

# 264 Belsize Road

## Energy Statement



September 2022

Peter Deer and Associates Ltd

Solar House, 282 Chase Road, Southgate, London N14 6HA

T: 020 3232 0080 • E: Maitiniyazi.B@pd-a.co.uk

Registered in England No. 3022343

Document Control

Revision History

Number	Reason	Date
1	First issue for comment	26 <sup>th</sup> August 2022
1A	Revised as per comments	07 <sup>th</sup> September 2022
2	For Planning	05 <sup>th</sup> October 2022

Quality Assurance

Written by:	Checked by:
Maitiniyazi Bake	Arshpreet Chugh

Contact Author

Maitiniyazi Bake  
Solar House, 282 Chase Road, Southgate, London N14 6HA  
T: 020 3232 0080 • E: [Maitniyazi.B@pd-a.co.uk](mailto:Maitniyazi.B@pd-a.co.uk)

Contents

Contents .....3

List of Figures .....4

List of Tables .....4

Executive summary .....5

GLA Energy Hierarchy .....5

Be Lean.....5

Be Clean .....5

Be Green.....5

Be seen measures.....5

Summertime Overheating .....5

Energy Hierarchy Tables .....6

SAP 10.2 Block Compliance .....7

Block Compliance Explanation .....7

1. Introduction .....8

Site location .....8

Proposed development .....8

Local air quality .....8

Potential for District Heating.....9

Transport .....9

2. Planning Policy Requirements .....10

London Plan .....10

London Borough of Camden .....12

Conclusion .....14

3. Energy Strategy Approach .....15

SAP Energy Modelling .....15

Carbon Offset .....16

Camden Council, Carbon Offset Fund .....16

Baseline CO<sub>2</sub> Emissions .....16

4. Energy Demand Reduction (Be Lean) .....17

Thermal Elements .....17

Proposed Construction of the Thermal Elements .....18

Thermal Bridging and Accredited Construction Details (PSI Values) .....18

Air Tightness .....18

Thermal Mass.....18

Water .....18

Hot water .....19

Mechanical Ventilation with Heat Recovery .....19

Kitchen Extract.....20

Lighting.....20

Energy Efficient Appliances .....20

External Communal Lighting.....20

Onsite electricity supply .....21

Overheating and Cooling .....21

5. Heating Infrastructure (Be Clean) .....22

Connection to existing district heating networks .....22

Onsite Heat Supply .....22

Affordability of heat .....22

6. Renewable Energy (Be Green) .....23

Heat Pumps .....23

Photovoltaics.....23

Alternative renewable energy options.....25

7. Glossary .....26

8. Appendices .....27

Appendix A. Energy Tables .....28

Appendix B. Block Compliance.....30

Appendix C. Thermal Fabric Efficiency (U values) .....31

Appendix D. Proposed Air Source Heat Pump Heating System Schematic .....34

Appendix E. Propose Heat Pump Specification for Heating.....35

Appendix F. Early-Stage Overheating Risk Tool, Good Homes Alliance (2019). .....36

Appendix G. SAP 10.2 Compliance Report & EPC .....37

List of Figures

Figure 1 Site Energy relates to Carbon Dioxide Emissions (SAP 10).....6

Figure 2 Excerpt from The Building Regulations Approved Document Part L1 Volume 1: Dwellings .....7

Figure 3 Site location (Open Street Map 2022).....8

Figure 4 Nitrogen Dioxide (<https://londonair.org.uk/map-maker/>) .....9

Figure 5 Heat Map for the site (<https://maps.london.gov.uk/heatmap>) .....9

Figure 6 London plan Energy Hierarchy.....11

Figure 7 Typical MVHR Installation with Carbon filter supply air Valves. (Nuair Brochure May 2021) .....20

Figure 8 Van De Valk PV Green Roof PV Racking System.....23

Figure 9 Annual Zero Carbon Energy Generation from PV array .....24

Figure 10 Proposed Location of 4kW PV array .....24

List of Tables

Table 1 Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic buildings .....6

Table 2 Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for domestic buildings .....6

Table 3 Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for the site .....6

Table 4 SAP 10.2 Block Compliance .....7

Table 5 Accommodation Tenure Schedule .....8

Table 6 Annual Air Quality Limits .....9

Table 7 GLA Policy SI 2 Minimising greenhouse gas emissions .....10

Table 8 GLA Policy SI 3 Energy Infrastructure.....11

Table 9 GLA Policy SI 4 Managing Heat Risk.....12

Table 10 Camden Local Plan CC1 (March 2021) .....12

Table 11 Camden Local Plan CC2 (March 2021) .....13

Table 12 Camden Local Plan CC3 (March 2021) .....13

Table 13 Camden Local Plan CC4 (March 2021) .....14

Table 14 Camden Local Plan CC5 (March 2021) .....14

Table 15 Carbon Dioxide Emissions after each stage of the Energy Hierarchy. ....15

Table 16 Site Energy Table SAP 10.....15

Table 17 Site Energy Related Emission Table SAP 10 .....16

Table 18 Emissions Factors .....16

Table 19 Energy demand following energy efficiency measures .....16

Table 20 Part L 2021 Fabric Energy Efficiency Standard .....16

Table 21 Building Fabric construction and thermal U Values .....18

Table 22 Exposed Thermal Element U values.....18

Table 23 Linear Thermal Bridging Elements .....18

Table 24 Recommended specification for sanitary fittings.....19

Table 25 MVHR specification .....20

Table 26 Financial Input Summary of PV Energy Generation .....24

Table 27 Summary of PV Energy Generation per month.....24

## Executive summary

This energy assessment has been prepared to support the planning application for the redevelopment of the mixed-use commercial/community building, 264 Belsize Road, Camden, London, NW6 4BT.

The current owner proposes alterations and extensions to the existing redundant non-residential institutional and mixed-used commercial building; replacing it with new residential development containing 5 dwelling units (4 no. two-bedroom duplexes and 1 no. three-bedroom duplex).

The New London Plan "The Spatial Development Strategy for Greater London" March 2021, Policy SI 2 Minimising Greenhouse Gas emissions requires new major developments to achieve 35% energy-related emissions reduction from the current building regulations.

**This development is not considered a major development according to the London Plan 2021 (FLA of 580m² <1000²)** but it is regarded as medium development. The Camden Planning Guidance expects this development to achieve a minimum of 20% carbon emission reduction (refer to Table 2a Energy reduction targets, domestic, Energy efficiency and adaptation, January 2021).

The development is designed to achieve over 50% energy-related carbon emission reduction through the following design measures:

- Efficient fabric design and passive measures to reduce energy demand (Be Lean)
- Onsite energy supply (Be Clean)
- Use of highly-efficient energy source like an all-electric air source heat pump and proposed onsite renewable energy generation using photovoltaics (Be Green)

The energy and emission rates are calculated under Part L 2021 of the Building Regulations using SAP 10.2 methodology as per the London Plan Energy Statement Guidance. The results shown in Table 1, Table 2, and Table 3 show compliance against the current building regulations (Part L 2021). SAP 10.2 Block compliance is shown in Table 4. Details of the calculations and worksheets are shown in the Appendices.

## GLA Energy Hierarchy

### Be Lean

As part of a 'fabric first approach', the building fabric has been carefully considered and specified to exceed the current Building Regulation Part L 2021 minimum requirement. The improved fabric U-values reduce the energy demand by 7% in comparison to the Building Regulations

The proposal targets an air permeability rate (4m³/m²h @50Pa) of less than the notional building and will require improved window and wall junction details. This report recommends that the contractor undertakes several early samples of an air permeability test to identify the main air leakage points before the second fix starts.

Full details of the construction of the thermal elements are shown in Section 4 – Energy Demand Reduction.

### Be Clean

Figure 4 indicates that this proposed development is not within the heat network priority area but the close distance to the proposed future heat network

Given the lack of existing nearby district heating or community heating infrastructure to connect to at present and cost-effective connection options in the near future and due to the small scale of the project, it is proposed to provide an onsite energy supply option.

The Government has announced that by 2025, all new homes will be banned from installing gas and oil boilers and will be heated by low-carbon alternatives instead. The ban is part of a UK action plan to reach carbon Net-Zero by 2050. **An all-electric Air source heat pump (per dwelling) with an underfloor heating system is proposed.** The proposed schematic of this system is presented in Appendix D.

### Be Green

Heat Pumps extract heat from the environment to provide space heating and domestic hot water and are included under a third "Be Green" element of the GLA energy assessment guidance. A Vaillant aroTHERM plus 12kW Air source heat pump is proposed for each residential dwelling.

The PV assessment shows that circa 2,854 kWh/year with 4kWp of renewable electricity generation for the entire development is required. This output is sufficient to achieve over 20% CO₂ reduction target using onsite energy generation in accordance with Camden Local Plan.

### Be seen measures

The new GLA's London Plan Policy requires the major developments to monitor their energy performance and report on the GLA's online post-construction monitoring platform.

This development is not considered as a major development and "Be seen" measures will be voluntary and not recommended due to the small scale of this project.

### Summertime Overheating

The Good Homes overheating design tool and dynamic thermal model confirm that all dwellings achieve an acceptable level of overheating risk.

It is proposed to provide appropriate energy-efficient mechanical ventilation systems such as continuous Mechanical Ventilation with Heat Recovery (MVHR) to meet the overheating and fresh air supply requirements. Additionally, all dwellings will have openable windows; therefore, the ability to naturally ventilate should meet the occupant's desire. Natural ventilation can be provided via openable windows and balcony doors. The windows and balcony doors of dwellings affected by noise will be open during the day and closed at night.

A dynamic overheating risk analysis using DesignBuilder 7.1.0.110 was conducted, and a separate overheating risk analysis report is written and submitted as part of the Planning application.



	Carbon Dioxide Emissions for domestic buildings (Tonnes CO2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2021 of the Building Regulations Compliant Development	10.0	0.3
After energy demand reduction	9.3	0.3
After heat network / CHP	9.3	0.3
After renewable energy	1.9	0.3

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

	Regulated domestic carbon dioxide savings	
	(Tonnes CO2 per annum)	(%)
Savings from energy demand reduction	0.7	7%
Savings from heat network / CHP	0.0	0%
Savings from renewable energy	7.4	74%
Cumulative onsite savings	8.1	81%
Annual savings from offset payment	1.9	-
	(Tonnes CO2)	
Cumulative savings for offset payment (£95/tonne)	180.9	-
Cash in-lieu contribution (£)	£5,427	

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

	Total regulated emissions (Tonnes CO2 / year)	CO2 savings (Tonnes CO2 / year)	Percentage savings (%)
Part L 2013 baseline	10.0		
Be lean	9.3	0.7	0.1
Be clean	9.3	0.0	0.0
Be green	1.9	7.4	0.7
		CO2 savings off-set (Tonnes CO2)	0.8
Offset		£5,427	

Table 3 Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for the site

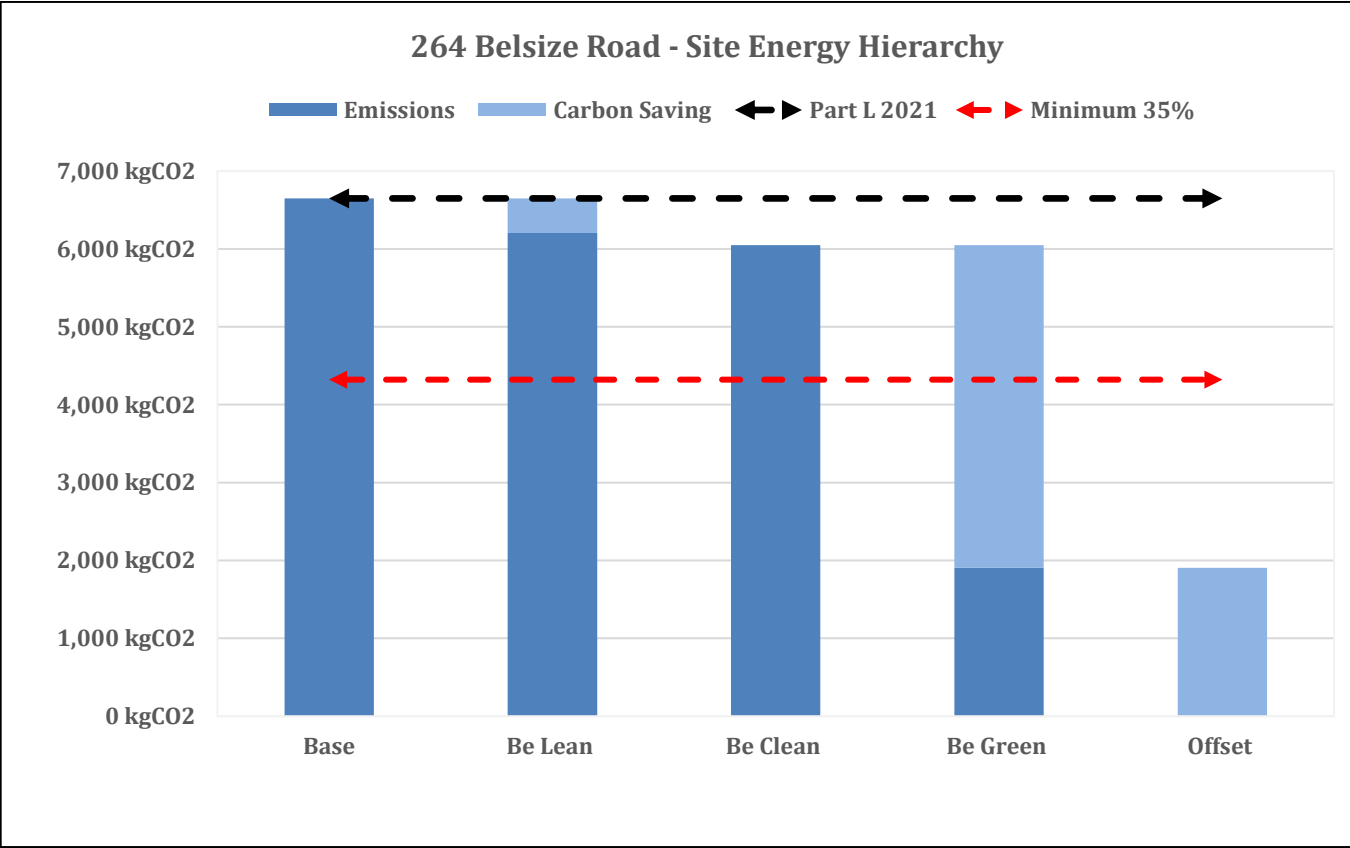


Figure 1 Site Energy relates to Carbon Dioxide Emissions (SAP 10)

SAP 10.2 Block Compliance

Dwelling	Flat Type	Total Floor Area	TER	DER	Saving	Test	TFEE	DFEE	Better	Test	TPE	DPE	Saving	Test
		m²	kgCO2/m²	kgCO2/m²	%		W/m²	W/m²			kgCO2/m²	kgCO2/m²		
264 Belsize Road Unit 1	2B_4P	118.00 m²	14.99	4.28	70%	Pass	57.0	57.4	-1%	Fail	79.02	46.08	42%	Pass
264 Belsize Road Unit 2	2B_4P	108.80 m²	10.9	3.77	65%	Pass	39.4	37.3	5%	Pass	56.95	40.65	29%	Pass
264 Belsize Road Unit 3	2B_4P	108.80 m²	10.72	3.73	65%	Pass	38.6	36.4	6%	Pass	55.95	40.30	28%	Pass
264 Belsize Road Unit 4	2B_4P	108.80 m²	10.55	3.62	66%	Pass	37.9	35.6	6%	Pass	55.03	39.34	29%	Pass
264 Belsize Road Unit 5	2B_4P	114.30 m²	11.51	3.72	68%	Pass	43.5	39.9	8%	Pass	60.28	40.21	33%	Pass
Block Compliance		558.64 m²	11.79	3.83	67%	Pass	43.51	41.57	4%	Pass	61.72	41.38	33%	Pass

Table 4 SAP 10.2 Block Compliance

Block Compliance Explanation

Buildings that contain multiple dwellings

1.4 For a building that contains more than one dwelling – for example a block of flats or a terrace of houses – an average target primary energy rate, target emission rate and target fabric energy efficiency rate may be calculated as an alternative to individual target rates for each dwelling. The floor-area-weighted average of the target primary energy rate, target emission rate and target fabric energy efficiency rate for all the dwellings in the building should be calculated using the following formula:

$$\frac{[(\text{target primary energy rate}_1 \times \text{floor area}_1) + (\text{target primary energy rate}_2 \times \text{floor area}_2) + (\text{target primary energy rate}_3 \times \text{floor area}_3) + \dots]}{(\text{floor area}_1 + \text{floor area}_2 + \text{floor area}_3 + \dots)}$$

1.5 The average target emission rate should be calculated using the formula above but replacing target primary energy rate with target emission rate.

The average target fabric energy efficiency rate should be calculated using the formula above but replacing target primary energy rate with target fabric energy efficiency rate.

1.6 Calculating an average target primary energy rate, target emission rate or target fabric energy efficiency rate for separate buildings on the same site is not considered a reasonable method to show compliance.

Figure 2 Excerpt from The Building Regulations Approved Document Part L1 Volume 1: Dwellings

1. Introduction

- 1.1 Control Electrical Engineers Ltd has appointed Peter Deer and Associates Ltd (PDA) to provide an Energy Statement for the proposed development of the 5 new dwellings to support a full application to Camden Borough Council.
- 1.2 This report has been prepared by a Chartered Building Services/Sustainability Engineer, Maitiniyazi Bake (MCIBSE) of PDA.
- 1.3 This document should be read in conjunction with:
  - Design and Access Statement
  - Sustainability report
  - Overheating analysis report
  - Ecology Assessment

Site location

- 1.4 Location: 264 Belsize Road, Kilburn, London, NW6 4BT. Proposed dwelling units face southeast.



Figure 3 Site location (Open Street Map 2022)

- 1.5 The site is located in Kilburn within the Borough of Camden. It is located on the northern side of Belsize Road (<https://www.openstreetmap.org/#map=19/51.53769/-0.19249>). The site area is approximately 470m², previously occupied by an existing redundant non-residential institution building.
- 1.6 It is approximately 40 metres east of Kilburn High Road. It is adjacent to the Priory Road Conservation Area but is not in the Conservation Area itself. The site is within an Archaeological Priority Area due to its close proximity to an old Roman road, now the A5.
- 1.7 The site is in flood zone 1and it has a low probability of flooding from rivers and the sea.

Proposed development

- 1.8 This development contains 5 units and combines various tenures and dwelling types. Each property would have access to a private garden or balcony.
- 1.9 The residential entrances plus cycle and waste storage areas are accessible from the public street.
- 1.10 The Architects have designed windows and openable rooflights creating connecting natural ventilation (stack effect mainly) through the dwellings. This recommended design strategy is supported by CIBSE overheating guidance documents.
- 1.11 Full details of the proposal are set out in Alan Power Architects Ltd.’s Design and Access Statement. The proposed development includes 5no. two-bedroom units, and it is not regarded as major development according to the London Plan 2021 (FLA of 580m² <1000m²)

Ref	Type	Floor Area	Living Room Area
Unit 01	2B_4P	118.00 m²	38.77 m²
Unit 02	2B_4P	108.69 m²	31.42 m²
Unit 03	2B_4P	108.78 m²	31.42 m²
Unit 04	2B_4P	108.82 m²	31.42 m²
Unit 05	2B_4P	114.37 m²	28.54 m²

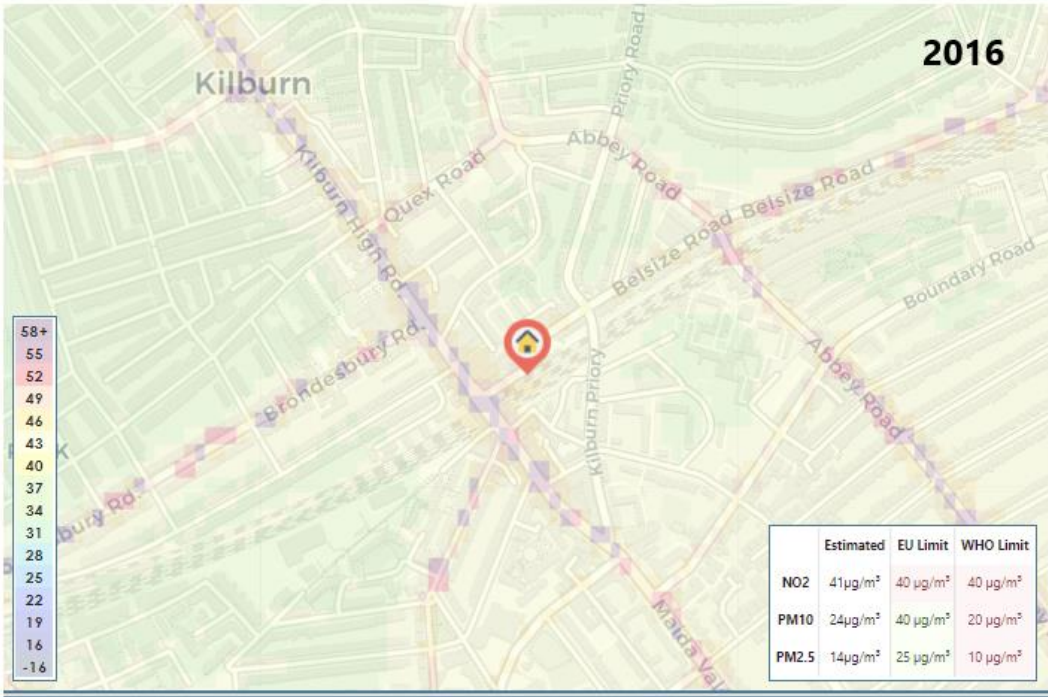
Table 5 Accommodation Tenure Schedule

- 1.12 The top floor studio is located on a mezzanine level which is open to the living room area below.
- 1.13 The proposed architectural design advances the benefits of stack effect ventilation by using lightwell and openable rooflight features so that the warm air will rise sufficiently from the bedrooms and escape naturally from the roof light, which minimises the overheating risk further.

Local air quality

- 1.14 Air pollution is associated with several adverse health impacts, particularly affecting the most vulnerable in society. The whole of Camden Borough has been declared an Air Quality Management Area (AQMA) for both NO2 (Nitrogen Dioxide) and PM10 (Particulate Matter). Camden is also working to assess and address PM2.5 (the smallest fraction of particulate) because, despite Camden meeting EU limit values for PM2.5, research suggests that particulates of this size have the worst health impacts.
- 1.15 Kilburn High Road and Belsize Road are on bus routes that increase NOx and particulate emissions that generally dissipate above 5m. The mechanical ventilation will take air from the Kilburn Place side. The adjacent building shields the proposed development from the polluted street air.
- 1.16 Introduction of the ultra-low emission zone within the North Circular Road, general promotion of improved public transport and cycle lanes, and the inclusion of the proposed green roof, will help improve the air quality of this site.





Nitrogen Dioxide (µg/m³) - Camden, NW6 4BT

Figure 4 Nitrogen Dioxide (<https://londonair.org.uk/map-maker/>)

- 1.17 This map was used with permission from The Greater London Authority and Transport for London, who fund, develop, and maintain the London Atmospheric Emissions Inventory. For more information, please visit <https://data.london.gov.uk/>.
- 1.18 **Error! Reference source not found.** shows the annual mean pollution for NO2, PM10 and PM2.5 for NW6 4BT. The data is based on the most recent year for which an accurate model is available, 2016. The reading is taken on the street and the proposed development is setback from the street; shielded by the neighbouring properties from the pollution sources.
- 1.19 The site passes the EU airborne particle targets (PM10 & PM2.5). However, the site fails on WHO annual mean Nitrogen Dioxide targets and the WHO airborne particle targets. The airborne particles are mainly caused by roads containing a bus route and railway line close to the site.

	Estimated	EU Limit	WHO Limit	
NO2	41µg/m³	40µg/m³	40µg/m³	Fail (WHO)
PM10	24µg/m³	40µg/m³	20µg/m³	Fail (WHO)
PM2.5	14µg/m³	25µg/m³	10µg/m³	Fail (WHO)

Table 6 Annual Air Quality Limits

- 1.20 The construction site air quality plan outlines how dust emissions from demolition and construction must be controlled and delivery vehicle movements reduced. The contractor will submit a construction management plan which will outline how dust emissions will be controlled and how delivery vehicle movements will be managed during the demolition and construction.
- 1.21 All Air Quality parameters are within annual target limits. The prediction is that air quality will improve because of planning policies that limit the use of combustion heating for larger developments, restriction on personal

car ownership by reducing the number of car parking spaces per development, expansion of ultra-low emission zone within London, and general promotion of improved public transport and cycle lanes.

- 1.22 Kilburn High Road and Belsize Road are on bus routes that increase NOx and particulate emissions that generally dissipate above 5m. The mechanical ventilation will take air from the Kilburn Place side. The adjacent buildings shield the proposed development from the polluted street air.

Potential for District Heating

- 1.23 The New London Plan Heating Hierarchy (2021), in line with Policy SI 3 D, states that the priority is for new major developments to connect to local existing or planned district heat networks where the operator has or is in the process of developing a strategy to decarbonise the network and has shared it with the GLA.
- 1.24 This development is not regarded as a major development (FLA of 580m² <1000²) and is not within the heat network priority area but close to the proposed future heat network as in **Error! Reference source not found..**

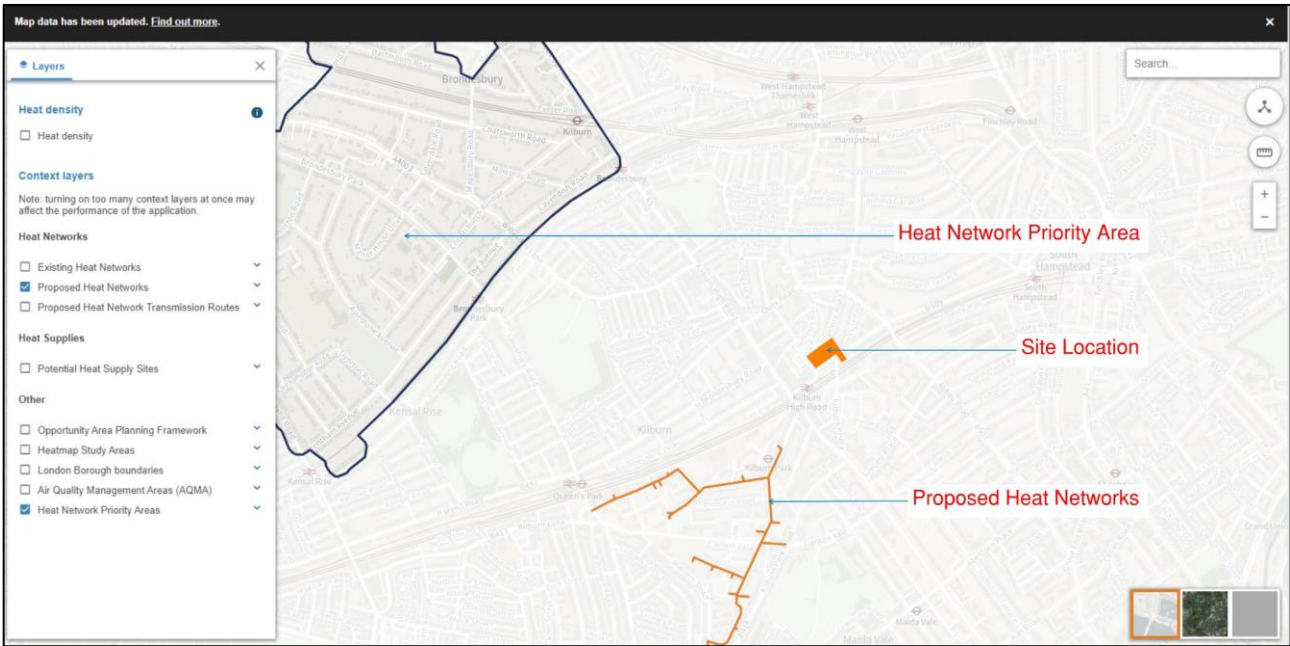


Figure 5 Heat Map for the site (<https://maps.london.gov.uk/heatmap>)

Transport

- 1.25 The location provides a range of transport options, including the London Overground (50m from Kilburn High Road Overground Station), London Underground (Kilburn Park Underground Station) and excellent links to National Rail. The Public Transport Accessibility Level (PTAL) rating of 6a confirms that the site has good public transport with an Accessibility Index of 30.6.

2. Planning Policy Requirements

- 2.1 The National Planning Policy Framework ('NPPF') was published in February 2019 and superseded the 2012 and 2018 editions. Paragraphs 2 and 12 within the Framework confirm that the NPPF must be considered a material planning consideration in planning decisions.
- 2.2 To ensure that sustainable development is pursued positively, a presumption favouring sustainable development is at the heart of the NPPF. This is explained in more detail in NPPF paragraph 11, which requires Local Planning Authorities to:
- (a) Approve development proposals that accord with an up-to-date development plan without delay
  - Or
  - (b) Where there are no relevant development plan policies or the policies which are most important for determining the application are out-of-date, granting permission unless:
    - i. The application of policies in the Framework that protect areas of assets of particular importance provides a clear reason for refusing the development proposed;
  - Or
  - ii. Any adverse impacts of doing so would significantly and demonstrably outweigh the benefits when assessed against the policies in this Framework when taken as a whole
- 2.3 The NPPF includes a 'presumption in favour of sustainable development. It states that for plan-making, the presumption means that local authorities should positively seek opportunities to meet the development needs of their area and that plans should meet objectively assessed needs. Plans should also be based on the Local Plan.

London Plan

- 2.4 The London Plan (March 2021) is the mayor's planning strategy for Greater London. It sets borough-level housing targets and identifies locations for future growth of London-wide importance.
- 2.5 The London Plan is the overall strategic Plan for London, setting out an integrated economic, environmental, transport and social Framework for the development of London over the next 20 to 25 years.
- 2.6 The London Plan is part of the Development Plan. It guides boroughs' development Plans to ensure that they work toward a shared vision for London. It establishes policies that allow everyone involved in new developments to know what is expected.

<p><b>Policy SI 2 Minimising greenhouse gas emissions</b></p> <p>A) Major development should be net zero-carbon. This means reducing greenhouse gas emissions in operation and minimising both annual and peak energy demand under the following energy hierarchy:</p> <ul style="list-style-type: none"><li>1) be lean: use less energy and manage demand during operation</li><li>2) be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly</li><li>3) be green: maximise opportunities for renewable energy by producing, storing, and using renewable energy onsite</li><li>4) be seen: monitor, verify and report on energy performance.</li></ul> <p>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.</p> <p>C) A minimum onsite 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 demonstrated that the zero-carbon target cannot be fully achieved onsite, any shortfall should be provided, in agreement with the borough, either:</p> <ul style="list-style-type: none"><li>A. Through cash in lieu contribution to the borough's carbon offset fund, or</li><li>B. off-site provided that an alternative proposal is identified and delivery is certain.</li></ul> <p>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 annually</p> <p>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.</p> <p>F) Development proposals referable to the Mayor should calculate whole lifecycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions.</p>
---

Table 7 GLA Policy SI 2 Minimising greenhouse gas emissions

- 2.7 Policy SI 2 above is aimed at all major developments but as this development is not considered as a major development, the above policy is not applicable to this project.
- 2.8 The mayor is committed to London becoming a zero-carbon city. This will require the reduction of all greenhouse gases, of which carbon dioxide is the most prominent. London homes and workplaces are responsible for producing approximately 78 percent of its greenhouse gas emissions. New developments need to meet the Framework's requirements as London aims to become a zero-carbon city by 2050. Development involving major refurbishment should also aim to meet this Framework.
- 2.9 The energy hierarchy should inform new buildings' design, construction, and operation. The priority is to minimise energy demand and address how energy will be supplied and renewable technologies incorporated. An important aspect of managing demand will be to reduce peak energy loadings.
- 2.10 Boroughs should ensure that all developments maximise onsite Electricity and heat production opportunities from solar technologies (photovoltaic and thermal) and use innovative building materials and smart technologies. This approach will reduce carbon emissions, reduce energy costs to occupants, improve London's energy resilience and support the growth of green jobs.
- 2.11 A zero-carbon target for major residential developments has been in place for London since October 2016 and applies to major non-residential developments on the final publication of this Plan.
- 2.12 An onsite reduction of at least 35 percent beyond the baseline of Part L of the current Building Regulations is required to meet the zero-carbon target.



- 2.13 The minimum improvement over the Target Emission Rate (TER) will increase over time to achieve the zero-carbon London ambition and reflect the costs of more efficient construction methods. This will be reflected in future updates to the London Plan.
- 2.14 The Mayor recognises that Building Regulations use outdated carbon emission factors and that this will continue to cause uncertainty until Government updates them. Interim guidance has been published in the Mayor's Energy Planning Guidance on using appropriate emissions factors. This guidance will be updated once Building Regulations are updated to help developers determine how these policies are implemented.
- 2.15 Major Developments are expected to achieve carbon reductions beyond Part L from energy efficiency measures alone to reduce energy demand as far as possible. Residential development should achieve 10%, and non-residential development should achieve 15% over Part L.

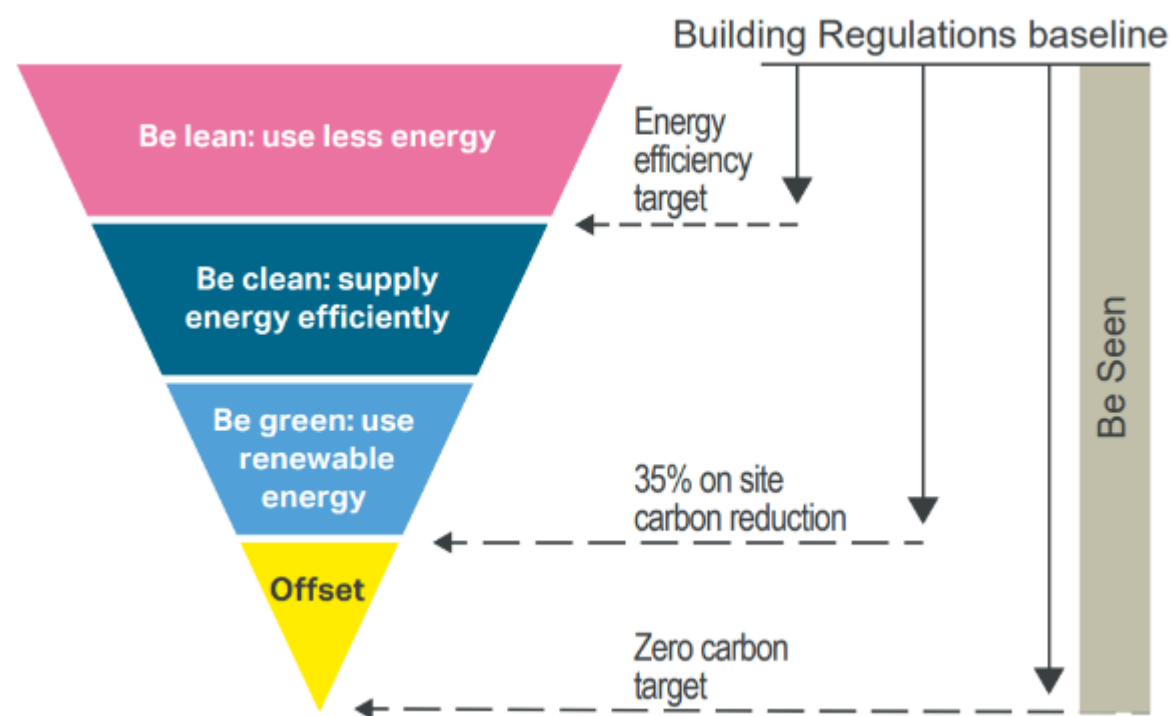


Figure 6 London plan Energy Hierarchy

- 2.16 The cost for offsetting carbon is regularly reviewed. Changes to the GLA's suggested carbon offset price will be updated in future guidance. All new major developments are expected to get as close as possible to zero-carbon target rather than relying on offset fund payments to make up for any shortfall in emissions. However, offset funds can unlock carbon savings from the existing building stock through energy efficiency programmes and by installing renewable technologies – typically more expensive to deliver in London due to the building's age, type, and tenure.
- 2.17 As this development is not considered as a major development no carbon offset payment is required.

**Policy SI 3 Energy Infrastructure**

- A) *Boroughs and developers should engage with relevant energy companies and bodies at an early stage 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), establishing the most effective energy supply options. Energy masterplans should identify:*
- 1) *major heat loads (including anchor heat loads, with 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*
  - 7) *possible heating and cooling network routes*
  - 8) *opportunities for futureproofing utility infrastructure networks to minimise the impact of 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 and 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 Electricity following 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)*
    - b) *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)*
    - c) *use ultra-low NO<sub>x</sub> gas boilers*
  - 2) *CHP and ultra-low NO<sub>x</sub> 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 a cost-effective connection later.*
- E) *Heat networks should achieve good practice design and specification standards for primary, secondary, and tertiary systems comparable to those in the CIBSE/ADE Code of Practice CP1 or equivalent.*

Table 8 GLA Policy SI 3 Energy Infrastructure

- 2.18 Policy SI 3 above is aimed at all major developments but as this development is not considered as a major development, the above policy is not applicable to this project.
- 2.19 The mayor will work with boroughs, energy companies, and major developers to promote London's energy system's timely and effective development (energy production, distribution, storage, supply, and consumption).
- 2.20 London is part of a national energy system and currently sources approximately 95 per cent of its energy from outside the GLA boundary. Meeting the Mayor's zero-carbon target by 2050 requires changes to how we use and supply energy to generate power and heat for our buildings and transport from clean, low-carbon, and renewable sources. London will need to shift from relying on natural gas as its main energy source to a more diverse range of low and zero-carbon sources, including renewable energy and secondary heat sources.

Decentralised energy and local secondary heat sources will become an increasingly important element of London's energy supply. They will help London become more self-sufficient and resilient concerning its energy needs.

- 2.21 The heating system should be designed to facilitate cost-effective future connections where developments are proposed within Heat Network Priority Areas but are beyond existing heat networks. This may include, for example, allocating space in plant rooms for heat exchangers and thermal stores, safeguarding suitable routes for pipework from the site boundary and making provision for connections to the future network at the site boundary. The Mayor is taking a more direct role in delivering district-level heat networks. Newer communally-heated developments will connect to them and develop a comprehensive decentralised energy support package. Further details are available in the London Environment Strategy.
- 2.22 Electricity is essential for the functioning of any modern city. Demand is expected to rise in London in response to a long-term growing population and economy, the increased take-up of electric vehicles, and the switch to electric heating systems (such as through heat pumps). The Electricity network and substations are at or near capacity in several areas, especially in central London. The Mayor will work with the Electricity and heat industry, boroughs, and developers to ensure that appropriate infrastructure is integrated within a wider smart energy system designed to meet London's needs.

**Policy SI 4 Managing Heat Risk.**

- A) Development proposals should minimise adverse impacts on the urban heat island through design, layout, orientation, materials, and 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.

**Table 9 GLA Policy SI 4 Managing Heat Risk**

- 2.23 Climate change means London is already experiencing higher than historical average temperatures and more severe hot weather events. This, combined with a growing population, urbanisation, and the urban heat island effect, means London must manage heat risk in new developments, using the cooling hierarchy above. The cooling hierarchy applies to major developments, and the principles can also be applied to minor development.
- 2.24 In managing heat risk, new developments in London face two challenges – the need to ensure London does not overheat (the urban heat island effect) and that individual buildings do not overheat. The urban heat island effect is caused by extensive built-up areas absorbing and retaining heat day and night, leading to parts of London being several degrees warmer than the surrounding area. This can become problematic on the hottest days of the year as daytime temperatures can reach well over 30°C and not drop below 18°C at night. These circumstances can lead many people to feel too hot or not sleep, but for certain health conditions and 'at risk' groups such as some young or elderly Londoners, the effects can be serious and worsen health conditions. Green infrastructure can mitigate this effect by shading roof surfaces and through evapotranspiration.

Development proposals should incorporate green infrastructure in line with Policy G1 Green Infrastructure and Policy G5 Urban Greening.

**London Borough of Camden**

- 2.25 The Council aims to tackle the causes of climate change in the borough by ensuring developments use less energy and assessing the feasibility of decentralised energy and renewable energy technologies.
- 2.26 Any new development in Camden can potentially increase carbon dioxide emissions in the borough. Suppose we are to achieve local and support national carbon dioxide reduction targets. In that case, it is crucial that planning policy limits carbon dioxide emissions from new development wherever possible and supports sensitive energy efficiency improvements to existing buildings.
- 2.27 The Council will seek to minimise and mitigate climate change by requiring developments to incorporate the three aspects of the energy hierarchy of the London Plan 2021: Firstly, reducing the demand for energy (lean option), secondly supplying energy in the most efficient way (clean option), and thirdly using renewable energy sources (green option).

**Policy CC1 Climate change Mitigation**

*The Council will require all development to minimise the effects of climate change and encourage all developments to meet the highest possible environmental standards that are financially viable during construction and occupation.*

*We will:*

- a. *promote zero carbon development and require all development to reduce carbon dioxide emissions through following the steps in the energy hierarchy;*
- b. *require all major development to demonstrate how London Plan targets for carbon dioxide emissions have been met;*
- c. *ensure that the location of development and mix of land uses minimise the need to travel by car and help to support decentralised energy networks;*
- d. *support and encourage sensitive energy efficiency improvements to existing buildings;*
- e. *require all proposals that involve substantial demolition to demonstrate that it is not possible to retain and improve the existing building; and*
- f. *expect all developments to optimise resource efficiency.*

*For decentralised energy networks, we will promote decentralised energy by:*

- g. *working with local organisations and developers to implement decentralised energy networks in the parts of Camden most likely to support them;*
- h. *protecting existing decentralised energy networks (e.g. at Gower Street, Bloomsbury, King's Cross, Gospel Oak and Somers Town) and safeguarding potential network routes; and*
- i. *requiring all major developments to assess the feasibility of connecting to an existing decentralised energy network, or where this is not possible establishing a new network.*

*To ensure that the Council can monitor the effectiveness of renewable and low carbon technologies, major developments will be required to install appropriate monitoring equipment.*

**Table 10 Camden Local Plan CC1 (March 2021)**



- 2.28 New developments in Camden will be expected to be designed to minimise energy use and CO2 emissions in operation through the application of the energy hierarchy. The Council's Sustainability Plan 'Green Action for Change' commits the Council to seek low and zero-carbon buildings. It is understood that some sustainable design measures may be challenging for listed buildings and some conservation areas, and we would advise developers to engage early with the Council to develop innovative solutions.
- 2.29 Adapting to a changing climate is identified in Camden's environmental sustainability plan, Green Action for Change (2011-2020). The three key risks that require adaptation are flooding, drought and overheating. Specific design measures and 'green infrastructure' such as green roofs, green walls and open spaces can help mitigate some of these risks.

**Policy CC2 Adapting to climate change**

*The Council will require development to be resilient to climate change. All development should adopt appropriate climate change adaptation measures such as:*

The protection of existing green spaces and promoting new appropriate green infrastructure;

- a. not increasing, and wherever possible reducing, surface water runoff through increasing permeable surfaces and use of Sustainable Drainage Systems;*
- b. incorporating bio-diverse roofs, combination green and blue roofs and green walls where appropriate; and*
- c. measures to reduce the impact of urban and dwelling overheating, including the application of the cooling hierarchy.*
- d. Any development involving 5 or more residential units or 500 sqm or more of any additional floorspace is required to demonstrate the above in a Sustainability Statement.*
- e. Sustainable design and construction measures*
- f. The Council will promote and measure sustainable design and construction by:*
- g. ensuring development schemes demonstrate how adaptation measures and sustainable development principles have been incorporated into the design and proposed implementation;*
- h. encourage new build residential development to use the Home Quality Mark and Passivhaus design standards;*
- i. encouraging conversions and extensions of 500 sqm of residential floorspace or above or five or more dwellings to achieve "excellent" in BREEAM domestic refurbishment; and*
- j. expecting non-domestic developments of 500 sqm of floorspace or above to achieve "excellent" in BREEAM assessments and encouraging zero carbon in new development from 2019.*

**Table 11 Camden Local Plan CC2 (March 2021)**

- 2.30 To minimise the risks of climate change, the London Borough of Camden will expect the design of developments to consider anticipated changes to the climate.
- 2.31 Development should also consider the impacts of overheating and flooding on human health and should be designed so that they are adaptable by policies CC2 Adapting to climate change and CC3 Water and flooding.
- 2.32 As noted in Policy CC2 Adapting to climate change, flooding and drought are key risks which require mitigation and adaptation measures in the borough. Camden experienced significant flooding in 1975 and 2002, and the probability of such recurring events is likely to increase due to climate change. Changes to our climate

can also threaten the quantity and quality of our water supply. Such risks impact the health and well-being of Camden residents.

- 2.33 This development is retaining the existing ground floor slab, and much of the 1st floor slab, boundary walls and the steel frame therefore utilising much of the embodied carbon of the existing building in the creation of the new dwellings.
- 2.34 Despite the re-use of most of the existing fabric the development is considered as a newly built development and the BREEAM Domestic Refurbishment is not relevant to this scheme.

**Policy CC3: Water and Flooding**

*Council will seek to ensure that development does not increase flood risk and reduces the risk of flooding where possible.*

*We will require development to:*

- a. incorporate water efficiency measures;*
- b. avoid harm to the water environment and improve water quality;*
- c. consider the impact of development in areas at risk of flooding (including drainage);*
- d. incorporate flood resilient measures in areas prone to flooding;*
- e. utilise Sustainable Drainage Systems (SuDS) in line with the drainage hierarchy to achieve a greenfield run-off rate where feasible; and*
- f. not locate vulnerable development in flood-prone areas.*

Where an assessment of flood risk is required, developments should consider surface water flooding in detail and groundwater flooding where applicable. The Council will protect the borough's existing drinking water and foul water infrastructure, including the reservoirs at Barrow Hill, Hampstead Heath, Highgate and Kidderpore.

**Table 12 Camden Local Plan CC3 (March 2021)**

- 2.35 Developments must be designed to be water efficient. This can be achieved by installing water-efficient fittings and appliances (which can help reduce energy consumption and water consumption) and by capturing and reusing rain water and grey water onsite. Residential developments will be expected to meet the requirement of 110 litres per person per day (including 5 litres for external water use). Refurbishments and other non-domestic development will be expected to meet BREEAM water efficiency credits. Major and high or intense water use developments, such as hotels, hostels and student housing, should include grey water and rainwater harvesting system. Where such a system is not feasible or practical, developers must demonstrate to the Council's satisfaction that this is the case.
- 2.36 Air pollution is associated with many adverse health impacts, and it particularly affects the most vulnerable in society. It is recognised that parts of Camden have some of the poorest air quality levels in London, and since 2000 the whole of the borough has been declared an Air Quality Management Area (AQMA) for both NO2 (Nitrogen Dioxide) and PM10 (Particulate Matter). Camden is also working to assess and address PM2.5 (the smallest fraction of particulate) despite Camden meeting EU limit values for PM2.5, research suggests that particulates of this size have the worst health impacts.

**Policy CC4: Air quality**

*The Council will ensure that the impact of development on air quality is mitigated and ensure that exposure to poor air quality is reduced in the borough.*

*The Council will take into account the impact of air quality when assessing development proposals, through the consideration of both the exposure of occupants to air pollution and the effect of the development on air quality. Consideration must be taken to the actions identified in the Council's Air Quality Action Plan.*

*Air Quality Assessments (AQAs) are required where development is likely to expose residents to high levels of air pollution. Where the AQA shows that a development would cause harm to air quality, the Council will not grant planning permission unless measures are adopted to mitigate the impact. Similarly, developments that introduce sensitive receptors (i.e. housing, schools) in locations of poor air quality will not be acceptable unless designed to mitigate the impact.*

*Development that involves significant demolition, construction or earthworks will also be required to assess the risk of dust and emissions impacts in an AQA and include appropriate mitigation measures to be secured in a Construction Management Plan.*

**Table 13 Camden Local Plan CC4 (March 2021)**

- 2.37 To help reduce air pollution and adhere to London planning policy, developments must demonstrate that they comply with Policy 7.14 of the London Plan (to be at least air quality neutral).
- 2.38 Developments will also be expected to include measures to ensure that occupants' exposure to air pollution is reduced to acceptable levels. In addition to mitigation, major developments in these areas will be expected to address local problems of air quality which may include various design solutions and buffers. Measures that can be taken to reduce exposure to air pollution are contained in our supplementary planning document Camden Planning Guidance on amenity.

**Policy CC5: Waste**

*The Council will seek to make Camden a low waste borough. We will:*

- g. aim to reduce the amount of waste produced in the borough and increase recycling and the reuse of materials to meet the London Plan targets of 50% of household waste recycled/composted by 2020 and aspiring to achieve 60% by 2031;*
- h. deal with North London's waste by working with our partner boroughs in North London to produce a Waste Plan, which will ensure that sufficient land is allocated to manage the amount of waste apportioned to the area in the London Plan;*
- i. safeguard Camden's existing waste site at Regis Road unless a suitable compensatory waste site is provided that replaces the maximum throughput achievable at the existing site; and*
- j. make sure that developments include facilities for the storage and collection of waste and recycling.*

**Table 14 Camden Local Plan CC5 (March 2021)**

- 2.39 The Council recognises that Camden cannot adequately deal with its isolated waste. Therefore, it is a member of the North London Waste Authority, which is responsible for the disposal of waste collected in the boroughs of Barnet, Camden, Enfield, Haringey, Hackney, Islington and Waltham Forest and is working in partnership with these authorities to prepare a joint North London Waste Plan (NLWP).

**Conclusion**

- 2.40 The London plan policy summarised in this section apply to major developments and this development is not considered to be a major development according to the London Plan 2021 (FLA of 580m<sup>2</sup> <1000<sup>2</sup>) but it is regarded as medium development. The Camden Planning Guidance expects this development to achieve minimum of 20% carbon emission reduction through Be Lean, Be Clean, and Be Green measures in place (refer to Table 2a Energy reduction targets, domestic, Energy efficiency and adaptation, January2021).
- 2.41 This scheme is design to follow the Camden local plan policies mentioned in this section. All possible design options have been considered to maximise use of sustainable design principle by followings:
- Efficient fabric design and passive measures to reduce energy demand (Be Lean)
  - Onsite energy supply (Be Clean)
  - Use of highly-efficient energy source like an all-electric air source heat pump and proposed onsite renewable energy generation (Be Green)
  - It is proposed to retain the existing ground floor slab, and much of the 1st floor slab, boundary walls and the steel frame therefore, utilising much of the embodied carbon of the existing building in the creation of the new dwellings.
  - The building is setback from the main road and shielded by the neighbouring properties, which indicates the air quality for this site is expected to better than the street.
  - The inclusion of a green roof will reduce surface water run-off, reduce overheating risk and improve local air quality.
  - The development is in Low Flood risk zone (Zone 1), in addition the proposed green roof will contribute to reducing and delaying surface water run-off
  - The dwellings will be fitted with bins to allow for the segregation of waste to allow for recycling in accordance with Local plan policy CC5.

3. Energy Strategy Approach

- 3.1 The proposed energy strategy for the development will follow the London Plan Energy Hierarchy approach of Be Lean, Be Clean and Be Green, Be Seen to enable the maximum viable reductions in regulated and total CO<sub>2</sub> emissions over the baseline.
- Be Lean - Use less energy
  - Be Clean - Supply energy efficiently;
  - Be Green - Use renewable energy systems.
  - Be Seen – Monitor, Verify and report on energy performance.
- 3.2 The proposed energy supply solutions aim to match the development's energy profiles, ensuring effective use. The proposed solutions also consider the viability and flexibility of the scheme from a technical and economic point of view by identifying an optimal combination of energy efficiency measures as well as decentralised and renewable energy supply solutions. Applying these principles:
- Council is aiming to achieve the following objectives:
  - Comply with the relevant regulatory requirements;
  - Improve the viability of the scheme by developing a technically robust and viable energy strategy;
- 3.3 The proposed energy supply solutions aim to match the development's energy profiles, ensuring effective use. The proposed solutions also consider the viability and flexibility of the scheme from a technical and economic point of view by identifying an optimal combination of energy efficiency measures as well as decentralised and renewable energy supply solutions.

SAP Energy Modelling

- 3.4 The predicted regulated energy consumption defined within the Building Regulations is assessed using BRE Standard Assessment Procedure 10.2 (SAP 10.2). The energy for domestic appliances and cooking is separately calculated using BRE Domestic Energy Model 12, Formula.
- 3.5 Since January 2019, applicants submitting GLA referable applications have been encouraged to use the SAP 10.2 emission factors.
- 3.6 This report primarily uses the current SAP 10.2 energy compliance model and emission factors to calculate the regulated emission savings shown in Table 15.
- 3.7 The DER and DPER are difficult to achieve a pass in Base and Be Lean, and Be clean scenarios as a boiler is used to provide space heating and hot water, and renewable energy resources are not included, so it is difficult to meet the TER and TPER in Be lean/clean as the notional building has renewable sources like PV.
- 3.8 However, SAP results show the dwellings achieve can 7% carbon emission reduction through the proposed improved building fabric U-values. The dwelling fabric energy efficiency rate (DFEE) is better than the target fabric energy efficiency rate (TFEE).
- 3.9 Using a Heat pump and renewable energy source like PV in Be Green scenario, the dwelling achieves a minimum of 35% carbon emission reduction, and the DPER is better than TPER.

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO <sub>2</sub> per annum)	
	Regulated	Unregulated
Baseline: Part L 2021 of the Building Regulations Compliant Development	10.0	0.3
After energy demand reduction	9.3	0.3
After heat network / CHP	9.3	0.3
After renewable energy	1.9	0.3

Table 15 Carbon Dioxide Emissions after each stage of the Energy Hierarchy.

- 3.10 The SAP methodology is used for assessing the energy performance of dwellings. The indicators of energy performance are Fabric Energy Efficiency (FEE), energy consumption per unit floor area, energy cost rating (the SAP rating), Environmental Impact rating based on CO<sub>2</sub> emissions (the EI rating) and Dwelling CO<sub>2</sub> Emission Rate (DER).
- 3.11 The Dwelling CO<sub>2</sub> Emission Rate is used to comply with building regulations. It equals the annual CO<sub>2</sub> emissions per unit floor area for space heating, water heating, ventilation, and lighting, less the emissions saved by energy generation technologies, expressed in kg CO<sub>2</sub>/m<sup>2</sup>/year.
- 3.12 The Baseline Energy Emission is calculated per GLA Energy Assessment Guidance (2022) Appendix 4. It uses the information of the building services equipment installed, which has produced a similar EPC rating to the published EPC rating.

Energy	Base	Be Lean	Be Clean	Be Green
FLA	559 m <sup>2</sup>	559 m <sup>2</sup>	559 m <sup>2</sup>	559 m <sup>2</sup>
Heating	26,317 kWh	23,067 kWh	21,278 kWh	5,248 kWh
Cooling	12 kWh	12 kWh	12 kWh	12 kWh
Aux Energy	2,068 kWh	2,068 kWh	2,672 kWh	1,638 kWh
Lighting	1,177 kWh	1,095 kWh	1,095 kWh	1,095 kWh
Hot Water	19,312 kWh	19,365 kWh	19,410 kWh	8,645 kWh
PV Energy Produced				
Equipment	2,284 kWh	2,284 kWh	2,284 kWh	2,284 kWh
Total	51,170 kWh	47,890 kWh	46,749 kWh	16,286 kWh
Regulated	48,886 kWh	45,607 kWh	44,465 kWh	16,636 kWh
Unregulated	2,284 kWh	2,284 kWh	2,284 kWh	2,284 kWh
Regulated /m <sup>2</sup>	89 kWh	83 kWh	81 kWh	28 kWh

Table 16 Site Energy Table SAP 10



CO <sub>2</sub> Emissions	Base	Be Lean	Be clean	Be Green
FLA	559 m <sup>2</sup>	559 m <sup>2</sup>	559 m <sup>2</sup>	559 m <sup>2</sup>
Heating	3,579 kgCO <sub>2</sub>	3,137 kgCO <sub>2</sub>	2,894 kgCO <sub>2</sub>	714 kgCO <sub>2</sub>
Cooling	2 kgCO <sub>2</sub>	2 kgCO <sub>2</sub>	2 kgCO <sub>2</sub>	2 kgCO <sub>2</sub>
Aux Energy	281 kgCO <sub>2</sub>	281 kgCO <sub>2</sub>	363 kgCO <sub>2</sub>	223 kgCO <sub>2</sub>
Lighting	160 kgCO <sub>2</sub>	149 kgCO <sub>2</sub>	149 kgCO <sub>2</sub>	149 kgCO <sub>2</sub>
Hot Water	2,626 kgCO <sub>2</sub>	2,634 kgCO <sub>2</sub>	2,640 kgCO <sub>2</sub>	1,176 kgCO <sub>2</sub>
PV Energy Produced	0 kgCO <sub>2</sub>	0 kgCO <sub>2</sub>	0 kgCO <sub>2</sub>	-358 kgCO <sub>2</sub>
Equipment	311 kgCO <sub>2</sub>	311 kgCO <sub>2</sub>	311 kgCO <sub>2</sub>	311 kgCO <sub>2</sub>
Total	6,959 kgCO <sub>2</sub>	6,513 kgCO <sub>2</sub>	6,358 kgCO <sub>2</sub>	2,215 kgCO <sub>2</sub>
Regulated	6,648 kgCO <sub>2</sub>	6,202 kgCO <sub>2</sub>	6,047 kgCO <sub>2</sub>	1,904 kgCO <sub>2</sub>
Unregulated	311 kgCO <sub>2</sub>	311 kgCO <sub>2</sub>	311 kgCO <sub>2</sub>	311 kgCO <sub>2</sub>
Regulated /m <sup>2</sup>	12 kgCO <sub>2</sub>	11 kgCO <sub>2</sub>	11 kgCO <sub>2</sub>	4 kgCO <sub>2</sub>

Table 17 Site Energy Related Emission Table SAP 10

Fuel	SAP 10 (Residential)
Natural Gas	0.2100 kgCO <sub>2</sub> /kWh
Grid Electricity	0.1360 kgCO <sub>2</sub> /kWh

Table 18 Emissions Factors

Building use	Energy demand following energy efficiency measures (kWh/year)			
	Space Heating	Hot Water	Lighting	Auxiliary
Domestic	5,248 kWh	8,645 kWh	1,095 kWh	1,638 kWh

Table 19 Energy demand following energy efficiency measures

	Target Fabric Energy Efficiency (kWh/m <sup>2</sup> )	Dwelling Fabric Energy Efficiency (kWh/m <sup>2</sup> )	Improvement (%)
Development total	43.28	41.15	5%

Table 20 Part L 2021 Fabric Energy Efficiency Standard

3.13 The energy modelling uses SAP 10.2 Grid Electricity emission factor (0.1360 kgCO<sub>2</sub> /kWh).

## Carbon Offset

### Camden Council, Carbon Offset Fund

3.14 Changes were made to the Carbon Offset Fund on 1st October 2016. The London Plan forms part of the Council's development plan and is considered in planning decisions. In March 2016, the Greater London Authority (GLA) adopted a revised Housing Supplementary Planning Guidance (SPG), which includes changes in the level and type of financial contributions to Borough Level Carbon Offset Funds to mitigate additional carbon emissions from new housing developments. Financial contributions will be required to offset all carbon emissions from housing developments, i.e., 100% of carbon emissions.

3.15 The calculation, which equates to **£95 a tonne over 30 years**, is:

$$\text{CO}_2 \text{ emitted from the development (tonnes) per year minus CO}_2 \text{ target emissions (tonnes) per year} \times \text{£2850}$$

3.16 Through the London Plan (Policy SI 2), all major developments are required to meet net zero carbon targets. Where these emissions targets cannot be met on-site the London Plan states any short fall should be provided off-site or through cash-in-lieu contribution which is used to secure carbon dioxide savings elsewhere. As this development is only a medium development requirement of meeting net zero carbon is not applicable.

3.17 Camden Local Plan requires developments of 5 or more dwellings to achieve a 20% reduction in carbon dioxide emissions from on-site renewable energy generation. The proposed photovoltaic array and use of ASHP allows this development to comply with requirements of Camden Local Plan.

3.18 Carbon offset payments are not required to be made for this project as the carbon emission targets in the Local Plan are being achieved through the use of AHP and photovoltaic installation.

## Baseline CO<sub>2</sub> Emissions

3.19 A CO<sub>2</sub> emissions baseline must be established to assess the CO<sub>2</sub> performance of the proposed energy strategy. This section sets out the approach taken to calculate the baseline CO<sub>2</sub> emissions for the development.

3.20 The total baseline CO<sub>2</sub> emissions for the proposed development are defined as regulated CO<sub>2</sub> emissions covered by Building Regulations Part L and unregulated CO<sub>2</sub> emissions not covered by Part L. Unregulated CO<sub>2</sub> emissions should be excluded when compliance with the planning policy is calculated.

3.21 In line with current GLA guidance, the heating strategy at the baseline level will be a Boiler with a Radiator. Therefore, it isn't easy for DER & DPER to comply with TER & TPER as a renewable energy source is not included in the baseline scenario.

3.22 The regulated CO<sub>2</sub> emissions baseline is based on all dwellings' Part L1A 2021 Target Emission Rate (TER) performance. The baseline CO<sub>2</sub> performance has been determined by carrying out SAP 10.2 modelling to establish the TER of the dwellings.

3.23 The PartL GLA Carbon emission reporting spreadsheet will be submitted as part of the planning application document and it will include Baseline TER reports of the dwellings and predicts the residential regulated CO<sub>2</sub> emissions baseline.



## 4. Energy Demand Reduction (Be Lean)

- 4.1 In accordance with the London Plan Energy Hierarchy, the key focus of the proposed energy strategy is to reduce the energy demands of the development as far as practically possible and viable by implementing various energy demand reduction measures. The aim is to achieve Part L 2021 Building Regulations compliance without contribution from low carbon or renewable energy sources.
- 4.2 PartL GLA Carbon emission reporting spreadsheet will be submitted as part of the planning application document and it will include Be Lean DER reports of the dwellings and predicts the residential regulated CO<sub>2</sub> emissions baseline.
- 4.3 The proposed development design follows sustainable design principles and standards, aiming to use natural resources efficiently, reduce energy consumption, avoid internal overheating and contributing to the urban heat island effect.
- 4.4 A range of measures to reduce CO<sub>2</sub> emissions and increase resilience to climate change is proposed to be incorporated into the building design, including good building fabric standards and energy-efficient M&E systems and lighting.
- 4.5 Through adopting best design practices and in response to the planning policies, the development has considered sustainable design and construction standards to reduce potential overheating and reliance on air conditioning systems through the following approaches and measures.
- 4.6 The development will incorporate passive solar design measures. The proposed windows will aim to maximise daylight and, at the same time, minimise overheating. The glazing specification will be selected to provide a balance of solar control and access to passive solar gain.
- 4.7 It is assumed that dwellings will utilise openable windows for purge ventilation, with a background mechanical ventilation system. The MVHR provides background ventilation with heat recovery from the exhaust air and a summer bypass of the heat recovery element
- 4.8 Openable windows are proposed, albeit they will not be essential to provide a fresh air supply. Nonetheless, they will allow residents and occupiers to control their indoor environment further. The openable windows can also be used for purge ventilation.
- 4.9 The ventilation strategy will be reviewed as the design progresses to ensure compliance with all the relevant regulations and standards.
- 4.10 More recently, the selection of wall insulation has become an issue. All building materials and wall insulation are to be specified as non-combustible materials where possible.

### Thermal Elements

- 4.11 A "fabric first" approach to building design includes maximising the components and materials that make up the building fabric before considering mechanical or Electricity building services systems. This can help to reduce capital and operational costs, improve energy efficiency, and reduce carbon emissions whilst reducing ongoing maintenance costs.
- 4.12 A "fabric first" approach is to reduce building energy usage and CO<sub>2</sub> through five different factors as follows:

- High-Quality Insulation
- Promotes heat retention
- Reduces heat loss
- Increased Air-Tightness
- Consider air leakage through gaps/cracks in the building envelope
- The best result is dependent on the construction method
- Structural Insulated Panels (SIP) or Insulated Concrete Form (ICF) generally provide great airtightness
- Check the frames on windows and doors

### Avoid Thermal Bridging

- Thermal bridging occurs in areas with higher thermal conductivity, allowing an easier path for heat loss, e.g., where the Floor and walls meet
- Consider your insulation system to reduce thermal bridging

### Maximise Solar Gain

- Think about your build orientation
- Choose your window positions carefully
- Consider triple glazed windows for further heat retention
- Mixed-mode Natural Ventilation
- Mechanical ventilation with heat recovery
- Reduces condensation and mould
- Consider a low-level air inlet for fresh air and a high-level vent to remove stale air
- Think about the amount of wind around your location

- 4.13 The proposed U Values for the thermal elements are the same as the expected standard U values in Table 21 Building Fabric construction and thermal U Values.
- 4.14 Most manufacturers of building materials consider these U values the lowest possible U values and have not developed details for building elements with better thermal U values. The manufacturer's accredited details consider the thermal and structural properties of the thermal building element. There is an increasing risk of exceeding the building warranty in specifying better thermal U values.

Element	% Improvement	Proposed U Value	Building Regulation Notional dwelling	Building Regulation Limiting fabric parameters
External wall	50%	0.15 W/m²K	0.18 W/m²K	0.26 W/m²K
Flat roof	57%	0.10 W/m²K	0.11 W/m²K	0.16 W/m²K
Ground/external floor	57%	0.11 W/m²K	0.13 W/m²K	0.18 W/m²K
Party wall	0%	0.00 W/m²K	0.00 W/m²K	0.20 W/m²K
All windows, including frames Window frame Factor 0.8. g value 0.55	14%	1.20 W/m²K	1.20 W/m²K	1.40 W/m²K
Rooflight (FF:0.80, g value:0.40)	45%	1.20 W/m²K	1.70 W/m²K	2.20 W/m²K
External Door (Secure by design PAS 24)	33%	1.00 W/m²K	1.00 W/m²K	1.60 W/m²K
Air permeability rate	30%	4m³/m².h@50pa	5m³/m².h@50pa	8m³/m².h@50pa
Linear thermal transmittance (thermal bridging)		Accredited details	0.15 W/m²K	

Table 21 Building Fabric construction and thermal U Values

4.15 The proposed detailed building fabric build-up is included in Appendix C Thermal Fabric Efficiency (U values).

Proposed Construction of the Thermal Elements

Exposed Element	Construction	Cm kJ/m2K
Ground (supported) Floor	Suspended beam and block, screed over insulation	110
Exposed Wall	Cavity wall: dense plaster, AAC block, filled cavity, any outside structure	70
Roof	Plasterboard, insulated flat roof	9
Party wall	Fully filled cavity wall-Plaster on dabs and single plasterboard on both sides, dense cellular block, cavity	70
Door	Solid Wood Door (PAS 24 Locks)	
Window	Solar shading glass (g value 0.40), High-performance acoustic glazing comprising 10/16/8.8 or equivalent having an Rw+Ctr of 38dB.	

Table 22 Exposed Thermal Element U values

4.16 Party wall elements are also included in the current Building Regulations as these walls contribute toward the thermal mass of the dwelling that attenuates internal temperatures.

Thermal Bridging and Accredited Construction Details (PSI Values)

4.17 Thermal bridges occur at junctions between building elements. Heat loss is associated with a thermal bridge's linear thermal transmittance (PSI, Ψ). This is a property of a thermal bridge, and the heat flow rate per degree per unit length of the bridging is not accounted for in the U-values of the basic building elements containing the thermal bridge.

- 4.18 Accredited construction details for thermal bridging elements are to be found on the BRE website <https://tools.bregroup.com/certifiedthermalproducts/podpage.jsp?id=3075>
- 4.19 The Certified Thermal Details and Products scheme and database allow users to search a wide range of accurate and independently assessed thermal junction details, products, and elements, ensuring accuracy, consistency, credibility and quality throughout the design and specification process.

Linear	Description	Detail	Value
E2	Other lintels (including other steel lintels)	Accredited	0.05
E3	Sill	Accredited	0.05
E4	Jamb	Accredited	0.05
E5	Ground Floor (normal)	Accredited	0.16
E7	Party floor between dwellings	Accredited	0.07
P3	Intermediate Floor within dwellings	Accredited	0
E16	Corner (normal)	Accredited	0.09
E17	Corner (an inverted – internal area greater than external)	Accredited	-0.09
E18	Party wall between dwellings	Accredited	0.06

Table 23 Linear Thermal Bridging Elements

Air Tightness

- 4.20 Building airtightness is a major saving of heating energy, more important than external wall U values. Most new domestic dwellings typically achieve permeability rates of less than 4m³/m²h@50Pa.
- 4.21 The buildings will be designed to achieve an airtightness of less than 4m³/m²h@50Pa. This is a challenging but achievable target. The design team will be required to specify taping corner and sealing joints and detailing window-wall interfaces to reduce air movement into the dwelling. Air leakage is usually caused either by a lack of awareness of the importance of airtightness or by a lack of contractual responsibility for this requirement.

Thermal Mass

- 4.22 Thermal mass is the ability of a material to absorb and store heat energy. Significant heat energy is required to change the temperature of high-density materials like concrete, bricks, and tiles. They are therefore said to have a high thermal mass. Lightweight materials such as timber have a low thermal mass. Appropriate use of thermal mass throughout the home can significantly affect thermal comfort.
- 4.23 The dwellings being considered to have a medium level of thermal mass, as shown in the SAP Building Regulation compliance model.

Water

- 4.24 The UK has less water per person than most other European countries. London is drier than Istanbul, and the South East of England has less water available per person than Sudan and Syria. As our population grows, more and more people share this limited resource. The more water consumed, the less available for the environment. Therefore, it is important that we use water wisely and not waste it.

4.25 This development aims to reduce water consumption to less than 110 litres per person per day (including 5 litres for external water use), in line with the recommended target set out in the London Plan using water-efficient fittings and those listed below (Table 24).

Fitting	Fitting specification
WC	6/4 litres dual flush
Kitchen sink tap	6 litres per min
Washbasin tap	4 litres per min
Shower	8 litres per min
Bath	180 litres
Washing machine	8.17 litres/kg
Dishwasher	1.25 litres/place setting

Table 24 Recommended specification for sanitary fittings

- 4.26 The design team is committed to achieving a target of maximum internal water use of 105 litres per person/day.
- 4.27 This will be incorporated into the design and the sanitary ware/fittings selection at the detailed design stage to ensure that this target is achieved.
- 4.28 The above target can be achieved though specifying all or some of the following water saving fittings:
- A low and water saving dual flush WC
  - Aerated showerhead
  - Flow regulating access valve for showers
  - Water saving flow regulator for basin
  - Water efficient lever operated Monobloc tap
  - Water efficient Monobloc kitchen tap and water saving tub.

Hot water

- 4.29 Hot water cylinders designed specifically to be used with heat pumps have larger heat transfer surfaces (bigger coils) within the cylinder. The hot water storage temperature is set at 60°C in accordance with guidance from WRAS. The lower hot water storage temperature requires a greater hot to cold water ratio to achieve the required useable 40°C water temperature.
- 4.30 The lower hot water storage temperature requires a regular disinfecting anti-legionella control cycle. The hot water cylinder is heated above 60°C for an extended period, usually weekly to eliminate any bacteria growth and risk of legionella. Most manufacturers use backup electric immersion heaters for this purpose when using a heat pump to generate domestic hot water.
- 4.31 A cylinder with 400 litres of the storage volume is proposed for each dwelling, and the proposed Cylinder is suitable to be used with a heat pump.

Mechanical Ventilation with Heat Recovery

- 4.32 Whole house mechanical ventilation units (MVHR) provide filtered fresh air from outside and extract air from kitchen, toilets & utility rooms. MVHR units are generally designed to meet the minimum requirements of the Building Regulations, which only require a background airflow rate to replace window trickle vents.
- 4.33 At this stage, it is proposed to provide appropriate energy-efficient mechanical ventilation systems such as continuous Mechanical Ventilation with Heat Recovery (MVHR) to meet the overheating and fresh air supply requirements. Additionally, all dwellings will have openable windows and, therefore, the ability to naturally ventilate should the occupant desire.
- 4.34 It is proposed to provide MVHR ventilation which can provide 0.5 air changes per hour within the dwellings. This reduces the number of times the occupants must leave the window open to maintain internal comfort.
- 4.35 Indoor Air Pollution, also called poor indoor air quality, is the term used to describe build-up of harmful pollutants in the home that negatively affect health and well-being of the occupants. A grown adult requires more than 10,000 litres of air daily, breathing approximately 20,000 times. We spend up to 80% of our time indoors, and indoor air can be up to 50 times more polluted than outdoor air, so achieving good indoor air quality is now more important than ever.
- 4.36 Many pollutants in the home are generated from simple, everyday activities like cooking with gas, use of cleaning sprays and beauty products, and even air fresheners. Without adequate ventilation, these pollutants remain trapped inside the home, where, over time, they can seriously impact our health. Long-term exposure to a damp environment or polluted air is linked to serious health conditions, including asthma, respiratory infections, lung disease and heart disease.
- 4.37 In areas with poor outdoor air quality, the standard filters in MVHR units are not able to capture all of the contaminants before supplying the air to rooms. **Error! Reference source not found.** indicates the Typical MVHR Installation with carbon filter supply air valves which provide enhanced filtration of fresh air, and the specification of the proposed MVHR is shown in Table 25 MVHR specification.
- 4.38 It is also important to consider the future impact of climate change on the occupant's thermal comfort experience. Providing adequate natural cross ventilation through the living areas delivers relief from overheating. Low-level air movement through the dwelling reduces the internal relative humidity, providing a small natural cooling effect on the occupants.
- 4.39 The window openings enable safe and secure ventilation day or night.
- 4.40 Approved Document Part F requires that:
- 'There shall be adequate means of ventilation provided for people in the building.'**
- 4.41 It should be noted that failure of the MVHR fans does not result in the total loss of ventilation as the units are designed with very low frictional losses and will operate in passive mode.
- 4.42 The MVHR unit will include an internal humidity sensor monitoring the extracted air. The MVHR fan will operate in boost mode when the unit senses elevated humidity, e.g., drying clothes within the dwelling. The homeowner manual will encourage use of external balconies and bathrooms as natural clothes drying areas. This avoids internal condensation in the winter months.



TYPICAL NUAIRE DUCTING INSTALLATION

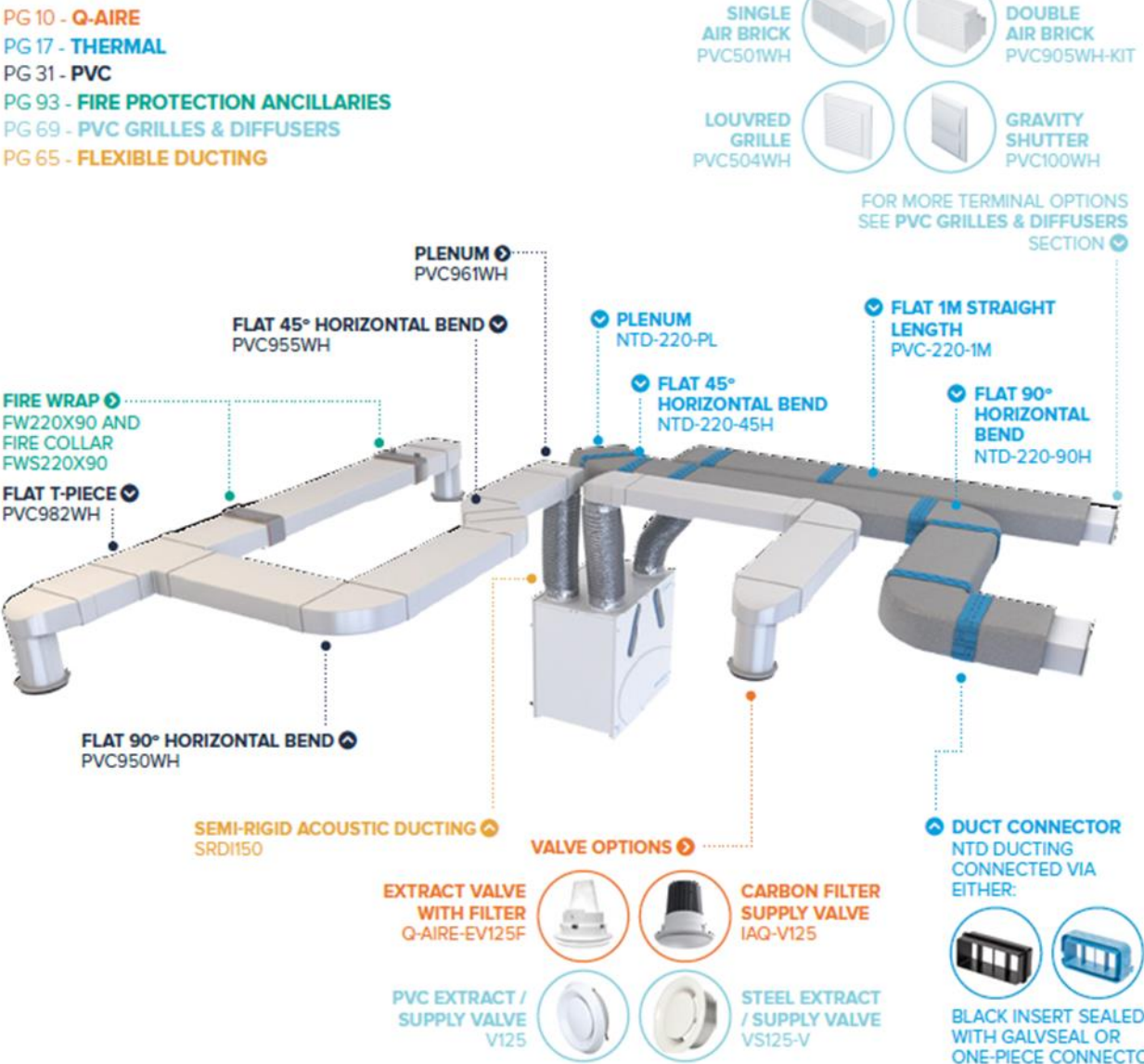


Figure 7 Typical MVHR Installation with Carbon filter supply air Valves. (Nuaire Brochure May 2021)

Manufacturer	The Nuaire Group
Brand	Nuaire
Model Name	MRXBOX-ECO3
Main Type	balanced whole-house mechanical ventilation with heat recovery
Efficiency (heat exchanger)	91%

Table 25 MVHR specification

Kitchen Extract

- 4.43 A separate cooker hood extractor unit is specified to extract air above the cooker and vent to the outside through dedicated ductwork. This is required to avoid contaminating the MVHR heat exchanger unit with grease from cooking.
- 4.44 An alternative to whole-house mechanical ventilation units fits large trickle vent grilles built into the windows or walls with the mechanical extract. These manually operated grilles often cause cold draughts in winter, and

the grilles are often left closed off by the occupants. Once closed, the grilles are rarely reopened, resulting in the loss of background ventilation to the dwellings. Trickle vents are unsuitable for developments in an urban environment with poor background air quality.

Lighting

- 4.45 The proposed windows maximise daylight to minimise the need for artificial lighting. The specified lighting for the dwellings will be 100% low energy using integrated LED light fittings.
- 4.46 Recent advances in LED lighting technology with the development of multichip LED Lamps mean it is now possible to install high-quality, low-energy lights with short warm-up periods and low fading loss over the life of the lamps. The lighting industry continually develops stylish compact LED luminaires to replace the less efficient halogen luminaires.
- 4.47 The external lighting designers will be required to consult with the local crime officer and ensure the energy efficiency lighting measures do not compromise the occupant's health, safety, and security internally and externally. The lighting design also needs to demonstrate that it reduces intrusive light pollution. The Electricity of the lampposts and luminaires will be positioned to avoid directing light through residential windows. As the primary requirement, the communal areas provide suitable daylight from windows and artificial lighting to maintain a safe and secure space.
- The designers have taken the following measures to reduce consumption:
  - Automatic presence-controlled lighting
  - Use long-life, energy-saving LED lamps.
  - Natural daylight where appropriate
  - Time control and daylight sensors for external luminaires
  - Reduce external lighting from midnight to 06:00
  - All security lighting to have dual lamp luminaires

Energy Efficient Appliances

- 4.48 It is very challenging to design and construct living spaces to reduce unregulated electricity demands because this is almost entirely dependent on the occupant and can vary substantially.
- 4.49 Unregulated energy demand and the associated CO<sub>2</sub> emissions can be reduced by providing energy-efficient white goods. Quality saving is difficult, but it is assumed that these measures can reduce the unregulated CO<sub>2</sub> emissions associated with residential development by circa 6-10%. These savings have not been accounted for in this report.

External Communal Lighting

- 4.50 The designer will use LED lighting.
- 4.51 The presence detection control will be specified in internal spaces, stairwells.



- 4.52 Wall-mounted luminaires along walkways linked to daylight sensors for on/off operations. The fitting should allow for a lower light level after midnight and before dawn. This may be made up of a second luminaire at a lower level.
- 4.53 Courtyard lighting will be designed using low energy LED with daylight on/off control and reduced light levels between midnight and dawn.

### Onsite electricity supply

- 4.54 The electricity supply for the residential units will be from the local LV Network supplied by the local DNO. Each unit will be metered individually with a separate landlord meter for common areas.

### Overheating and Cooling

- 4.55 There is an expectation that designers can design new residential properties without the assistance of an active cooling system to avoid overheating. GLA and Camden Council guidance requires that natural ventilation and other passive measures are used to address the risk of overheating to avoid unnecessarily increasing a development's energy demand and carbon emissions. The GLA requires London Borough Councils to reject planning proposals for active cooling in new residential developments.
- 4.56 All homes use a combination of passive mechanical ventilation and natural purge ventilation to mitigate the overheating risk.
- 4.57 A dynamic overheating analysis is completed for this development and submitted as a separate document as part of the planning application. The results show that all dwellings are at the acceptance level of overheating risk.
- 4.58 The GHA Early-Stage Overheating risk tool indicates the dwelling presents a low risk of overheating, and the detailed results are included in Appendix F Early-Stage Overheating Risk Tool, Good Homes Alliance (2019).

## 5. Heating Infrastructure (Be Clean)

- 5.1 The New London Plan Heating Hierarchy (2021), in line with Policy SI 3 D, states that the priority is for new major developments to connect to local existing or planned district heat networks where the operator has or is in the process of developing a strategy to decarbonise the network and has shared it with the GLA. The London plan outlines the following order of preference:
- Connection to existing heating or cooling network
  - Site-wide heat network
  - Communal heating and cooling
- 5.2 The inclusion of decentralised heating has been investigated in terms of appropriateness to the proposed development as it can help to provide the greatest reductions in CO<sub>2</sub> emissions.
- 5.3 The PartL GLA carbon emission reporting spreadsheet will be submitted as part of the planning application document and it will include Be Clean DER reports of the dwellings and predicts the residential regulated CO<sub>2</sub> emissions baseline.

### Connection to existing district heating networks

- 5.4 The London Heat Map was investigated to identify an existing or planned district heating network. **Error! Reference source not found.** indicates that this proposed development is not within the heat network priority area but the close distance to the proposed future heat network
- 5.5 Given the lack of existing nearby district heating or community heating infrastructure to connect to at present and cost-effective connection options in the near future and due to the small scale of the project, it is proposed to provide an onsite energy supply option.

### Onsite Heat Supply

- 5.6 The provision of a communal heating system for the development has been considered. The assessment showed that, due to the small size and the development layout, it is not well suited for a communal heating system. In addition, the communal heating system will require significant plant room and riser space, which is very difficult and costly to accommodate within the design. In addition, due to its small size, the communal heating system will likely significantly increase the residents' energy bills, which will go against the target to reduce fuel poverty.
- 5.7 Technically, a small communal heating system can be provided for the development. However, practically, it will unnecessarily complicate the design and significantly increase the heating system's capital and operating costs. The provision of the community heating system for the development is considered impractical.
- 5.8 The Government has announced that by 2025, all new homes will be banned from installing gas and oil boilers and will be heated by low-carbon alternatives instead. The ban is part of a UK action plan to reach carbon Net-Zero by 2050. **An all-electric Air source heat pump (per dwelling) with an underfloor heating system is proposed.** The proposed schematic of this system is presented in Appendix D.
- 5.9 A Vaillant aroTHERM plus 12kW Air source heat pump is proposed for each residential dwelling, and the specification of ASHP is shown in Appendix E Propose Heat Pump Specification for Heating.

- 5.10 The heat distribution system using Underfloor heating is far more efficient than radiators because lower water temperatures can be utilised which further improves heat pump efficiency, ensuring maximum benefit from the heat pump system.
- 5.11 An air source heat pump extracts heat from the outside air like a fridge extracts heat from its inside. It can get heat from the air even when it is as low as -15° C. The heat that is extracted from the ground, air, or water is constantly being renewed naturally, saving you on fuel costs and reducing harmful CO<sub>2</sub> emissions.
- 5.12 Underfloor heating with an air source heat pump:
- Low flow temperature solution – maximising the air source heat pump efficiency
  - Up to 40% more efficient than a boiler and radiators system
  - Reduces carbon footprint
- 5.13 There is a preference for using natural refrigerants created using substances that exist inherently in the environment with a zero-ozone depletion potential (ODP) and very low or zero global warming potential (GWP). Natural refrigerants are the definitive solution to the environmental damage caused by all commonly used synthetic refrigerants. Many natural refrigerants have better heating thermal properties than synthetic refrigerants and are commonly used in domestic appliances designed for use in kitchens and utility rooms without additional safety measures. Most natural refrigerants are flammable but safe for domestic use when used in sealed, low-volume systems.

### Affordability of heat

- 5.14 In line with the GLA London plan, the following measures will be taken into consideration to achieve the affordability of heat:
- Use the "fabric first approach" by improving the U-values for building fabric elements to increase fabric energy efficiency and reduce the energy demand of the building.
  - Use highly efficient Heat Pumps to improve the efficiency of the heating system.
  - Install PV and use Electricity generated by PV to operate heat pumps.
- 5.15 An all-electric Air source heat pump heating system is proposed to futureproof this development and ensure that the development can be constructed post-2025. The system schematic is included in Appendix D Proposed Air Source Heat Pump Heating System Schematic.
- 5.16 The development will employ a registered energy supplier (one of the heat trust scheme participants) to protect the occupier. This includes support for consumers in vulnerable circumstances, responding to faults and emergencies, guaranteed service payments for interruptions in supply, metering and billing and complaints handling.
- 5.17 This developer is encouraged to apply to be a registered site for the heat trust scheme when connected to the future District Heat Network.

## 6. Renewable Energy (Be Green)

- 6.1 In accordance with GLA London Plan Policy SI 2, Development proposals should seek to utilise renewable energy technologies such as biomass heating, cooling and electricity; renewable energy from waste; photovoltaics; solar water heating; wind and heat pumps. The mayor encourages using a full range of renewable energy technologies, which should be incorporated wherever site conditions make them feasible and where they contribute to the highest overall and most cost-effective carbon dioxide emissions savings for a development proposal.
- 6.2 The GLA London Plan Policy SI 2 expects all major development proposals to maximise onsite renewable energy generation. In particular, solar PV should be maximised on roof spaces. This is regardless of whether the 35% onsite target has already been reached through earlier stages of the energy hierarchy.
- 6.3 This development is not considered a major development according to the London Plan 2021 (FLA of 580m<sup>2</sup> <1000<sup>2</sup>) but it is regarded as medium development by Camden. the Camden Planning Guidance expects this development to achieve minimum of 20% carbon emission reduction (refer to Table 2a Energy reduction targets, domestic, Energy efficiency and adaptation, January 2021).
- 6.4 The PartL GLA carbon emission reporting spreadsheet will be submitted as part of the planning application document and it will include Be Green DER reports of the dwellings and predicts the residential regulated CO<sub>2</sub> emissions baseline.

### Heat Pumps

- 6.5 Heat pumps should always be categorised under 'Be Green' of the energy hierarchy unless they serve district heating networks. In that case, they should be categorised under Be Clean category.
- 6.6 Where heat pumps are proposed, a high energy efficiency specification will be expected to ensure the system operates efficiently and reduce peak electricity demand. This applies to any heat pump proposal, including air source heat pumps (ASHPs), ground source heat pumps (GSHPs), water source heat pumps (WSHPs), or hybrid ambient loop systems.
- 6.7 Heat pumps operate on a similar principle to a domestic refrigerator. Low-grade heat is extracted from ground, air or an ambient water loop and absorbed by a refrigerant solution which is then compressed to a high temperature. The compressed heat is used to generate hot water and heating.
- 6.8 Heat pumps are better suited for use with low-temperature underfloor heating systems and are less efficient when used to provide higher-temperature domestic hot water.
- 6.9 Heat pumps are not boilers and should not be set up like a boiler. For efficient operation, the heat installation should include a thermal buffer and reduce hot water storage temperatures. In the past, there has been a failure by the manufacturers to train installers and owners of the heat pumps to correctly set up and use the heat pump efficiently, resulting in higher operational costs.
- 6.10 The following low and zero carbon technologies have been considered and compared for this particular development:
- Photovoltaic Panels (PV)
  - Ground Source Heat Pump (GSHP)

- Wind Turbines
- Biomass Boiler
- Solar Thermal

- 6.11 The assessment of these technologies shows that PV systems are considered to be the most suitable renewable energy technology option for this development.

### Photovoltaics

- 6.12 PV is the most practical renewable energy technology, which can be applied to almost any building; 1kWp of PV generates around 850kWh in an average year. Since the feed-in tariff incentive removal in April 2019, the financial payback for PV has lengthened to about 15 years.
- 6.13 The proposal is to install a low-angle PV array on the roof of the building to offset 35% of the building's regulated energy carbon emission.
- 6.14 Photovoltaic cells are panels you can attach to your roof or walls. There are many different types available, e.g., panels, tile cladding, and other bespoke finishes. Each cell is made from one or two layers of semiconducting material, usually silicon.
- 6.15 When light shines on the PV cell, it creates an electric field across the layers. The stronger the sunshine, the more Electricity is produced.
- 6.16 Generally, 5m<sup>2</sup> (1KW) of conducting material such as a crystalline array will provide an average output of 900-110 kW hours per year.



Figure 8 Van De Valk PV Green Roof PV Racking System



Financial Inputs		Financial Inputs	
System Size		Financial Inputs	
System Cost	4.0 kW	FiT	£0.00
RPI	-£6,000.0	Exported	£69.21
Fuel inflation	3.00%	Saving	£193.36
Number of years	0.25%	Total income	£262.58
Feed in Tariff	20 years	Yield	4.38%
Cost of Electricity	0.00 p/kWh	Payback (years)	22 years
Export Price	16.00 p/kWh	PV Variables	
Electricity Exported	4.85 p/kWh	Location	Thames
Electricity Used In-House	50.00%	Direction	SSE/SSW
Generated Electricity	50.00%	Panel Angle	30°
Export	2,854 kWh	Shading Factor	Modest
Used	1,427 kWh	Array Sizes	4.0 kW
Return after 20 years	1,427 kWh	Annual electricity	2,854 kWh

Table 26 Financial Input Summary of PV Energy Generation

	Days	Day Length	kWh/kW Month	PV Panel Factors	Total	Cumulative
January	31	8	33	1	85 kW	85 kW
February	28	9	50	1	129 kW	214 kW
March	31	11	86	1	221 kW	434 kW
April	30	13	121	1	309 kW	743 kW
May	31	15	146	1	374 kW	1117 kW
June	30	16	154	1	395 kW	1512 kW
July	31	17	150	1	385 kW	1897 kW
August	31	16	134	1	342 kW	2239 kW
September	30	14	103	1	264 kW	2504 kW
October	31	11	69	1	177 kW	2681 kW
November	30	10	40	1	103 kW	2784 kW
December	31	8	27	1	70 kW	2854 kW

Table 27 Summary of PV Energy Generation per month

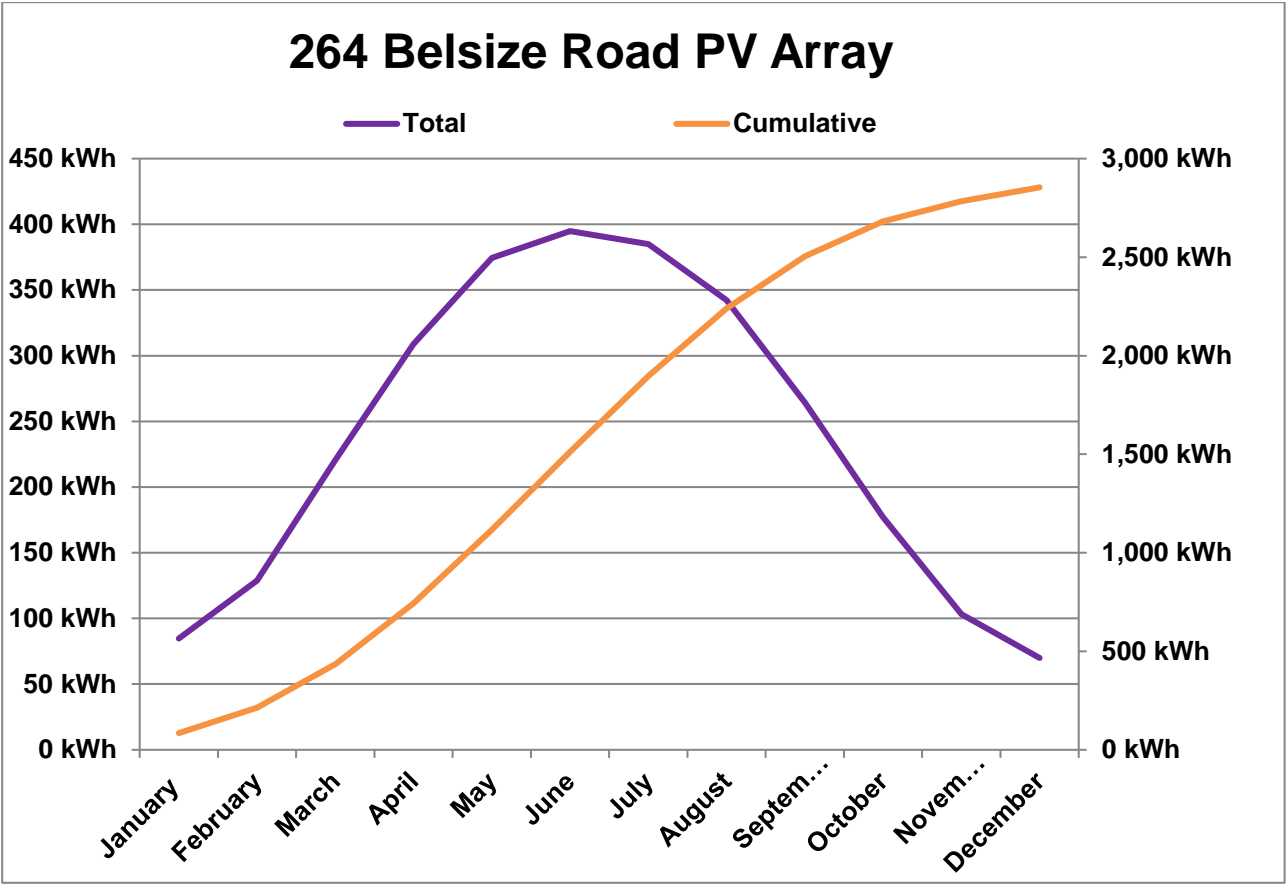


Figure 9 Annual Zero Carbon Energy Generation from PV array

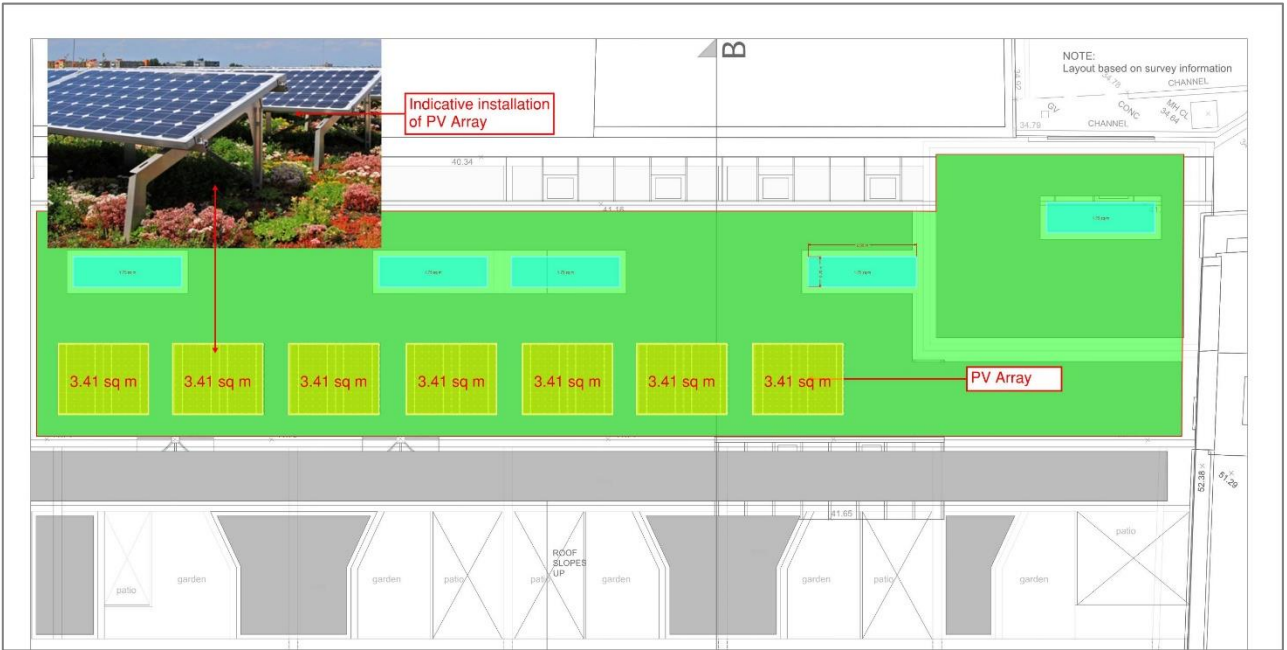


Figure 10 Proposed Location of 4kW PV array

6.17 The PV assessment shows that circa 2,854kWh/year with 4kWp of renewable electricity generation, which would require PV Array of 24m².

6.18 PV systems should ideally face south with an incline of 30°, although orientations within 45° of south and other angles can still generate outputs if panels are not overshadowed. Optimum design of the PV installation is required to ensure maximum electricity generation per kWp installed. There are several design considerations to be made to ensure the best use of the system. The key design considerations for designing and installing PV systems are:

- Design of PV installation to optimise inclination and orientation;
- Ensure that PV panels are not overshadowed;
- Ensure correct installation of PV arrays for good ventilation
- Ensure that the electrical wiring from PV arrays to inverters is kept to a minimum to reduce electrical losses;
- Provide sufficient space around PV installations for safe access and maintenance of the modules and other equipment installed on the roof.

6.19 The Electricity generating potential of PV panels is not dependent on development demand but on suitable available roof space for installation. **Error! Reference source not found.** identifies suitable roof space for PV to be installed. This will provide a suitable unshaded location for the PV required to meet the London Plan 35% reduction target.

### Alternative renewable energy options

6.20 The following alternative renewable options have been considered but found not to be appropriate for this scheme:

- **Solar thermal collector**- it can be used to provide hot water using the irradiation from the sun. They can generally provide approximately 50% of domestic hot water demand. However, the carbon savings are quite low and it is a high-cost technology. **So solar thermal collectors are not recommended for this scheme.**
- **Biomass** – Solid, liquid or gaseous fuels derived from plant material can provide boiler heat for space and water heating. A biomass boiler would supplement a standard gas heating system so some of the cost may be offset through money saved on using smaller traditional boiler's reliability of fuel access/supply can be a problem. **Not suitable for an urban location** as installation will reduce local air quality through smoke emission and increase vehicle movement from the transportation of biomass fuel. **So it is not recommended for this scheme.**  
**Ground Source Heat Pump** – Ground Source Heat pump (GSHP) Utilise horizontal loops or vertical boreholes, GSHP make use of the grounds almost constant temperature to provide heating and/or cooling using a heat exchanger connected to a space/water heating delivery system. Optimum efficiency with underfloor heating systems. **It is not a feasible technology for the site** since there is limited external space available to install boreholes. **So it is not recommended for this scheme.**
- **Wind Turbines** – Vertical and horizontal axis wind turbines enable electricity to be generated using the power within the wind Not suitable for urban environments due to low wind conditions and obstructions. It is unsuitable in an urban location with turbulent airflow around the building, generating

a reasonable amount of electricity requires a substantial unit with a blade diameter over 6m. **So it is not recommended for this scheme.**

## 7. Glossary

### *Building Emissions Rate (BER) or Dwelling Emission Rate (DER)*

The actual building/dwelling CO<sub>2</sub> emission rate, is expressed in terms of the mass of CO<sub>2</sub> emitted per year per square metre of the total useful floor area of the building (kg/m<sup>2</sup>/year). In order to comply with Part L of the Building Regulations, the BER/DER must be less than the TER (see below).

### *Target CO<sub>2</sub> Emission Rate (TER)*

The minimum energy performance requirement for a new dwelling/building. It is expressed in terms of the mass of CO<sub>2</sub> emitted per year per square metre of the total useful floor area of the building (kg/m<sup>2</sup>/year).

### *DER Dwelling Emission Rate*

This is the dwelling Emission Rate as kgCO<sub>2</sub>/m<sup>2</sup>

### *TPER Target Primary Energy Rate*

The Target Primary Energy Rate will consider how much energy (in kilowatt hours) is required to provide heating and hot water to a newly built dwelling. It will also include energy used by lighting, ventilation, cooling systems and showers et of flow and return pipes circulating hot water to the apartment blocks (and dwellings contained therein) and non-domestic buildings on a development. Expressed as kWhPE/m<sup>2</sup>/year and determined using the standard assessment procedure. The maximum primary energy use for the dwelling in a year

### *DPER*

The Dwelling Primary Energy Rate is **the actual primary energy rate of the actual new dwelling, expressed as** Expressed as kWh<sub>PE</sub>/m<sup>2</sup>/year and determined using the standard assessment procedure.

### *TFEE Target Fabric Energy Efficiency Rate*

The Target Fabric Energy Efficiency Rate is defined as the space heating and cooling requirements per square metre of floor area, presented in kWh/m<sup>2</sup>/year, and is based on how well the fabric of the dwelling performs. This is the target dwelling heat loss through the building fabric expressed as kWh/m<sup>2</sup>. year

### *DFEE Dwelling Fabric Energy Efficiency Rate*

The Dwelling Fabric Energy Efficiency rate is **the actual energy performance of the new dwelling**. In accordance with regulation 26A of the building regulations, the calculated Dwelling Fabric Energy Efficiency rate must not be greater than the Target Fabric Energy Efficiency rate. kWh/m<sup>2</sup>/year and determined using the standard assessment procedure.

### *Dwelling*

A dwelling is self-contained unit to accommodate a single household.

### *Energy Assessment/Strategy*

An energy assessment/strategy is a document which explains how the London Plan targets for CO<sub>2</sub> reduction will be met for a particular development within the context of the energy hierarchy.

### *Air Source Heat Pump*

An air source heat pump, sometimes referred to as an air-to-water source heat pump, **transfers heat from the outside air to water, which heats your rooms via radiators or underfloor heating**. It can also heat water stored in a hot water cylinder for your hot taps, showers and baths.

### *Kilowatt (kW)*

One thousand watts. A watt is a measure of power.

### *Part L of the Building Regulations*

Approved documents L1A and L2A of the Building Regulations relate to the conservation of fuel and power in new dwellings and buildings.

### *Regulated CO<sub>2</sub> emissions*

The CO<sub>2</sub> emissions arising from energy used by fixed building services, as defined in Approved Document Part L of the Building Regulations. These include fixed systems for lighting, heating, hot water, air conditioning and mechanical ventilation.

### *Standard Assessment Procedure (SAP)*

A methodology for assessing and comparing the energy and environmental performance of dwellings. Its purpose is to provide accurate and reliable assessments of dwelling energy performances that are needed to underpin Building Regulations and other policy initiatives.

### *Air permeability*

The measure of airtightness of the building fabric. It is defined as the air leakage rate per hour per m<sup>2</sup> of envelope area at the test reference pressure differential of 50Pa or 4Pa.

- The limiting air permeability is the worst allowable air permeability.
- The design air permeability is the target value set at the design stage.
- The assessed air permeability is the value used in establishing the building emission rate and the building primary energy rate. The assessed air permeability is based on a measurement of the air permeability of the building concerned.

### *Airtightness*

The resistance of the building envelope to infiltration when ventilators are closed. The greater the airtightness at a given pressure difference across the envelope, the lower the infiltration.

### *Renewable technology*

Technology that uses renewable resources, which are naturally replenished on a human timescale, to produce Electricity. Resources include wind, wave, marine, hydro, biomass and solar.

### *Existing district heat network*

A district heat network that is either in operation or is under construction on 15th June 2022. For these purposes, under construction means any of the following.

- The building to house the energy centre has been constructed.
- There is a heat offtake agreement signed between the heat network and a third party.
- Excavation for pipework has been completed.



8. Appendices

Appendix A.	Energy Tables .....	28
Appendix B.	Block Compliance.....	30
Appendix C.	Thermal Fabric Efficiency (U values) .....	31
Appendix D.	Proposed Air Source Heat Pump Heating System Schematic.....	34
Appendix E.	Propose Heat Pump Specification for Heating.....	35
Appendix F.	Early-Stage Overheating Risk Tool, Good Homes Alliance (2019). .....	36
Appendix G.	SAP 10.2 Compliance Report & EPC.....	37

Appendix A. Energy Tables

Baseline scenario

Ref	FLA	Heating (kWh p.a.) R307a	Heating	Domestic Hot Water (kWh p.a.) R310a	Fuel type Domestic Hot Water	Lighting (kWh p.a.)	Auxiliary (kWh p.a.)	Equipment	Cooking	DER 2012 (kgCO2 / m2)	DFEE (kWh/m²)
Unit 01	118.0 m²	8,411 kWh	Gas	3,880 kWh	Gas	257 kWh	513 kWh	555.40 kWh	1 kWh	18.71	54.3
Unit 02	108.8 m²	4,399 kWh	Gas	3,854 kWh	Gas	228 kWh	385 kWh	434.00 kWh	2 kWh	13.14	39.4
Unit 03	108.8 m²	4,276 kWh	Gas	3,856 kWh	Gas	228 kWh	385 kWh	406.80 kWh	2 kWh	15.4	38.6
Unit 04	108.8 m²	4,115 kWh	Gas	3,858 kWh	Gas	228 kWh	385 kWh	429.10 kWh	2 kWh	12.74	37.9
Unit 05	114.2 m²	5,116 kWh	Gas	3,865 kWh	Gas	235 kWh	401 kWh	450.50 kWh	2 kWh	13.7	43.5
Total	558.6 m²	26317 kWh		19313 kWh	0 kWh	1,177 kWh	2,068 kWh	2,276 kWh	8 kWh	14.91 kgCO2/m²	43.3 kWh/m²
SAP 10.2 Emissions		5,527 kgCO2		4,056 kgCO2		160 kgCO2	281 kgCO2	310 kgCO2	1 kgCO2	2 kgCO2	22526.10 kWh

Be Lean Scenario

Ref	FLA	Heating (kWh p.a.) R307a	Heating	Domestic Hot Water (kWh p.a.) R310a	Fuel type Domestic Hot Water	Lighting (kWh p.a.)	Auxiliary (kWh p.a.)	Equipment	Cooking	DER 2021 (kgCO2 / m2)	DFEE (kWh/m²)
Unit 01	118.0 m²	7,681 kWh	Gas	3,886 kWh	Gas	239 kWh	513 kWh	555.40 kWh	1 kWh	19.24 kgCO2/m²	53.6 kWh/m²
Unit 02	108.8 m²	3,781 kWh	Gas	3,865 kWh	Gas	212 kWh	385 kWh	434.00 kWh	2 kWh	13.63 kgCO2/m²	37.3 kWh/m²
Unit 03	108.8 m²	3,660 kWh	Gas	3,868 kWh	Gas	212 kWh	385 kWh	406.80 kWh	2 kWh	15.86 kgCO2/m²	36.4 kWh/m²
Unit 04	108.8 m²	3,556 kWh	Gas	3,870 kWh	Gas	212 kWh	385 kWh	429.10 kWh	2 kWh	13.19 kgCO2/m²	35.6 kWh/m²
Unit 05	114.2 m²	4,389 kWh	Gas	3,876 kWh	Gas	218 kWh	401 kWh	450.50 kWh	2 kWh	14.14 kgCO2/m²	39.9 kWh/m²
Total	558.6 m²	23,067 kWh		19,365 kWh	0 kWh	1,095 kWh	2,068 kWh	2,276 kWh	8 kWh	15.39 kgCO2/m²	41.2 kWh/m²
SAP 10.2 Emissions		4,844 kgCO2		4,067 kgCO2		149 kgCO2	281 kgCO2	310 kgCO2	1 kgCO2		23695.66 kWh

Ref	FLA	Heating (kWh p.a.)	Fuel type Space Heating	Hot Water (kWh p.a.)	Hot Water	Space and Domestic Hot Water from CHP (kWh p.a.)	Fuel type CHP	Electricity by CHP (kWh p.a.)	Lighting (kWh p.a.)	Auxiliary (kWh p.a.)	DER 2021 (kgCO <sub>2</sub> / m <sup>2</sup> ) R384
Unit 01	118.0 m <sup>2</sup>	7,681 kWh	Gas	3,886 kWh	Gas				239 kWh	513 kWh	19.24 kgCO <sub>2</sub> /m <sup>2</sup>
Unit 02	108.8 m <sup>2</sup>	3,781 kWh	Gas	3,865 kWh	Gas				212 kWh	385 kWh	13.63 kgCO <sub>2</sub> /m <sup>2</sup>
Unit 03	108.8 m <sup>2</sup>	3,660 kWh	Gas	3,868 kWh	Gas				212 kWh	385 kWh	15.86 kgCO <sub>2</sub> /m <sup>2</sup>
Unit 04	108.8 m <sup>2</sup>	3,556 kWh	Gas	3,870 kWh	Gas				212 kWh	385 kWh	13.19 kgCO <sub>2</sub> /m <sup>2</sup>
Unit 05	114.2 m <sup>2</sup>	4,389 kWh	Gas	3,876 kWh	Gas				218 kWh	401 kWh	14.14 kgCO <sub>2</sub> /m <sup>2</sup>
Total	558.6 m <sup>2</sup>	23,067 kWh		19,365 kWh					1,094.6 kWh	2,068.1 kWh	15.39 kgCO <sub>2</sub> /m <sup>2</sup>
<b>SAP 10.2 Emissions</b>		<b>4,844 kgCO<sub>2</sub></b>		<b>4,067 kgCO<sub>2</sub></b>					<b>149 kWh</b>	<b>281 kWh</b>	

Be Green Scenario

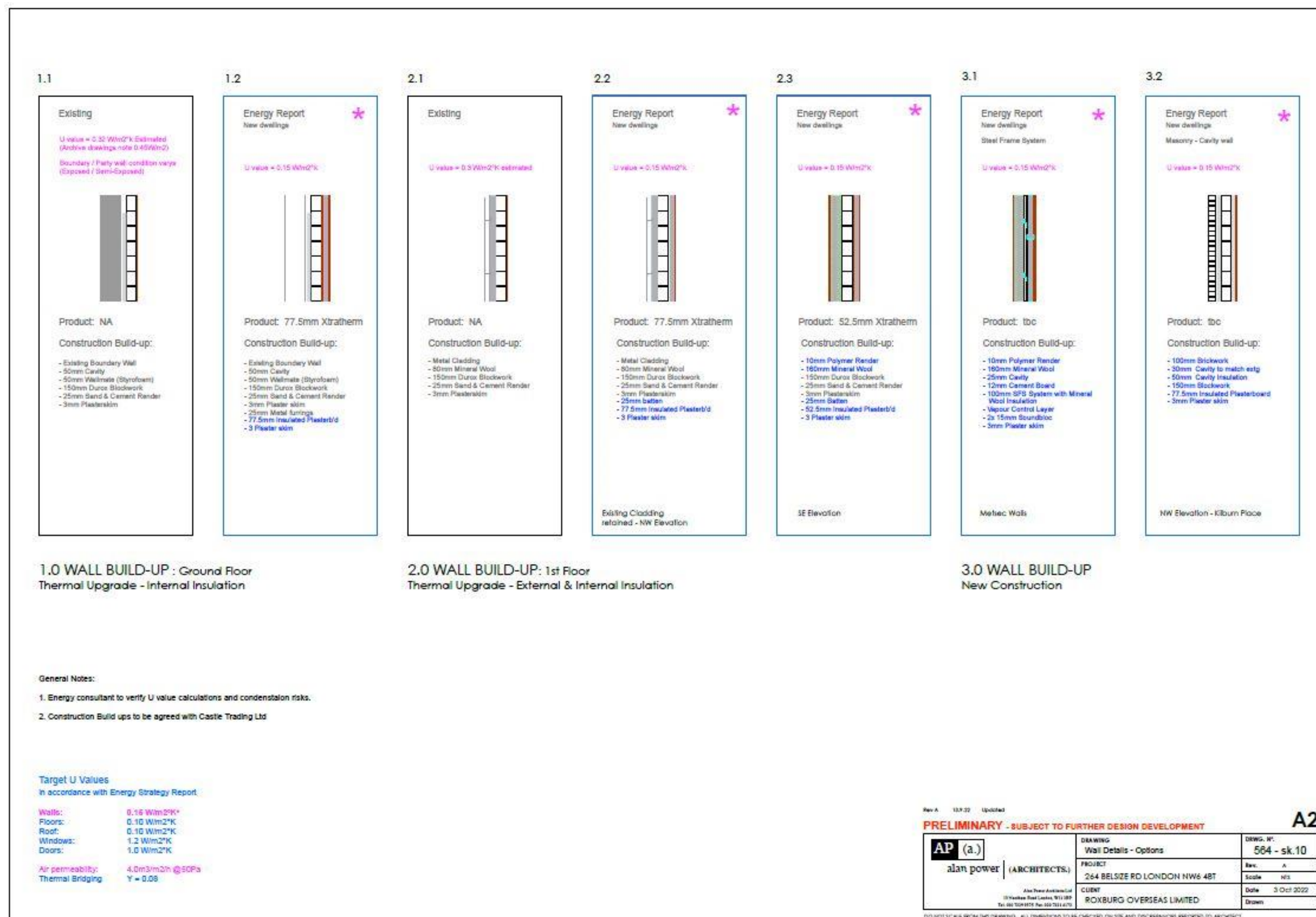
Ref	FLA	Heating (kWh p.a.) R307b	r307b/(R367b*0.01)	Heating	Hot Water (kWh p.a.) R310c	Fuel type Domestic Hot Water	Heat from CHP (kWh p.a.)	Fuel type CHP	Electricity by CHP (kWh p.a.)	Electricity by renewable (kWh p.a.)	Lighting (kWh p.a.)	Auxiliary (kWh p.a.)	DER 2021 (kgCO <sub>2</sub> / m <sup>2</sup> ) R384
Unit 01	118.0 m <sup>2</sup>	1,700 kWh		Electricity	1,763 kWh	Gas				-659 kWh	239 kWh	427 kWh	3.97 kgCO <sub>2</sub> /m <sup>2</sup>
Unit 02	108.8 m <sup>2</sup>	875 kWh		Electricity	1,717 kWh	Gas				-461 kWh	212 kWh	299 kWh	3.77 kgCO <sub>2</sub> /m <sup>2</sup>
Unit 03	108.8 m <sup>2</sup>	847 kWh		Electricity	1,717 kWh	Gas				-461 kWh	212 kWh	299 kWh	3.73 kgCO <sub>2</sub> /m <sup>2</sup>
Unit 04	108.8 m <sup>2</sup>	823 kWh		Electricity	1,716 kWh	Gas				-527 kWh	212 kWh	299 kWh	3.62 kgCO <sub>2</sub> /m <sup>2</sup>
Unit 05	114.2 m <sup>2</sup>	1,003 kWh		Electricity	1,732 kWh	Gas				-527 kWh	218 kWh	315 kWh	3.72 kgCO <sub>2</sub> /m <sup>2</sup>
Total	558.6 m <sup>2</sup>	5,248 kWh			8,645 kWh					-2,635 kWh	1,095 kWh	1,638 kWh	3.77 kgCO <sub>2</sub> /m <sup>2</sup>
<b>SAP 10.2 Emissions</b>		<b>714 kgCO<sub>2</sub></b>			<b>1,176 kgCO<sub>2</sub></b>					<b>-358 kgCO<sub>2</sub></b>	<b>149 kgCO<sub>2</sub></b>	<b>223 kgCO<sub>2</sub></b>	



Dwelling	Flat Type	Total Floor Area	TER	DER	Saving	Test	TFEE	DFEE	Better	Test	TPE	DPE	Saving	Test
		m²	kgCO2/m²	kgCO2/m²	%		W/m²	W/m²			kgCO2/m²	kgCO2/m²		
264 Belsize Road Unit 1	2B_4P	118.00 m²	14.99	4.28	70%	Pass	57.0	57.4	-1%	Fail	79.02	46.08	42%	Pass
264 Belsize Road Unit 2	2B_4P	108.80 m²	10.9	3.77	65%	Pass	39.4	37.3	5%	Pass	56.95	40.65	29%	Pass
264 Belsize Road Unit 3	2B_4P	108.80 m²	10.72	3.73	65%	Pass	38.6	36.4	6%	Pass	55.95	40.30	28%	Pass
264 Belsize Road Unit 4	2B_4P	108.80 m²	10.55	3.62	66%	Pass	37.9	35.6	6%	Pass	55.03	39.34	29%	Pass
264 Belsize Road Unit 5	2B_4P	114.30 m²	11.51	3.72	68%	Pass	43.5	39.9	8%	Pass	60.28	40.21	33%	Pass
Block Compliance		558.64 m²	11.79	3.83	67%	Pass	43.51	41.57	4%	Pass	61.72	41.38	33%	Pass

## Appendix C. Thermal Fabric Efficiency (U values)

### External Wall







## Roof



Project ID : Online  
Structure element : Flat roof  
Description : Flat roof - bonded  
File reference : 1Z178K5479.FCF



Calculated 'U' value = 0.10W/m<sup>2</sup>K (Calculated in accordance with BS EN ISO 6946:2017)

Condensation risk has been assessed up to and including Level 4 Humidity Class (dwellings with high occupancy) within UK worst case environmental conditions.

Element Description	Element Thickness (mm)	Thermal Conductivity (W/mK)	Thermal Resistance (m²K/W)	Vapour Resistivity (MN/gm)	Vapour Resistance (MN/g)	Mean T (K)	Delta T (K)
Outside surface resistance	-	-	0.040	-	-	78.24	0.06
GREEN ROOF SYSTEM	80.0	-	0.000	-	0.00	78.27	0.00
SINGLE PLY MEMBRANE (adhered)	1.5	0.160	0.009	-	138.00	78.28	0.01
<a href="#">KINGSPAN THERMAROOF TR27</a>	120.0	0.024	5.000	300.00	36.00	82.19	7.81
<a href="#">KINGSPAN THERMAROOF TR27</a>	110.0	0.025	4.400	300.00	33.00	89.54	6.88
VAPOUR CHECK BITUMINOUS	3.0	0.230	0.013	0.00	300.00	92.98	0.02
PROFILED METAL DECK	50.0	-	0.000	-	10.00	92.99	0.00
Inside surface resistance	-	-	0.100	-	-	93.07	0.16

### Detailed U-value Calculation Results

Total resistance of roof

$$R_T = (R_{upper} + R_{lower}) / 2 = (9.562 + 9.562) / 2 = 9.562 \text{ m}^2\text{K/W}$$

(Correction for mechanical fasteners,  $\Delta U_f = 0.0000 \text{ W/m}^2\text{K}$  | Correction for air gaps,  $\Delta U_g = 0.0000 \text{ W/m}^2\text{K}$ )

(Alpha 0.0 m<sup>-1</sup> | Fasteners per square metre 0.0000)

(Fasteners cross-sectional area 0.000 mm<sup>2</sup> | Thermal conductivity of fastener 0.00 W/mK)

(Delta Uf + Delta Ug) is less than 3% of (1 / Rt) so  $U = (1 / Rt) = 0.10 \text{ W/m}^2\text{K}$

**For further information on the specified products, e.g. literature or specification clauses, please follows the links below:-**

Thermarroof TR27 LPC / FM

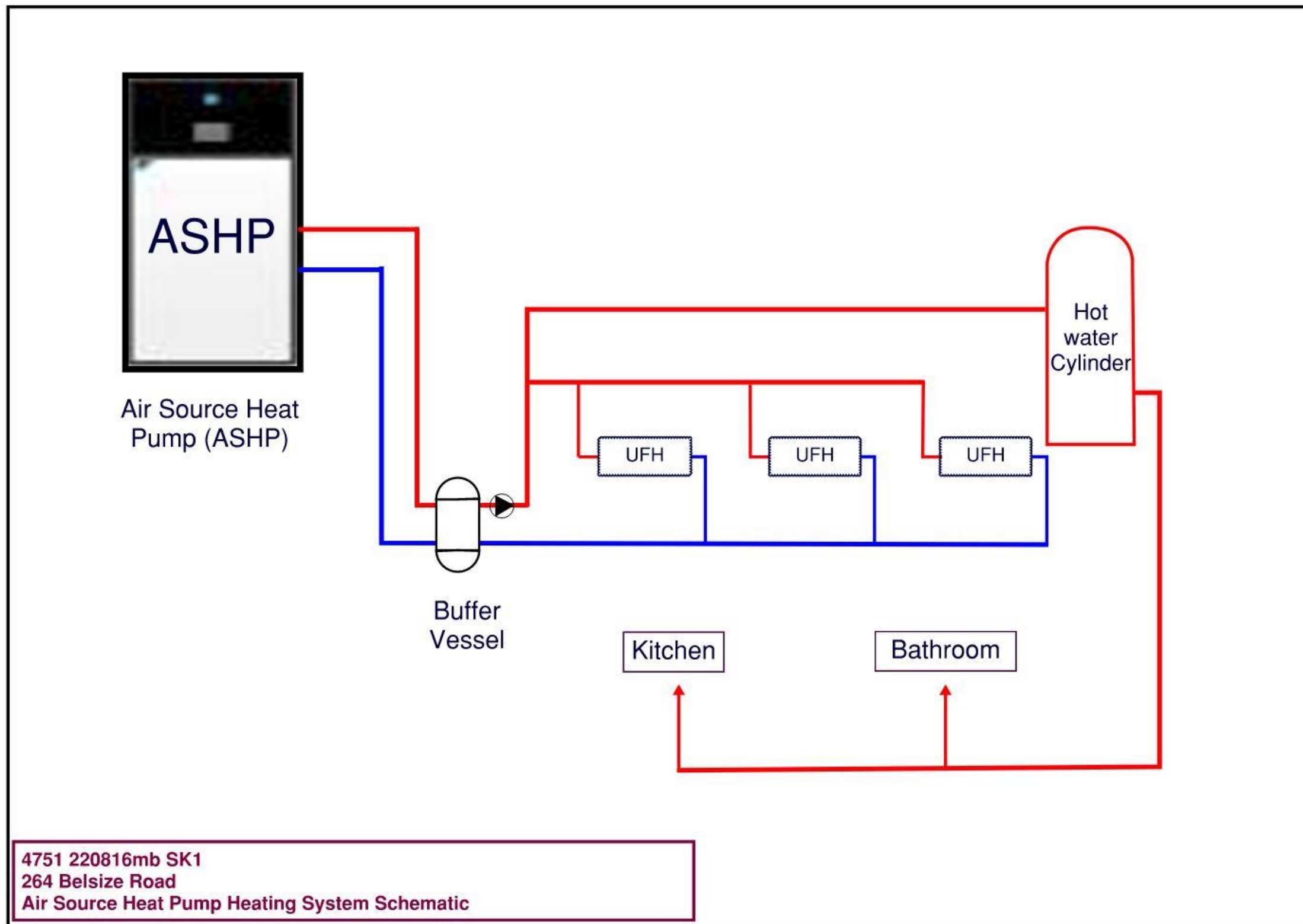
Not all insulation thicknesses shown may currently be stocked, so please check with Kingspan Insulation Customer Service Department on 01544 388601.

Whilst the information and/or specification contained herein is to the best of our knowledge true and accurate we specifically exclude any liability for errors, omissions or otherwise arising therefrom. Details, practices, principles, values and calculations should be verified as to accuracy and suitability for the required purpose for use.

FabCalc 2.06z

© Kingspan Insulation Ltd. Aug 2020

Page 1 of 1, 1Z178K5479.FCF



## Appendix E. Propose Heat Pump Specification for Heating



### Technical specifications

aroTHERM plus	Unit	3.5kW VWL 35 / 6	5kW VWL 55 / 6	7kW VWL 75 / 6	10kW VWL 105 / 6	12kW VWL 125 / 6
General						
Width	mm	1,100				
Height	mm	765		965	1,565	
Depth	mm	450				
Weight, ready for operation	kg	114		128	194	
Connection, heating circuit		G 1 1/4"				
Rated voltage	V	230 V (+10%/- 15%), 50 Hz, 1~/N/PE				
Rated current, maximum	A	14.3		15.0	23.3	
Fuse size		16			25	
Fuse type	A	C/D				
RCD type		A				
eBUS (2-core communication cable)	mm2	0.75				
Maximum length eBUS cable (communication cable)	m	50				
IP rating		IP 15 B				
Fan, power consumption	W	40			50	
Fan quantity		1			2	
Fan, air flow , maximum	m³ /h	2,300			5,100	
Heating pump, power consumption	W	2 - 50			3 - 87	
Heating circuit						
Heating water temperature, minimum/maximum	° C	20 - 75				
Basic length of the heating water pipe, maximum, between the outdoor unit and indoor unit	m	20				
Operating pressure, minimum	bar	0.50				
Operating pressure, maximum	bar	3.00				
Volume flow, minimum	l/h	400		540	995	
Volume flow, maximum	l/h	860		1,205	2,065	
Water volume, in the outdoor unit	l	1.5		2.0	2.5	
Water volume, in the heating circuit, minimum, thawing mode, activated/deactivated back-up heater	l	15 / 40		20 / 55	45 / 150	
Remaining feed pressure, hydraulic	kPa (mbar)	56.0 (560.0)		44.0 (440.0)	55.0 (550.0)	

aroTHERM plus	Unit	3.5kW VWL 35 / 6	5kW VWL 55 / 6	7kW VWL 75 / 6	10kW VWL 105 / 6	12kW VWL 125 / 6
Refrigerant circuit						
Fluid type		R290				
Fluid fill quantity	kg	0.6		0.9	1.3	
Refrigerant, Global Warming Potential (GWP)		3				
CO <sub>2</sub> equivalent	t	0.0018		0.0027	0.0039	
Permissible operating pressure	bar	31.5				
Compressor type		Rotary piston			Scroll compressor	
Compressor oil type		Specific polyalkylene glycol (PAG)				
Compressor, control		Electronic				

<b>Noise emissions, heating mode</b>						
Sound power, EN 12102, EN 14511 LWA, A7/W35	dB(A)	51		53		58
Sound power, EN 12102, EN 14511 LWA, A7/W45	dB(A)	53				58
Sound power, EN 12102, EN 14511 LWA, A7/W55	dB(A)	54		55		60

<b>Efficiency</b>						
Energy efficiency class 35°C	(A+++ to F)	A+++				
Energy efficiency class 55°C	(A+++ to F)	A++				

<b>Combination with uniTOWER</b>						
Energy efficiency class	(A+++ to F)	A++				
Energy efficiency class for hot water supply	(A+ to F)	A				

uniTOWER	Unit	VIH QW 190 / 6
Total storage cylinder capacity	l	188
Temperature hot water (max. – with auxiliary heating)	°C	55 - 75
Dimensions, unpacked (height/width/depth)	mm	1880 x 599 x 693
Weight, unpacked	kg	175
Auxiliary electric heater	kW	6kW (230V/50Hz) / 9kW (400V/50Hz)

Hydraulic station	Unit	VWZ MEH 97
Dimensions, unpacked (height/width/depth)	mm	720 x 440 x 350
Weight, unpacked	kg	15
Power electric backup heater	kW	6 kW (230V/50Hz) / 9 kW (400V/50Hz)



## EARLY STAGE OVERHEATING RISK TOOL Version 1.0, July 2019

This tool provides guidance on how to assess overheating risk in residential schemes at the early stages of design. It is specifically a pre-detail design assessment intended to help identify factors that could contribute to or mitigate the likelihood of overheating. The questions can be answered for an overall scheme or for individual units. Score zero wherever the question does not apply. Additional information is provided in the accompanying guidance, with examples of scoring and advice on next steps. Find out more information and download accompanying guidance at [goodhomes.org.uk/overheating-in-new-homes](http://goodhomes.org.uk/overheating-in-new-homes).



KEY FACTORS INCREASING THE LIKELIHOOD OF OVERHEATING				KEY FACTORS REDUCING THE LIKELIHOOD OF OVERHEATING			
<b>Geographical and local context</b>							
#1 Where is the scheme in the UK? <small>See guidance for map</small>	South east	4	4	#8 Do the site surroundings feature significant blue/green infrastructure? <small>Proximity to green spaces and large water bodies has beneficial effects on local temperatures; as guidance, this would require at least 50% of surroundings within a 100m radius to be blue/green, or a rural context</small>	1	1	
	Northern England, Scotland & NI	0					
	Rest of England and Wales	2					
#2 Is the site likely to see an Urban Heat Island effect? <small>See guidance for details</small>	Central London (see guidance)	3	3				
	Gtr London, Manchester, B'ham	2					
	Other cities, towns & dense sub-urban areas	1					
<b>Site characteristics</b>							
#3 Does the site have barriers to windows opening? <small>- Noise/Acoustic risks - Poor air quality/smells e.g. near factory or car park or very busy road - Security risks/crime - Adjacent to heat rejection plant</small>	Day - reasons to keep all windows closed	8	0	#9 Are immediate surrounding surfaces in majority pale in colour, or blue/green? <small>Lighter surfaces reflect more heat and absorb less so their temperatures remain lower; consider horizontal and vertical surfaces within 10m of the scheme</small>	1	1	
	Day - barriers some of the time, or for some windows e.g. on quiet side	4					
	Night - reasons to keep all windows closed	8					
	Night - bedroom windows OK to open, but other windows are likely to stay closed	4					
#4 Are the dwellings flats? <small>Flats often combine a number of factors contributing to overheating risk e.g. dwelling size, heat gains from surrounding areas; other dense and enclosed dwellings may be similarly affected - see guidance for examples</small>		3	0	#10 Does the site have existing tall trees or buildings that will shade solar-exposed glazed areas? <small>Shading onto east, south and west facing areas can reduce solar gains, but may also reduce daylight levels</small>	1	1	
#5 Does the scheme have community heating? <small>i.e. with hot pipework operating during summer, especially in internal areas, leading to heat gains and higher temperatures</small>		3	0	#11 Do dwellings have high exposed thermal mass AND a means for secure and quiet night ventilation? <small>Thermal mass can help slow down temperature rises, but it can also cause properties to be slower to cool, so needs to be used with care - see guidance</small>	1	1	
#6 What is the estimated average glazing ratio for the dwellings? <small>(as a proportion of the facade on solar-exposed areas i.e. orientations facing east, south, west, and anything in between). Higher proportions of glazing allow higher heat gains into the space</small>	>65%	12	0	#12 Do floor-to-ceiling heights allow ceiling fans, now or in the future? <small>Higher ceilings increase stratification and air movement, and offer the potential for ceiling fans</small>	2	1	
	>50%	7					
	>35%	4					
#7 Are the dwellings single aspect? <small>Single aspect dwellings have all openings on the same facade. This reduces the potential for ventilation</small>	Single-aspect	3	3	#13 Is there useful external shading? <small>Shading should apply to solar exposed (E/S/W) glazing. It may include shading devices, balconies above, facade articulation etc. See guidance on "full" and "part". Scoring depends on glazing proportions as per #6</small>	Full	Part	0
	Dual aspect	0					
#8 Do windows & openings support effective ventilation? <small>Larger, effective and secure openings will help dissipate heat - see guidance</small>	Single-aspect	3	3	#14 Do windows & openings support effective ventilation? <small>Openings compared to Part F purge rates</small>	= Part F	+50%	+100%
	Dual aspect	2					
<b>Scheme characteristics and dwelling design</b>							
#4 Are the dwellings flats? <small>Flats often combine a number of factors contributing to overheating risk e.g. dwelling size, heat gains from surrounding areas; other dense and enclosed dwellings may be similarly affected - see guidance for examples</small>				#11 Do dwellings have high exposed thermal mass AND a means for secure and quiet night ventilation? <small>Thermal mass can help slow down temperature rises, but it can also cause properties to be slower to cool, so needs to be used with care - see guidance</small>			
#5 Does the scheme have community heating? <small>i.e. with hot pipework operating during summer, especially in internal areas, leading to heat gains and higher temperatures</small>				#12 Do floor-to-ceiling heights allow ceiling fans, now or in the future? <small>Higher ceilings increase stratification and air movement, and offer the potential for ceiling fans</small>			
#6 What is the estimated average glazing ratio for the dwellings? <small>(as a proportion of the facade on solar-exposed areas i.e. orientations facing east, south, west, and anything in between). Higher proportions of glazing allow higher heat gains into the space</small>				#13 Is there useful external shading? <small>Shading should apply to solar exposed (E/S/W) glazing. It may include shading devices, balconies above, facade articulation etc. See guidance on "full" and "part". Scoring depends on glazing proportions as per #6</small>			
#7 Are the dwellings single aspect? <small>Single aspect dwellings have all openings on the same facade. This reduces the potential for ventilation</small>				#14 Do windows & openings support effective ventilation? <small>Openings compared to Part F purge rates</small>			
TOTAL SCORE 10 = Sum of contributing factors: 10				minus Sum of mitigating factors: 8			
<div> <div>High 12</div> <div>Medium 8</div> <div>Low</div> </div>							
<div> <div>score &gt;12: Incorporate design changes to reduce risk factors and increase mitigation factors AND Carry out a detailed assessment (e.g. dynamic modelling against CIBSE TM59)</div> <div>score between 8 and 12: Seek design changes to reduce risk factors and/or increase mitigation factors AND Carry out a detailed assessment (e.g. dynamic modelling against CIBSE TM59)</div> <div>score &lt;8: Ensure the mitigating measures are retained, and that risk factors do not increase (e.g. in planning conditions)</div> </div>							



Unit 01

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Mon 03 Oct 2022 10:48:50

Project Information			
Assessed By	Sapdemo Peterdeer	Building Type	House, Mid-terrace
OCDEA Registration	STRO037608	Assessment Date	2022-09-05

Dwelling Details			
Assessment Type	As designed	Total Floor Area	118 m²
Site Reference	264 Belsize Road Unit 1 Be Green	Plot Reference	Unit 01
Address	264 Belsize Road, Kilburn, CAMDEN, NW6 4BT		

Client Details	
Name	Not Provided
Company	Not Provided
Address	Not Provided, Not Provided

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	14.99 kgCO <sub>2</sub> /m²	
Dwelling carbon dioxide emission rate	4.28 kgCO <sub>2</sub> /m²	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	79.02 kWh <sub>PE</sub> /m²	
Dwelling primary energy	46.08 kWh <sub>PE</sub> /m²	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	57 kWh/m²	
Dwelling fabric energy efficiency	57.4 kWh/m²	FAIL

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m²K]	Dwelling average U-Value [W/m²K]	Element with highest individual U-Value	
External walls	0.26	0.15	N. Ex Wall (0.15)	OK
Party walls	0.2	0	Party Wall (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	0.06	Exposed Floor (0.1)	OK
Roofs	0.16	0.1	Roof (0.1)	OK
Windows, doors, and roof windows	1.6	1.19	2 (1.2)	OK
Rooflights	2.2	N/A	N/A	N/A

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))			
Name	Net area [m²]	U-Value [W/m²K]	
Exposed wall: N. Ex Wall	37.4185	0.15	
Exposed wall: S.Ex Wall	29.485	0.15	
Exposed wall: E.Ex Wall	75.54	0.15	
Exposed wall: W.Ex Wall	17.86	0.15	
Party wall: Party Wall	64.76	0 (!)	
Upper floor: Exposed Floor	65.13	0.1 (!)	
Upper floor: Exposed Floor	41.55	0 (!)	
Upper floor: Exposed Floor	65.13	0.1 (!)	
Upper floor: Exposed Floor	41.55	0 (!)	
Upper floor: Exposed Floor	65.13	0.1 (!)	
Upper floor: Exposed Floor	41.55	0 (!)	
Exposed roof: Roof	63.38	0.1 (!)	

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m²]	Orientation	Frame factor	U-Value [W/m²K]
1, Doors	1.935	South West	N/A	1 (!)
2, Windows (1)	7.0315	North East	0.8	1.2
3, Windows (1)	3.84	South East	0.8	1.2
4, Windows (1)	7.59	South East	0.8	1.2

Name	Area [m²]	Orientation	Frame factor	U-Value [W/m²K]
5, Windows (1)	4.62	North East	0.8	1.2
6, Windows (1)	7.71	South West	0.8	1.2
7, Windows (1)	5.88	North East	0.8	1.2
8, Windows (1)	5.46	South West	0.8	1.2
9, Windows (1)	2.76	North East	0.8	1.2
10, Roof windows (1)	1.75	South West	0.8	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Not government-approved scheme	0.05	Not Provided
External wall	E3: Sill	Not government-approved scheme	0.05	Not Provided
External wall	E4: Jamb	Not government-approved scheme	0.05	Not Provided
External wall	E5: Ground floor (normal)	Not government-approved scheme	0.16	Not Provided
External wall	E16: Corner (normal)	Not government-approved scheme	0.09	Not Provided
External wall	E17: Corner (inverted - internal area greater than external area)	Not government-approved scheme	-0.09	Not Provided
External wall	E18: Party wall between dwellings	Not government-approved scheme	0.06	Not Provided

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa		
8 m³/hm²		
Dwelling air permeability at 50Pa		4 m³/hm², Design value
Air permeability test certificate reference		Not Provided
		OK

4 Space heating	
Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	396.8%
Emitter type	Both radiators and underfloor
Flow temperature	35°C
System type	
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	400 litres
Declared heat loss	1.9 kWh/day
Primary pipework insulated	Yes
Manufacturer	Gledhill
Model	Stainless Lite Plus Unvented Cylinder
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	

<b>Water heating</b> - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	
<b>7 Lighting</b>	
Minimum permitted light source efficacy	75 lm/W
Lowest light source efficacy	100 lm/W <span>OK</span>
External lights control	N/A
<b>8 Mechanical ventilation</b>	
<b>System type:</b> Balanced whole-house mechanical ventilation with heat recovery	
Maximum permitted specific fan power	1.5 W/(l/s)
Specific fan power	0.71 W/(l/s) <span>OK</span>
Minimum permitted heat recovery efficiency	73%
Heat recovery efficiency	89% <span>OK</span>
Manufacturer/Model	The Nuaire Group Nuaire
Commissioning	Not Provided / Not Provided
<b>9 Local generation</b>	
Technology type: <b>Photovoltaic system (1)</b>	
Peak power	1 kWp
Orientation	South East
Pitch	30°
Overshading	Modest
Manufacturer	Not Provided
MCS certificate	
<b>10 Heat networks</b>	
N/A	
<b>11 Supporting documentary evidence</b>	
N/A	
<b>12 Declarations</b>	
<b>a. Assessor Declaration</b>	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed:	Assessor ID:
Name:	Date:
<b>b. Client Declaration</b>	
N/A	

Unit 01

EPC Lodgement

LodgeEPC

### Energy Performance Certificate Information

264 Belsize Road,Kilburn,CAMDEN,NW6 4BT

Dwelling type:Mid Terrace house

Date of assessment:05 September 2022

Date of certificate:03 October 2022

Type of assessment:SAP, new dwelling

Total floor area:118 m²

	Current	Potential
Very energy efficient - lower running costs		
(92 plus) A		
(81-91) B		
(69-80) C	80	
(55-68) D		
(39-54) E		
(21-38) F		
(1-20) G		0
Not energy efficient - higher running costs		
England	EU Directive 2002/91/EC	



## Unit 02

## Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Tue 06 Sep 2022 16:02:05

Project Information			
Assessed By	Sapdemo Peterdeer	Building Type	House, Mid-terrace
OCDEA Registration	STRO037608	Assessment Date	2022-09-05

Dwelling Details			
Assessment Type	As designed	Total Floor Area	109 m <sup>2</sup>
Site Reference	264 Belsize Road Unit 2 Be Green	Plot Reference	Unit 02
Address	264 Belsize Road, Kilburn, CAMDEN, NW6 4BT		

Client Details	
Name	Not Provided
Company	Not Provided
Address	Not Provided, Not Provided

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate	
Fuel for main heating system	Electricity
Target carbon dioxide emission rate	10.9 kgCO <sub>2</sub> /m <sup>2</sup>
Dwelling carbon dioxide emission rate	3.77 kgCO <sub>2</sub> /m <sup>2</sup> OK
1b Target primary energy rate and dwelling primary energy	
Target primary energy	56.95 kWh <sub>PE</sub> /m <sup>2</sup>
Dwelling primary energy	40.65 kWh <sub>PE</sub> /m <sup>2</sup> OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency	
Target fabric energy efficiency	39.4 kWh/m <sup>2</sup>
Dwelling fabric energy efficiency	37.3 kWh/m <sup>2</sup> OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m <sup>2</sup> K]	Dwelling average U-Value [W/m <sup>2</sup> K]	Element with highest individual U-Value	
External walls	0.26	0.15	N. Ex Wall (0.15)	OK
Party walls	0.2	0	Party Wall (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	0.1	Not Provided (0.1)	OK
Roofs	0.16	0.1	Roof (0.1)	OK
Windows, doors, and roof windows	1.6	1.19	2 (1.2)	OK
Rooflights	2.2	N/A	N/A	N/A

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))			
Name	Net area [m <sup>2</sup> ]	U-Value [W/m <sup>2</sup> K]	
Exposed wall: N. Ex Wall	23.61	0.15	
Exposed wall: S.Ex Wall	20.635	0.15	
Exposed wall: E.Ex Wall	10.25	0.15	
Party wall: Party Wall	110.6	0 (!)	
Upper floor: Not Provided	53.1	0.1 (!)	
Exposed roof: Roof	47.512	0.1 (!)	

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m <sup>2</sup> ]	Orientation	Frame factor	U-Value [W/m <sup>2</sup> K]
1, Doors	1.935	South West	N/A	1 (!)
2, Windows (1)	3.36	North East	0.8	1.2
3, Windows (1)	5.25	South East	0.8	1.2
4, Windows (1)	3.36	South East	0.8	1.2
5, Windows (1)	7.71	North East	0.8	1.2
6, Windows (1)	5.46	South West	0.8	1.2
7, Roof windows (1)	1.75	South West	0.8	1.2
8, Roof windows (1)	3.808	South West	0.8	1.2

Date generated: 2022-09-06 16:02:05

Page 1 of 3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Not government-approved scheme	0.05	Not Provided
External wall	E3: Sill	Not government-approved scheme	0.05	Not Provided
External wall	E4: Jamb	Not government-approved scheme	0.05	Not Provided
External wall	E5: Ground floor (normal)	Not government-approved scheme	0.16	Not Provided
External wall	E16: Corner (normal)	Not government-approved scheme	0.09	Not Provided
External wall	E17: Corner (inverted - internal area greater than external area)	Not government-approved scheme	-0.09	Not Provided
External wall	E18: Party wall between dwellings	Not government-approved scheme	0.06	Not Provided

3 Air permeability (better than typically expected values are flagged with a subsequent (!))	
Maximum permitted air permeability at 50Pa	8 m <sup>3</sup> /hm <sup>2</sup>
Dwelling air permeability at 50Pa	4 m <sup>3</sup> /hm <sup>2</sup> , Design value OK
Air permeability test certificate reference	Not Provided

4 Space heating	
Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	380.9%
Emitter type	Both radiators and underfloor
Flow temperature	35°C
System type	
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	400 litres
Declared heat loss	1.9 kWh/day
Primary pipework insulated	Yes
Manufacturer	Gledhill
Model	Stainless Lite Plus Unvented Cylinder
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	

7 Lighting	
Minimum permitted light source efficacy	75 lm/W
Lowest light source efficacy	100 lm/W OK
External lights control	N/A

Date generated: 2022-09-06 16:02:05

Page 2 of 3

8 Mechanical ventilation	
System type: Balanced whole-house mechanical ventilation with heat recovery	
Maximum permitted specific fan power	1.5 W/(l/s)
Specific fan power	0.71 W/(l/s) <span>OK</span>
Minimum permitted heat recovery efficiency	73%
Heat recovery efficiency	89% <span>OK</span>
Manufacturer/Model	The Nuaire Group Nuaire
Commissioning	Not Provided / Not Provided
9 Local generation	
Technology type: Photovoltaic system (1)	
Peak power	0.7 kWp
Orientation	South East
Pitch	30°
Overshading	Modest
Manufacturer	Not Provided
MCS certificate	
10 Heat networks	
N/A	
11 Supporting documentary evidence	
N/A	
12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed:	Assessor ID:
Name:	Date:
b. Client Declaration	
N/A	

Unit 02

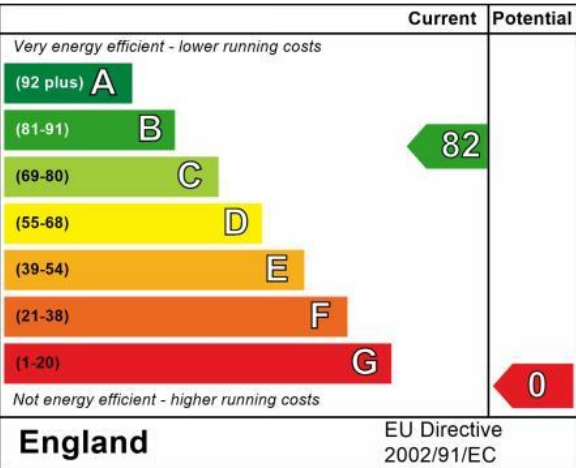
EPC Lodgement

LodgeEPC

Energy Performance Certificate Information

264 Belsize Road, Kilburn, CAMDEN, NW6 4BT

Dwelling type: Mid Terrace house  
Date of assessment: 05 September 2022  
Date of certificate: 06 September 2022  
Type of assessment: SAP, new dwelling  
Total floor area: 109 m²





**Unit 03****Building Regulations England Part L (BREL) Compliance Report**

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Tue 06 Sep 2022 16:02:48

Project Information			
Assessed By	Sapdemo Peterdeer	Building Type	House, Mid-terrace
OCDEA Registration	STRO037608	Assessment Date	2022-09-05

Dwelling Details			
Assessment Type	As designed	Total Floor Area	109 m <sup>2</sup>
Site Reference	264 Belsize Road Unit 3 Be Green	Plot Reference	Unit 03
Address	264 Belsize Road, Kilburn, CAMDEN, NW6 4BT		

Client Details	
Name	Not Provided
Company	Not Provided
Address	Not Provided, Not Provided

**This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.**

1a Target emission rate and dwelling emission rate	
Fuel for main heating system	Electricity
Target carbon dioxide emission rate	10.72 kgCO <sub>2</sub> /m <sup>2</sup>
Dwelling carbon dioxide emission rate	3.73 kgCO <sub>2</sub> /m <sup>2</sup> <b>OK</b>
1b Target primary energy rate and dwelling primary energy	
Target primary energy	55.95 kWh <sub>PE</sub> /m <sup>2</sup>
Dwelling primary energy	40.3 kWh <sub>PE</sub> /m <sup>2</sup> <b>OK</b>
1c Target fabric energy efficiency and dwelling fabric energy efficiency	
Target fabric energy efficiency	38.6 kWh/m <sup>2</sup>
Dwelling fabric energy efficiency	36.4 kWh/m <sup>2</sup> <b>OK</b>

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m <sup>2</sup> K]	Dwelling average U-Value [W/m <sup>2</sup> K]	Element with highest individual U-Value	
External walls	0.26	0.15	N. Ex Wall (0.15)	<b>OK</b>
Party walls	0.2	0	Party Wall (0)	<b>N/A</b>
Curtain walls	1.6	0	N/A	<b>N/A</b>
Floors	0.18	0.1	Not Provided (0.1)	<b>OK</b>
Roofs	0.16	0.1	Roof (0.1)	<b>OK</b>
Windows, doors, and roof windows	1.6	1.19	2 (1.2)	<b>OK</b>
Rooflights	2.2	N/A	N/A	<b>N/A</b>

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))			
Name	Net area [m <sup>2</sup> ]	U-Value [W/m <sup>2</sup> K]	
Exposed wall: N. Ex Wall	31.32	0.15	
Exposed wall: S.Ex Wall	14.815	0.15	
Exposed wall: W.Ex Wall	8.36	0.15	
Party wall: Party Wall	110.6	0 (!)	
Upper floor: Not Provided	53.1	0.1 (!)	
Exposed roof: Roof	47.512	0.1 (!)	

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m <sup>2</sup> ]	Orientation	Frame factor	U-Value [W/m <sup>2</sup> K]
1, Doors	1.935	South West	N/A	1 (!)
2, Windows (1)	3.36	South West	0.8	1.2
3, Windows (1)	5.25	South West	0.8	1.2
4, Windows (1)	3.36	North East	0.8	1.2
5, Windows (1)	7.71	South West	0.8	1.2
6, Windows (1)	5.46	South East	0.8	1.2
7, Roof windows (1)	1.75	South West	0.8	1.2
8, Roof windows (1)	3.808	South West	0.8	1.2

Date generated: 2022-09-06 16:02:48

Page 1 of 3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Not government-approved scheme	0.05	Not Provided
External wall	E4: Jamb	Not government-approved scheme	0.05	Not Provided
External wall	E5: Ground floor (normal)	Not government-approved scheme	0.16	Not Provided
External wall	E16: Corner (normal)	Not government-approved scheme	0.09	Not Provided
External wall	E17: Corner (inverted - internal area greater than external area)	Not government-approved scheme	-0.09	Not Provided
External wall	E18: Party wall between dwellings	Not government-approved scheme	0.06	Not Provided

3 Air permeability (better than typically expected values are flagged with a subsequent (!))	
Maximum permitted air permeability at 50Pa	8 m <sup>3</sup> /hm <sup>2</sup>
Dwelling air permeability at 50Pa	4 m <sup>3</sup> /hm <sup>2</sup> , Design value <b>OK</b>
Air permeability test certificate reference	Not Provided

4 Space heating	
Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	380.9%
Emitter type	Both radiators and underfloor
Flow temperature	35°C
System type	
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	400 litres
Declared heat loss	1.9 kWh/day
Primary pipework insulated	Yes
Manufacturer	Gledhill
Model	Stainless Lite Plus Unvented Cylinder
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	

7 Lighting	
Minimum permitted light source efficacy	75 lm/W
Lowest light source efficacy	100 lm/W <b>OK</b>
External lights control	N/A

Date generated: 2022-09-06 16:02:48

Page 2 of 3

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	1.5 W/(l/s)	
Specific fan power	0.71 W/(l/s)	OK
Minimum permitted heat recovery efficiency	73%	
Heat recovery efficiency	89%	OK
Manufacturer/Model	The Nuaire Group Nuaire	
Commissioning	Not Provided / Not Provided	
9 Local generation		
Technology type: Photovoltaic system (1)		
Peak power	0.7 kWp	
Orientation	South East	
Pitch	30°	
Overshading	Modest	
Manufacturer	Not Provided	
MCS certificate		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
b. Client Declaration		
N/A		

Unit 03

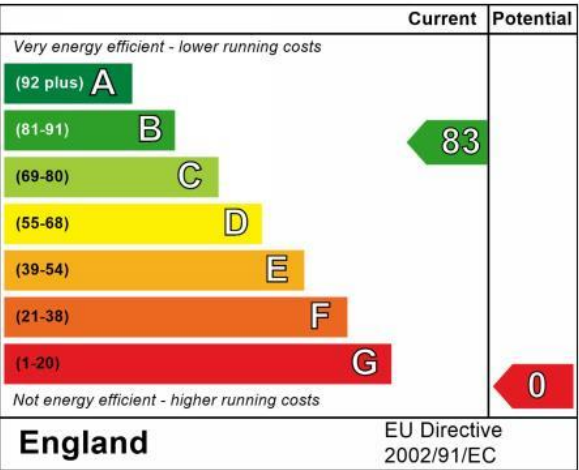
EPC Lodgement

LodgeEPC

Energy Performance Certificate Information

264 Belsize Road, Kilburn, CAMDEN, NW6 4BT

Dwelling type: Mid Terrace house  
Date of assessment: 05 September 2022  
Date of certificate: 06 September 2022  
Type of assessment: SAP, new dwelling  
Total floor area: 109 m²





## Unit 04

## Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Tue 06 Sep 2022 16:03:33

Project Information			
Assessed By	Sapdemo Peterdeer	Building Type	House, Mid-terrace
OCDEA Registration	STRO037608	Assessment Date	2022-09-05

Dwelling Details			
Assessment Type	As designed	Total Floor Area	109 m <sup>2</sup>
Site Reference	264 Belsize Road Unit 4 Be Green	Plot Reference	Unit 04
Address	264 Belsize Road, Ilburn, CAMDE, 6 4BT		

Client Details	
Name	ot Provided
Company	ot Provided
Address	ot Provided, ot Provided

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate	
Fuel for main heating system	Electricity
Target carbon dioxide emission rate	10.55 kgCO <sub>2</sub> /m <sup>2</sup>
Dwelling carbon dioxide emission rate	3.62 kgCO <sub>2</sub> /m <sup>2</sup> OK

1b Target primary energy rate and dwelling primary energy	
Target primary energy	55.03 kWh <sub>PE</sub> /m <sup>2</sup>
Dwelling primary energy	39.34 kWh <sub>PE</sub> /m <sup>2</sup> OK

1c Target fabric energy efficiency and dwelling fabric energy efficiency	
Target fabric energy efficiency	37.9 kWh/m <sup>2</sup>
Dwelling fabric energy efficiency	35.6 kWh/m <sup>2</sup> OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m <sup>2</sup> K]	Dwelling average U-Value [W/m <sup>2</sup> K]	Element with highest individual U-Value	
External walls	0.26	0.15	External wall (0.15)	OK
Party walls	0.2	0	Party wall (0)	N/A
Curtain walls	1.6	0	/A	N/A
Floors	0.18	0.1	ot Provided (0.1)	OK
Roofs	0.16	0.1	Roof (0.1)	OK
Windows, doors, and roof windows	1.6	1.19	2 (1.2)	OK
Rooflights	2.2	/A	/A	N/A

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	Net area [m <sup>2</sup> ]	U-Value [W/m <sup>2</sup> K]
Exposed wall: External wall	34.68	0.15
Exposed wall: S.External wall	11.455	0.15
Exposed wall: E.External wall	8.36	0.15
Party wall: Party wall	110.6	0 (!)
Upper floor: ot Provided	53.1	0.1 (!)
Exposed roof: Roof	47.512	0.1 (!)

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m <sup>2</sup> ]	Orientation	Frame factor	U-Value [W/m <sup>2</sup> K]
1, Doors	1.935	South east	/A	1 (!)
2, Windows (1)	3.36	South East	0.8	1.2
3, Windows (1)	5.25	South East	0.8	1.2
4, Windows (1)	3.36	South East	0.8	1.2
5, Windows (1)	7.71	South East	0.8	1.2
6, Windows (1)	5.46	South East	0.8	1.2
7, Roof windows (1)	1.75	South east	0.8	1.2
8, Roof windows (1)	3.808	South east	0.8	1.2

Date generated: 2022-09-06 16:03:33

Page 1 of 3

## 2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Not government-approved scheme	0.05	Not Provided
External wall	E4: Jamb	Not government-approved scheme	0.05	Not Provided
External wall	E5: Ground floor (normal)	Not government-approved scheme	0.16	Not Provided
External wall	E16: Corner (normal)	Not government-approved scheme	0.09	Not Provided
External wall	E17: Corner (inverted - internal area greater than external area)	Not government-approved scheme	-0.09	Not Provided
External wall	E18: Party wall between dwellings	Not government-approved scheme	0.06	Not Provided

## 3 Air permeability (better than typically expected values are flagged with a subsequent (!))

Maximum permitted air permeability at 50Pa	8 m <sup>3</sup> /hm <sup>2</sup>
Dwelling air permeability at 50Pa	4 m <sup>3</sup> /hm <sup>2</sup> , Design value OK
Air permeability test certificate reference	Not Provided

## 4 Space heating

Main heating system 1: Heat pump with radiators or underfloor heating - Electricity

Efficiency	380.6%
Emitter type	Both radiators and underfloor
Flow temperature	35°C
System type	
Manufacturer	
Model	
Commissioning	

Secondary heating system: N/A

Fuel	N/A
Efficiency	N/A
Commissioning	

## 5 Hot water

Cylinder/store - type: Cylinder

Capacity	400 litres
Declared heat loss	1.9 kWh/day
Primary pipework insulated	Yes
Manufacturer	Gledhill
Model	Stainless Lite Plus Unvented Cylinder
Commissioning	

Waste water heat recovery system 1 - type: N/A

Efficiency	
Manufacturer	
Model	

## 6 Controls

Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services

Function	
Ecodesign class	
Manufacturer	
Model	

Water heating - type: Cylinder thermostat and HW separately timed

Manufacturer	
Model	

## 7 Lighting

Minimum permitted light source efficacy	75 lm/W
Lowest light source efficacy	100 lm/W OK
External lights control	N/A

Date generated: 2022-09-06 16:03:33

Page 2 of 3

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	1.5 W/(l/s)	
Specific fan power	0.71 W/(l/s)	OK
Minimum permitted heat recovery efficiency	73%	
Heat recovery efficiency	89%	OK
Manufacturer/Model	The Nuaire Group Nuaire	
Commissioning	Not Provided / Not Provided	
9 Local generation		
Technology type: Photovoltaic system (1)		
Peak power	0.8 kWp	
Orientation	South East	
Pitch	30°	
Overshading	Modest	
Manufacturer	Not Provided	
MCS certificate		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
b. Client Declaration		
N/A		

Unit 04

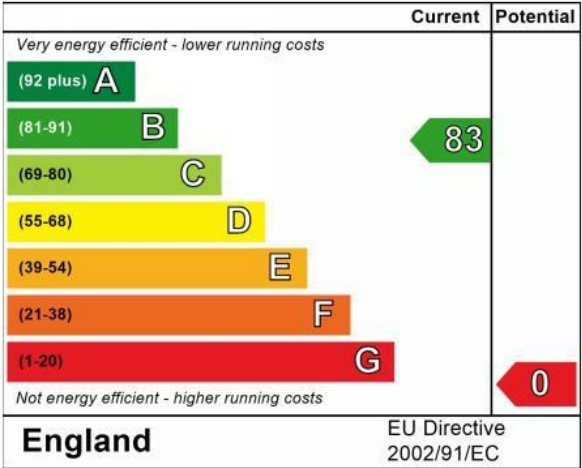
EPC Lodgement

LodgeEPC

Energy Performance Certificate Information

264 Belsize Road, Kilburn, CAMDEN, NW6 4BT

Dwelling type: Mid Terrace house  
Date of assessment: 05 September 2022  
Date of certificate: 06 September 2022  
Type of assessment: SAP, new dwelling  
Total floor area: 109 m²





## Unit 05

## Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Tue 06 Sep 2022 16:04:18

Project Information			
Assessed By	Sapdemo Peterdeer	Building Type	House, Mid-terrace
OCDEA Registration	STRO037608	Assessment Date	2022-09-05

Dwelling Details			
Assessment Type	As designed	Total Floor Area	114 m <sup>2</sup>
Site Reference	264 Belsize Road Unit 5 Be Green	Plot Reference	Unit 05
Address	264 Belsize Road, Kilburn, CAMDEN, NW6 4BT		

Client Details	
Name	Not Provided
Company	Not Provided
Address	Not Provided, Not Provided

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate	
Fuel for main heating system	Electricity
Target carbon dioxide emission rate	11.51 kgCO <sub>2</sub> /m <sup>2</sup>
Dwelling carbon dioxide emission rate	3.72 kgCO <sub>2</sub> /m <sup>2</sup> OK

1b Target primary energy rate and dwelling primary energy	
Target primary energy	60.28 kWh <sub>PE</sub> /m <sup>2</sup>
Dwelling primary energy	40.21 kWh <sub>PE</sub> /m <sup>2</sup> OK

1c Target fabric energy efficiency and dwelling fabric energy efficiency	
Target fabric energy efficiency	43.5 kWh/m <sup>2</sup>
Dwelling fabric energy efficiency	39.9 kWh/m <sup>2</sup> OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m <sup>2</sup> K]	Dwelling average U-Value [W/m <sup>2</sup> K]	Element with highest individual U-Value	
External walls	0.26	0.15	N. Ex Wall (0.15)	OK
Party walls	0.2	0	Party Wall (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	0.1	Not Provided (0.1)	OK
Roofs	0.16	0.1	Roof (0.1)	OK
Windows, doors, and roof windows	1.6	1.19	2 (1.2)	OK
Rooflights	2.2	N/A	N/A	N/A

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	Net area [m <sup>2</sup> ]	U-Value [W/m <sup>2</sup> K]
Exposed wall: N. Ex Wall	36.42	0.15
Exposed wall: S.Ex Wall	6.715	0.15
Exposed wall: W.Ex Wall	67.42	0.15
Party wall: Party Wall	68.14	0 (!)
Upper floor: Not Provided	65.13	0.1 (!)
Exposed roof: Roof	47.904	0.1 (!)

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m <sup>2</sup> ]	Orientation	Frame factor	U-Value [W/m <sup>2</sup> K]
1, Doors	1.935	South West	N/A	1 (!)
2, Windows (1)	3.36	South East	0.8	1.2
3, Windows (1)	5.25	South West	0.8	1.2
4, Windows (1)	3.36	North East	0.8	1.2
5, Windows (1)	7.71	South West	0.8	1.2
6, Windows (1)	5.46	South West	0.8	1.2
7, Roof windows (1)	1.75	South West	0.8	1.2
8, Roof windows (1)	3.416	South West	0.8	1.2

Date generated: 2022-09-06 16:04:18

Page 1 of 3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part 1 - Main Dwelling: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Not government-approved scheme	0.05	Not Provided
External wall	E4: Jamb	Not government-approved scheme	0.05	Not Provided
External wall	E5: Ground floor (normal)	Not government-approved scheme	0.16	Not Provided
External wall	E16: Corner (normal)	Not government-approved scheme	0.09	Not Provided
External wall	E17: Corner (inverted - internal area greater than external area)	Not government-approved scheme	-0.09	Not Provided
External wall	E18: Party wall between dwellings	Not government-approved scheme	0.06	Not Provided
External wall	E1: Steel lintel with perforated steel base plate	Not government-approved scheme	0.05	Not Provided

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	8 m <sup>3</sup> /hm <sup>2</sup>	
Dwelling air permeability at 50Pa	4 m <sup>3</sup> /hm <sup>2</sup> , Design value	OK
Air permeability test certificate reference	Not Provided	

4 Space heating	
Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	385.8%
Emitter type	Both radiators and underfloor
Flow temperature	35°C
System type	
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	400 litres
Declared heat loss	1.9 kWh/day
Primary pipework insulated	Yes
Manufacturer	Gledhill
Model	Stainless Lite Plus Unvented Cylinder
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	100 lm/W	OK
External lights control	N/A	

Date generated: 2022-09-06 16:04:18

Page 2 of 3

8 Mechanical ventilation	
System type: Balanced whole-house mechanical ventilation with heat recovery	
Maximum permitted specific fan power	1.5 W/(l/s)
Specific fan power	0.71 W/(l/s) <span>OK</span>
Minimum permitted heat recovery efficiency	73%
Heat recovery efficiency	89% <span>OK</span>
Manufacturer/Model	The Nuaire Group Nuaire
Commissioning	Not Provided / Not Provided
9 Local generation	
Technology type: Photovoltaic system (1)	
Peak power	0.8 kWp
Orientation	South East
Pitch	30°
Overshading	Modest
Manufacturer	Not Provided
MCS certificate	
10 Heat networks	
N/A	
11 Supporting documentary evidence	
N/A	
12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed:	Assessor ID:
Name:	Date:
b. Client Declaration	
N/A	

Unit 05

EPC Lodgement

LodgeEPC

Energy Performance Certificate Information

264 Belsize Road, Kilburn, CAMDEN, NW6 4BT

Dwelling type: Mid Terrace house  
Date of assessment: 05 September 2022  
Date of certificate: 06 September 2022  
Type of assessment: SAP, new dwelling  
Total floor area: 114 m²

