.2 Purpose of this Volume

This Volume demonstrates how the Proposed North Island B3 Development, as part of the wider Island Sites Development, addresses the relevant policies of the London Plan (2016) and the Strategic Policies DPD and DM DPD which both form part of LBH Local Plan. It also has regard to the GLA Planning Energy Guidance and the Draft London Plan.

As detailed in Volume 1, the overarching site-wide energy strategy has been carried out for the wider Tottenham Hale Centre development by BuroHappold Engineering, setting out the strategy for supplying energy efficiently to the five development plots as per London Plan Policy 5.2 - Minimising carbon dioxide emissions. This and subsequent Volumes 2, 4 and 5 contain the energy assessment of the other plots.

Energy calculations for the Proposed North Island B3 Development were carried out using the SAP2012 methodology for the residential units and Dynamic Simulation Modelling (DSM/SBEM) for the non-domestic areas. This is in line with Building Regulations Part L 2013. Sample of the residential units includes for each typical apartment type, the SAP and DSM outputs are provided in Appendix 3A and 3B.

3.2 GLA Energy Assessment Summary

This section presents the methodology used to establish the target CO₂ emissions and a summary of the building's regulated carbon emissions.

The Energy Assessment for the Proposed Island Sites Development has been carried out in accordance with Section 8 of the Greater London Authority ("GLA") Energy Planning

Guidance (March 2016 – the ‘GLA Energy Planning Guidance’); Chapter 5 of the London Plan (March 2016): London’s Response to Climate Change (March 2015) specifically Policy 5.2, which follows the Mayor’s Energy Hierarchy:

1. Using less energy ‘Be Lean’
2. Supply energy efficiently ‘Be Clean’
3. Using renewable energy ‘Be Green’

Policy DM 21 of the DM DPD also refers to the Mayor’s Energy Hierarchy to minimise energy use and reduce carbon emissions.

Although still in draft, Policy SI2 (Minimising greenhouse gas emissions) of the Draft London Plan sets out minimum targets of carbon emissions as below and those will be cross-referenced throughout the report.

The draft Policy SI2, as detailed in section 1.4 of Volume 1, introduces a new energy efficiency requirement for both residential and non-residential developments:

- Residential development should aim to achieve 10 per cent on-site carbon dioxide emissions reduction, and non-residential development should aim to achieve 15 per cent on-site carbon dioxide emissions reduction through energy efficiency measures.

This means these savings should be achieved at the ‘Lean’ stage of the Mayor’s Energy Hierarchy, once the Draft London Plan is adopted.

In line with Policy 5.2 of the London Plan and draft Policy SI2 of the Draft London Plan, the GLA Energy Planning Guidance explains that the carbon reduction target for new development has changed from 1 October 2016 as follows:

- Non-domestic areas must achieve at least 35% reduction in regulated carbon emissions below Part L of the Building Regulations 2013, represented by the calculated Target Emissions Rate (the “TER”);
- Residential areas must be zero carbon, as defined in section 5.2 of Housing Supplementary Planning Guidance (March 2016) (“Housing SPG”) and achieve at least 35% reduction in regulated carbon emissions over Part L of the Building Regulations 2013 (i.e. the TER). The remaining regulated CO₂ emissions to achieve 100% savings are to be offset through a cash in lieu contribution to the relevant borough (shown as the last bar of Figure 3-3).

Section 3.7 of this Volume explains the current carbon offset charge for LBH in relation to the Proposed Island Sites Development, based on the Council’s Planning Obligations SPD (2018).

3.2.1 Target CO₂ savings

The concept of applying the Mayor's Energy Hierarchy in relation to Part L 2013 of the Building Regulations is illustrated in Figure 3-2 and Figure 3-3 for non-domestic and residential buildings, respectively.

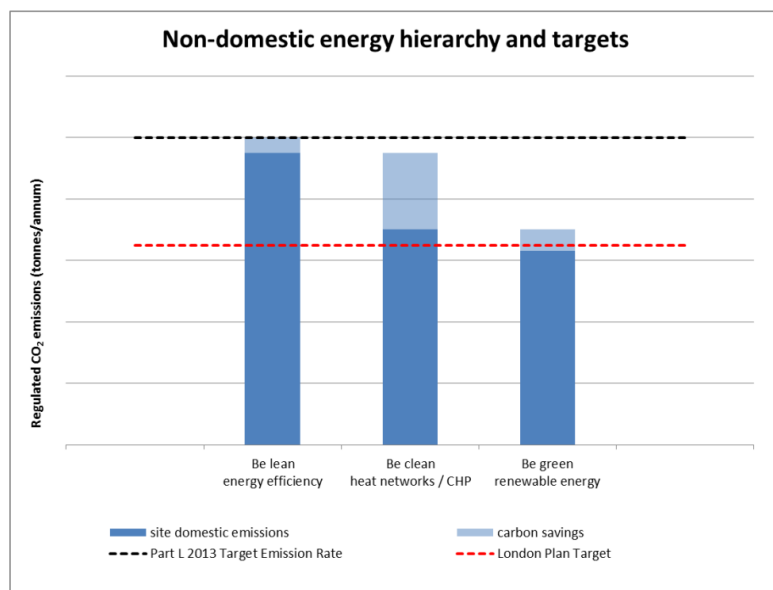


Figure 3-2 The Non-domestic Energy Hierarchy and targets (source: GLA's Energy Planning Guidance, 2016)

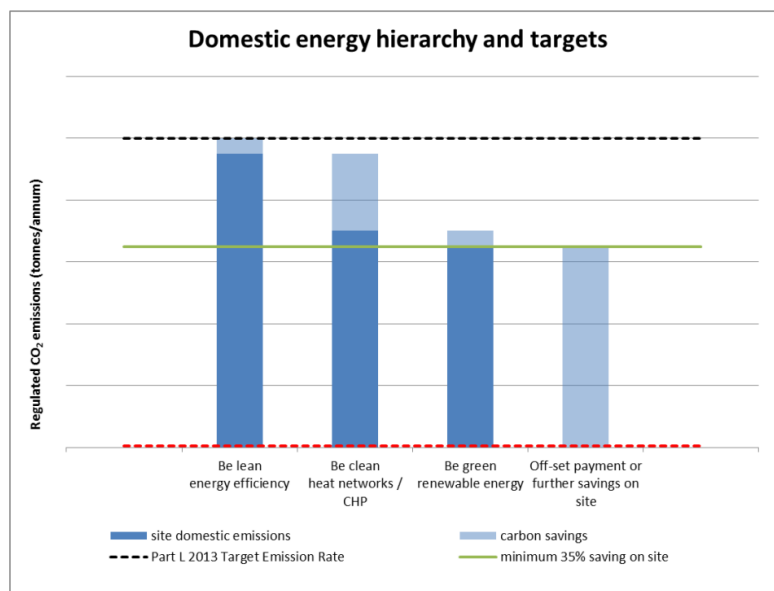


Figure 3-3 The Domestic Energy Hierarchy and targets (source: GLA's Energy Planning Guidance, 2016)

Where the blue bars drop below the black dotted line, this demonstrates savings in regulated CO₂ emissions compared to a development that just complies with Part L 2013 of the Building Regulations.

Sweco UK use Integrated Environmental Systems ("IES") VE Compliance software to demonstrate compliance with Part L2A of the Building Regulations 2013 for the non-domestic areas.

The IES VE Compliance software has been approved by the Department for Communities and Local Government ("DCLG") for use as a Dynamic Simulation Model ("DSM") software package. As part of its approval process, the IES software had to demonstrate that it satisfies all of the tests and other requirements defined in accordance with ISO 90003:2004 – 'Guidelines for the application of ISO 9001:2000 to computer software.

The methodology used by the IES accredited software is summarised below:

- A three dimensional software model of the proposed non-domestic areas of the building is generated using the software's Model IT component. This model is based on the architectural drawings and is an accurate geometric representation of the building.
- The building usage is defined for the building as a whole in line with the National Calculation Method's ("NCM") various definitions for building uses.

- The building systems are defined and allocated to each of the rooms within the building.
- The software calculates a Building Emissions Rate ("BER") based on the geometry of the building, its use and the efficiency of the building systems defined.
- The software automatically generates a notional building using the geometry for the proposed building, by allocating glazing coverage, U-values and plant efficiency in accordance with the Elemental Method as defined in NCM modelling Guide 2013.

The software also calculates an Emissions Rate for the Notional building, which is referred to as the TER for the actual building.

Accredited Standard Assessment Procedure ("SAP") software was used to establish the baseline regulated and unregulated carbon emissions of the residential areas of the development.

Regulated energy is the building energy consumption resulting from the specification of controlled, fixed building services and fittings, including space heating and cooling, hot water, ventilation and lighting. Whereas, unregulated energy results from a system or process that is not controlled, i.e. energy consumption from systems in the building on which the Building Regulations do not impose a requirement. For example, lifts, escalators, refrigeration systems, computers, servers, printers, photocopiers, laptops, cooking, and other appliances.

As per paragraph 2.7 of Part L1A of the Building Regulations 2013, where a building contains more than one dwelling, such as a block of flats, an average Dwelling Emissions Rate ("DER") and TER can be calculated for all dwellings in the building using the area-weighted average of all the individual DERs and TERs. This is referred to as "block averaging" (Part L1A, Building Regulations 2013).

Table 3-2 presents the TER for the non-domestic and residential components of the Proposed Island Sites Development.

The regulated TER for the non-domestic areas is 197 tonnes of CO₂/annum and a minimum 35% improvement is required for the Proposed Island Sites Development. The residential areas must be zero carbon by achieving at least 35% reduction over the overall TER of 603.9 tonnes of CO₂ per annum for Ferry Island and North Island sites and contribute to a carbon offsetting fund of the remaining emissions over 30 years.

Table 3-2 Target Emission Rate – TER: Non-domestic and residential buildings

Baseline: Part L 2013 of the Building Regulations Compliant Development	Target Carbon Dioxide Emissions (Tonnes CO ₂ per Annum)
	Regulated Energy
Non-domestic Buildings (Part L2A)	197
Ferry Island - Domestic Buildings (Part L1A)	475.2
North Island - Domestic Buildings (Part L1A)	128.7

3.2.2 Proposed Island Sites Development Summary of CO₂ emissions

Following the energy and carbon evaluation described within the next sections of this Volume, it is proposed that passive design, energy efficiency measures along with low and zero carbon ("LZC") applications will be incorporated into the design at the Proposed Island Sites Development. Energy and carbon calculations have confirmed that the proposed energy efficiency design and LZC application will achieve:

- Regulated carbon dioxide savings of 35.6% against Part L2A 2013 relative to a new-build non-domestic development;
- Regulated carbon dioxide savings of 49.2% against Part L1A 2013 relative to a new-build dwelling development.

As the non-domestic development exceeds the minimum of 35% reduction in CO₂ emissions over the TER, any surplus of tonnes of CO₂ from the non-domestic areas will be used to compensate for the shortfall of carbon emissions of the residential development, as shown in Table 3-9.

The tables contained in the next pages show the carbon dioxide emissions for each building use and whole development totals to demonstrate compliance with the Energy Hierarchy and carbon targets proposed by the GLA and LBH.

The Proposed Island Sites Development complies with the relevant national, regional and local adopted and emerging (particularly draft Policy SI2 of the Draft London Plan) policies.

Non-domestic buildings CO₂ emissions

Table 3-3 Carbon Dioxide Emissions after each stage of the Energy Hierarchy for Non-domestic buildings

Non-domestic	Carbon Dioxide Emissions (Tonnes CO ₂ per Annum)	
	Regulated Energy	Unregulated Energy
Base line: Part L 2013 of the Building Regulations Compliant Development (TER)	197.0	309.9
After energy demand reduction (Be Lean)	155.1	247.9
After connection to DEN (Be Clean)	145.7	247.9
After renewable energy (Be Green)	125.5	247.9

Table 3-4 Regulated carbon dioxide savings from each stage of the Energy Hierarchy for Non-domestic buildings

Non-domestic	Regulated Non-domestic CO ₂ savings	
	(Tonnes CO ₂ per Annum)	(%)
Savings from reduced energy demand (Be Lean)	41.8	21.2%
Saving from connection to DEN (Be Clean)	9.4	4.8%
Savings from renewable energy (Be Green)	20.2	10.3%
Total Cumulative Savings	71.5	36.3%

Table 3-5 Shortfall in regulated carbon dioxide savings

Non-domestic	Annual Shortfall Tonnes CO ₂ (Regulated)
Total Target Savings	68.9
Shortfall	-2.6

Note: the negative shortfall relates to a surplus in CO₂ savings against the 35% improvement over the TER.

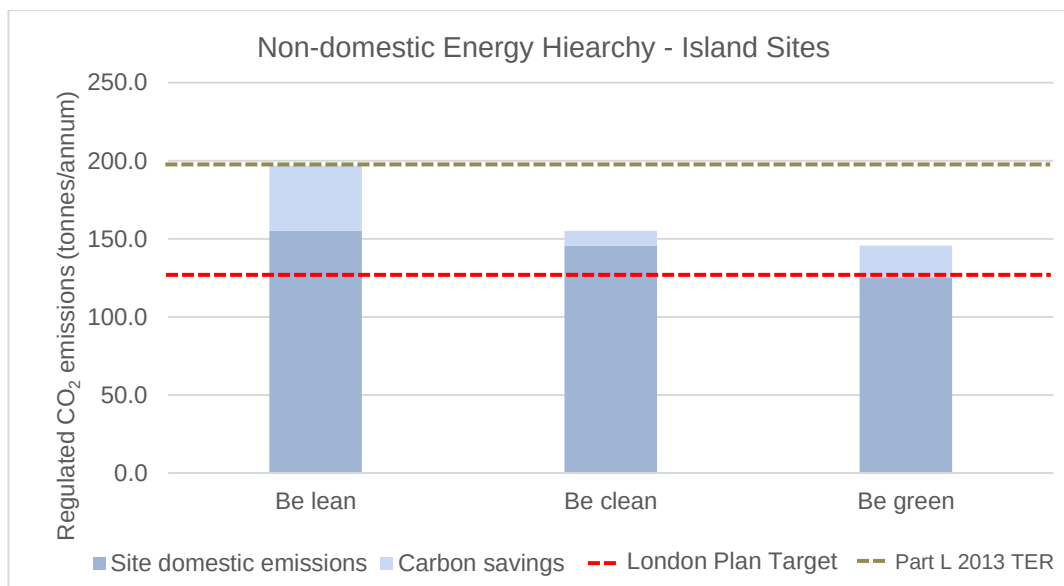


Figure 3-4 Non-domestic energy hierarchy at the Proposed Island Sites Development

Residential buildings CO₂ emissions

Table 3-6 Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic buildings

Residential	Carbon Dioxide Emissions (Tonnes CO ₂ per Annum)	
	Regulated Energy	Unregulated Energy
Base line: Part L 2013 of the Building Regulations Compliant Development (TER)	603.9	780.2
After energy demand reduction (Be Lean)	549.1	585.1
After connection to DEN (Be Clean)	306.8	585.1
After renewable energy (Be Green)	306.8	585.1

Table 3-7 Regulated carbon dioxide savings from each stage of the Energy Hierarchy for domestic

Residential	Regulated Domestic CO ₂ savings	
	(Tonnes CO ₂ per Annum)	(%)
Savings from reduced energy demand (Be Lean)	54.8	9.1%
Saving from connection to DEN (Be Clean)	242.3	40.1%
Savings from renewable energy (Be Green)	0.0	0.0%
Cumulative on site savings	297.1	49.2%
Annual savings from off-set payment	306.8	
	(Tonnes CO ₂)	
Cumulative savings for off-set payment	9,205.5	



Figure 3-5 Domestic energy hierarchy at the Proposed Island Sites Development

Proposed Island Sites Development Total CO₂ emissions – overall

Table 3-8 Site wide regulated carbon dioxide emissions and savings

	Total regulated emissions (Tonnes CO ₂ /year)	CO ₂ savings (Tonnes CO ₂ /year)	Percentage saving (%)
Part L 2013 baseline	800.9	-	-
Be lean	704.3	96.6	12%
Be clean	452.5	251.7	31%
Be green	432.3	20.2	3%
	CO₂ savings off-set (Tonnes CO₂)		
Off-set	9,128.6		

Carbon Offsetting

A £60 per tonne carbon offset charge has been confirmed by LBH. This will be applied to the carbon shortfalls for the regulated domestic and non-domestic energy demands to calculate the carbon offset charge payable to LBH.

Table 3-9 Shortfall in regulated carbon dioxide savings

	Annual Shortfall Tonnes CO ₂ (Regulated)
Domestic Areas Shortfall	306.8
Non-domestic Areas Shortfall	-2.6
Total Carbon Emissions for Offsetting	304.3

Note: the negative shortfall relates to a surplus in CO₂ savings against the 35% improvement over the TER.

Over 30 years, the shortfall of 304.3 tonnes of CO₂ per year is equal to 9,128.6 tonnes of CO₂ as shown in Table 3-8.

3.3 Demand reduction (Be Lean)

In accordance with London Plan Policy 5.3 and DM DPD Policy DM21, this section provides details of the energy efficient servicing strategies and equipment that will be used throughout the Proposed Island Sites development to reduce energy demand and carbon emissions as set out in Section 3.2 of this Volume.

3.3.1 Passive Design Features: Regulated Energy Use

Building Envelope – Residential Areas

The external envelope of a building can act as an important climatic modifier, with a well-designed façade significantly reducing the buildings energy demand.

The residential façade system will be designed to minimise energy requirements and improve thermal comfort. The 'Fabric Energy Efficiency' ("FEE") of dwellings is assessed using SAP 2012. The FEE is a measure of the primary energy associated to heating and cooling within dwellings due to fabric heat losses and infiltration.

The characteristics for U-values and air permeability for the Proposed Island Sites Development are significantly better than the minimum standards as set out by Part L1A 2013 and shown in Table 3-10 below. Wherever possible, the five plots making up the Tottenham Hale Centre Development, have used similar target values of fabric thermal performance for consistency across all buildings. However, slight differences will be found on a plot by plot basis due to FEE requirements which is subject to building geometry, floor areas, volume, orientation and overshadowing impact from nearby buildings or self-shading; therefore being plot specific.

The applied building values are set out against the Part L1A notional building parameters in Table 3-10 below.

Table 3-10 Proposed Building Thermal Envelope U-values for Residential Areas

Parameter	Part L1A Limiting Values	Part L1A Notional Building parameters	Applied Building Values
Designed Building Air Tightness	10m ³ /h/m ² @ 50pa	5m ³ /h/m ² @ 50pa	3 m ³ /h/m ² @ 50pa Note 1
Thermal Bridging (y-value)	N/A	0.05 W/m ² .K if the default value of y=0.15 W/m ² K is used in the actual building.	0.15 W/m ² K (default) Note 2
Thermal Mass	N/A	250 kJ/m ² .K	250 kJ/m ² .K

Parameter		Part L1A Limiting Values	Part L1A Notional Building parameters	Applied Building Values
U-values	Wall/Solid	0.30 W/m ² .K	0.18 W/m ² .K	B1: 0.22 W/m ² .K B2/B3 0.25 W/m ² .K
	Roof	0.20 W/m ² .K	0.13 W/m ² .K	0.13 W/m ² .K
	Exposed/ Ground Floor	0.25 W/m ² .K	0.13 W/m ² .K	0.13 W/m ² .K ^{Note 3}
	Party Walls ^{Note 4}	-	0.0 W/m ² .K	0.0 W/m ² .K ^{Note 5}
	Unitised Curtain Walling (overall)	2.00 W/m ² .K	Opaque wall: 0.18 W/m ² .K Glazing: 1.5 W/m ² .K, up to 25% of floor area	N/A
Glazing g-value (BS EN 410)		N/A	0.63	0.39 ^{Note 6}
Windows U-value		2.00 W/m ² .K	1.4 W/m ² .K 25% of floor area	≤ 1.2 W/m ² .K
Doors U-value (opaque)		2.00 W/m ² .K	1.0 W/m ² .K	≤ 0.6 W/m ² .K
Frame factor		N/A	0.7	0.85
Glazing Lighting Transmittance		N/A	0.8	≥ 65%

Note 1: Air Permeability tests will be required on **all** the apartments.

Note 2: Specialist consultants will be required to design thermal bridging details and calculate psi-values to improve upon default y-value indicated at planning stage. By calculating thermal bridging, the Notional psi values are also calculated by using Approved Construction Details.

Note 3: Relates to GF floor construction or slab between heated and unheated space; subject to floor detailing of the floating slab.

Note 4: For the purposes of SAP, party walls are considered to be those that are adjacent to other spaces that are assumed to be heated to the same level as the dwelling; this includes foyers, corridors, risers, stairwells and common areas.

Note 5: Considered as fully filled cavity with insulation.

Note 6: g-value range to be optimised against overheating analysis and FEE.

Building Envelope – Non-domestic Areas

The next table outlines the target U-values in order to improve fabric thermal performance to reduce heating loads and also increase comfort level within the non-domestic spaces by even heating and cooling distribution within the occupancy space.

The applied building values are set out against the Part L1A notional building parameters in Table 3-11 below.

Table 3-11 Proposed Building Thermal Envelope U-values for Non-domestic Areas

Parameter		Part L2A Value	Part L2A Notional Building Parameters	Applied Building Values
Building Air tightness		10m ³ /h/m ² @ 50pa	3 m ³ /h/m ² @ 50pa	3 m ³ /h/m ² @ 50pa
U-values	Opaque Wall & Insulated spandrel	0.35 W/m ² K	0.26 W/m ² K	0.22 W/m ² K
	Curtain Wall	2.2 W/m ² K	1.6 W/m ² K	Glazing – 1.4 W/m ² K Solid – 0.6 W/m ² K
	Roof	0.25 W/m ² K	0.18 W/m ² K	0.15 W/m ² K
	Floor	0.25 W/m ² K	0.22 W/m ² K	0.15 W/m ² K
Glazing U-value		2.2 W/m ² K	1.6 W/m ² K	≤1.4 W/m ² K Pavilion roof light: 1.8W/m ² K
Glazing g-value (BS EN 410)		N/A	0.4	Shop front: ≤ 0.50
				Amenities: 0.39
				Pavilion: 0.39 Roof light: 0.5
Glazing Lighting Transmittance		N/A	0.71	≥ 65%
Thermal Bridging		N/A	0.1 W/m ² K	0.1 W/m ² .K

Notes:

1. The “Applied Building Values” are the construction parameters applied to the Actual Building simulation model and are representative of average of various areas.
2. Glazing g-value to vary based upon exposure to sunlight in order to balance day lighting against the cooling loads.

3. Building elements subject to adjacent thermal conditions different from the main rooms should meet Part L limiting U-values or lower (e.g. heated to unheated space).

Façade Optimisation

Detailed thermal modelling analysis (using industry-recognised and DCLG Certified dynamic simulation software) has been used during the design process to optimise the glazing for balancing cooling loads against day lighting and thus ensure good levels of natural daylight penetration whilst limiting unwanted solar gain and heat loss. The apartments are designed with a glazing to wall ratio of less than 35%, highly efficient glazing system, solar gains are also controlled via the use of window reveals with depth, balconies and shading devices such as internal blinds, where necessary (refer to Appendix 3F for further details to where blinds will be provided). Moreover, the layout of the buildings enable overshadowing by nearby blocks to minimise solar gains.

Building Form / Massing

The buildings are designed such that their form and massing takes into account environmental factors, such as wind, solar angles, daylight and sunlight.

The form of the three buildings and pavilion at the Proposed Island Sites Development has been informed by the desire to create a significant new public space that serves as a destination and much needed amenity for local residents.

As detailed in DAS Volume 5, Buildings 1, 2 and 3 are conceived as a family of buildings, each of which responds to its local context whilst together, the buildings share a common approach to proportions and expression that helps to unify and create a common language to the new civic centre.

Building 1 is proposed to be the key-marker building, as the tallest building, for the Masterplan and the Tottenham Hale District Centre. Building 1 will provide a new east-west pedestrian connection between the transport interchange and the new public space to the west.

Building 2 is lower in scale than Building 1 and oriented to allow Ferry Square to benefit from good levels of daylight and sunlight. A public route through the building allows pedestrians to walk in a safe car-free environment towards North Island and the neighbouring context.

Building 3 is a marker building from the south-west and Broad Lane and defines the south-west corner of North Island, completing the recently redeveloped northern edge of Station Road. The Building has been designed to work with any future development to the north by preserving a pedestrian route through the Building at ground level should this be desired.

Communal terraces are provided at the 7th floor of Buildings 1 and 2 and on 19th floor of Building 1. Each terrace will have its own planters and will function as an external space

accessible directly from the communal areas. The communal terraces also provide an opportunity to add additional greenery to Tottenham Hale and improve the biodiversity and ecological credentials of the development.

Brown/blue roofs¹ are proposed on the topmost roofs of Ferry Island and North Island buildings as a means of attenuating surface water run-off and to increase biodiversity. The design development will further detail the strategies for brown or blue roof by taking into account recommendations by ecologist and drainage engineer, where relevant. The roof of the Pavilion will have roof-mounted photovoltaic panels installed for renewable energy generation.

The Pavilion's building form and massing respond to the local context and design objectives such as aiming to reduce the impact of noise and poor air quality from Ferry Lane to Ferry Square, being low-rise and of a scale and form that maximises sunlight and daylight entering Ferry Square and maximising open and activated frontage to the square and along Ferry Lane.

The solid mass of the Pavilion building is 'carved' out to create transparent and semi-transparent openings which respond specifically to its immediate context. The form has been established by identifying key pedestrian sight lines and by addressing the orientation of neighbouring buildings within Ferry Island. Movement of pedestrians through the public space and those passing along the southern pavement on Ferry Lane, have been considered to ensure an interesting environment is provided from all aspects. The 'carving' of the mass also allows the internal space to open up to the square, increasing its active frontage (see DAS Volume 6).

All of the buildings on Ferry Island and North Island (Buildings 1, 2 and 3) are largely exposed to the predominant SW winds. Extensive analyses of the impact of the Proposed Island Sites Development on wind conditions at ground level and façade down washing have been undertaken and informed the balcony strategy and landscaping design of the Proposed Island Sites Development.

Projecting balconies are provided where the apartment overlooks either a public space or where the apartment is set back from the neighbouring road network. Projecting balconies, are replaced with recessed balconies/oversized units above 15th floor in response to the high levels of exposure of wind/noise.

¹ Brown roofs, or biodiverse roofs, are similar to green roofs but without the intensive/extensive planting. It aims to create a natural habitat to support a variety of plants, birds, animals and invertebrates. Blue roof is a flat roof design that intends to store water temporarily and attenuate the water flow discharge (typically from rainfall) as a part of a Sustainable Urban Drainage Systems (SUDs).

Recessed balconies are provided on the corners of buildings and where the façade is deemed to be too close to busy roads to warrant a projecting balcony.

Oversized units are provided in areas where the external environment is such that it is not deemed appropriate to provide projecting or recessed external amenity.

A summary of the findings of the Wind Microclimate assessment can be found in section 4.15 of DAS Volume 5 and Chapter 13 of the Environmental Statement ("ES") that accompany this planning application.

Daylight Optimisation

Lighting energy consumption can be considerably reduced by enhancing the potential for natural light entering the building. This is achieved through the design of narrow floor plates, dual aspect spaces and maximising view outs. Moreover, daylighting provision contributes to health and wellbeing of building occupants.

Daylighting levels at the Proposed Island Sites Development are assessed and compared against BREEAM criteria - as set out in the pre-assessment accompanying the Sustainability Statement - and BS 8206 Part 2: '*Code of practice for daylighting*' recommendations of average daylight factor.

Please refer to separate Daylight, Sunlight and Overshadowing assessment in Chapter 12 of the ES accompanying this planning application.

Low Water Consumption

Strategic Policy SP 6 of LBH Local Plan encourages developments to be water efficient during construction and operation.

Reduced water usage through use of low flow water outlets and appliances can also lead to a reduction in the energy required to heat domestic hot water. SAP 2012 methodology recognises a 5% reduction in domestic hot water heating energy if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day total water consumption.

The residential units will be designed to achieve indoor water consumption of 105 litres per person per day, in line with Building Regulations Approved Document Part G (2015 edition with 2016 amendments), by the appropriate distribution system design and provision of low water use fixtures and fittings.

The commercial areas will comply with BREEAM New Construction's requirements to reduce water consumption.

More details can be found in the separate Sustainability Statement and accompanying BREEAM pre-assessments which form part of this planning application.

3.3.2 Active Design Features: Regulated Energy Use

Building Energy Management System and Metering

A comprehensive Building Energy Management System (“BMS”/“EMS”) will be installed to monitor and report on the overall energy consumption of the buildings. The system will highlight any out of range consumption figures and readings, allowing a preventative approach through interrogation and resolution of potential problems.

The BMS will also provide intelligent control of the building services systems to ensure that occupant comfort is maintained throughout and that the systems are running to their peak ‘as designed’ efficiencies.

Metering of energy usage on all floors will allow building owners / occupiers to view and interrogate where potential energy savings can be made throughout the building.

Smart meters, along with an energy display devices, enable the end user to monitor and control their energy usage. Moreover, smart meters will be provided to support the growth of demand side response by smart grids. It is proposed that the metering infrastructure will incorporate smart meters. These devices, along with the residential unit’s heat meter will be linked to the apartment’s energy display device.

All residential units will be provided with independent apartment control systems that will provide intelligent control of the unit’s environmental services systems.

Section 3.8 of this Volume details the monitoring strategy further.

EC/DC Motors for Variable Refrigerant Flow (“VRF”) systems

The current Part L Building Regulations set stringent efficiencies for the fans used in all air conditioning/mechanical ventilation systems. Recent advances in fan motor technology have resulted in substantial reductions in energy consumption, an otherwise significant proportion of building energy use.

EC/DC (electronically commutated direct current) motors will be used in place of conventional AC motors. These will be of the variable air volume type whereby the flow rate, and hence energy consumption, are reduced to a minimum set back rate when possible.

Provisions for mechanical cooling will be made to the non-domestic communal areas for thermal comfort. The retail/leisure/office areas will be served by their own dedicated equipment. No mechanical cooling is proposed to the residential areas. For the purposes of the energy assessment, the system efficiencies assigned to those spaces are outlined in Table 3-13.

Air Handling Unit Heat Recovery

The energy required to heat or cool the incoming fresh air supply to the buildings will be significantly reduced by using an efficient heat recovery system. The heat recovery systems will utilise the thermal properties of the return air to transfer 'free' heat/cooling to the incoming fresh air supply. These will be controlled so as to minimise the demand for any heating and cooling of the fresh air supply.

Heat recovery between the return/exhaust air and outside air shall be provided on all supply and extract units via thermal wheel or plate heat exchangers with efficiencies of at least 78%. A run-around coil will be used for the plantroom ventilation, as appropriate, with efficiencies of at least 68%. The efficiencies will conform to the European Directive 2009/125/EC, which requires increased efficiencies from 1st January 2018.

Low Energy Lighting

In dwellings, the Part L1A 2013 Building Regulations require that 75% of all fixed internal light fittings must be capable of accepting only low energy lamps.

For the Proposed Island Sites Development, all fixed light fittings in the residences will be capable of accepting only low energy lamps.

High frequency ballasts and high efficacy lamps and luminaires will be utilised. Lighting throughout the occupied areas of the building will be intelligently controlled according to the building / area usage. For instance, the commercial WC areas will be controlled via PIR movement detectors which will monitor occupancy and switch off the lights when the area is vacant for a sustained length of time. The use of high efficiency LED lighting products within the interior lighting design where appropriate will be targeted.

Lighting in communal and lobby areas, stairwells and the basement will include timed control to ensure switching off to reduce energy consumption.

All lighting (within the residential and commercial areas) within the Proposed Island Sites Development will be LED only.

Efficient Lighting Control

Introducing presence detection and daylight dimming within spaces which have access to day light will reduce the lighting levels for times when the lux levels are available via natural day light, thus reducing energy usage.

As stated previously, all installed lighting will be LED and all day lit areas will have daylight dimming controls with local sensors with presence detectors. All transient areas will have on/off presence detectors.

Table 3-12 Applied Lighting Specifications for Non-domestic areas

System	Parameter	Applied Value
Lighting Efficiency: Non-domestic Areas	Retail Areas (including Pavilion)	≥ 85 lm/W
	Amenity Areas	6 W/m ²
	Reception Areas	≥ 85 lm/W
	Transient Areas	≥ 85 lm/W
	Toilet Areas	≥ 85 lm/W
	Storage	≥ 90 lm/W
	Plant	≥ 90 lm/W
Lighting Controls	Occupancy Areas	Presence Detection on/off AND Day light Dimming Control
	Transient Areas with glazing	

High Efficiency Variable Speed Drives

By varying the fan and pump speeds for the water and air distribution systems to match the building load profiles, fan and pump energy consumption will be considerably reduced. This will be maintained and controlled through constant monitoring via the BMS.

Efficient HVAC Parameters

The following design parameters were assigned to the base build heating, ventilation and air conditioning ("HVAC") systems in order to establish its CO₂ emission rate over a year. The system efficiencies applied are above the minimum efficiencies set out by the Non-domestic and Domestic Building Services Compliance Guide².

Table 3-13 Applied HVAC parameters for Main Central Plant – Non-domestic Areas

System	Parameter	Applied Value
Boilers	Seasonal Efficiency	92%
	Delivery Efficiency	95%

² The Non-domestic Building Services Compliance Guide and the Domestic Building Services Compliance Guide set out recommended minimum energy efficiency standards for components of building services systems, including the use of controls. For systems installed in new buildings, the standards are design limits (or back-stop values).

System	Parameter	Applied Value
VRF Units - Retail	Heating: Seasonal Efficiency ("SEER")	6
	Cooling: Nominal Efficiency ("EER")	3.9
	Seasonal Efficiency ("SEER")	7
Ground Floor Fresh Air Unit (AHU)	SFP	1.7 W/l/sec
Amenity Local Cooling Units (FCU's)	SFP	0.16 W/l/sec
WC Extract Fans	SFP	0.4 W/l/sec
Pumps	Pump Type	Variable speed multiple pressure sensors
Centralised Fresh Air Unit With Speed Control	Amenity Areas	Yes
Ductwork & AHU Leakage	Ductwork Leakage Testing	Class B
	AHU CEN Standards	Class L1
Domestic Hot Water	Storage Losses	0.004 (kWh/(l.day))
	Circulation Losses	5 W/m
	DHW Controls	Timed Control
Electrical /Metering	Power Factor	Greater Than 0.95
	Lighting system have provision for metering	Yes
	Automatic Monitoring of energy Data?	Yes
	Controls	Central Start & Stop Optimum Start & Stop Local time & temperature Control Weather Compensation Control

The residential areas will be served by community space heating and energy efficient mechanical ventilation with heat recovery (see Table 3-14). The applied efficiencies for the new dwellings are also above the minimum efficiencies set out by the Domestic Building Services Compliance Guide.

Table 3-14 Applied HVAC parameters for Main Central Plant – Residential areas

System	Parameter	Applied Value
DHW & Space Heating System	Community, gas fired CHP Boiler efficiency:	89%
Mechanical Ventilation	MVHR SFP	0.63 W/L/sec (Kitchen + 1 Wet rooms) 0.60 W/L/sec (Kitchen + 2 Wet rooms)
	Heat recovery efficiency η	95-96%
	Fuel Type	District heating network / natural gas
Domestic Hot Water	Heat Exchanger	

Power Factor Correction

The Building Regulations Approved Document L (2013) identifies that the provision of power factor correction to the building electrical supply can provide significant savings in electrical consumption. A saving in electrical energy consumption of 1.5% is awarded for power factor correction to 0.9 and a saving of 2.5% awarded for power factor correction to 0.95 power factor. This development will have a power factor correction of 0.95 as a minimum.

3.3.3 Active Design Features: Unregulated Energy Use

Low Energy White Goods – Residential Buildings

White goods are responsible for about two thirds of electrical consumption in dwellings. Electrical consumption is responsible for roughly half the carbon emissions from a dwelling.

Where provided by the developer, white goods will come with a certified energy label. These are rated from A+++, to D with D being the least efficient. Data supplied by the Energy Advice Centre suggests that using A++ rather than C rated white goods would reduce electrical energy consumption in each dwelling by approximately 800kWh/year.

It is anticipated that any white goods provided for the apartments in the Proposed Island Sites Development, including washing machines, dryers, dishwashers and fridge/freezers, will have a minimum rating of 'A'.

Information on the EU Energy Efficiency Labelling Scheme of efficient white goods will be provided to each affordable and market dwellings for the following appliances:

- Fridge
- Freezer
- Wine storage appliance
- Washer/dryer
- Washing machine
- Tumble drier
- Dishwasher
- Oven

High Efficiency Vertical Transportation

Vertical transportation can be fitted with a number of energy saving measures to reduce their energy use both whilst moving and when in standby mode. These include:

- Controls that ensure that no more lifts are in use than required and that as few stops as possible are made;
- Energy efficient lighting;
- Control that switches off the lighting when the car is not occupied.

Low Energy Culture

Providing building users and operators with practical guidance on the importance and methods of energy efficiency can lead to effective, cost-free reductions in energy usage and carbon emissions. Savings can be expected in, for example:

- Operating comfort cooling systems efficiently in the non-domestic areas.
- Lighting Energy: a culture of 'Turn-It-Off'.
- Small Power: avoiding monitors and PCs etc. in stand-by mode.
- Cooling/Heating Energy: widening 'acceptable' temperature range.

Training of operators and facility managers is particularly important to provide them with the skills and knowledge to implement and continue to improve an energy management programme.

The amount of energy that can be saved will be dependent upon the motivation of the occupants and the effectiveness of the awareness programmes. The development will actively encourage a low energy culture through a "Home/Building User Guide" which will be provided to incoming residents/tenants containing information on how to operate and maintain the buildings efficiently.

3.3.4 Be Lean – Reduction on CO₂ emissions

Residential Areas

In accordance with the Energy Hierarchy, the table below outlines the carbon emissions after the energy efficient design measures are taken into account.

Table 3-15 outlines the carbon emissions after the energy efficient design, 'Lean' version for the residential dwellings at B1, B2 and B3 and FEE performance.

In accordance with Building Regulations Part L, Criterion 1 the calculated Dwelling Fabric energy efficiency ("DFEE") rate must not be greater than the Target Fabric Energy Efficiency (TFEE).

The dwellings at the Proposed Island Sites Development pass FEE and reduce carbon emissions by **9.1%** compared to Part L 2013 and going beyond the requirements of Criterion 1 of Part L 2013 and following the principles of the energy hierarchy to reduce energy demand through energy efficiency measures.

Table 3-15 Detailed Regulated Emissions for the Lean Building and FEE – Residential Dwellings

Residential	Carbon Dioxide Emissions (Tonnes CO ₂ per Annum)	
	Regulated Energy	Unregulated Energy
Part L 2013 baseline	603.9	780.2
After energy demand reduction	549.1	585.1
Total percentage improvement over baseline	9.1%	-
Fabric Energy Efficiency (FEE) – B1		
TFEE	34.6	kWh/m ² /year
DFEE	33.8	kWh/m ² /year
% Improvement TFEE-DFEE	2.3%	Pass
Fabric Energy Efficiency (FEE) – B2		
TFEE	33.9	kWh/m ² /year
DFEE	32	kWh/m ² /year
% Improvement TFEE-DFEE	5.5%	Pass
Fabric Energy Efficiency (FEE) – B3		
TFEE	33.5	kWh/m ² /year
DFEE	31.4	kWh/m ² /year
% Improvement TFEE-DFEE	6.1%	Pass

Non-domestic Areas

Based on the energy efficient design parameters, a summary of the energy consumption and CO₂ emissions rate for the 'Lean' non-domestic building can be seen in tables and figures below based on the BRUKL report and following the GLA's Energy Planning Guidance.

The 'Lean' energy efficiency measures described here are calculated to reduce overall carbon dioxide emissions of the commercial and communal areas by **21.2%** compared to Part L 2013. This complies with the current London Plan and exceeds the target of 15% carbon savings by energy efficiency measures over Part L for non-residential areas as per emerging Policy SI2 Minimising greenhouse gas emissions of the Draft London Plan.

Table 3-16 Detailed Regulated Emissions for the Lean Building – Non-domestic Areas

Non-domestic	Carbon Dioxide Emissions (Tonnes CO ₂ per Annum)				
	Regulated Energy	Unregulated Energy	Total CO ₂ Reductions	Lean Regulated % Reduction	Lean Unregulated % Reduction
Part L 2013 baseline	197.0	309.9	-	-	-
Savings from reduced energy demand (Be Lean)	155.1	247.9	103.8	21.2%	20.0%

Proposed Island Sites Development - overall

At the 'Be Lean' stage of the Energy Hierarchy, the Proposed Island Sites Development achieves a 12% overall reduction on carbon emissions.

Table 3-17 Be Lean - Overall regulated carbon dioxide emissions and savings

	Total regulated emissions (Tonnes CO ₂ /year)	CO ₂ savings (Tonnes CO ₂ /year)	Percentage saving (%)
Part L 2013 baseline	800.9	-	-
Be lean	704.3	96.6	12%

The above shows that considerable carbon emissions saving can be achieved by the proposed energy efficiency measures against the baseline. This is a result of the highly insulated and airtight building envelope, optimised glazing ratio and solar gains, energy efficient systems and lighting applied across the Proposed Island Sites Development.

3.4 Heating infrastructure (Be Clean)

As stated in Policy 5.6 of the London Plan and Policy DM 22 of the DM DPD, all major developments should demonstrate that the proposed heating and cooling systems have been selected in accordance with the following order of preference:

- Connection to an existing C/CHP scheme
- Site-wide C/CHP
- Communal heating and cooling

Where C/CHP is to be installed in a new development, the feasibility of extending the system beyond the site should be investigated. In addition, provision will be made for the heating and cooling network for future connections to district heating networks.

3.4.1 Site-wide Energy Strategy

As presented in section 1.5 of Volume 1 – Tottenham Hale Centre site wide energy strategy, the following specifications have been considered for the purpose of energy assessment of the Proposed Island Sites Development:

- Boilers are to be installed in each building to be 'connection ready' to the proposed future DEN.
- When the DEN is installed, boilers would be de-commissioned (or utilized by DEN) and heat would be supplied from an energy centre, planned to be located under Watermead Way flyover.
- Heat fraction from CHP – 75%
- Gas boilers, 85% efficiency, with economiser taking it to 89%
- Primary heat network losses @ 5%
- Carbon intensity of heat network at bulk meter therefore: 0.107 kgCO₂/kWh
- CHP unit(s) of ~2MWe based on the parameters outlined in Table 3-18.
- To maximise the efficiency of the low carbon heat sources and pumps, lower operating temperatures and larger flow and return temperature differentials will be an essential part of the system design. Flow temperature will be specified at 70°C with a return water temperature of 40°C.
- Heat Interface Units will be selected to provide a low return temperature when in heating or hot water mode. Secondary heat circuits will be designed with lower flow and return temperatures of 65°C/35°C. Heat Interface Units will be insulated to reduce heat losses.

Table 3-18 Site-Wide Energy Strategy Proposed CHP Parameters

ENER – G 2020 500 NOx		
Space Heating System	Space Heating	Community
	System Type	Thermal store
	Fuel	Natural gas
	CHP Efficiency	76%
	Electrical CHP Efficiency (GCV)	38.6%
	Thermal CHP Efficiency (GCV)	37.7%
	Heat to power (CHP)	0.98

3.4.2 Heat Demand

As per Section 11.18 of the GLA Energy Planning Guidance, the Proposed Island Sites Development will design and deliver communal heating systems in compliance with the CIBSE Heat Networks: Code of Practice for the UK.

The operational feasibility of the network has been assessed to ensure accurate peak and annual heat demands which meet the requirements of the Proposed Island Sites Development. In accordance with CIBSE/ADE Heat Networks Code of Practice and the Danish diversity curve in DS439, the total peak heating loads for the Proposed Island Sites Development are illustrated in the table below.

Table 3-19 Peak Heat Demand at the Proposed Island Sites Development

Ferry Island (inc. Pavilion)	Peak Demand (kW)	Annual consumption (MWh)*
Residential	2,742	1,167.5
Non-domestic	559	27
Total	3,300	1,194.5
North Island	Peak Demand (kW)	Annual consumption (MWh)*
Residential	767	301.3
Non-domestic	(via VRF system)	6
Total	767	307.3

CAN BE REDUCED
TO 650kW IF
BUFFER VESSEL IS
PROVIDED

Note: * annual consumption in MWh extracted from compliance energy models (Dynamic Simulation Model - DSM / SAP) and must not be used for the purposes of sizing.

Space heating to the residential areas will be provided by the DEN. The domestic hot water ("DHW") demand of the residential areas will be served by the DEN, when it comes forward, whereas the non-residential units will use local electric heaters for DHW heating and reversible air source heat pumps for space heating and cooling as outlined in Section 3.6 of this Volume and summarized below:

- **Retail Areas:** VRF provides heating and cooling, local electric heater provides DHW;
- **Amenity:** VRF provides heating and cooling, DEN provides DHW (Level 7 in Building 1);
- **Pavilion:** VRF provides heating and cooling, DEN provides DHW;
- **Transient space:** (stairs, corridors etc.), storage and plantroom: no cooling, DEN provides both heating and DHW.

Where VRF provides heating and cooling to the space, this system is considered to be a renewable energy technology. Therefore, the carbon savings associated with it are taken into account in the 'Be Green' stage of the energy hierarchy (see section 3.6.1 of this Volume).

3.4.3 Island Sites DEN Connection and future proofing

The heating required for the Proposed Island Sites Development will initially be provided by local boilers. However, as explained in Volume 1 of this Energy Assessment it is proposed that the plots will be connected to the Tottenham Hale DEN when the Tottenham Hale District Energy Centre is completed. The Tottenham Hale District Heating Energy Centre, currently planned to be located to the North of the site under the Watermead Way flyover, will provide the heating required to meet both plot's heating load (as outlined in section 3.4.2 of this Volume), as well as the rest of the Tottenham Hale Centre development.

The most significant advantage of connecting these plots to the DEN is that if in future the grid is decarbonised, the energy source could be more easily amended, allowing, for example, fuel cells or heat pumps to be installed in the energy centre. The primary pipework has been sized to allow potential development plots to be served beyond the Site including Tottenham Retail Park to the south.

Boiler rooms within the Proposed Island Sites Development will have a space allocation for the installation of heat substations for connection to the proposed DEN (see Appendix 3D).

Connections to the DEN network are proposed to Building 1 North on Ferry Island and to the north of Building 3 on North Island as illustrated in Figure 3-6.

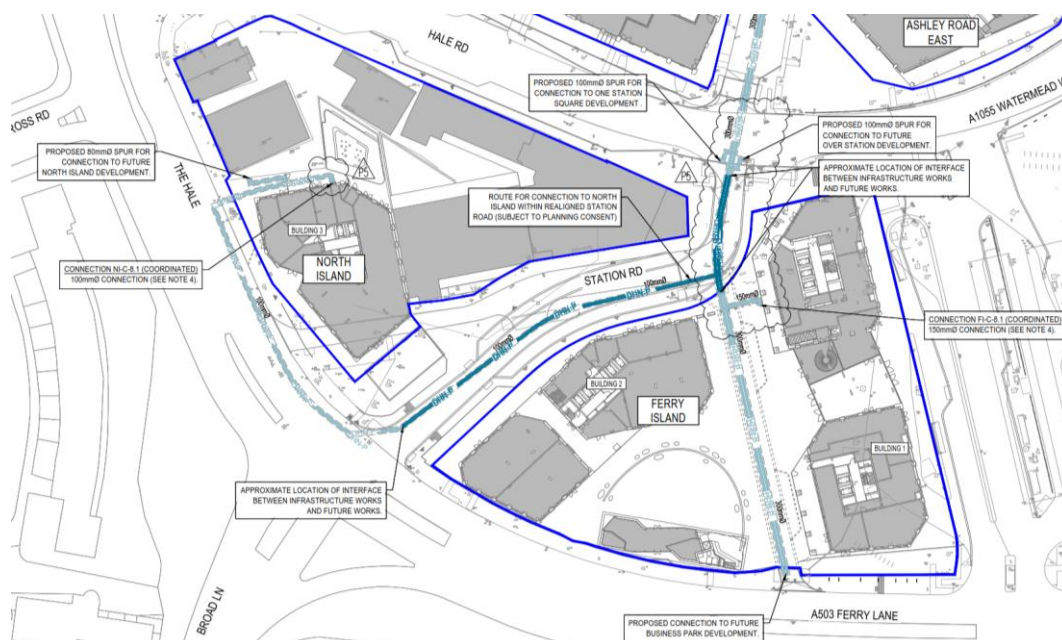


Figure 3-6 District Heating Connection Proposed to the Proposed Island Sites Development

3.4.4 Be Clean – Reduction on CO₂ emissions

Residential Areas

The table below outlines the carbon emissions for the residential units after the clean energy supply from the DEN is considered. The residential areas achieve **49.2%** cumulative savings on CO₂ emissions at the 'Clean' stage compared to the baseline (Table 3-20).

Table 3-20 Detailed Regulated Emissions for the Clean Building - Residential Dwellings

Residential	Carbon Dioxide Emissions (Tonnes CO ₂ per Annum)	
	Regulated Energy	Unregulated Energy
Part L 2013 baseline	603.9	780.2
After energy demand reduction	549.1	585.1
After connection to DEN	306.8	585.1
Total percentage improvement over baseline	49.2%	-

Non-domestic Areas

The 'Clean' measures described here are calculated to reduce overall carbon dioxide emissions of the commercial and communal areas by **4.8%** hence the cumulative savings are **26%** lower than Part L 2013 baseline.

Table 3-21 Detailed Regulated Emissions for the Clean Building – Non-domestic Areas

Non-domestic	Carbon Dioxide Emissions (Tonnes CO ₂ per Annum)				
	Regulated Energy	Unregulated Energy	Total CO ₂ Reductions	Lean Regulated % Reduction	Lean Unregulated % Reduction
Part L 2013 baseline	197.0	309.9	-	-	-
Savings from reduced energy demand (Be Lean)	155.1	247.9	103.8	21.2%	20.0%
Savings from connection to DEN (Be Clean)	145.7	247.9	9.4	4.8%	20.0%

Proposed Island Sites Development – Overall

At the 'Clean' stage of the Energy Hierarchy, the Proposed Island Sites Development achieves **43%** overall reduction on carbon emissions.

Table 3-22 Be Clean - Overall regulated carbon dioxide emissions and savings

	Total regulated emissions (Tonnes CO ₂ /year)	CO ₂ savings (Tonnes CO ₂ /year)	Percentage saving (%)
Part L 2013 baseline	800.9	-	-
Be lean	704.3	96.6	12%
Be clean	452.5	251.7	31%

3.5 Cooling and overheating

Policy 5.9 of the London Plan and policy DM 21 of the DM DPD state that major development proposals should reduce potential overheating and reliance on air-conditioning systems and demonstrate this in accordance with the following cooling hierarchy:

Table 3-23 Proposed Development Cooling Strategy

London Plan: Policy 5.9 – Cooling hierarchy	Applied Strategy
1. Minimise internal heat generation through energy efficient design	Façade optimisation and passive design implemented and confirmed by the FEE analysis, refer to Section 3.3.4 of this Volume. LED lighting will be installed across the development to reduce internal heat gains and improve energy consumption. Use of more vertical risers so as to minimise horizontal distribution pipework within communal corridors.
2. Reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls.	As described in Section 3.3.1 of this Volume, the average glazing to wall ratio at the Proposed Island Sites Development is less than 35%, which combined with window reveals with depth and solar control glass, minimise solar gains while providing sufficient daylight. Balconies also provide additional shading to residential areas. Commercial areas have façade set-backs to reduce exposure of the glazed shopfronts to direct solar gains. Moreover, terraces and external green amenity spaces are proposed to the roof of the podium levels. The vegetation of the terraces will provide cooling effect via evapotranspiration and reduce the urban heat island effect.
3. Manage the heat within the building through exposed internal thermal mass and high ceilings	The potential of introducing thermal mass to building elements was considered, but due to the required levels of insulation necessary to achieve the applied U-values the impact of thermal mass in managing heat into the spaces is considered to be medium. The building maximises floor to ceiling height to accommodate building services whilst creating a large space.

London Plan: Policy 5.9 – Cooling hierarchy	Applied Strategy
4. Passive ventilation	Natural ventilation is possible through inward opening windows across all dwellings. Cross ventilation is facilitated by dual aspect flats and inset balconies to single aspect units.
5. Mechanical ventilation	Highly efficient mechanical background ventilation is proposed for all dwellings according to Part F of the Building Regulations.
6. Active cooling systems	Reversible air source heat pumps provide low carbon cooling to the non-domestic areas.

3.5.1 Residential Areas

Appendix 3F details the overheating analysis for the residential areas in line with Part L1A 2013 criterion 3, paragraphs 2.38 to 2.42 and CIBSE TM 59:2017: *“Design methodology for the assessment of overheating risk in homes”*.

In summary, all the residential areas comply with the overheating criteria through the use of the following measures:

- Openable windows;
- Internal blinds fitted by the developer, in Buildings 1 and 2 only, as specified in the overheating analysis (see Appendix 3F).

3.5.2 Non-domestic Areas

Dynamic modelling was carried out using industry recognised IES VE software from which the Building Regulation UK Part L (“BRUKL”) reports were generated. The BRUKL reports can be found in Appendix 3B of this document.

Table 3-24 presents the active cooling demand of the retail/leisure/office and amenity spaces calculated by the compliance method, following the GLA Energy Planning Guidance and extracted from the BRUKL report (HVAC Systems Performance).

Table 3-24 Average cooling demand for non-domestic areas within the development

Area weighted average building cooling demand (MJ/m ²)	Actual Building	Notional Building
Island Sites non-domestic areas	197.2	151.5

The cooling loads taken from compliance tools should only be referred to satisfy GLA's requirement of data collection for monitoring purposes and it is not indicative of the designed cooling demand of the buildings. Those tools are used for compliance, with a rigid methodology and the mechanical design will better inform the cooling demand within the occupied areas of the development.

The actual building cooling demand is higher than the notional due to larger glazing area required for retailer function. The following measures have therefore been applied to reduce the cooling loads from outset:

- Non-domestic facades are set-back and protected by external colonnades as means of shading to the glazed shopfronts and amenity areas on Building 1
- Buildings orientation facilitate overshadowing to lower levels, i.e. Buildings 1 and 2 massing cast shadows to each other in the morning and afternoon and to the Pavilion, consequently.
- The HVAC system design already considers SEER (Seasonal Energy Efficiency Ratio) and EER (Energy Efficiency Ratio), beyond the minimum required for the VRF system on-site, being very energy efficient;
- Consideration of surrounding buildings to cast shadows on the lower levels.

3.6 Renewable Energy (Be Green)

As stated in Policy 5.7, the current London Plan includes a notional target for on-site renewable energy, unless it can be demonstrated that such provision is not feasible. There is a presumption that all major development proposals will seek to reduce carbon dioxide emissions by at least 20 per cent through the use of on-site renewable energy generation wherever feasible, regardless of whether a 35% target has already been reached through earlier stages of the energy hierarchy. This approach has been applied according to paragraph 5.42 of the London Plan (2016).

3.6.1 Consideration of Low and Zero Carbon Technologies

Further energy and carbon dioxide emissions savings could in principle be made through the adoption of renewable technologies on the Proposed Island Sites Development.

The suitability of available technologies is sensitive to a number of factors, including site constraints, development footprint, surrounding environment, access limitations and development type.

To this end, the following renewable energy technologies have been investigated to establish their suitability and feasibility.

Table 3-25 Evaluations of low and zero carbon technologies

LZC Technologies	Applicable (Yes/No)	Reasons
Photovoltaic panels	Yes	Roof mounted PV panels are proposed across all three buildings to supply electricity to landlord area and amenity spaces. The panels will face south orientation, 30° due east or west, where overshadowing from nearby buildings is minimised. Refer to Section 3.6.2 of this Volume for number of panels and estimated energy generation.
Biomass	No	There is limited information available of biomass fuel availability in the surrounding area. An installed biomass boiler has ongoing maintenance, running and fuel delivery costs that are not required with other forms of renewable energy. These systems do require substantial and safe access for large delivery vehicles close to the biomass boiler, which cannot be accommodated on the Tottenham Hale Centre development.

LZC Technologies	Applicable (Yes/No)	Reasons
		Moreover, Tottenham Hale is within an Air Quality Management Area (AQMA), the NO_x emissions from burning biomass on site could contribute to poor air quality to the site. We have excluded CHP or CCHP running on biofuel from this study, due to the high particulate matter (PM) and nitrogen oxide (NO_x) emissions and the potential nitrous oxide (N₂O) biomass and biofuel installations that may not meet air quality requirements. Biomass boilers are therefore not recommended for this development.
Wind Turbines	No	Although wind turbines are a highly visible form of renewable energy, they can normally provide only a very small contribution to the total electrical consumption of buildings in city and urban locations. Wind turbines can also be visually unacceptable in planning terms and there are concerns that, for residents, turbines would create unacceptable noise levels during day and night. As a consequence, wind turbines are not considered to be viable for this project.
Solar Hot Water	No	Although efficient and cost effective in implementation, solar hot water systems can only offset a fraction of the hot water demand for the plot, which is quite small compared to other energy demands. The proposed district heating network would provide the hot water requirements. Therefore solar hot water panels are not recommended for this development as they would conflict with the proposed district heating system.
Ground Source	No	A ground source heat pump system would be in direct conflict with the potential district heating network connection, where the two technologies would compete for the same load. Consequently, because the benefits of both cannot be additive in this development scenario, ground source heat pumps have not been proposed for this scheme.

LZC Technologies	Applicable (Yes/No)	Reasons
Air Source Heat Pumps (ASHPs)	Yes	Reversible Air Source Heat Pump (ASHP) systems use the ambient air as the medium from which heat is extracted. Heat from the air is absorbed at low temperature into a fluid. This fluid then passes through a compressor where its temperature is increased, and transfers its higher temperature heat to the heating and hot water circuits of the building. As these heat pumps are reversible, they can potentially displace or reduce the size of the cooling plant that otherwise would be installed and thus does not add much roof plant space. Reversible air source heat pumps (VRFs) will provide heating and cooling to the commercial units on site using VRF units.
Aquifer Heat Pumps	No	There is limited information on aquifer sources in the surrounding area and licence from the Environment Agency is required to extract aquifer water. It is thus not recommended for this project.

To conclude, the low and zero carbon technologies proposed are photovoltaic panels and VRFs which are reversible ASHPs that provide heating and cooling to the commercial units.

3.6.2 Areas available for PV panels

The feasibility study outlined above in Table 3-25 shows that PV is a suitable renewable technology for the Proposed Island Sites Development for the following reasons:

- There is sufficient roof space to install enough PV modules to have an impact on carbon dioxide emissions.
- Photovoltaics sited on the roof are less visually intrusive when compared to wind turbines for generation of electricity.
- The renewable technology works well with a DEN.

The area indicated in Figure 3-7 in orange below are available for installing roof mounted PV panels on B3. The number of panels is based on a 320Wp panel size.



Building 3

Figure 3-7 Proposed areas for roof mounted PV panels on B3

The area above is based on the maximum available roof area of the current design on each building (see Table 3-26). The precise area depends on the specification of the panels. To the extent there are any changes to these area as part of the detailed design, the carbon offset payment (see Section 3.7 of this Volume) will be recalculated. Table 3-26 shows the anticipated number of panels and predicted output at the Proposed Building 3 Development based on this area.

The orientation, mounted angle and the practicalities of installation and maintenance will all be considered in the specification of the panels.

Table 3-26 Number of panels and estimated energy generated per building

Plot	Building	PV area available (m ²)	Potential No. of panels	Estimated annual energy generation (kWh)
North Island	B3	55	30	9,000

Notes:

- PV area available includes allowance for panel's spacing and walkways.
- Estimated energy generation based on a south facing panel with efficiency greater than 19% and 15° panel inclination - Solar manufactures to confirm the estimated figures above prior the final issue.
- Refer to Appendix 3G for indicative PV panel layout.

3.6.3 Be Green – Reduction on CO₂ emissions

Residential Areas

The table below outlines the carbon emissions for the 'Green' option absent of any renewable technologies assessed in the previous 'Clean' stage. The carbon savings from PV power have been assigned to the non-domestic areas because of their predominantly day-time energy use profile which benefits most from the solar power availability. Therefore, the regulated CO₂ emissions for the residential areas are the same as the 'Clean' stage.

Table 3-27 Detailed Regulated Emissions for the Green Building – Residential Dwellings

Residential	Carbon Dioxide Emissions (Tonnes CO ₂ per Annum)	
	Regulated Energy	Unregulated Energy
Part L 2013 baseline	603.9	780.2
After energy demand reduction	549.1	585.1
After connection to DEN	306.8	585.1
After renewable energy	306.8	585.1
Total percentage improvement over baseline	49.2%	-

Table 3-28 Regulated CO₂ savings – Residential Dwellings

Residential	Regulated Carbon Dioxide Savings	
	(Tonnes CO ₂ per annum)	(%)
Savings from reduced energy demand	54.8	9.1%
Saving from DEN	242.3	40.1%
Savings from renewable energy	0.0	0.0%
Total Cumulative Savings	297.1	49.2%
Total Target Savings	603.9	100%
Regulated Annual Shortfall	306.8	

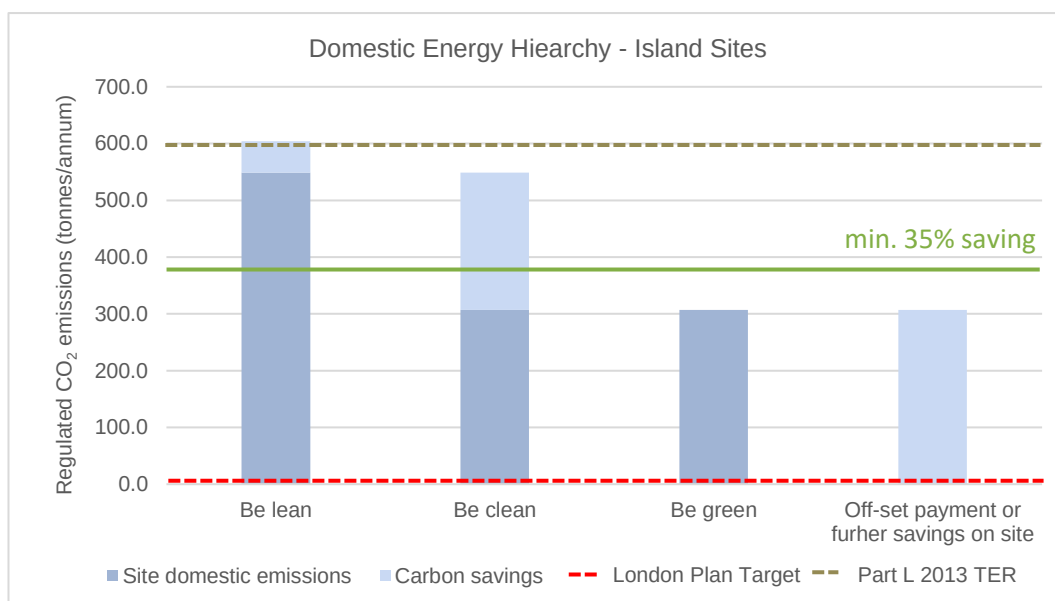


Figure 3-8 Domestic energy hierarchy at the Proposed Island Sites Development

Non-domestic areas

The 'Green' measures: PV power and ASHPs will be fed into the non-residential areas reducing the carbon dioxide emissions by a further **10.3%**. The cumulative savings

taking into account 'Lean', 'Clean' and 'Green' measures is therefore **36.3%** lower than Part L 2013.

Table 3-29 Detailed Regulated Emissions for the Green Building – Non-domestic Areas

Ferry Island and North Island	Carbon Dioxide Emissions (Tonnes CO ₂ per Annum)				
	Regulated Energy	Unregulated Energy	Total CO ₂ Reductions	Lean Regulated % Reduction	Lean Unregulated % Reduction
Part L 2013 baseline	197.0	309.9	-	-	-
Savings from reduced energy demand (Be Lean)	155.1	247.9	103.8	21.2%	20.0%
Savings from connection to DEN (Be Clean)	145.7	247.9	9.4	4.8%	20.0%
Savings from renewable energy (Be Green)	125.5	247.9	20.2	10.3%	20.0%

Table 3-30 Regulated CO₂ savings – Non-domestic Areas

Non-domestic	Regulated Carbon Dioxide Savings	
	(Tonnes CO ₂ per annum)	(%)
Savings from reduced energy demand	41.8	21.2%
Saving from DEN	9.4	4.8%
Savings from renewable energy	20.2	10.3%
Total Cumulative Savings	71.5	36.3%
Total Target Savings	68.9	35%
Regulated Annual Surplus	2.6	

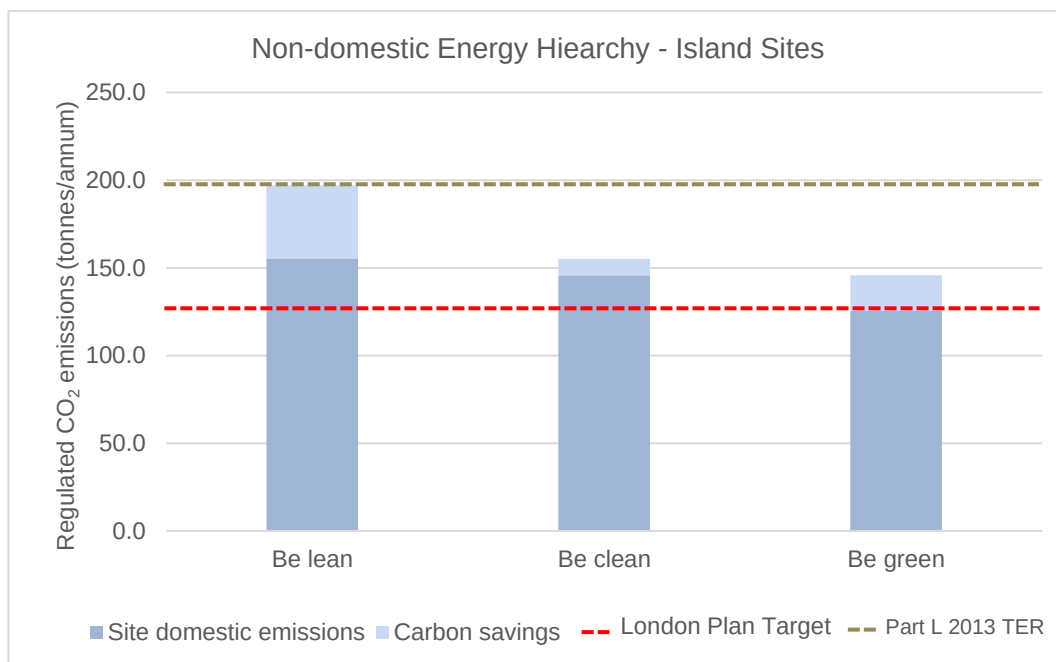


Figure 3-9 Domestic energy hierarchy at the Proposed Island Sites Development

Proposed Island Sites Development - Overall

Table 3-31 summarises the overall regulated carbon emissions and percentage savings of the Proposed Island Sites Development by combining the residential and non-residential regulated emissions outputs from Table 3-27 and Table 3-29, in accordance with the GLA Energy Planning Guidance.

As the non-domestic development exceeds the minimum of 35% reduction in CO₂ emissions over the TER, any surplus of tonnes of CO₂ from the non-domestic areas will be used to compensate for the shortfall of carbon emissions of the residential development, as shown in Table 3-32.

The Proposed Island Sites Development achieves 46% combined savings against Part L 2013.

Table 3-31 Site wide regulated carbon dioxide emissions and savings

	Total regulated emissions (Tonnes CO ₂ /year)	CO ₂ savings (Tonnes CO ₂ /year)	Percentage saving (%)
Part L 2013 baseline	800.9	-	-
Be lean	704.3	96.6	12%
Be clean	452.5	251.7	31%
Be green	432.3	20.2	3%
	CO₂ savings off-set (Tonnes CO₂)		
Off-set	9,128.6		

3.7 Carbon offsetting

The shortfall in regulated carbon emissions are outlined in this section for:

- Domestic areas to achieve **zero carbon** for regulated carbon emissions as outlined in the GLA Housing SPG and in line with policy 5.2E of the London Plan.

As presented in Table 3-31, the Proposed Island Sites Development achieves 46% overall reduction on CO₂ emissions against Part L 2013, after the incorporation of passive design, energy efficiency measures, low carbon energy supply by district heating network and renewable energy in line with Policy 5.2 of the London Plan (2016).

As the non-domestic development exceeds the minimum of 35% reduction in CO₂ emissions over the TER, any surplus of tonnes of CO₂ from the non-domestic areas will be used to compensate for the shortfall of carbon emissions of the residential development, as shown in Table 3-32. The regulated carbon emissions shortfall is **304.3** tonnes of CO₂ per year for the Proposed Island Sites development (Table 3-32):

Table 3-32 Shortfall in regulated carbon dioxide savings and associated carbon offset payment

Proposed Island Sites Development	Annual Shortfall Tonnes CO ₂ (Regulated)
Domestic Areas Shortfall	306.8
Non-domestic Areas Shortfall	-2.6
Total Carbon Emissions for Offsetting	304.3

Note: the negative shortfall relates to a surplus in CO₂ savings against the 35% improvement over the TER.

A £60 per tonne carbon offset charge has been confirmed by LBH. This will be applied to the carbon shortfalls for the regulated domestic and non-domestic energy demands to calculate the carbon offset charge payable to LBH.

The above annual regulated CO₂ emissions shortfall and surplus are based on the target savings of zero carbon for the residential areas and 35% improvement over baseline for commercial areas taken from

Table 3-30 shown previously.

Over 30 years, the shortfall of 304.3 tonnes of CO₂ per year is equal to 9,128.6 tonnes of CO₂ as shown previously in Table 3-31.

3.8 Monitoring

The Building Regulations Approved Document L2A identifies that the provision of automatic monitoring and targeting with alarms for out of range values, can provide significant savings in energy consumption of the building services systems.

A saving in energy consumption of 5% is awarded for complete installations that measure, record, transmit, analyse, report and communicate meaningful energy management information to enable the operator to interrogate and manage energy usage.

The energy metering and sub metering strategy will be in line with best practice as outlined in CIBSE TM31, 39 and 46 to ensure compliance with current legislation, together with Parts L2A and L2B 2013 of the Building Regulations.

The strategy will be compliant with The Heat Network (Metering and Billing) Regulations 2014 and the EU Energy Efficiency Directive. All notifications and assessments as required by the regulations shall be made by the Contractor.

Any meter associated with a billing function will be MID (Measuring and Instruments Directive) approved. Meters will be provided with local displays allowing the operator to routinely check that logged data matches actual readings.

Energy management software (EMS) will be provided on the BMS server to measure, monitor and record all services energy usage via real time meter data exchange with the BMS, in order that consumption charges are appropriately allocated to the correct end user, by the Landlord.

3.8.1 Landlord's Services

Water, gas and electricity to the development will be metered in accordance with the relevant service provider's requirements. Additional, sub-metering of the mechanical and electrical services installations within the development will be provided to satisfy the requirements of Approved Documents Part L of the Building Regulations and CIBSE TM39 Building Energy Metering.

All Landlord and residential supplier meters (in the Applicant's name) and sub-check meters (electrical, gas, water and heat) will be connected and interfaced with the building management system (BMS) to enable billing data to be collated and distributed by the EMS.

The main incoming gas supply serving the potential DEN connection and LTHW boiler plant will be metered; the meter will be supplied and installed by the gas shipper. The meter is provided for direct contract billing between the landlord and the utility service provider.

The main incoming electrical supply serving the development will be provided with an electricity meter, supplied and installed by the energy provider. The meter is provided for

direct contract billing between the landlord and the utility service provider, the meter will not connect to the BMS/EMS. A check-meter will be provided downstream of the energy provider's electricity meter for connection to the landlord's BMS/EMS for monitoring.

The main incoming water supply serving the development will be provided with a water meter, supplied and installed by the water authority (Thames Water). The meter is provided for direct contract billing between the landlord and the water authority, the meter will not connect to the BMS/EMS. A check-meter shall be provided downstream of the water authority water meter for connection to the landlord's BMS/EMS for monitoring.

3.8.2 Residential Apartments

The electrical supply serving each residential apartment will be provided with an electricity meter, supplied and installed by the energy provider. The meters are provided for direct contract billing between the individual occupant and the occupant's chosen utility service provider and therefore the meters will not connect to the BMS/EMS.

Smart meters, along with an Energy Display Device enable the end user to monitor and control their energy usage. It is proposed the metering infrastructure will incorporate smart meters.

The LTHW supplies serving each residential apartment shall be fitted with heat meters. The heat meters shall connect to the landlord's BMS/EMS, for direct contract billing between individual occupant and the landlord.

The Potable / fluid category 1 water supply serving each residential apartment will be provided with a water meter, supplied and installed by the water authority (Thames Water). The meters are provided for direct contract billing between the individual occupant and the water authority, the meter shall not connect to the BMS/EMS. A sub-meter will be provided downstream of each water authority water meter for connection to the landlord's BMS for apartment leak detection reporting.

The residential units will have energy display devices for occupiers to monitor and be aware of their energy consumption patterns.

3.8.3 Future Retail Units

The incoming electrical supply serving each retail unit will be provided with an electricity meter, supplied and installed by the energy provider. The meters are provided for direct contract billing between the individual occupant and the occupant's chosen utility service provider, the meters will not connect to the BMS/EMS.

Where a gas supply is provided to a retail unit, gas meter will be provided, supplied and installed by the gas shipper. The meters are provided for direct contract billing between

the individual occupant and the utility service provider, the meters will not connect to the BMS/EMS.

The incoming water supply serving each retail unit will be provided with a water meter, supplied and installed by the water authority (Thames Water). The meters are provided for direct contract billing between the individual occupant and the water authority; the meters will not connect to the BMS/EMS.