Central Somers Town CIP

Energy and Sustainability Statement – Plot 3 Charrington Street Terraced Housing

DECEMBER 2015

Somers Town Community Investment Programme

Camden

Energy and Sustainability Statement

Charrington Street Terrace

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1.0 EXECUTIVE SUMMARY

This report has been produced to demonstrate that the proposed Charrington Street Terrace Housing is capable of meeting the requirements of the London Plan Policy 5.2 and is to accompany the planning application for the proposed development. Details on the key measures and CO2 reductions achieved in the energy assessment are set out in this report, as well as the wider sustainability considerations of the proposal.

The houses' energy performance is aimed at reaching carbon reduction targets for new dwellings, in line with the Greater London Authority (GLA) London Plan and Building Regulations (England) Part L1A 2013. Policy 5.2 of the London Plan states that development proposals are expected to contribute to meeting their target for 2013-2016 by achieving a DER that is 35% below the Building Regulations 2013 TER. Following the energy assessment, the development proved successful in achieving this target using the London Plan Energy Hierarchy;

The first step in the hierarchy required the application of demand reduction measures (Be Lean). Using the passive design strategies and energy efficient services described in Section 6, the houses out-performed the baseline notional building by exceeding Building Regulation requirements for CO2 emissions by 1.2%.

The second step in the hierarchy involved the assessment of heating infrastructure (Be Clean) in accordance with Policy 5.6B. For such a small group of independent terraced houses, a connection to district heating was deemed not to be feasible or technically desirable. As a result, no carbon emissions reductions were recorded for this stage of the hierarchy.

The third and final step in the assessment required the consideration of renewable energy technologies (Be Green) in line with Policy 5.7 of the London Plan. Previous analysis concluded that photovoltaics are the most feasible technology for this development. Through the addition of 2kW$_p$ PV arrays to each of the three terraces, the development exceeded the London Plan target of 35% CO2 reductions beyond Part L 2013, achieving a 40% improvement over the baseline, and significantly exceeding the 20% energy generation from on-site renewables called for by the London Plan.

A detailed description of the demand reduction measures applied in each step of the hierarchy can be found in Sections 6, 7 and 8. The SAP compliance sheets for each stage of the assessment are included in Appendix I.

Table 1.1: Carbon dioxide emissions after each stage of the Energy Hierarchy

	Carbon dioxide emissions (Tonnes CO2 per annum)	
	Regulated	**Unregulated**
Baseline: Part L 2013 of the Building Regulations Compliant Development	6.05	5.34
After energy demand reduction	5.97	5.34
After CHP	5.97	5.34
After renewable energy	3.61	5.34

Table 1.2: Regulated carbon dioxide savings from each stage of the Energy Hierarchy

	Regulated Carbon dioxide savings	
	(Tonnes CO2 per annum)	**(%)**
Savings from energy demand reduction	0.07	1.2%
Savings from CHP	0.00	0.0%
Savings from renewable energy	2.37	39.2%
Total Cumulative Savings	2.44	40.4%
Total Target Savings	2.12	35%
Annual Surplus	0.32	

Figure 1.1 – The Energy Hierarchy

2.0 INTRODUCTION

2.1 Scope of Report

This statement has been prepared on behalf of the London Borough of Camden (hereafter referred to as 'the Applicant') in support of a planning application for the redevelopment of Central Somers Town.

This report is intended to describe the sustainability proposals for the extension of the housing terrace on Charington Street by the building of three new four-storey terraced houses. These proposals have been framed in the context of local, regional and national planning policies.

As part of this, an energy assessment is included to quantify the predicted emissions reductions from these measures, and to address the requirements of the London Plan and Camden planning policy.

2.2 Project Background and Masterplan

The redevelopment of Central Somers Town is led by the Department for Children, Schools and Families and will be delivered as part of an approved regeneration strategy to deliver significant improvements to the public realm, provide a replacement primary school, nursery, play facilities and community hall. The development will also provide 136 housing units as well as maximising the amount of affordable housing which can be delivered by the scheme. Central to the development is the provision of public open space across the site. This space will be greatly improved as a result of the proposals and there will be no net loss of area following completion of the scheme.

The Central Somers Town project is self-funding, with the receipts from the private sale housing used to cross subsidise the delivery of the public realm, Edith Neville Primary School, nursery, community play facilities and community hall, in line with the wider vision for the Central Somers Town area.

Central Somers Town CIP
The Council has a significant property portfolio in the Somers Town area. Primarily this is made up of residential stock but also includes schools, a play project, children's centres and nurseries. These facilities provide an important service to children and their families and form an important part of bringing the wider community together. The area also contains two distinctive areas of public open space, these being Polygon Open Space and Purchese Open Space, which are maintained by the Council and provide a key component in how Somers Town functions as a place to live and work.

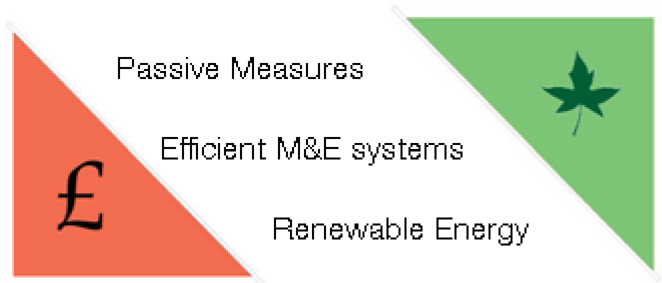
Central to the CIP is the Edith Neville Primary School and Children's Centre which were constructed as buildings with a short life expectancy. Remedial works have been necessary (both planned and unplanned) to keep it in service but the pressing need for replacement has been widely agreed for a considerable period of time.

Central Somers Town area is being addressed strategically as part of the CIP to tackle the significant need for investment. The scheme is intended to be self-funding, with the provision of residential development being utilised to pay for the redevelopment of the primary school and community facilities. It will also be possible to provide wider benefits through the delivery of an element of new affordable housing as well as public realm and public open space improvements.

2.3 General design approach

Even before we look at the regulatory and planning policy context of this project as we will in the next section, it is worth outlining our general approach to the environmental design of buildings.

Achieving the balance between sustainability, user comfort and cost is at the heart of pour approach. We wish to maintain a comfortable and appropriate internal environment whilst using the minimum amount of energy possible. Our approach to this is driven by the following design hierarchy:



The image above summarises how we go about achieving this – first by the application of passive measures, the form, orientation and fabric of the building; then by selection and design of appropriate and efficient active systems; before finally giving due consideration to renewable technologies that are suitable for the site and building. Moving through this process it can be appreciated how diminishing returns, in terms of energy or C02 emissions reduction, are achieved at a greater cost. To put it simply, it is much cheaper and more effective to choose the direction a building faces and what it is built from, than it is to buy and install a high technology renewable system.

3.0 PLANNING POLICY CONTEXT AND DESIGN BRIEF

The design of the new development will be influenced by the planning and regulatory context in which it is being built – involving a hierarchy of requirements and guidance, ranging from national legal regulations, to regional and then local planning policy.

In this section the key documents and their policies relating to sustainability will be highlighted.

3.1 Building Regulations – Part L1A 2013 (England)

The Building Regulations Part L1A, Conservation of Fuel and Power in new dwellings, details the overarching sustainability requirements on all new dwellings built in England.

The key requirements are divided in to 5 criteria that the building, as designed and built, must meet. While these requirements are in most cases exceeded by the requirements of regional and local planning policy, they provide a useful benchmark, and form the basis of some of the more stringent planning requirements.

Criterion 1: Achieving the TER and TFEE Rate
In order to meet Criterion 1 the dwelling CO_2 emission rate (DER) must not be greater than the target CO_2 emission rate (TER) and the Dwelling Fabric Energy Efficiency rate (DFEE) must not be greater than the Target Energy Efficiency Rate (TFEE), as calculated using the Standard Assessment Procedure 2012 (SAP 2012). The DER and DFEE are calculated based on the actual building geometry, fabric and systems specification, but with occupancy and set point schedules determined by the NCM. The TER and TFEE calculated for a notional building of the same size, shape and orientation as the actual building, but with pre-defined fabric, properties and service efficiencies. In order to meet this criterion, fabric properties and services efficiencies of the actual building must be better than those of the notional building.

Refer to the Energy Assessment sections of this report for details of the compliance calculations carried out.

Criterion 2: Limits on Design Flexibility
This criterion places absolute limits on the minimum fabric performance and system efficiency for the proposed building and its systems. To some extent this criterion is made obsolete by the increased stringency of criterion 1, as the limiting values are in most cases worse than those used by the notional building. Hence if parameters were targeted at or around the limiting values, the building would fail to meet criterion 1.

Criterion 3 – Limiting the Effects of Heat Gains in Summer
Criterion 3 imposes limits on the solar gain permitted in any occupied space. The SAP 2012 provides a calculation procedure that allows designers to check that solar gain is not excessive. This criterion is deemed to be achieved if the SAP does not indicate the building is at risk of high internal temperatures.

Criterion 4- Building Performance is Consistent with DER and DFEE Rate
This criterion places responsibilities on the builder to ensure that the constructed dwelling will perform as designed.

These include pressure testing for air tightness, commissioning guidelines, and requirements for the calculation of thermal bridging.

Criterion 5- Enable energy efficient operation of building
This criterion requires that the owner of the dwellings is provided with sufficient information to enable energy efficient operation of the dwelling. This is generally achieved by the production of detailed operation and maintenance (O&M) manuals, but useful supplements to this can be achieved by the production of simple and easy to follow user-guides.

3.2 GLA London Plan

The London Plan (2011) is the overall strategic policy framework for Greater London's development to 2031. It sets out the London-wide policy context within which London boroughs should set their detailed local planning policies. It also forms the policy framework for the Mayor's own decisions on the strategic planning applications referred to the Greater London Authority.

The London Plan Policy 5.2
The Government's Climate Change Act 2008 sets a target of reducing the UK's greenhouse gas emissions by 80% compared to 1990 levels by 2050. In order to help achieve this target the Mayor has set London the target of reducing its carbon dioxide emissions by 60% compared to 1990 levels by 2025. **Policy 5.2** states that development proposals are expected to contribute to meeting this target by achieving a BER that is 35% below the Building Regulations Part L 2013 TER. These targets are broadly equivalent to the target of 40% improvement over Part L 2010 of the Building Regulations, as specified in Policy 5.2 of the London Plan for 2013-2016.

All new developments must consider ways to reduce their carbon emissions. The London Plan requires that the consideration of carbon emissions reducing measures to be used by the development follow their Energy Hierarchy as depicted in **Figure 3.1**.

Be Lean first encourages a reduction in energy use. This can be achieved through both passive and active measures. Passive measures include improvements to the building fabric and ensuring the design of the building minimises solar gains and thus reduces the need for cooling. Active measures include using the most efficient building services.

Be Clean ensures energy is supplied efficiently by requiring the consideration of connecting to a district heating network or using cogeneration for efficient on-site energy production.

Finally **Be Green** encourages the use of renewable energy to offset carbon emissions that would otherwise occur from the use of natural gas or electricity from the grid.

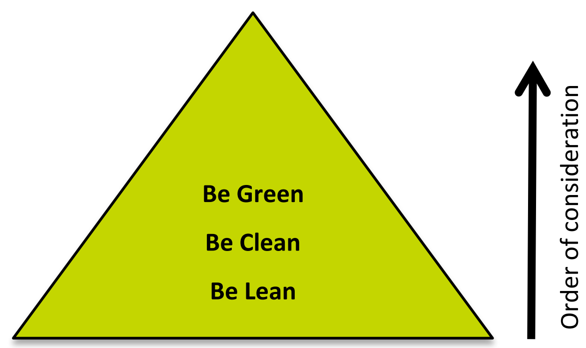


Figure 3.1 **The Energy Hierarchy from the London Plan**

In line with the London Plan Policy 5.2, this report contains a detailed Energy Assessment that demonstrates how the targets for carbon dioxide emissions reduction are met within the framework of the aforementioned energy hierarchy.

Policy 5.6 Decentralised energy in development proposals
This policy requires developments to assess the feasibility of Combined Heat and Power (CHP) systems. It also states that major developments should consider energy sources in line with the following hierarchy:

1. Connection to existing heating or cooling networks
2. Site wide CHP network
3. Communal heating and cooling

Policy 5.7 Renewable energy
Within the scope of the Energy Hierarchy, it is expected that all major developments reduce carbon emissions through the use of on-site renewable technology. This should be selected, sited and designed to minimise adverse effect son biodiversity and heritage.

There is a presumption that all major development proposals will seek to reduce carbon dioxide emissions by at least 20 per cent using on-site renewable energy generation wherever feasible.

Policy 5.9 Overheating and Cooling
Developments should be designed to minimise the risk of overheating, and to minimise their contribution to the urban heat island effect.

For major developments, efforts to minimise overheating risk should follow the following 'cooling hierarchy':

a. minimise internal heat generation through energy efficient design
b. reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls
c. manage the heat within the building through exposed internal thermal mass and high ceilings
d. passive ventilation
e. mechanical ventilation

f. Active cooling systems (ensuring they are the lowest carbon options).

Policy 5.3 Sustainable Construction
This policy requires that new developments meet the highest standards in sustainable design and construction, and highlights the following key points:

a. minimising carbon dioxide emissions across the site, including the building and services (such as heating and cooling systems)
b. avoiding internal overheating and contributing to the urban heat island effect
c. efficient use of natural resources (including water), including making the most of natural systems both within and around buildings
d. minimising pollution (including noise, air and urban runoff)
e. minimising the generation of waste and maximising reuse or recycling
f. avoiding impacts from natural hazards (including flooding)
g. ensuring developments are comfortable and secure for users, including avoiding the creation of adverse local climatic conditions
h. securing sustainable procurement of materials, using local supplies where feasible, and
i. promoting and protecting biodiversity and green infrastructure

Other Relevant Policies
Other London Plan policies relevant to sustainable design that have been considered in the design of the buildings include:

5.8 Innovative energy technologies
5.11 Green roofs and development site environs
5.12 Flood risk management
5.13 Sustainable drainage
5.14 Water quality and wastewater infrastructure
5.15 Water use and supplies
5.18 Construction excavation and demolition waste
6.1 Strategic transport approach
6.9 Cycling
6.10 Walking
7.14 Improving air quality
7.15 Reducing noise and enhancing soundscapes
7.19 Biodiversity and access to nature

Supplementary Planning Guidance- Sustainable Construction - April 2014
The Sustainable Design and Construction SPG provides further details and best practice on how to achieve the London Plan's environmental targets in the most efficient and effective way. It also introduces additional requirements and more details on those touched upon in the London Plan.

Key Additional Points:
Overheating
Developers should include measures in the design of the schemes in line with the cooling hierarchy set out in London Plan Policy 5.9 to prevent overheating in the schemes lifetime.

To prevent overheating developers should incorporate passive and active measures as appropriate, into their schemes including:

Passive measures:
- appropriate room placement, window sizing, shading devices and solar orientation
- use of thermal mass;
- Use green roofs and green walls to keep the heat out, and keep the building and its surroundings cool;
- Maximise passive ventilation, including operable windows, a shallow floor plan, high floor to ceiling heights, the stack effect, etc.

Active measures:
- energy efficient lighting and equipment to minimise internal heat generation;

Water
- Residential schemes should be designed to meet 105l or less per person per day.
- New no residential developments including refurbishments, should aim to achieve the maximum number of water credits in a BREEAM assessment or the 'best practice' level of the AECB water standards
- All developments should be designed to incorporate rainwater harvesting.
- All residential units including flats/apartments and commercial units. Wherever practical large commercial properties should be metered.

Materials
Design for development should prioritise materials that:

- Have low embodied energy, including those that can be re-used intact or recycled.
- At least three of the key elements of the building envelope (external walls, windows, roof, upper floor slabs, internal walls, floor finishes/coverings are to achieve a rating of A+ to D in the BRE's the Green Guide of Specification a mandatory requirement under Code for Sustainable Homes.
- At least 50% of timber and timber products should be sourced from accredited Forest Stewardship Council,
- Will not release toxins to internal and external environments.
- Design of developments should maximise the potential to use pre-fabricated elements.

Waste
- Developers should provide sufficient internal space for the storage of recyclable and compostable materials and waste in their schemes
- The design of development should meet the borough's requirements for the size and location of recycling, composting and refuse storage and its removal.

Nature conservation and Biodiversity
The Mayor's priorities are:

- No net loss in the quality and quantity of biodiversity.
- Developer contributes to biodiversity on their development.

In accordance with London Plan Policy 7.19, developers should adhere to the following hierarchy when considering biodiversity on their development site:

1. avoid adverse impact to the biodiversity interest by considering the following factors:
   - identifying the biodiversity interest within the site
   - considering the particular structure of landscape or vegetation required by any important plant or animal species;
   - carefully considering the location, design, form and foundation
   - requirements for the development to protect existing biodiversity as well as the length and timing of the construction phase and the specific processes involved ; and
   - considering the implications of the development on changes to the local natural environment over time, for example space required for maturing trees, the impact of additional lighting and noise.
2. Minimise impact and seek mitigation, biodiversity impacts should be reduced as far as reasonably possible.
3. Only in exceptional cases where the benefits of the proposal clearly outweigh the biodiversity impacts, seek appropriate compensation.

3.3 Camden Council

Core Strategy
Camden's Local Development Framework Core Strategy 2010-2015 sets out the council's strategic planning policy.

Key Policies include:

CS11 – Promoting Sustainable Travel

CS13 – Tackling climate change through promoting higher environmental standards

CS14 – Promoting high quality places and conserving our heritage

CS15 – Protecting and improving our parks and open spaces and improving biodiversity

CS16 – Improving Camden's health and well-being

CS18 Dealing with our waste and encouraging recycling

However, the only specific environmental requirement in this document, from CS13, is the expectation that developments will achieve at least a 20% reduction in CO_2 emissions through the use of on-site renewable technology.

Development Policies
The Camden Development Policies set out detailed planning criteria that are used to determine applications in the borough. Key sustainability policies include:

DP6 – Lifetime homes and wheelchair housing

DP16 – The transport implications of development

DP17 – Walking, cycling and public transport

DP20 – Movement of goods and materials

DP22 – Promoting sustainable design and construction

DP23 – Water

DP26 – Managing the impact of development on occupiers and neighbours

DP28 – Noise and Vibration

DP32 – Air Quality and Camden's clear zone

The only specific sustainability targets in this document come from DP6 – requiring 10% of new homes to meet wheelchair housing standards or be easily adaptable to them; and DP 22 which expects all new non-residential developments over 500m^2 to achieve at least BREEAM 'Very Good', and BREEAM excellent from 2016.

CPG3 Sustainability
This planning guidance document contains the following key messages:

- Section 2: All developments are to be designed to reduce carbon dioxide emissions in line with the energy hierarchy.
- Section 3: Computer modelling of developments over 500m^2 to be carried out to optimise daylight and solar gain.
- Section 5: Where feasible and viable developments will be required to connect to a decentralised energy network or include CHP.
- Section 6: Developments are to target 20% reduction in carbon dioxide emissions from on-site renewable technologies.
- Section 7: Developments should consider harvesting and recycling of water.
- Section 8: Developments should aim for at least 10% of the value of materials to come from recycled sources
- Section 9: Developments with 500 m^2 or more of non-residential floorspace will need to be assessed in line with BREEAM.
- Section 10: All developments are expected to incorporate green or brown roofs where possible and appropriate
- Section 11: Developments must not increase the risk of flooding, with all sites over 10 000m^2 requiring a flood risk assessment.
- Section 13: requires that any loss or damage to an ecosystem or biodiversity must be compensated for with other measures.

4.0 SUSTAINABILITY STRATEGY

In this section, the strategies adopted to address the regional and local sustainability planning policies that do not have a direct impact on the Energy Assessment will be described. Where a sustainability strategy has a direct impact on energy consumption, it will be detailed in the following sections as part of the Energy Assessment.

4.1 Water Efficiency

Currently, during dry weather, London's water consumption outstrips available supply. The city's water resources should be used as efficiently and sustainably as possible. The water strategy on site has been designed to minimise water consumption and achieve 105 litres/person/day these are in line with legislative requirements from the following documents:

- The London Plan 2011 – Minimising water use and maximising rainwater recycling where possible.
- The Code for Sustainable Homes (CfSH) Level 4 – Water usage of no greater than 105 litres/person/day

This requires all fittings to be of a "lower water use" than normal fittings.

Low water demand planting and well-designed irrigation systems will also reduce the amount of mains potable water used for external irrigation. This will be explored through detailed design.

Given their stand-alone nature, the limited roof and land area associated with them and the relatively low water use of the houses, they are not considered suitable for rainwater or greywater harvesting for internal use. However, opportunities will be explored to use rainwater for garden watering.

The use of leak detection measures, smart meters and pressure reduction valves will be amongst strategies for reducing potable demand that will be explored in the detailed design phase.

4.2 Light Pollution

External lighting to the new houses will be extremely limited in scope – perhaps only security lighting at the entrances, and some low-level lighting to the outside areas.

All external lighting will be design in accordance with the ILP Guidance for the reduction of Obtrusive Light. Fittings will be selected with an upward light ratio of zero and controlled either by a timeclock, presence detection or a combination of both.

4.3 Future Climate Adaptation

As will be described in Section 6, the approach to overheating control will be assessed against a number of weather years that could be representative of frequent warm-weather events in a future climate. However, occupant comfort, and specifically control of internal temperature is not the only measure required for successful adaptation to a warmer climate. Other measures that have been considered by the design team include:

- Ensuring that the glazing ratio of window to wall area is less than 50%.
- Consideration of how the building form can be arranged to provide solar shading.
- Avoidance of low-level glazing where possible. It increases heat gains and losses without improving daylighting
- Ensuring that spaces are capable of being naturally ventilated, with the ability to cross-ventilate the houses for high purge ventilation rates
- Consideration of the site-wide vegetation strategy that includes planting and shading from deciduous plants.
- Ensuring that vents can be left opened in a secure fashion to provide night-time cooling.
- Specify low-flow water fittings to reduce water stress
- Specify planting that can cope well with long periods of dry weather
- Irrigate the planting with rainwater.

Refer to the landscaping proposals for further details on the planting proposed, and the SUDs assessment for climate change adaptation measures associated with surface water drainage.

4.4 Monitoring Energy Use

Monitoring and sub-metering energy use has a number of benefits and can contribute to reducing energy use and carbon emissions in a number of ways. As well as helping to identify leaks or problems with the building's systems, it can also be used to identify the major areas of energy consumption, and thus help to target energy saving measures both through retro-fitting equipment and influencing occupant behaviour.

As such, all the new houses will be provided with smart utility meters, providing occupants with the ability to view their water, gas and electricity consumption, and how it has changed over time. In addition, where major loads or fixed equipment is present, the primary energy of these loads will be independently monitored.

4.5 Materials and Waste

Building and construction activities worldwide consume 3 billion tonnes of raw materials each year, equalling 40% of total global resources; on average 10% of virgin construction materials from building projects go straight to landfill. Reclaiming construction materials and reusing them in a manner that preserves the embodied energy and carbon already invested in the material is therefore environmentally the most advantageous.

For the Charrington Street Terrace Extension, the palette of materials has been chosen for longevity, robustness and low maintenance. The materials used in the design will have Green Guide ratings between A+ to D as required by code for sustainable homes and the sustainable construction SPG. In terms of the GLA checklist all the Mayor's preferred standards will be achieved if feasible. The aspiration to source 50% of construction materials by mass from a source 35 miles of site may not be feasible due to possible logistic constraints and local market pressures. However, there will be a requirement on the contractor to source local materials wherever possible.

Despite detailed early-stage consideration, the nature of the site makes it impractical to reuse buildings or materials that are found on the site.

Refer to the Architect's Design and Access statement for further details of the materials proposed.

4.6 Ecology and Urban Greening

Biodiversity

The development seeks to maximise opportunities for outdoor space-creating new high quality public realm, private spaces and communal gardens. An ecology survey has been undertaken on the site in its current state, and it is anticipated that the proposals will have a net positive effect on biodiversity on the site.

Robustness and maintainability reviews have been considered to ensure a quality landscape for future generations. Native plants will be selected that are suited to their intended location and planting method, and where possible rainwater will be used for garden watering to relieve pressures on water resources.

Full details are in the Ecology report accompanying this planning application.

Urban Greening

The outdoor space across the new houses has been maximised through the inclusion of terraces and balconies. These spaces will give opportunity for areas of planting, contributing to the overall 'urban greening' effect of the Central Somers Town masterplan.

4.7 Flooding

A site-wide flood risk assessment has been undertaken for the overall Central Somers Town redevelopment masterplan, covering the Charrington Street Terrace Housing site – refer to the Flood Risk Assessment accompanying this planning application for further details.

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5.0 ENERGY STRATEGY

5.1 Establishing CO2 Emissions from Regulated Loads

In order to carry out this assessment, we have used FSAP SAP 2012 calculation tool to calculate the regulated loads of the building for each stage of the energy hierarchy. Details of fabric and services properties at each stage of the Energy Hierarchy are described in this section. Their respective CO_2 emissions and % savings are presented in Table 1.2.

In an SAP assessment, most variables are defined by the National Calculation Methodology – such as occupancy patterns, internal gains and heating set points. This ensures that buildings do not receive an unfair advantage simply through being less used. The notional building's emission rate is known as the 'Target emission rate' (TER), and the modelled building's emission rate is known as the 'Building emission rate' (BER).

For this energy assessment we have modelled the proposals for the new houses at each stage of the London Plan's design hierarchy, and compared the predicted carbon emissions with the baseline TER, and the London Plan target of a 35% improvement upon this.

5.2 Establishing CO2 Emissions from Unregulated Loads

Unregulated loads for dwellings based on equipment plug loads and electric cooking have been estimated using BREDEM 2012 methodology.

6.0 DEMAND REDUCTION: BE LEAN

In the 'Be Lean' case we will examine the performance of the proposed housing with only the passive and active demand reduction measures in place. The development was designed to limit its contribution to the heat island effect, as set out in Policy 5.9 for overheating and cooling hierarchy:

The passive and active measures adopted at this stage of the hierarchy are described in more detail as follows:

6.1 Building orientation

Given the situation of the new houses – that is, the extension of an existing housing terrace – opportunities to manipulate the orientation and form for passive benefits were limited. However, careful location of windows, terraces and screens were devised to balance the need for good daylighting, with the safeguarding requirements of the school and the limitation of summertime solar gains.

6.2 Building envelope and fabric performance

Air Infiltration
With modern well insulated buildings significant amounts of heat loss is typically caused by unwanted air infiltration through the fabric, and in particular through the points where different building elements meet. This requires good attention to detailing through design and monitoring of the construction process and workmanship on site.

The current Building Regulations (Approved Document L1A 2013) requires that the air permeability of the building fabric does not exceed 10 $m^3/h/m^2$ at an applied pressure difference of 50Pa. However, this is not a particularly onerous target, and in a building with a high-thermal performance envelope infiltration would become a major cause of heat loss at this level. As such an airtightness of 3 $m^3/h/m^2$ is being targeted.

Air tightness design target
3 $m^3/h/m^2$ at 50 Pa test pressure

Thermal Insulation
The thermal performance of the fabric has been proposed to optimise the balance between energy savings and other considerations such as cost, wall thicknesses and the diminishing returns available from further increasing the thermal performance of a building envelope. As seen in Table 6.1 below, a significant improvement both on the Criterion 2 limiting values and those used for the SAP notional building are proposed.

Thermal Bridging
Again, as building envelope thermal performance improves, so the heat loss due to thermal bridging begins to become a dominant factor.

As such, the houses will be designed using the standard robust details for minimising thermal bridging, or equivalent details appropriate to the situation.

Table 6.1 – Proposed fabric properties

	Limiting W/m^2K	Notional W/m^2K	Proposed W/m^2K
Ex wall	0.35	0.18	0.15
Floor	0.25	0.13	0.13
Roof	0.25	0.13	0.13
Door (<30% glazed)	2.2	1.00	1.80
Windows	2.2	1.40	1.40
Rooflights	2.2	1.40	1.40

6.3 Natural Ventilation and Overheating

This element of the houses design has been based around the 'cooling hierarchy' as defined in the London plan and described in section 3 of this report.

As such, while the background ventilation will be provided by mechanical means, the sole mechanism for summertime cooling will be natural ventilation.

Minimise internal heat generation through energy efficient design
The lighting design for the flats is based around high efficiency light sources – primarily LED – thus reducing the power required, and consequently the heat gains associated with the lighting.

Reduce the amount of heat entering a building in summer
Careful location of the windows, within the limitations of the site, has helped to reduce the potential for high levels of solar gain. Alongside this, where windows are required to provide even daylight levels, they have been set in deep reveals or beneath terraces and balconies to assist with summertime solar shading.

On top of this the glazing specification has been made to balance between limiting solar gains and allowing passive winter heating.

Passive ventilation
A comprehensive passive ventilation strategy has been developed for the houses, with large opening windows spread throughout the house and on different levels to enable cross ventilation and stack-driven high ventilation rates.

Overheating Assessment
The overheating risk, assessed as part of the SAP calculations, was found to be 'not significant' for all three of the properties, however, in order to further assess the overheating risk, and in line with GLA requirements, an overheating assessment based on CIBSE TM49 has been undertaken.

As all three terraced houses have similar floor plates and ventilation strategies, so only the worst case house has been assessed – the southernmost house which has an additional south facing façade.

This house was modelled using IES dynamic thermal simulation software, and assessed against the three weather years as specified in TM49: 1976, 1989 and 2003. The results are presented in the table below.

	1976			1989			2003		
	1	2	3	1	2	3	1	2	3
Kitchen	✓	✗	✓	✓	✗	✓	✓	✗	✗
Living	✓	✗	✓	✓	✗	✓	✓	✗	✗

Table 6.2: TM49 overheating assessment results

As can be seen, while the occupied rooms perform well, meeting the criteria for the 1976 and 1989 weather years, but both rooms fail to meet these criteria during the 2003 weather year.

Looking more closely at this weather year, as can be seen from figure 6.1 below, when processed through the TM52 calculation procedure a maximum upper limit temperature more than 3K below the peak external temperature is arrived at on the hottest day of the year. This means that in order to meet the criteria for the 2003 weather year, internal temperatures more than 3K lower than outdoor temperatures would need to be maintained for a significant part of the day.

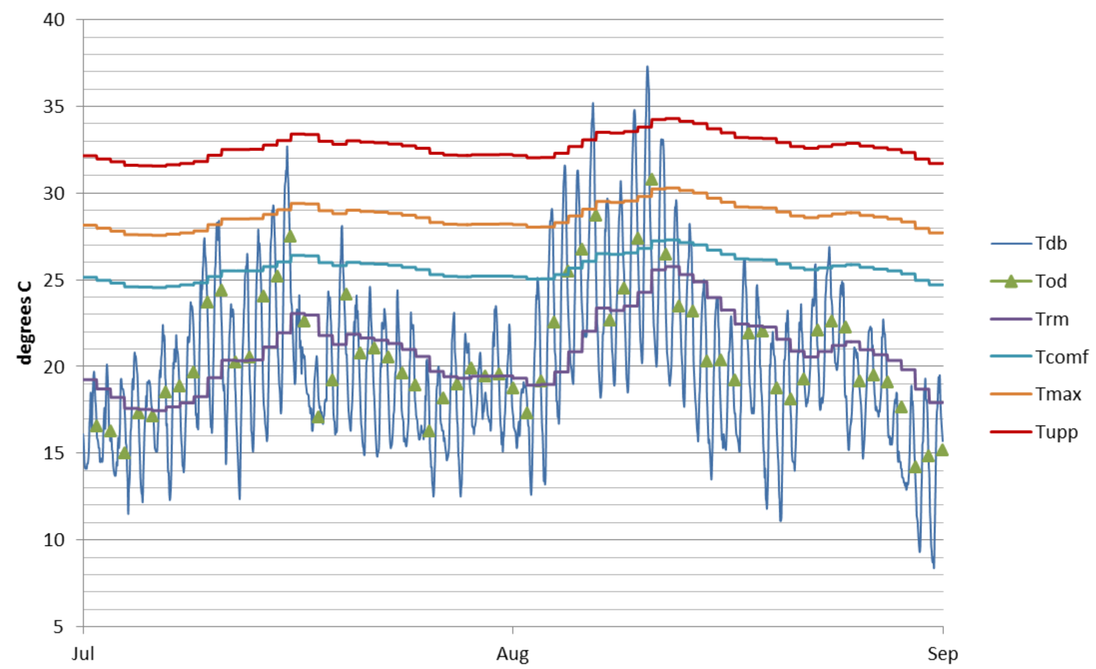

Figure 6.1: TM49 Overheating criteria for the 2003 weather year

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Figure 6.2 below shows the temperature profile and ventilation rates achieved in the living room during August 10th, the hottest day of the 2003 weather file. The external temperature is shown in Blue, the internal temperature in red and the natural ventilation rate in green.

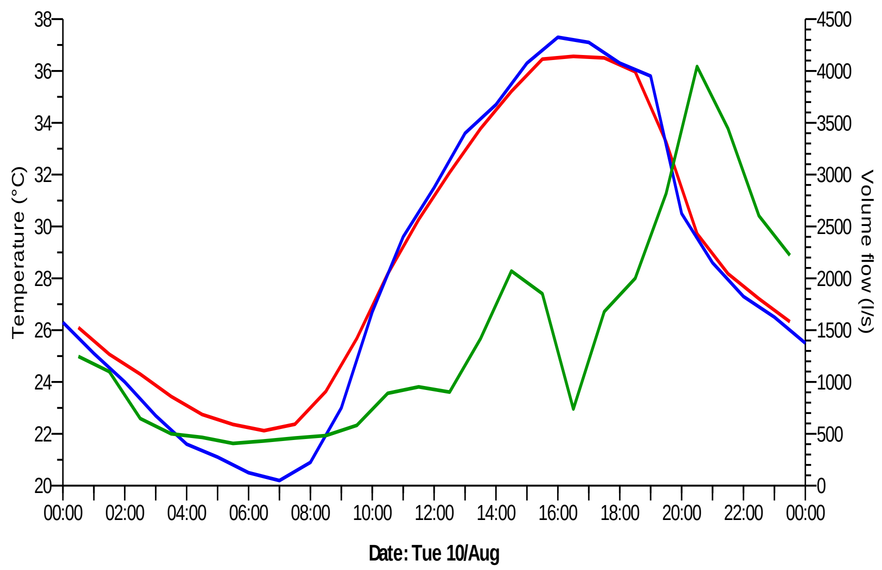


Figure 6.2: Peak Day internal and external temperature profile, with ventilation rate shown.

As can be seen, throughout most of the day the internal temperature remains below external, and extremely high ventilation rates are achieved. It is felt that while according to the criteria of TM49 and TM52, this space overheats, in reality, it is felt that adequate and appropriate measures have been put in place to minimise the potential discomfort due to overheating. In a naturally ventilated building it would be difficult to achieve much better performance without negatively compromising the design in other ways.

It should be noted that the perceived temperature of the space will be much improved due to the high air volumes, and consequent air speeds, experienced in the space. In addition, the transition from a warmer outside to a cooler inside will improve perceived comfort during these particularly hot days.

6.4 Daylighting

Orientation of the glazing and provision of shading devices where appropriate is key to an effective daylighting strategy. For example, north facing glazing can be extremely useful for providing daylight as there is no direct sunlight incident on this orientation, and thus shading is only required when necessary to reduce internal light levels. On the other hand, west-facing glazing needs to be carefully selected to ensure the thermal performance is adequate, and consideration given to the shading provisions as this is critical to limiting solar gains in the afternoon – the time of highest air temperatures – as well as providing glare control.

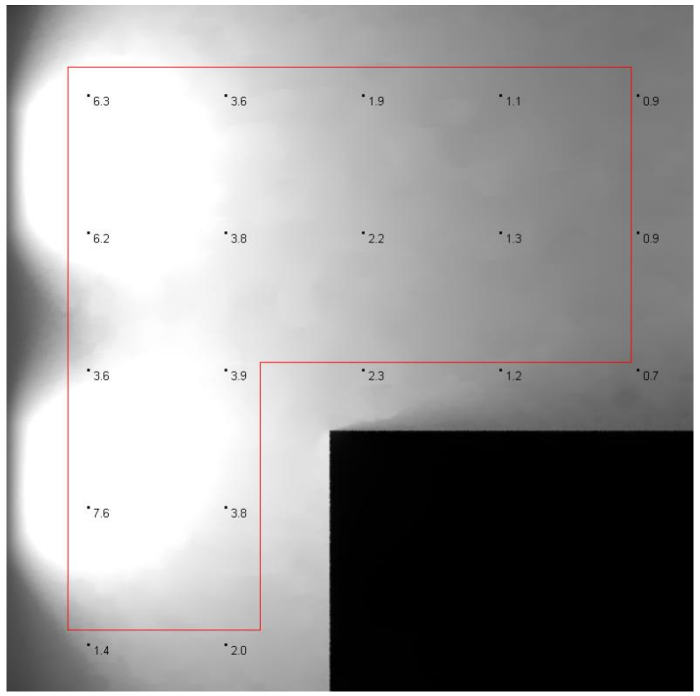
The distribution of openings is also key to establishing a good even spread of daylight throughout a room, and as such where possible dual aspect rooms have been design, and where this isn't possible, the use of rooflights and light borrowed from adjacent spaces have helped to create good daylight levels throughout the houses.

Daylight Assessment
Radiance in IES software has been used to assess the daylight levels in the worst performing house – that to the north of the terrace extension.

At this stage, standard reflectance values have been assumed as a worst case – though it is likely that these will be improved upon with the final décor.

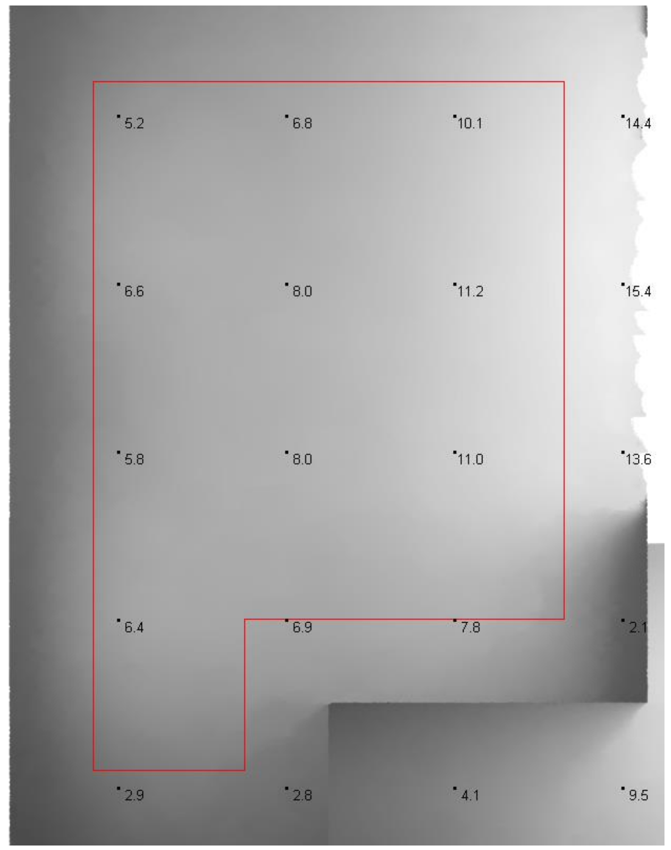
The results are demonstrated in the images below.

First Floor Kitchen Dining Room



Average DF: 3.15	**Uniformity:** 0.24

Second Floor Living Room



Average DF: 8.39	**Uniformity:** 0.34

As can be seen, both rooms assessed show excellent light levels. The kitchen dining room, by necessity a single-aspect room that must be closed to adjacent spaces, still achieves a daylight factor greater than 3% - suggesting that electric lights will not be required for the vast majority of daylight hours. The uniformity in this room is also excellent for a single-aspect space. The living room performs even better – which is unsurprising owing to its large glazed doors out to the terrace in addition to the front windows. The uniformity here is also correspondingly excellent – and it is unlikely that electric lighting would be necessary at all during daylight hours in this space.

These results have a double advantage – both reducing the energy consumption associated with electric lighting, but also reducing the heat gain from the lights and therefore the overheating risk.

6.5 Active measures

Following the passive measures described above, the next most effective energy- and carbon-saving measures come from the selection and specification of the active systems in the houses.

Mechanical ventilation with heat recovery
As described, in high-performance modern buildings, unwanted air infiltration is a major cause of heat loss. An even greater burden on the heating system is the fresh air that must be brought in to maintain good air quality.

As such, a mechanical ventilation with heat recovery system has been proposed for each house. In this system, the heat from the warm air extracted from the building is transferred to the cold fresh air brought in – thus reducing heating energy consumption, and corresponding fuel bills and carbon emissions.

Only the low volumes required for background ventilation will be supplied by this system, with high volume air for temperature control supplied by natural means as described. This helps to minimise the fan energy associated with the system.

To avoid the recovery of unwanted heat during summer, and the corresponding contribution to the overheating risk, the systems will be designed with an automatic summer bypass.

Energy efficient lighting
Low energy electric lighting, primarily LED source, will be provided for those hours where daylight is inadequate. Fittings with a high light output ratio (LOR) will be used to further maximise efficiency.

Luminaires will be circuited and switched so as to maximise flexibility and minimise the unnecessary use of lights.

Again, as well as reducing the energy directly consumed by the electric lighting, this approach also reduces the heat gains associated with the lighting and therefore the risk of overheating.

Controls
Local and zonal controls will be provided to optimise the heat output of the emitters. Various control modes for all active equipment will be provided so that systems can be switched to a setting appropriate to the occupancy (or lack of) and so avoid excess energy consumption.

6.6 Carbon Summary – Be Lean

The results for the 'Be Lean' strategy are shown in Figure 6.5 and Table 6.1 and Table 6.2. The figures demonstrate compliance with the Building Regulations part L1A 2013 simply from the passive and active sustainability measures proposed. This puts the development in an excellent position to achieve compliance with the London Plan at the second and third stages of the energy hierarchy.

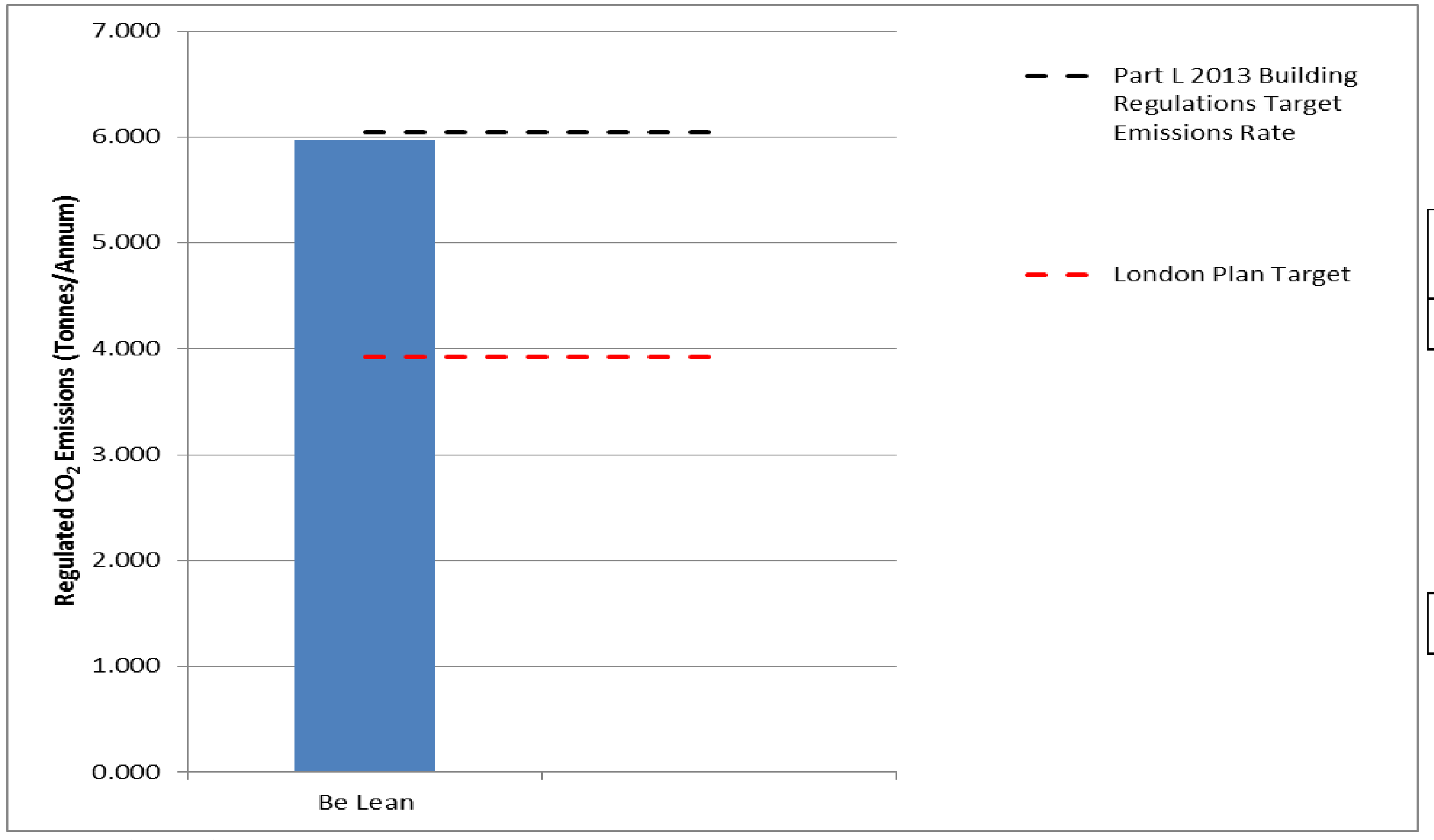


Figure 6.5 – 'Be Lean' Carbon emissions

Table 6.1 – 'Be Lean' Carbon emissions

	Carbon dioxide emissions (Tonnes CO2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	6.046	5.344
After energy demand reduction	5.974	5.344

Table 6.2 – 'Be Lean' Carbon Reductions

	Regulated Carbon dioxide savings	
	(Tonnes CO2 per annum)	(%)
Savings from energy demand reduction	0.07	1.2%

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7.0 EFFICIENT ENERGY SUPPLY: BE CLEAN

As part of the second stage of the energy hierarchy, Policy 5.6 of the London Plan states that 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#

However, given the scale of the proposed Charrington Street Terrace extension – amounting to three individual terraced houses – many considerations of this hierarchy, intended for 'major developments', do not apply.

For example it would be neither physically practical, economically feasible or technically desirable to provide site-wide CHP or a communal heating network to these three houses alone, As such, the following section will discuss the issues relating to connection to an existing district heating network.

7.1 District Heating

A nearby district heating system exists, and extensions to it are underway to connect many of the existing residential blocks in Somers Town, and also a number of the proposed developments that form the Central Somers Town Masterplan.

The three proposed houses however lie some distance away from the nearest proposed main pipe run. This has two main disadvantages for what is a relatively small scale development:

- The cost of providing 3 separate new supplies, including trenching, pipework, heat interface units and infrastructure, would be extremely high relative to the construction cost.
- The additional heat losses resulting from the new district pipework branches would be disproportionate to the heat consumption by the highly thermally efficient new houses.

Again, due to the small scale of the development, it would be uneconomic and technically undesirable to provide a new communal heat network between them – and the low level of heat consumption would make a CHP network unfeasible.

As such, it is proposed that at this stage of the energy hierarchy, heat be provided by an individual natural gas fired combi boiler, and as such the carbon emissions results are the same as for the previous, be lean, stage.

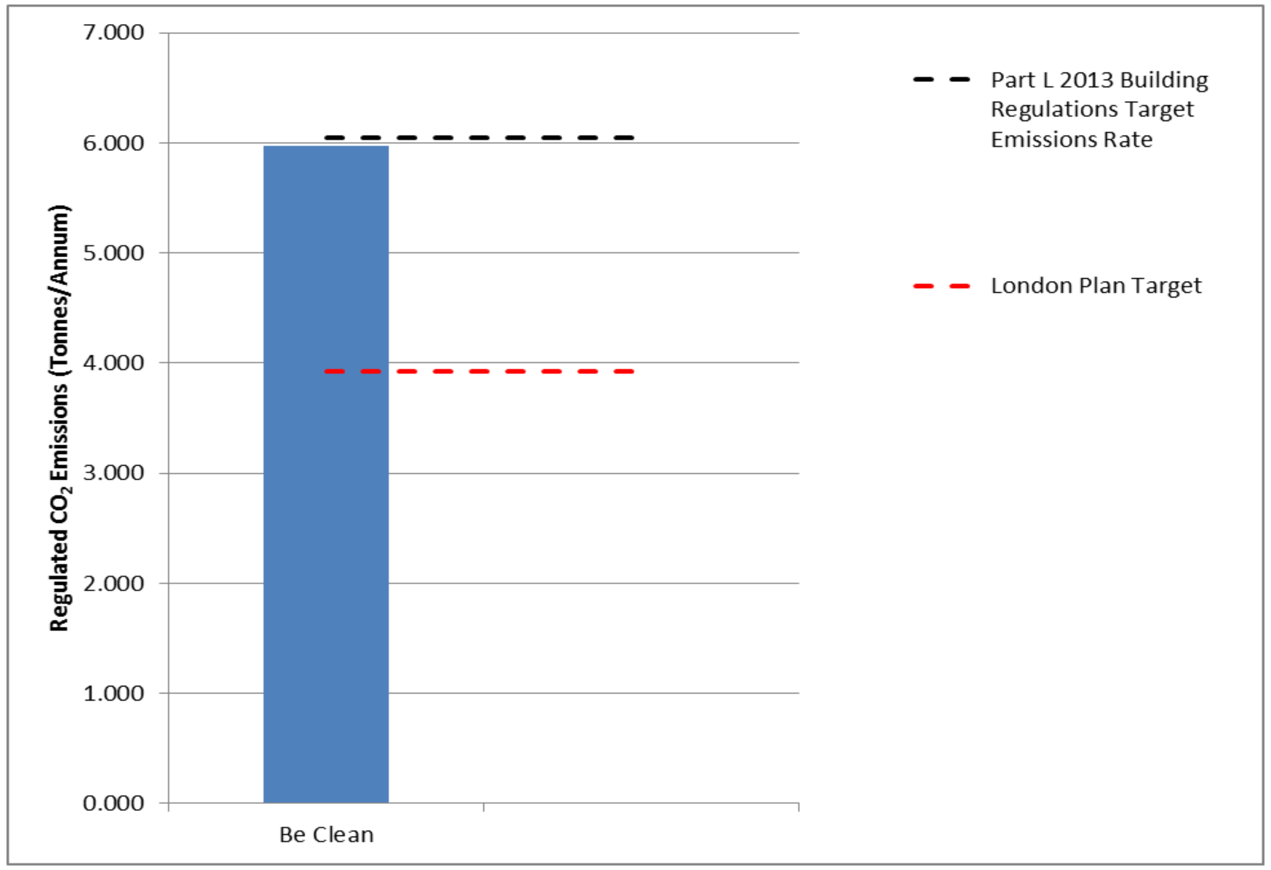

Figure 7.1 – 'Be Clean' Carbon Emissions

Table 7.1 – 'Be Clean' Carbon Emissions

	Carbon dioxide emissions (Tonnes CO2 per annum)	
	Regulated	**Unregulated**
Baseline: Part L 2013 of the Building Regulations Compliant Development	6.046	5.344
After CHP	5.974	5.344

Table 7.2 – 'Be Clean' Carbon Reductions

	Regulated Carbon dioxide savings	
	(Tonnes CO2 per annum)	**(%)**
Savings from CHP	0.00	0.0%

8.0 RENEWABLE ENERGY: BE GREEN

Within the framework of the energy hierarchy, proposals should provide a reduction in expected CO_2 emissions through the use of on-site renewable energy generation. For major developments it is expected that a 20% reduction in carbon emissions be achieved through the use of on-site renewable technology.

A study was undertaken to investigate which renewable technologies were best suited to the development. This assessment concluded that the most appropriate and effective way to deliver the renewable energy target on this development would be through the addition of solar photovoltaic panels.

8.1 Renewable Technologies Discounted

Solar Thermal
While solar thermal panels can provide a useful contribution to the energy demands of a house, it was decided not to pursue them in this case for a number of reasons. If the heat demand on a solar thermal system is not closely matched to the system output, there is a risk of the panels overheating and requiring replacement of the heat transfer fluid – this can become an issue if the final occupancy of a house is uncertain, or indeed may necessitate the covering of panels during holidays. In addition, because the solar power would be displacing gas, a much lower carbon intensity fuel than electricity, it was found that the overall carbon benefit on the small roof area available was greater with solar photovoltaics.

Heat Pumps
Again, in many situations heat pumps can be a viable technology for independent houses, however primarily practical factors limited their suitability for this project. With limited garden or outside area associated with each house, ground source heat pumps were immediately dismissed as there was not the physical space for the ground loop. Air source heat pumps were more promising, however again, with all external area located close to opening windows or terraces it was felt there was no suitable place where this technology would not cause an acoustic nuisance to the occupants. In addition, because they were replacing a gas boiler and they run on the much more carbon intensive fuel electricity, the carbon savings provided were not adequate to meet the London Plan requirements.

Wind
While small-scale wind turbines suitable for this size of development are available, it would not be a practical solution for this particular proposal. Wind turbines are noisy in operation, and it has been found that city-centre turbines generate far less electricity than anticipated due to the turbulent and inconsistent wind experienced in a densely built up environment.

Biomass
Again, biomass is a well understood and tested technology for this type of building; however logistical concerns make its installation difficult to recommend in this case. Regular fuel deliveries are required – a potentially significant expense and inconvenience in London's city centre – and then of course an area for fuel storage would be needed – occupying valuable floor or land area. In addition there would also be concerns over its contribution to air quality issues in an area where this is already of potential concern.

Other technologies considered that were more straightforward to dismiss included:

- Water source heat pumps: no nearby and suitable water source make this impossible.
- CHP: as a stand-alone system the heat demand would not be adequate to achieve any carbon benefit from the installation of a CHP engine.
- Tidal Power: again, the distance from a tidal flow makes this impossible.
- Biodigestion: the quantity of organic waste generated is nowhere near adequate to sustain this technology.

8.2 Solar Photovoltaic (PV) Panels

PVs convert energy from sunlight directly into electricity. The main advantage, particularly over solar thermal, is that the generated electricity can be used for a wider range of applications than hot water and can also be exported to the National Grid. Furthermore, electricity can be considered a more valuable energy source than heat in terms of CO2 emissions. For these reasons, PVs can be easily integrated into most schemes.

Current 'feed-in-tariff' rates and decreasing costs of PV cells for on-site electrical generation mean that PV installations are currently a relatively economic renewable energy technology.

Each house has $20m^2$ of roof area available where PV panels could be mounted. This would allow approximately $15m^2$ of panels, while still allowing access for cleaning and maintenance, and for any ancillary equipment required. To ensure these panels are not visible from the road, and to avoid any significant effects of self-shading, they would need to be mounted at a low inclination – at which point the orientation of the panels becomes less critical.

$15m^2$ of a typical-efficiency panel amounts to an approximate peak output of $2kW_p$. As such, a $2kW_p$ array is proposed for each house, and as can be seen from the graph and table below this brings the overall carbon emissions for the development below the London Plan Target. In fact a 5% surplus is recorded after this measure. This also equates to a 39% reduction in carbon emissions through on site renewables – far in excess of the 20% called for by the London Plan. These results are shown overleaf in Figure 8.1, and Tables 8.1 and 8.2

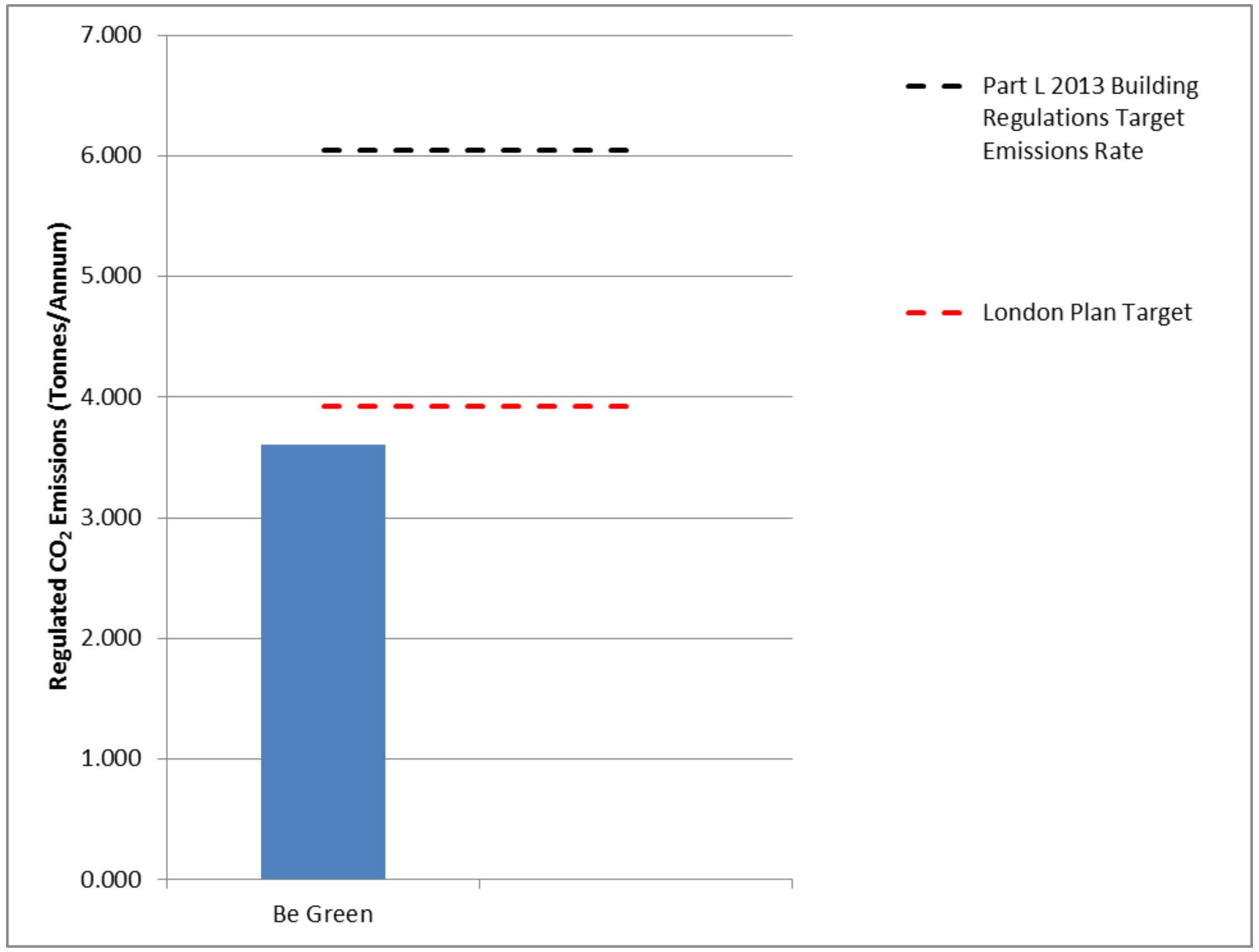

Figure 8.1 – 'Be Green' Carbon Emissions

Table 8.1 – 'Be Green' Carbon Emissions

	Carbon dioxide emissions (Tonnes CO2 per annum)	
	Regulated	**Unregulated**
Baseline: Part L 2013 of the Building Regulations Compliant Development	6.046	5.344
After renewable energy	3.605	5.344

Table 8.2 – 'Be Green' Carbon Reductions

	Regulated Carbon dioxide savings	
	(Tonnes CO2 per annum)	**(%)**
Savings from renewable energy	2.37	39.2%

9.0 APPENDIX I: SAP COMPLIANCE SHEETS

9.1 Be Lean

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.1.25
Printed on 30 October 2015 at 19:10:07

Project Information:

Assessed By: () **Building Type:** Mid-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 124.5m²

Site Reference : Charrington Street Terrace **Plot Reference:** House 1

Address : Charrington Street, Central Somers Town, Camden, London, NW1

Client Details:

Name:

Address :

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

1a TER and DER

Fuel for main heating system: Mains gas
Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)	15.62 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.57 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.4 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	50.1 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.43 (max. 2.00)	1.80 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Boiler systems with radiators or underfloor heating - mains gas
Data from manufacturer
Combi boiler
Efficiency 89.5 % SEDBUK2009
Minimum 88.0 % **OK**

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: No cylinder

N/A

Regulations Compliance Report

6 Controls

Space heating controls	TTZC by plumbing and electrical services		OK
Hot water controls:	No cylinder		
Boiler interlock:	Yes		OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.63	
Maximum	1.5	OK
MVHR efficiency:	90%	
Minimum	70%	OK

9 Summertime temperature

Overheating risk (Thames valley):	Not significant	OK

Based on:

Overshading:	More than average
Windows facing: West	2.1m²
Windows facing: West	2.2m²
Windows facing: East	9.3m²
Windows facing: West	4.6m²
Windows facing: South East	5.1m²
Windows facing: West	3.1m²
Windows facing: East	7.4m²
Windows facing: North	2m²
Roof windows facing: Horizontal	3.6m²
Roof windows facing: Horizontal	2.9m²
Ventilation rate:	8.00
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 100% of daylight hours

10 Key features

Air permeablility	3.0 m³/m²h
Party Walls U-value	0 W/m²K

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.1.25
Printed on 30 October 2015 at 19:10:03

Project Information:

Assessed By: ()

Building Type: Mid-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 124.5m²

Site Reference : Charrington Street Terrace

Plot Reference: House 2

Address : Charrinton Street, Central Somers Town, Camden, London, NW1

Client Details:

Name:

Address :

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

1a TER and DER

Fuel for main heating system: Mains gas
Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)	15.54 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.48 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	50.0 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.43 (max. 2.00)	1.80 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Boiler systems with radiators or underfloor heating - mains gas Data from manufacturer Combi boiler Efficiency 89.5 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

5 Cylinder insulation

Hot water Storage:	No cylinder	
		N/A

Regulations Compliance Report

6 Controls

Space heating controls	TTZC by plumbing and electrical services	**OK**
Hot water controls:	No cylinder	
Boiler interlock:	Yes	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.63	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (Thames valley):	Not significant	**OK**

Based on:

Overshading:	More than average
Windows facing: West	2.1m^2
Windows facing: West	2.2m^2
Windows facing: East	9.3m^2
Windows facing: West	4.6m^2
Windows facing: South East	5.1m^2
Windows facing: West	3.1m^2
Windows facing: East	7.4m^2
Windows facing: North	2m^2
Roof windows facing: Horizontal	3.6m^2
Roof windows facing: Horizontal	4.1m^2
Ventilation rate:	8.00
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 100% of daylight hours

10 Key features

Air permeablility	3.0 m^3/m^2h
Party Walls U-value	0 W/m^2K

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.1.25
Printed on 30 October 2015 at 19:10:00

Project Information:

Assessed By: ()

Building Type: End-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 135.3m²

Site Reference : Charrington Street Terrace

Plot Reference: House 3

Address : Charrinton Street, Central Somers Town, Camden, London, NW1

Client Details:

Name:

Address :

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

1a TER and DER

Fuel for main heating system: Mains gas
Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)	16.01 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.58 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	54.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	52.1 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.43 (max. 2.00)	1.80 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Boiler systems with radiators or underfloor heating - mains gas
Data from manufacturer
Combi boiler
Efficiency 89.5 % SEDBUK2009
Minimum 88.0 % OK

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: No cylinder

N/A

Regulations Compliance Report

6 Controls

Space heating controls	TTZC by plumbing and electrical services	**OK**
Hot water controls:	No cylinder	
Boiler interlock:	Yes	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.63	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (Thames valley):	Not significant	**OK**

Based on:

Overshading:	More than average
Windows facing: West	2.1m²
Windows facing: West	2.2m²
Windows facing: East	9.3m²
Windows facing: West	4.6m²
Windows facing: South East	7.6m²
Windows facing: West	3.1m²
Windows facing: East	7.4m²
Windows facing: North	2m²
Windows facing: South West	2m²
Roof windows facing: Horizontal	3.6m²
Roof windows facing: Horizontal	3.8m²
Ventilation rate:	8.00
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 100% of daylight hours

10 Key features

Air permeablility	3.0 m³/m²h
Party Walls U-value	0 W/m²K

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9.2 Be Green

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.1.25
Printed on 30 October 2015 at 19:12:29

Project Information:

Assessed By: () **Building Type:** Mid-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 124.5m²

Site Reference : Charrington Street Housing **Plot Reference:** House 1

Address : Charrington Street, Central Somers Town, Camden, London, NW1

Client Details:

Name:

Address :

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

1a TER and DER

Fuel for main heating system: Mains gas
Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)	15.62 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	9.23 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.4 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	50.1 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.43 (max. 2.00)	1.80 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Boiler systems with radiators or underfloor heating - mains gas
Data from manufacturer
Combi boiler
Efficiency 89.5 % SEDBUK2009
Minimum 88.0 % **OK**

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: No cylinder

N/A

Regulations Compliance Report

6 Controls

Space heating controls	TTZC by plumbing and electrical services	OK
Hot water controls:	No cylinder	
Boiler interlock:	Yes	OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.63	
Maximum	1.5	OK
MVHR efficiency:	90%	
Minimum	70%	OK

9 Summertime temperature

Overheating risk (Thames valley):	Not significant	OK

Based on:

Overshading:	More than average
Windows facing: West	2.1m²
Windows facing: West	2.2m²
Windows facing: East	9.3m²
Windows facing: West	4.6m²
Windows facing: South East	5.1m²
Windows facing: West	3.1m²
Windows facing: East	7.4m²
Windows facing: North	2m²
Roof windows facing: Horizontal	3.6m²
Roof windows facing: Horizontal	2.9m²
Ventilation rate:	8.00
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 100% of daylight hours

10 Key features

Air permeablility	3.0 m³/m²h
Party Walls U-value	0 W/m²K
Photovoltaic array	

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.1.25
Printed on 30 October 2015 at 19:12:26

Project Information:

Assessed By: () **Building Type:** Mid-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 124.5m²

Site Reference : Charrington Street Housing **Plot Reference:** House 2

Address : Charrington Street, Central Somers Town, Camden, London, NW1

Client Details:

Name:

Address :

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

1a TER and DER

Fuel for main heating system: Mains gas
Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)	15.54 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	9.14 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	50.0 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.43 (max. 2.00)	1.80 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Boiler systems with radiators or underfloor heating - mains gas
Data from manufacturer
Combi boiler
Efficiency 89.5 % SEDBUK2009
Minimum 88.0 % **OK**

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: No cylinder

N/A

Regulations Compliance Report

6 Controls

Space heating controls	TTZC by plumbing and electrical services		OK
Hot water controls:	No cylinder		
Boiler interlock:	Yes		OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.63	
Maximum	1.5	OK
MVHR efficiency:	90%	
Minimum	70%	OK

9 Summertime temperature

Overheating risk (Thames valley):	Not significant	OK

Based on:

Overshading:	More than average
Windows facing: West	2.1m²
Windows facing: West	2.2m²
Windows facing: East	9.3m²
Windows facing: West	4.6m²
Windows facing: South East	5.1m²
Windows facing: West	3.1m²
Windows facing: East	7.4m²
Windows facing: North	2m²
Roof windows facing: Horizontal	3.6m²
Roof windows facing: Horizontal	4.1m²
Ventilation rate:	8.00
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 100% of daylight hours

10 Key features

Air permeablility	3.0 m³/m²h
Party Walls U-value	0 W/m²K
Photovoltaic array	

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.1.25
Printed on 30 October 2015 at 19:12:23

Project Information:

Assessed By: ()

Building Type: End-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 135.3m²

Site Reference : Charrington Street Housing

Plot Reference: House 3

Address : Charrington Street, Central Somers Town, Camden, London, NW1

Client Details:

Name:

Address :

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

1a TER and DER

Fuel for main heating system: Mains gas
Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)	16.01 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	9.74 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	54.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	52.1 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.43 (max. 2.00)	1.80 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Boiler systems with radiators or underfloor heating - mains gas
Data from manufacturer
Combi boiler
Efficiency 89.5 % SEDBUK2009
Minimum 88.0 % **OK**

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: No cylinder

N/A

Regulations Compliance Report

6 Controls

Space heating controls	TTZC by plumbing and electrical services	**OK**
Hot water controls:	No cylinder	
Boiler interlock:	Yes	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.63	
Maximum	1.5	**OK**
MVHR efficiency:	90%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (Thames valley):	Not significant	**OK**

Based on:

Overshading:	More than average
Windows facing: West	2.1m²
Windows facing: West	2.2m²
Windows facing: East	9.3m²
Windows facing: West	4.6m²
Windows facing: South East	7.6m²
Windows facing: West	3.1m²
Windows facing: East	7.4m²
Windows facing: North	2m²
Windows facing: South West	2m²
Roof windows facing: Horizontal	3.6m²
Roof windows facing: Horizontal	3.8m²
Ventilation rate:	8.00
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 100% of daylight hours

10 Key features

Air permeablility	3.0 m³/m²h
Party Walls U-value	0 W/m²K
Photovoltaic array	