Therapia Lane Depot

Energy Strategy Report

TLVD-VZV-ZZ-XX-RP-Z-0001 - Energy Strategy Report

Caveat

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Revision	Date	Details	Author	Checked by
P01	06/12/2023	Pre-application	HST	PV
P02	07/12/2023	Draft for planning	AG	PV
P03	14/12/2023	Planning submission	AG	PV

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Glossary

ADL2021	Approved Document L 2021 Edition
ASHP	Air Source Heat Pump
BER	Building Emission Rate
BREEAM	Building Research Establishment Environmental Assessment Methodology
BRUKL	Building Regulations United Kingdom Part L
CHP	Combined Heat and Power
DCLG	Department for Communities and Local Government
DHW	Domestic Hot Water
EPC	Energy Performance Certificate
FiT	Feed in Tariff
GLA	Greater London Authority

GSHP	Ground Source heat Pump
IES	Integrated Environmental Systems
LTHW	Low Temperature Hot Water
LZC	Low and zero carbon technologies
PV	Photovoltaic
SBEM	Simplified Building Energy Model
TER	Target Emission Rate

1 Introduction

This report outlines the proposed energy strategy for the redevelopment of the Therapia Lane Depot in Croydon.

The development aims to achieve compliance with the Approved Document L2 (2021) and London Borough of Sutton's Policy 31 by maximising feasible reductions in carbon.

The new depot consists of two distinct building elements; a two-storey office space and a workshop. It is proposed to retain the structural frame and ground floor slab of the existing building, but replace the façade treatment and roof with new. The office space will be heated and cooled, and as such greater emphasis will be placed on the thermal performance of the envelope to this area. The workshop is classified as a 'low energy demand' space as defined by Approved Document L2 (2021), with only localised radiant heaters at workstations. As such it is proposed to employ more relaxed standards for the envelope to the workshop as permitted under ADL2.

The proposed energy assessment has been developed in line with the following energy hierarchy:

"Baseline"	Generate baseline CO_2 emissions assuming the notional specification for existing buildings, shown in Appendix 3 of the GLA Energy Assessment Guidance, and which is based on Approved Documents L1 and L2.
"Be Lean"	Reduce the building's energy requirements by incorporating passive design measures and reduce the building's energy consumption through the use of energy efficient mechanical and electrical engineering systems.
"Be Clean"	Reduce the building's carbon dioxide emissions through the efficient supply of heat.
"Be Green"	Reduce the building's carbon dioxide emissions through the use of renewable technologies.

This hierarchy of a passive first and energy efficient design is well proven and a useful format to demonstrate how passive, energy efficient and renewable/low carbon technologies are incorporated within the design.

"Baseline" Where major refurbishments are being carried out, an estimate of the CO_2 savings from the refurbishment of the building will be expected. To provide this an estimation of the CO_2 emission baseline performance of the existing building using Building Regulations approved compliance software. The baseline energy benchmarks for refurbished buildings are based on the Building Emissions Ratings (BERs) for Building Regulations Part L 2021 using IES VE 2023 thermal modelling software, and as defined in Appendix 3 of the GLA Energy Assessment Guidance.

"Be Lean" A fabric first approach where the design will consider the building form and fabric to provide a highly efficient envelope to drive down the energy demand from heating and cooling. The building services plant and equipment are specified to be as efficient as practical to drive down energy consumption. These measures alone show an improvement to Approved Document (ADL 2) 2021 by 22%.

"Be Clean" Be Clean: A study has been undertaken to consider the feasibility to connect to any existing or proposed heat networks.

"Be Green" This includes the consideration of low and zero carbon technologies. After applying the above Be Lean passive and active technologies, low or zero carbon technologies are used to enhance the overall energy strategy. These measures will provide a reduction of around 33% in CO_2 emissions.

The overall predicted reduction in CO_2 emissions from the Baseline development for the proposed development is 55%. This equates to an annual saving of approximately 5.2 tonnes of CO_2.

Table 1 below shows the CO_2 emissions breakdown and Table 2 shows the percentage breakdown at each stage of the hierarchy for the proposed developed.

	Carbon Dioxide Emissions (tonnes CO_2 per annum)
	Regulated emissions
Notional Baseline as defined in Appendix 3 of GLA Energy Assessment Guidance	9.6
After energy demand reduction *"Be Lean"*	7.5
After heat network and/or CHP *"Be Clean"*	7.5
After renewable energy *"Be Green"*	4.3

Table 1 | Carbon Emissions Breakdown

	Carbon Dioxide Emissions Savings
	Tonnes of CO_2 per annum %
Savings from energy demand reduction	22%
Savings from heat network / CHP	0%
Savings from renewable energy	33%
Cumulative on-site savings	**55%**

Table 2 | Regulated CO_2 Emissions Savings

Figure 1 below sets out how the proposed development building energy efficiency measures and LZC systems reduce CO_2 emissions in line with the proposed energy hierarchy:

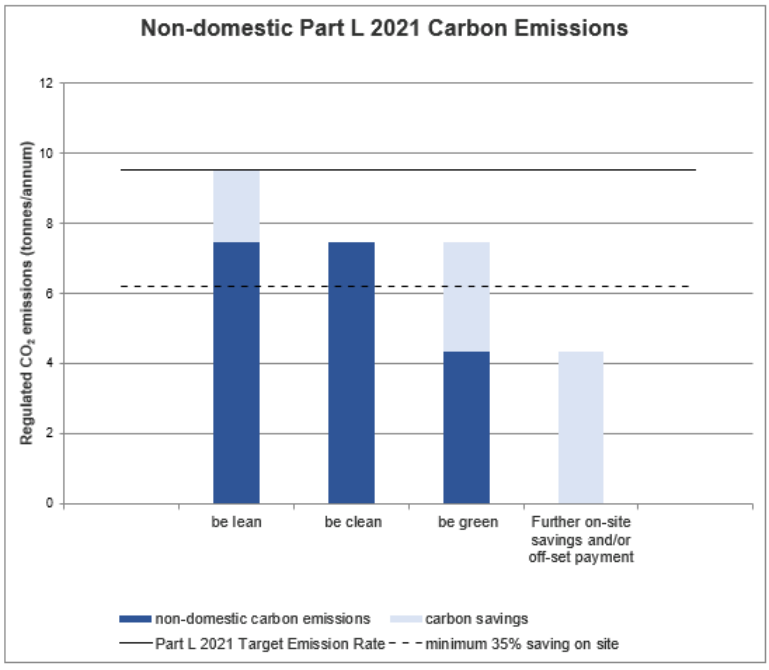


Figure 1 - Energy Hierarchy

2 Baseline Energy Demand Assessment

VZDV uses IES VE 2023 using DSM methodology to assess the building. 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 within sections 2 and 3 of the document "CIBSE TM33:2006, CIBSE standard tests for the assessment of building services design software".

The baseline energy benchmarks for the energy strategy are based on the Building Emissions Ratings (BERs) for Building Regulations Part L 2021.

3 Establish the Baseline Emissions *"Baseline"*

In accordance with the GLA's Energy Assessment Guidance, applicants are required to generate baseline CO_2 emissions assuming the notional specification for existing buildings, shown in Appendix 3 of the GLA energy assessment document, and which is based on Approved Documents L1 and L2. This provides a consistent baseline across all refurbishments and clearly distinguish the improvements in CO_2 emissions that are over and above what would ordinarily be undertaken through meeting Building Regulation requirements.

Table 3 below shows the BER for the notional building as defined by Appendix 3 of the GLA's Energy Assessment Guide. This will be used as the baseline figure to determine energy and carbon reduction on the later stages.

Energy Hierarchy	Regulated Carbon Dioxide Emissions	
	Tonnes of CO_2 per annum	**%**
Baseline: Appendix 3 of GLA's Energy Assessment Guidance	9.6	-

Table 3 | Baseline Carbon Emissions ADL2021

A complete BRUKL for the Baseline (Notional) Building is included in Appendix A.

4 Energy Efficient Design Measures *"Be Lean"*

4.1.1 Passive Measures

The energy strategy adopts a fabric first approach whereby the thermal envelope of the building is enhanced to improve the overall energy efficiency of the building. It is proposed to retain the structural frame and ground floor slab of the existing building, but replace the façade treatment and roof with new materials.

The office space will be heated and cooled, and as such the greater emphasis is placed on the thermal performance of the envelope to this area. The workshop is classified as a 'low energy demand' space as defined by Approved Document L2 (2021), with only localised radiant heaters at workstations. As such it is proposed to employ more relaxed standards for the envelope to the workshop as permitted under ADL2.

The passive design measures to be considered include:

- limiting the heat loss through walls, roof, windows, doors
- avoiding thermal bridging
- day lighting
- thermal heating in winter
- reducing air permeability
- provision of rooflights to provide natural light

The thermal envelope enhancements are summarised elementally in the following table, this is subject to change following detailed thermal modelling:

	Part L2 (2021) Minimum Performance	Proposed Performance
Construction Element	U-value (W/m²K)	U-value (W/m²K)
External Wall to office areas	0.26	0.16
Roof to office areas	0.16	0.12
Windows	1.60	1.40
Pedestrian Doors	1.60	1.60
Opaque envelope to workshop	0.70	0.70
	Infiltration (m²/hm² @ 50Pa)	Infiltration (m²/hm² @ 50Pa)
Air tightness to office areas	8	5

Table 4 - Targeted Building Fabric Thermal Performance

The artificial lighting is a significant proportion of the overall building energy and carbon emissions. Avoiding the need to use lighting by utilising the available daylight is an important factor in reducing carbon emissions. Windows are used to provide natural daylight into the office areas. Detailed modelling has been undertaken to determine the right balance between useful light and thermal gain, and set performance characteristics for the glazed elements.

It is proposed to provide polycarbonate (or similar material) rooflights to the workshop space. The rooflights will provide an element of natural light into the workshop, as well as provide smoke ventilation in the event of a fire. The following parameters have been used to strike a good balance between thermal gain and light transmittance:

	G-value (BS EN 410)	U-value (W/m^2K)	Blinds
Windows	0.33	1.4	Yes
Rooflights over unheated areas	0.57	1.6	No

Table 5 | Targeted Glazing Performance

4.1.2 Active Measures

The mechanical and electrical services are critical to reducing energy consumption. The following active energy saving products and techniques will be considered to achieve reductions in CO_2 emissions:

- Dimming controls linked to daylight sensors
- Local light switching
- Movement and absence sensors for lighting control
- Low energy lighting via LED lamp types
- Variable speed drives on air handling plant and pumps
- Heat recovery mechanical ventilation
- Low specific fan power
- Metering for energy management
- Rigorous commissioning
- Heating controls to optimize plant efficiency

- Controls set up to dynamically adjust heating, ventilation, hot water generation to reduce carbon emissions and maximise energy efficiency
- Localised radiant heating to workstations in workshop only

The building's carbon emissions after the introduction of the Be Lean measures are summarised in the table below:

Energy Hierarchy	Regulated Carbon Dioxide Emissions	
	Tonnes of CO_2 per annum	**%**
Be Lean: After energy efficiency measures	7.5	22%

Table 6 | Baseline Carbon Emissions ADL2021

Refer to Appendix B for a detailed BRUKL for the Be Lean measures.

5 Heating Infrastructure *"Be Clean"*

This section addresses the ***Be Clean*** stage of the energy hierarchy, and although this development is considered a 'minor' development, the energy strategy has been developed following the principles of the London Plan's heating hierarchy.

5.1 Area Wide Heat Networks

The first step in selecting energy systems according to Policy 5.6 is to consider a connection to an existing heating or cooling network.

A review of the London Heat Map suggests the New Mill Quarter Energy Centre is approximately 2km from the site. VZDV have contacted the network operator to establish the possibility of extending the existing network and await their response; refer Appendix C for a copy of the correspondence.

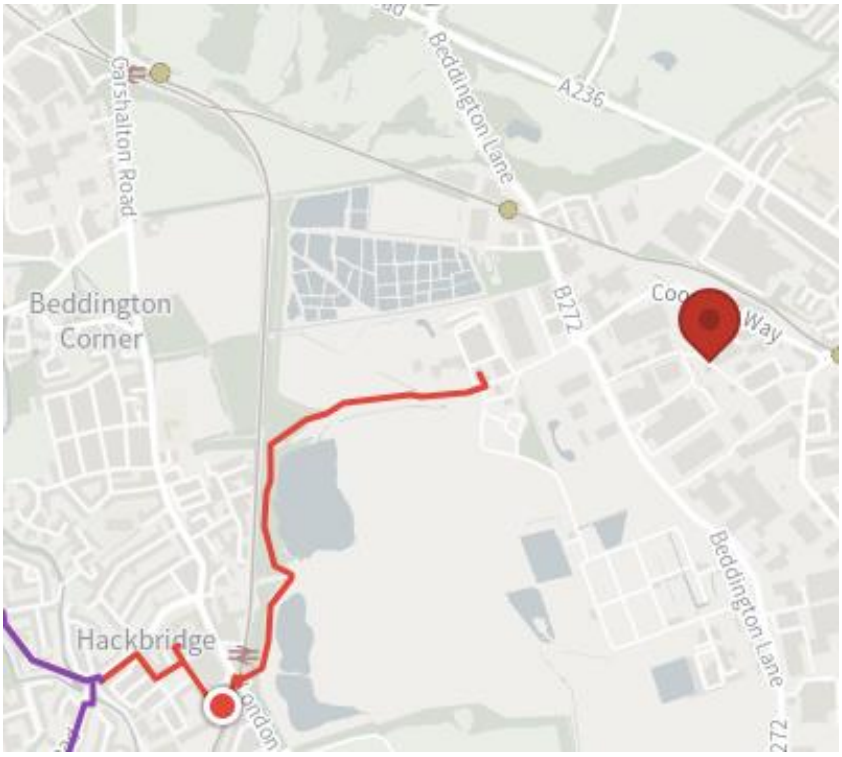


Image 1 - Extract from London Heat Map showing proximity to existing heat network

5.2 Gas-fired Combined Heat and Power (CHP)

Recent developments in London Plan 2022 have reduced the carbon benefits from the electricity produced by the CHP by using SAP 10 carbon emission factors. Under the London Plan, CHP is only considered if it is part of an existing network being connected to.

5.3 Heat Pumps

It is proposed to serve the office areas within the depot with VRF type air source heat pumps to provide both heating and cooling. This may be reviewed if a connection to a heat network becomes available in the future.

5.4 Future Network Provisions

The site is within a Heat Network Priority Area and as part of the planning application it will be demonstrated how a possible future heat network connection can be facilitated.

Below is an extract from the proposed site plan showing the proposed location for pipe route into the site, as well as proposed location for any future heat network substation.

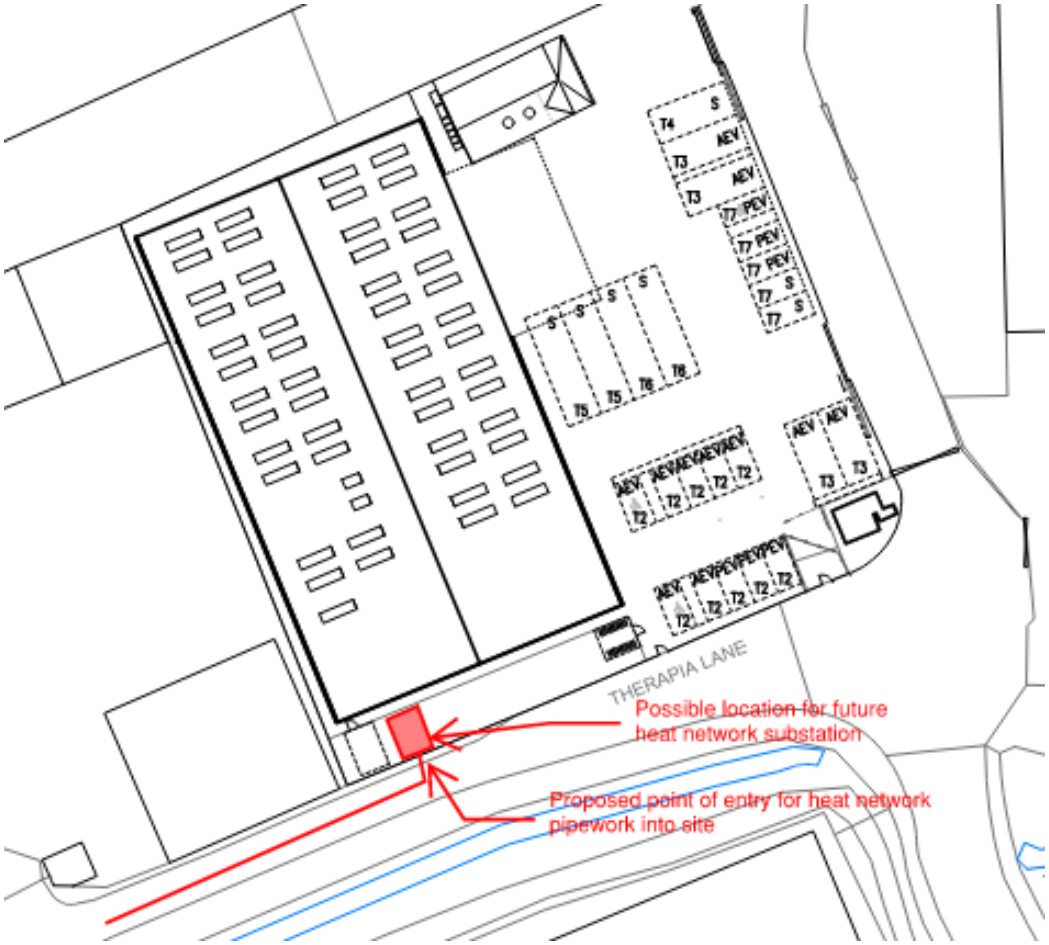


Image 2 - Future heat network connection provision

6 Renewable Energy *"Be Green"*

A number of renewable technologies have been appraised in terms of technical, physical and financial feasibility as potential renewable systems for use on the project.

The following low and zero carbon technologies were considered and compared for the development:

- Wind turbines
- Solar thermal heating
- Photovoltaic panels
- Air source heat pumps
- Ground source heat pumps

These are summarised in the following table:

	Financially Viable	Comments
Wind Turbines	20 – 25 years	Not considered appropriate because of the potential visual impact, noise, planning issues and relatively small carbon benefit. Also wind turbines not most efficient in urban setting.
Solar Thermal Panels	15 – 20 years	The majority of heat is generated in summer months when the heat demand of the development is at its lowest. Also it competes with other heat generating technologies such as heat pumps.
Photovoltaic Panels (PV)	< 10 years	Good CO_2 reduction, reasonable payback, and its potential is only limited by available roof area. Compliments heat pumps well as it generates electricity that can be used, and is the customer's preferred choice.
Air source heat pumps	15 – 20 years	Ideal form of heating for relatively small heat demand; improved carbon reduction benefit under SAP10
Ground Source Heat Pumps (GSHP)	> 30 years	Discounted on the basis of costs. Also being an industrial area the risk of soil contamination is high, and disturbance of the soil for ground energy collectors could cause other issues.

Table 7 | Summary of Considered Renewable Technologies

Although all LZC technologies contribute towards CO_2 reduction, some are more suitable than others and the list of LZC technologies that can make a significant contribution has been narrowed down to:

I. Air Source Heat Pumps (ASHP)
II. Photovoltaic (PV)

There is a need to provide rooflights for smoke ventilation purposes to the workshop and storage areas of the development. These rooflights are manufactured from polycarbonate that will melt during a fire condition. Polycarbonate as a material is less robust than for example a glass rooflight, and although there is space between the rooflights to install PV panels, the need to provide edge protection around each rooflight makes it unpractical. Also there is no stair access to the roof, and there is not enough space around three sides of the depot for a working platform that will provide access for maintenance of the PV panels.

Given the constraints of locating PV panels on the main roof it is proposed to install PV panels on the area of canopy over the vehicle yard. This is ideal as there are no rooflights to consider, and the PV panels can be maintained from a working platform located in the yard.

The canopy can accommodate 115 m^2 of PV panels that will generate an estimated 21,340 kWh per annum. This represents 32% of the development's regulated energy demand.

The image below shows the proposed location of the PV panels:

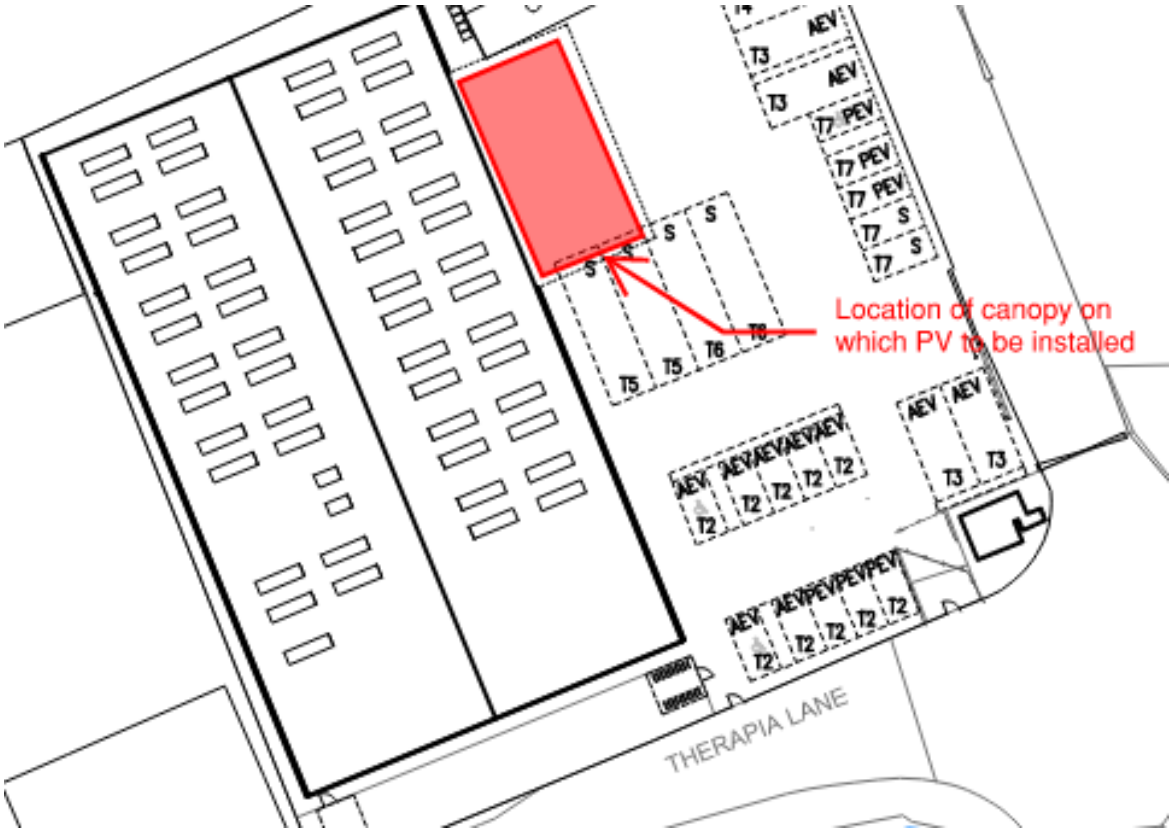


Image 3 - Site plan showing location of PV panels

The estimated regulated carbon dioxide emissions after the “Be Green” stage taking into account the ASHPs and PVs is summarised below:

Energy Hierarchy	Regulated Carbon Dioxide Emissions	
	Tonnes of CO_2 per annum	**%**
Be Green: After renewable technologies	4.3	55%

Table 8 | Baseline Energy and Carbon Emissions after Renewable Technology

Refer to Appendix D for BRUKL output.

7 Conclusions

The proposed energy strategy for the development follows the energy hierarchy detailed within this report with the aim to achieve compliance with ADL 2 (2021) and London Borough of Sutton's Policy 31.

"Be Lean" A fabric first approach where the design considers the building form and fabric to provide a highly efficient envelope and drive down the energy demand for heating. The building services plant and equipment has been specified to be as efficient as practical to drive down energy consumption. These measures alone show an improvement to of 22% when compared with the Notional Building.

"Be Clean" Be Clean: There are no heat networks in the immediate vicinity and contact has been made with the nearest network operator to establish the possibility of extending the network. Provision has been made for a future heat network connection.

As part of the ***"Be Green"*** stage a number of low carbon and renewable technologies have been appraised in terms of technical, physical and financial feasibility for use on the project. Air source heat pumps and roof mounted photovoltaic panels are considered to be the most favourable for the development. These measures will provide a reduction of an additional 33% in CO_2 emissions.

The overall predicted reduction in CO_2 emissions from the Baseline for the proposed development is 55%. This equates to an annual saving of approximately 5.2 tonnes of CO_2.

Table 8 below shows the CO_2 emissions breakdown and Table 9 shows the percentage breakdown at each stage of the hierarchy for the proposed developed.

	Carbon Dioxide Emissions (tonnes CO_2 per annum)
	Regulated
Notional Building as defined in Appendix 3 of the GLA's Energy Assessment Guidance	9.6
After energy demand reduction ***"Be Lean"***	7.5
After heat network and/or CHP ***"Be Clean"***	7.5
After renewable energy ***"Be Green"***	4.3

Table 9 | Carbon Emissions Breakdown

	Carbon Dioxide Emissions Savings	
	Tonnes of CO_2 per annum	**%**
Savings from energy demand reduction	2.1	22%
Savings from heat network / CHP	0.0	0%
Savings from renewable energy	3.1	33%
Cumulative on-site savings	**5.2**	**55%**

Table 10 | Regulated CO_2 Emissions Savings

The figure below sets out how the proposed development building energy efficiency measures and LZC systems reduce CO_2 emissions in line with the proposed energy hierarchy:

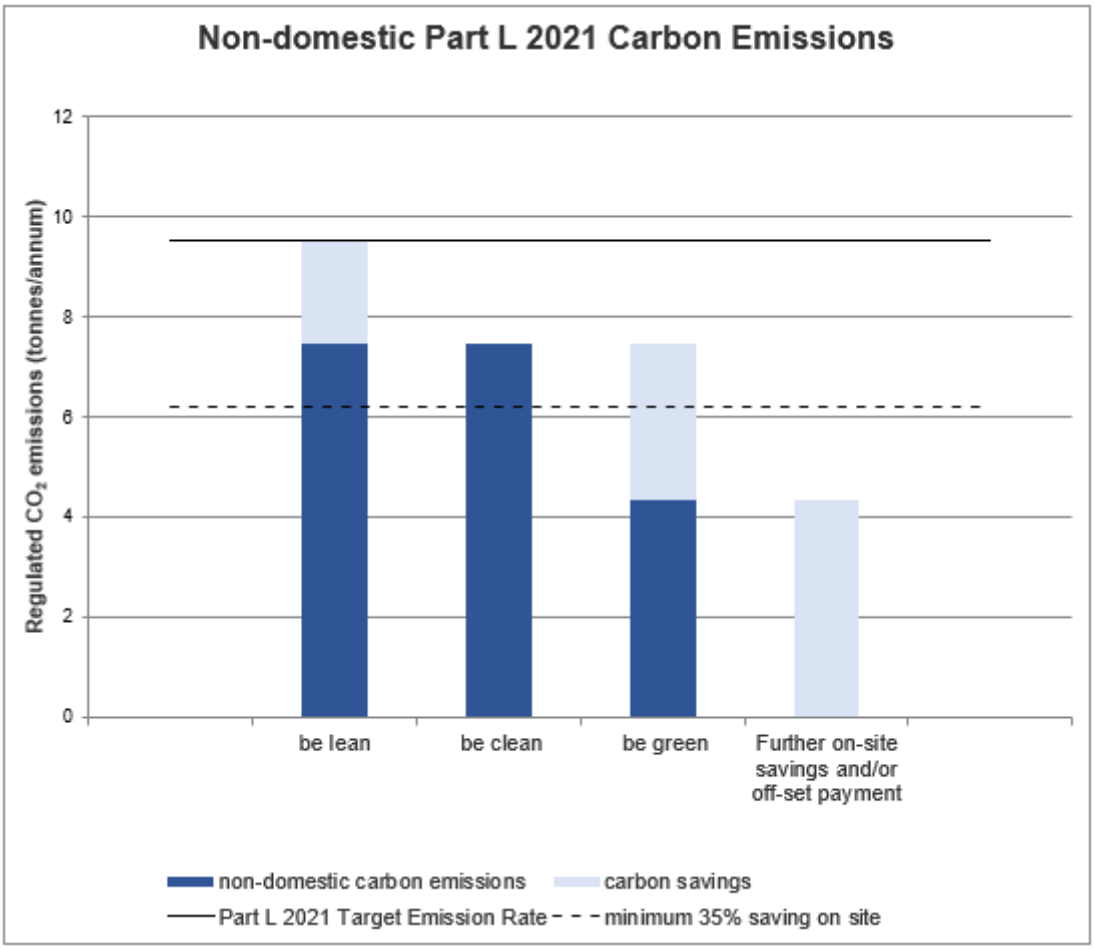


Figure 2 - Energy Hierarchy

A copy of the GLA's Carbon Reporting Spreadsheet is enclosed in Appendix E.

8 Appendix A – Notional Building BRUKL

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Therapia Lane (Baseline)

As designed

Date: Thu Dec 07 14:46:42 2023

Administrative information

Building Details

Address: London, CR0 4TD

Certifier details

Name: Alexandros Grigoropoulos

Telephone number: 07837047051

Address: , ,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.23

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.23

BRUKL compliance module version: v6.1.e.1

Foundation area [m^2]: 368.76

The CO_2 emission and primary energy rates of the building must not exceed the targets

The building does not comply with England Building Regulations Part L 2021

Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	5.15	
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	8.36	
Target primary energy rate (TPER), $kWh_{PE}/m^2.annum$	33.82	
Building primary energy rate (BPER), $kWh_{PE}/m^2.annum$	62.99	
Do the building's emission and primary energy rates exceed the targets?	BER > TER	BPER > TPER

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.55	0.55	00000000:Surf[1]
Floors	0.18	0.25	0.25	00000000:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.18	0.18	RM000000:Surf[6]
Windows** and roof windows	1.6	1.4	1.4	00000001:Surf[1]
Rooflights***	2.2	1.3	1.3	RM000000:Surf[0]
Personnel doors^	1.6	1.6	1.6	0000000F:Surf[0]
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$]

$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

** Display windows and similar glazing are excluded from the U-value check.

*** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m^2K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	5

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- HVAC 4 - EMHB + MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0	-	0.7
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

2- HVAC 7 - EPH + NV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

3- HVAC 3 - EPH + MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0	-	0.7
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

4- HVAC 2 - VRF (First Floor)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.5	5	0	2.6	0.7
Standard value	2.5*	N/A	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

5- HVAC 1 - VRF (Ground Floor)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.5	5	0	2.6	0.7
Standard value	2.5*	N/A	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

6- HVAC 5 - DX

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.5	5	-	-	-
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

1- DHW service

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	0.91	N/A

Zone-level mechanical ventilation, exhaust, and terminal units

ID	System type in the Approved Documents
A	Local supply or extract ventilation units
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter

NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
00_07_Drying Room	-	-	-	2.6	-	-	-	-	-	-	N/A
00_10_Female WC	-	-	-	2.6	-	-	-	-	-	-	N/A
01_26_Lobby	-	-	-	2.6	-	-	-	-	-	-	N/A
00_11_Showers	-	-	-	2.6	-	-	-	-	-	-	N/A
00_Corridor	-	-	-	2.6	-	-	-	-	-	-	N/A
00_08_Male WC	-	-	-	2.6	-	-	-	-	-	-	N/A
00_09_Access WC	-	-	-	2.6	-	-	-	-	-	-	N/A
00_11_Showers	-	-	-	2.6	-	-	-	-	-	-	N/A
00_08_Male WC	-	-	-	2.6	-	-	-	-	-	-	N/A
00_11_Showers	-	-	-	2.6	-	-	-	-	-	-	N/A
00_08_Male WC	-	-	-	2.6	-	-	-	-	-	-	N/A
00_10_Female WC	-	-	-	2.6	-	-	-	-	-	-	N/A
00_10_Female WC	-	-	-	2.6	-	-	-	-	-	-	N/A
00_01_Deployment Area	-	-	-	2.6	-	-	-	-	-	-	N/A
00_08_Male WC	-	-	-	2.6	-	-	-	-	-	-	N/A
00_08_Male WC	-	-	-	2.6	-	-	-	-	-	-	N/A
00_11_Showers	-	-	-	2.6	-	-	-	-	-	-	N/A
01_28_Male WC	-	-	-	2.6	-	-	-	-	-	-	N/A
00_08_Male WC	-	-	-	2.6	-	-	-	-	-	-	N/A
01_29_Access WC	-	-	-	2.6	-	-	-	-	-	-	N/A
01_28_Male WC	-	-	-	2.6	-	-	-	-	-	-	N/A
01_30_Female WC	-	-	-	2.6	-	-	-	-	-	-	N/A
01_28_Male WC	-	-	-	2.6	-	-	-	-	-	-	N/A
01_30_Female WC	-	-	-	2.6	-	-	-	-	-	-	N/A
01_30_Female WC	-	-	-	2.6	-	-	-	-	-	-	N/A
00_08_Male WC	-	-	-	2.6	-	-	-	-	-	-	N/A
00_Corridor	-	-	-	2.6	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
00_06_Locker Room	-	-	-	2.6	-	-	-	-	-	-	N/A
00_10_Female WC	-	-	-	2.6	-	-	-	-	-	-	N/A

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
00_07_Drying Room	60	-	-
00_Corridor	60	-	-
00_10_Female WC	60	-	-
01_26_Lobby	60	-	-
01_23_Meeting Room 04	60	-	-
00_12_Workshop Welfare	60	-	-
00_02_Stairs 01	60	-	-
00_Corridor	60	-	-
00_04_Meeting Room 02	60	-	-
00_13_Workshop Office	60	-	-
00_03_Meeting Room 01	60	-	-
00_11_Showers	60	-	-
00_Corridor	60	-	-
00_16_LV	60	-	-
00_08_Male WC	60	-	-
00_09_Access WC	60	-	-
00_14_Deliveries and Storage	60	-	-
00_03_Stairs	60	-	-
00_11_Showers	60	-	-
00_15_Intake	60	-	-
00_08_Male WC	60	-	-
00_11_Showers	60	-	-
00_08_Male WC	60	-	-
00_10_Female WC	60	-	-
00_10_Female WC	60	-	-
00_01_Deployment Area	60	-	-
00_08_Male WC	60	-	-
00_08_Male WC	60	-	-
00_02_Stairs	60	-	-
00_11_Showers	60	-	-
00_05_Training Room	60	-	-
01_02_Stair	60	-	-
01_28_Male WC	60	-	-
00_08_Male WC	60	-	-
01_34_Workshop Store	60	-	-
01_29_Access WC	60	-	-
01_21_Meeting Room 03	60	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
01_31_Plant	60	-	-
01_28_Male WC	60	-	-
01_02_Stair 01	60	-	-
00_Corridor	60	-	-
01_30_Female WC	60	-	-
01_28_Male WC	60	-	-
01_30_Female WC	60	-	-
01_Store	60	-	-
01_20_Clienting Office	60	-	-
01_24_Meeting Room 05	60	-	-
01_30_Female WC	60	-	-
00_08_Male WC	60	-	-
00_Corridor	60	-	-
00_06_Locker Room	60	-	-
00_10_Female WC	60	-	-
01_32_Waste management Office	60	-	-
01_22_Street Cleasing Office	60	-	-
01_27_Server Store	60	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
01_23_Meeting Room 04	N/A	N/A
00_12_Workshop Welfare	N/A	N/A
00_04_Meeting Room 02	NO (-67.9%)	YES
00_13_Workshop Office	NO (-100%)	NO
00_03_Meeting Room 01	NO (-67.9%)	YES
00_05_Training Room	NO (-83.6%)	YES
01_21_Meeting Room 03	NO (-100%)	NO
01_20_Clienting Office	NO (-88.4%)	YES
01_24_Meeting Room 05	N/A	N/A
01_32_Waste management Office	NO (-77.7%)	YES
01_22_Street Cleasing Office	NO (-75.2%)	YES
01_27_Server Store	N/A	N/A

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	1142.7	1142.7
External area [m^2]	1834.5	1834.5
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	5	3
Average conductance [W/K]	700.52	0
Average U-value [W/m^2K]	0.38	0
Alpha value* [%]	27.3	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
100	**Offices and Workshop Businesses**
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger Terminals
	Others: Emergency Services
	Others: Miscellaneous 24hr Activities
	Others: Car Parks 24 hrs
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	12.15	5.18
Cooling	1.68	1.41
Auxiliary	5.92	3.27
Lighting	12.83	7.53
Hot water	15.11	15.59
Equipment*	24.58	24.58
TOTAL**	**47.69**	**32.99**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	5.57
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*0*	*5.57*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	79.19	47.64
Primary energy [kWh_{PE}/m^2]	62.99	33.82
Total emissions [kg/m^2]	8.36	5.15

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	126.4	58.4	14.5	5.3	10.2	2.42	3.06	2.5	5
	Notional	52.2	79.8	5.2	4.8	7.8	2.78	4.63	----	----
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	87.3	65.6	10	6	10.2	2.42	3.06	2.5	5
	Notional	30	81.3	3	4.9	7.6	2.78	4.63	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Natural Gas, [CFT] Electricity										
	Actual	64	0	17.8	0	10.8	1	0	1	0
	Notional	20.1	0	6.2	0	1.4	0.91	0	----	----
[ST] Other local room heater - fanned, [HS] Direct or storage electric heater, [HFT] Natural Gas, [CFT] Electricity										
	Actual	87.7	0	24.4	0	9.6	1	0	1	0
	Notional	31.4	0	9.6	0	1.2	0.91	0	----	----
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	0	0	0	0	0	2.33	3.55	2.5	5
	Notional	0	0	0	0	0	2.78	4.63	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Natural Gas, [CFT] Electricity										
	Actual	147.9	0	41.1	0	0	1	0	1	0
	Notional	98.7	0	30.3	0	0	0.91	0	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

9 Appendix B – Be Lean BRUKL

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Therapia Lane (Be Lean)

As designed

Date: Thu Dec 07 14:48:13 2023

Administrative information

Building Details

Address: London, CR0 4TD

Certifier details

Name: Alexandros Grigoropoulos

Telephone number: 07837047051

Address: , ,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.23

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.23

BRUKL compliance module version: v6.1.e.1

Foundation area [m^2]: 368.76

The CO_2 emission and primary energy rates of the building must not exceed the targets

The building does not comply with England Building Regulations Part L 2021

Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	5.13	
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	6.53	
Target primary energy rate (TPER), $kWh_{PE}/m^2.annum$	33.59	
Building primary energy rate (BPER), $kWh_{PE}/m^2.annum$	46.58	
Do the building's emission and primary energy rates exceed the targets?	BER > TER	BPER > TPER

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.16	0.16	00000000:Surf[1]
Floors	0.18	0.25	0.25	00000000:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.12	0.12	RM000000:Surf[6]
Windows** and roof windows	1.6	1.4	1.4	00000001:Surf[1]
Rooflights***	2.2	1.3	1.3	RM000000:Surf[0]
Personnel doors^	1.6	1.6	1.6	0000000F:Surf[0]
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m^2K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	5

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- HVAC 4 - EMHB + MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0	-	0.75
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

2- HVAC 7 - EPH + NV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

3- HVAC 3 - EPH + MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0	-	0.75
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

4- HVAC 2 - VRF (First Floor)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.86	5	0	1.5	0.75
Standard value	2.5*	N/A	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

5- HVAC 1 - VRF (Ground Floor)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.86	5	0	1.5	0.75
Standard value	2.5*	N/A	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

6- HVAC 5 - DX

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.86	5	-	-	-
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

1- DHW service

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	0.91	N/A

Zone-level mechanical ventilation, exhaust, and terminal units

ID	System type in the Approved Documents
A	Local supply or extract ventilation units
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter

NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
00_07_Drying Room	-	-	-	1.5	-	-	-	-	-	-	N/A
00_10_Female WC	-	-	-	1.5	-	-	-	-	-	-	N/A
01_26_Lobby	-	-	-	1.5	-	-	-	-	-	-	N/A
00_11_Showers	-	-	-	1.5	-	-	-	-	-	-	N/A
00_Corridor	-	-	-	1.5	-	-	-	-	-	-	N/A
00_08_Male WC	-	-	-	1.5	-	-	-	-	-	-	N/A
00_09_Access WC	-	-	-	1.5	-	-	-	-	-	-	N/A
00_11_Showers	-	-	-	1.5	-	-	-	-	-	-	N/A
00_08_Male WC	-	-	-	1.5	-	-	-	-	-	-	N/A
00_11_Showers	-	-	-	1.5	-	-	-	-	-	-	N/A
00_08_Male WC	-	-	-	1.5	-	-	-	-	-	-	N/A
00_10_Female WC	-	-	-	1.5	-	-	-	-	-	-	N/A
00_10_Female WC	-	-	-	1.5	-	-	-	-	-	-	N/A
00_01_Deployment Area	-	-	-	1.5	-	-	-	-	-	-	N/A
00_08_Male WC	-	-	-	1.5	-	-	-	-	-	-	N/A
00_08_Male WC	-	-	-	1.5	-	-	-	-	-	-	N/A
00_11_Showers	-	-	-	1.5	-	-	-	-	-	-	N/A
01_28_Male WC	-	-	-	1.5	-	-	-	-	-	-	N/A
00_08_Male WC	-	-	-	1.5	-	-	-	-	-	-	N/A
01_29_Access WC	-	-	-	1.5	-	-	-	-	-	-	N/A
01_28_Male WC	-	-	-	1.5	-	-	-	-	-	-	N/A
01_30_Female WC	-	-	-	1.5	-	-	-	-	-	-	N/A
01_28_Male WC	-	-	-	1.5	-	-	-	-	-	-	N/A
01_30_Female WC	-	-	-	1.5	-	-	-	-	-	-	N/A
01_30_Female WC	-	-	-	1.5	-	-	-	-	-	-	N/A
00_08_Male WC	-	-	-	1.5	-	-	-	-	-	-	N/A
00_Corridor	-	-	-	1.5	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
00_06_Locker Room	-	-	-	1.5	-	-	-	-	-	-	N/A
00_10_Female WC	-	-	-	1.5	-	-	-	-	-	-	N/A

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
00_07_Drying Room	100	-	-
00_Corridor	100	-	-
00_10_Female WC	100	-	-
01_26_Lobby	100	-	-
01_23_Meeting Room 04	100	-	-
00_12_Workshop Welfare	100	-	-
00_02_Stairs 01	100	-	-
00_Corridor	100	-	-
00_04_Meeting Room 02	100	-	-
00_13_Workshop Office	100	-	-
00_03_Meeting Room 01	100	-	-
00_11_Showers	100	-	-
00_Corridor	100	-	-
00_16_LV	100	-	-
00_08_Male WC	100	-	-
00_09_Access WC	100	-	-
00_14_Deliveries and Storage	100	-	-
00_03_Stairs	100	-	-
00_11_Showers	100	-	-
00_15_Intake	100	-	-
00_08_Male WC	100	-	-
00_11_Showers	100	-	-
00_08_Male WC	100	-	-
00_10_Female WC	100	-	-
00_10_Female WC	100	-	-
00_01_Deployment Area	100	-	-
00_08_Male WC	100	-	-
00_08_Male WC	100	-	-
00_02_Stairs	100	-	-
00_11_Showers	100	-	-
00_05_Training Room	100	-	-
01_02_Stair	100	-	-
01_28_Male WC	100	-	-
00_08_Male WC	100	-	-
01_34_Workshop Store	100	-	-
01_29_Access WC	100	-	-
01_21_Meeting Room 03	100	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
01_31_Plant	100	-	-
01_28_Male WC	100	-	-
01_02_Stair 01	100	-	-
00_Corridor	100	-	-
01_30_Female WC	100	-	-
01_28_Male WC	100	-	-
01_30_Female WC	100	-	-
01_Store	100	-	-
01_20_Clienting Office	100	-	-
01_24_Meeting Room 05	100	-	-
01_30_Female WC	100	-	-
00_08_Male WC	100	-	-
00_Corridor	100	-	-
00_06_Locker Room	100	-	-
00_10_Female WC	100	-	-
01_32_Waste management Office	100	-	-
01_22_Street Cleasing Office	100	-	-
01_27_Server Store	100	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
01_23_Meeting Room 04	N/A	N/A
00_12_Workshop Welfare	N/A	N/A
00_04_Meeting Room 02	NO (-73.7%)	YES
00_13_Workshop Office	NO (-100%)	NO
00_03_Meeting Room 01	NO (-73.8%)	YES
00_05_Training Room	NO (-86.6%)	YES
01_21_Meeting Room 03	NO (-100%)	NO
01_20_Clienting Office	NO (-90.5%)	YES
01_24_Meeting Room 05	N/A	N/A
01_32_Waste management Office	NO (-81.7%)	YES
01_22_Street Cleasing Office	NO (-79.8%)	YES
01_27_Server Store	N/A	N/A

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	1142.7	1142.7
External area [m^2]	1834.5	1834.5
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	5	3
Average conductance [W/K]	497.43	0
Average U-value [W/m^2K]	0.27	0
Alpha value* [%]	26	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
100	**Offices and Workshop Businesses**
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger Terminals
	Others: Emergency Services
	Others: Miscellaneous 24hr Activities
	Others: Car Parks 24 hrs
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	7.98	5.18
Cooling	1.76	1.41
Auxiliary	3.42	3.27
Lighting	7.92	7.53
Hot water	15.11	15.59
Equipment*	24.58	24.58
TOTAL**	**36.2**	**32.99**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	5.72
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*0*	*5.72*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	60.47	47.64
Primary energy [kWh_{PE}/m^2]	46.58	33.59
Total emissions [kg/m^2]	6.53	5.13

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	86.6	61	9.1	5.3	5.9	2.65	3.18	2.86	5
	Notional	52.2	79.8	5.2	4.8	7.8	2.78	4.63	----	----
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	54	72.7	5.7	6.4	5.9	2.65	3.18	2.86	5
	Notional	30	81.3	3	4.9	7.6	2.78	4.63	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Natural Gas, [CFT] Electricity										
	Actual	48.5	0	13.5	0	6.2	1	0	1	0
	Notional	20.1	0	6.2	0	1.4	0.91	0	----	----
[ST] Other local room heater - fanned, [HS] Direct or storage electric heater, [HFT] Natural Gas, [CFT] Electricity										
	Actual	58.2	0	16.2	0	5.6	1	0	1	0
	Notional	31.4	0	9.6	0	1.2	0.91	0	----	----
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	0	0	0	0	0	2.67	3.55	2.86	5
	Notional	0	0	0	0	0	2.78	4.63	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Natural Gas, [CFT] Electricity										
	Actual	103.5	0	28.7	0	0	1	0	1	0
	Notional	98.7	0	30.3	0	0	0.91	0	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

10 Appendix C – Correspondence with Heat Network Operator

Paul Vorster

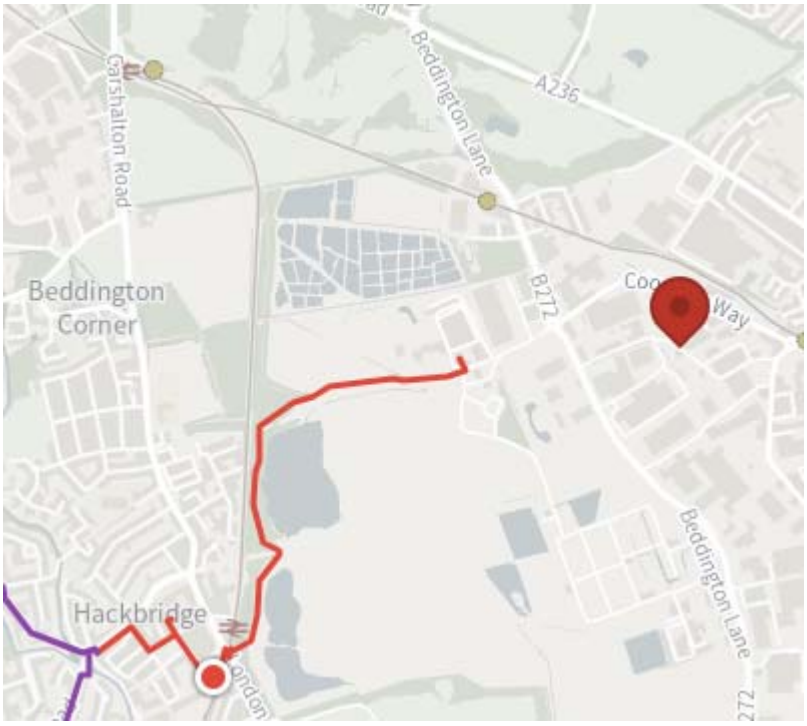
From: Paul Vorster
Sent: 29 November 2023 15:03
To: contactus@sden.org.uk
Cc: Craig Morgan; Sai Burra
Subject: Therapia Lane Depot - Connection to heat network

Good afternoon

VZDV are acting on behalf of London Borough of Sutton who is proposing the refurbishment of a vehicle depot located in Therapia Lane at the address below:

- Therapia Lane Depot
- Beddington
- CR0 4TN

Having reviewed the London Heat Map, the New Mill Quarter energy network seems to be approximately 2km from the depot's site; refer extract below from London Heat Map:



As part of the planning requirements for the depot the applicant is required to contact nearby heat networks to establish the viability of connecting to the network, either now or in the future. I would appreciate it you could acknowledge receipt of this email and comment on the feasibility (or otherwise) to connect to the New Mill Quarter heat network.

Thank you
Paul Vorster

Paul Vorster

van zyl & de villiers

paul@vzdv.com
office +44(0)1727 731560 mobile +44(0)7979 858223
6a parkway, valley road, porters wood, St Albans. AL3 6PA

vzdv.com

11 Appendix D – Be Green BRUKL

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Therapia Lane (Be Green)

As designed

Date: Thu Dec 07 14:49:49 2023

Administrative information

Building Details

Address: London, CR0 4TD

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.23

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.23

BRUKL compliance module version: v6.1.e.1

Certifier details

Name: Alexandros Grigoropoulos

Telephone number: 07837047051

Address: , ,

Foundation area [m^2]: 368.76

The CO_2 emission and primary energy rates of the building must not exceed the targets

Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	5.13	
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	3.8	
Target primary energy rate (TPER), $kWh_{PE}/m^2.annum$	33.59	
Building primary energy rate (BPER), $kWh_{PE}/m^2.annum$	15.68	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.16	0.16	00000000:Surf[1]
Floors	0.18	0.25	0.25	00000000:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.12	0.12	RM000000:Surf[6]
Windows** and roof windows	1.6	1.4	1.4	00000001:Surf[1]
Rooflights***	2.2	1.3	1.3	RM000000:Surf[0]
Personnel doors^	1.6	1.6	1.6	0000000F:Surf[0]
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m^2K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	5

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- HVAC 4 - EMHB + MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0	-	0.75
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

2- HVAC 7 - EPH + NV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

3- HVAC 3 - EPH + MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0	-	0.75
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

4- HVAC 2 - VRF (First Floor)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	6.4	11.69	0	1.5	0.75
Standard value	2.5*	N/A	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

5- HVAC 1 - VRF (Ground Floor)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	6.83	13.34	0	1.5	0.75
Standard value	2.5*	N/A	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

6- HVAC 5 - DX

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.2	6.8	-	-	-
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

1- DHW service

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	0.91	N/A

Zone-level mechanical ventilation, exhaust, and terminal units

ID	System type in the Approved Documents
A	Local supply or extract ventilation units
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter

NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
00_07_Drying Room	-	-	-	1.5	-	-	-	-	-	-	N/A
00_10_Female WC	-	-	-	1.5	-	-	-	-	-	-	N/A
01_26_Lobby	-	-	-	1.5	-	-	-	-	-	-	N/A
00_11_Showers	-	-	-	1.5	-	-	-	-	-	-	N/A
00_Corridor	-	-	-	1.5	-	-	-	-	-	-	N/A
00_08_Male WC	-	-	-	1.5	-	-	-	-	-	-	N/A
00_09_Access WC	-	-	-	1.5	-	-	-	-	-	-	N/A
00_11_Showers	-	-	-	1.5	-	-	-	-	-	-	N/A
00_08_Male WC	-	-	-	1.5	-	-	-	-	-	-	N/A
00_11_Showers	-	-	-	1.5	-	-	-	-	-	-	N/A
00_08_Male WC	-	-	-	1.5	-	-	-	-	-	-	N/A
00_10_Female WC	-	-	-	1.5	-	-	-	-	-	-	N/A
00_10_Female WC	-	-	-	1.5	-	-	-	-	-	-	N/A
00_01_Deployment Area	-	-	-	1.5	-	-	-	-	-	-	N/A
00_08_Male WC	-	-	-	1.5	-	-	-	-	-	-	N/A
00_08_Male WC	-	-	-	1.5	-	-	-	-	-	-	N/A
00_11_Showers	-	-	-	1.5	-	-	-	-	-	-	N/A
01_28_Male WC	-	-	-	1.5	-	-	-	-	-	-	N/A
00_08_Male WC	-	-	-	1.5	-	-	-	-	-	-	N/A
01_29_Access WC	-	-	-	1.5	-	-	-	-	-	-	N/A
01_28_Male WC	-	-	-	1.5	-	-	-	-	-	-	N/A
01_30_Female WC	-	-	-	1.5	-	-	-	-	-	-	N/A
01_28_Male WC	-	-	-	1.5	-	-	-	-	-	-	N/A
01_30_Female WC	-	-	-	1.5	-	-	-	-	-	-	N/A
01_30_Female WC	-	-	-	1.5	-	-	-	-	-	-	N/A
00_08_Male WC	-	-	-	1.5	-	-	-	-	-	-	N/A
00_Corridor	-	-	-	1.5	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
00_06_Locker Room	-	-	-	1.5	-	-	-	-	-	-	N/A
00_10_Female WC	-	-	-	1.5	-	-	-	-	-	-	N/A

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
00_07_Drying Room	100	-	-
00_Corridor	100	-	-
00_10_Female WC	100	-	-
01_26_Lobby	100	-	-
01_23_Meeting Room 04	100	-	-
00_12_Workshop Welfare	100	-	-
00_02_Stairs 01	100	-	-
00_Corridor	100	-	-
00_04_Meeting Room 02	100	-	-
00_13_Workshop Office	100	-	-
00_03_Meeting Room 01	100	-	-
00_11_Showers	100	-	-
00_Corridor	100	-	-
00_16_LV	100	-	-
00_08_Male WC	100	-	-
00_09_Access WC	100	-	-
00_14_Deliveries and Storage	100	-	-
00_03_Stairs	100	-	-
00_11_Showers	100	-	-
00_15_Intake	100	-	-
00_08_Male WC	100	-	-
00_11_Showers	100	-	-
00_08_Male WC	100	-	-
00_10_Female WC	100	-	-
00_10_Female WC	100	-	-
00_01_Deployment Area	100	-	-
00_08_Male WC	100	-	-
00_08_Male WC	100	-	-
00_02_Stairs	100	-	-
00_11_Showers	100	-	-
00_05_Training Room	100	-	-
01_02_Stair	100	-	-
01_28_Male WC	100	-	-
00_08_Male WC	100	-	-
01_34_Workshop Store	100	-	-
01_29_Access WC	100	-	-
01_21_Meeting Room 03	100	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
01_31_Plant	100	-	-
01_28_Male WC	100	-	-
01_02_Stair 01	100	-	-
00_Corridor	100	-	-
01_30_Female WC	100	-	-
01_28_Male WC	100	-	-
01_30_Female WC	100	-	-
01_Store	100	-	-
01_20_Clienting Office	100	-	-
01_24_Meeting Room 05	100	-	-
01_30_Female WC	100	-	-
00_08_Male WC	100	-	-
00_Corridor	100	-	-
00_06_Locker Room	100	-	-
00_10_Female WC	100	-	-
01_32_Waste management Office	100	-	-
01_22_Street Cleasing Office	100	-	-
01_27_Server Store	100	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
01_23_Meeting Room 04	N/A	N/A
00_12_Workshop Welfare	N/A	N/A
00_04_Meeting Room 02	NO (-73.7%)	YES
00_13_Workshop Office	NO (-100%)	NO
00_03_Meeting Room 01	NO (-73.8%)	YES
00_05_Training Room	NO (-86.6%)	YES
01_21_Meeting Room 03	NO (-100%)	NO
01_20_Clienting Office	NO (-90.5%)	YES
01_24_Meeting Room 05	N/A	N/A
01_32_Waste management Office	NO (-81.7%)	YES
01_22_Street Cleasing Office	NO (-79.8%)	YES
01_27_Server Store	N/A	N/A

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	1142.7	1142.7
External area [m^2]	1834.5	1834.5
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	5	3
Average conductance [W/K]	497.43	0
Average U-value [W/m^2K]	0.27	0
Alpha value* [%]	26	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
100	**Offices and Workshop Businesses**
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger Terminals
	Others: Emergency Services
	Others: Miscellaneous 24hr Activities
	Others: Car Parks 24 hrs
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	6.82	5.18
Cooling	0.73	1.41
Auxiliary	3.42	3.27
Lighting	7.92	7.53
Hot water	15.11	15.59
Equipment*	24.58	24.58
TOTAL**	**34**	**32.99**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	18.68	5.72
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*18.68*	*5.72*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	60.47	47.64
Primary energy [kWh_{PE}/m^2]	15.68	33.59
Total emissions [kg/m^2]	3.8	5.13

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	86.6	61	3.5	2	5.9	6.83	8.49	6.83	13.34
	Notional	52.2	79.8	5.2	4.8	7.8	2.78	4.63	----	----
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	54	72.7	2.3	2.7	5.9	6.4	7.44	6.4	11.69
	Notional	30	81.3	3	4.9	7.6	2.78	4.63	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Natural Gas, [CFT] Electricity										
	Actual	48.5	0	13.5	0	6.2	1	0	1	0
	Notional	20.1	0	6.2	0	1.4	0.91	0	----	----
[ST] Other local room heater - fanned, [HS] Direct or storage electric heater, [HFT] Natural Gas, [CFT] Electricity										
	Actual	58.2	0	16.2	0	5.6	1	0	1	0
	Notional	31.4	0	9.6	0	1.2	0.91	0	----	----
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	0	0	0	0	0	4.2	4.83	4.2	6.8
	Notional	0	0	0	0	0	2.78	4.63	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Natural Gas, [CFT] Electricity										
	Actual	103.5	0	28.7	0	0	1	0	1	0
	Notional	98.7	0	30.3	0	0	0.91	0	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

12 Appendix E – GLA Carbon Reporting Spreadsheet

Part L 2021 Performance

Residential

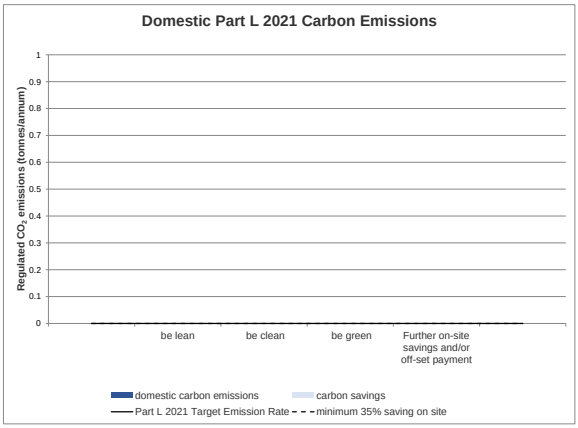
Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for residential buildings

	Carbon Dioxide Emissions for residential buildings (Tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2021 of the Building Regulations Compliant Development	0.0	
After energy demand reduction (be lean)	0.0	
After heat network connection (be clean)	0.0	
After renewable energy (be green)	0.0	

Table 2: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for residential buildings

	Regulated residential carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Be lean: savings from energy demand reduction	0.0	0%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	0.0	0%
Cumulative on site savings	**0.0**	**0%**
Annual savings from off-set payment	0.0	-
	(Tonnes CO_2)	
Cumulative savings for off-set payment	**0**	-
Cash in-lieu contribution (£)	**0**	

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development Information' tab



Non-residential

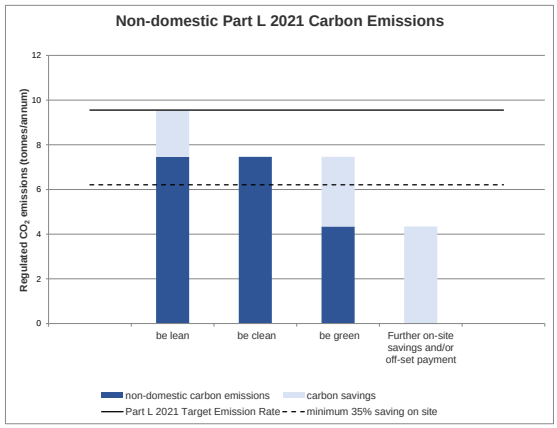
Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for non-residential buildings

	Carbon Dioxide Emissions for non-residential buildings (Tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2021 of the Building Regulations Compliant Development	9.6	
After energy demand reduction (be lean)	7.5	
After heat network connection (be clean)	7.5	
After renewable energy (be green)	4.3	

Table 4: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for non-residential buildings

	Regulated non-residential carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Be lean: savings from energy demand reduction	2.1	22%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	3.1	33%
Total Cumulative Savings	**5.2**	**55%**
Annual savings from off-set payment	4.3	-
	(Tonnes CO_2)	
Cumulative savings for off-set payment	**130**	-
Cash in-lieu contribution (£)	**12,375**	

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development Information' tab



SITE-WIDE

	Total regulated emissions (Tonnes CO_2 / year)	CO_2 savings (Tonnes CO_2 / year)	Percentage savings (%)
Part L 2021 baseline	9.6		
Be lean	7.5	2.1	22%
Be clean	7.5	0.0	0%
Be green	4.3	3.1	33%
Total Savings	-	5.2	55%
	-	**CO_2 savings off-set (Tonnes CO_2)**	-
Off-set	-	**130.3**	-

	Target Fabric Energy Efficiency (kWh/m²)	Dwelling Fabric Energy Efficiency (kWh/m²)	Improvement (%)
Development total	0.00	0.00	

	Area weighted non-residential cooling demand (MJ/m^2)	Total non-residential cooling demand (MJ/year)
Actual		
Notional		