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London WC1N 1PG

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Energy Statement

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Preamble

This Energy Statement Addendum has been prepared in support of S.73 application for The Old Dairy, 7 Wakefield Street, Camden, for:

"Variation of condition 25 (approved drawings) attached to planning permission 2011/6032/P dated 14/03/2012 and 2015/0825/P dated 19.10.2015 (for redevelopment of site to provide a mixed residential/commercial development in 2 blocks, comprising Class B1 business space in two basement and 2 storey units at western end of site; Class C3 dwellinghouses in five basement and 2 storey units at eastern end of site; plus associated landscaping, courtyard servicing and vehicular access from Wakefield Street, and retention of existing northern boundary wall and gable end walls of warehouse adjoining Regent Square) namely to allow the amendments to the residential mix, increase in the total number of units to 13 and minor associated external alterations.

Planning History

2011/6032/P – Planning permission was approved for the redevelopment of site to provide a mixed residential/commercial development in 2 blocks, comprising Class B1 business space in two basement and 2 storey units at western end of site; Class C3 dwellinghouses in five basement and 2 storey units at eastern end of site; plus associated landscaping, courtyard servicing and vehicular access from Wakefield Street, and retention of existing northern boundary wall and gable end walls of warehouse adjoining Regent Square. Permission dated 14/03/2012.

2015/0825/P - Variation of condition 25 (requiring development to be carried out in accordance with approved plans) attached to planning permission reference 2011/6032/P dated 14/03/12 (for redevelopment of site to provide a mixed residential/commercial development in 2 blocks, comprising Class B1 business space in two basement and 2 storey units at western end of site; Class C3 dwellinghouses in five basement and 2 storey units at eastern end of site; plus associated landscaping, courtyard servicing and vehicular access from Wakefield Street, and retention of existing northern boundary wall and gable end walls of warehouse adjoining Regent Square), namely to allow (as a Minor Material Amendment) change of use from 3 approved houses in centre of site to 8 new flats plus additional windows on rear and front facades, 3 reconfigured roof terraces, and associated enlarged cycle and refuse stores in communal yard.

Summary of amendments

The following minor material amendments are proposed:

Mix

	1 Bed/2 Person	2 Bed/4 Person	3 Bed/6 Person	Total Unit Number	Total Number of People	Total Number of People (Variance)	Unit Mix Percentage	Variance %
Original PP	0	1	4	5	28		20% 2 bed 80% 3 bed	
Section 73 (2015)	0	8	2	10	44		0% 1bed 80% 2 bed 20% 3 bed	+60% 2 bed -60% 3 bed
Section 73 2017 – proposed scheme	1	10	2	13	54	+10	8% 1 bed 77% 2 bed 15% 3 bed	+8% 1 bed -3% 2 bed -5% 3 bed

External alterations

- Minor fenestration changes
- Relocation of entrances to reflect mix changes.
- Reduction in massing along the rear elevation of one of the houses to create a courtyard to one of the townhouses.

Internal changes

- Amendments to both townhouses have been made to improve the plan form and provide more appropriate quantum of internal accommodation.
- Reduction in number of rooflights.

Scope of the document

As agreed with Camden Council Planning Department, this document is an addendum to the approved Energy Report Doc 11b dated November 2011, incorporated into planning permission 2011/6032/P and amended by 2015/0825/P and as such this report should be read alongside the approved Energy Report.

Residential Development

This Energy Statement shall reassess compliance of the residential portion of the development and shall demonstrate the equivalent carbon reductions against a Part L 2013 baseline.

Commercial Development

The proposed design of the commercial units has not been amended since the approved Energy Report of November 2011. This report shall therefore present its CO_2 emissions and relevant targets to demonstrate the equivalent carbon reductions against a Part L 2013 baseline.

Based on the London Plan 2011 targets, the development is required to achieve a 25% CO_2 emissions improvement over Part L 2010. Given the energy efficiency improvement of the notional building in Part L 2013, the equivalent target over Part L 2013 would be approximately 19%.

The CO_2 emissions and the relevant targets for the proposed commercial development are summarised in the following table:

	Regulated CO_2 emissions (tonnes CO_2 per annum)	Savings against Part L **2010** (tonnes CO_2 per annum)	Savings against Part L **2013** (tonnes CO_2 per annum)
Notional development Part L 2010	31.2		
Equivalent Part L 2013 Notional development Part L 2013	28.7		
Proposed development after energy demand reduction	20.1	35.6%	30.0%
Proposed development after heat network/CHP	20.1	35.6%	30.0%
Proposed development after renewable energy	17.3	44.5%	39.6%

As demonstrated in the table above, the proposed design achieves a 44.5% CO_2 emissions reduction against Part L 2010, which would be is approximately equivalent to a 39.6% reduction against Part L 2013. Therefore, the non-domestic portion of the development surpasses the carbon emissions targets.

As the design of the commercial units is unchanged, the non-domestic portion of the development shall still achieve a BREEAM ‘Very Good’ rating. As presented in the original Sustainability Statement dated November 2011, the predicted score is 60.8%, with mandatory credits in the energy section being achieved for a Very Good rating.

1. Executive Summary

This report describes how the proposed residential units at Wakefield Street, London WC1N 1PG respond to the objectives of reducing energy consumption and CO_2 emissions.

The approach seeks to take into account National, Regional and Local guidance and to exceed the minimum requirements of the Building Regulations.

The National policy requirement is that new developments should conserve energy by implementing energy efficient and renewable energy strategies using a defined energy hierarchy implemented in the following order:

- Use less energy
- Supply energy efficiently
- Use renewable energy

Our analysis has consisted of:

- Setting realistic targets for the thermal and environmental properties of the building to determine U-values, air permeability and glazing specifications.
- Using software modelling to calculate the energy demand and CO_2 emission reductions that can be achieved in the development by employing energy efficient techniques.
- Investigating the viability of low and/or zero carbon technologies and their contribution to achieving CO_2 emission reductions.

The design features adopted include:

- Enhanced U-values applied to all thermal elements; these are considerably better than the minimum standards by current Building Regulations.
- The inclusion of high specification, low ‘g’ value rooflights and exposed thermal mass where possible to minimise summer overheating and mitigate the future effects of climate change.
- A communal ground source heat pump system of high efficiency meeting the heating and hot water demands for the proposed residences, while decreasing their carbon emissions at the same time.
- Extensive use of low energy lighting and controls.

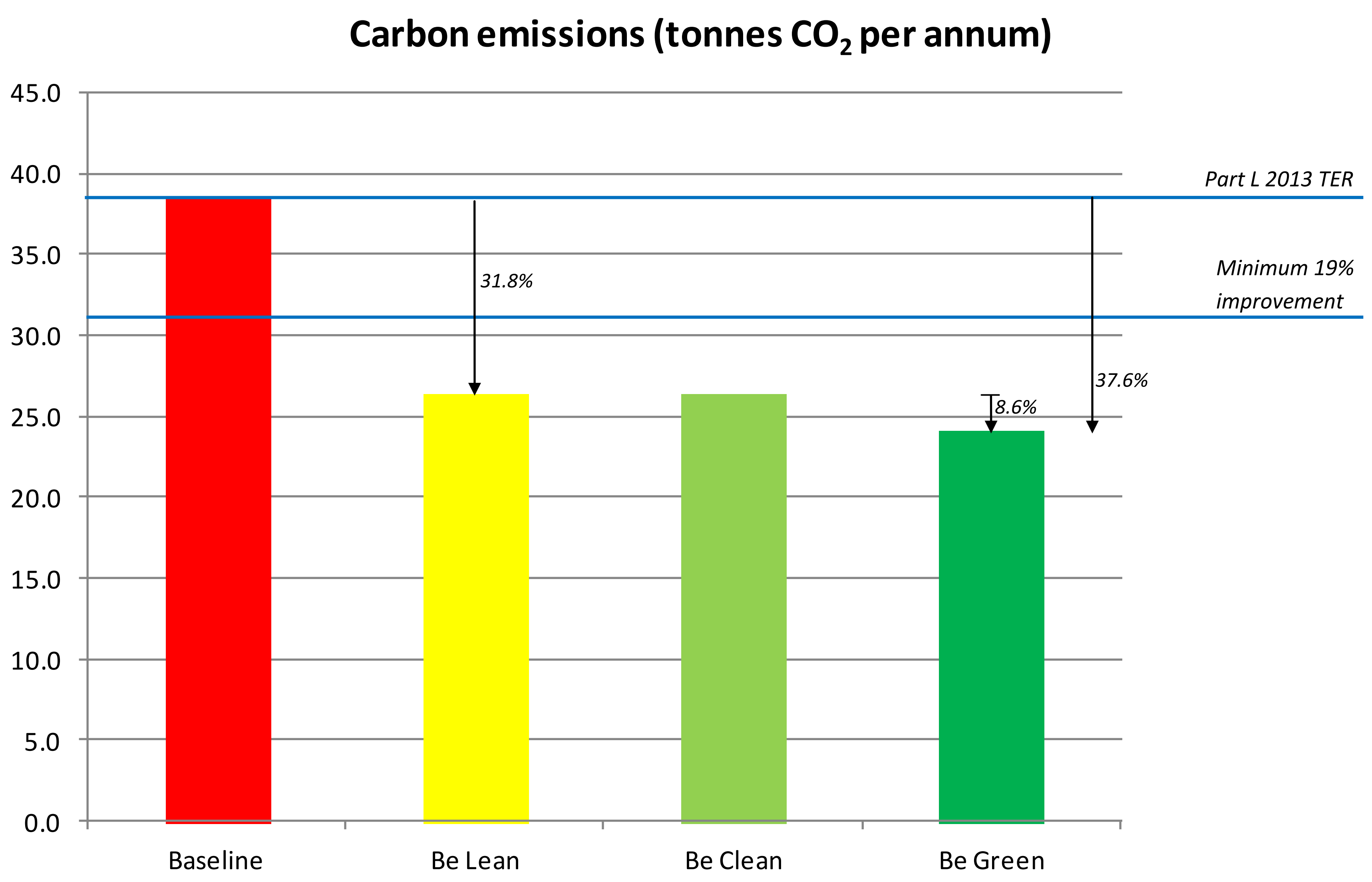
In summary, this report confirms that:

- By the provision of passive measures alone the proposed development exceeds the requirements of Part L1A 2013, with carbon emissions being 26.3 tonnes CO_2 per annum, achieving a 31.8% reduction against Part L1A.
- Through the inclusion of a GSHP system a further reduction of 8.6% of the CO_2 emissions is achieved.
- The proposed design achieves a total CO_2 reduction of 37.6% against the building regulations 2013 from on-site energy efficiency and renewable energy strategies. Therefore, the design meets the London Plan 2011 carbon target, exceeding the 19% improvement over Part L 2013, which is equivalent to a 25% improvement on Part L 2010.

The modelling results are presented in tabular and graphical form below.

	Regulated (tonnes CO_2 per annum)	**Unregulated (tonnes CO_2 annum)**	**Total (tonnes CO_2 annum)**
Baseline: Part L 2013 of the Building Regulations	38.6	22.0	60.6
Step 1, after energy demand reduction	26.3	22.0	48.3
Step 2, after heat network/CHP	26.3	22.0	48.3
Step 3, after renewable energy	24.1	22.0	46.1

	Regulated (tonnes CO_2 per annum)	**Savings (tonnes CO_2 per annum)**	**Savings (%)**	**Unregulated (tonnes CO_2 annum)**
Savings from energy demand reduction	26.3	12.3	31.8	22.0
Savings from heat network/CHP	26.3	0.0	0.0	22.0
Savings from renewable energy	24.1	2.3	8.6	22.0
Total savings on site	-	14.5	37.6	-


Carbon emissions (tonnes CO2 per annum)
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Part L 2013 TER
Minimum 19% improvement
31.8%
37.6%
8.6%
Baseline
Be Lean
Be Clean
Be Green

2. Introduction

2.1. Location

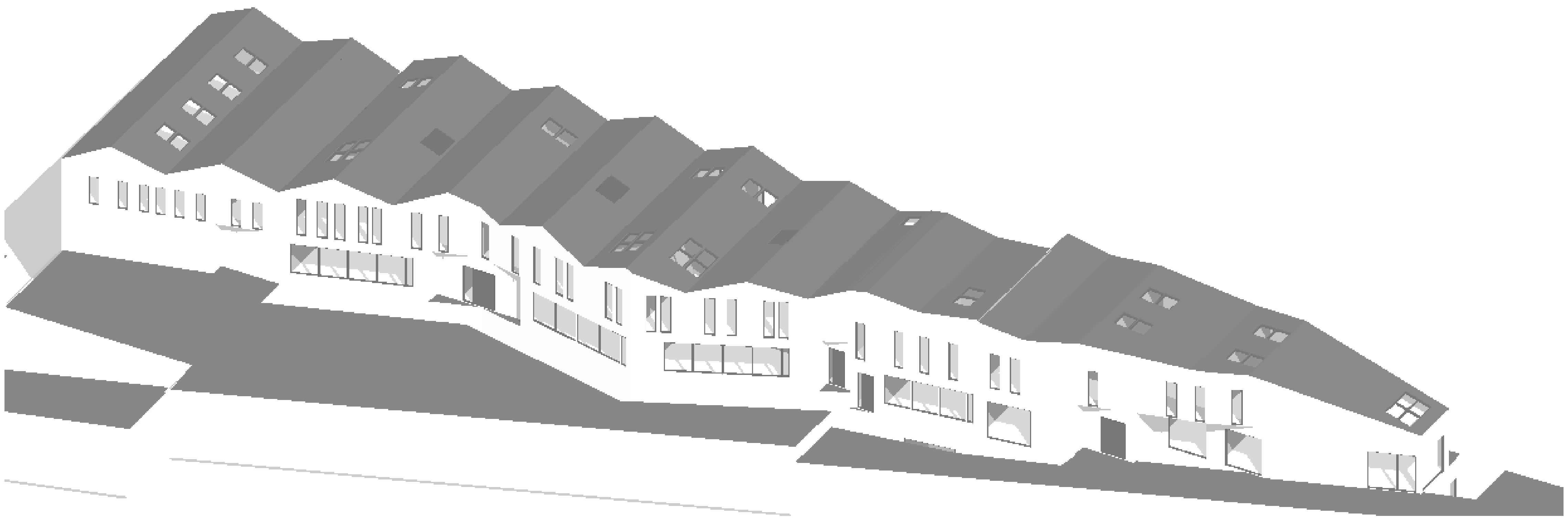
The proposed development is located at Wakefield Street in Bloomsbury, in the London Borough of Camden. It shall replace an existing warehouse and is designed to reflect the form of the warehouse as well as the Georgian town houses that surround it.

It is situated on a quiet road and surrounded by a mix of domestic and non-domestic buildings.

2.2. Building Characteristics

The proposed residential development has the following key characteristics:

- Total gross floor area of approximately 1,824 m^2
- The floor area of communal circulation spaces is approximately 75m^2
- Provision of 11 flats and 2 townhouses.



3. Policy Context

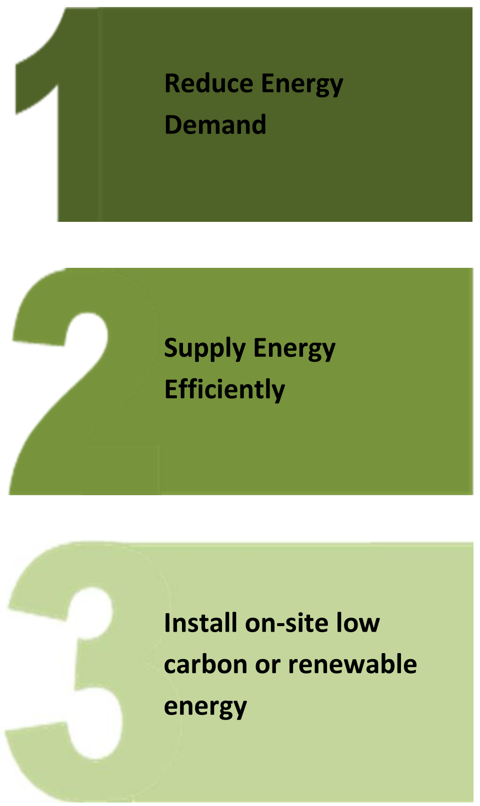
3.1. General

Our approach is informed by national, regional and local planning policy. The London Plan encourages the conservation of energy in buildings by a defined energy hierarchy which should be implemented in the following order:

- Use less energy, in particular by adopting sustainable design and construction measures (“be lean”)
- Supply energy efficiently, in particular by prioritising decentralised energy generation (“be clean”)
- Using low and/or zero carbon energy generation technologies (“be green”)

The hierarchy has been used in parallel with the requirements of current Building Regulations for the conservation of fuel and power, Part L2A 2013, which sets out specific benchmarks for the performance of the basic building design.

The structure of this report follows the ordered approach of the hierarchy, discussing compliance with Building Regulations and using less energy, supplying energy efficiently, and deploying an effective renewable energy solution to the building.



3.2. National

PPS1: Delivering Sustainable Development

PPS22: Renewable Energy

Both the above policies are referenced by the Local Policies below.

3.3. Regional - Local

The London Plan Policies 5.1, 5.2 and 5.3 respond to climate change and the sustainability requirements of new developments in London.

Development proposals should make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy:

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

The Mayor will work with boroughs and developers to ensure that major developments meet the targets for carbon dioxide emissions reduction over and above the Building Regulations Part L requirements.

Additionally, the highest standards of sustainable design and construction should be achieved in London to improve the environmental performance of new developments and to adapt to the effects of climate change over their lifetime.

The proposed residential development comprising of 13 dwellings and total area of 1,824m^2 is classed as a major development.

The current document, being an addendum to the approved Energy Report dated November 2011, demonstrates compliance with carbon reduction targets as set out in Policy 5.2 of the London Plan 2011 guidelines for major developments.

Residential buildings:

Year	Improvement on 2010 Building Regulatons
2010 – 2013	25 per cent (Code for Sustainable Homes level 4)t
2013 – 2016	40 per cent
2016 – 2031	Zero Carbon

The targets for 2010-2013 in Policy 5.2 of the London Plan 2011 are equivalent to the energy requirements for Code Level 4 of the CfSH for residential buildings. The equivalent improvement above 2013 Building Regulations is approximately 19%.

Overheating

Policy 5.9 of the London Plan 2011 requires major development proposals to reduce potential overheating and reliance on air conditioning systems, demonstrating this in accordance with the following cooling hierarchy:

1. Minimise internal heat generation through energy efficient design
2. Reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation, green roofs and walls
3. Manage the heat within the building through exposed internal thermal mass and high ceilings
4. Passive ventilation
5. Mechanical ventilation
6. Active cooling systems (ensuring they are the lowest carbon options)

Major development proposals should demonstrate how the design, materials, construction and operation of the development would minimise overheating and also meet its cooling needs. New development in London should also be designed to avoid the need for energy intensive air conditioning systems as much as possible. Further details and guidance regarding overheating and cooling are outlined in the London Climate Change Adaptation Strategy.

Policy CS13 – Renewable energy

The Council will expect developments to achieve a reduction in carbon dioxide emissions of 20% from on-site renewable energy generation (which can include sources of site-related decentralised renewable energy) unless it can be demonstrated that such provision is not feasible.

Calculation Methodology

The method employed for the energy calculations, and to demonstrate compliance with the Building Regulations App. Doc. Part L1A, of the proposed new-build dwellings is as detailed in the Standard Assessment Procedure (SAP) 2012 document. This procedure calculates the predicted carbon emissions from the heating, fixed lighting, hot water and other building services systems of each dwelling and compliance is achieved when the predicted annual carbon emissions in each dwelling is lower than a notional value as set out in the SAP 2012 documentation.

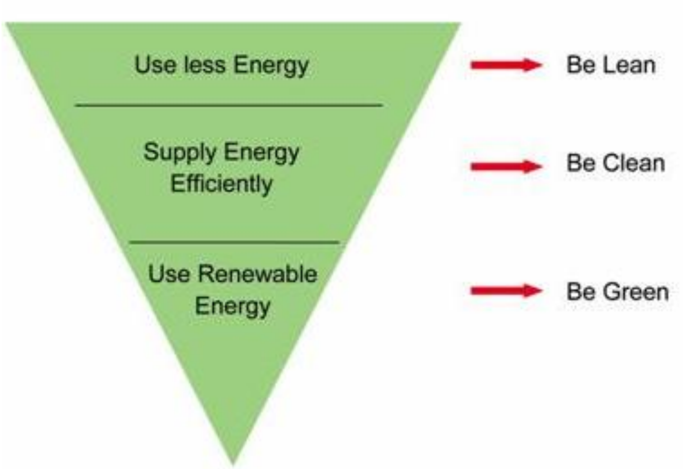
4. The Energy Analysis

4.1. Compliance with Building Regulations

The first stage of our energy analysis ensures compliance with the Building Regulations. App. Doc. Part L1A applies to the proposed residences and sets out specific benchmarks of performance for the building design.

Compliance with Building Regulations shall be achieved using the following hierarchy:

- using less energy
- supplying energy efficiently
- deploying an effective renewable energy solution



The method employed for the energy calculations of the residential development is as detailed in the Standard Assessment Procedure (SAP) 2012 documentation. This tool is used to calculate the predicted CO_2 emissions from the heating, fixed lighting, hot water and other building services systems.

Part L1A requires that each dwelling's annual CO_2 emission rate (DER) and each dwelling's fabric energy efficiency (DFEE), calculated using the approved SAP 2012 methodology, should not exceed the target annual CO_2 emission rate (TER) and the target fabric energy efficiency (TFEE), with units $kgCO_2/m^2$/year and kWh/m^2/year respectively.

Part L 2013 Regulations include the TFEE within the mandatory element of L1A (Criterion 1) to ensure that dwellings are not constructed to a poor fabric standard and still achieve compliance by using low or zero carbon heating sources or renewable energy technologies. TFEE is defined as the space heating and cooling requirements per square metre of floor area. It is influenced by heat losses through fabric, ventilation rate, thermal mass, thermal bridging, air tightness and solar gains.

The TER and TFEE are both based upon the performance of a newly defined Notional Dwelling, which is the same size and shape as the proposed building but constructed according to reference values, e.g. U-values, heating system etc. which are more rigorous than 2013 Building Regulations.

4.2. Step 1 – Be Lean

Complying with the first stage of the energy hierarchy can be achieved by incorporating 'passive' energy efficiency measures to reduce the demand for energy rather than meeting a larger demand from other sources.

The following strategies shall be included in the design to enhance the energy efficiency of the proposed building:

4.2.1. Design

- Building orientation and shape that maximises the potential for cross ventilation and daylight.
- Window design that maximises sunlight and daylight levels in the interior spaces. Using daylight analysis, the following daylight factors shall be achieved:
  - Kitchens: 2.0%
  - Living rooms & study rooms: 1.5%
  - Bedrooms: 1.0%

4.2.2. Building Elements

- Improved insulation, exceeding Part L requirements. The U-values for the proposed building are summarised in the following table:

Element	Limiting U-values (Part L1A) (W/m^2K)	Proposed U-values (W/m^2K)
Walls	0.30	0.15
Roof	0.20	0.13
Floor	0.25	0.10
Windows	2.00	0.9
Rooflights	2.00	0.9
Air permeability	10. 0 m^3/hm^2 at 50Pa	3.0 m^3/hm^2 at 50Pa

- Double glazed, argon filled windows with a u-value as low as $0.9W/m^2K$ minimise heat losses through openings.
- Low-e glazing achieving a low g-value of 0.50 limits undesired summer solar gains.
- Accredited construction details used throughout to reduce unwanted air infiltration, certified air-tight windows and post completion air-pressure testing to ensure compliance with design standards.

4.2.3. Services

- A centralised heating system comprising a gas boiler of 89.5% efficiency (as per the London Plan requirements)
- Intelligent, zoned light controls and low-energy light fittings.
- Low energy equipment and eco-labelled goods.

4.2.4. Results

The building was modelled using the following criteria:

- U-values and permeability as detailed in the previous table.
- Opaque, internal blinds fitted to all windows.

The proposed design achieves a 31.8% CO_2 emissions reduction against the notional building, as shown in the following table:

	Regulated (tonnes CO_2 annum)	Unregulated (tonnes CO_2 annum)
Notional development CO_2 emissions	38.6	22.0
Proposed development CO_2 emissions – Step 1, after energy demand reduction	26.3	22.0

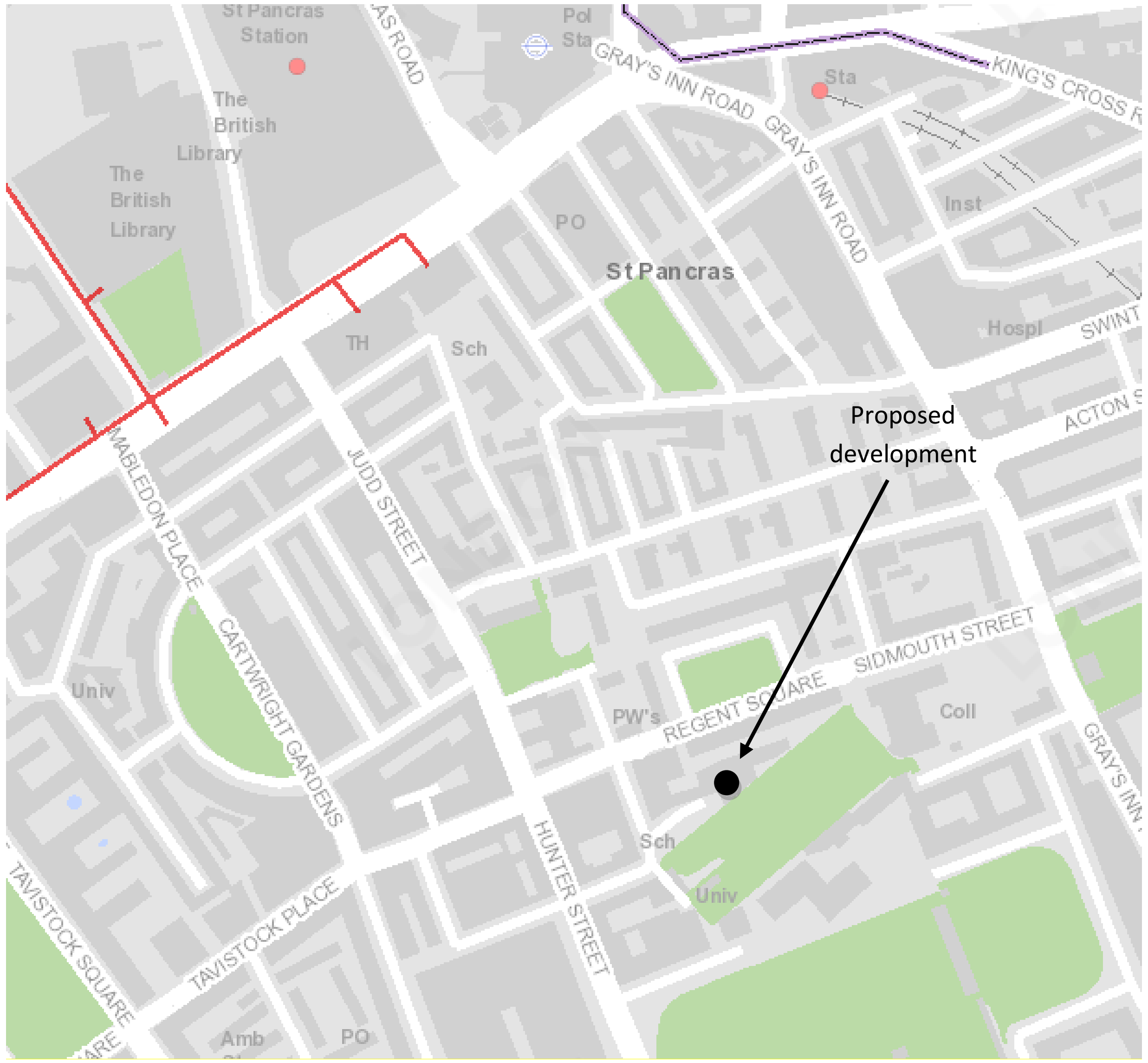
The total dwelling fabric energy efficiency is 39.3 kWh/m^2 per annum, representing a 20% reduction against the notional building.

	kWh/m^2 per annum
Notional development Fabric Energy Efficiency	49.1
Proposed development Fabric Energy Efficiency	39.3

4.3. Step 2 – Be Clean

4.3.1. District Heating

The London Heat Map has been reviewed and no District heating sources are known to be available in close proximity to the proposed development, as illustrated in the image below. However, with heating networks potentially built in the area in the future, provision will be made for future connection to a system should it be installed at a later date.

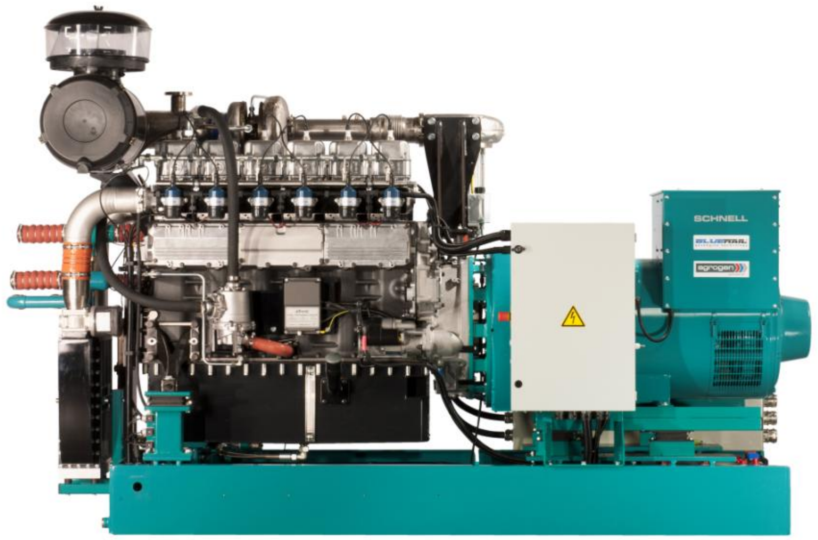


Site location, Bloomsbury, London borough of Camden

- *Red and yellow lines indicate existing district heating networks.*
- *The purple circles indicate areas where there is a potential for future district heating systems.*

4.3.2. Combined Heat & Power

The energy usage patterns and small scale of the proposed development do not generate a base demand for heating that would make the installation of a Combined Heat and Power unit (CHP) viable.



CHP engine

4.4. Step 3 – Be Green (Low & Zero Carbon technologies)

Once energy efficiency measures have been applied, the next step is to consider the introduction of low and zero carbon technologies to reduce the CO_2 emissions produced by the energy consumed by the building.

Zero carbon technologies harness non-fossil fuel energy (for example sun, wind and water power) to generate heat or electricity whilst not producing any CO_2 emissions. Technologies include:

- Photovoltaic panels
- Solar thermal panels
- Wind turbines
- Hydropower

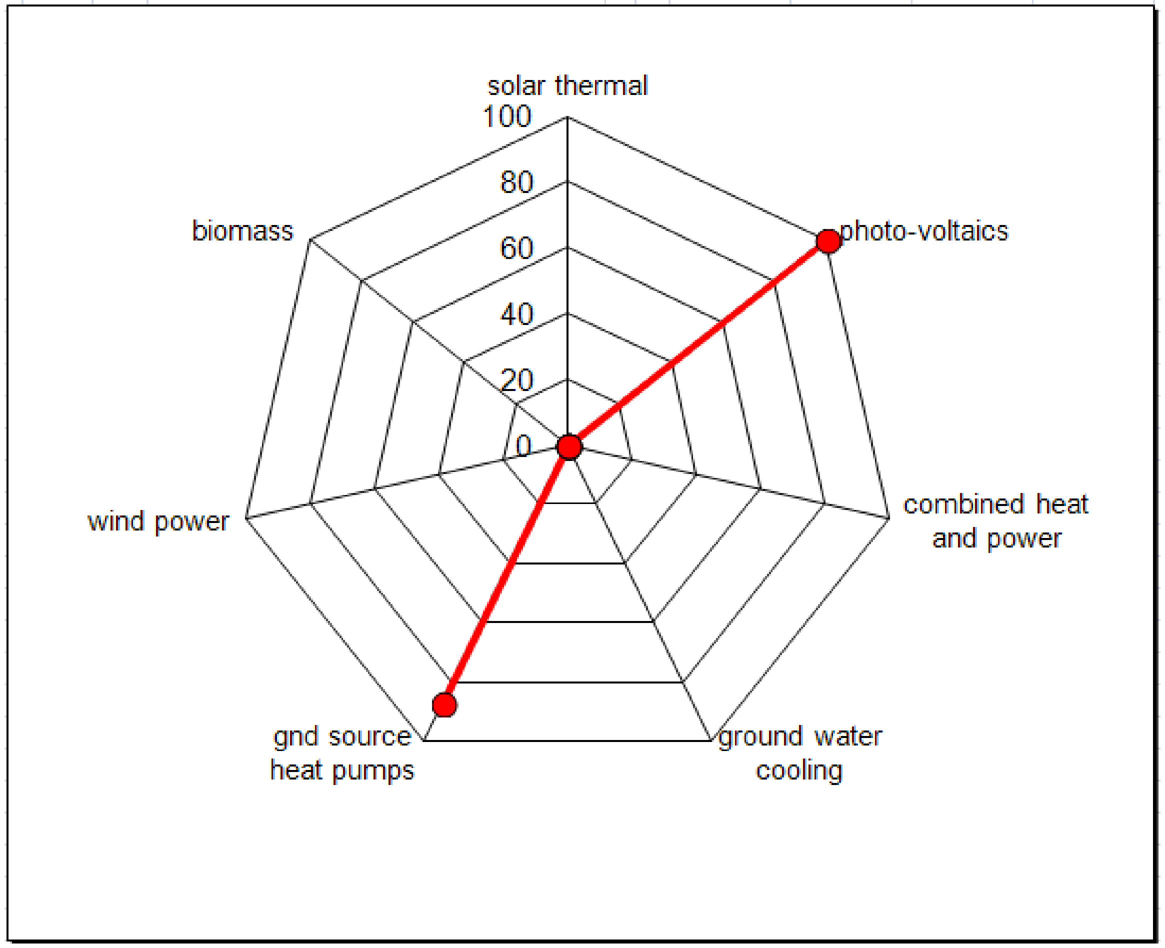
Low carbon technologies use fossil fuels to generate heat or power more efficiently, or use fuels that have a low CO_2 footprint (e.g. biofuel). These technologies result in lower CO_2 emissions than traditional mains gas or electricity use. Technologies include:

- Geothermal and ground source heat pumps
- Air source heat pumps (applicable when used for heating)
- Biomass heating and CHP

The initial renewables selection process has been formalised into a tool (TM38) developed by CIBSE. Using the information provided in the specifications and knowledge of the site, the output of this tool is as follows:

Building Information	
Type	**apartment blocks**
Location	**urban**
Exposure	**normal**

Ranking	
Cost Effectiveness:	4
Carbon Savings:	5
Marketing / Image:	2
Technology Risk:	3



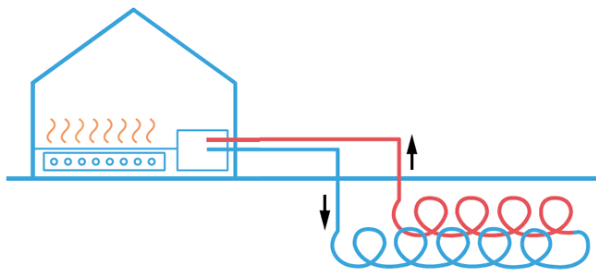
Output of CIBSE TM38 renewables selector tool

The spider diagram shows which technologies are most worthy of further consideration; the closer to the outside of the 'web' the point is, the more viable it is likely to be. The tool is only an indication and technologies may be included or discounted due to other factors.

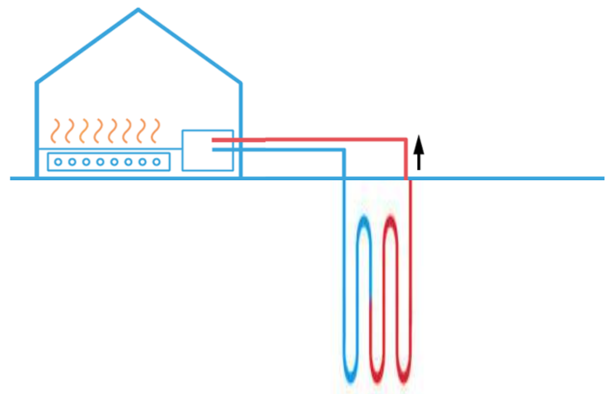
4.4.1. Ground Source Heat Pumps

Ground source heating involves extracting heat from the ground to heat the building by circulating water through buried pipes.

The pipes may run horizontally in trenches ("slinkies"), or vertically as U-tube boreholes.



Horizontal ground array- 'slinkies'



Vertical ground array- 'boreholes'

Low grade heat (≈12C) extracted from the ground is passed through a heat pump, which via a reverse refrigeration cycle provides high grade heat (in the form of hot water, ≈50C) to each dwelling.

Energy savings are achieved through the determination of the system's efficiency which is measured as the 'Coefficient of Performance' (CoP). CoPs in heating systems are typically between 3.5 and 4.0 meaning that for every 1.0 kW of electricity used by the heat pump, 3.5 to 4.0 kW of heat will be transferred to the building- or an electrical efficiency of 350-400% is realised.

The ground source heat pump (GSHP) system has integral controls which enable switching between serving the space heating system and the hot water cylinder local to each dwelling.

INITIAL ASSESSMENT:-

- **Technical**

The building will require heating in order to maintain a thermally comfortable environment for the occupants. Each ground source heat pump will also have the capability of serving the hot water cylinders, however the heating and hot water will not be provided simultaneously. Based on peak heating loads of 30W/m^2, the proposed building's estimated peak load is approximately 50kW.

Horizontal GSHP

A horizontal "slinkies" array would require a spacing of approximately 1m to the next array, generating an average of 25W/m^2. By installing the horizontal "slinkies" under the proposed building of (800m^2), horizontal GSHPs would have a maximum output of 20kW, not enough to cover the heating and hot water demand of the building.

Therefore, based on the available area and the anticipated duty a horizontal array is not considered viable.

Vertical GSHP

Typical borehole spacing is for 100-200 metre deep bores at 7 metre centres. Therefore each borehole occupies approximately 50m^2 of ground. In the proposed design, if we cover all the area below the proposed building with boreholes, there would be space for an array of at least 15 boreholes, which exceeds the heating and hot water demand.

- **Architectural**

There is no architectural impact incurred by a ground source solution.

- **Operational**

GSHP systems require no more maintenance or ongoing care than any traditional heating systems.

The major operational consideration for a ground array is to consider the possibility of the ground freezing in the winter; this can happen when more heat is drawn from the ground than it can regenerate from the surroundings. The sizing and spacing of the boreholes will need to be carefully considered to eliminate this risk.

- **Performance**

The system performance relies heavily on the COP of the heat pump. For the purposes of the cost comparison, we shall assume a COP of 4.0, with the GSHP system meeting 100% of the space heating and hot water load.

Based on the aforementioned data and the SAP calculations, the GSHP system is expected to reduce the CO_2 emissions of the proposed development by 2.3 tonnes CO_2 per annum, equivalent to an 8.6% reduction.

- **Simple lifetime cost comparison**

Gas cost: £0.043/kWh Electricity cost: £0.141/kWh

Gas carbon factor: 0.185 Electricity carbon factor: 0.49

The base case assumes a traditional gas-fired boiler of 90% efficiency is installed to provide heating and stored hot water.

	GSHP	GAS BOILER (base case)
Capital cost of system (estimated)	£177,490	£18,000
Estimated space heating requirement (kWh/y)	30,000	
EER/Efficiency for heating	400%	90%
Energy used (kWh/y)	7,500	33,333
Carbon emissions (kgCO_2/y)	3,675	6,167
Carbon emissions saving (kgCO_2/y)	2,492	
Annual energy cost	£1,058	£1,433
Annual ESCO payment	£1,300	
Renewable heat incentive @ 19.10 pence /kWh) – 20 years	-£9,000	n/a
20 year cost (inc capital cost)	£44,640	£46,667
Capital investment against CO_2 saving (£/kgCO_2)	£17.9	n/a

- **Conclusion**

The ground source system's contribution in the CO_2 emissions savings is significant, but its capital cost is higher compared to other heating systems. Energy Supplier Companies (ESCo's) have been approached to pay the capital cost and in return receive the RHI repayments.

4.4.2. Discounted LZC technologies

The following low and zero carbon technologies have also been considered, but discounted for this project:

- **Solar thermal panels**

Solar thermal panels use heat from the sun to heat domestic hot water.

Solar thermal realises very little benefit when compared to the additional complexities of installation involved. It is expected that domestic hot water demand in the building will be served by the ground source heat pump system. Therefore, the benefits from a solar thermal array are reduced and this technology is not deemed to be economically viable.

- **Photovoltaic panels**

Solar photovoltaic (PV) power takes advantage of the photovoltaic effect to generate electricity.

While a photovoltaic array would complement the ground source heat pump system, PVs are not desirable architecturally as the roofs will be visible by occupants as well as neighbouring properties which overlook the development.

- **Wind power**

Wind turbines use the wind's lift forces to turn aerodynamic blades that turn a rotor thus generating electricity.

Wind turbines have a significant visual impact and can create noise and vibration issues. Additionally, the turbulent air flow across the urban site of the proposed development would not allow for generation of a significant electrical output.

Therefore a wind turbine installation would not be recommended as it is unlikely to provide a cost effective source of electricity.

- **Small scale hydro power, tidal power and wave power**

These technologies use power from water flow to generated energy.

The development is located in an urban location without any waterways nearby, hence such technologies have been deemed unviable.

- **Biomass boilers**

Biomass boilers use natural resources as fuel for combustion. Biomass heating is deemed to be carbon neutral process, as the carbon emissions from burning biomass are balanced by those absorbed during its growth.

Biomass boilers are considered renewable energy technologies, subject to the distance of the biomass source.

In the proposed development, there is not sufficient space to house a biomass boiler, its fuel delivery system and fuel storage. In addition, problems associated with the regular fuel deliveries cause this option to be rejected.

4.4.3. Results

The building was modelled using the same fabric criteria as the stage 1 (Be Lean) calculation, but with the inclusion of the GSHP system. The space heating and hot water demand will be met via the efficient communal ground source heat pump system, consisting of vertical boreholes located beneath the building serving heat pumps within each residence via flow and return distribution pipework. Each heat pump then delivers heating to the residence via radiators or underfloor heating and hot water via a storage cylinder. For the purposes of this report, the seasonal heating efficiency (SEER) of the system is assumed at 400%.

	Regulated (tonnes CO_2 annum)	Unregulated (tonnes CO_2 annum)
Notional development CO_2 emissions	38.6	22.0
Proposed development CO_2 emissions – Step 3, After renewable energy	24.1	22.0

Policy 5.2

The above strategies lead to a reduction of 37.6% over Part L1A 2013 requirements and a carbon saving of 14.5 tonnes/year. This exceeds the London Plan 2011 requirement for 25% minimum carbon reduction over the building regulations 2010, an approximate equivalent to 19% reduction over Part L1A 2013.

Policy CS13

The renewable energy strategies lead to an 8.6% reduction in the CO_2 emissions. While the 20% reduction target in carbon dioxide emissions from on-site renewable energy generation as set out in Policy CS13 is not achieved, the proposed design maximises the potential of viable renewable energy technologies on the site, given the location, orientation and usage constraints.

4.5. Cooling Hierarchy

As detailed before, Policy 5.9 of the London Plan requires major development proposals to reduce potential overheating and reliance on air conditioning systems.
The following strategies demonstrate our approach to the reduction of overheating and of reliance on comfort cooling. The strategies are in accordance with the cooling hierarchy of the London Plan.

1. Minimise internal heat generation through energy efficient design
   - The orientation of the proposed development with long south and north facing facades minimises west and east facing openings. The proposed development comprises dual aspect dwellings allowing for cross ventilation
   - Improved daylight design by means of generous glazed surfaces and high ceilings reduces the heat gains from electrical lighting.
2. Reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls
   - High levels of insulation and carefully sized window design reduce summer heat gains.
   - Opaque internal blinds to be used throughout.
   - Design integrated overhangs in some south facing windows.
3. Manage the heat within the building through exposed internal thermal mass and high ceilings
   - High ceilings allow for enhanced air flow within the dwellings while increasing daylight ingress within the spaces.
4. Passive ventilation
   - Operable windows in all habitable rooms shall maximise the potential of natural ventilation.
   - Dual aspect dwellings allow for cross ventilation.
5. Mechanical ventilation
   - The proposed spaces have been designed to be ventilated naturally, avoiding the use of the mechanical ventilation where possible.
6. Active cooling systems (ensuring they are the lowest carbon options)
   - The above measures lead to a significant reduction of overheating and reliance on comfort cooling. The ground source heat pump system will also be able to provide means to remove heat from the building, thus providing an element of cooling.

In conclusion, the residences have been designed to reduce undesired heat gains, increase air flow and avoid comfort cooling as far as possible, in accordance with Policy 5.9.

4.6. Domestic Overheating Checklist

In line with the London Plan requirements, the following checklists have been completed and presented in this report.

Section 1 - Site features affecting vulnerability to overheating		
Site location	Urban – within central London or in a high density conurbation	Yes
	Peri-urban – on the suburban fringes of London	No
Air quality and/or Noise sensitivity – are any of the following in the vicinity of buildings?	Busy roads / A roads	No
	Railways / Overground / DLR	No
	Airport / Flight path	No
	Industrial uses / waste facility	No
Proposed building use	Will any buildings be occupied by vulnerable people (e.g. elderly, disabled, young children)?	No
	Are residents likely to be at home during the day (e.g. students)?	No
Dwelling aspect	Are there any single aspect units?	No
Glazing ratio	Is the glazing ratio (glazing: internal floor area) greater than 25%?	Yes
	If yes, is this to allow acceptable levels of daylighting?	Yes
Security - Are there any security issues that could limit opening of windows for ventilation?	Single storey ground floor units	Yes
	Vulnerable areas identified by the Police Architectural Liaison Officer	No
	Other	No

Section 2 – Design features implemented to mitigate overheating risk		
Landscaping	Will deciduous trees be provided for summer shading (to windows and pedestrian routes)?	Yes
	Will green roofs be provided?	No
	Will other green or blue infrastructure be provided around buildings for evaporative cooling?	Vegetation in courtyards
Materials	Have high albedo (light colour) materials been specified?	Yes
Dwelling aspect	% of total units that are single aspect	0%
Glazing ratio - What is the glazing ratio (glazing; internal floor area) on each facade?	N / NE / NW	47.4%
	E	25.0%
	S / SE / SW	32.8%
	W	21.5%
Daylighting	What is the average daylight factor range?	1%-3%
Window opening	Are windows openable?	Yes
	What is the average percentage of openable area for the windows?	73%
Window opening - What is the extent of the opening?	Fully openable	74%
	Limited (e.g. for security, safety, wind loading reasons)	26%
Security	Where there are security issues (e.g. ground floor flats) has an alternative night time natural ventilation method been provided (e.g. ventilation grates)?	No
Shading	Is there any external shading?	Louvres
	Is there any internal shading?	Internal blinds
Glazing specification	Is there any solar control glazing?	Yes, g-value 0.5

Section 2 continued – Design features implemented to mitigate overheating risk		
Ventilation - What is the ventilation strategy?	Natural – background	Yes
	Natural – purge	Yes
	Mechanical – background (e.g. MVHR)	No
	Mechanical – purge	No
	What is the average design air change rate	1.5
Heating system	Is communal heating present?	Yes
	What is the flow/return temperature?	50/45˚C
	Have horizontal pipe runs been minimised?	Y Yes
	Do the specifications include insulation levels in line with the London Heat Network Manual	Yes

5. Sustainability

The proposed development shall meet the sustainability targets as set out in the previously consented Sustainability Statement. This entails requirements as described in the London Plan 2011 and Policy DP22 Promoting Sustainable Design and Construction documentation.

Code for Sustainable Homes

As described in the previously approved Sustainability Statement dated November 2011, Code for Sustainable Homes Level 3 shall be achieved in all dwellings. A Code Level score of 57.9% is predicted for the site.

As well as achieving CfSH Level 3, mandatory Code Level 4 credits shall be achieved in the Energy and Water categories. These are equivalent to at least 25% reduction of the CO_2 emissions against Part L 2010 (and approximately 19% against Part L 2013) and a maximum water consumption of 105 litres per person per day.

Sustainable Design and Construction SPG

In addition, the proposed design shall meet the Sustainable Design and Construction SPG regarding:

1. Re-use land and buildings
2. Conserve energy, materials, water and other resources
3. Ensure designs make the most of natural systems both within, in and around the building
4. Reduce the impacts of noise, pollution, flooding and micro-climatic effects
5. Ensure developments are comfortable and secure for users
6. Conserve and enhance the natural environment, particularly in relation to biodiversity
7. Promote sustainable waste behaviour in new and existing developments, including support for local integrated recycling schemes, CHP schemes and other treatment options.

For additional information, please refer to the Sustainability Statement dated November 2011.

6. Conclusion

An energy assessment of the proposed residential portion of The Old Dairy has been carried out.

The Target emission rate (TER) for the notional baseline building is 38.6 tonnes CO_2 per annum.

Various energy reduction measures have been considered to reduce the energy consumption of the development. These are summarised as:

- Fabric standards:

Element	U values (W/m²K)
Walls	0.15
Roof	0.13
Floor	0.10
Windows	0.9
Air permeability	3 m³/hm² at 50Pa

- Low-e, double glazed, argon filled windows, achieving a low g-value of 0.50.
- Space heating and hot water via ground source heat pumps.
- Energy efficient and passive design to reduce resilience on comfort cooling.

This results in carbon emissions of 24.1 tonnes CO_2 per annum. **It represents a reduction of 37.6% over part L1A 2013 requirements and an annual carbon saving of 14.5 tonnes CO_2**, exceeding the 19% CO_2 target of the London Plan 2011.

The GSHP system serves the space heating and hot water storage systems in each dwelling. This provides an 8.6% CO_2 reduction. While this figure does not achieve the 20% target, the GSHP is deemed as the only suitable renewable energy technology for the proposed development and is responsible for a carbon reduction of 2.3 tonnes per annum.

The results are summarised below in tabular and graphical form:

	Regulated (tonnes CO_2 per annum)	Savings (tonnes CO_2 per annum)	Savings (%)	Unregulated (tonnes CO_2 annum)
Baseline: Part L 2013 of the Building Regulations	38.6	-	-	22.0
Step 1, after energy demand reduction	26.3	12.3	31.8	22.0
Step 2, after heat network/CHP	26.3	0.0	0	22.0
Step 3, after renewable energy	24.1	2.3	8.6	22.0
Total savings on site	-	14.5	37.6	-