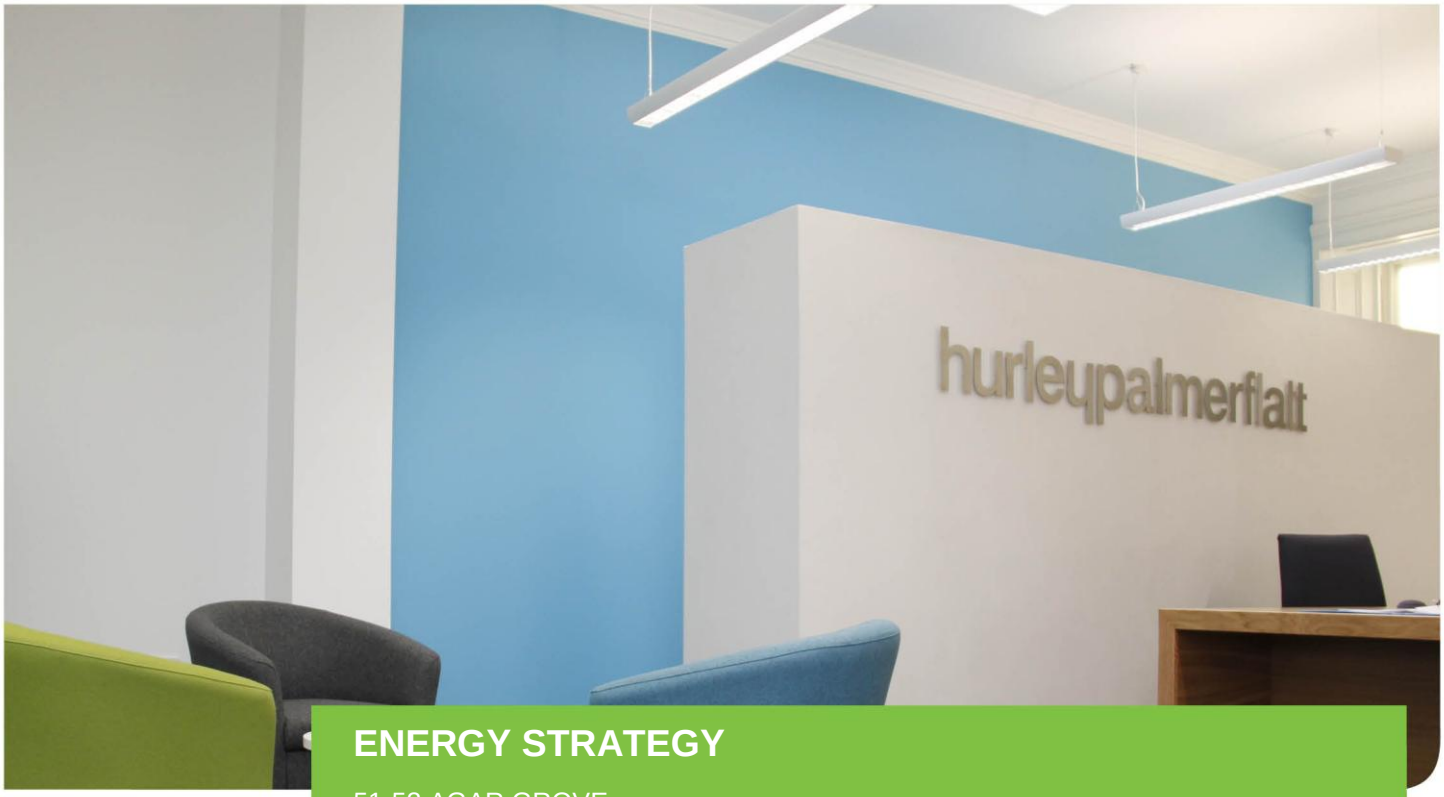

ENERGY STRATEGY

51-53 AGAR GROVE
LONDON

Date	June 2014	**Reference**	WED07348
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APPENDICES

1.0 EXECUTIVE SUMMARY

This energy statement has been developed to detail the energy strategy for the proposed redevelopment of the 51-53 Agar Grove site, located within the London Borough of Camden. This statement relates to the final proposals, and is submitted as part of a full planning application for the development.

This energy strategy document follows the Mayor's energy hierarchy approach to energy statements as detailed in the London Plan Policy 5.2 *'Minimising Carbon Dioxide Emissions'* (July 2011) and Camden Planning Guidance (CPG3).

Energy and climate change planning policy within the Camden Council currently follows the London Plan with the requirement for development to meet carbon reduction targets that are one step ahead of building regulations (e.g. 40% reduction in CO_2 emissions over a Part L1A 2010 baseline for new development during the period 2013-2016).

The London Plan also requires the development to follow the energy hierarchy when considering reducing CO_2 emissions. The energy hierarchy must consider incorporation of energy efficiency measures including passive design, supplying energy efficiently (with particular emphasis on decentralised energy generation including CHP) and using renewable energy technologies. The following summarises the key technical solutions that are proposed for the development:

Energy Efficiency Measures (Be Lean):

- Passive design principles adopted in building massing and orientation
- Thermal performance of building fabric maximised
- Air permeability improved on Part L notional values
- Space heating and domestic hot water (DHW) delivered through highly efficient communal heat pumps
- Ventilation to the dwellings is provided via highly efficient balanced whole house mechanical ventilation with heat recovery
- All dwellings to be fitted with low energy light fittings.

Decentralised Energy including CHP (Be Clean)

- Availability of exiting district heating networks (DHN) has been reviewed and it has been established that there is not an existing or proposed DHN in close proximity to the site and therefore connection will not be possible in the near future or economically viable.
- Provision of an on-site centeralised CHP engine is not practical at the application site due to the size of the development, anticipated building base loads and running hours being below the minimum viable for this type of system.

Renewable Energy (Be Green)

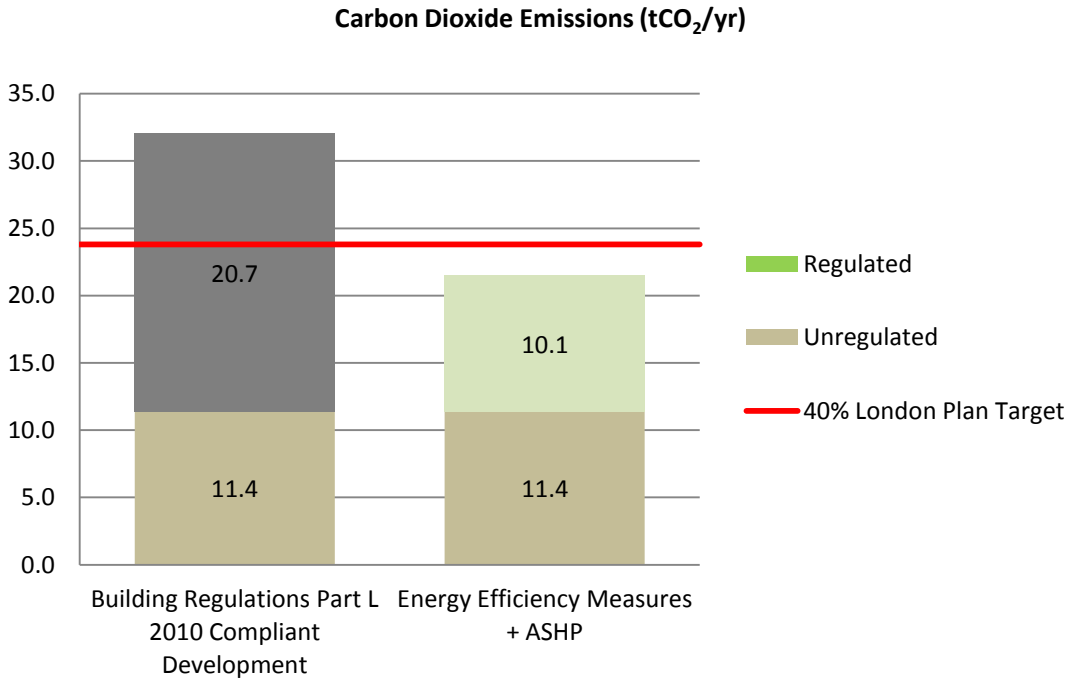
- Space heating and DHW to the dwellings will be provided via the high efficiency communal Air Source Heat Pumps which is recognised as a source of renewable energy in the London Plan Policy 5.7.

The total CO_2 savings calculated to be achieved by the energy strategy are **10.6 tonnes** when compared against the base-line scenario. The savings equate to a **51.1% reduction** in regulated CO_2 emissions over the baseline Part L compliant scheme (exceeding the Code for Sustainable Homes Level 4 mandatory requirement of 25%), and a **32.9% reduction** including unregulated CO_2 emissions. The following table shows the breakdown in savings for each stage of the energy hierarchy.

Table 1: Summary of total carbon dioxide emissions for each stage of the hierarchy

	Carbon Dioxide Emissions (tCO_2/yr)		
	Regulated	Unregulated	Total
Building Regulations Part L 2010 Compliant Development	**20.7**	**11.4**	**32.1**
After energy demand reduction and ASHP	**10.1**	**11.4**	**22.5**

Figure 1: Summary of total carbon dioxide emissions for each stage of the hierarchy



2.0 INTRODUCTION

This document presents the Energy Assessment and Strategy for the proposed redevelopment of the 51-53 Agar Grove site, located within the London Borough of Camden. It details the assessment process and the estimated CO_2 savings achieved through integration of passive design, energy efficiency measures and Low and Zero Carbon (LZC) technologies and sets out how the London Plan and local policies on energy and CO_2 emissions have been addressed.

The approach taken for the energy assessment is in line with London Plan and London Borough of Camden planning policy for energy:

- Calculate baseline CO_2 emissions
- Integrate measures to reduce energy demand and ensure efficient use of energy
- Integrate CHP/CCHP (where appropriate)
- Integrate renewable energy technology
- Calculate total CO_2 savings and final development CO_2 emissions

2.1 Project Background

51-53 Agar Grove is situated at the corner of St. Paul's Crescent, in the Camden Square Conservation Area close to the shopping/travelling facilities of Camden Town and in close proximity to King's Cross and the Eurostar Link at St. Pancras where one of Europe's biggest regeneration and development projects has benefitted the area. Figure 2 below indicates the location of the proposed site.

The proposal is to demolish the existing structure and to provide 7 new apartments and a detached mews house with the total internal floor area of 747m^2. This is in comparison to what was the pre-existing floor area of 368m^2.

Figure 2: Development site

3.0 PLANNING POLICY AND BUILDING REGULATION TARGETS

The development has been designed to meet sustainability and energy targets which are driven through:

- Building Regulations (Part L1A 2010)
- London Borough of Camden planning policy
- GLA planning policy

3.1 Building Regulation Part L Summary

The scheme has been conceptually designed in accordance with the guidance of Part L1A:2010. Unfortunately a Transitional Requirement was not secured by April 2014 resulting in the scheme now being required to build-out to Part L1A:2013.

The original planning application documents and submission occurred around the time of the Transitional Requirements being put in place and associated deadline in April 2014. As a result this energy strategy has been compiled to support the original planning 'Design and Access Statement' section 7.2.

Although the development will need to be designed to comply with Part L1A 2013 of Building Regulations (Conservation of fuel and power in dwellings), the improvement of 40% over Part L required for by the GLA and London Borough of Camden will be assessed against L1A 2010, meeting the transitional conditions of GLA for planning applications submitted before 6th July 2014.

The building must be assessed against five criteria including Criterion 1 (Achieving the TER and TFEE) and Criterion 3 (Limiting the effects of solar gain in summer). Criterion 1 requires the CO_2 emissions of the new build development to be less than a target (Target Emissions Rate or TER) and Criterion 3 requires the building façade to be designed to limit heat gain and reduce the requirement for air-conditioning.

3.2 London Borough of Camden Planning Policy

Energy targets are set in the Local Development Framework (LDF), November 2010 and Core Strategy policies CS13 - Tackling climate change through promoting higher environmental standards and DP22 - Promoting sustainable design and construction.

CS13 - Tackling climate change through promoting higher environmental standards

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:

(i) Ensuring developments use less energy,

(ii) Making use of energy from efficient sources, such as the King's Cross, Gower Street, Bloomsbury and proposed Euston Road decentralised energy networks,

(iii) 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.

DP22 - Promoting sustainable design and construction

The Council will require development to incorporate sustainable design and construction measures. Schemes must:

(a) Demonstrate how sustainable development principles have been incorporated into the design and proposed implementation; and

(b) Incorporate green or brown roofs and green walls wherever suitable.

The Council will promote and measure sustainable design and construction by:

(c) Expecting new build housing to meet Code for Sustainable Homes Level 3 by 2010 and Code Level 4 by 2013 and encouraging Code Level 6 (zero carbon) by 2016;

3.3 GLA Planning Policy (London Plan), July 2011 and Revised Early Minor Alterations, October 2013

The Greater London Authority (GLA) has set out guidance relating to sustainable design within the London Plan (Spatial Development Strategy for Greater London) and the additional Energy Planning Guidance released in September 2013. The current adopted Plan is dated July 2011 with the Revised Early Minor Alterations published in October 2013 and includes the following policies:

Policy 5.2 Minimising carbon dioxide emissions

Planning decisions

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 and zero carbon non-domestic buildings from 2019.

Residential buildings:

Year Improvement on 2010 Building Regulations

2010 – 2013 25 per cent (Code for Sustainable Homes level 4)
2013 – 2016 40 per cent
2016 – 2031 Zero carbon

Non-Domestic Buildings:

Year Improvement on 2010 Building Regulations

2010 – 2013 25 per cent
2013 – 2016 40 per cent
2016 – 2019 As per building regulations requirements
2019 – 2031 Zero carbon

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 (see paragraph 5.22) 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.

(v) 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 the relevant borough to be ring fenced to secure delivery of carbon dioxide savings elsewhere.

Policy 5.6 Decentralised energy in development proposals

Planning decisions

A. Development proposals should evaluate the feasibility of Combined Heat and Power (CHP) systems, and where a new CHP system is appropriate also examine opportunities to extend the system beyond the site boundary to adjacent sites.

B. 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*

C. Potential opportunities to meet the first priority in this hierarchy are outlined in the London Heat Map tool. Where future network opportunities are identified, proposals should be designed to connect to these networks.

Policy 5.7 Renewable energy

Strategic

A. The Mayor seeks to increase the proportion of energy generated from renewable sources, and expects that the projections for installed renewable energy capacity outlined in the Climate Change Mitigation and Energy Strategy and in supplementary planning guidance will be achieved in London.

Planning decisions

B. Within the framework of the energy hierarchy (see Policy 5.2), major development proposals should provide a reduction in expected carbon dioxide emissions through the use of on-site renewable energy generation, where feasible.

Policy 5.9 Overheating and cooling

Strategic

A. The Mayor seeks to reduce the impact of the urban heat island effect in London and encourages the design of places and spaces to avoid overheating and excessive heat generation, and to reduce overheating due to the impacts of climate change and the urban heat island effect on an area wide basis.

Planning decisions

B. Major development proposals should reduce potential overheating and reliance on air conditioning systems and demonstrate this in accordance with the following cooling hierarchy:

1. *Minimise internal heat generation through energy efficient design*

2. *Reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls*

3. *Manage the heat within the building through exposed internal thermal mass and high ceilings*

4. *Passive ventilation*

5. *Mechanical ventilation*

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

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

3.4 GLA Guidance on Preparing Energy Assessments, April 2014

The calculations in this report follow the methodology set out in GLA guidance updated in April 2014 on addressing the London Plan's energy hierarchy.

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 reduction over and above 2013 (or 2010) Building Regulations will be met using the Mayor's energy hierarchy.

To allow developers time to transfer to the new SAP/SBEM modelling software, Stage 1 applications received by the Mayor between 6 April and the 5 July 2014 (inclusive) can demonstrate compliance with either the new 35 per cent target beyond the 2013 Building Regulations or the 40 per cent target beyond 2010 Building Regulations.

4.0 METHODOLOGY

4.1 Application of Energy Hierarchy

The project team has developed a holistic approach to energy and carbon performance, expanding on the Mayor's Energy Hierarchy. This approach is designed to reduce energy consumption and related CO_2 emissions in the first instance before considering how energy is to be supplied, as per the following methodology.

Use less energy

Step 1: form and façade – review the natural/energy resources at the site and consider adapting both the new and existing façades to respond to these studies.

Step 2: optimise criteria – optimise the design to reduce heating and cooling loads within the buildings.

Supply energy efficiently

Step 3: building fabric and passive design – develop passive heating and cooling design concepts for the buildings.

Step 4: energy efficient building services – develop an energy efficient building services strategy, through design and specification.

Step 5: operations – consider life-cycling issues, operational and maintenance factors.

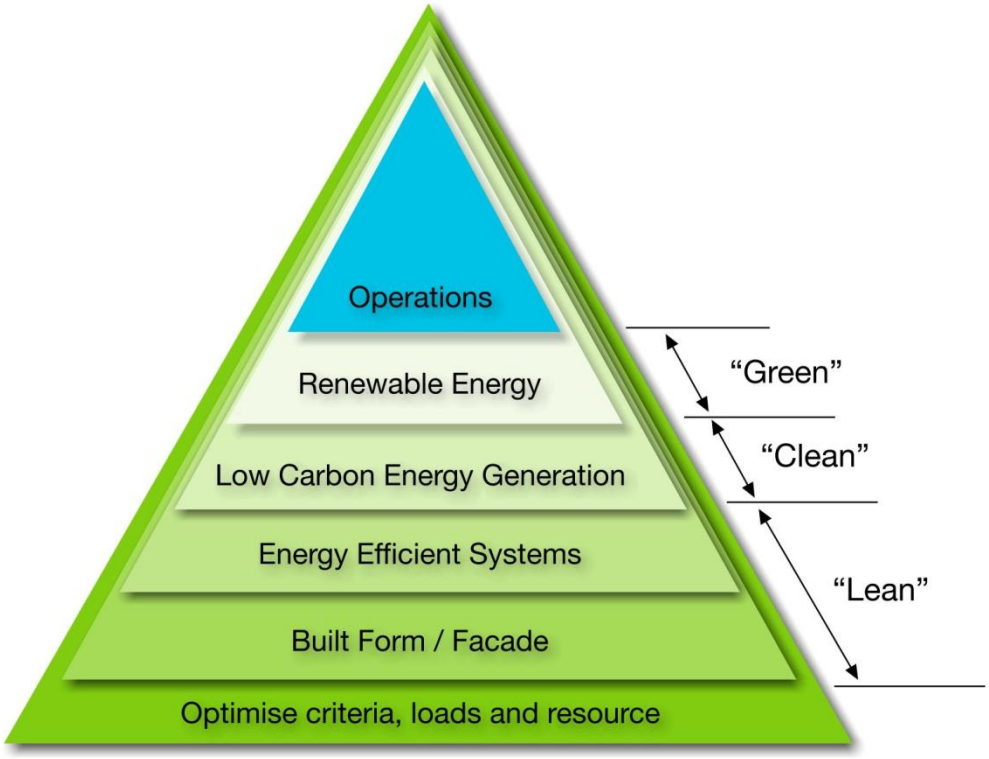
Use low carbon technology

Step 6: low-carbon energy generation – consider decentralised vs. Centralised plant including combined heat and power (CHP).

Use renewable energy

Step 7: renewable energy – analyse the suitability of the site for renewable energy generation and recommend appropriate technologies.

Figure 3: Energy hierarchy followed for 51-53 Agar Grove energy strategy



Each step in the Energy Hierarchy has been followed and carbon savings quantified for the 'Lean', 'Clean' and 'Green' scenarios within this statement.

5.0 BASELINE ENERGY CONSUMPTION AND CO_2 EMISSIONS

The strategy considers Part L1A (2010) TER as Building Regulations compliant baseline. The development has been modelled using FSAP 2009 software. This software is used to indicate compliance with Building Regulations Part L, energy consumption and resulting CO_2 emissions. It calculates the Dwelling CO_2 Emission Rate (DER) and Notional Target Emission Rate (TER) using the Building Regulations 2010 methodology based on the Standard Assessment Procedure (SAP).

FSAP calculates regulated energy consumption i.e. energy uses considered under Part L 2010, such as heating, cooling, domestic hot water (DHW), and electricity for lighting, pumps and fans.

Unregulated carbon emissions include all CO_2 not considered under Part L 2010, for example, energy for appliances and cooking.

An estimation of unregulated energy consumption has been calculated using the results from SAP Section 16 calculations to provide a total development carbon footprint.

Carbon emission factors are based upon the Part L 2010 published figures:

Table 2: Carbon emissions factors

Gas	0.198	$kgCO_2/kWh$
Grid Supplied Electricity	0.517	$kgCO_2/kWh$
Grid Displaced Electricity	0.529	$kgCO_2/kWh$

The following table demonstrates the calculated CO_2 emissions of the development.

Table 3: CO_2 emissions for the Baseline Scheme

BASELINE	CO_2 emissions (tCO_2/year)		
	Regulated	Unregulated	Total
Baseline	**20.7**	**11.4**	**32.1**

The total baseline CO_2 emissions are **20.7 tCO_2** (regulated energy uses) and **32.1 tCO_2** (regulated and unregulated energy uses). Input parameters used to model the baseline TER can be found in Appendix B.

6.0 IMPACT OF PASSIVE DESIGN AND ENERGY EFFICIENCY MEASURES

A key element of the energy strategy is to maximise the energy efficiency of the buildings, through passive design and efficient servicing. The measures included within the design and outlined previously within the methodology are described in greater detail below:

6.1 Form and Façade

The building has been analysed to determine the natural/energy resources available on the site. The results from these studies have been used to inform the design in terms of massing of the new elements and design of the façades to harness the wind and solar benefits, maximising opportunities for using natural lighting, heating and cooling.

A parametric study has been undertaken to understand the projected solar gain, and to avoid the risk of overheating based on the SAP methodology and in line with Criterion 3 requirements.

Effectiveness of the proposed design has been tested against Part L Building Regulations and compliance with Criterion 3 is achieved.

6.2 Optimise Criteria

The design team have looked for opportunities to reduce the heating and cooling loads within the building. Examples of where this has had an impact on the design include the following:

- Optimisation of the lighting strategy means that sizable electricity loads are removed from the building;
- Passive solar design principles have been adopted to reduce energy consumption;
- Maximising fabric performance will reduce the space heating loads in winter.

6.3 Building Fabric and Passive Design

Detailed analysis has been undertaken to assess the impact of various building fabric and passive design solutions. The resulting design includes the following key features:

- The glazing g-value specification has been optimised to control solar gain;
- Glazing areas have been optimised in order to increase the benefits from natural day-lighting, reducing the need for electric lighting whilst minimising heat loss from the buildings;
- The building fabric (glazing, walls, roof etc.) has been optimised to achieve the highest thermal performance possible for the construction element type;

- The building is designed to be airtight, with an air permeability of 4m^3/m^2/hr at 50 Pa currently targeted.

A summary of the proposed fabric and glazing specification for each element of the development contains within the table below:

Table 4: Target fabric and glazing specifications

Element	Notional Building	Proposed Targets
External wall U -Value	0.35 W/m^{2}K	0.17 W/m^{2}K
Roof U –Value	0.16 W/m^{2}K	0.18 W/m^{2}K
Ground floor U –Value	0.25 W/m^{2}K	0.25 W/m^{2}K
Windows (inc. Frame) U –Value	2.0 W/m^{2}K	1.38 W/m^{2}K
Allowance for thermal bridging	0.11 W/m^{2}K	0.08 W/m^{2}K
Air permeability	10 m^3/m^2/hr @ 50Pa	4 m^3/m^2/hr @ 50Pa

On-going studies will be carried out through detailed design to ensure the optimum façade solution is carried forward for the proposed building, i.e. the solutions that give the best result in terms of energy consumption, CO_2 emissions, and also comfort, in respect to thermal transmittance (U-values), light transmittance of glazing (g-value) and air-tightness.

6.4 Energy Efficient Building Services

The following energy efficiency measures within the building services are proposed for the development:

- Lighting to all areas of the building will be highly efficient and incorporate occupancy sensors where applicable;
- Heating and DHW to be delivered through highly efficient communal air source heat pumps;
- All main plant items are to include central time control, weather compensation and metering linked to use of community heating, programmer and TRVs (where applicable);
- Whole house balanced mechanical ventilation with heat recovery (MVHR) with the efficiency of 89% and specific fan power of 0.8 W/l/s is specified.
- Enhanced pipework, ductwork and hot water cylinder thermal insulation;
- Measures to reduce water consumption within the dwellings will have an impact on the energy consumption. A reduction in water consumption should result in reduced energy demand due to the reduction in electricity required to pump water, and reduction in energy for heating the domestic hot water (DHW) supply.

Whilst these are the design standards currently targeted, their achievability will be reviewed through detailed design stages to ensure the overall CO_2 reduction targets are achieved, and to take into account any design changes.

Details of the energy efficiency inputs for the proposed development can be found in Appendix B.

6.5 Energy Efficient Scheme Energy Consumption and CO_2 Emissions

The FSAP calculations have been used to calculate the resulting energy consumption and CO_2 emissions taking into account the passive design and energy efficiency measures detailed within the previous section.

Referring back to the baseline scheme, due to the nature of Building Regulations compliance calculations and the fact that TER of the development is based on the electricity as the main fuel source, the resulting CO_2 savings for the energy efficient scheme are included in the following chapter where the renewable technology is applied.

7.0 ASSESSMENT OF LOW CARBON TECHNOLOGIES

The second stage of the Lean, Clean, Green methodology concerns low-carbon energy generation (‘clean' solutions) and considers decentralised energy generation, including combined heat and power (CHP).

7.1 Heat Networks and Cooling Strategy

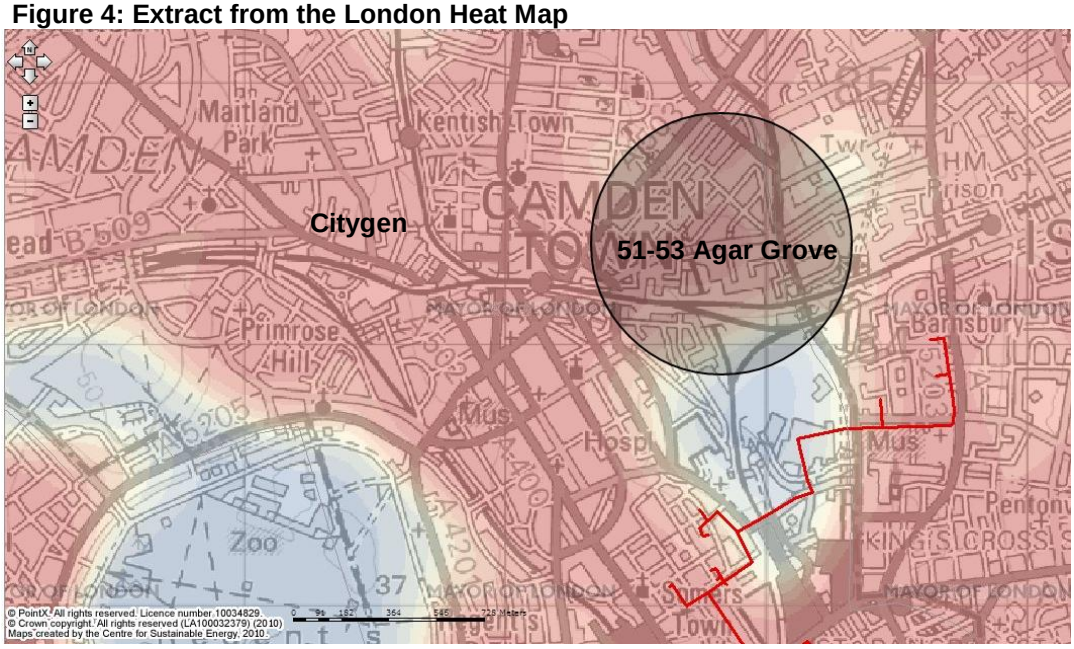
The following opportunities have been assessed within the development:

- Connection to existing heat networks beyond the site boundary
- Connection to existing low carbon heat distribution networks including combined heat and power (CHP)
- Providing a site-wide heating network including combined heat and power (CHP)

7.2 Centralised Energy Centre and Connection to the District Heating Network

The development at 51-53 Agar Grove is marked with a circle indicating the 500m radius around the proposed development on the London Heat Map diagram below (Figure 4). There are not existing heating networks in close proximity to the development. The nearest proposed District Heating Network is around 1km distant and, as a result, does not provide the opportunity to connect.

Figure 4: Extract from the London Heat Map

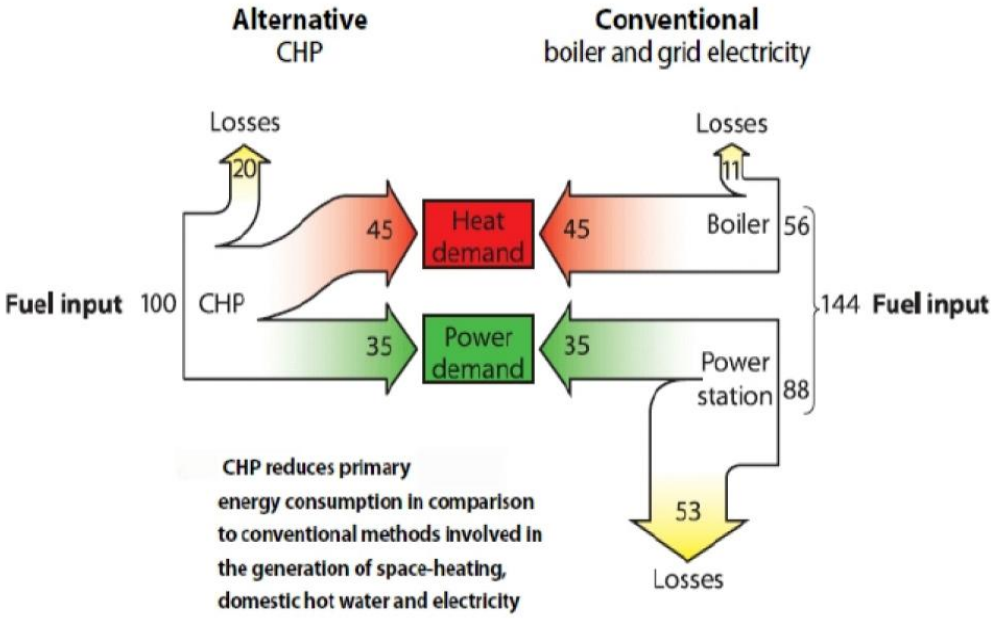


According to CPG3 guidance only developments which are proposed within 500m of a potential network which have no timetable for delivery should ensure that the development is capable of connecting to a network in the future. Therefore, the provision of isolation valves for future connection to DHN is not considered to be feasible.

7.3 Combined Heat and Power (CHP)

As no current opportunities can be confirmed for connection to existing district heat networks, decentralised energy generation from an on-site CHP engine has been considered. CHP converts a single fuel into both electricity and heat in a single process at the point of use.

Figure 5: Comparison of heat supply, power supply and losses for CHP and conventional sources



When sizing CHP plant, it is fundamental to ensure that 100% of its outputs (both electrical and thermal) are going to be used. For efficient and economical operation, a CHP unit should run for more than 4,500 hours per year, ideally to meet a constant heat load and without frequent start ups and shut downs. It is recommended that any CHP system considered for installation is sized based on the base heat load and/or the heat required for feeding absorption chillers in order to meet the base cooling demand.

CIBSE Good Practice Guide 176 “Small-scale combined heat and power for buildings” (http://www.slsag.org.uk/docs/SLSAG-submission/Appendix-B.pdf) recommends consideration of on-site CHP engine for applications which have a simultaneous demand for heat and power for more than 4000 hours per year. GLA planning guidance on preparing energy assessments states that it is not expected that small purely residential developments include on-site CHP.

Provision of an on-site CHP engine is not practical due to the size of the development, anticipated building base loads and running hours. Therefore, there will be a **0% reduction in regulated and unregulated CO_2** emissions due to the use of Low Carbon Technologies, as CHP has not been proposed as a viable technology for the development.

8.0 ASSESSMENT OF RENEWABLE TECHNOLOGIES

A feasibility study has been carried out to establish the most appropriate local Low and Zero Carbon (LZC) energy source for the building. The study has assessed the natural resources available on site, and analysed the feasibility of each LZC energy source against the building's energy demands.

The following LZC technologies are identified within both the London Plan and Code credit guidance. These technologies have been considered for use at 51-53 Agar Grove.

Table 5: Renewable and low carbon technologies considered for the development

Solar	• Solar thermal • Solar photovoltaic panels (PV)
Wind	• Wind turbines
Biomass	• Biomass single room heaters/stoves • Biomass boilers • Biomass community heating schemes
Heat Pumps	• Ground source heat pumps • Water source heat pumps • Air source heat pumps • Geothermal heating systems
Fuel Cells	• Fuel cells using hydrogen generated from any of the above 'renewable' sources.

8.1 Feasibility of Renewable Technologies

An initial assessment has been carried out to determine which technologies are technically feasible on the site. For technologies which are identified as feasible, the following factors have been considered to determine which technologies are appropriate in terms of economic and local planning feasibility:

- Energy generated from each LZC energy source per year
- Payback
- Land Use
- Local Planning Criteria
- Noise
- Life cycle cost/lifecycle impact of the potential specification in terms of carbon emissions
- Any available grants

All technologies appropriate to the site and energy demand of the development have been assessed. Where technologies are not considered appropriate, justification for their exclusion has been provided.

8.2 Solar Panels (Solar Thermal and Photovoltaic)

Feasibility of PV and solar thermal panels is typically dependent on the availability of unshaded, south-facing locations for mounting an array of panels. In the London area there is an annual average solar energy availability of 1MWh/m2 at the optimum (south facing) angle of 30^{o} from the horizontal plane. The amount of this energy that can be utilised is dependent upon the availability of unshaded roof space and efficiency of the solar panels considered. Aesthetic, access and structural implications need to be considered in indentifying panel locations.

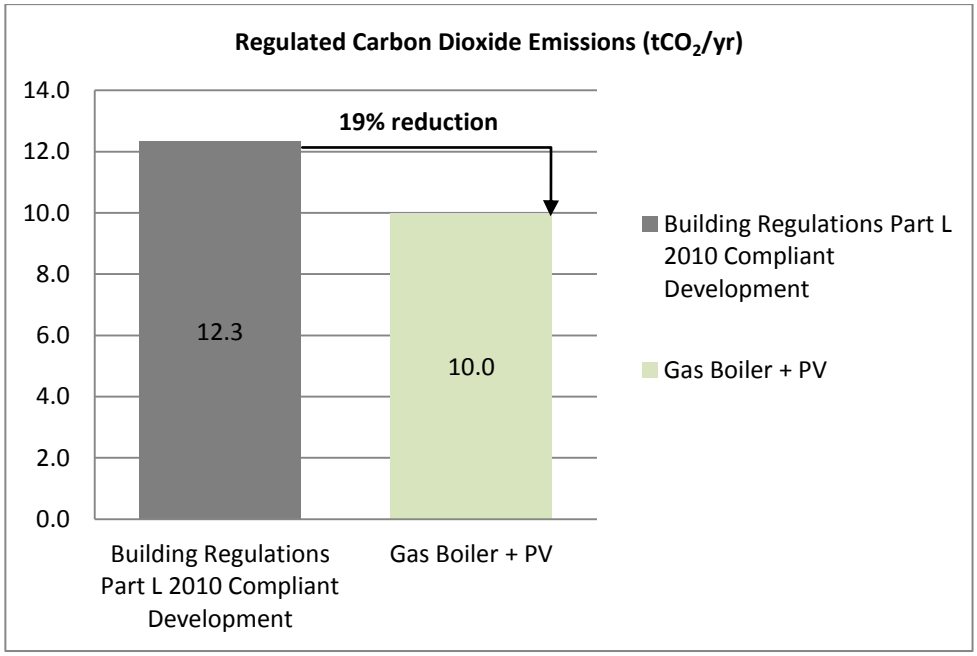
Solar thermal and PV panels are not considered appropriate for the site due to insufficient roof space available for efficient allocation of the panels. Also, the fact that the modules would be facing Agar Grove and St. Paul's Crescent may have a negative visual impact in the sensitive Camden Square Conservation Area.

The usage profile of the development and the fact that the proposed air source heat pumps are able to deliver heating and DHW efficiently meeting the demand in full indicate that solar thermal panels are less beneficial when compared to ASHP.

Both, PV and solar thermal panels are unable to achieve the Council's 40% carbon reduction target with PVs achieving around 19% reduction over Part L compliant development as can be seen in Figure 6 below.

Therefore, the preference has been given to the ASHP option as this can provide a greater carbon reduction for the development at a lower cost. This technology and total carbon savings are described in the following section.

Figure 6: Regulated CO_2 emissions of the gas boiler and PV panels option



8.3 Wind Turbines

Roof mounted wind turbines in urban locations typically have a very limited output. Although data from desktop studies can suggest that appropriate average

wind-speeds may exist on-site, accurately predicting mean wind-speeds in urban locations is rarely possible without on-site anemometer testing.

Additional issues which would require investigation include structural vibration and the risk of visual discomfort to occupants of surrounding buildings (flicker).

Wind technology is therefore not recommended at 51-53 Agor Grove.

8.4 Biomass Heating

Wood chips / pellets would require a large number of deliveries and significant storage space, not compatible with the site location. Delivery logistics for liquid biofuel would pose similar issues, and require careful consideration; however liquid biofuel requires less storage space, and therefore has been considered in further detail by the design team.

The biodiesel is typically tested against EN14214, and supplied as pure Biodiesel at B100. Certain suppliers have plans to supply liquid biodiesel to sites around London via tanker. The tanker is anticipated to be sized to hold between 3,000 and 5,000 litres per delivery. Once delivered, the fuel would be pumped to a holding tank onsite, so the location of this tank would need to be accommodated.

Suppliers link their prices to crude oil and kerosene, reviewing prices monthly against the Rotterdam Exchange which considers waste oil prices. As waste oil is now traded as a commodity, prices are high and subject to fluctuation.

Suppliers sell Biodiesel as both road transport fuel and heating oil. When sold as a road transport fuel, the supply company can claim 25p/litre back through the Renewable Fuel Certificates (RFC's). This subsidy is not available for biodiesel heating fuel so, to compensate, this additional cost is added into the fuel price and passed onto the client.

Typical prices of Biodiesel are based upon the supplier's fixed processing costs (15p) + RFC (25p) + price of waste cooking oil (variable, but potentially 45p – 60p). This means that the overall fuel cost is likely to be in the region of 85p - £1.00 per litre, compared to gas which is currently in the region of 30-50p per litre. Discussions with various suppliers determined that there is a lot of uncertainty regarding pricing in the market and this fuel price is likely to fluctuate over the next few years.

Due to uncertainties in the market, regarding pricing and supply, as well as the demand from the transport industry, liquid biofuel is not recommended for the development.

On-site biomass heating systems are not considered appropriate for the site due to spatial and access limitations, air quality issues and availability of sustainable fuel supplies.

8.5 Biofuel Combined Heat and Power (CHP)

On-site biomass / biomass CHP heating systems are not considered appropriate for the site due to anticipated building loads and due to the reasons explained in section 7.2 of this report.

8.6 Fuel Cells

The primary fuel source for fuel cells is hydrogen. This can be obtained (using a reformer) from a wide range of fuel supplies including natural gas, coal gas, methanol, landfill gas and other fuels containing hydrogen.

The efficiencies of fuel-cell plants are in the range of 40 to 55% (electrical power generation) and waste heat is generated making it a co-generation energy source.

There is not currently a hydrogen network in London, although there is a very good natural gas infrastructure hence the majority of fuel cells are operating using natural gas.

The lower efficiencies when compared to ASHP option coupled with the higher capital costs mean that fuel cell technology is not considered appropriate at this time for 51-53 Agar Grove.

8.7 Heat Pumps

8.7.1 Ground Source Heat Pumps (GSHP)

Ground source heat pump option has been considered and due to the limited space available at the site a horizontal loop system is deemed to be unsuitable. Similarly, as the site footprint and heat demand is relatively small, it is unlikely that a significant yield could be achieved via boreholes or thermopiles in the ground.

The use of ASHP has been identified as viable and cost effective and it is further explained below.

8.7.2 Air Source Heat Pumps (ASHP)

The air source heat pump system is considered to be very energy efficient as it works at low ambient air temperatures. One outdoor unit can serve multiple indoor units connected by refrigerant piping. The combination of the efficient refrigerant of R-410A, variable refrigerant volume, inverter driven compressor, DC fan and compressor motors provide high coefficients of performance (COP).

In addition, ASHP systems have very few components, which mean reduced maintenance costs. There are no boilers to tune, flues to clean, or pumps to rebuild.

The benefit of applying an ASHP system rather than a gas-fired boiler system to provide heating in terms of Dwelling CO_2 Emission Rate (DER) can be seen in the table below:

Table 6: Carbon Savings of ASHP System against Gas-fired Boiler Heating System – Dwelling Emission Rate

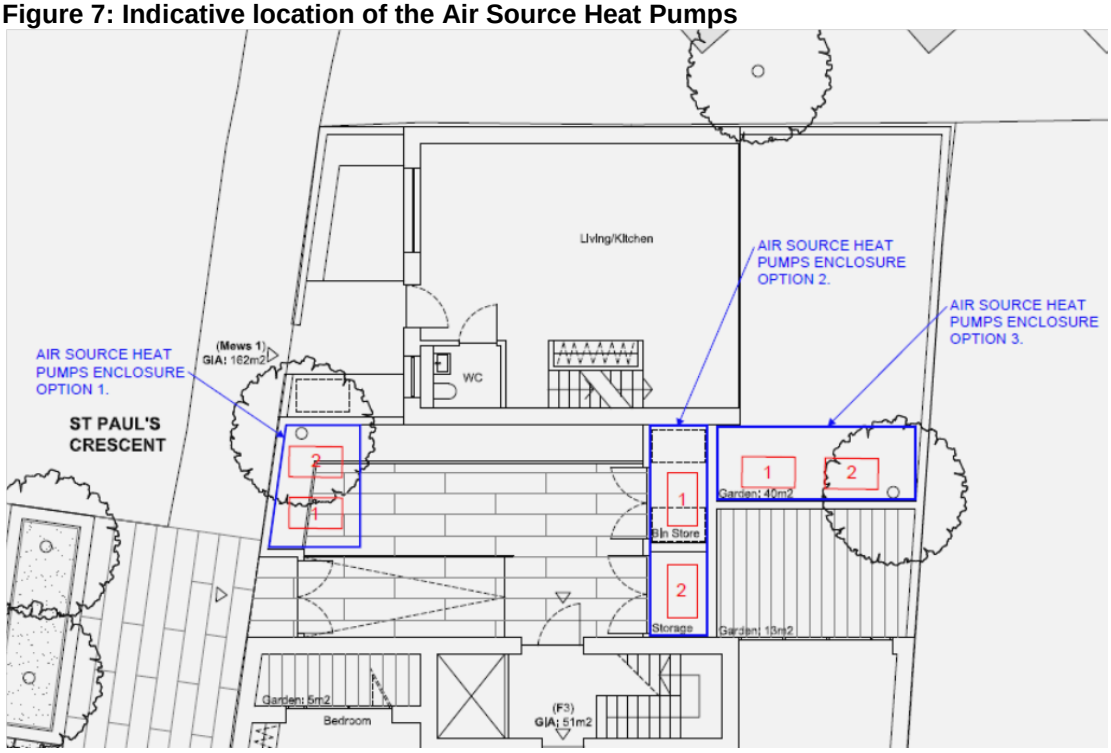
DER of ASHP system ($kgCO_2/m^2/yr$)	DER of gas-fired boiler system ($kg\ CO_2/m^2/yr$)	CO_2 savings ($kgCO_2/m^2/yr$)	% Reduction with ASHP system
15.39	17.96	2.57	14.3%

These results show that the use of the Air Source Heat Pump system will reduce the carbon emissions associated with heating and DHW production within the dwellings by 14.3% when compared to gas-fired boiler heating system.

The ASHP (condenser units) would be positioned in the areas indicated in the .

Figure 7 below. The plant layout and ASHP enclosure will be in accordance with the London Borough of Camden planning requirements. Any noise impacts from plant will be mitigated with an acoustic plant enclosure.

Figure 7: Indicative location of the Air Source Heat Pumps



The total CO_2 savings achieved through integration of energy efficiency measures and ASHP is **10.6 tonnes** per year. This is equivalent to a **51.1% reduction in regulated CO_2 emissions**, which drops to 32.9% once unregulated emissions are included.

Table 7: Carbon emissions savings as a result of energy efficiency measures and renewable technology (ASHP)

"GREEN"	Carbon Dioxide Emissions		
	Regulated	Unregulated	Total
Emissions after demand reduction and Renewables (ASHP) (tCO_2/yr)	10.1	11.4	21.5
Savings (tCO_2/yr)	10.6	0	10.6
Savings (%)	51.1%	0%	32.9%

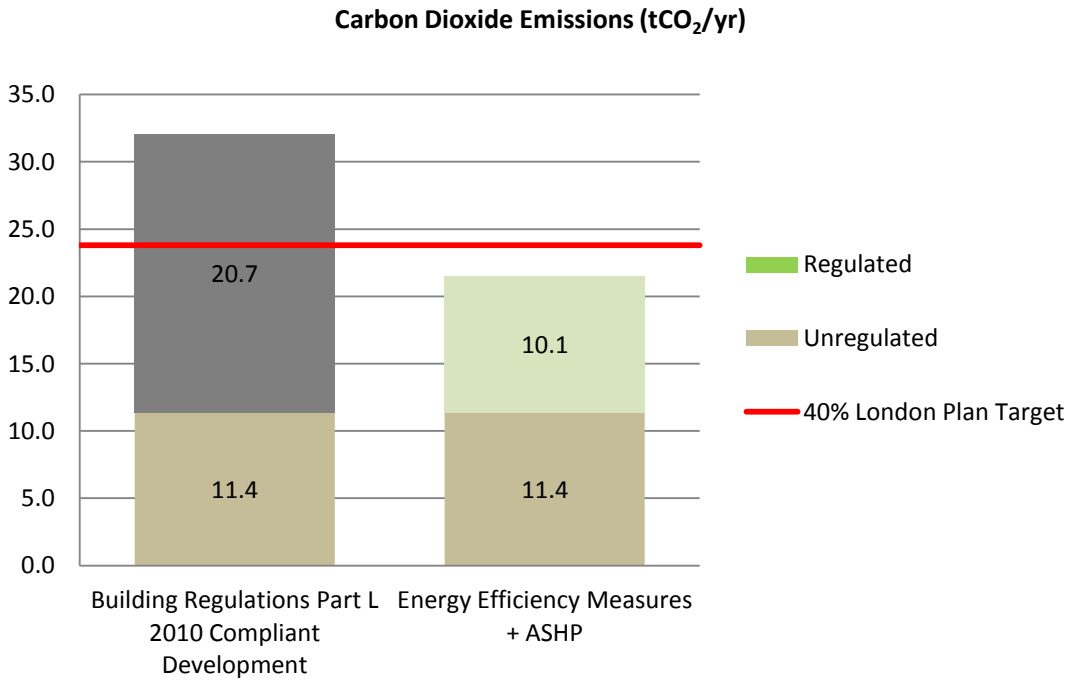
9.0 CONCLUSIONS

The total CO_2 savings achieved by the energy strategy is **10.6 tonnes** when compared against the base-line scenario. The table below shows the breakdown in savings for each stage of the energy hierarchy. The savings equate to a **51.1% reduction** in regulated scheme CO_2 emissions over the baseline building emissions, and a **32.9% reduction** in regulated & unregulated scheme CO_2 emissions. The achieved carbon reduction is in line with the London Plan and London Borough of Camden policy requirements for 40% CO_2 reduction as well as the mandatory Code Level 4 requirement for 25% DER/TER improvement.

Table 8: Summary of total carbon dioxide emissions for each stage of the hierarchy

	Carbon Dioxide Emissions (tCO_2/yr)		
	Regulated	Unregulated	Total
Building Regulations Part L 2010 Compliant Development	**20.7**	**11.4**	**32.1**
After energy demand reduction and ASHP	**10.1**	**11.4**	**22.5**

Figure 8: Summary of total carbon dioxide emissions for each stage of the hierarchy



APPENDIX A

CSH REPORTS

Code for Sustainable Homes Report

Assessor and House Details

Assessor Name: **Assessor Number:**

Property Address: Flat 1
51-53, Agar Grove
LONDON
NW1 9UE

Buiding regulation assessment

	kg/m²/year
TER	32.64
DER	16.42

The following code calculations are taken from the Code for Sustainable Homes Technical Guide (Nov 10)

Ene 1 Assessment - Dwelling Emission Rate

Total Energy Type CO2 Emissions for Codes Levels 1 - 5

	%	kg/m²/year	
DER from SAP 2009 DER Worksheet		16.42	*(ZC1)*
TER		32.64	
Residual CO2 emissions offset from biofuel CHP		0	*(ZC5)*
CO2 emissions offset from additional allowable electricty generation		0	*(ZC7)*
Total CO2 emissions offset from SAP Section 16 allowances		0	
DER accounting for SAP Section 16 allowances		16.42	
% improvement DER/TER	49.7		

Total Energy Type CO2 Emissions for Codes Levels 6

	kg/m²/year	
DER accounting for SAP Section 16 allowances	16.42	*(ZC1)*
CO2 emissions from appliances, equation (L14)	16.76	*(ZC2)*
CO2 emissions from cooking, equation (L16)	2.55	*(ZC3)*
Net CO2 emissions	35.7	*(ZC8)*

Result:

Credits awarded for Ene 1 = 5.2

Code Level = 4

Ene 2 - Fabric energy Efficiency

Fabric energy Efficiency: 53.19

Credits awarded for Ene 2 = 0

Ene 7 - Low or Zero Carbon (LZC) Technologies

Reduction in CO2 Emissions

	%	kg/m²/year
Standard Case CO2 emissions		40.15
Standard DER		20.84
Actual Case CO2 emissions		35.73
Actual DER		16.42
Reduction in CO2 emissions	11.01	

Credits awarded for Ene 7 = 1

Technologies eligible to contribute to achieving the requirements of this issue must produce energy from renewable sources and meet all other ancillary requirements as defined by Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

The following requirements must also be met:

- Where not provided by accredited external renewables there must be a direct supply of energy produced to the dwelling under assessment.
- Where covered by the Microgeneration Certification Scheme (MCS), technologies under 50kWe or 300kWth must be certified.
- Combined Heat and Power (CHP) schemes above 50kWe must be certified under the CHPQA standard.
- All technologies must be accounted for by SAP.

CHP schemes fuelled by mains gas are eligible to contribute to performance against this issue. Where these schemes are above 50kWe they must be certified under the CHPQA.

It is the responsibly of the Accredited OCDEA and Code Assessor to ensure all technologies use in the calculation are appropriate before awarding credits.

Code for Sustainable Homes Report

Assessor and House Details

Assessor Name: **Assessor Number:**

Property Address: Flat 2
51-53, Agar Grove
LONDON
NW1 9UE

Buiding regulation assessment

	kg/m²/year
TER	37.48
DER	19.14

The following code calculations are taken from the Code for Sustainable Homes Technical Guide (Nov 10)

Ene 1 Assessment - Dwelling Emission Rate

Total Energy Type CO2 Emissions for Codes Levels 1 - 5

	%	kg/m²/year	
DER from SAP 2009 DER Worksheet		19.14	*(ZC1)*
TER		37.48	
Residual CO2 emissions offset from biofuel CHP		0	*(ZC5)*
CO2 emissions offset from additional allowable electricty generation		0	*(ZC7)*
Total CO2 emissions offset from SAP Section 16 allowances		0	
DER accounting for SAP Section 16 allowances		19.14	
% improvement DER/TER	48.9		

Total Energy Type CO2 Emissions for Codes Levels 6

	kg/m²/year	
DER accounting for SAP Section 16 allowances	19.14	*(ZC1)*
CO2 emissions from appliances, equation (L14)	17.38	*(ZC2)*
CO2 emissions from cooking, equation (L16)	3.19	*(ZC3)*
Net CO2 emissions	39.7	*(ZC8)*

Result:

Credits awarded for Ene 1 = 5.2

Code Level = 4

Ene 2 - Fabric energy Efficiency

Fabric energy Efficiency: 62.6

Credits awarded for Ene 2 = 0

Ene 7 - Low or Zero Carbon (LZC) Technologies

Reduction in CO2 Emissions

	%	kg/m²/year
Standard Case CO2 emissions		45.18
Standard DER		24.61
Actual Case CO2 emissions		39.71
Actual DER		19.14
Reduction in CO2 emissions	12.11	

Credits awarded for Ene 7 = 1

Technologies eligible to contribute to achieving the requirements of this issue must produce energy from renewable sources and meet all other ancillary requirements as defined by Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

The following requirements must also be met:

- Where not provided by accredited external renewables there must be a direct supply of energy produced to the dwelling under assessment.
- Where covered by the Microgeneration Certification Scheme (MCS), technologies under 50kWe or 300kWth must be certified.
- Combined Heat and Power (CHP) schemes above 50kWe must be certified under the CHPQA standard.
- All technologies must be accounted for by SAP.

CHP schemes fuelled by mains gas are eligible to contribute to performance against this issue. Where these schemes are above 50kWe they must be certified under the CHPQA.

It is the responsibly of the Accredited OCDEA and Code Assessor to ensure all technologies use in the calculation are appropriate before awarding credits.

Code for Sustainable Homes Report

Assessor and House Details

Assessor Name: **Assessor Number:**

Property Address: Flat 3
51-53, Agar Grove
LONDON
NW1 9UE

Buiding regulation assessment

	kg/m²/year
TER	37.06
DER	19.46

The following code calculations are taken from the Code for Sustainable Homes Technical Guide (Nov 10)

Ene 1 Assessment - Dwelling Emission Rate

Total Energy Type CO2 Emissions for Codes Levels 1 - 5

	%	kg/m²/year	
DER from SAP 2009 DER Worksheet		19.46	*(ZC1)*
TER		37.06	
Residual CO2 emissions offset from biofuel CHP		0	*(ZC5)*
CO2 emissions offset from additional allowable electricty generation		0	*(ZC7)*
Total CO2 emissions offset from SAP Section 16 allowances		0	
DER accounting for SAP Section 16 allowances		19.46	
% improvement DER/TER	47.5		

Total Energy Type CO2 Emissions for Codes Levels 6

	kg/m²/year	
DER accounting for SAP Section 16 allowances	19.46	*(ZC1)*
CO2 emissions from appliances, equation (L14)	17.27	*(ZC2)*
CO2 emissions from cooking, equation (L16)	3.05	*(ZC3)*
Net CO2 emissions	39.8	*(ZC8)*

Result:

Credits awarded for Ene 1 = 5

Code Level = 4

Ene 2 - Fabric energy Efficiency

Fabric energy Efficiency: 65.25

Credits awarded for Ene 2 = 0

Ene 7 - Low or Zero Carbon (LZC) Technologies

Reduction in CO2 Emissions

	%	kg/m²/year
Standard Case CO2 emissions		45.26
Standard DER		24.94
Actual Case CO2 emissions		39.78
Actual DER		19.46
Reduction in CO2 emissions	12.11	

Credits awarded for Ene 7 = 1

Technologies eligible to contribute to achieving the requirements of this issue must produce energy from renewable sources and meet all other ancillary requirements as defined by Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

The following requirements must also be met:

- Where not provided by accredited external renewables there must be a direct supply of energy produced to the dwelling under assessment.
- Where covered by the Microgeneration Certification Scheme (MCS), technologies under 50kWe or 300kWth must be certified.
- Combined Heat and Power (CHP) schemes above 50kWe must be certified under the CHPQA standard.
- All technologies must be accounted for by SAP.

CHP schemes fuelled by mains gas are eligible to contribute to performance against this issue. Where these schemes are above 50kWe they must be certified under the CHPQA.

It is the responsibly of the Accredited OCDEA and Code Assessor to ensure all technologies use in the calculation are appropriate before awarding credits.

Code for Sustainable Homes Report

Assessor and House Details

Assessor Name: **Assessor Number:**

Property Address: Flat 4
51-53, Agar Grove
LONDON
NW1 9UE

Buiding regulation assessment

	kg/m²/year
TER	28.58
DER	13.84

The following code calculations are taken from the Code for Sustainable Homes Technical Guide (Nov 10)

Ene 1 Assessment - Dwelling Emission Rate

Total Energy Type CO2 Emissions for Codes Levels 1 - 5

	%	kg/m²/year	
DER from SAP 2009 DER Worksheet		13.84	*(ZC1)*
TER		28.58	
Residual CO2 emissions offset from biofuel CHP		0	*(ZC5)*
CO2 emissions offset from additional allowable electricty generation		0	*(ZC7)*
Total CO2 emissions offset from SAP Section 16 allowances		0	
DER accounting for SAP Section 16 allowances		13.84	
% improvement DER/TER	51.6		

Total Energy Type CO2 Emissions for Codes Levels 6

	kg/m²/year	
DER accounting for SAP Section 16 allowances	13.84	*(ZC1)*
CO2 emissions from appliances, equation (L14)	16.64	*(ZC2)*
CO2 emissions from cooking, equation (L16)	2.47	*(ZC3)*
Net CO2 emissions	32.9	*(ZC8)*

Result:

Credits awarded for Ene 1 = 5.4

Code Level = 4

Ene 2 - Fabric energy Efficiency

Fabric energy Efficiency: 39.95

Credits awarded for Ene 2 = 6.5

Ene 7 - Low or Zero Carbon (LZC) Technologies

Reduction in CO2 Emissions

	%	kg/m²/year
Standard Case CO2 emissions		36.83
Standard DER		17.72
Actual Case CO2 emissions		32.95
Actual DER		13.84
Reduction in CO2 emissions	10.53	

Credits awarded for Ene 7 = 1

Technologies eligible to contribute to achieving the requirements of this issue must produce energy from renewable sources and meet all other ancillary requirements as defined by Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

The following requirements must also be met:

- Where not provided by accredited external renewables there must be a direct supply of energy produced to the dwelling under assessment.
- Where covered by the Microgeneration Certification Scheme (MCS), technologies under 50kWe or 300kWth must be certified.
- Combined Heat and Power (CHP) schemes above 50kWe must be certified under the CHPQA standard.
- All technologies must be accounted for by SAP.

CHP schemes fuelled by mains gas are eligible to contribute to performance against this issue. Where these schemes are above 50kWe they must be certified under the CHPQA.

It is the responsibly of the Accredited OCDEA and Code Assessor to ensure all technologies use in the calculation are appropriate before awarding credits.

Code for Sustainable Homes Report

Assessor and House Details

Assessor Name: **Assessor Number:**

Property Address: Flat 5
51-53, Agar Grove
LONDON
NW1 9UE

Buiding regulation assessment

	kg/m²/year
TER	31.92
DER	14.98

The following code calculations are taken from the Code for Sustainable Homes Technical Guide (Nov 10)

Ene 1 Assessment - Dwelling Emission Rate

Total Energy Type CO2 Emissions for Codes Levels 1 - 5

	%	kg/m²/year	
DER from SAP 2009 DER Worksheet		14.98	*(ZC1)*
TER		31.92	
Residual CO2 emissions offset from biofuel CHP		0	*(ZC5)*
CO2 emissions offset from additional allowable electricty generation		0	*(ZC7)*
Total CO2 emissions offset from SAP Section 16 allowances		0	
DER accounting for SAP Section 16 allowances		14.98	
% improvement DER/TER	53.1		

Total Energy Type CO2 Emissions for Codes Levels 6

	kg/m²/year	
DER accounting for SAP Section 16 allowances	14.98	*(ZC1)*
CO2 emissions from appliances, equation (L14)	17.3	*(ZC2)*
CO2 emissions from cooking, equation (L16)	3.1	*(ZC3)*
Net CO2 emissions	35.4	*(ZC8)*

Result:

Credits awarded for Ene 1 = 5.5

Code Level = 4

Ene 2 - Fabric energy Efficiency

Fabric energy Efficiency: 39.63

Credits awarded for Ene 2 = 6.7

Ene 7 - Low or Zero Carbon (LZC) Technologies

Reduction in CO2 Emissions

	%	kg/m²/year
Standard Case CO2 emissions		40.06
Standard DER		19.66
Actual Case CO2 emissions		35.38
Actual DER		14.98
Reduction in CO2 emissions	11.68	

Credits awarded for Ene 7 = 1

Technologies eligible to contribute to achieving the requirements of this issue must produce energy from renewable sources and meet all other ancillary requirements as defined by Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

The following requirements must also be met:

- Where not provided by accredited external renewables there must be a direct supply of energy produced to the dwelling under assessment.
- Where covered by the Microgeneration Certification Scheme (MCS), technologies under 50kWe or 300kWth must be certified.
- Combined Heat and Power (CHP) schemes above 50kWe must be certified under the CHPQA standard.
- All technologies must be accounted for by SAP.

CHP schemes fuelled by mains gas are eligible to contribute to performance against this issue. Where these schemes are above 50kWe they must be certified under the CHPQA.

It is the responsibly of the Accredited OCDEA and Code Assessor to ensure all technologies use in the calculation are appropriate before awarding credits.

Code for Sustainable Homes Report

Assessor and House Details

Assessor Name: **Assessor Number:**

Property Address: Flat 6
51-53, Agar Grove
LONDON
NW1 9UE

Buiding regulation assessment

	kg/m²/year
TER	30.65
DER	14.58

The following code calculations are taken from the Code for Sustainable Homes Technical Guide (Nov 10)

Ene 1 Assessment - Dwelling Emission Rate

Total Energy Type CO2 Emissions for Codes Levels 1 - 5

	%	kg/m²/year	
DER from SAP 2009 DER Worksheet		14.58	*(ZC1)*
TER		30.65	
Residual CO2 emissions offset from biofuel CHP		0	*(ZC5)*
CO2 emissions offset from additional allowable electricty generation		0	*(ZC7)*
Total CO2 emissions offset from SAP Section 16 allowances		0	
DER accounting for SAP Section 16 allowances		14.58	
% improvement DER/TER	52.4		

Total Energy Type CO2 Emissions for Codes Levels 6

	kg/m²/year	
DER accounting for SAP Section 16 allowances	14.58	*(ZC1)*
CO2 emissions from appliances, equation (L14)	14.3	*(ZC2)*
CO2 emissions from cooking, equation (L16)	1.63	*(ZC3)*
Net CO2 emissions	30.5	*(ZC8)*

Result:

Credits awarded for Ene 1 = 5.4

Code Level = 4

Ene 2 - Fabric energy Efficiency

Fabric energy Efficiency: 54.74

Credits awarded for Ene 2 = 0

Ene 7 - Low or Zero Carbon (LZC) Technologies

Reduction in CO2 Emissions

	%	kg/m²/year
Standard Case CO2 emissions		33.88
Standard DER		17.95
Actual Case CO2 emissions		30.51
Actual DER		14.58
Reduction in CO2 emissions	9.95	

Credits awarded for Ene 7 = 0

Technologies eligible to contribute to achieving the requirements of this issue must produce energy from renewable sources and meet all other ancillary requirements as defined by Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

The following requirements must also be met:

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- Where covered by the Microgeneration Certification Scheme (MCS), technologies under 50kWe or 300kWth must be certified.
- Combined Heat and Power (CHP) schemes above 50kWe must be certified under the CHPQA standard.
- All technologies must be accounted for by SAP.

CHP schemes fuelled by mains gas are eligible to contribute to performance against this issue. Where these schemes are above 50kWe they must be certified under the CHPQA.

It is the responsibly of the Accredited OCDEA and Code Assessor to ensure all technologies use in the calculation are appropriate before awarding credits.

Code for Sustainable Homes Report

Assessor and House Details

Assessor Name: **Assessor Number:**

Property Address: Flat 7
51-53, Agar Grove
LONDON
NW1 9UE

Buiding regulation assessment

	kg/m²/year
TER	32.46
DER	15.68

The following code calculations are taken from the Code for Sustainable Homes Technical Guide (Nov 10)

Ene 1 Assessment - Dwelling Emission Rate

Total Energy Type CO2 Emissions for Codes Levels 1 - 5

	%	kg/m²/year	
DER from SAP 2009 DER Worksheet		15.68	*(ZC1)*
TER		32.46	
Residual CO2 emissions offset from biofuel CHP		0	*(ZC5)*
CO2 emissions offset from additional allowable electricty generation		0	*(ZC7)*
Total CO2 emissions offset from SAP Section 16 allowances		0	
DER accounting for SAP Section 16 allowances		15.68	
% improvement DER/TER	51.7		

Total Energy Type CO2 Emissions for Codes Levels 6

	kg/m²/year	
DER accounting for SAP Section 16 allowances	15.68	*(ZC1)*
CO2 emissions from appliances, equation (L14)	15.35	*(ZC2)*
CO2 emissions from cooking, equation (L16)	1.91	*(ZC3)*
Net CO2 emissions	32.9	*(ZC8)*

Result:

Credits awarded for Ene 1 = 5.4

Code Level = 4

Ene 2 - Fabric energy Efficiency

Fabric energy Efficiency: 56.53

Credits awarded for Ene 2 = 0

Ene 7 - Low or Zero Carbon (LZC) Technologies

Reduction in CO2 Emissions

	%	kg/m²/year
Standard Case CO2 emissions		36.73
Standard DER		19.46
Actual Case CO2 emissions		32.95
Actual DER		15.68
Reduction in CO2 emissions	10.29	

Credits awarded for Ene 7 = 1

Technologies eligible to contribute to achieving the requirements of this issue must produce energy from renewable sources and meet all other ancillary requirements as defined by Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

The following requirements must also be met:

- Where not provided by accredited external renewables there must be a direct supply of energy produced to the dwelling under assessment.
- Where covered by the Microgeneration Certification Scheme (MCS), technologies under 50kWe or 300kWth must be certified.
- Combined Heat and Power (CHP) schemes above 50kWe must be certified under the CHPQA standard.
- All technologies must be accounted for by SAP.

CHP schemes fuelled by mains gas are eligible to contribute to performance against this issue. Where these schemes are above 50kWe they must be certified under the CHPQA.

It is the responsibly of the Accredited OCDEA and Code Assessor to ensure all technologies use in the calculation are appropriate before awarding credits.

Code for Sustainable Homes Report

Assessor and House Details

Assessor Name: **Assessor Number:**

Property Address: Mews 1
51-53, Agar Grove
LONDON
NW1 9UE

Buiding regulation assessment

	kg/m²/year
TER	28.1
DER	13.58

The following code calculations are taken from the Code for Sustainable Homes Technical Guide (Nov 10)

Ene 1 Assessment - Dwelling Emission Rate

Total Energy Type CO2 Emissions for Codes Levels 1 - 5

	%	kg/m²/year	
DER from SAP 2009 DER Worksheet		13.58	*(ZC1)*
TER		28.1	
Residual CO2 emissions offset from biofuel CHP		0	*(ZC5)*
CO2 emissions offset from additional allowable electricty generation		0	*(ZC7)*
Total CO2 emissions offset from SAP Section 16 allowances		0	
DER accounting for SAP Section 16 allowances		13.58	
% improvement DER/TER	51.7		

Total Energy Type CO2 Emissions for Codes Levels 6

	kg/m²/year	
DER accounting for SAP Section 16 allowances	13.58	*(ZC1)*
CO2 emissions from appliances, equation (L14)	12.43	*(ZC2)*
CO2 emissions from cooking, equation (L16)	1.23	*(ZC3)*
Net CO2 emissions	27.2	*(ZC8)*

Result:

Credits awarded for Ene 1 = 5.4

Code Level = 4

Ene 2 - Fabric energy Efficiency

Fabric energy Efficiency: 55.95

Credits awarded for Ene 2 = 3.8

Ene 7 - Low or Zero Carbon (LZC) Technologies

Reduction in CO2 Emissions

	%	kg/m²/year
Standard Case CO2 emissions		30.32
Standard DER		16.66
Actual Case CO2 emissions		27.24
Actual DER		13.58
Reduction in CO2 emissions	10.16	

Credits awarded for Ene 7 = 1

Technologies eligible to contribute to achieving the requirements of this issue must produce energy from renewable sources and meet all other ancillary requirements as defined by Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

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- Where covered by the Microgeneration Certification Scheme (MCS), technologies under 50kWe or 300kWth must be certified.
- Combined Heat and Power (CHP) schemes above 50kWe must be certified under the CHPQA standard.
- All technologies must be accounted for by SAP.

CHP schemes fuelled by mains gas are eligible to contribute to performance against this issue. Where these schemes are above 50kWe they must be certified under the CHPQA.

It is the responsibly of the Accredited OCDEA and Code Assessor to ensure all technologies use in the calculation are appropriate before awarding credits.

APPENDIX B

MODELLING INPUTS

SAP Input

Property Details: Flat 1

Address:	Flat 1, 51-53, Agar Grove, LONDON, NW1 9UE
Located in:	England
Region:	Thames valley
UPRN:	
Date of assessment:	04 June 2014
Date of certificate:	09 June 2014
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Medium

Dwelling designed to use less than 125 litres per Person per day: True

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2014

Floor Location:	Floor area:	Storey height:
Floor 0	67 m²	2.7 m

Living area:	31.4 m² (fraction 0.469)
Front of dwelling faces:	North

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Entrance Door	Manufacturer	Solid			Wood
Window 1	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	
Window 2	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	
Window 3	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	
Window 4	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	
Window 5	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
Entrance Door	mm	0	0	2	1.9	1
Window 1	12mm	0.7	0.63	1.38	5.7	1
Window 2	12mm	0.7	0.63	1.38	0.7	1
Window 3	12mm	0.7	0.63	1.38	5.7	1
Window 4	12mm	0.7	0.63	1.38	2	1
Window 5	12mm	0.7	0.63	1.38	2	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Entrance Door		External Wall	North	0	0
Window 1		External Wall	South	0	0
Window 2		External Wall	South	0	0
Window 3		External Wall	South	0	0
Window 4		External Wall	West	0	0
Window 5		External Wall	West	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
External Wall	53.5	18	35.5	0.17	0	False	N/A
Exposed Ceiling	5.1	0	5.1	0.18	0		N/A
Ground Floor	67			0.25			N/A

SAP Input

Internal Elements
Party Elements

Thermal bridges:

Thermal bridges:	User-defined y-value y =0.08 Reference: Enhanced

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 2 Ductwork: Insulation, Rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of sides sheltered:	2
Pressure test:	4

Main heating system:

Main heating system:	Community heating schemes Heat source: Community heat pump heat from electric heat pump, heat fraction 1, efficiency 300 Piping>=1991, pre-insulated, low temp, variable flow

Main heating Control:

Main heating Control:	Charging system linked to use of community heating, programmer and TRVs Control code: 2306

Secondary heating system:

Secondary heating system:	None

Water heating:

Water heating:	From main heating system Water code: 901 Fuel :heat from electric heat pump Hot water cylinder Cylinder volume: 260 litres Cylinder insulation: Factory 80 mm Primary pipework insulation: True Cylinderstat: True Cylinder in heated space: True Solar panel: False

Others:

Electricity tariff:	standard tariff
In Smoke Control Area:	Yes
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

SAP Input

Property Details: Flat 2

Address:	Flat 2, 51-53, Agar Grove, LONDON, NW1 9UE
Located in:	England
Region:	Thames valley
UPRN:	
Date of assessment:	04 June 2014
Date of certificate:	09 June 2014
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Medium
Dwelling designed to use less than 125 litres per Person per day:	True

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2014

Floor Location:	Floor area:	Storey height:
Floor 0	50 m²	2.7 m

Living area:	32.6 m² (fraction 0.652)
Front of dwelling faces:	North

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Entrance Door	Manufacturer	Solid			Wood
Window 1	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Window 2	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Window 3	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
Entrance Door	mm	0	0	2	1.9	1
Window 1	12mm	0.7	0.63	1.38	5.7	1
Window 2	12mm	0.7	0.63	1.38	0.7	1
Window 3	12mm	0.7	0.63	1.38	7.6	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Entrance Door		External Wall	North	0	0
Window 1		External Wall	South	0	0
Window 2		External Wall	South	0	0
Window 3		External Wall	East	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
External Wall	47.3	15.9	31.4	0.17	0	False	N/A
Exposed Ceiling	9.8	0	9.8	0.18	0		N/A
Ground Floor	50			0.25			N/A
Internal Elements							
Party Elements							

Thermal bridges:

Thermal bridges:	User-defined y-value y =0.08 Reference: Enhanced

SAP Input

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 2 Ductwork: Insulation, Rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of sides sheltered:	2
Pressure test:	4

Main heating system:

Main heating system:	Community heating schemes Heat source: Community heat pump heat from electric heat pump, heat fraction 1, efficiency 300 Piping>=1991, pre-insulated, low temp, variable flow

Main heating Control:

Main heating Control:	Charging system linked to use of community heating, programmer and TRVs Control code: 2306

Secondary heating system:

Secondary heating system:	None

Water heating:

Water heating:	From main heating system Water code: 901 Fuel :heat from electric heat pump Hot water cylinder Cylinder volume: 260 litres Cylinder insulation: Factory 80 mm Primary pipework insulation: True Cylinderstat: True Cylinder in heated space: True Solar panel: False

Others:

Electricity tariff:	standard tariff
In Smoke Control Area:	Yes
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

SAP Input

Property Details: Flat 3

Address:	Flat 3, 51-53, Agar Grove, LONDON, NW1 9UE
Located in:	England
Region:	Thames valley
UPRN:	
Date of assessment:	04 June 2014
Date of certificate:	09 June 2014
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Medium
Dwelling designed to use less than 125 litres per Person per day:	True

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2014

Floor Location:	Floor area:	Storey height:
Floor 0	53 m²	2.7 m

Living area:	24.6 m² (fraction 0.464)
Front of dwelling faces:	North

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Entrance Door	Manufacturer	Solid			Wood
Window 1	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Window 2	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Entrance Door	mm	0	0	2	1.9	1
Window 1	12mm	0.7	0.63	1.38	2.5	1
Window 2	12mm	0.7	0.63	1.38	7.6	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Entrance Door		External Wall	North	0	0
Window 1		External Wall	West	0	0
Window 2		External Wall	North	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
External Wall	47.1	12	35.1	0.17	0	False	N/A
Exposed Ceiling	27	0	27	0.18	0		N/A
Ground Floor	53			0.25			N/A
Internal Elements							
Party Elements							

Thermal bridges:

Thermal bridges:	User-defined y-value y =0.08 Reference: Enhanced

SAP Input

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 2 Ductwork: Insulation, Rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of sides sheltered:	2
Pressure test:	4

Main heating system:

Main heating system:	Community heating schemes Heat source: Community heat pump heat from electric heat pump, heat fraction 1, efficiency 300 Piping>=1991, pre-insulated, low temp, variable flow

Main heating Control:

Main heating Control:	Charging system linked to use of community heating, programmer and TRVs Control code: 2306

Secondary heating system:

Secondary heating system:	None

Water heating:

Water heating:	From main heating system Water code: 901 Fuel :heat from electric heat pump Hot water cylinder Cylinder volume: 260 litres Cylinder insulation: Factory 80 mm Primary pipework insulation: True Cylinderstat: True Cylinder in heated space: True Solar panel: False

Others:

Electricity tariff:	standard tariff
In Smoke Control Area:	Yes
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

SAP Input

Property Details: Flat 4

Address:	Flat 4, 51-53, Agar Grove, LONDON, NW1 9UE
Located in:	England
Region:	Thames valley
UPRN:	
Date of assessment:	04 June 2014
Date of certificate:	09 June 2014
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Medium
Dwelling designed to use less than 125 litres per Person per day:	True

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2014

Floor Location:	Floor area:	Storey height:
Floor 0	70 m²	2.7 m

Living area:	28 m² (fraction 0.4)
Front of dwelling faces:	North

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Entrance Door	Manufacturer	Solid			Wood
Window 1	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Window 2	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Window 3	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Window 4	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Window 5	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Window 6	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
Entrance Door	mm	0	0	2	1.9	1
Window 1	12mm	0.7	0.63	1.38	2.5	1
Window 2	12mm	0.7	0.63	1.38	4	1
Window 3	12mm	0.7	0.63	1.38	5.5	1
Window 4	12mm	0.7	0.63	1.38	2.5	1
Window 5	12mm	0.7	0.63	1.38	2.8	1
Window 6	12mm	0.7	0.63	1.38	2.8	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Entrance Door		External Wall	North	0	0
Window 1		External Wall	West	0	0
Window 2		External Wall	North	0	0
Window 3		External Wall	West	0	0
Window 4		External Wall	South	0	0
Window 5		External Wall	South	0	0
Window 6		External Wall	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
External Wall	64.2	22	42.2	0.17	0	False	N/A
Semi Exposed Wall	14.2	0	14.2	0.3	0.4	False	N/A

SAP Input

Internal Elements
Party Elements

Thermal bridges:

Thermal bridges:	User-defined y-value y =0.08 Reference: Enhanced

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 2 Ductwork: Insulation, Rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of sides sheltered:	1.5
Pressure test:	4

Main heating system:

Main heating system:	Community heating schemes Heat source: Community heat pump heat from electric heat pump, heat fraction 1, efficiency 300 Piping>=1991, pre-insulated, low temp, variable flow

Main heating Control:

Main heating Control:	Charging system linked to use of community heating, programmer and TRVs Control code: 2306

Secondary heating system:

Secondary heating system:	None

Water heating:

Water heating:	From main heating system Water code: 901 Fuel :heat from electric heat pump Hot water cylinder Cylinder volume: 260 litres Cylinder insulation: Factory 80 mm Primary pipework insulation: True Cylinderstat: True Cylinder in heated space: True Solar panel: False

Others:

Electricity tariff:	standard tariff
In Smoke Control Area:	Yes
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

SAP Input

Property Details: Flat 5

Address:	Flat 5, 51-53, Agar Grove, LONDON, NW1 9UE
Located in:	England
Region:	Thames valley
UPRN:	
Date of assessment:	04 June 2014
Date of certificate:	09 June 2014
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Medium
Dwelling designed to use less than 125 litres per Person per day:	True

Property description:

Dwelling type:	Flat
Detachment:	
Year Completed:	2014

Floor Location:	Floor area:	Storey height:
Floor 0	52 m²	2.7 m

Living area:	25.8 m² (fraction 0.496)
Front of dwelling faces:	North

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Entrance Door	Manufacturer	Solid			Wood
Window 1	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Window 2	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Window 3	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Window 4	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
Entrance Door	mm	0	0	2	1.9	1
Window 1	12mm	0.7	0.63	1.38	2.5	1
Window 2	12mm	0.7	0.63	1.38	2.5	1
Window 3	12mm	0.7	0.63	1.38	2.8	1
Window 4	12mm	0.7	0.63	1.38	2.8	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Entrance Door		External Wall	North	0	0
Window 1		External Wall	East	0	0
Window 2		External Wall	North	0	0
Window 3		External Wall	South	0	0
Window 4		External Wall	South	0	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
External Wall	48.2	12.5	35.7	0.17	0	False	N/A
Semi Exposed Wall	13.4	0	13.4	0.3	0.4	False	N/A
Internal Elements							
Party Elements							

Thermal bridges:

SAP Input

Thermal bridges:	User-defined y-value y =0.08 Reference: Enhanced

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Balanced with heat recovery Number of wet rooms: Kitchen + 2 Ductwork: Insulation, Rigid Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of sides sheltered:	1.5
Pressure test:	4

Main heating system:

Main heating system:	Community heating schemes Heat source: Community heat pump heat from electric heat pump, heat fraction 1, efficiency 300 Piping>=1991, pre-insulated, low temp, variable flow

Main heating Control:

Main heating Control:	Charging system linked to use of community heating, programmer and TRVs Control code: 2306

Secondary heating system:

Secondary heating system:	None

Water heating:

Water heating:	From main heating system Water code: 901 Fuel :heat from electric heat pump Hot water cylinder Cylinder volume: 260 litres Cylinder insulation: Factory 80 mm Primary pipework insulation: True Cylinderstat: True Cylinder in heated space: True Solar panel: False

Others:

Electricity tariff:	standard tariff
In Smoke Control Area:	Yes
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

SAP Input

Property Details: Flat 6

Address:	Flat 6, 51-53, Agar Grove, LONDON, NW1 9UE
Located in:	England
Region:	Thames valley
UPRN:	
Date of assessment:	04 June 2014
Date of certificate:	09 June 2014
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Medium
Dwelling designed to use less than 125 litres per Person per day:	True

Property description:

Dwelling type:	Maisonette
Detachment:	
Year Completed:	2014

Floor Location:	Floor area:	Storey height:
Floor 0	70 m²	2.7 m
Floor 1	45 m²	4 m

Living area:	33.5 m² (fraction 0.291)
Front of dwelling faces:	North

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Entrance Door	Manufacturer	Solid			Wood
Window 1	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Window 2	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Window 3	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Window 4	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Window 5	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Window 6	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Window 7	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Window 8	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Window 9	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Rofflight 1	Manufacturer	Roof Windows	low-E, En = 0.15, hard coat	Yes	Wood
Rofflight 2	Manufacturer	Roof Windows	low-E, En = 0.15, hard coat	Yes	Wood
Rofflight 3	Manufacturer	Roof Windows	low-E, En = 0.15, hard coat	Yes	Wood
Rofflight 4	Manufacturer	Roof Windows	low-E, En = 0.15, hard coat	Yes	Wood

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Entrance Door	mm	0	0	2	1.9	1
Window 1	12mm	0.7	0.63	1.38	2.3	1
Window 2	12mm	0.7	0.63	1.38	5.2	1
Window 3	12mm	0.7	0.63	1.38	2.3	1
Window 4	12mm	0.7	0.63	1.38	2.5	1
Window 5	12mm	0.7	0.63	1.38	2.5	1
Window 6	12mm	0.7	0.63	1.38	7.1	1
Window 7	12mm	0.7	0.63	1.38	1.5	1
Window 8	12mm	0.7	0.63	1.38	2.4	1
Window 9	12mm	0.7	0.63	1.38	2.4	1
Rofflight 1	12mm	0.7	0.63	1.4	0.6	1
Rofflight 2	12mm	0.7	0.63	1.4	0.6	1
Rofflight 3	12mm	0.7	0.63	1.4	0.6	1
Rofflight 4	12mm	0.7	0.63	1.4	0.6	1

SAP Input

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Entrance Door		External Wall	North	0	0
Window 1		External Wall	West	0	0
Window 2		External Wall	West	0	0
Window 3		External Wall	South	0	0
Window 4		External Wall	South	0	0
Window 5		External Wall	South	0	0
Window 6		External Wall	West	0	0
Window 7		External Wall	West	0	0
Window 8		External Wall	South	0	0
Window 9		External Wall	South	0	0
Rofflight 1		Roof	North	0	0
Rofflight 2		Roof	North	0	0
Rofflight 3		Roof	South	0	0
Rofflight 4		Roof	South	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
External Wall	140.2	30.1	110.1	0.17	0	False	N/A
Semi Exposed Wall	12	0	12	0.3	0.4	False	N/A
Exposed Ceiling	21.2	0	21.2	0.18	0		N/A
Roof	47	2.4	44.6	0.18	0		N/A
Internal Elements							
Party Elements							

Thermal bridges:

Thermal bridges: User-defined y-value
y =0.08
Reference: Enhanced

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, Rigid
Approved Installation Scheme: False
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of sides sheltered: 1.5
Pressure test: 4

Main heating system:

Main heating system: Community heating schemes
Heat source: Community heat pump
heat from electric heat pump, heat fraction 1, efficiency 300
Piping>=1991, pre-insulated, low temp, variable flow

Main heating Control:

Main heating Control: Charging system linked to use of community heating, programmer and TRVs
Control code: 2306

Secondary heating system:

Secondary heating system: None

SAP Input

Water heating:

Water heating:	From main heating system Water code: 901 Fuel :heat from electric heat pump Hot water cylinder Cylinder volume: 260 litres Cylinder insulation: Factory 80 mm Primary pipework insulation: True Cylinderstat: True Cylinder in heated space: True Solar panel: False

Others:

Electricity tariff:	standard tariff
In Smoke Control Area:	Yes
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

SAP Input

Property Details: Flat 7

Address:	Flat 7, 51-53, Agar Grove, LONDON, NW1 9UE
Located in:	England
Region:	Thames valley
UPRN:	
Date of assessment:	04 June 2014
Date of certificate:	09 June 2014
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Medium
Dwelling designed to use less than 125 litres per Person per day:	True

Property description:

Dwelling type:	Maisonette
Detachment:	
Year Completed:	2014

Floor Location:	Floor area:	Storey height:
Floor 0	51 m²	2.7 m
Floor 1	45 m²	4 m

Living area:	28.7 m² (fraction 0.299)
Front of dwelling faces:	North

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Entrance Door	Manufacturer	Solid			Wood
Window 1	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Window 2	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Window 3	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Window 4	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Window 5	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Window 6	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Window 7	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Window 8	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Window 9	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Window 10	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Rofflight 1	Manufacturer	Roof Windows	low-E, En = 0.15, hard coat	Yes	Wood
Rofflight 2	Manufacturer	Roof Windows	low-E, En = 0.15, hard coat	Yes	Wood
Rofflight 3	Manufacturer	Roof Windows	low-E, En = 0.15, hard coat	Yes	Wood
Rofflight 4	Manufacturer	Roof Windows	low-E, En = 0.15, hard coat	Yes	Wood

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Entrance Door	mm	0	0	2	1.9	1
Window 1	12mm	0.7	0.63	1.38	2.3	1
Window 2	12mm	0.7	0.63	1.38	2.3	1
Window 3	12mm	0.7	0.63	1.38	2.5	1
Window 4	12mm	0.7	0.63	1.38	2.5	1
Window 5	12mm	0.7	0.63	1.38	2.5	1
Window 6	12mm	0.7	0.63	1.38	2.2	1
Window 7	12mm	0.7	0.63	1.38	3.6	1
Window 8	12mm	0.7	0.63	1.38	1.1	1
Window 9	12mm	0.7	0.63	1.38	2.4	1
Window 10	12mm	0.7	0.63	1.38	2.4	1
Rofflight 1	12mm	0.7	0.63	1.4	0.6	1
Rofflight 2	12mm	0.7	0.63	1.4	0.6	1

SAP Input

Rofflight 3	12mm	0.7	0.63	1.4	0.6	1
Rofflight 4	12mm	0.7	0.63	1.4	0.6	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Entrance Door		External Wall	North	0	0
Window 1		External Wall	East	0	0
Window 2		External Wall	East	0	0
Window 3		External Wall	East	0	0
Window 4		External Wall	South	0	0
Window 5		External Wall	South	0	0
Window 6		External Wall	North	0	0
Window 7		External Wall	North	0	0
Window 8		External Wall	East	0	0
Window 9		External Wall	South	0	0
Window 10		External Wall	South	0	0
Rofflight 1		Roof	North	0	0
Rofflight 2		Roof	North	0	0
Rofflight 3		Roof	South	0	0
Rofflight 4		Roof	South	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
External Wall	124.2	25.7	98.5	0.17	0	False	N/A
Semi Exposed Wall	11	0	11	0.3	0.4	False	N/A
Exposed Ceiling	6	0	6	0.18	0		N/A
Roof	47	2.4	44.6	0.18	0		N/A
Internal Elements							
Party Elements							

Thermal bridges:

Thermal bridges: User-defined y-value
y =0.08
Reference: Enhanced

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, Rigid
Approved Installation Scheme: False
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of sides sheltered: 1.5
Pressure test: 4

Main heating system:

Main heating system: Community heating schemes
Heat source: Community heat pump
heat from electric heat pump, heat fraction 1, efficiency 300
Piping>=1991, pre-insulated, low temp, variable flow

Main heating Control:

Main heating Control: Charging system linked to use of community heating, programmer and TRVs
Control code: 2306

SAP Input

Secondary heating system:	
Secondary heating system:	None
Water heating:	
Water heating:	From main heating system Water code: 901 Fuel :heat from electric heat pump Hot water cylinder Cylinder volume: 260 litres Cylinder insulation: Factory 80 mm Primary pipework insulation: True Cylinderstat: True Cylinder in heated space: True Solar panel: False
Others:	
Electricity tariff:	standard tariff
In Smoke Control Area:	Yes
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

SAP Input

Property Details: Mews 1

Address:	Mews 1, 51-53, Agar Grove, LONDON, NW1 9UE
Located in:	England
Region:	Thames valley
UPRN:	
Date of assessment:	04 June 2014
Date of certificate:	09 June 2014
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Medium
Dwelling designed to use less than 125 litres per Person per day:	True

Property description:

Dwelling type:	House
Detachment:	Detached
Year Completed:	2014

Floor Location:	Floor area:	Storey height:
Floor 0	43.4 m²	2.4 m
Floor 1	41.2 m²	2.8 m
Floor 2	41.2 m²	2.8 m
Floor 3	28.7 m²	2.7 m

Living area:	38 m² (fraction 0.246)
Front of dwelling faces:	North

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Entrance Door	Manufacturer	Solid			Wood
Window 1	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Window 2	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Window 3	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Window 4	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Window 5	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Window 6	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Window 7	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Window 8	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Window 9	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Window 10	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Window 11	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Window 12	Manufacturer	Windows	low-E, En = 0.15, hard coat	Yes	Wood
Basement Rooflight	Manufacturer	Roof Windows	low-E, En = 0.15, hard coat	Yes	Wood

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
Entrance Door	mm	0	0	2	2.1	1
Window 1	12mm	0.7	0.63	1.38	7.7	1
Window 2	12mm	0.7	0.63	1.38	1.6	1
Window 3	12mm	0.7	0.63	1.38	8.8	1
Window 4	12mm	0.7	0.63	1.38	8.8	1
Window 5	12mm	0.7	0.63	1.38	3.3	1
Window 6	12mm	0.7	0.63	1.38	1.7	1
Window 7	12mm	0.7	0.63	1.38	3.3	1
Window 8	12mm	0.7	0.63	1.38	1.7	1
Window 9	12mm	0.7	0.63	1.38	3.3	1
Window 10	12mm	0.7	0.63	1.38	1.7	1
Window 11	12mm	0.7	0.63	1.38	1.4	1

SAP Input

Window 12	12mm	0.7	0.63	1.38	0.7	1
Basement Rooflight	12mm	0.7	0.63	1.4	3.3	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Entrance Door		External Wall	North	0	0
Window 1		External Wall	East	0	0
Window 2		External Wall	East	0	0
Window 3		External Wall	East	0	0
Window 4		External Wall	West	0	0
Window 5		External Wall	West	0	0
Window 6		External Wall	West	0	0
Window 7		External Wall	East	0	0
Window 8		External Wall	East	0	0
Window 9		External Wall	West	0	0
Window 10		External Wall	West	0	0
Window 11		External Wall	East	0	0
Window 12		External Wall	East	0	0
Basement Rooflight		Roof	East	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
External Wall	215.2	46.1	169.1	0.17	0	False	N/A
Exposed Ceiling	13.5	0	13.5	0.18	0		N/A
Roof	28.7	3.3	25.4	0.18	0		N/A
Basement Floor	43.4			0.25			N/A
Internal Elements							
Party Elements							

Thermal bridges:

Thermal bridges: User-defined y-value
y =0.08
Reference: Enhanced

Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 3
Ductwork: Insulation, Rigid
Approved Installation Scheme: False
Number of chimneys: 0
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Number of fans: 0
Number of sides sheltered: 1.5
Pressure test: 4

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Others:	
Electricity tariff:	standard tariff
In Smoke Control Area:	Yes
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No