energycounsel
engineering sustainable buildings

Energy Statement
Ref: Z61061 Rev.1

Proposed Office Extension & Refurbishment

at

2A St George's Road
London
NW11 0LR

for

Highwater Associates



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The proposed development at office extension at 2A St George's Road includes the addition of a single floor on an existing three-storey office development. The new third floor will utilise the existing conditioning and air handling plant, which is to be relocated from the existing second floor roof to the third floor roof.

The area of the new office extension (179m^2) equates to 13.5% of the existing building floor area (1330m^2), therefore compliance under the existing building criteria of Building Regulations Approved Document Part L2 (2021) is required. The floor area of the proposed development does not meet the threshold to be considered a 'major development'. Supporting information is provided within this report for the proposed energy strategy to be considered on site in accordance with the following planning policies:

London Borough of Barnet's Local Plan (2012)
The London Plan (2021)
National Planning Policy Framework (2023)

The following low and zero carbon technologies have been evaluated:

- Biomass
- Wind
- Biogas
- Air Source Heat Pumps & Exhaust Air Heat Pumps
- Geothermal
- Combined Heat & Power (CHP)
- Solar Hot Water
- Solar Photovoltaic

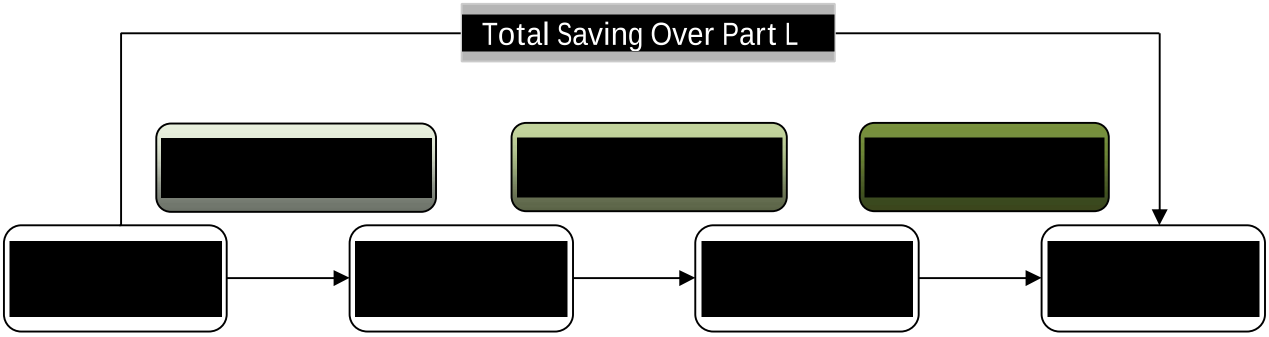
The approach for the proposed office extension at 2A St George's Road is to embed sustainability into the heart of the development through a range of design measures based on the 'Be Lean, Be Clean, Be Green' design hierarchy. Measures will include:

1. Building fabric to exceed existing building criteria within Building Regulation ADL2 2021
2. Efficient supply and extract ventilation via AHU
3. Heating and hot water will be provided from an existing heat pump system
4. Hot water will be provided by instantaneous electric water heaters
5. Efficient LED lighting strategy with daylight dimming and occupancy sensing lighting controls

For the purpose of the assessment we have modelled and assessed the proposed third floor extension using the DSM (Dynamic Simulation Methodology) approach within the IES-VE software.

Summary

The development has been provided with energy savings through the use of passive improvement measures such as improved energy efficiency. In line with the energy hierarchy illustrated below, the development complies with ADL2 2021 through efficiency measures alone. The development is serviced by a mix of highly efficient heat pumps from a centralised air handling unit system installed in 2017.



The principles of a Be Lean, Be Clean, Be Green design philosophy have been applied, which results in an overall 44% improvement over Building Regulations Part L2, as indicated in Table 1. A full design specification that confirms inputs used within the Part L calculations is provided within the appendices of this report.

Table 1 - Proposed development CO_2 emissions against Building Regulations Part L

	Total Regulated CO2 Emissions ($kgCO_2/yr$)	
Baseline Regulated Emissions of Development (pre improvement)	1,991	
Be Lean, Be Clean & Be Green	1,109	
Total Reduction in Energy ($kgCO_2/yr$)		882
Percentage Improvement in Carbon Emissions (above Bldg Regs Part L2 2021)		44.30%

1. Introduction

The proposed development at office extension at St George's Road includes the addition of a single floor on an existing three-storey office development. The new third floor will utilise the existing conditioning and air handling plant, which is to be relocated from the existing second floor roof to the third floor roof.

The area of the new office extension (179m^2) equates to 13.5% of the existing building floor area (1330m^2), therefore compliance under the existing building criteria of Building Regulations Approved Document Part L2 (2021) is required. The floor area of the proposed development does not meet the threshold to be considered a 'major development'.

Supporting information is provided within this report for the proposed energy strategy to be considered on site in accordance with the following planning policies:

- London Borough of Barnet's Local Plan (2012)
- The London Plan (2021)
- National Planning Policy Framework (2023)

Throughout this report, passive design techniques, energy efficient equipment and appropriate low carbon technologies will be appraised in line with the 'Be Lean, Be Clean, Be Green' philosophy of relevant planning documents and the Energy Hierarchy.

An assessment of CO_2 emissions will be made based on the calculation methodology dictated by the National Calculation Methodology (NCM) applied within IES-VE for the DSM modelling and in line with the requirements of London Borough of Barnet and Greater London Authority planning policy.

1.1. Location

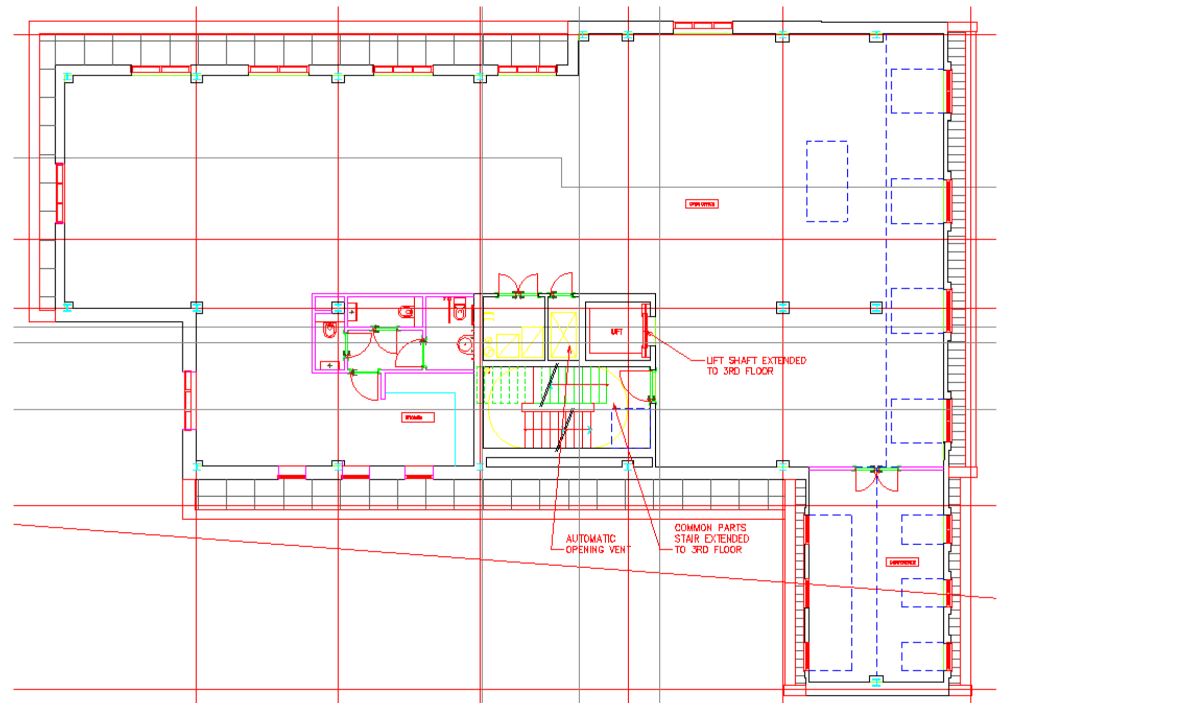
The site for the proposed office extension at 2A St George's Road, London is shown below in Figure 1. Golders Green underground station is located half a mile to the south of the site.

Figure 1 - Location and surrounding area of proposed office extension development at 2A St George's Road, London

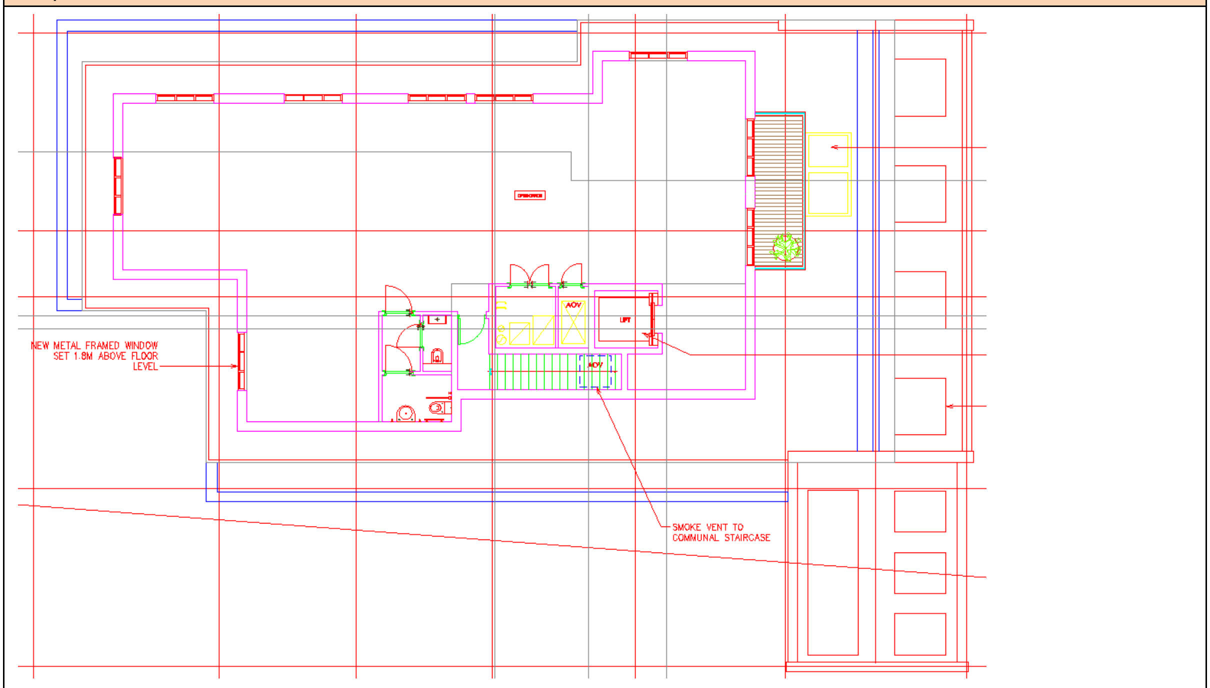
The site is located along St George's Road, off Finchley Road. Existing residential and commercial building surround the site. The proposed development site is therefore considered to be located in a dense urban area.

The proposed development consists of a single floor on an existing three-storey office development. The new third floor will utilise the existing conditioning and air handling plant, which is to be relocated from the existing second floor roof to the third floor roof. The second floor office area will have a rooflight removed due to the footprint of the new floor above, which will be compensated by the addition of windows to the north and west elevations. The area of second floor openings in relation to external wall changes from 12.12% to 14.07% and the rooflights from 2.28% to 1.07% in relation to the second floor roof area, therefore remaining under the allowable levels for openings as per ADL2 2021, Table 10.1. Other than this change, the second floor office will remain unchanged.

1.2. Floor Plans



Proposed Second Floor Plan



Proposed Third Floor Plan

Figure 2 – Second and third floor plans for the proposed St George's Road office extension

The proposed office extension is shown in Figure 2 above. Amendments will be undertaken to the second floor to allow for the third floor footprint and provide access from the existing stairwell. Open plan office space with amenity and plant areas are provided to both levels.

2. Policy Drivers for Energy Efficiency and Renewable Energy

This section presents a range of planning policy that is applicable to the proposed development site, at both a national and a local level.

2.1. National Policy

The National Planning Policy Framework was published in September 2023 and sets out the government's planning policies for England and they should be applied. Table 2 sets out the relevant energy standards for new developments and provides an indication of the design response to be provided.

Table 2 – Key National Planning Policy Requirements and Design Responses

Section	Policy Requirements	Design Response
14. Meeting the challenge of climate change, flooding and coastal change	The planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change. It should help to: Shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure.	This development will follow the principles set out in both the London Plan (2021) and the London Borough of Barnet's Local Plan (2012), using a 'Be Lean, Be Clean, Be Green' approach in reducing operational carbon emissions. An overview of current decentralised energy schemes around the site and an assessment on the potential for future schemes in relation to this development is provided in Section 6 of this report. This energy statement appraises site specific information to determine the most appropriate approach to minimise energy consumption.

2.2. Local Policy

The adopted London Borough of Barnet's Local Plan (2012) and The London Plan (2021) provide a set of guidelines for new development. All relevant energy policy within this document is provided within this section together with a design response.

Table 3 – Key Local Planning Policy Requirements and Design Responses

London Plan (2021)		
Section	Policy Requirements	Design Response
Policy SI 2 Minimising greenhouse gas emissions	A. Major development should be net zero-carbon. This means reducing greenhouse gas emissions in operation and minimising both annual and peak energy demand in accordance with the following energy hierarchy: 1. be lean: use less energy and manage demand during operation 2. be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly 3. be green: maximise opportunities for renewable energy by producing, storing and using renewable energy on-site 4. be seen: monitor, verify and report on energy performance. B. Major development proposals should include a detailed energy strategy to demonstrate how the zero-carbon target will be met within the framework of the energy hierarchy. C. A minimum on-site reduction of at least 35 per cent beyond Building Regulations is required for major development. Residential development should achieve 10 per cent, and non-residential development should achieve 15 per cent through energy efficiency measures. Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided, in agreement with the borough, either: 1. through a cash in lieu contribution to the borough's carbon offset fund, or 2. off-site provided that an alternative proposal is identified and delivery is certain.	The proposed third floor office extension development at 2A St George's Road, London will follow the principles of the 'Be Lean, Be Clean, Be Green' hierarchy to ensure that carbon emissions are reduced through a well-insulated thermal fabric and through energy efficiency measures. A review of the development's performance against the London Plan energy hierarchy is provided in Section 8.1 of this report. This report seeks to provide an overview of the energy demand and carbon dioxide emissions of the development, in respect to Building Regulations Part L (2021). Whilst this development area does not constitute

	D. Boroughs must establish and administer a carbon offset fund. Offset fund payments must be ring-fenced to implement projects that deliver carbon reductions. The operation of offset funds should be monitored and reported on annually. E. Major development proposals should calculate and minimise carbon emissions from any other part of the development, including plant or equipment, that are not covered by Building Regulations, i.e. unregulated emissions. F. Development proposals referable to the Mayor should calculate whole life-cycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions.	a major development, the principles and process of The London Plan (2013) methodology have been applied to minimise carbon emissions as a result of the development. A significant carbon reduction will be made on site through efficiency measures alone. Carbon calculations are provided in Section 8.
Policy SI 3 Energy infrastructure	A. Boroughs and developers should engage at an early stage with relevant energy companies and bodies to establish the future energy and infrastructure requirements arising from large-scale development proposals such as Opportunity Areas, Town Centres, other growth areas or clusters of significant new development. B. Energy masterplans should be developed for large-scale development locations (such as those outlined in Part A and other opportunities) which establish the most effective energy supply options. Energy masterplans should identify: 1) major heat loads (including anchor heat loads, with particular reference to sites such as universities, hospitals and social housing) 2) heat loads from existing buildings that can be connected to future phases of a heat network 3) major heat supply plant including opportunities to utilise heat from energy from waste plants 4) secondary heat sources, including both environmental and waste heat 5) opportunities for low and ambient temperature heat networks 6) possible land for energy centres and/or energy storage	An assessment of the development's proximity to existing heat networks is provided in Section 6 with extracts from the London Heat Map and the Association for Decentralised Energy District Heating Installation Map. In addition to this, an assessment of district heating feasibility for the development is also provided in this section. As the site is not within close proximity to any existing heat networks, and the development is relatively small-scale, a decentralised energy

	7) possible heating and cooling network routes 8) opportunities for futureproofing utility infrastructure networks to minimise the impact from road works 9) infrastructure and land requirements for electricity and gas supplies 10) implementation options for delivering feasible projects, considering issues of procurement, funding and risk, and the role of the public sector 11) opportunities to maximise renewable electricity generation and incorporate demand-side response measures. C. Development Plans should: 1) identify the need for, and suitable sites for, any necessary energy infrastructure requirements including energy centres, energy storage and upgrades to existing infrastructure 2) identify existing heating and cooling networks, identify proposed locations for future heating and cooling networks and identify opportunities for expanding and inter-connecting existing networks as well as establishing new networks. D. Major development proposals within Heat Network Priority Areas should have a communal low-temperature heating system: 1. the heat source for the communal heating system should be selected in accordance with the following heating hierarchy: a. connect to local existing or planned heat networks b. use zero-emission or local secondary heat sources (in conjunction with heat pump, if required) c. use low-emission combined heat and power (CHP) (only where there is a case for CHP to enable the delivery of an area-wide heat network, meet the development's electricity demand and provide demand response to the local electricity network) d. use ultra-low NOx gas boilers	network is not considered feasible in this instance. The location of the development on the London Heat Map is shown in Section 6. The proposed development is assessed under the existing building criteria of the Building Regulations Part L (2021). In addition, the proposed office extension size does not constitute a major development as per the guidance within The London Plan (2021). As the development an extension of an existing building, there is no scope for the development of a new heat network. However the existing air handling unit and air source heat pump units will be retained and moved to the roof above the proposed extension and connected into the new extension area. This provides minimal

	2. CHP and ultra-low NOx gas boiler communal or district heating systems should be designed to ensure that they meet the requirements in Part B of Policy SI 1 Improving air quality 3. where a heat network is planned but not yet in existence the development should be designed to allow for the cost-effective connection at a later date. E. Heat networks should achieve good practice design and specification standards for primary, secondary and tertiary systems comparable to those set out in the CIBSE/ADE Code of Practice CP1 or equivalent.	embodied carbon impact and ensures that a high efficiency system (installed in 2017) is re-used to achieve compliance, rather than new technologies being required.
Policy SI 4 Managing heat risk	A. Development proposals should minimise adverse impacts on the urban heat island through design, layout, orientation, materials and the incorporation of green infrastructure. B. Major development proposals should demonstrate through an energy strategy how they will reduce the potential for internal overheating and reliance on air conditioning systems in accordance with the following cooling hierarchy: 1) reduce the amount of heat entering a building through orientation, shading, high albedo materials, fenestration, insulation and the provision of green infrastructure 2) minimise internal heat generation through energy efficient design 3) manage the heat within the building through exposed internal thermal mass and high ceilings 4) provide passive ventilation 5) provide mechanical ventilation 6) provide active cooling systems.	The proposed office extension development will utilise the existing air handling systems with heat pump condensing units already installed. However, a low glazing ratio of ~13% ensures solar gains are controlled through fenestration design, with a low g-value of 0.4 also applied. This aims to provide adequate levels of thermal comfort in peak summer conditions without the use of cooling, where possible.
London Borough of Barnet's Local Plan (2012)		
Section	Policy Requirements	Design Response
Policy CS 13: Ensuring the efficient use of natural resources	We will seek to minimise Barnet's contribution to climate change and ensure that through the efficient use of natural resources the borough develops in a way which respects environmental limits and improves quality of life. We will promote the highest environmental standards for development and through our SPDs on Sustainable Design and	The development will exceed the carbon efficiency requirements of Barnet's Local Plan (2012) and The London Plan (2021). An overview

	Construction and Green Infrastructure we will continue working to deliver exemplary levels of sustainability throughout Barnet in order to mitigate and adapt to the effects of a changing climate. We will expect all development to be energy efficient and seek to minimise any wasted heat or power. In line with London Plan Policy 5.2 – Minimising Carbon Dioxide Emissions we will expect major development in accordance with the Mayor's energy hierarchy to reduce carbon dioxide emissions beyond the 2010 Building Regulations. We will maximise opportunities for implementing new district-wide networks supplied by decentralised energy (including renewable generation) in partnership with key stakeholders in areas of major mixed use growth including town centres. Where feasible we will expect all development to contribute to new and existing frameworks. We will support solutions that minimise or avoid harm to a heritage asset's significance while delivering improved energy performance or generation. We will make Barnet a water efficient borough and minimise the potential for fluvial and surface flooding by ensuring development does not cause harm to the water environment, water quality and drainage systems. Development should utilise Sustainable Urban Drainage Systems (SUDS) in order to reduce surface water run-off and ensure such run-off is managed as close to its source as possible subject to local geology and ground water levels. We will improve air and noise quality by requiring Air Quality Assessments and Noise Impact Assessments from development in line with Barnet's SPD on Sustainable Design and Construction.	of carbon emissions reductions is provided within Section 8. An overview of decentralised energy is provided in Section 6. The small scale and nature of this development suggests that it is not feasible for a decentralised energy network to be created. An overview of suitable renewable technologies is provided in Section 7. Air source heat pumps will be included within this development. The proposed development does not meet the threshold for major development and will be assessed as an extension to the existing building under Part L2 2021 as it forms less than 25% of the existing building floor area.

3. Methodology

The first step of the full energy strategy assessment has been to undertake a baseline energy assessment. The baseline energy assessment consists of calculating the total CO_2 emissions of the development to meet Building Regulations and then compare the proposed improvement measures against this baseline.

The existing building criteria within Building Regulations Part L2 2021 applies to the new build office extension given it is below 25% of the existing building floor area. No significant refurbishment will be provided to other floor of the existing building. Building Regulations Part L provides a benchmark of carbon emissions from regulated energy. The development can then be benchmarked/thermally modelled using the energy hierarchy:

1. Be Lean A reduction in energy use as a result of passive design and energy efficiency
Thermal performance of envelope (U-values) Glazing design Airtight construction Efficient mechanical ventilation and heat recovery Variable speed fans and pumps Energy Efficient lighting
2. Be Clean A focus on supplying energy to the development through efficient means
Connect to low carbon heat networks Develop site wide heat network from single energy centre On site CHP Provide energy efficient individual heating
3. Be Green The installation of renewable technologies to meet energy demand where possible
Consider the feasibility of renewable energy technologies Assess the integration of renewable technologies based on the above measures

The development must be provided with energy savings through the use of thermal improvements to fabric (a 'fabric first' approach), followed by other clean energy solutions (energy efficiency improvements, district heating, etc.) and finally the use of renewable energy technologies, where practical. This hierarchy complements the integrated approach to the sustainable energy objectives of the London Plan (2021).

The planning policies require a full review of the technical and economic feasibility of the following renewable technologies:

- Biomass heating
- Biomass combined heat and power
- Solar hot water
- Solar photovoltaic
- Ground source heat pumps
- Air source heat pumps / exhaust air heat pumps
- Wind power

To achieve the targets set the development must achieve a balance between fabric, heating and control, ventilation and air leakage improvements, the amount of zero or low carbon technology installed and the capital, life cycle and running costs, maintenance and operation, etc.

Feasible renewable energy technologies have been considered during the assessment to ensure the most suitable renewable energy is chosen for the demands of this scheme. The pros and cons of each technology with respect to this site are considered as part of this statement.

4. Baseline Energy Assessment

Energy Counsel have based the analysis on current Building Regulations Part L 2021. As the extension area is less than 25% of the total floor area of the existing building, it will be assessed under the existing building/extension criteria under Building Regulations ADL2 2021.

The energy model measures the Target Emissions Rate (TER) of a proposed development against the Building Emissions Rate (BER) to establish compliance. These calculations will be undertaken using Dynamic Simulation Modelling (DSM) using IES-VE 2023.

For existing building and refurbishment developments, two separate models are required. If the Actual Building consumes less CO_2 emissions than the Notional Building (Baseline BRUKL), therefore compliance against Part L2 2021 is confirmed. BRUKL reports for pre and post-development have been provided to demonstrate, but please be aware that the BER does not have to be lower than the TER on the BRUKL (as for new build), it is just the comparison between the two BERs that is relevant.

4.1. Predicted Baseline Energy Requirements

Table 4 - Baseline Part L2 notional building carbon emissions

Ref	Unit Type	Area (m^2)	TER	Regulated Carbon Emissions (Kg CO_2/yr)	Unregulated Carbon Emissions (Kg CO_2/yr)
Z61061	3F Office Extension (L2B)	178.6	11.15	1,991	1,110
Total				1,991	1,110

The baseline regulated carbon emissions is 1,991 KgCO_2/yr.

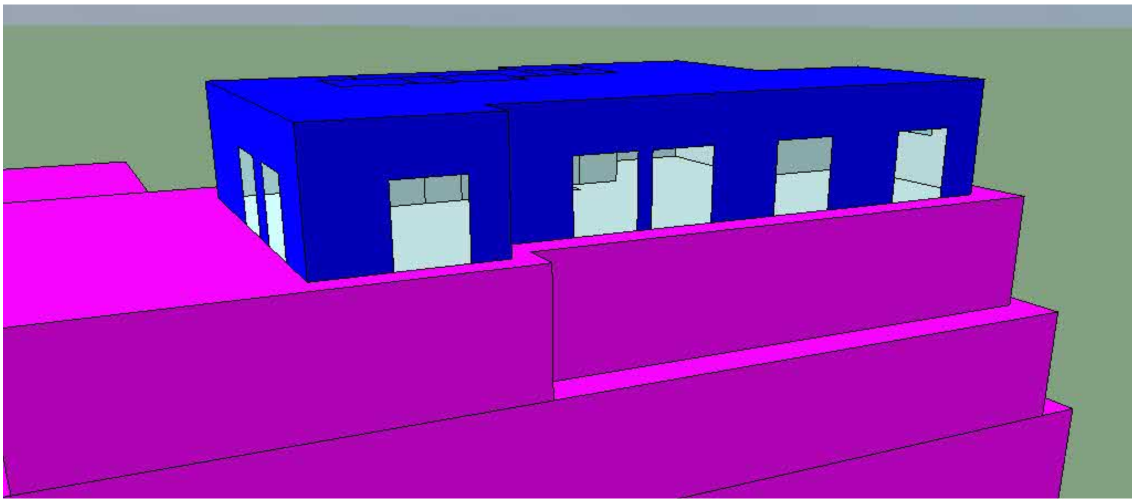


Figure 3 – Visualisation of proposed additional storey modelled dynamically within IES-VE 2023

5. Passive Design and Energy Efficiency

The approach of the development is to embed sustainability into the heart of the design from the outset of the project design process. The design will be developed with sustainable solutions, taking into account the relevant policies and strategies of the London Plan (2021) and the London Borough of Barnet's Local Plan (2012).

The development will seek to consider all aspects and principles of sustainable development, taking into account environmental, social and economic impacts.

5.1. Passive Design Measures

The philosophy for the site is to achieve as much of the necessary reduction in carbon emissions through the use of passive design techniques and energy efficient measures as possible, before resorting to the use of LZCs. This ensures that the highest standards of building fabric and energy efficiency are achieved.

This will be undertaken through a fabric-first energy efficient design approach with high levels of thermal efficiency and a reduction in energy demand through efficient lighting design.

5.2. Energy Efficient Systems

Options have been reviewed for improving the energy efficiency of the development and the most appropriate option is to connect to the existing air handling unit installed in 2017. This Daikin unit links to rooftop heat pump condenser units with heat recovery ventilation, providing a high seasonal coefficient of performance (SCOP) and allows for the use of existing equipment to reduce the embodied carbon of the development.

6. District & Communal Heating Networks

This section outlines how consideration of energy supplied efficiently from a district heating network can be provided to the dwellings in line with the energy hierarchy.

6.1. Decentralised Heating Networks

The energy policy reaffirms the view that energy generated by centralised power stations and transmitted through the national grid is highly inefficient and wasteful.

One of priorities for reducing CO_2 emissions is to reduce reliance on centralised power stations. This means increasing the use of local, low-carbon energy supplies through de-centralised energy systems.

De-centralised plant generally means any heating and hot water and/or electricity generation provided on a district wide (DHN) or site wide (CHN) basis. DHN and CHN can typically include combined heat and power equipment (CHP). CHP is an engine which, when running, generates electricity and heats water which can then be distributed around a development.

Benefits of district heating networks can include:

- Provision of low carbon / lower cost heat to domestic and commercial customers
- Diversification of the energy mix
- Reductions in region-wide carbon emissions
- Targeting and reduction of fuel poverty
- Potential long-term revenue streams for local authorities
- Alignment with regeneration programmes
- Driving the growth of the low carbon services sector

There are currently no existing district heating networks within proximity to the site, as shown in Figure 4, and the development of a decentralised system would not be feasible or beneficial for a project of this scale. The site location is indicated on the London Heat Map in Figure 5, which confirms the site is not within an existing heat network area.

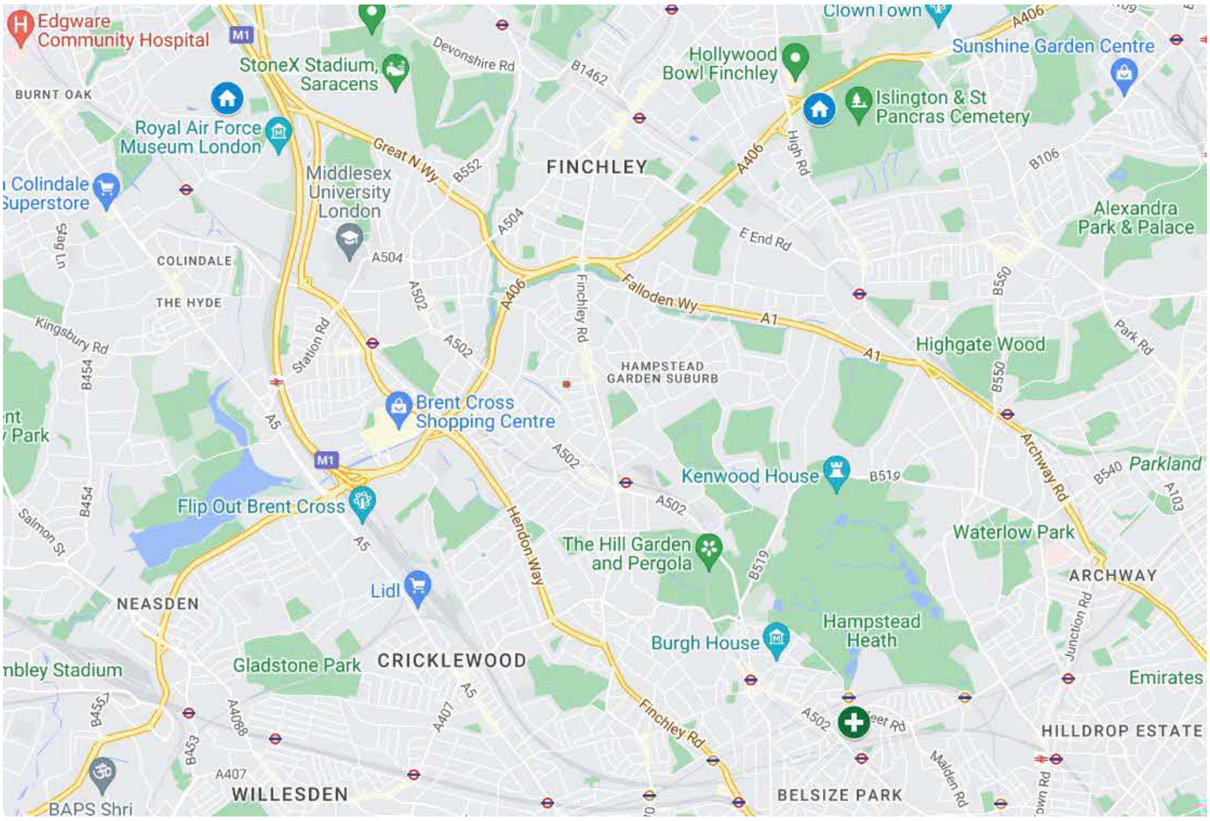


Figure 4 - District heating networks nearby site (indicated by red dot)

Figure 5 - Site location indicated on the London Heat Map

7. Renewable Energy Technologies

Energy Counsel have reviewed options for the use of on-site renewable energy/Low or Zero Carbon Technology (LZT) in line with the policy aspirations of the London Plan (2021) and the London Borough of Barnet's Local Plan (2012).

This renewable energy statement/strategy reviews the technical and economic feasibility of the following technologies:

- Solar Photovoltaic
- Solar Hot Water
- Ground Source Heat Pumps
- Air Source Heat Pumps / Exhaust Air Heat Pumps
- Micro Wind Power
- Biomass

7.1. Photovoltaics (PV)

Photovoltaic panels convert sunlight into electricity to run lights and appliances. Photovoltaic panels use cells to convert light into electricity. A PV cell normally consists of 1 or 2 layers of a semi conducting material such as silicon. When light shines on a cell it generates energy causing electricity to flow, the higher the light intensity is, the more electricity flows.

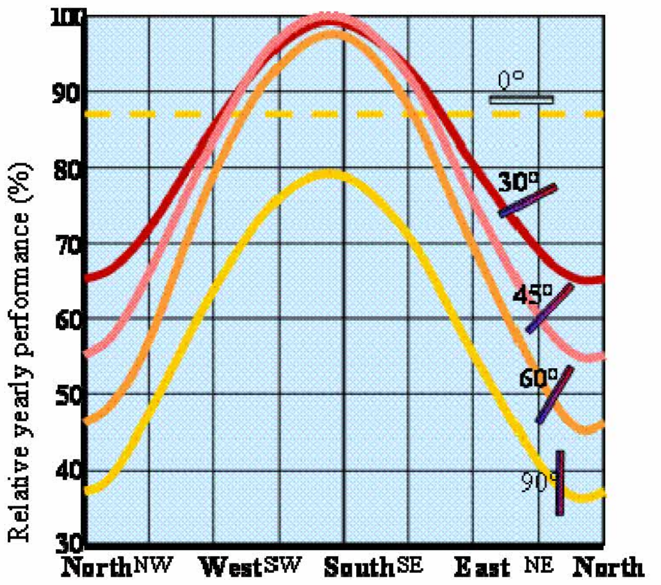


Figure 6 - Performance of photovoltaic panel orientation

The amount of energy PV cells generate is referred to as Kilowatt Peak (KWp). PV arrays now come in a variety of shapes and colours, ranging from grey 'solar tiles' that look like roof tiles to panels and transparent cells that you can use on conservatories and glass to provide shading as well as generating electricity. As solar panels can be heavy, the roof should be strong enough to take their weight, especially if the panel is placed on top of existing tiles. For flat roofs the panels can be mounted on A-frames to give the optimum angle.

The optimum panel inclination for solar collection is 35°, oriented due south; however panels that are inclined between 35° and 45° and oriented south of west or east are generally suitable. If solar collectors are oriented away from due south, then a larger surface area will be required to generate a set amount of energy. The effect of non-optimal orientation is illustrated by the graph to the right:

Figure 7 - Photovoltaic array on a pitched roof

The cost to install PV is typically £1,000 - £1,500 per kWp for 'on-roof' panel systems.

The flat roof will be of a relatively small size and with the relocated existing AHU plant there is not likely to be much space for a photovoltaic panel array that would provide any kind of significant impact on the Part L performance. For this reason a PV array is discounted.

7.2. Solar Thermal HW Panels

Solar panel heating uses the radiant energy from the sun to heat hot water, most commonly for domestic hot water needs. There are two types of collectors used for solar water heating – flat plate collectors and evacuated tubes collectors. The systems function successfully in all parts of the UK, as they can work in diffuse light conditions. The collector should be mounted on a 10-60 degrees pitch facing south, although other variations can be used, south is the most efficient.

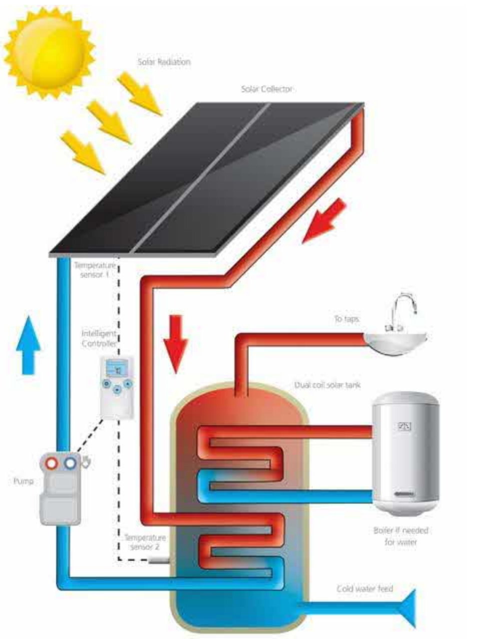


Figure 8 - The principles of a solar thermal system

The cost of installing the system is dependent on the distance between the solar collector and the hot water storage and therefore costs vary. The closer the collectors are to the hot water storage, the less pipe work is required. Annual maintenance checks are recommended. The solar collectors are connected to a condensing boiler via a HW cylinder with twin coil.

A typical installation in the UK has a panel size of 3-5m^2 which is used in conjunction with a HW storage tank of 180-300litres, of which a minimum of 90-150 litres must be dedicated to solar hot water storage.

They are a 'simple' and guaranteed technology which will act as a pre-heat for the Hot Water and Heating usage. Payback between capital cost and energy saving can normally be achieved within 12 – 20 years, subject to usage and dwelling type.

The use of solar thermal panels work best in conjunction with individual heating systems for dwellings. The orientation of the development is fine for the utilisation of solar water heating to provide domestic hot water however it will not achieve significant carbon savings. Carbon savings of approximately 4-5% are achievable with this technology. The proposed development is unlikely to require sufficient hot water storage to deem solar thermal a feasible technology for this site. For the reasons aforementioned this is not an appropriate option for this scheme.

7.3. Ground Source Heat Pump (GSHP)

GSHPs have been developed specifically for the housing market and are now considered to be an established reliable technology. The GSHP would be sized to cater for the heating and domestic hot water requirements. Typically, they are more suited to apartments as a centralised system would be installed with multiple bore holes to a depth of up to 125 metres depending on the ground conditions. GSHPs use a heat exchanger to extract heat from the earth.

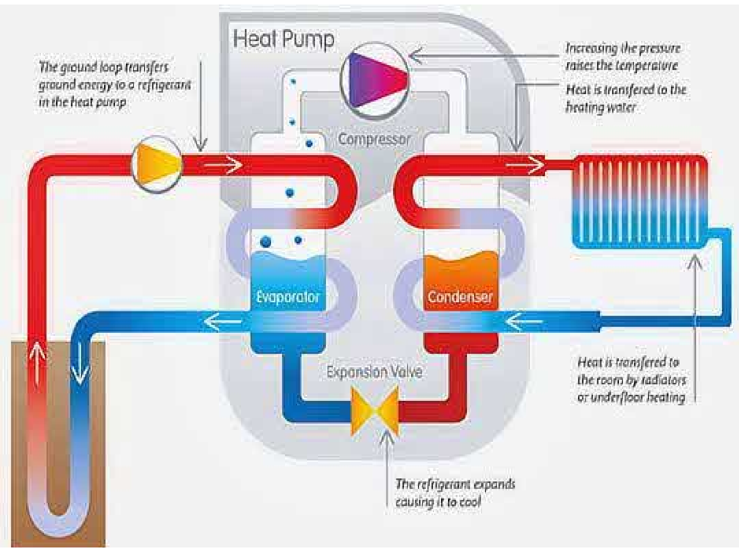


Figure 9 - Principles of a GSHP system

The efficiency of ground source heat pumps is measured by Co-efficient of Performance (CoP), this is the ratio of units of heat output for each unit of electricity used to drive the compressor and pump for the ground loop. Average CoP is around 2-4 although some systems may produce a greater rate of efficiency. This means that for every unit of electricity used to pump the heat, 2-4 units of heat are produced, making it an efficient way of heating a building. If grid electricity is used for the compressor and pump, then there is the opportunity to consider a range of energy suppliers to benefit from the lowest running costs, for example by choosing an economy 10 or economy 7 tariff.

Due to the relatively small scale of this development, GSHPs are not considered an appropriate design solution.

7.4. Air Source Heat Pump/Exhaust Air Heat Pump

Air source heat pumps (ASHP) and exhaust air heat pumps (EAHP) work in a similar way to GSHP. Air source heat pumps can be fitted on the external façade or in the roof space. An air source heat pump uses small amounts of electricity to take in large quantities of air and extract heat. The efficiency of ASHP is measured by Coefficient of Performance (CoP); this is the ratio of units of heat output for each unit of electricity used to drive the system. Average CoP is around 2-4 although some systems may produce a greater rate of efficiency.

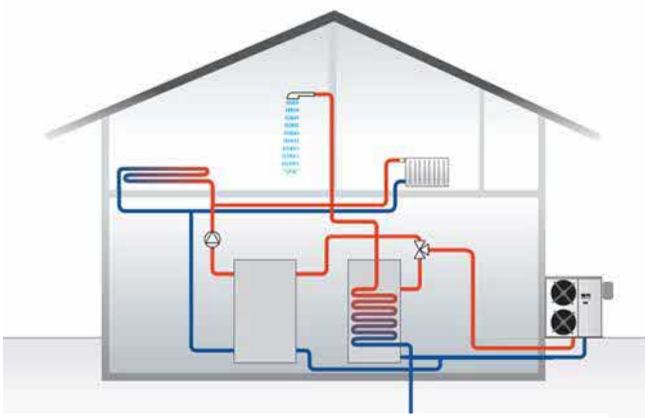


Figure 10 - Principles of an ASHP system

Exhaust air heat pumps such as the NIBE F370 work in a similar manner to ASHP units but have only indoor units (no outdoor compressors) and in addition they also recover heat from their integral exhaust air ventilation system. These units work well on apartment blocks and dwellings where mains gas is unavailable or unsuitable for a development. They are expensive in terms of capital cost of the equipment, installation and the enhanced structural requirements.

ASHP technology is currently in use via the existing office building AHU and will also be applied to the new build office extension. The SCOP/SEER values from the existing Daikin system have been applied within the proposed development Part L calculations.

7.5. Micro Wind Power

Wind power is one of the cleanest and safest methods of generating electricity. However, wind power is unfeasible due to the fact the development is in an urban area and local wind conditions would not be sufficient to provide enough power. Most small wind turbines generate Direct Current (DC) electricity. Systems that are not connected to the national grid require battery storage and an inverter to convert DC electricity into Alternating Current (AC) which is mains electricity.

There are two types of wind turbine available:

Roof mounted – Mounted on the roof of dwellings

Mast mounted – Free standing units

Important issues to consider when using wind turbines are:

Figure 11 - Mounted wind turbine

- Wind speed increases with height so it's best to have the turbine high on a mast or tower.
- Generally speaking the ideal site is a smooth top hill with a flat, clear exposure, free from excessive turbulence and obstructions such as large trees, dwellings or other buildings.
- Small scale wind power is particularly suitable for remote off grid locations where conventional methods of supply are expensive or impractical.
- Where the local annual average wind speed is 6 m/s or more.
- Where there are no significant nearby obstacles such as buildings, trees or hills that are likely to reduce the wind speed or increase turbulence

As this development is in an urban area there will be obstacles which reduce wind speed. The average wind speed in this area is 4.9 m/s at a height of 10 metres, which is less than the 6 m/s required. Therefore, micro wind is not a viable technology for this development.

7.6. Biomass

Biomass is a generic name for any fuel produced from organic sources and falls into mainly two categories:

- Woody biomass- forest products, untreated wood products, energy crops and wood pellets
- Non-wood biomass – liquid biofuels (such as biodiesel, bioethanol) or animal waste industrial municipal products and high energy crops such as rape seed, sugar cane and maize.

For domestic properties the fuel used is normally wood pellets, wood chips or wood logs. For larger applications, biomass boilers replace conventional fossil fuel boilers and come with an automated feed by screw drives from hoppers.

Biomass systems require more cleaning than gas or oil boilers and they must be capable of being taken out of service for cooling and cleaning whilst maintaining the building heating supply particularly in communal heating systems. Centralised gas boilers are therefore still required to support the biomass boiler, which would be the lead boiler. The size of the dedicated plant rooms is substantial. Fuel availability, delivery and storage are also important issues to consider.

Air quality issues are also an important factor when looking to install biomass. The cost of the fuel depends on the type, delivery distances and whether it is obtained as simple waste product or from another organisation. The cost of wood pellets is currently a little more expensive than mains gas, and woodchip is approx. 30% cheaper, however prices are fluctuating rapidly in the bio-fuel market at the present time creating uncertainty over their take up.

Figure 12 - Biomass boiler and hopper

Biomass CHP is still relatively new to the UK market and is more suitable to large developments where energy demand does not require significant modulation. There are technical issues with small scale Biomass CHP and until these can be resolved and proven the take up of these systems in the UK and Europe has been slow.

Overall carbon savings of 40%+ are achievable with biomass technology. Biomass is more suited to a communal heating system; there is insufficient space to accommodate the equipment and fuel storage to facilitate a biomass boiler. Furthermore, there are noise and air quality issues associated with this type of technology. For this reason, biomass is discounted.

8. Energy Assessment of Proposed Scheme

The proposed office extension at 2A St George's Road has adopted the principles of the 'Be Lean, Be Clean, Be Green' approach.

The most practical and economically feasible solution for the development is a good quality thermally insulated fabric, airtight envelope, passive improvements and the use of highly efficient heating and ventilation systems.

Air source heat pumps are included in new office areas based on the performance of the retained Daikin system. Ventilation is provided by a centralised AHU to all new office areas with heat recovery.

Table 5 - Proposed carbon emissions from the proposed office extension at 2A St George's Road

Ref	Unit Type	TER	DER	Improv. Factor (%)	Regulated Carbon Emissions (Kg CO_2/yr)	Unregulated Carbon Emissions (Kg CO_2/yr)
Z61061	3F Office Extension (L2B)	11.15	6.21	44.30	1,109	1,110
Total				44.30%	1,109	1,110

The regulated carbon emissions are 1,109 Kg/CO_2/yr. This is a total carbon reduction of 882 Kg/CO_2/yr from the baseline regulated emissions of 1,991 Kg/CO_2/yr this equates to a 44.30% carbon reduction over Part L 2021.

The development proposal meets local policy including energy efficient lighting, efficient mechanical ventilation with heat recovery, improved thermal bridging, low air leakage and highly efficient space and water heating through the existing air source heat pumps.

8.1. London Plan (2021) Requirements

This development provides reductions of 44% on Part L (2021) through a combination of an enhanced building fabric, efficient lighting, air source heat pumps and mechanical ventilation with heat recovery. Calculations are provided below against each level of the London Plan (2021) for the proposed office extension.

Table 6 - London Plan (2021) carbon calculation tables

GLA Energy Hierarchy	New-Build Carbon Dioxide Emissions (Tonnes CO_2 per Annum)		
	Total Regulated Emissions (Tonnes CO_2 per Annum)	CO_2 Savings (Tonnes CO_2 per Annum)	Saving (%)
BASELINE: Part L 2021	2.0		
BE LEAN: After Energy Demand Reduction	1.1	0.9	44.3
BE CLEAN: After CHP	1.1	0.0	0
BE GREEN: After Renewable Energy	1.1	0.0	0
Total Savings (Tonnes CO_2)		19.38	44.3

The table above adopts the calculation methodology within the GLA Energy Assessment Guidance (2022) and confirms that a 44.3% emissions reduction is provided through energy efficiency measures on site.

The development achieves greater than a 35% on site reduction in CO_2 emissions, additional carbon offsetting calculations is not required for this development given it is below the threshold for major development.

9. Conclusion

Following the 'Be Lean, Be Clean, Be Green' hierarchy, the proposed design solutions are predicted to reduce the total carbon emissions by 882 kg/CO_2/yr from the baseline emissions of 1,991 kg/CO_2/yr. This equates to a 44.30% carbon reduction from the calculated baseline regulated energy emissions of Part L 2021.

The approach for the proposed office extension at 2A St George's Road, London is to embed sustainability into the heart of the development through a range of design measures based on the 'Be Lean, Be Clean, Be Green' design hierarchy. Measures will include:

1. Building fabric to exceed existing building criteria within Building Regulation ADL2 2021
2. Efficient supply and extract ventilation via AHU
3. Heating and hot water will be provided from an existing heat pump system
4. Hot water will be provided by instantaneous electric water heaters
5. Efficient LED lighting strategy with daylight dimming and occupancy sensing lighting controls

5.1. Low/ Zero Carbon Technologies (LZT) Review

Photovoltaic panels have not been proposed for the development due to the relatively small area of flat roof available due to the relocation of the existing AHU and heat pump condensing units.

Solar Thermal Hot Water is not considered a suitable option due to spatial issues and a low level of hot water demand.

Biomass has been discounted as it poses problems in terms of air quality, delivery of fuel, storage and transportation for deliveries etc. It would require a centralised larger plant space for storing fuel, which on this constrained site is not viable.

Micro-wind turbines do not work on this type of development due to problems with wind turbulence and mounting of the units. The wind speeds in the area are not conducive to wind power electricity generation and there would be issues with turbulence, wind shading, noise and air traffic.

GSHPs are not viable for site as the office extension will be provided on an existing building with no access to the ground for borehole installation.

ASHP units are included within the preliminary SBEM/DSM calculations for the proposed office extension to meet heating demand. Efficiencies are based on the existing Daikin system.

A more detailed overview of LZT technologies is provided in the appendices of this report.

5.2. Summary Headlines

A passive fabric-first approach has been taken to reduce the energy demand of the proposed office extension development at 2A St George's Road below the TER of ADL2 (2021) before the application of low and zero carbon technologies.

A highly efficient servicing strategy of air source heat pumps (ASHP) and a heat recovery ventilation system provides significant reductions on the TER of ADL2 (2021).

An overall 44% improvement in CO_2 emissions above the Part L 2021 baseline is proposed to support our application.

Table 7 - Summary of Carbon Emissions

	Regulated CO_2 Emissions ($kgCO_2/yr$)	
	Total	
Baseline Regulated Emissions of Development (pre improvement)	1,991	
Be Lean, Be Clean & Be Green	1,109	
Total Reduction in Energy ($kgCO_2/yr$)		882
Percentage Improvement in Carbon Emissions (above Building Regs Part L 2021)		44.30%

6. Appendices

6.1. LZT Feasibility Table

Technology	Technical Feasibility	Carbon Savings	Estimated Costs	Financial Viability
Solar photovoltaics	The relatively small area of roof on this development means that a photovoltaic panel installation is unlikely to provide significant benefit.	A 0.5kWp system could save around 204 kg of CO2 per year per dwelling.	Average cost for such a system is around £1.5K per dwelling.	Current potential income generation is around £230 per annum per dwelling, with a fuel cost saving of around £60 per year per dwelling.
Wind	Average wind speeds on the site according to the NOABL Wind Speed Database are 4.9m/s. To be technically feasible a minimum of 6m/s is required, therefore this site is not considered feasible.	N/A	N/A	N/A
Micro Hydro	There is no capacity for micro hydro on this site since there are no local water courses available.	N/A	N/A	N/A
District Heating	There are currently no existing or planned district heating networks to facilitate connection at this stage.	N/A	N/A	N/A
Solar Hot Water	This technology has been discounted as the level of hot water usage does not merit a storage system, which poses space issues.	Around 270 kg of CO2 per year per dwelling.	£3-5K per dwelling	Income generation from RHI in a 4-person household would be in the region of £340 / year (per dwelling) with a fuel saving of around £65 per year per dwelling
Heat Pumps	GSHP: As this is a top floor extension on an existing building, the installation of GSHP boreholes would not be feasible. ASHP: Heat pumps are already installed in the existing building and the performance values from these units are applied in the Part L calculations.	GSHP: 2,100 to 3,300 kg CO2 per year per dwelling ASHP: 1,700 to 2,700 kg CO2 per year per dwelling.	GSHP @ £13-20K per dwelling ASHP: £7-11K per dwelling	GSHP: £2,590 minimum annual RHI income generation per dwelling with fuel saving of £440 per year minimum per dwelling ASHP: £920 minimum annual RHI income generation per dwelling with fuel saving of £335 per year minimum per dwelling
Biomass	The small scale of this development would not facilitate the installation of biomass boilers due to the space required for pellet storage.	N/A	N/A	N/A

6.2. Specification for Energy Assessments

Item	Brief Description	Notes	Confirm
	The following information is required for the design submission (as per ADL2 2021).	Please note submission is now in two stages. A) **Design** B) As installed	
1. Building Details			
1.1	Building Regulations Part L2 2021 applies.		
1.2	Full building address is:		
1.3	Building owner is:		
1.4	Electric Power Factor Correction = <0.90		
2. Floor Construction Details			
2.1	There is no ground floor element to the proposed development.		
3. Wall Construction Details			
3.1	External walls are insulated and achieve the U-value stated opposite.	U-Value = 0.18 W/m²K	
4. Roof Construction Details			
4.1	Roof areas are insulated to achieve the U-value indicated opposite.	U-Value = 0.13 W/m²K	
5. Openings			
5.1	All double-glazed windows and glazed doors are to achieve the U-value and G-value indicated opposite.	U-Value = 1.4 W/m²K G-Value = 0.40	
6. Ventilation			
6.1	A design stage air permeability rate of 4m3/hr.m2 at 50pa has been applied.		
6.2	Centralised mechanical ventilation with heat recovery is provided by an AHU to main office area.	SFP = 1.28 W/l/s HR = 88%	
6.3	Local continuous extract ventilation is provided to WC areas.	SFP = 0.3 W/l/s	
6.4	All other areas of the building are naturally ventilated.		
7. Space Heating and Cooling			
7.1	Heating and cooling to offices to be provided by an air-to-air heat pump from the existing Daikin system.	SCOP = 4.09 SEER = 3.77	
7.2	Heating and cooling to circulation and WC areas to be provided by electric panel heaters.		
7.3	All heating systems provided with central time control and local temperature controls.		
7.4	Heating systems are metered but are not provided with automatic monitoring and targeting with alarms to warn out-of-range values.		
8. Water Heating			
8.1	Water heating is provided to WCs by instantaneous electric systems.		
8.2	Secondary circulation has not been provided on hot water systems.		
9. Lighting and Lighting Controls			
9.1	Luminaire efficacies have been applied as per the figure opposite. LED lighting is assumed throughout.	Efficacy = 110 lm/W LOR = 1	
9.2	Presence detection is provided to all WC and circulation areas.	Parasitic Power = 0.1W/m	
9.3	Daylight dimming has been provided to all office areas.	Parasitic Power = 0.1W/m	
9.4	Light fitting energy use is metered but not provided with automatic monitoring and targeting with alarms to warn out-of-range values.		

10. Renewables			
10.1	No renewable technologies included within the development.		
11. Other			
11.1	All fans are in accordance with the minimum requirements of Table 6.9 of ADL Volume 2: Buildings other than dwellings, 2021 in terms of Specific Fan Power.		
11.2	A Building Log Book will be provided following the guidance in CIBSE TM31, Building Log Book Toolkit.		
11.3	Building Regulations Part L2 2021 apply. Please confirm that all fixed building services are in accordance with the minimum standards set out in Section 6 of ADL2 2021.		

6.3. Index of Tables and Figures

6.4. BRUKL Outputs Reports (Baseline & Proposed)

BRUKL Output Document

Compliance with England Building Regulations Part L 2021

HM Government

Project name

Z61061 Office Extension - Part L Baseline

As designed

Date: Tue Oct 31 09:16:44 2023

Administrative information

Building Details

Address: Royal Mail Sorting Office, London, NW11 0LS

Certifier details

Name: Anthony Turner

Telephone number:

Address: Energy Counsel, Viridor House, 3 Bolholt Terrace, Bury, BL8 1PP

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 [m²]: 174.15

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	4.51	
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	11.15	
Target primary energy rate (TPER), kWh_{PE}/m^2.annum	48.7	
Building primary energy rate (BPER), kWh_{PE}/m^2.annum	120.13	
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	$U_{a-Limit}$	U_{a-Calc}	U_{i-Calc}	First surface with maximum value
Walls*	0.26	0.26	0.26	3F000001:Surf[2]
Floors	0.18	-	-	UNKNOWN
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.18	0.18	3F000001:Surf[0]
Windows** and roof windows	1.6	1.6	1.6	3F000001:Surf[1]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	-	-	No personnel doors in building
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

$U_{a-Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
U_{i-Calc} = Calculated maximum individual element U-values [W/(m²K)]
U_{a-Calc} = Calculated area-weighted average U-values [W/(m²K)]

* 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/m²K

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
m³/(h.m²) at 50 Pa	8	8

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- FCU Baseline

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	2.5	3	0	2.6	-
Standard value	2.5*	4.5**	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.

** Standard shown is for air-cooled chillers >=400 kW. For chillers <400 kW, limiting SEER is 4.

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

1- DHW - Local Elec

	Water heating efficiency	**Storage loss factor [kWh/litre per day]**
This building	1	-
Standard value	1	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**
3F Open Plan Office	-	-	-	-	-	-	-	0.9	-	-	N/A
3F WC	-	-	-	-	-	-	-	0.9	-	-	N/A
3F Circulation	-	-	-	-	-	-	-	0.9	-	-	N/A
3F WC	-	-	-	-	-	-	-	0.9	-	-	N/A
3F Stairwell	-	-	-	-	-	-	-	0.9	-	-	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
3F Open Plan Office	95	-	-
3F WC	95	-	-

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
3F Circulation	95	-	-
3F WC	95	-	-
3F Stairwell	95	-	-
3F Plant	95	-	-

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?
3F Open Plan Office	NO (-64.8%)	NO
3F WC	N/A	N/A
3F Circulation	N/A	N/A
3F WC	N/A	N/A
3F Stairwell	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?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m²]	178.6	178.6
External area [m²]	395.4	395.4
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	8	3
Average conductance [W/K]	124.59	168.23
Average U-value [W/m²K]	0.32	0.43
Alpha value* [%]	25.19	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/m²]

	Actual	Notional
Heating	22.57	7.7
Cooling	6.79	5.26
Auxiliary	31.99	11.69
Lighting	15.01	5.79
Hot water	2.54	2.41
Equipment*	43.29	43.29
TOTAL**	**78.9**	**32.85**

* 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/m²]

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	234.84	164.73
Primary energy [kWh_{PE}/m²]	120.13	48.7
Total emissions [kg/m²]	11.15	4.51

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] Fan coil systems, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	188.7	52.1	23.1	7	32.8	2.26	2.08	2.5	3
	Notional	79	90	7.9	5.4	12	2.78	4.63	----	----
[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

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Z61061 Office Extension

As designed

Date: Tue Oct 31 09:02:47 2023

Administrative information

Building Details

Address: Royal Mail Sorting Office, London, NW11 0LS

Certifier details

Name: Anthony Turner

Telephone number:

Address: Energy Counsel, Viridor House, 3 Bolholt Terrace, Bury, BL8 1PP

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 [m²]: 174.15

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), $kgCO_2/m^2.annum$	6.38	
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	6.21	
Target primary energy rate (TPER), $kWh_{PE}/m^2.annum$	51.79	
Building primary energy rate (BPER), $kWh_{PE}/m^2.annum$	63.48	
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	$U_{a-Limit}$	U_{a-Calc}	U_{i-Calc}	First surface with maximum value
Walls*	0.26	0.18	0.18	3F000001:Surf[2]
Floors	0.18	-	-	UNKNOWN
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.13	0.13	3F000001:Surf[0]
Windows** and roof windows	1.6	1.4	1.4	3F000001:Surf[1]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	-	-	No personnel doors in building
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

$U_{a-Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
U_{a-Calc} = Calculated area-weighted average U-values [W/(m²K)]
U_{i-Calc} = Calculated maximum individual element U-values [W/(m²K)]

* 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/m²K

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
m³/(h.m²) at 50 Pa	8	4

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	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- AHU H&C w/HR

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	4.09	3.77	0	1.28	0.88
Standard value	2.5*	N/A	N/A	1.5^	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.

2- Elec Panels + Extract

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	1	-	0.2	-	-
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

1- DHW - Local Elec

	Water heating efficiency	**Storage loss factor [kWh/litre per day]**
This building	1	-
Standard value	1	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**
3F Open Plan Office	-	-	-	-	-	-	-	0.9	-	-	N/A
3F WC	-	-	-	-	-	0.3	-	-	-	-	N/A
3F Circulation	-	-	-	-	-	-	-	0.9	-	-	N/A
3F WC	-	-	-	-	-	0.3	-	-	-	-	N/A
3F Stairwell	-	-	-	-	-	-	-	0.9	-	-	N/A

General lighting and display lighting	**General luminaire**	**Display light source**	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m^2]**
Standard value	95	80	0.3
3F Open Plan Office	110	-	-

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
3F WC	110	-	-
3F Circulation	110	-	-
3F WC	110	-	-
3F Stairwell	110	-	-
3F Plant	110	-	-

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?
3F Open Plan Office	NO (-64.9%)	NO
3F Circulation	N/A	N/A
3F Stairwell	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?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	178.6	178.6
External area [m^2]	395.4	395.4
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	4	3
Average conductance [W/K]	95.27	168.23
Average U-value [W/m^{2}K]	0.24	0.43
Alpha value* [%]	25.21	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	5.46	16.59
Cooling	6.21	5.17
Auxiliary	22.52	11.1
Lighting	6.52	5.79
Hot water	2.54	2.41
Equipment*	43.29	43.29
TOTAL**	**43.25**	**41.06**

* 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	2.17
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*0*	*2.17*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	119.28	165.81
Primary energy [kWh$_{PE}$/m^2]	63.48	51.79
Total emissions [kg/m^2]	6.21	6.38

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] Fan coil systems, [HS] ASHP, [HFT] Natural Gas, [CFT] Electricity										
	Actual	54.6	68.3	4.4	6.6	23.9	3.42	2.87	4.09	3.77
	Notional	78.5	91.8	16.4	5.5	11.8	1.33	4.63	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	105.8	0	36.7	0	0.9	0.8	0	1	0
	Notional	162.5	0	32	0	1.1	1.41	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

6.5. Part L 2021 GLA Carbon Emissions Reporting Spreadsheet

Part L 2021 Performance

Residential

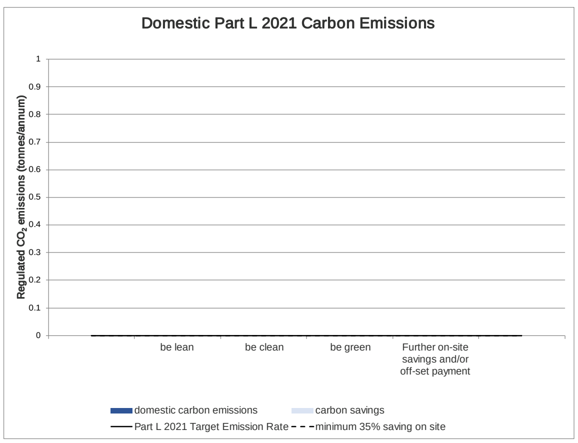
Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for residential buildings

	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

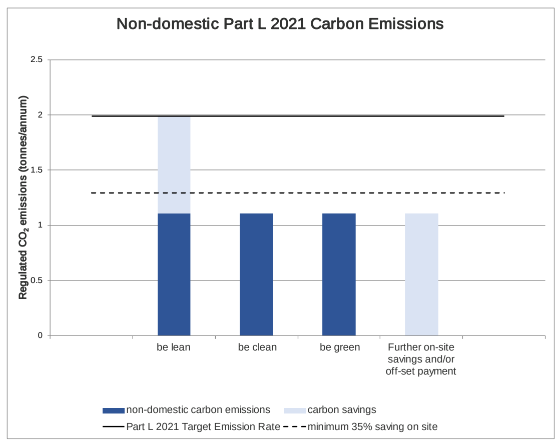
Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for non-residential buildings

	Carbon Dioxide Emissions for non-residential buildings (Tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2021 of the Building Regulations Compliant Development	2.0	1.1
After energy demand reduction (be lean)	1.1	1.1
After heat network connection (be clean)	1.1	1.1
After renewable energy (be green)	1.1	1.1

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	0.9	44%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	0.0	0%
Total Cumulative Savings	**0.9**	**44%**
Annual savings from off-set payment	1.1	-
	(Tonnes CO_2)	
Cumulative savings for off set payment	**33**	-
Cash in-lieu contribution (£)	**3,161**	

*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	2.0		
Be lean	1.1	0.9	44%
Be clean	1.1	0.0	0%
Be green	1.1	0.0	0%
Total Savings	-	0.9	44%
	-	CO_2 savings off-set (Tonnes CO_2)	-
Off-set	-	**33.3**	-

	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/m²)	Total non-residential cooling demand (MJ/year)
Actual		
Notional		

EUI & space heating demand (predicted energy use

Residential

Building type	EUI (kWh/m²/year) (excluding renewable energy)	Space heating demand (kWh/m²/year) (excluding renewable energy)	EUI value from Table 4 of the guidance (kWh/m²/year) (excluding renewable energy)	Space heating demand from Table 4 of the guidance(kWh/m²/year) (excluding renewable energy)	Methodology used (e.g. 'be seen' methodology or an alternative predictive energy modelling methodology)	Explanatory notes (if expected performance differs from the Table 4 values in the guidance)

Non-residential

Building type	EUI (kWh/m²/year) (excluding renewable energy)	Space heating demand (kWh/m²/year) (excluding renewable energy)	EUI value from Table 4 of the guidance (kWh/m²/year) (excluding renewable energy)	Space heating demand from Table 4 of the guidance(kWh/m²/year) (excluding renewable energy)	Methodology used (e.g. 'be seen' methodology or an alternative predictive energy modelling methodology)	Explanatory notes (if expected performance differs from the Table 4 values in the guidance)
Office	86.53975364	33.13549832	55	15	Part L2 - approved DSM & Other (provide details in column T)	Values from BRUKL report