# Kidderpore Avenue, London

## Energy Statement

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|---|---|
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## Contents



## 1.0 EXECUTIVE SUMMARY

1.1 NLG Associates have been appointed by Mount Anvil to undertake an Energy Statement on a proposed development on Kidderpore Avenue in the London Borough of Camden.

1.2 The scheme comprises 156 proposed residential units.

1.3 This document has been produced to satisfy:
- Policy 5.2 of the London Plan 2011, consolidated with Revised Minor Alterations published October 2013 and Further Alterations published March 2015, by providing a 35% improvement in regulated $CO_2$ over Part L of the Building Regulations 2013, which took effect on 6th April 2014.
- Camden Core Strategy Policy CS13, adopted in November 2010
- Camden Council's Planning Guidance
  - -CPG 1 – Design, published in September 2014
  - -CPG 3 – Sustainability, published in September 2013

1.4 This statement details how the targets are met via:
- Passive Design Measures
- Low U-Values
- Low Air Permeability
- A high efficiency communal Gas Heating System
- Photovoltaic Panels

1.5 This document has been written in adherence to the GLA Guidance on Preparing Energy Assessments, published in April 2015.

## 2.0 INTRODUCTION

This document outlines the energy strategy for the proposed new development at Kidderpore Avenue, London and in particular demonstrates the steps that are being considered to address relevant policies. The applicable policies are outlined in section three of this report.

The proposed development involves the retention of the site's five Grade II statutorily listed buildings. Kidderpore Hall, the Maynard Wing, the Chapel and the old Skeel Library will all be sensitively converted to residential use, and the Summerhouse will be restored in a new location on the site close to the Chapel.

Other unlisted buildings will also be retained and sensitively converted to residential use, namely Bay House, Dudin Brown, and Lady Chapman Hall.

Three existing buildings will be demolished and replaced with new residential buildings: Lord Cameron, Rosalind Franklin and the Queen Mother's Hall.

Integrated in the Kidderpore Avenue elevation of the replacement for the Queen Mother's Hall will be an access to a basement area where car parking for residents and visitors will be provided. In total 97 spaces are proposed. The majority of cycle parking requirements will also be accommodated in the basement, amount to 312 spaces. Some cycle parking – in particular that intended to be used by visitors, amounting to 16 spaces – will be provided at ground floor level, carefully integrated into the hard and soft landscaping scheme.

New buildings are proposed in two locations on the site. The first is between the Chapel and Queen Mother's Hall where 'pavilion' houses are proposed. A terrace of 'townhouses' is proposed between the Chapel and the Maynard Wing on the site of the previously consented student accommodation development, planning permission for which remains extant by virtue of the development having been commenced.

The proposed development also includes residents' facilities and a concierge.

There are numerous constraints on site due to the Thames Water reservoir to the north of the site, several protected trees and a protected formal garden. Improving the energy efficiency on listed and historic buildings will be challenging, as a balance will need to be found on energy efficiency and protection of the character and fabric of the historic building.

## 3.0 POLICY FRAMEWORK

3.1 With 156 residential units proposed the development falls within the Government's "Major" category of planning applications.

### National Policies

3.2 On 25 March 2015, the Government confirmed its policy to limit local energy requirements and continue to support low carbon infrastructure. The Mayor has considered the Government's intentions regarding energy performance standards and its support for energy infrastructure and considers his energy targets within his energy hierarchy to be in line with this approach. The hierarchy encourages developers to make carbon savings on-site, firstly through demand reduction. These reductions are in line with the Government's preferred maximum energy requirement (19 per cent reduction beyond Part L 2013 (Code 4) equivalent). The remaining energy savings are met through low carbon infrastructure, either on-site or off-site.

3.3 The Mayor has also commissioned a viability study as part of his Minor Alterations to the London Plan which confirms that current and future London Plan targets are viable for development in London. The targets in the London Plan will therefore continue to be applied in line with the energy hierarchy, across both residential and non-domestic development until the implementation of zero carbon policies in 2016. (Source: Pg.11 *GLA Guidance on preparing energy assessments* – April 2015)

### Regional Policies

3.4 A revised version of the London Plan was published in March 2015. A link to this version can be found here: https://www.london.gov.uk/priorities/planning/london-plan/further-alterations-to-the-london-plan

3.5 According to Policy 5.2 – Minimising Carbon Dioxide Emissions:

A 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.

B The Mayor will work with boroughs and developers to ensure that major developments meet the following targets for carbon dioxide emissions reduction in buildings. These targets are expressed as minimum improvements over the Target Emission Rate (TER) outlined in the national Building Regulations leading to zero carbon residential buildings from 2016: Improvement on 2013 Building Regulations: 2013 - 2016 - **35 percent** (as of 6th April 2014).

C Major development proposals should include a detailed energy assessment to demonstrate how the targets for carbon dioxide emissions reduction outlined above are to be met within the framework of the energy hierarchy.

D As a minimum, Energy Assessments should include the following details:

i. Calculation of the energy demand and carbon dioxide emissions covered by the Building Regulations and, separately, the energy demand and carbon dioxide emissions from any other part of the development, including plant or equipment, that are not covered by the Building Regulations, at each stage of the energy hierarchy.

ii. Proposals to reduce carbon dioxide emissions through the energy efficient design of the site, buildings and services.

iii. Proposals to further reduce carbon dioxide emissions through the use of decentralised energy where feasible, such as district heating and cooling and combined heat and power (CHP).

iv. Proposals to further reduce carbon dioxide emissions through the use of on-site renewable energy technologies.

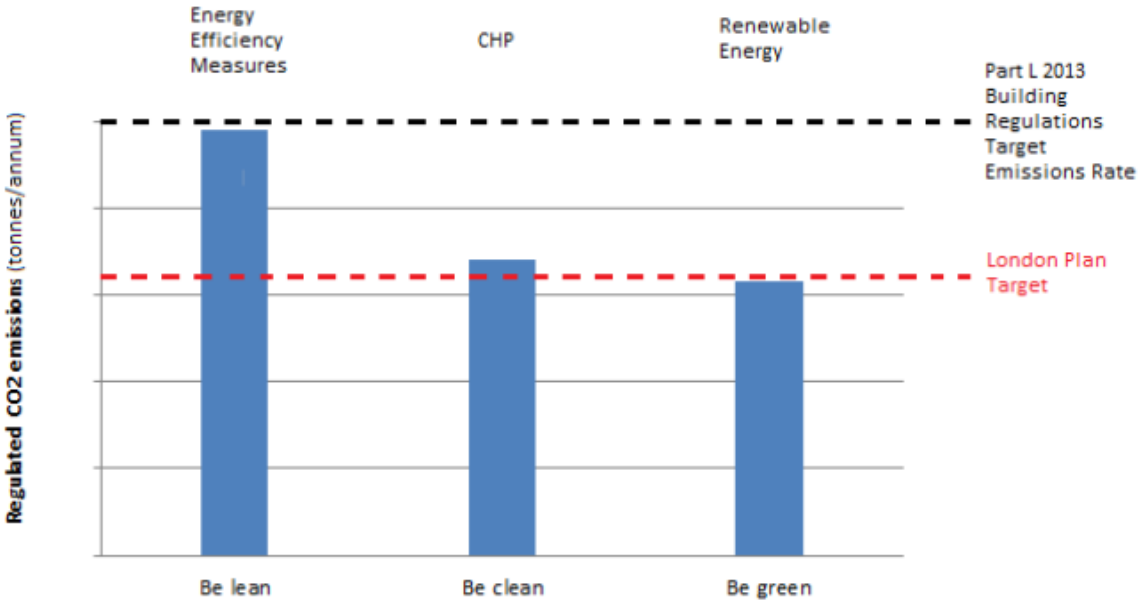
E The carbon dioxide reduction targets should be met on-site. Where it is clearly demonstrated that the specific targets cannot be fully achieved on-site, any shortfall may be provided off-site or through a cash-in-lieu contribution to be ring-fenced to secure delivery of carbon dioxide savings elsewhere.

3.6 As of 6th April 2014, The London Plan changed the targets required for major developments from 40% reduction in $CO_2$ emissions over the Part L 2010 baseline to 35% reduction in $CO_2$ emissions over the Part L 2013 baseline. Text from the GLA website confirms this:

*The GLA provides guidance for developers and their advisers on preparing energy assessments to accompany strategic planning applications. Each assessment is required to demonstrate how the targets for regulated* $CO_2$ *emission reductions over and above 2013 Building Regulations will be met using the Mayor's energy hierarchy. As outlined in the Sustainable Design and Construction SPG, since 6 April 2014, the Mayor has applied a 35 per cent carbon reduction target beyond Part L 2013 of the Building Regulations - this is deemed to be broadly equivalent to the 40 per cent target beyond Part L 2010 of the Building Regulations, as set out in London Plan Policy 5.2 for 2013-2016.*

(Source: Pg.10 *GLA Guidance on preparing energy assessments* – April 2015) [ONLINE] Available at: https://www.london.gov.uk/priorities/planning/strategic-planning-applications/preplanning-application-meeting-service/energy-planning-gla-guidance-on-preparing-energy-assessments) [Accessed April 15].

3.7 A visual representation of the GLA Target in relation to Building Regulations where feasible is:




(Source: Pg.13 *GLA Guidance on preparing energy assessments* – April 2015) [ONLINE] Available at: https://www.london.gov.uk/sites/default/files/GLA%20guidance%20on%20preparing%20energy%20assessments%20April%202015.pdf. [Accessed April 15].

## Local Policies

3.8 The **Camden Core Strategy** sets out policy in relation to sustainable development. Policy **CS13** states that:

> **CS13 - Tackling climate change through promoting higher environmental standards**
>
> ***Reducing the effects of and adapting to climate change***
> The Council will require all development to take measures to minimise the effects of, and adapt to, climate change and encourage all development to meet the highest feasible environmental standards that are financially viable during construction and occupation by:
> a) ensuring patterns of land use that minimise the need to travel by car and help support local energy networks;
> b) promoting the efficient use of land and buildings;
> c) minimising carbon emissions from the redevelopment, construction and occupation of buildings by implementing, in order, all of the elements of the following energy hierarchy:
> - ensuring developments use less energy,
> - making use of energy from efficient sources, such as the King's Cross, Gower Street, Bloomsbury and proposed Euston Road decentralised energy networks;
> - generating renewable energy on-site; and
> d) ensuring buildings and spaces are designed to cope with, and minimise the effects of, climate change.
> The Council will have regard to the cost of installing measures to tackle climate change as well as the cumulative future costs of delaying reductions in carbon dioxide emissions

Therefore this statement will lay out how the highest feasible environmental standards, taking into account financial factors, will be met on this development.

3.9 Camden Council's Planning Guidance is also a material consideration. It is in line with the Energy Hierarchy contained within the GLA London Plan and Guidance on Preparing Energy Assessments.

3.10 Regarding the units in the retained buildings, the GLA Guidance states:

> 8.12 Where significant refurbishments are being carried out, it is expected that an estimate of the $CO_2$ savings from the refurbishment of the building is provided. To provide this, firstly the regulated $CO_2$ emissions of the unrefurbished, existing building should be modelled using building regulations compliance software to determine a BER/DER, which will be used to determine a baseline. The BER/DER of the refurbished building should also be determined at each stage of the energy hierachy using building regulations compliance software. These figures should then be used to report the $CO_2$ savings at each element of the energy hierarchy in the format of Table 2 above.

Therefore a 35% improvement in emissions over the existing dwellings will be achieved for the dwellings in retained buildings.

For clarity:
- a 35% improvement in regulated $CO_2$ over Part L of the Building Regulations 2013 will be sought for the new build dwellings
- A 35% improvement over the existing emissions will be sought for the units in retained buildings.

## 4.0 BASELINE

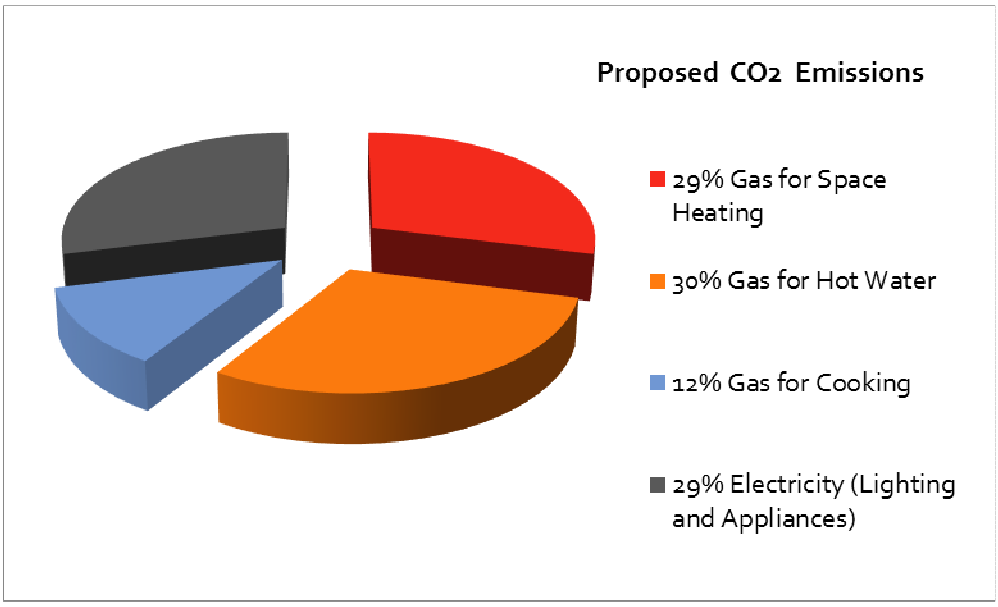
4.1 SAP Calculations have been carried out on a representative sample using the NHER Plan Assessor Version 6.1 (SAP v9.92) to gain the regulated emissions for the site.

Regulated Emissions are the $CO_2$ emissions covered under Part L of the Building Regulations and comprise of:

a) Space Heating and Cooling
b) Hot Water
c) Lighting
d) Pumps and Fans

A licensed and OCDEA accredited SAP Assessor has carried out the calculations.

4.2 Typical $CO_2$ emissions for housing developments is broken down as follows:




4.3 A table can be found in the Appendix 1 which:

- Sets out the floor area of each dwelling,

- Shows the Target Emission Rate (TER) and Dwelling Emission Rate (DER) in terms of $kgCO_2/m^2/year$

- Highlights the percentage reduction of the DER over the TER.

- Displays the $CO_2$ saved through the proposed use of energy efficient measures.

4.4 Also included in the table in Appendix 1 are the Unregulated Emissions for the development. These are $CO_2$ emissions that occur in a residential dwelling but are not counted for the purposes of Part L of the Building Regulations and within SAP. These emissions cover the use of:

a) Small Power

b) Cooking

This has been calculated using the BREDEM-12 methodology via a spreadsheet issued by NHER which is based on the occupancy rate of the dwellings, derived from the size of the plot.

Due to the nature of the emissions, it is considered extremely difficult/impossible to reduce these emissions through design measures and therefore they remain the same during each stage of the hierarchy.

4.6 Development emissions at this stage of the hierarchy are as follows:

| | UNITS IN RETAINED BUILDINGS - $CO_2$ Emissions - (Tonnes per Annum) | | |
|---|---|---|---|
| | **Regulated** | **% improvement on TER** | **Unregulated** |
| **Emissions of existing dwellings (DER)** | **307.3** | | **117.4** |
| **After energy demand reduction (proposed dwellings)** *'Be Lean'* | | | |
| **After CHP/district heating** *'Be Clean'* | | | |
| **After renewable energy** *'Be Green'* | | | |

| | NEW BUILD UNITS - $CO_2$ Emissions – (Tonnes per Annum) | | |
|---|---|---|---|
| | **Regulated** | **% improvement on TER** | **Unregulated** |
| **Baseline: Part L 2013 of the Building Regulations Compliant Development (TER)** | **140.6** | | **139.0** |

| | | | |
|---|---|---|---|
| **After energy demand reduction** *'Be Lean'* | | | |
| **After CHP/district heating** *'Be Clean'* | | | |
| **After renewable energy** *'Be Green'* | | | |

## 5.0 BE LEAN

5.1.1 Construction Details have been selected that meet the existing buildings requirements of Part L of the Building Regulations (2013) and all Heating, Hot Water and Ventilation elements are in compliance with the Domestic Building Services Compliance Guide (2013).

However, in Building Regulations L1B, exceptions apply to the energy efficiency requirements of listed and historic buildings. Best endeavours shall be made to improve the energy efficiency of these buildings as far as is reasonably practicable whilst protecting the character and fabric of the host building.

The proposed construction details for the **dwellings in retained buildings** are as follows:

| Elements | U Value | Development Notes |
|---|---|---|
| **Ground Floor** | **0.22 w/m2/k** | |
| **Main External Walls** | **0.28 w/m2/k** | |
| **Sheltered Walls (Flats to Common Areas)** | **1.10 w/m2/k** | |
| **Party Walls** | **0.00 w/m2/k** | **Fully Filled Cavity** |
| **Roof - Sloping** | **0.18 w/m2/k** | |
| **Roof – Insulated at ceiling level** | **0.16 w/m2/k** | |
| **Windows** | **4.8 w/m2/k** | |
| **Doors** | **1.4 w/m2/k** | |
| **Air Permeability** | **n/a** | |
| **Ventilation** | **System 1 - Trickle Ventilation** | |
| **Community Heating** | **Gas Boiler** | **96.8 % seasonal efficiency, providing 100% of heating demand** |
| **Heating Controls** | **Charging system linked to use, programmer, TRVs** | |
| **Emitters** | **Radiators** | |
| **Secondary Heating** | **No** | |
| **Thermal Bridging** | **0.15 w/m2/k** | |
| **Lighting** | **100%** | **Low Energy Bulbs that have a luminous efficacy of over 45 lumens/circuit/watt.** |

5.1.2 Construction Details have been selected to ensure that all fabric U-Values exceed the requirements of Part L of the Building Regulations (2013) and all Heating, Hot Water and Ventilation elements are in compliance with the Domestic Building Services

Compliance Guide (2013). The proposed construction details for the **new build dwellings** are as follows:

| Elements | U Value | Development Notes |
|---|---|---|
| **Ground Floor** | **0.13 w/m2/k** | |
| **Floors above unheated spaces** | **0.13 w/m2/k** | |
| **Main External Walls** | **0.18 w/m2/k** | |
| **Sheltered Walls (Flats to Common Areas)** | **0.24 w/m2/k** | |
| **Party Walls** | **0.00 w/m2/k** | **Fully Filled Cavity** |
| **Roof – Sloping insulated at rafters** | **0.13 w/m2/k** | |
| **Roof – Insulated at ceiling level** | **0.13 w/m2/k** | |
| **Roof – flat (Houses)** | **0.13 w/m2/k** | |
| **Windows** | **1.4 w/m2/k** | |
| **Doors** | **1.4 w/m2/k** | |
| **Air Permeability** | **5m³/hm²@50Pa** | |
| **Ventilation** | **System 1 - Trickle Ventilation** | |
| **Community Heating** | **Gas Boiler** | **96.8 % seasonal efficiency, providing 100% of heating demand** |
| **Heating Controls** | **Charging system linked to use, programmer, TRVs** | **Weather Compensator** |
| **Emitters** | **Radiators** | |
| **Secondary Heating** | **No** | |
| **Thermal Bridging** | **Y-value** | **Psi values to be manually calculated for each junction at Construction Stage. Current assumption is for the values to be in-line with the heat loss (W/mK) associated with Accredited Details.** |
| **Lighting** | **100%** | **Low Energy Bulbs that have a luminous efficacy of over 45 lumens/circuit/watt.** |

5.2 Full sample SAP Input Data Sheets and SAP L1a Checklists can be found in Appendix 2 to verify the above inputs.

5.3 Following SAP Calculations, $CO_2$ emissions at this stage of the hierarchy are as follows:

| | **UNITS IN RETAINED BUILDINGS - $CO_2$ Emissions -** |
|---|---|

| | (Tonnes per Annum) | | |
|---|---|---|---|
| | Regulated | % improvement on TER | Unregulated |
| **Emissions of existing dwellings (DER)** | **307.3** | | **117.4** |
| **After energy demand reduction (proposed dwellings)** *'Be Lean'* | **166.5** | **45.81%** | **117.4** |

By refurbishing the dwellings, a saving of 140.8 tonnes $CO_2$/annum is achieved, a 45.81% reduction over the emissions of the previously existing dwellings. Therefore, no further action is required on the refurbishment flats as this exceeds the 35% improvement in $CO_2$ emissions over the refurbishment dwellings required by the GLA Guidance.

| | NEW BUILD UNITS - $CO_2$ Emissions – (Tonnes per Annum) | | |
|---|---|---|---|
| | Regulated | % improvement on TER | Unregulated |
| **Baseline: Part L 2013 of the Building Regulations Compliant Development (TER)** | **140.6** | | **139.0** |
| **After energy demand reduction** *'Be Lean'* | **122.5** | **12.9%** | **139.0** |
| **After CHP/district heating** *'Be Clean'* | | | |
| **After renewable energy** *'Be Green'* | | | |

## 6.0 BE CLEAN

6.1 Policy 5.6b of the London Plan advises the following:

*Major development proposals should select energy systems in accordance with the following hierarchy:*

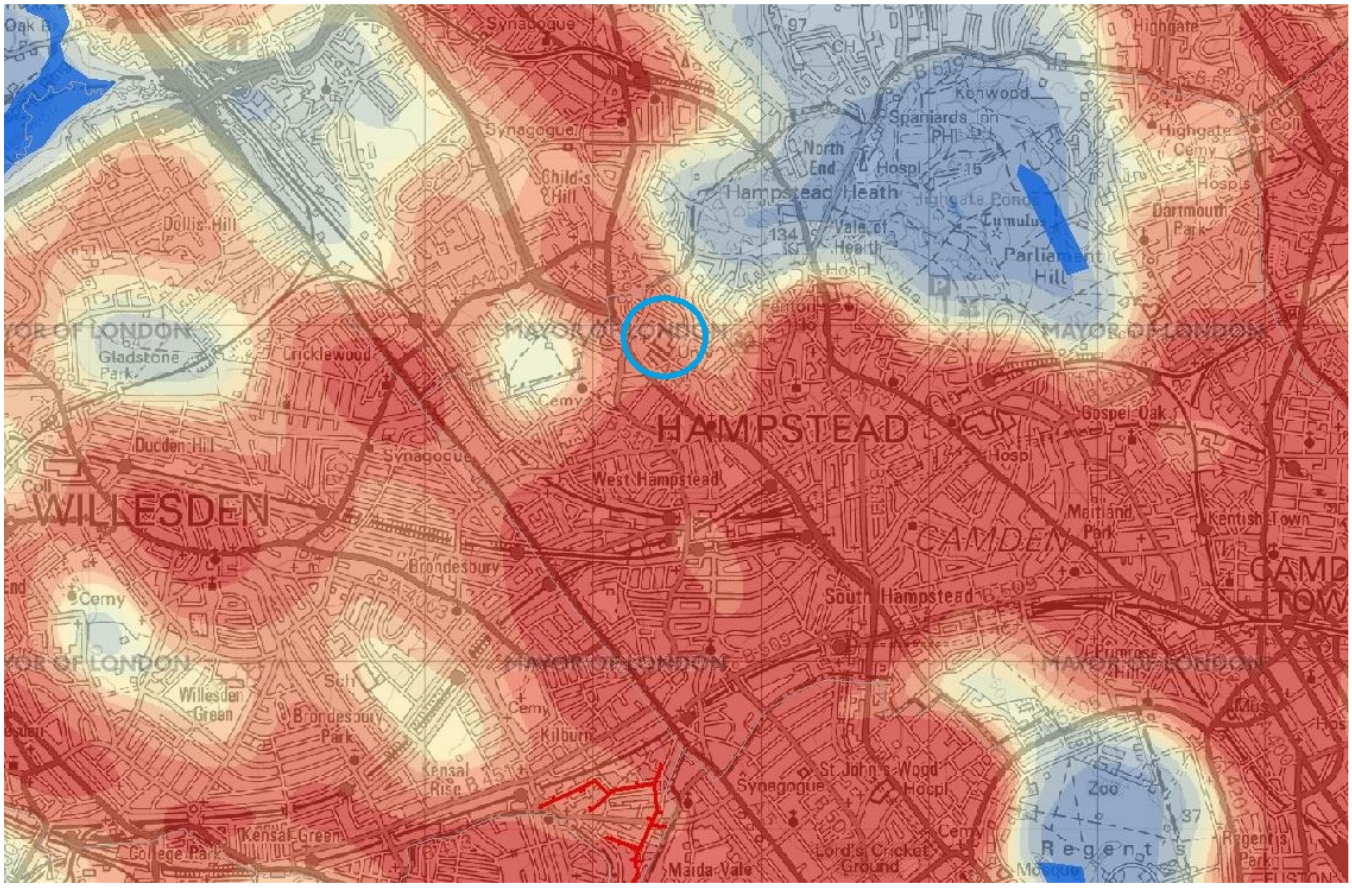
*1. Connection to existing heating or cooling networks;*
*2. Site wide CHP network;*

*3. Communal heating and cooling.*
*4. Individual heating*

(Source: Mayor of London. 2015. Pg. 197, *The London Plan March 2015*. [ONLINE] Available at: https://www.london.gov.uk/sites/default/files/London%20Plan%20March%202015%20%28FALP%29.pdf) [Accessed April 15].

**Heat map**

The blue circle in the picture represents the Site. As can be seen there are no planned District Heating Networks within the vicinity.




**Connection to area wide low carbon heat distribution networks**

Existing networks

6.2 There are no existing heat networks within 1 km of the development.

Feasibility of utilising existing area wide connection

6.3 Infeasible due to there being no existing Heat Networks.

Planned networks

6.4 There are no planned heat networks within 1 km of the development.

Feasibility of providing a site heat network for future area wide connection

6.5 It was raised during the Pre-Application process that there is a development being built on the south side of Kidderpore Avenue (Planning Ref: 2013/0685/P) containing CHP and community heating.

NLG Associates have raised the possibility of connecting to the scheme with the developer Barratt Homes and found the site contains only 128 units. The current design would not allow for additional plant in terms of room size as the full scheme is based on two phases only without additional capacity for further use/upgrade as it would not be required.

Furthermore distribution would be an issue given the topography of the site and the amount of services being distributed. Also, the Barratt development's plant room has a level difference of 11-12m in height from Kidderpore Avenue road level making distribution unfeasible.

The programme for completion would not be workable as Barratt's scheme commences with handovers at the end of June 2015, thus the fit out and strategies are well advanced with services already installed. Therefore, it is not feasible to connect with Barratt's scheme.

6.6 Even though there are no current or planned networks nearby according to the London Heat Map, the development will still be supplied with future network connection capability. This will be comprised of:

a) A High Efficiency Community Gas Heating Network.

b) Infrastructure for connection to the proposed Heating Network when operational.

The future connection infrastructure will be installed in-line with Appendix 1 of the London Heat Network Manual.

This can be found at - http://www.londonheatmap.org.uk/Content/TheManual.aspx

6.7 Development emissions at this stage of the hierarchy are as follows:

| | UNITS IN RETAINED BUILDINGS - $CO_2$ Emissions - (Tonnes per Annum) | | |
|---|---|---|---|
| | **Regulated** | **% improvement on TER** | **Unregulated** |
| **Emissions of existing dwellings (DER)** | **307.3** | | **117.4** |
| **After energy demand reduction (proposed dwellings)** *'Be Lean'* | **166.5** | **45.81%** | **117.4** |

| | NEW BUILD DWELLINGS - $CO_2$ Emissions – (Tonnes per Annum) | | |
|---|---|---|---|
| | Regulated | % improvement on TER | Unregulated |
| **Baseline: Part L 2013 of the Building Regulations Compliant Development (TER)** | **140.6** | | **139.0** |
| **After energy demand reduction** *'Be Lean'* | **122.5** | **12.9%** | **139.0** |
| **After CHP/district heating** *'Be Clean'* | **122.5** | **12.9%** | **139.0** |
| **After renewable energy** *'Be Green'* | | | |

## 7.0 BE GREEN

7.1 The potential renewable energy applicable to this development and its feasibility is investigated below:

| Renewable | Advantages | Disadvantages | Feasibility |
|---|---|---|---|
| **Photovoltaic Panels** | • Can have significant impact on carbon by offsetting electricity which has a high carbon footprint.<br>• Low maintenance.<br>• No noise issues associated with PV.<br>• No additional land use from the installation of PV panels. | • Needs unobstructed space on roof.<br>• Can sometimes "clash" with Green Roof's / Roof Terraces.<br>• Can be an issue in sensitive areas such as conservation areas and on listed buildings | • The development incorporates a roof which is perfectly suited to PV.<br>• PV would be feasible as it can contribute to meet the on-site electrical demand and any unused electricity can be sent back to the grid. |
| **Solar Thermal Collectors** | • No additional land use from the installation of solar thermal collectors.<br>• Low maintenance and easy to manage.<br>• Low capital cost.<br>• No noise issues associated with solar thermal collectors. | • Limited $CO_2$ offset<br>• No Grants or Tariffs for new build installations. | • Solar thermal collectors are feasible for the development, although it is not possible to meet the required carbon saving as the maximum demand that solar thermal collectors can be designed to meet can be no greater than 50% of the hot water demand. |
| **Biomass Heating** | • Potential to reduce large component of the total $CO_2$.<br>• A biomass boiler would replace a standard gas heating system so some of the cost may be offset through money saved on a traditional boiler. | • Regular maintenance will be required. Reliability of fuel may become a problem, therefore limited cost saving for residents.<br>• A plant room and fuel store will be required which may take additional land from the proposed development or surroundings.<br>• The fuel will need to be delivered, which can cause issues with | • Biomass is not considered feasible for such a development due to the need for space to accommodate fuel storages, access for delivery vehicles and local NOx emissions. |

| | | | |
|---|---|---|---|
| | | access etc. | |
| **Ground Source Heat Pumps** | • Low maintenance and easy to manage Optimum efficiency with under- floor heating systems.<br>• As heat pumps would replace standard heating systems, some of the cost may offset through money saved on a traditional boiler. | • The heat pump has a noise level around 45-60dB so some attenuation may be required and it should be sensibly located.<br>• Huge capital cost.<br>• For communal systems plant room required which may take additional land from the proposed development/ surroundings.<br>• High payback. | • Ground Source Heat Pumps are feasible as there is very limited space for boreholes as the only open area is the protected gardens on the east side of the site. |
| **Air Source Heat Pumps** | • ASHP systems are generally cheaper than ground source as there is no requirement for long lengths of buried piping.<br>• Low maintenance and easy to manage.<br>• Optimum efficiency with under- floor heating systems.<br>• As heat pumps would replace standard heating systems, some of the cost may offset through money saved on a traditional boiler. | • The heat pump has a noise level around 50-60dB so some attenuation may be required and it should be sensibly located.<br>• The potential noise from the external unit may mean there is local opposition to their installation.<br>• Requires electricity to run the pump, therefore limited carbon savings in most cases.<br>• For communal systems plant room required which may take additional land from the proposed development/surroundings potential noise issues. | • As Gas is available to the Site, the benefit of ASHPs is limited.<br>• Lack of space, sensitivity of site due to listed buildings, distribution length limitations and limited efficiencies of Air Heat Pumps means $CO_2$ savings are too low to make the systems economical when compared to Gas and PV. |

7.2.1 During the Pre-Application stage, Air Source Heat Pumps (ASHPs) have been fully investigated as an option to provide heat to the site. An installer was approached but as above, ASHP would necessitate 35 ASHPs which would impact on site character and noise levels. Maximum pipe run of 150 meters caused a technical limitation on the large site. Refer to Appendix 3 for the full investigation.

7.2.2 Following the above feasibility investigation, the chosen technology, Solar PV, will be implemented.

7.3 To achieve the remaining carbon dioxide emissions reduction to satisfy the London Plan 2015 requirements of 35%, we need to provide an additional improvement of 22.1%, which equates to a further offset of **31.07 tonnes of $CO_2$ /year.**

In addition to this requirement, Camden's Core Strategy Document CS13, paragraph 13.11 states that developments will be expected to achieve a 20% reduction in

carbon dioxide emissions from on-site renewable energy generation, once stages 1 and 2 of the energy hierarchy have been applied, unless it can be demonstrated that such provision is not feasible. To meet the required 20% emissions reductions from renewables, this equates to an offset of **28.13 tonnes of $CO_2$ /year.**

7.4 Due to the sensitive nature of the site and the Grade II listed buildings, the proposals only include for PV to be installed on the new buildings, and then only where suitable flat roofs are available and where the installed panels would not be seen by passers-by. These requirements will have a limiting effect on the extent of the PV installation and therefore the associated carbon emissions reductions.

Proposed PV installation:

| Figure | $CO_2$ Emissions Reduction – (%) | $CO_2$ Emissions Reduction – (kg $CO_2$/annum) | PV Installation |
|---|---|---|---|
| PV $CO_2$ offset required to complete 35% reduction target of London Plan Policy 5.2 | 22.1% | 31,068 kg$CO_2$/annum | 78.65 kW peak |
| PV $CO_2$ offset required to provide on-site renewables emissions reduction target of Camden CS13 | 20% | 28,128 kg$CO_2$/annum | 71.21 kW peak |
| PV $CO_2$ offset from proposed installation (Maximum PV on the Roofs of the New-Build Units designated for PV) | 12.1% | 17,048 kg$CO_2$/annum | 43.16 kW peak |
| Proposed Panel Configuration | 132 Panels @ 327 Watts each based on:<br>i. 10 degree mounting angle<br>ii. Horizontal orientation<br>iii. Less than 20% over-shading of total system.<br>Based on SAP 2012 data, 1kWpeak of PV offsets 395kg/$CO_2$ per annum. | | |
| Panel Configuration required to offset $CO_2$ reductions required to complete 35% reduction target of London Plan Policy 5.2 | 240 Panels @ 327 Watts each based on above configuration | | |

7.5 To illustrate the above, Appendix 4 contains the following information:

1. Manufacturer Datasheet of PV Panel.
2. Drawing showing the proposed PV on the Roofs of the Development.

Please note to achieve MCS certification a lifetime efficiency of the panels may be required which would increase the number of panels.

7.6 The proposed PV installation, which is based on the criteria discussed in 6.4 above, equates to a carbon dioxide emissions offset of **17.05 tonnes of $CO_2$ /year.**

7.7 Final $CO_2$ emissions based on this installation are:

| | UNITS IN RETAINED BUILDINGS - $CO_2$ Emissions - (Tonnes per Annum) | | |
|---|---|---|---|
| | Regulated | % improvement on TER | Unregulated |

| | | | |
|---|---|---|---|
| **Emissions of existing dwellings (DER)** | **307.3** | | **117.4** |
| **After energy demand reduction (proposed dwellings)** *'Be Lean'* | **166.5** | **45.81%** | **117.4** |

| | NEW BUILD DWELLINGS - $CO_2$ Emissions – (Tonnes per Annum) | | |
|---|---|---|---|
| | **Regulated** | **% improvement on TER** | **Unregulated** |
| **Baseline: Part L 2013 of the Building Regulations Compliant Development (TER)** | **140.6** | | **139.0** |
| **After energy demand reduction** *'Be Lean'* | **122.5** | **12.9%** | **139.0** |
| **After CHP/district heating** *'Be Clean'* | **122.5** | **12.9%** | **139.0** |
| **After renewable energy** *'Be Green'* | **105.4** | **25.0%** | **139.0** |

7.8 The tables above confirm that the proposed PV installation will not provide the further carbon emissions reductions required to meet the London Plan target of 35% or the Camden Core Strategy target of 20% carbon emissions to be met by on-site renewables. As discussed in Section 8 below, any shortfall in the carbon emissions reduction target is subject to a carbon offset payment.

It is possible that further panels could be included if additional roof space could be found on the existing buildings, some of which have areas of flat roof. Lady Chapman Hall would appear to have such a roof, subject to the roof construction being suitable and fulfilling the criteria of panels not being visible to passers-by.

Alternatively, it is also possible that again, due to the sensitive nature of the site, the installation of PV is resisted. This would ultimately lead to the carbon dioxide emissions savings not accounted for by stage three of the energy hierarchy being offset by carbon offset payments.

## 8.0 COOLING AND OVERHEATING

The cooling hierarchy

8.1 Pursuant with Policy 5.9 of the London Plan (March 2015) the following measures have been investigated:

| Cooling Hierarchy | Measures Undertaken |
|---|---|
| 1. Minimising internal heat generation through energy efficient design | • Heat distribution infrastructure within buildings should be designed to minimise pipe lengths, particularly lateral pipework in corridors of apartment blocks.<br>• Adopting pipe configurations which minimise heat loss e.g. twin pipes and high levels of pipework insulation. |
| 2. Reducing the amount of heat entering the building in summer | • Carefully designed shading measures have been considered, including:<br>i. Balconies,<br>ii. Specification of Internal blinds |
| 3. Use of thermal mass and high ceilings to manage the heat within the building | • Level of exposed thermal mass has been maximised to help to absorb excess heat within the building. |
| 4. Passive Ventilation | • The use of:<br>i. Openable windows,<br>ii. Dual aspect units,<br>iii. Designing in the stack effect. |
| 5. Mechanical Ventilation | • MVHR is not being installed on this development. |

Overheating risk analysis

8.2 Criterion 3 of Part L 2013 of the Building Regulations relates to limiting the effects of heat gains in summer - this is implemented for new dwellings as set out in Appendix P of SAP 2012.

All dwellings pass this Criterion.

However, the Building Regulations recognises that Criterion 3 does not cover all factors influencing overheating and that there is no guarantee that buildings will not overheat.

8.3 CIBSE Guide A – Environmental Design (2015) is the reference standard for overheating in the GLA SPG on Sustainability and the current industry standard amongst other CIBSE guides such as CIBSE TM52 "The Limits of Thermal Comfort: Avoiding Overheating in European Buildings" (2013). These set out guidelines on the number of hours a dwelling should not exceed a certain temperature. CIBSE TM49 "Design Summer Years for London" addresses the question of whether the current weather data for London is the most appropriate data to assess the risk of summertime overheating and cooling needs of buildings in London.

8.4 For naturally ventilated buildings that are free running, as is common in summertime, Guide A sets the criteria for overheating in Figure 1.8, where the nominal comfort threshold temperature (θcom) and limiting value for operative temperature to avoid overheating (θmax) are based on the running mean of the outdoor temperature.

8.5 TM52 sets out 3 criteria by which a building could be classed as overheating should 2 of the criteria fail. Criterion 1: Sets a limit for the number of hours during which the operative temperature can exceed the comfort threshold temperature by 1°C or above to 3% of the occupied hours, during the period of May to September inclusive. Criterion 2: Deals with the severity of overheating within any one day, the level of which is a function of both temperature rise and its duration. Criterion 3: Sets an absolute maximum daily temperature for a room, beyond which the level of overheating is unacceptable, of 4°C above the thermal comfort threshold.

8.6 TM49 sets out new weather data that can be used to examine different levels of risk of summertime overheating, and suggests that overheating modelling should be conducted using three design weather years: 1976: a year with a prolonged period of sustained warmth; 1989: a moderately warm summer; 2003: a year with a very intense warm spell.

The current design year for London (CIBSE Design Summer Year (DSY) weather data) is the 1989 year, and has been used for the purposes of this report.

In the absence of running mean outdoor temperature data, the comfort threshold temperature (θcom) and limiting value for operative temperature to avoid overheating (θmax) values have been calculated using the maximum annual outdoor dry bulb temperature – 33.6°C – from the London DSY data as follows:

Comfort threshold temperature θcom = (0.33*33.6) + 18.8 = 29.88°C. *Say 29°C*.
Maximum overheating temperature θmax = θcom + 3 = 32.88°C. *Say 32°C*.

8.7 For the purposes of this report, by combining the Criteria as set out in Guide A and TM52 discussed above, the following criteria have been used to assess the mitigation of overheating:

- Criterion 1: Limit the number of hours that the internal temperature can exceed the comfort threshold temperature (θcom) to 3% of the occupied hours, during the period of May to September inclusive. For a year based on continuous occupation during the typical non-heating season, this equates to 3% of 3672 hours = 111 hours.
- Criterion 2: Limit the absolute maximum daily temperature for a room (θmax), beyond which the level of overheating is unacceptable, to 3°C above the thermal comfort threshold (θcom).

8.8 Passive Design Measures:

Pursuant to Level 2 of the London Plan Cooling Hierarchy, in order to reduce the amount of heat entering the building, the use of internal blinds has been simulated within the thermal model to help mitigate overheating within the habitable rooms.

For the purposes of the calculations, the blinds will be controlled within the model to close if the outside air temperature rises above 24°C.

Pursuant to Level 4 of the London Plan Cooling Hierarchy, the use of openable windows to provide natural ventilation has been simulated within the thermal model to help mitigate overheating within the habitable rooms. The opening lights of the external windows in the new buildings should be designed to comply with the minimum requirements of Building Regulations Approved Document F (Ventilation) in order to provide 4 air changes per hour of 'purge ventilation' to the rooms during hot weather. For the purposes of the calculations, the habitable rooms within the model will be provided with 4 air changes per hour of external air if the room internal air temperature rises above 24°C, as long as the external temperature is below the internal temperature.

8.9 Dynamic modelling has been carried out to the standards in section 7.3 to assess the risk of overheating, and the results are as follows:

| Building/Apartment | Risk of Overheating |
|---|---|
| **Lord Cameron Hall** | |
| **LCH_Flats 01-06** | **Not Modelled** |
| **LCH_Flat 07** | **Slight** |
| **LCH_Flat 08** | **Slight** |
| **LCH_Flat 09** | **Slight** |
| **LCH_Flat 10** | **Medium** |
| **LCH_Flat 11** | **Slight** |
| **LCH_Flat 12** | **Slight** |
| **LCH_Flat 13** | **Slight** |
| **LCH_Flat 14** | **Slight** |
| **LCH_Flat 15** | **Medium** |
| **LCH_Flat 16** | **Medium** |
| **LCH_Flat 17** | **Slight** |
| **LCH_Flat 18** | **Slight** |
| **LCH_Flat 19** | **Slight** |
| **LCH_Flats 20-25** | **Not Modelled** |
| | |
| **Pavilions** | |
| **PAV_House 01** | **High** |
| **PAV_House 02** | **High** |
| **PAV_House 03** | **High** |
| | |
| **Queen Mother's Hall** | |
| **QMH_Flat 01** | **Slight** |
| **QMH_Flat 02** | **Not Modelled** |
| **QMH_Flat 03** | **Slight** |
| **QMH_Flat 04** | **Slight** |
| **QMH_Flat 05** | **Slight** |
| **QMH_Flat 06** | **Not Modelled** |

| | |
|---|---|
| QMH_Flat 07 | Slight |
| QMH_Flat 08 | Slight |
| QMH_Flat 09 | Slight |
| QMH_Flat 10 | Slight |
| QMH_Flat 11 | Slight |
| QMH_Flat 12 | Slight |
| QMH_Flats 13-14 | Not Modelled |
| QMH_Flat 15 | Slight |
| QMH_Flats 16-18 | Not Modelled |

| Building/Apartment | Risk of Overheating |
|---|---|
| Rosalind Franklin Hall | |
| RFH_Flats 01-07 | Not Modelled |
| RFH_Flat 08 | Medium |
| RFH_Flat 09 | Slight |
| RFH_Flat 10 | Slight |
| RFH_Flat 11 | Slight |
| RFH_Flat 12 | Slight |
| RFH_Flat 13 | Slight |
| RFH_Flat 14 | Slight |
| RFH_Flat 15 | Slight |
| RFH_Flat 16 | Slight |
| RFH_Flat 17 | Slight |
| RFH_Flat 18 | Slight |
| RFH_Flat 19 | Not Modelled |
| RFH_Flat 20 | Slight |
| RFH_Flat 21 | Slight |
| RFH_Flat 22 | Slight |
| RFH_Flat 23 | Slight |
| RFH_Flat 24 | Slight |
| RFH_Flat 25 | Slight |
| RFH_Flat 26 | Medium |
| RFH_Flat 27 | Slight |
| RFH_Flat 28 | Slight |
| RFH_Flat 29 | Slight |
| RFH_Flat 30 | Slight |
| RFH_Flat 31 | Slight |
| RFH_Flat 32 | Slight |
| RFH_Flat 33 | Slight |
| RFH_Flat 34 | Slight |
| RFH_Flats 35-46 | Not Modelled |
| | |
| Townhouses | |
| TWN_House 01 | High |
| TWN_House 02 | High |

| | |
|---|---|
| **TWN_House 03** | **High** |
| **TWN_House 04** | **High** |
| **TWN_House 05** | **High** |
| **TWN_House 06** | **High** |
| **TWN_House 07** | **High** |
| **TWN_House 08** | **High** |

| Building/Apartment | Risk of Overheating |
|---|---|
| **Dudin Brown** | |
| **DB_Flat 01** | **Slight** |
| **DB_Flat 02** | **Slight** |
| **DB_Flat 03** | **Slight** |
| **DB_Flat 04** | **Slight** |
| **DB_Flat 05** | **Slight** |
| **DB_Flat 06** | **Slight** |
| | |
| **Kidderpore Hall** | |
| **KH_Flat 01** | **Slight** |
| **KH_Flat 02** | **Slight** |
| | |
| **Maynard Wing** | |
| **MW_Flat 01** | **Slight** |
| **MW_Flat 02** | **Slight** |
| **MW_Flat 03** | **Slight** |
| **MW_Flat 04** | **Slight** |
| **MW_Flat 05** | **Slight** |
| **MW_Flat 06** | **Slight** |
| **MW_Flat 07** | **Slight** |
| **MW_Flat 08** | **Slight** |
| **MW_Flat 09** | **Slight** |
| **MW_Flat 10** | **Slight** |
| **MW_Flat 11** | **Slight** |
| **MW_Flat 12** | **Slight** |
| **MW_Flat 13** | **Slight** |
| **MW_Flat 14** | **Slight** |
| **MW_Flat 15** | **Slight** |
| **MW_Flat 16** | **Slight** |
| | |
| **Skeel House** | |
| **SH_House 01** | **Slight** |

Active cooling

8.10 Active cooling will be installed in new build units. The results above and in Appendix 5 indicate that in many new build units there will be a high overheating risk,

especially in the pavilions and townhouses after passive cooling methods have been undertaken.

Cooling shall be provided on new build units in the master bedroom and living area as occupants will spend most of their time in these rooms whilst in the dwelling.

Cooling will be provided by an air cooled chilled water communal cooling system. The plant will be located above the main energy centre in the basement of Rosalind Franklin Hall. The energy and emissions impact of these systems has been minimised as much as practicable, with the chiller having an EER of no less than 2.4.

## 9.0 CARBON OFFSETTING

9.1 In April 2015, the Greater London Authority (GLA) published:

- *GLA Energy Planning Guidance on Preparing Energy Assessments* - April 2015.
- *Sustainable Design and Construction – Supplementary Planning Guidance.*

These documents contain updated guidance on Sustainability Guidance for major schemes and also set formal guidance for Carbon Offsetting for the first time. Carbon Offsetting was introduced to reflect that on tight urban sites, meeting the Mayor's $CO_2$ reduction targets was becoming increasingly difficult despite more energy efficient buildings being designed. In lieu of being able to feasibly meet the targets on-site, an off-site payment would be made to the Local Authority to be spent elsewhere in the borough to reduce $CO_2$ emissions.

9.2 The SPG states:
2.5.6 - *London Plan Policy 5.2 sets out that where the target percentage improvements beyond Part L of the Building Regulations, also set in this policy, cannot be met on-site, any short fall should be provided off-site or through a cash in lieu contribution to the relevant borough. This is to be ring fenced to secure delivery of carbon dioxide savings elsewhere*.

9.3 In terms of the cost of the contribution, London Boroughs can either set their own price, based on the actual cost of offsetting Carbon in the borough or, use the "national standard" as set by the Zero Carbon Hub.

Contact has been attempted with the local council to establish whether they have such a report but an answer could not be found and there are no documents mentioning Carbon Offsetting on the website so the "national standard" shall be followed. According to the SPG (page 47), this should be calculated as:

Nationally recognised prices for carbon dioxide include:

- The Zero Carbon Hub price, currently £60 per tonne
- The non-trading price of carbon.

2.5.13 The overall contribution should be calculated over 30 years. For example, using the Zero Carbon Hub price equates to £60 x 30 years = £1,800 per tonne of carbon dioxide to be off-set.

Using methodology above, the Carbon Offsetting payment for the scheme should be £25,236.

9.4 However, it must be noted that this payment must not impact on the viability of the scheme and should be reviewed in conjunction with all other statutory and contributory payments. The SPG (page 47) states:

2.5.11 The price set should not put an unreasonable burden on development and must enable schemes to remain viable.

9.5 Therefore, while the above follows the exact guidance in regards to Planning Policy targets, it is in by no way a legally binding commitment or absolute requirement, as full SAPs and Construction Stage drawings will mean the final $CO_2$ emissions will be slightly different of that of this document.

The contribution shall be recalculated at this stage.

9.6 Final $CO_2$ emissions therefore are:

| | UNITS IN RETAINED BUILDINGS - $CO_2$ Emissions - (Tonnes per Annum) | | |
|---|---|---|---|
| | Regulated | % improvement on TER | Unregulated |
| **Emissions of existing dwellings (DER)** | **307.3** | | **117.4** |
| **After energy demand reduction (proposed dwellings)** *'Be Lean'* | **166.5** | **45.81%** | **117.4** |

| | NEW BUILD DWELLINGS - $CO_2$ Emissions - (Tonnes per Annum) | | |
|---|---|---|---|
| | Regulated | % improvement on TER | Unregulated |
| **Baseline: Part L 2013 of the Building Regulations Compliant Development (TER)** | **140.6** | | **130.9** |
| **After energy demand reduction** *'Be Lean'* | **122.5** | **12.9%** | **130.9** |
| **After CHP** *'Be Clean'* | **122.5** | **12.9%** | **130.9** |
| **After renewable energy** *'Be Green'* | **105.4** | **25.0%** | **130.9** |
| **After Carbon Offsetting** | **91.4** | **35.0%** | **130.9** |

## 10.0 CONCLUSION

10.1 This statement is written in accordance with the guidelines and requirements of:
i. GLA Guide on Preparing Energy Assessments (April 2015)
ii. The London Plan (March 2015) – Section 5
iii. London Borough of Camden Local Policies

10.2 The development has $CO_2$ baseline emissions that are Part L compliant via passive Energy Efficiency Measures alone as highlighted in Section 4 and indeed the $CO_2$ emission reduction through the "Be Lean" scenario is a commendable 12.9%.

10.3 In addition to the passive measures, **43.16 kWpeak** of PV is being installed in order to achieve a 25.00% reduction in $CO_2$ emissions on-site.

10.4 Several renewable energy options were concerned, including air source heat pumps in detail but a PV installation was found most sympathetic and suitable for the historic site.

10.5 The remainder of the 35% reduction, 14.02 tonnes of CO2 per annum will be achieved through Carbon Offsetting to the value of £25,236. It is expected that at Construction Stage full SAP Calculations and the associated Revised Energy Report will confirm this amount through means of a Planning Condition.

10.6 Combining the onsite and offsite reduction the 35% reduction target is achieved.

# APPENDIX 1 – $CO_2$ Emissions Tables (Regulated and Un-Regulated)

Kidderpore Avenue- New Units
REDUCTION OF CARBON EMISSIONS BY 35%

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| PLOT | AREA | TER | Un-Regulated Emissions (Appliances & Cooking) | Regulated Part L Baseline | DER | Total Regulated Only |
| | $m^2$ | $kgCO_2/m^2/yr$ | $kgCO_2/m^2/yr$ | $kgCO_2/yr$ | $kgCO_2/m^2/yr$ | $kgCO_2/yr$ |
| LCH-01 | 108.93 | 15.36 | 16.52 | 1,673 | 13.45 | 1,465 |
| LCH-03 | 87.81 | 16.32 | 18.07 | 1,433 | 14.35 | 1,260 |
| LCH-06 | 88.28 | 14.79 | 18.04 | 1,306 | 12.83 | 1,133 |
| LCH-14 | 57.77 | 17.04 | 20.24 | 984 | 14.73 | 851 |
| LCH-22 | 53.32 | 18.59 | 20.60 | 991 | 16.06 | 856 |
| QMH-04 | 59.60 | 20.24 | 20.10 | 1,206 | 17.60 | 1,049 |
| QMH-05 | 50.62 | 21.41 | 20.84 | 1,084 | 18.84 | 954 |
| QMH-10 | 50.62 | 19.06 | 20.84 | 965 | 16.61 | 841 |
| QMH-16 | 58.54 | 17.83 | 20.18 | 1,044 | 15.52 | 909 |
| QMH-18 | 78.68 | 17.09 | 18.74 | 1,345 | 14.64 | 1,152 |
| RFH-03 | 84.30 | 16.44 | 18.33 | 1,386 | 14.45 | 1,218 |
| RFH-06 | 49.98 | 20.09 | 20.90 | 1,004 | 18.11 | 905 |
| RFH-08 | 75.15 | 15.64 | 18.99 | 1,175 | 13.77 | 1,035 |
| RFH-11 | 76.22 | 17.23 | 18.91 | 1,313 | 14.96 | 1,140 |
| RFH-20 | 76.22 | 15.53 | 18.91 | 1,184 | 13.23 | 1,008 |
| RFH-21 | 75.55 | 14.86 | 18.96 | 1,123 | 13.00 | 982 |
| RFH-25 | 50.57 | 19.18 | 20.84 | 970 | 16.68 | 844 |
| RFH-46 | 77.10 | 16.38 | 18.85 | 1,263 | 14.25 | 1,099 |
| TWN-07 | 186.91 | 13.45 | 12.63 | 2,514 | 11.64 | 2,176 |
| TWN-08 | 186.98 | 14.68 | 12.63 | 2,745 | 12.75 | 2,384 |
| Total | 1633.15 | | | 26,707 | | 23,260 |
| | | | | $1m^2$ TER | | $1m^2$ DER |
| | | UN_REGULATED TOTAL | 139,077 | *16.35* | | *14.24* |
| | | | | TOTAL TER $CO_2$ | | TOTAL DER $CO_2$ |
| Total Site ($m^2$) | 8,600 | | | 140,639 | | 122,483 |

| | | |
|---|---|---|
| Multiple TER | 140,639 | $kgCO_2/yr$ |
| Multiple DER | 122,483 | $kgCO_2/yr$ |
| $CO_2$ Offset | 31,068 | $kgCO_2/yr$ |
| Required for 35% Reduction | | |
| PV Orientation | Horizontal | |
| 1kWP PV | 395.00 | $kgCO_2/kWP$ |
| PV Required | 78.65 | kWP |
| Maximum PV on Roof | 43.16 | kWP |
| PV $CO_2$ Offset | 17,048 | $kgCO_2/yr$ |
| On-Site $CO_2$ Total | 105,435 | $kgCO_2/yr$ |
| Off-Site $CO_2$ Offset Required for 35% Reduction | 14,020 | $kgCO_2/yr$ |
| Carbon Offset Payment (£60 per tonne per annum x 30 years) | £25,235 | |

**Kidderpore Avenue- Retained Units**
**REDUCTION OF CARBON EMISSIONS BY 35%**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| PLOT TYPE | AREA | DER - Existing | Un-Regulated Emissions (Appliances & Cooking) | Regulated Part L Baseline | DER - Proposed | Total Regulated Only |
| | $m^2$ | $kgCO_2/m^2/yr$ | $kgCO_2/m^2/yr$ | $kgCO_2/yr$ | $kgCO_2/m^2/yr$ | $kgCO_2/yr$ |
| BH-01 | 46.53 | 57.80 | 21.25 | 2,689 | 34.13 | 1,588 |
| BH-13 | 81.90 | 53.00 | 18.50 | 4,341 | 21.14 | 1,731 |
| DB-02 | 75.68 | 55.57 | 18.96 | 4,206 | 30.94 | 2,342 |
| DB-03 | 124.33 | 36.10 | 15.48 | 4,488 | 23.52 | 2,924 |
| DB-04 | 74.35 | 44.09 | 19.05 | 3,278 | 25.76 | 1,915 |
| DB-06 | 63.80 | 46.78 | 19.79 | 2,985 | 27.99 | 1,786 |
| LC-04 | 88.54 | 45.33 | 18.01 | 4,014 | 25.64 | 2,270 |
| LC-07/1 | 71.25 | 42.10 | 19.27 | 3,000 | 24.44 | 1,741 |
| MW-01 | 66.96 | 49.27 | 19.57 | 3,299 | 30.90 | 2,069 |
| MW-12 | 95.06 | 59.04 | 17.53 | 5,612 | 22.90 | 2,177 |
| **Total** | **788.40** | | | **37,911** | | **20,544** |
| | | | | $1m^2$ DER | | $1m^2$ DER |
| | | UN-REGULATED TOTAL | 117,416 | *48.09* | | *26.06* |
| | | | | TOTAL DER $CO_2$ | | TOTAL DER $CO_2$ |
| Total Site ($m^2$) | 6,390 | | | 307,272 | | 166,507 |

| | | |
|---|---|---|
| DER Existing | 307,272 | $kgCO_2/yr$ |
| DER Proposed | 166,507 | $kgCO_2/yr$ |
| Percentage Improvement Compared to Existing Development | 45.81% | |

# APPENDIX 2 – Sample SAP Input Date Sheet and L1a Checklist

## Data Input Report
### Design - Draft

NHER

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

| | | | |
|---|---|---|---|
| Assessor name | Mr Neil Rothon | Assessor number | 4282 |
| Client | | Last modified | 20/05/2015 |
| Address | DB06 Kidderpore Avenue, London, NW3 | | |

**Dwelling**

| | | | |
|---|---|---|---|
| Development: | N/A | House type: | |
| Property type: | Flat | | |
| Flat type: | Top floor | Year built: | 1950 |
| Tariff: | Standard | Assess summer overheating: | Yes |
| Thermal mass: | Medium | Thermal mass parameter: | 250.00 |
| Separated heated conservatory: | Yes | Degree day region: | Thames |
| Sheltered sides: | 2 | Terrain: | Dense Urban |

**Storeys:**

| Name | Area (m²) | Height (m) |
|---|---|---|
| Lowest occupied | 64.00 | 2.40 |

**Floors**

| Ref - Name | Type | Construction | Storey Location | Living Area (m²) | Area (m²) | U-value (W/m²K) |
|---|---|---|---|---|---|---|

Living area that has no heat loss: 37.19

**Walls**

| Ref - Name | Type | Construction | Gross Area (m²) | U-value (W/m²K) |
|---|---|---|---|---|
| Wall 1 - DORMERS | External | Timber | 13.20 | 0.28 |
| Wall 2 - EXISTING | External | Brick | 9.00 | 0.28 |
| Wall 3 - party | Party | Solid | 11.04 | 0.00 |
| Wall 4 - sheltered | Sheltered | Brick | 16.32 | 1.10 |

**Roofs**

| Ref - Name | Construction | Gross Area (m²) | U-value (W/m²K) |
|---|---|---|---|
| Roof 1 - INS@CEILING | Pitched (joists) | 10.00 | 0.16 |
| Roof 2 - SLOPING | Pitched (rafters) | 54.00 | 0.18 |

**Openings**

**Opening Ref: 1 Door to corridor, N/A, ' N/A', master: Yes, linked to: 0**

| | | | | | |
|---|---|---|---|---|---|
| Location: | Wall 4 | Source: | From Manufacturer | Orientation: | North East |
| Overshading: | N/A | Width (m): | 0.91 | Height (m): | 2.10 |
| Frame: | u-PVC | Transmittance factor: | N/A | U-value (W/m²K): | 1.40 |

**Opening Ref: 2 Window, Single glazed, ' N/A', master: Yes, linked to: 0**

| | | | | | |
|---|---|---|---|---|---|
| Location: | Wall 1 | Source: | From Manufacturer | Orientation: | South West |
| Overshading: | Average / Unknown | Width (m): | 0.80 | Height (m): | 1.60 |
| Frame: | Wood | Transmittance factor: | 0.85 | U-value (W/m²K): | 4.80 |

**Opening Ref: 3 Window, Single glazed, ' N/A', master: No, linked to: 2**

| | | | | | |
|---|---|---|---|---|---|
| Location: | Wall 1 | Source: | From Manufacturer | Orientation: | South West |
| Overshading: | Average / Unknown | Width (m): | 0.80 | Height (m): | 1.60 |
| Frame: | Wood | Transmittance factor: | 0.85 | U-value (W/m²K): | 4.80 |

URN: Kidderpore version 8
NHER Plan Assessor version 6.1.1
SAP version N/A

Page 1

**Opening Ref: 4 Window, Single glazed, ' N/A', master: No, linked to: 2**

| | | | | | |
|---|---|---|---|---|---|
| Location: | Wall 1 | Source: | From Manufacturer | Orientation: | South West |
| Overshading: | Average / Unknown | Width (m): | 1.75 | Height (m): | 1.20 |
| Frame: | Wood | Transmittance factor: | 0.85 | U-value (W/m²K): | 4.80 |

**Opening Ref: 5 Window, Single glazed, ' N/A', master: No, linked to: 2**

| | | | | | |
|---|---|---|---|---|---|
| Location: | Wall 1 | Source: | From Manufacturer | Orientation: | South East |
| Overshading: | Average / Unknown | Width (m): | 1.80 | Height (m): | 1.60 |
| Frame: | Wood | Transmittance factor: | 0.85 | U-value (W/m²K): | 4.80 |

**Opening Ref: 6 Window, Single glazed, ' N/A', master: No, linked to: 2**

| | | | | | |
|---|---|---|---|---|---|
| Location: | Wall 1 | Source: | From Manufacturer | Orientation: | South East |
| Overshading: | Average / Unknown | Width (m): | 1.80 | Height (m): | 1.60 |
| Frame: | Wood | Transmittance factor: | 0.85 | U-value (W/m²K): | 4.80 |

**Opening Ref: 7 Window, Single glazed, ' N/A', master: No, linked to: 2**

| | | | | | |
|---|---|---|---|---|---|
| Location: | Wall 2 | Source: | From Manufacturer | Orientation: | North East |
| Overshading: | Average / Unknown | Width (m): | 1.75 | Height (m): | 1.20 |
| Frame: | Wood | Transmittance factor: | 0.85 | U-value (W/m²K): | 4.80 |

## Thermal Bridging

| | | | |
|---|---|---|---|
| Thermal bridge specification: | Default y value | y-value: | 0.15 |

## Ventilation

| | | | |
|---|---|---|---|
| Air permeability entered: | No | Draught lobby: | N/A |

| Number of... | Open fireplaces | Open flues | Flueless gas fires | Extract fans | Passive vents |
|---|---|---|---|---|---|
| | 0 | 0 | 0 | 2 | 0 |

Mechanical ventilation: Not present (natural)

## Space heating

| | | | |
|---|---|---|---|
| Main heating category: | Community scheme | | |
| Secondary heating: | No | Open flue or chimney: | N/A |
| Unconnected gas point: | N/A | Smoke control area: | N/A |

**Heat source: Mains gas - Boilers**

| | | | |
|---|---|---|---|
| Fraction of heat: | 1.00 | Efficiency (%): | 96.80 |

**Community system:**

| | | | |
|---|---|---|---|
| User entered distribution loss factor: | Yes | Distribution loss factor: | 1.00 |
| Controls: | Charging system linked to use, programmer and room thermostat | | |
| Emitter: | Radiators | | |

## Water heating

| | | | |
|---|---|---|---|
| Type: | From main | Cylinder in dwelling: | No |

## Renewables

No renewables present

## Other

**Internal lighting**

| | | | | | |
|---|---|---|---|---|---|
| Standard fittings: | 0 | Low energy fittings: | 4 | Total fittings: | 4 |

**Summer overheating**

| | | | |
|---|---|---|---|
| Thermal mass parameter (TMP): | 250.00 | | |
| User defined air change rate: | No | Air change rate (ach): | N/A |
| Cross ventilation on most floors: | Yes | Window ventilation: | Fully open |
| Source of user defined values: | N/A | | |
| Curtains closed in daylight hours: | No | Fraction curtains closed: | N/A |
| Blind/curtain type: | N/A | | |

**Special features (Appendix Q)**

No Appendix Q special features present

# L1A 2013 - Regulations Compliance Report

## Design - Draft

This design draft submission provides evidence towards compliance with Part L of the Building Regulations, in accordance with Appendix C of AD L1A. It has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the 'as built' property. This report covers only items included within the SAP and is not a complete report of regulations compliance.

| | | | |
|---|---|---|---|
| Assessor name | Mr Neil Rothon | Assessor number | 4282 |
| Client | | Last modified | 08/04/2015 |
| Address | DB06 Kidderpore Avenue, London, NW3 | | |

| Check | Evidence | Produced by | OK? |
|---|---|---|---|
| **Criterion 1: predicted carbon dioxide emission from proposed dwelling does not exceed the target** | | | |
| TER (kg $CO_2/m^2.a$) | Fuel = N/A<br>Fuel factor = 1.00<br>TER = 16.77 | Authorised SAP Assessor | |
| DER for dwelling as designed (kg $CO_2/m^2.a$) | DER = 46.78 | Authorised SAP Assessor | |
| Are emissions from dwelling as designed less than or equal to the target? | DER 46.78 > TER 16.77<br>Excess emissions = 30.01 kg/$m^2$ (178.95%) | Authorised SAP Assessor | Failed |
| Is the fabric energy efficiency of the dwellling as designed less than or equal to the target? | DFEE 201.31 > TFEE 40.04<br>Variance = 161.27 kWh/$m^2$ (402.77%) | Authorised SAP Assessor | Failed |
| **Criterion 2: the performance of the building fabric and the heating, hot water and fixed lighting systems should be no worse than the design limits** | | | |
| **Fabric U-values** | | | |
| Are all U-values better than the design limits in Table 2? | **Element** / **Weighted average** / **Highest**<br>Wall: 1.29 (max 0.30) / 1.90 (max 0.70)<br>Party wall: 0.00 (max 0.20) / N/A<br>Floor: (no floor)<br>Roof: 2.35 (max 0.20) / 2.35 (max 0.35)<br>Openings: 4.35 (max 2.00) / 4.80 (max 3.30) | Authorised SAP Assessor | Failed |
| **Thermal bridging** | | | |
| How has the loss from thermal bridges been calculated? | Thermal bridging calculated using default y-value of 0.15 | Authorised SAP Assessor | |
| **Heating and hot water systems** | | | |
| Does the efficiency of the heating systems meet the minimum value set out in the Domestic Heating Compliance Guide? | Community heating scheme<br><br>Secondary heating system: None | Authorised SAP Assessor | N/A |
| Does the insulation of the hot water cylinder meet the standards set out in the Domestic Heating Compliance Guide? | No hot water cylinder in the dwelling | Authorised SAP Assessor | |
| Do controls meet the minimum controls provision set out in the Domestic Heating Compliance Guide? | Space heating control:<br>Charging system linked to use, programmer and room thermostat<br><br>No hot water cylinder in the dwelling | Authorised SAP Assessor | Failed |
| **Fixed internal lighting** | | | |

| Check | Evidence | Produced by | OK? |
|---|---|---|---|
| Does fixed internal lighting comply with paragraphs 42 to 44? | Schedule of installed fixed internal lighting<br>Standard lights = 4<br>Low energy lights = 0<br><br>Percentage of low energy lights = 0%<br>Minimum = 75 % | Authorised SAP Assessor | Failed |
| Criterion 3: the dwelling has appropriate passive control measures to limit solar gains | | | |
| Does the dwelling have a strong tendency to high summertime temperatures? | Overheating risk (June) = Not significant<br>Overheating risk (July) = Not significant<br>Overheating risk (August) = Not significant<br>Region = Thames<br>Thermal mass parameter = 250.00<br>Ventilation rate in hot weather = 6.00 ach<br>Blinds/curtains = None | Authorised SAP Assessor | Passed |
| Criterion 4: the performance of the dwelling, as designed, is consistent with the DER | | | |
| Design air permeability ($m^3/(h.m^2)$ at 50Pa) | No air permeability rate entered | Authorised SAP Assessor | |
| Mechanical ventilation system Specific fan power (SFP) | Not applicable | Authorised SAP Assessor | |
| Have the key features of the design been included (or bettered) in practice? | The following party walls have a U-value less than $0.2W/m^2K$:<br>• party (0.00)<br>Community heating with CHP - Mains gas | Authorised SAP Assessor | |

# Data Input Report
## Design - Draft

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

| | | | |
|---|---|---|---|
| Assessor name | Mr Neil Rothon | Assessor number | 4282 |
| Client | | Last modified | 20/05/2015 |
| Address | DB06 Kidderpore Avenue, London, NW3 | | |

### Dwelling

| | | | |
|---|---|---|---|
| Development: | N/A | House type: | |
| Property type: | Flat | | |
| Flat type: | Top floor | Year built: | 1950 |
| Tariff: | Standard | Assess summer overheating: | Yes |
| Thermal mass: | Medium | Thermal mass parameter: | 250.00 |
| Separated heated conservatory: | Yes | Degree day region: | Thames |
| Sheltered sides: | 2 | Terrain: | Dense Urban |

**Storeys:**

| Name | Area (m²) | Height (m) |
|---|---|---|
| Lowest occupied | 64.00 | 2.40 |

### Floors

| Ref - Name | Type | Construction | Storey Location | Living Area (m²) | Area (m²) | U-value (W/m²K) |
|---|---|---|---|---|---|---|

Living area that has no heat loss: 37.19

### Walls

| Ref - Name | Type | Construction | Gross Area (m²) | U-value (W/m²K) |
|---|---|---|---|---|
| Wall 1 - DORMERS | External | Timber | 13.20 | 0.28 |
| Wall 2 - EXISTING | External | Brick | 9.00 | 0.28 |
| Wall 3 - party | Party | Solid | 11.04 | 0.00 |
| Wall 4 - sheltered | Sheltered | Brick | 16.32 | 1.10 |

### Roofs

| Ref - Name | Construction | Gross Area (m²) | U-value (W/m²K) |
|---|---|---|---|
| Roof 1 - INS@CEILING | Pitched (joists) | 10.00 | 0.16 |
| Roof 2 - SLOPING | Pitched (rafters) | 54.00 | 0.18 |

### Openings

**Opening Ref: 1 Door to corridor, N/A, ' N/A', master: Yes, linked to: 0**

| | | | | | |
|---|---|---|---|---|---|
| Location: | Wall 4 | Source: | From Manufacturer | Orientation: | North East |
| Overshading: | N/A | Width (m): | 0.91 | Height (m): | 2.10 |
| Frame: | u-PVC | Transmittance factor: | N/A | U-value (W/m²K): | 1.40 |

**Opening Ref: 2 Window, Single glazed, ' N/A', master: Yes, linked to: 0**

| | | | | | |
|---|---|---|---|---|---|
| Location: | Wall 1 | Source: | From Manufacturer | Orientation: | South West |
| Overshading: | Average / Unknown | Width (m): | 0.80 | Height (m): | 1.60 |
| Frame: | Wood | Transmittance factor: | 0.85 | U-value (W/m²K): | 4.80 |

**Opening Ref: 3 Window, Single glazed, ' N/A', master: No, linked to: 2**

| | | | | | |
|---|---|---|---|---|---|
| Location: | Wall 1 | Source: | From Manufacturer | Orientation: | South West |
| Overshading: | Average / Unknown | Width (m): | 0.80 | Height (m): | 1.60 |
| Frame: | Wood | Transmittance factor: | 0.85 | U-value (W/m²K): | 4.80 |

URN: Kidderpore version 8
NHER Plan Assessor version 6.1.1
SAP version N/A

**Opening Ref: 4 Window, Single glazed, ' N/A', master: No, linked to: 2**

| | | | | | |
|---|---|---|---|---|---|
| Location: | Wall 1 | Source: | From Manufacturer | Orientation: | South West |
| Overshading: | Average / Unknown | Width (m): | 1.75 | Height (m): | 1.20 |
| Frame: | Wood | Transmittance factor: | 0.85 | U-value (W/m²K): | 4.80 |

**Opening Ref: 5 Window, Single glazed, ' N/A', master: No, linked to: 2**

| | | | | | |
|---|---|---|---|---|---|
| Location: | Wall 1 | Source: | From Manufacturer | Orientation: | South East |
| Overshading: | Average / Unknown | Width (m): | 1.80 | Height (m): | 1.60 |
| Frame: | Wood | Transmittance factor: | 0.85 | U-value (W/m²K): | 4.80 |

**Opening Ref: 6 Window, Single glazed, ' N/A', master: No, linked to: 2**

| | | | | | |
|---|---|---|---|---|---|
| Location: | Wall 1 | Source: | From Manufacturer | Orientation: | South East |
| Overshading: | Average / Unknown | Width (m): | 1.80 | Height (m): | 1.60 |
| Frame: | Wood | Transmittance factor: | 0.85 | U-value (W/m²K): | 4.80 |

**Opening Ref: 7 Window, Single glazed, ' N/A', master: No, linked to: 2**

| | | | | | |
|---|---|---|---|---|---|
| Location: | Wall 2 | Source: | From Manufacturer | Orientation: | North East |
| Overshading: | Average / Unknown | Width (m): | 1.75 | Height (m): | 1.20 |
| Frame: | Wood | Transmittance factor: | 0.85 | U-value (W/m²K): | 4.80 |

## Thermal Bridging

| | | | |
|---|---|---|---|
| Thermal bridge specification: | Default y value | y-value: | 0.15 |

## Ventilation

| | | | |
|---|---|---|---|
| Air permeability entered: | No | Draught lobby: | N/A |

| Number of... | Open fireplaces | Open flues | Flueless gas fires | Extract fans | Passive vents |
|---|---|---|---|---|---|
| | 0 | 0 | 0 | 2 | 0 |

Mechanical ventilation: Not present (natural)

## Space heating

| | | | |
|---|---|---|---|
| Main heating category: | Community scheme | | |
| Secondary heating: | No | Open flue or chimney: | N/A |
| Unconnected gas point: | N/A | Smoke control area: | N/A |

**Heat source: Mains gas - Boilers**

| | | | |
|---|---|---|---|
| Fraction of heat: | 1.00 | Efficiency (%): | 96.80 |

**Community system:**

| | | | |
|---|---|---|---|
| User entered distribution loss factor: | Yes | Distribution loss factor: | 1.00 |
| Controls: | Charging system linked to use, programmer and room thermostat | | |
| Emitter: | Radiators | | |

## Water heating

| | | | |
|---|---|---|---|
| Type: | From main | Cylinder in dwelling: | No |

## Renewables

No renewables present

## Other

**Internal lighting**

| | | | | | |
|---|---|---|---|---|---|
| Standard fittings: | 0 | Low energy fittings: | 4 | Total fittings: | 4 |

**Summer overheating**

| | | | |
|---|---|---|---|
| Thermal mass parameter (TMP): | 250.00 | | |
| User defined air change rate: | No | Air change rate (ach): | N/A |
| Cross ventilation on most floors: | Yes | Window ventilation: | Fully open |
| Source of user defined values: | N/A | | |
| Curtains closed in daylight hours: | No | Fraction curtains closed: | N/A |
| Blind/curtain type: | N/A | | |

**Special features (Appendix Q)**

No Appendix Q special features present

# L1A 2013 - Regulations Compliance Report

## Design - Draft

NHER

This design draft submission provides evidence towards compliance with Part L of the Building Regulations, in accordance with Appendix C of AD L1A. It has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the 'as built' property. This report covers only items included within the SAP and is not a complete report of regulations compliance.

| | | | |
|---|---|---|---|
| Assessor name | Mr Neil Rothon | Assessor number | 4282 |
| Client | | Last modified | 20/05/2015 |
| Address | DB06 Kidderpore Avenue, London, NW3 | | |

| Check | Evidence | Produced by | OK? |
|---|---|---|---|
| **Criterion 1: predicted carbon dioxide emission from proposed dwelling does not exceed the target** | | | |
| TER (kg $CO_2/m^2.a$) | Fuel = N/A<br>Fuel factor = 1.00<br>TER = 16.77 | Authorised SAP Assessor | |
| DER for dwelling as designed (kg $CO_2/m^2.a$) | DER = 27.99 | Authorised SAP Assessor | |
| Are emissions from dwelling as designed less than or equal to the target? | DER 27.99 > TER 16.77<br>Excess emissions = 11.22 kg/m² (66.91%) | Authorised SAP Assessor | Failed |
| Is the fabric energy efficiency of the dwellling as designed less than or equal to the target? | DFEE 88.03 > TFEE 40.04<br>Variance = 47.99 kWh/m² (119.86%) | Authorised SAP Assessor | Failed |
| **Criterion 2: the performance of the building fabric and the heating, hot water and fixed lighting systems should be no worse than the design limits** | | | |
| **Fabric U-values** | | | |
| Are all U-values better than the design limits in Table 2? | **Element** / **Weighted average** / **Highest**<br>Wall: 0.77 (max 0.30) / 1.10 (max 0.70)<br>Party wall: 0.00 (max 0.20) / N/A<br>Floor: (no floor)<br>Roof: 0.18 (max 0.20) / 0.18 (max 0.35)<br>Openings: 4.35 (max 2.00) / 4.80 (max 3.30) | Authorised SAP Assessor | Failed |
| **Thermal bridging** | | | |
| How has the loss from thermal bridges been calculated? | Thermal bridging calculated using default y-value of 0.15 | Authorised SAP Assessor | |
| **Heating and hot water systems** | | | |
| Does the efficiency of the heating systems meet the minimum value set out in the Domestic Heating Compliance Guide? | Community heating scheme<br><br>Secondary heating system: None | Authorised SAP Assessor | N/A |
| Does the insulation of the hot water cylinder meet the standards set out in the Domestic Heating Compliance Guide? | No hot water cylinder in the dwelling | Authorised SAP Assessor | |
| Do controls meet the minimum controls provision set out in the Domestic Heating Compliance Guide? | Space heating control:<br>Charging system linked to use, programmer and room thermostat<br><br>No hot water cylinder in the dwelling | Authorised SAP Assessor | Failed |
| **Fixed internal lighting** | | | |

| Check | Evidence | Produced by | OK? |
|---|---|---|---|
| Does fixed internal lighting comply with paragraphs 42 to 44? | Schedule of installed fixed internal lighting<br>Standard lights = 0<br>Low energy lights = 4<br><br>Percentage of low energy lights = 100%<br>Minimum = 75 % | Authorised SAP Assessor | Passed |
| Criterion 3: the dwelling has appropriate passive control measures to limit solar gains | | | |
| Does the dwelling have a strong tendency to high summertime temperatures? | Overheating risk (June) = Not significant<br>Overheating risk (July) = Slight<br>Overheating risk (August) = Slight<br>Region = Thames<br>Thermal mass parameter = 250.00<br>Ventilation rate in hot weather = 6.00 ach<br>Blinds/curtains = None | Authorised SAP Assessor | Passed |
| Criterion 4: the performance of the dwelling, as designed, is consistent with the DER | | | |
| Design air permeability ($m^3/(h.m^2)$ at 50Pa) | No air permeability rate entered | Authorised SAP Assessor | |
| Mechanical ventilation system Specific fan power (SFP) | Not applicable | Authorised SAP Assessor | |
| Have the key features of the design been included (or bettered) in practice? | The following party walls have a U-value less than $0.2W/m^2K$:<br>• party (0.00) | Authorised SAP Assessor | |

# Data Input Report
## Design - Draft

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

| | | | |
|---|---|---|---|
| Assessor name | Mr Neil Rothon | Assessor number | 4282 |
| Client | | Last modified | 20/05/2015 |
| Address | LCH14 Kidderpore Avenue, London, NW3 | | |

### Dwelling

| | | | |
|---|---|---|---|
| Development: | N/A | House type: | |
| Property type: | Flat | | |
| Flat type: | Mid floor | Year built: | 2015 |
| Tariff: | Standard | Assess summer overheating: | Yes |
| Thermal mass: | Medium | Thermal mass parameter: | 250.00 |
| Separated heated conservatory: | No | Degree day region: | Thames |
| Sheltered sides: | 2 | Terrain: | Dense Urban |

**Storeys:**

| Name | Area (m²) | Height (m) |
|---|---|---|
| Lowest occupied | 58.00 | 2.50 |

### Floors

| Ref - Name | Type | Construction | Storey Location | Living Area (m²) | Area (m²) | U-value (W/m²K) |
|---|---|---|---|---|---|---|

Living area that has no heat loss: 23.76

### Walls

| Ref - Name | Type | Construction | Gross Area (m²) | U-value (W/m²K) |
|---|---|---|---|---|
| Wall 1 - corridor | Sheltered | System build | 20.25 | 0.24 |
| Wall 2 - party | Party | Fully filled cavity with sealed edges | 35.00 | 0.00 |
| Wall 3 - Wall 1 | External | System build | 21.50 | 0.18 |

### Roofs

| Ref - Name | Construction | Gross Area (m²) | U-value (W/m²K) |
|---|---|---|---|

### Openings

**Opening Ref: 1 Door to corridor, N/A, ' N/A', master: Yes, linked to: 0**

| | | | | | |
|---|---|---|---|---|---|
| Location: | Wall 3 | Source: | From Manufacturer | Orientation: | South East |
| Overshading: | N/A | Width (m): | 0.91 | Height (m): | 2.10 |
| Frame: | u-PVC | Transmittance factor: | N/A | U-value (W/m²K): | 1.40 |

**Opening Ref: 2 Window, Double glazed (low-E), ' N/A', master: Yes, linked to: 0**

| | | | | | |
|---|---|---|---|---|---|
| Location: | Wall 3 | Source: | From Manufacturer | Orientation: | North West |
| Overshading: | Average / Unknown | Width (m): | 1.00 | Height (m): | 2.10 |
| Frame: | u-PVC | Transmittance factor: | 0.63 | U-value (W/m²K): | 1.40 |

**Opening Ref: 3 Window, Double glazed (low-E), ' N/A', master: No, linked to: 2**

| | | | | | |
|---|---|---|---|---|---|
| Location: | Wall 3 | Source: | From Manufacturer | Orientation: | North West |
| Overshading: | Average / Unknown | Width (m): | 0.50 | Height (m): | 2.10 |
| Frame: | u-PVC | Transmittance factor: | 0.63 | U-value (W/m²K): | 1.40 |

**Opening Ref: 4 Window, Double glazed (low-E), ' N/A', master: No, linked to: 2**

| | | | | | |
|---|---|---|---|---|---|
| Location: | Wall 3 | Source: | From Manufacturer | Orientation: | North West |

| | | | | | |
|---|---|---|---|---|---|
| Overshading: | Average / Unknown | Width (m): | 3.50 | Height (m): | 2.10 |
| Frame: | u-PVC | Transmittance factor: | 0.63 | U-value (W/m²K): | 1.40 |

**Thermal Bridging**

| Ref | Description | Length (m) | Source | ψ (W/m·K) | Result |
|---|---|---|---|---|---|
| E1 | Steel lintel with perforated steel | 0 | Default Value | N/A | 0 |
| E2 | Other lintels (including other stee | 5.91 | Approved | 0.3 | 1.773 |
| E3 | Sill | 5 | Approved | 0.04 | 0.2 |
| E4 | Jamb | 16.8 | Approved | 0.05 | 0.84 |
| E5 | Ground floor (normal) | N/A | Default Value | N/A | 0 |
| E19 | Ground floor (inverted) | N/A | Default Value | N/A | 0 |
| E20 | Exposed floor (normal) | N/A | Default Value | N/A | 0 |
| E21 | Exposed floor (inverted) | N/A | Default Value | N/A | 0 |
| E22 | Basement floor | N/A | Default Value | N/A | 0 |
| E6 | Intermediate floor within a dwellin | N/A | Default Value | N/A | 0 |
| E7 | Party floor between dwellings (in b | 24.2 | Approved | 0.07 | 1.694 |
| E8 | Balcony within a dwelling, wall ins | 3.4 | Approved | 0 | 0 |
| E9 | Balcony between dwellings, wall ins | N/A | Default Value | N/A | 0 |
| E23 | Balcony within or between dwellings | N/A | Default Value | N/A | 0 |
| E10 | Eaves (insulation at ceiling level) | N/A | Default Value | N/A | 0 |
| E24 | Eaves (insulation at ceiling level | N/A | Default Value | N/A | 0 |
| E11 | Eaves (insulation at rafter level) | N/A | Default Value | N/A | 0 |
| E12 | Gable (insulation at ceiling level) | N/A | Default Value | N/A | 0 |
| E13 | Gable (insulation at rafter level) | N/A | Default Value | N/A | 0 |
| E14 | Flat roof | N/A | Default Value | N/A | 0 |
| E15 | Flat roof with parapet | N/A | Default Value | N/A | 0 |
| E16 | Corner (normal) | N/A | Default Value | N/A | 0 |
| E17 | Corner (inverted - internal area gr | N/A | Default Value | N/A | 0 |
| E18 | Party wall between dwellings | 10 | Approved | 0.06 | 0.6 |
| E25 | Staggered party wall between dwelli | N/A | Default Value | N/A | 0 |
| P1 | Ground floor | N/A | Default Value | N/A | 0 |
| P6 | Ground floor (inverted) | N/A | Default Value | N/A | 0 |
| P2 | Intermediate floor within a dwellin | 28.8 | Default Value | 0 | 0 |
| P3 | Intermediate floor between dwelling | N/A | Default Value | N/A | 0 |
| P7 | Exposed floor (normal) | N/A | Default Value | N/A | 0 |
| P8 | Exposed floor (inverted) | N/A | Default Value | N/A | 0 |
| P4 | Roof (insulation at ceiling level) | N/A | Default Value | N/A | 0 |
| P5 | Roof (insulation at rafter level) | N/A | Default Value | N/A | 0 |
| R1 | Head | N/A | Default Value | N/A | 0 |
| R2 | Sill | N/A | Default Value | N/A | 0 |
| R3 | Jamb | N/A | Default Value | N/A | 0 |
| R4 | Ridge (vaulted ceiling) | N/A | Default Value | N/A | 0 |
| R5 | Ridge (inverted) | N/A | Default Value | N/A | 0 |
| R6 | Flat ceiling | N/A | Default Value | N/A | 0 |
| R7 | Flat ceiling (inverted) | N/A | Default Value | N/A | 0 |
| R8 | Roof wall (rafter) | N/A | Default Value | N/A | 0 |
| R9 | Roof wall (flat ceiling) | N/A | Default Value | N/A | 0 |

Equivalent y value: 0.122