BRUKL Output Document

HM Government

Compliance with England and Wales Building Regulations Part L 2010

Project name

Retail Unit Camden

As designed

Date: Fri Apr 12 11:35:54 2013

Administrative information

Building Details

Address: Retail Unit, Camden, London,

Certification tool

Calculation engine: SBEM

Calculation engine version: v4.1.e.5

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v3.0.0

BRUKL compliance check version: v4.1.e.5

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Glenn Shewan

Telephone number: 01476 870 504

Address: , , NG32 1QJ

Criterion 1: The calculated CO_2 emission rate for the building should not exceed the target

1.1	CO_2 emission rate from the notional building, $kgCO_2/m^2$.annum	44.2
1.2	Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	44.2
1.3	Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	35.6
1.4	Are emissions from the building less than or equal to the target?	BER =< TER
1.5	Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

2.a Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	grd floor - retail_W_6
Floor	0.25	0.14	0.17	grd floor - wc 2_S_3
Roof	0.25	0.13	0.13	grd floor - retail_R_5
Windows***, roof windows, and rooflights	2.2	1.5	1.5	grd floor - retail_G_7
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	5

2.b Building services

The building services parameters listed below are expected to be checked by the BCO against guidance. No automatic checking is performed by the tool.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- split system air con

Heating seasonal efficiency	Cooling nominal efficiency	SFP [W/(l/s)]	HR seasonal efficiency
3.95	6.01	-	-
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			NO

1- HWS1

Heating seasonal efficiency	Hot water storage loss factor [kWh/litre per day]
1	-

Local mechanical ventilation and exhaust

Zone	Supply/extract SFP [W/(l/s)]	HR seasonal efficiency	Exhaust SFP [W/(l/s)]
grd floor - wc 1	-	-	0.5
grd floor - wc 2	-	-	0.5
grd floor - tea	-	-	0.5

General lighting and display lighting

Zone	General lighting [W]	Display lamps efficacy [lm/W]
grd floor - retail	810	50
grd floor - wc 1	10	-
grd floor - wc 2	20	-
grd floor - tea	20	50

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
grd floor - retail	NO (-52%)	NO
grd floor - tea	N/A	N/A

Criterion 4: The performance of the building, as built, should be consistent with the BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	216.1	216.1
External area [m^2]	453.4	453.4
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	5	5
Average conductance [W/K]	110.5	190.06
Average U-value [W/m^{2}K]	0.24	0.42
Alpha value* [%]	23.86	16.41

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
100	**A1/A2 Retail/Financial and Professional services**
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others - Stand alone utility block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	3.31	7.71
Cooling	12.73	16.05
Auxiliary	0.84	0.68
Lighting	47.1	59.9
Hot water	4.89	5.84
Equipment*	21.3	21.3
TOTAL**	**68.88**	**90.18**

* Energy used by equipment does not count towards the total for calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Indicative Target
Heating + cooling demand [MJ/m^2]	239.45	275.49
Primary energy* [kWh/m^2]	201.12	246.3
Total emissions [kg/m^2]	35.6	44.2

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	43.9	195.6	3.3	12.7	0.8	3.68	4.27	3.95	6.01
	Notional	67.5	208	7.7	16	0.7	2.43	3.6	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.2	grd floor - retail_W_6
Floor	0.2	0.13	grd floor - retail_S_3
Roof	0.15	0.13	grd floor - retail_R_5
Windows, roof windows, and rooflights	1.5	1.5	grd floor - retail_G_7
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)]

$U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
$m^3/(h.m^2)$ at 50 Pa	5	5

BRUKL Output Document

HM Government

Compliance with England and Wales Building Regulations Part L 2010

Project name

Retail Unit Camden

As designed

Date: Fri Apr 12 11:38:58 2013

Administrative information

Building Details

Address: Retail Unit, Camden, London,

Certification tool

Calculation engine: SBEM

Calculation engine version: v4.1.e.5

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v3.0.0

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Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	5

2.b Building services

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Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- split system air con

Heating seasonal efficiency	Cooling nominal efficiency	SFP [W/(l/s)]	HR seasonal efficiency
3.95	6.01	-	-
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			NO

1- HWS1

Heating seasonal efficiency	Hot water storage loss factor [kWh/litre per day]
1	-

Local mechanical ventilation and exhaust

Zone	Supply/extract SFP [W/(l/s)]	HR seasonal efficiency	Exhaust SFP [W/(l/s)]
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Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	15.7	0
Wind turbines	0	0
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Energy & CO_2 Emissions Summary

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Air Permeability	Typical value	This building
$m^3/(h.m^2)$ at 50 Pa	5	5

SBEM Main Calculation Output Document

Fri Apr 12 11:35:54 2013 v4.1.e.5

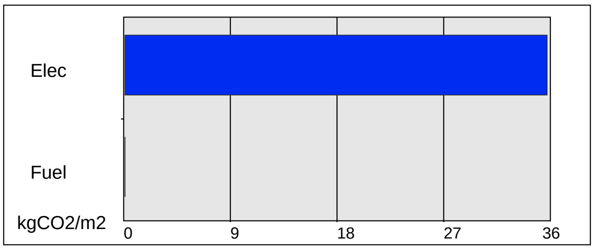
Building name

Retail Unit Camden

Building type: A1/A2 Retail and Financial/Professional services

SBEM is an energy calculation tool for the purpose of assessing and demonstrating compliance with Building Regulations (Part L for England and Wales, Section 6 for Scotland, Part F for Northern Ireland, Part L for Republic of Ireland and Building Bye-laws Jersey Part 11) and to produce Energy Performance Certificates and Building Energy Ratings. Although the data produced by the tool may be of use in the design process, **SBEM is not intended as a building design tool.**

Building Energy Performance and CO2 emissions

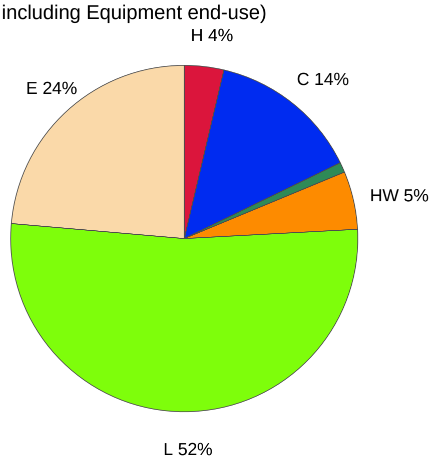


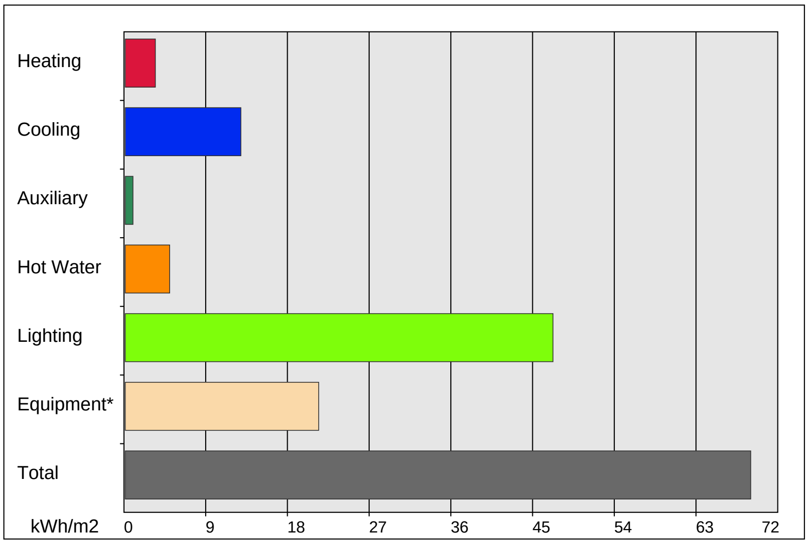
0 kgCO2/m2 displaced by the use of renewable sources.

Building area is 216.09 m2

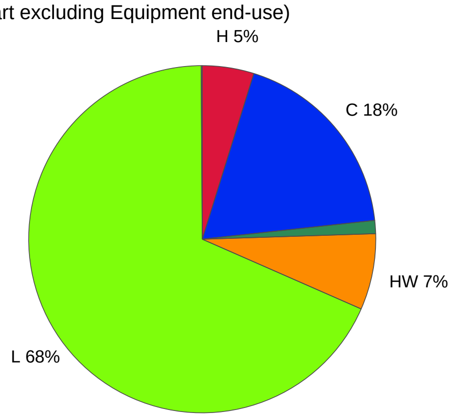
Annual Energy Consumption

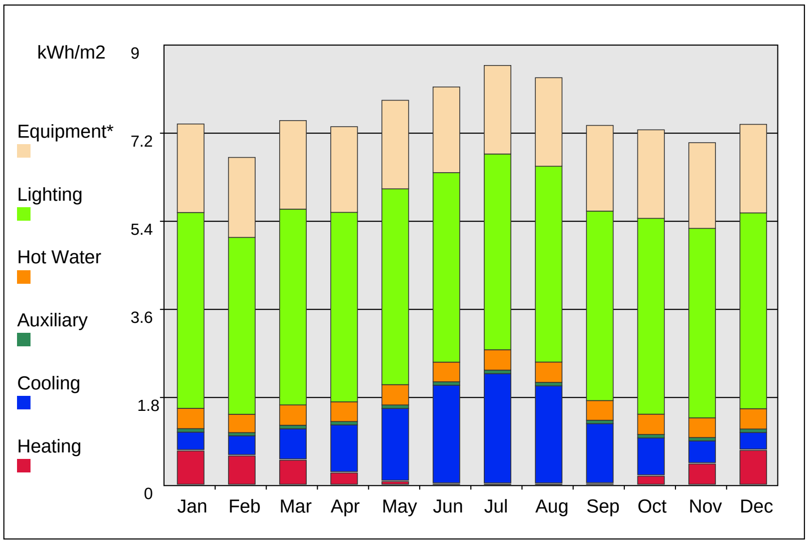
(Pie chart including Equipment end-use)





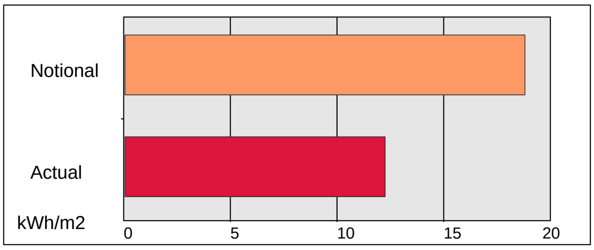
(Pie chart excluding Equipment end-use)

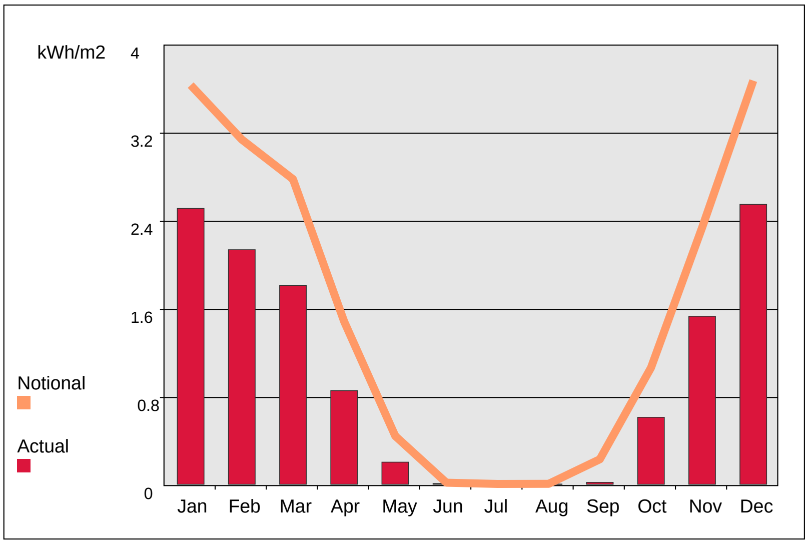




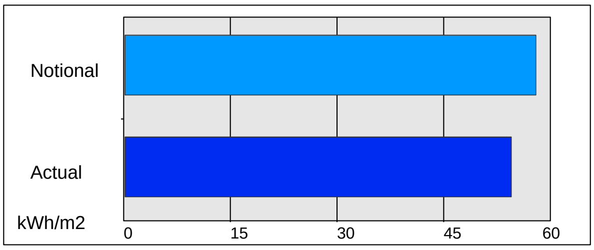
(*) Although energy consumption by equipment is shown in the graphs, the CO2 emissions associated with this end-use have not been taken into account when producing the rating.

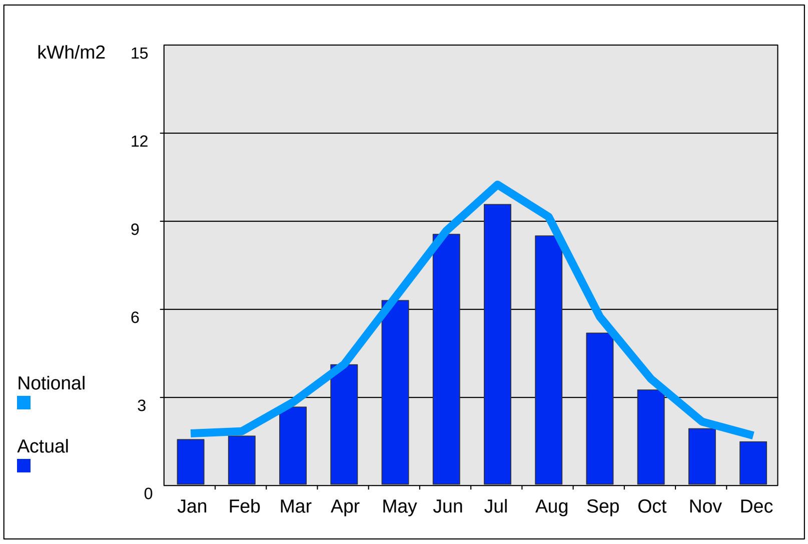
Annual Heating Demand





Annual Cooling Demand





SBEM Main Calculation Output Document

Fri Apr 12 11:38:57 2013 v4.1.e.5

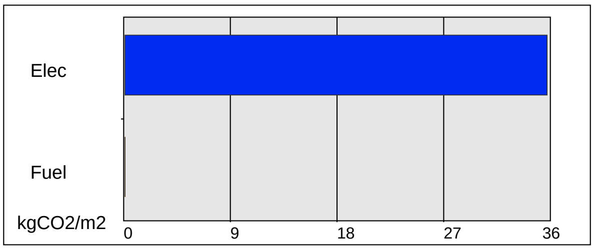
Building name

Retail Unit Camden

Building type: A1/A2 Retail and Financial/Professional services

SBEM is an energy calculation tool for the purpose of assessing and demonstrating compliance with Building Regulations (Part L for England and Wales, Section 6 for Scotland, Part F for Northern Ireland, Part L for Republic of Ireland and Building Bye-laws Jersey Part 11) and to produce Energy Performance Certificates and Building Energy Ratings. Although the data produced by the tool may be of use in the design process, **SBEM is not intended as a building design tool.**

Building Energy Performance and CO2 emissions

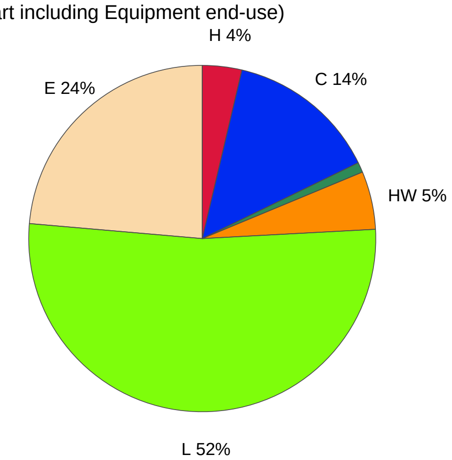


8 kgCO2/m2 displaced by the use of renewable sources.

Building area is 216.09 m2

Annual Energy Consumption

(Pie chart including Equipment end-use)



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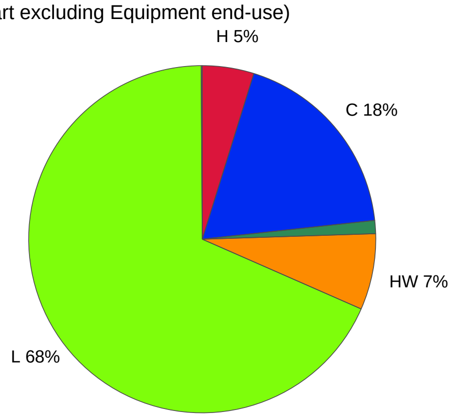

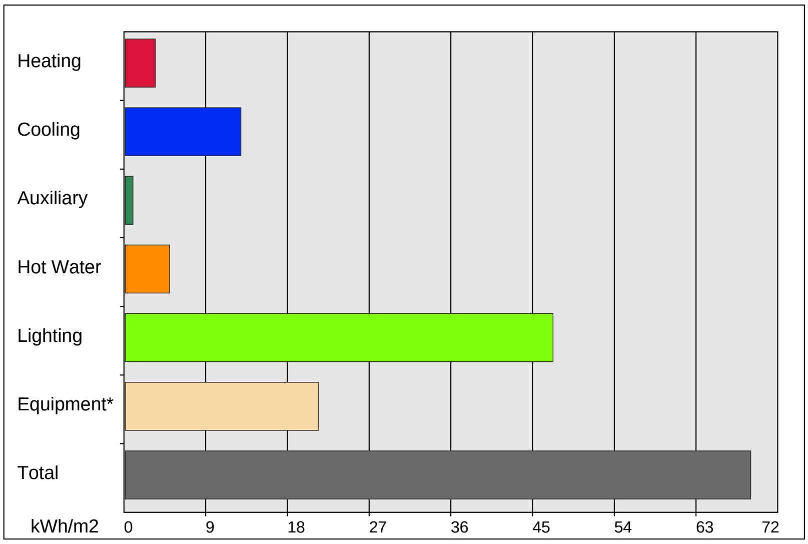

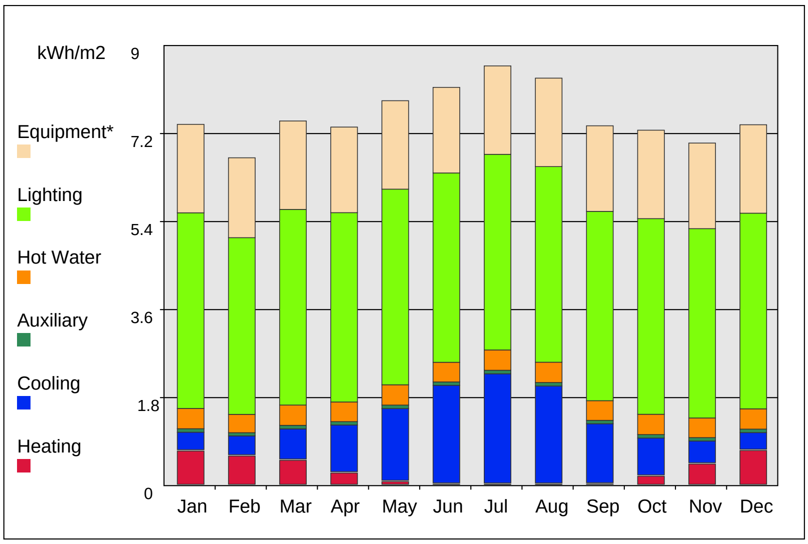

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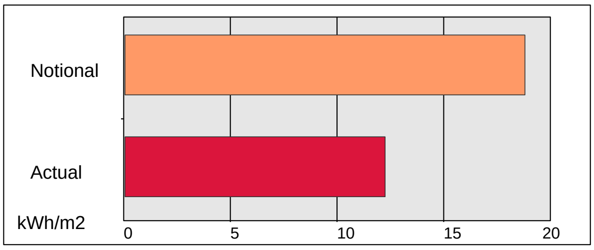
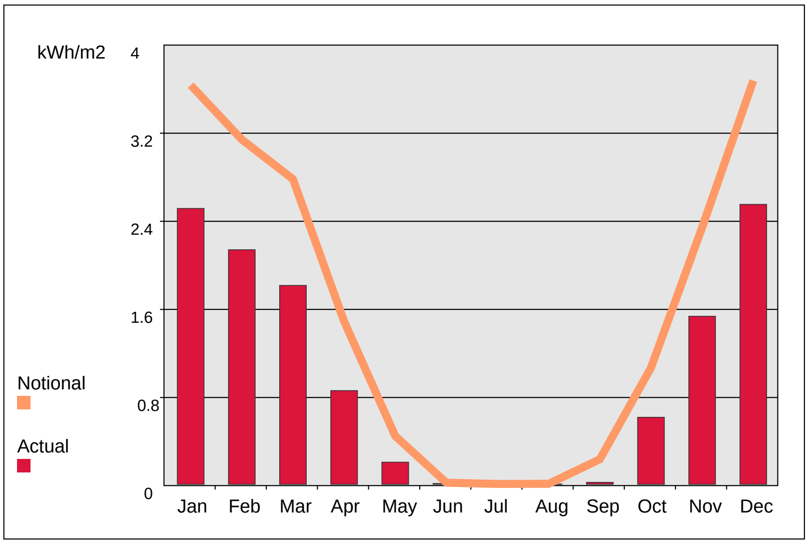
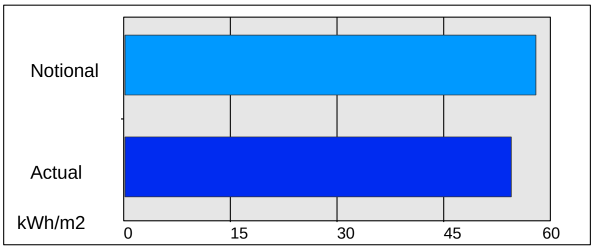
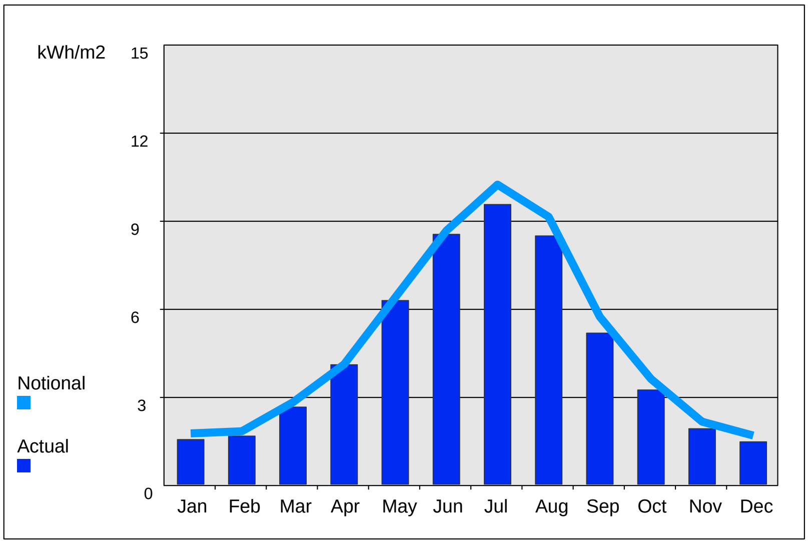




Annual Cooling Demand





BREEAM®

BREEAM 2011 New Construction Assessment Report: Rating & Key Performance Indicators

This assessment and indicative BREEAM rating is not a formal certified BREEAM assessment or rating and must not be communicated as such. The score presented is indicative of a buildings potential performance and is based on a simplified pre-formal BREEAM assessment and unverified commitments given at an early stage in the design process.

Overall Indicative Building Performance

Building name	Finchley Bell Retail Unit
Indicative building score (%)	70.18%
Indicative BREEAM rating	Pre-Assessment result indicates potential for BREEAM Excellent rating
Indicative minimum standards level achieved	Pre-Assessment result indicates the minimum standards for Excellent level

Summary of Indicative Building Performance by Environmental Section and Assessment Issue

Management	Indicative no. credits available	Indicative no. credits Achieved	Indicative contribution to score	Minimum standards level achieved
Man01 Sustainable Procurement	8.0	5.0	2.73%	Pre-Assessment result indicates the minimum standards for Outstanding level
Man02 Responsible Construction Practices	2.0	2.0	1.09%	Pre-Assessment result indicates the minimum standards for Outstanding level
Man03 Construction Site Impacts	5.0	2.0	1.09%	N/A
Man04 Stakeholder Participation	4.0	1.0	0.55%	Pre-Assessment result indicates the minimum standards for Outstanding level
Man05 Life cycle cost and service life planning	3.0	3.0	1.64%	N/A
Total indicative environmental section performance	**22.0**	**13.0**	**7.09%**	
Health & Wellbeing				
Hea01 Visual Comfort	4.0	4.0	4.00%	Pre-Assessment result indicates the minimum standards for Outstanding level
Hea02 Indoor Air Quality	4.0	4.0	4.00%	N/A
Hea03 Thermal Comfort	2.0	0.0	0.00%	N/A
Hea04 Water Quality	1.0	1.0	1.00%	Pre-Assessment result indicates the minimum standards for Outstanding level
Hea05 Acoustic Performance	2.0	0.0	0.00%	N/A
Hea06 Safety and Security	2.0	0.0	0.00%	N/A
Total indicative environmental section performance	**15.0**	**9.0**	**9.00%**	
Energy				
Ene01 Reduction of CO2 Emissions	15.0	12.0	9.12%	Pre-Assessment result indicates the minimum standards for Excellent level
Ene02 Energy Monitoring	2.0	1.0	0.76%	Pre-Assessment result indicates the minimum standards for Outstanding level
Ene03 External Lighting	1.0	1.0	0.76%	N/A
Ene04 Low and Zero Carbon Technology	5.0	4.0	3.04%	Pre-Assessment result indicates the minimum standards for Outstanding level
Ene05 Energy Efficient Cold Storage	N/A	N/A	N/A	N/A
Ene06 Energy Efficient Transportation Systems	N/A	N/A	N/A	N/A
Ene07 Energy Efficient Laboratory Systems	N/A	N/A	N/A	N/A
Ene08 Energy Efficient Equipment	2.0	2.0	1.52%	N/A
Ene09 Drying Space	N/A	N/A	N/A	N/A
Total indicative environmental section performance	**25.0**	**20.00**	**15.20%**	
Transport				
Tra01 Public Transport Accessibility	5.0	5.0	4.44%	N/A
Tra02 Proximity to Amenities	1.0	1.0	0.89%	N/A
Tra03 Cyclist facilities	2.0	1.0	0.89%	N/A
Tra04 Maximum Car Parking Capacity	N/A	N/A	N/A	N/A
Tra05 Travel Plan	1.0	1.0	0.89%	N/A
Total indicative environmental section performance	**9.0**	**8.0**	**7.11%**	
Water				
Wat01 Water Consumption	5.0	4.0	3.00%	Pre-Assessment result indicates the minimum standards for Outstanding level
Wat02 Water Monitoring	1.0	1.0	0.75%	Pre-Assessment result indicates the minimum standards for Outstanding level
Wat03 Water Leak Detection and Prevention	2.0	1.0	0.75%	N/A
Wat04 Water Efficient Equipment	N/A	N/A	N/A	N/A
Total indicative environmental section performance	**8.0**	**6.0**	**4.50%**	
Materials				
Mat01 Life Cycle Impacts	5.0	3.0	3.13%	N/A
Mat02 Hard Landscaping and Boundary Protection	1.0	1.0	1.04%	N/A
Mat03 Responsible Sourcing	3.0	2.0	2.08%	Pre-Assessment result indicates the minimum standards for Outstanding level
Mat04 Insulation	2.0	2.0	2.08%	N/A
Mat05 Designing for Robustness	1.0	0.0	0.00%	N/A
Total indicative environmental section performance	**12.0**	**8.00**	**8.33%**	
Waste				
Wst01 Construction Waste Management	4.0	3.0	3.75%	Pre-Assessment result indicates the minimum standards for Outstanding level
Wst02 Recycled Aggregates	1.0	1.0	1.25%	N/A
Wst03 Operational Waste	1.0	1.0	1.25%	Pre-Assessment result indicates the minimum standards for Outstanding level
Wst04 Speculative Floor and Ceiling Finishes	N/A	N/A	N/A	N/A
Total indicative environmental section performance	**6.0**	**5.00**	**6.25%**	
Land Use and Ecology				
LE01 Site Selection	2.0	1.0	1.00%	N/A
LE02 Ecological Value of Site and Protection of Ecological Features	1.0	1.0	1.00%	N/A
LE03 Mitigating Ecological Impact	2.0	2.0	2.00%	Pre-Assessment result indicates the minimum standards for Outstanding level
LE04 Enhancing Site Ecology	3.0	0.0	0.00%	N/A
LE05 Long Term Impact on Biodiversity	2.0	0.0	0.00%	N/A
Total indicative environmental section performance	**10.0**	**4.00**	**4.00%**	
Pollution				
Pol01 Impact of Refrigerants	3.0	3.0	2.31%	N/A
Pol02 NOx Emissions	3.0	3.0	2.31%	N/A
Pol03 Surface Water Run off	5.0	2.0	1.54%	N/A
Pol04 Reduction of Night Time Light Pollution	1.0	1.0	0.77%	N/A
Pol05 Noise Attenuation	1.0	1.0	0.77%	N/A
Total indicative environmental section performance	**13.0**	**10.00**	**7.69%**	
Innovation				
Inn01 Innovation	10.0	1.0	1.00%	N/A
Total indicative environmental section performance	**10.0**	**1.00**	**1.00%**	

Contents

1 Introduction

This report updates and replaces the original submission and incorporates a re-design and reduction in the number of domestic units, and a reduction in the size of the Retail Unit. Figures within the various tables have been recalculated to reflect these changes. This report explores and analyses the opportunities, technologies and methods which could be used to develop a low energy and sustainable environmental strategy for a proposed small residential development on the site of a redundant public house and bar at Finchley Road, in the London Borough of Camden.

Camden planning policy is informed by The London Plan – the Mayor of London's Spatial Development Strategy for Greater London, the latest issue of which was published by the Greater London Authority (GLA) on July 22nd 2011. The policies included in this document are taken into account by local authorities when producing their Local Development Frameworks and planning officers will consider these policies when taking relevant planning decisions, such as determining planning applications.

Planning policy for London is led by the government's strategy in mitigating the effects of climate change and a key factor in this strategy is the management of the energy consumed by buildings, together with their environmental impact. It is incumbent upon designers and developers to ensure that any building project considers the long term consequences of energy performance and the effects of building development on the environment.

The first part of this report takes the form of an Energy Statement; the second part examines the Code for Sustainable Homes and BREEAM; the final section details Air and Noise Pollution issues. The report addresses the following requirements:

- To minimise carbon dioxide emissions in accordance with the Energy Hierarchy:
    1. Be lean – use less energy
    2. Be clean – supply energy efficiently
    3. Be green – use renewable energy

  The development will incorporate low energy design and construction, including the use of renewable energy technology as set out in The London Plan; this will be illustrated by means of an Energy Statement, with modelling of the energy performance of the development being provided by the output from the government's Standard Assessment Procedure (SAP) methodology.

- Environmental impact; this will be in the form of a Code for Sustainable Homes Pre-Assessment exercise and a similar BREEAM Pre-Assessment to illustrate the strategies taken towards achieving the required performance.

- Air and Noise pollution issues.

2 Description of the Proposed Development

The proposed development is on the site of The Finchley Bell public house and 3one7 bar, situated at number 317 Finchley Road, Camden, London NW3 6EP. The public house is to be demolished and the proposed new build will contain:

- A six storey mixed use building, with basement storage and plant areas.
- The first to fifth floors will house nine one and two bedroom flats.
- The ground floor will comprise a small retail unit to the front, facing Finchley Road. To the side and rear are amenities (bin and cycle stores), services, and access stairs and a lift to the upper floors. A sub-basement is to be used for additional bin and cycle storage.

The development site covers the existing building and a very small part of the open space to the rear, an area of approximately $300m^2$, with a 21 metre facing to Finchley Road. The existing surrounding development comprises mostly dense urban buildings, including residential flats and commercial buildings. The Finchley Road and Frognal railway station bounds the site to the north.

The proposed site layout and floor plans, together with an aerial photograph, are included in Appendix A.

3 Executive Summary

In following The London Plan Policy 5.2 - Minimising Carbon Dioxide Emissions - Camden Council requires that development proposals use the three step energy hierarchy referred to in the Introduction to this report.

Guidance contained in the Camden Planning Guidance SPD has been followed in the assessment of the development proposal and the resulting Baseline consumption and emissions figures, together with reductions resulting from Energy Efficiency and Renewables, are illustrated in Table 1. Total energy efficiency savings are summarised in Table 2. Reductions in energy demand and carbon dioxide emissions are summarised in Table 3. These tables are on the following page.

	kWh/Year	Kg/CO^2/Year	Savings %
Baseline Consumption and CO2 Emissions	**104614.30**	**42153.66**	**-**
With Energy Efficient Design	**89945.10**	**32978.32**	**21.76**
With Efficient Energy Supply	**89945.10**	**32978.32**	**-**
With Renewables	**77160.40**	**26368.63**	**20.04**

Table 1: Carbon Dioxide Emissions Reductions

	Amount	Savings %
Reduction in Energy Demand (kWh)	**27453.90**	**26.24**
Reduction in CO2 Emissions	**15785.03**	**37.45**

Table 2: Energy Efficiency Savings Summary (Annual Figures)

	Baseline Scheme		Proposed Scheme		Change	Change
	kWh	Kg/CO2	kWh	Kg/CO2	kWh	Kg/CO2
Electricity	**50602.63**	**24833.64**	**34767.62**	**17245.07**	**-15835.01**	**-7588.57**
Heating	**51583.79**	**16295.45**	**40450.48**	**8119.39**	**-11133.31**	**-8176.06**
Cooling	**2427.88**	**1024.57**	**1942.30**	**1004.17**	**-485.58**	**-20.40**
Total	**104614.30**	**42153.66**	**77160.40**	**26368.63**	**-27453.90**	**-15785.03**

Table 3: Energy Efficiency Savings Against The Notional Baseline Scheme (Annual Figures)

3.1 Key Energy Efficiency Design Measures

The development needs to achieve not only a reduction in carbon emissions to meet the requirements of the council, but also to achieve a Code for Sustainable Homes Level 4 rating for the flats, and a BREEAM rating of Excellent; in order to achieve these ratings it is necessary to design the development with a focus on significantly reducing energy demand and carbon emissions.

In order to achieve the design efficiencies, some significant improvements have been made against the Baseline (Building Regulations Target) specification and these are, briefly:

1 - Flats

- Reduced U-Values of the fabric, windows and doors.
- A very airtight construction.
- Mechanical Ventilation with Heat Recovery (MVHR) – this technology is necessary when buildings are designed with very airtight envelopes, but also significantly reduces carbon dioxide emissions.
- Highly efficient gas condensing combi boilers with excellent heating and hot water controls.
- Reduced water usage through efficient water fittings, which in turn reduce the hot water requirement.
- The use of Accredited Construction Details to reduce heat loss through thermal (cold) bridging.
- Dedicated low energy light fittings throughout.

2 - Retail Unit

- Reduced U-Values of the fabric, windows and doors.
- An airtight construction.
- The main requirement for this unit is cooling, rather than heating, therefore an efficient Air Source Heat Pump unit has been introduced; this provides both heating and cooling as required.
- Instant hot water heating is used as the requirement for hot water is low and intermittent.
- Reduced water usage through efficient water fittings, which in turn reduce the hot water requirement.
- The use of Accredited Construction Details to reduce heat loss through thermal (cold) bridging.
- Dedicated low energy light fittings throughout.

The design improvements result in a reduction of **21.76%** in the emission rates against the Baseline development target rate, as shown in Table 1 on page 6. The main reason for this significant reduction is the use of Mechanical Ventilation with Heat Recovery (MVHR) in the flats, and an Air Source Heat Pump (ASHP) in the retail unit.

3.2 Efficient Supply of Energy

The site and development constraints are such that it is not viable to connect to an existing decentralised energy network, or to use a Combined Heat and Power (CHP) system. However, the design improvements included at step 1 of the Energy Hierarchy include the installation of mechanical ventilation with heat recovery (MVHR) units; these, together with the use of renewable energy technologies, have resulted in a significant reduction in carbon dioxide emissions.

3.3 Renewable Energy

The development will make use of two renewable energy technologies:

1) The domestic units will be connected to photovoltaic panels situated on the roof of the building. To achieve the required emission reductions, the total array area will amount to approximately $55m^2$ of panels. An additional array will feed the common areas.

2) The retail unit will be fitted with an Air Source Heat Pump (ASHP), which will also provide cooling (the figures for this technology are included in the energy efficient design measures section). Cooling for this unit is a much larger user of energy than heating, so the ASHP will reduce emissions significantly. Additionally, as the ASHP is fuelled by electricity, rather than gas, the retail unit will be connected to a $30m^2$ PV array on the roof of the building, so as to mitigate the use of electricity.

The incorporation of renewable energy technologies result in a further reduction in CO_2 emissions of **20.04%** as illustrated in Table 1 on page 6. The total carbon dioxide emissions reduction is **37.45%** against the Baseline scheme as shown in Table 2 on page 6.

3.4 Code for Sustainable Homes and BREEAM

Pre-Assessment Estimations have been prepared for the flats (Code for Sustainable Homes) and the retail unit (BREEAM) and the results indicate that Level 4 will be achieved for the flats and BREEAM Excellent for the retail unit. The updated BREEAM and CSH estimator tool results can be accessed in the Appendices, from page 26.

The energy demand and emissions figures for the Retail Unit have been amended to take account of the smaller area and are included in the energy tables within this report; the SBEM outputs are for the original, larger retail unit, and are included in the Appendices.

Air quality and noise assessments have been undertaken and the issues and recommendations have fed into the BREEAM assessment.

4 Energy Efficiency and Reducing Carbon Emissions

The London Plan Policy 5.2 requires that new building developments are designed to minimise carbon dioxide emissions in accordance with the three-step Energy Hierarchy:

Step 1: Be Lean – use less energy

Carbon Dioxide emissions should be reduced through the energy efficient design of the site, buildings and services

Step 2: Be Clean – supply energy efficiently

Carbon Dioxide emissions should be further reduced through the use of decentralised energy where feasible; some examples would be district heating and cooling and combined heat and power (CHP)

Step 3: Be Green – use renewable energy

Proposals should be made to further reduce Carbon Dioxide emissions through the use of on-site renewable energy technologies

The following sub-sections will illustrate how the development proposal meets the requirements of the Energy Hierarchy.

4.1 Assessment of the Baseline Energy Demand and Carbon Dioxide Emissions

In order to qualify and quantify the reductions in Carbon Dioxide emissions, it is first necessary to assess the "baseline" energy demand and emissions produced by the development in notional terms, modelled on the requirements of Building Regulations Part L1; in producing the baseline figures, calculations include both regulated demand (i.e. "fixed" consumption covered by the Building Regulations, such as fixed lighting, heating and hot water, ventilation/cooling, etc.) and non-regulated consumption (i.e. "plug-in" sources such as cooking and electrical appliances).

For the assessment of baseline demand, modelling has been undertaken using the following tools:

- Residential Units:

  National Home Energy Rating (NHER) SAP software "NHER Plan Assessor". This assessment will produce the energy demand and carbon emissions rate (TER) based on notional dwellings of the same shape and size as the actual dwellings, enabling a comparison with the emissions of the dwellings as designed; this, later in this report, will be used to illustrate the reductions in energy demand and Carbon Dioxide emissions, and also to quantify the contribution to savings made by renewables.

The unregulated demand and emissions are also calculated using SAP methodology as outlined in the Standard Assessment Procedure for Energy Rating of Dwellings 2009 Edition published by BRE on behalf of the Department for Energy and Climate Change.

- Retail Unit:

The retail unit has been modeled using the Simplified Building Energy Model (SBEM), which is a software tool developed by BRE that provides an analysis of a non residential building's energy consumption. SBEM is used in support of the National Calculation Methodology (NCM) and the Energy Performance of Buildings Directive (EPBD).

The tool is currently used to determine CO_2 emission rates for new buildings in compliance with Part L of the Building Regulations (England and Wales) and equivalent Regulations in Scotland, Northern Ireland, the Republic of Ireland and Jersey. It is also used to generate Energy Performance Certificates for non-domestic buildings on construction and at the point of sale or rent.

The fabric and services standards assumed for the Baseline calculations are shown in Table 4 on page 23.

The results of the baseline assessment are shown in Table 5 on page 24.

Having produced the baseline energy demand and carbon emissions figures it is now necessary to proceed to the three-step Energy Hierarchy; by following this the development will be designed to minimise emissions.

4.2 Designing for Energy Efficiency

- **Step 1 – Be Lean**

The first step of the hierarchy involves the incorporation of energy efficient design techniques to ensure the development is designed to be as energy efficient as is feasible and viable. The techniques to be considered include an integrated, site-wide approach to natural systems (i.e. solar gain, daylight), thermal performance (e.g. insulation, thermal materials, air permeability, thermal bridging), ventilation and heating and control systems.

As with the baseline assessments, modelling for the design demand and emissions has been undertaken with the use of SAP and SBEM.

4.2.1 Sunlight and Daylight

The development is on a narrow, elongated infill site, previously a public house, with dense surrounding building development; it is, therefore, constrained by the shape, orientation and surroundings of the site.

The south-eastern boundary is heavily shaded by tall buildings, reducing the possibilities for the principal living areas to benefit from the sun's heat. Accordingly, the living rooms of all flats have been designed to face north-eastward, towards Finchley Road, where there is the opportunity to maximise the use of daylight. These flats have large widows to the living rooms and bedrooms; they have also been designed with balconies, shaped to enable French doors to maximise daylight.

The retail unit is substantially glazed to the eastern elevation facing Finchley Road, allowing maximum benefit to be gained from natural lighting.

4.2.2 Overheating

As stated in the previous sub-section, the development is bounded on the south elevation by tall buildings, which provide heavy shading. The majority of the window areas are to the east and west, with argon filled, low-e glass double glazed window units, which help to limit heat loss and maximise solar gains in cold weather, whilst preventing overheating in hot weather. All of the flats are provided with balconies, with French doors which are helpful in the control of overheating.

The Thermal Mass of the building materials also has an effect on overheating and this has been included in the calculations. The SAP and SBEM modelling includes an assessment of overheating and the development as designed is shown to have minimal risk of overheating in the summer.

4.2.3 Natural Ventilation

All windows are openable and designed with trickle ventilation to enable the free flow of air through the building. However, as shown later in this report, the building design will include a very good level of airtightness and natural ventilation alone will not be sufficient; main ventilation in the flats will be provided by mechanical ventilation with heat recovery (which also helps reduce heating demand). The retail unit will have a higher permeability, due to the frequency of door openings during business hours, and will be served by an Air Source Heat Pump

4.2.4 Thermal Performance

When considering methods to improve the thermal performance of a building in the first step of the Energy Hierarchy, the designers have taken a "Fabric First" approach. This enables the developer to make the design applicable to the introduction of higher standards, as and when these are introduced through low and zero carbon technologies. Developers should always bear in mind the planned lifespan of the building, and ensure that the fundamental thermal performance of the fabric is sufficient to make the best use of potential changes to heating and renewable energy systems in the future. In terms of this particular assessment, the addition of clean and green energy in steps two and three of the hierarchy will be much enhanced by excellent thermal design of the fabric.

It should be noted that optimising the fabric (and services) performance of the design will provide opportunities for gaining additional credits in the Code for Sustainable Homes and BREEAM assessments, which also form part of Camden planning requirements for this development.

The thermal performance of a building determines the amount of heat retained within, and the heat lost to the outside air; no matter how efficient the heating and control systems (or indeed the clean and renewable energy technologies included), if too much of the generated heat is lost, more will need to be generated and the building will lose energy efficiency, resulting in higher carbon emissions. Ensuring a high thermal performance is one of the most effective ways of ensuring the development is energy efficient.

SAP and SBEM methodologies are used to measure the effectiveness of the thermal performance, and modelling enables the various methods of improving thermal performance to be tested. The modelling has been informed by various guides, but particularly by the Energy Savings Trust (EST), the Zero Carbon Hub, the Concrete Centre, the Aircrete Products Association (APA) and major insulation manufacturers, all of which have published guidance in designing through various revised targets in the Building Regulations, towards the government target of Zero Carbon building development by 2016. The results of the modelling, with comparisons to the baseline model, are shown in Table 4 on page 23. Methods used to enhance thermal performance follow.

4.2.4.1 Improving Fabric U-Values

A high level of insulation has historically been regarded as the most effective component of a high performance design; improving fabric U-values is, therefore, the first consideration (but not the only consideration, as will be seen later) in the improvement of fabric thermal performance.

The specification for the development will include significant reductions in U-values compared to Building Regulations requirements (in the building fabric and the windows and doors), and will also include methods to reduce the effects of thermal bridging, improved airtightness and ventilation strategies and other service improvements.

4.2.4.2 Reducing Thermal Bridging

A thermal bridge, also referred to as a cold bridge, occurs where reduced insulation or gaps in the insulation cause a significantly greater rate of heat loss than there is through adjoining insulated areas. This usually occurs either because a structural element passes through an insulation layer, or because the insulation layer is thinner where two construction elements meet.

The most familiar type of thermal bridge is caused in a cavity wall by steel wall ties, but other causes are where studworks, joists and rafters separates layers of insulation, and mortar joints in blockwork. These are referred to as **repeating** thermal bridges and are taken account of in the U-value calculations.

In recent years increasing importance has been given to the effects of **non-repeating** thermal bridges, and these now play a very important part in the energy/heat loss calculations in SAP. Examples of these are corners (where walls meet), junctions between elements (i.e. where walls meet floors), around openings and at some features such as balconies, where supports may pass through the insulation. These bridges are not included in the elemental U-value calculations, but are considered separately in the form of linear thermal transmittance (psi) values. The psi value represents the extra heat flow (i.e. heat loss) through the bridge over and above that through the adjoining thermal element.

The effect of these bridges can be reduced with the use of approved construction details. The Energy Savings Trust's Enhanced Construction Details (ECDs) and various Accredited Construction Details (ACDs) are examples of useful design approaches. In this development a range of ACDs will be incorporated in the design; although the ACD values are not as effective as ECDs, the nature of the structure of the building is such that EDCs will not be available. The building is more than four storeys high, therefore subject to stringent rules to satisfy Disproportionate Collapse; because of this, neither traditional cavity masonry, nor timber frame walls are likely to be appropriate. A framed (i.e. concrete) construction with infill blockwork and exterior insulation, finished with render (or other cladding), will be used. There are various ACDs suitable for this type of structure.

4.2.4.3 Airtightness

Airtightness forms a significant part of overall energy loss and is crucial to achieving good fabric performance. Poor airtightness causes increased carbon emissions by increasing the heating load, mainly through:

- Infiltration – leakage of cool external air into the building (draughts)
- Exfiltration – leakage of warmed internal air, which is replaced by cool external air

Both of these mechanisms occur via air leakage through gaps and cracks in the building fabric and happen continuously. In order to minimise air leakage it is fundamental to incorporate an airtightness strategy at the design stage – remedial works after construction are expensive, time consuming and may have a very limited effect on airtightness.

The use of approved construction details will assist with good design as the details incorporate airtight barriers. The Energy Savings Trust's Enhanced Construction Details (ECDs) and various Accredited Construction Details (ACDs) are examples of useful design approaches. In this development a range of ACDs will be incorporated in the design; although the ACD values are not as effective as ECDs, the use of framed construction does not allow ECDs.

Whilst designing for airtightness is of the first importance, it is also vital to ensure that site procedures are clearly explained to site staff and managers, and that these procedures are followed carefully. Airtightness testing is undertaken near to completion and this will demonstrate any leakage in excess of the design rates.

The flats will be designed for an airtightness level of no more than $3m^3/m^2/h$ @ 50Pa, compared to a Building Regulations requirement for $10m^3/m^2/h$ @ 50Pa, which is the Baseline figure. The retail unit will be more difficult to keep a low leakage, due to customers entering and leaving through the main doors regularly, and will be designed for $5m^3/m^2/h$ @ 50Pa.

4.2.4.4 Energy Efficient Ventilation

It has been seen previously that the flats will incorporate a very airtight design of $3m^3/m^2/h$ @ 50Pa, against a requirement of 10. However, buildings need to "breath" and it follows that, by reducing air leakage, controlled ventilation will be needed to maintain a comfortable internal environment. At historic airtightness levels of around 12 to $15m^3/m^2/h$ @ 50Pa, intermittent extract fans were sufficient to provide adequate fresh air to occupants. However, by reducing leakage to the planned maximum of $3m^3/m^2/h$ (in practice, the actual figure should be less than 3), some form of continuous ventilation will be necessary, such as positive input ventilation, mechanical extract ventilation, or mechanical ventilation with heat recovery (MVHR).

An airtightness level of below about $8m^3/m^2/h$ @ 50Pa is the point at which the 'Best Practice Recommended' MVHR systems become more efficient than intermittent extract fans. An efficient MVHR system in place of fan extraction would make significant reductions in emissions. Additionally, for airtightness levels below $3m^3/m^2/h$ @ 50Pa, intermittent fans would not be recommended.

The specified MVHR unit will be the ITHO HRU ECO 4 (or similar); this has a Specific Fan Power of 0.46 and a heat exchanger efficiency of 91%, which places it as an Energy Saving Trust "Very Good" system.

4.2.4.5 Efficient Heating and Cooling

The flats will be fitted with highly efficient mains gas condensing combi boilers, with energy efficient controls. Cooling is not an issue in the flats.

The retail unit, on the other hand, will require more energy for cooling than heating, and will be fitted with a highly efficient Air Source heat Pump, which will provide both heating and cooling. The unit used will be the Mitsubishi Mr. Slim (or similar), which has a cooling efficiency of 601% and a heating efficiency of 395%.

4.2.4.6 Other Energy Efficient Features

- Lighting forms a large proportion of the electricity usage of a building. The baseline percentage is set at 30% of fixed light fittings; the development specification will call for 100%, which shows a large improvement.
- External and communal lighting will be low energy and fitted with appropriate controls such as movement and light sensors, photo sensors and timers.
- Water usage will be restricted to less than 125 litres/person/day, for example by fitting low flow taps and showers, small capacity baths and reduced dual flush WCs; this which will significantly reduce the demand for hot water.

4.2.5 Results

Various efficiencies in the design have resulted in reductions against the Baseline of **21.76%,** as illustrated in Table 1 on page 6. The full figures are shown in Table 6 on Page 25.

4.3 Supplying Energy Efficiently

- **Step 2 – Be Clean**

The second step of the hierarchy involves the incorporation of an efficient supply of energy to contribute to further reductions in energy usage. In this stage of the hierarchy developments are required to investigate the possible use of decentralised energy networks and combined heat and power (CHP); CHP also has the potential of including cooling when appropriate.

Under the terms of Camden planning guidance, this section of the report considers the following steps, in the order listed:

1. The potential for connecting into an existing or planned decentralised energy scheme.
2. Installing a Combine Heat and Power (CHP) plant, with cooling (CCHP) to be included if possible.

3. Where neither of the above is feasible, providing a contribution for the expansion of decentralised energy networks in Camden; **and**
4. Designing the development to enable its connection to a decentralised energy network in the future.

4.3.1 Decentralised Energy

The suitability of a development for connection to a decentralised energy network depends largely on the following:

- High heating demand
- Mixed energy demands
- Location close to an existing network (within 1km), or a proposed network (within 500m).

The development, with twelve residential units, will have a fairly high seasonal heating demand and, with the inclusion of a retail unit, energy demand will be mixed.

The locations of existing and proposed networks have been investigated using information, and maps, from Camden's Core Strategy and considered for feasibility with regard to this development; the results are as follows:

a) The nearest existing decentralised source is based at the Royal Free Hospital; unfortunately, this is more than the 1 kilometre advisable distance and, therefore, it would not be technically viable nor economically feasible to connect a development of this relatively small size to this source.

b) The nearest proposed source is located at Swiss Cottage; this is considerably further than the recommended 500 metre limit from the development.

4.3.2 Combined Heat and Power (CHP)

As with decentralised energy, the suitability of a development for a CHP system depends largely on heating demand and, the type and mix of energy demands; however, the number of units to be served with heat and power and the plant room space available for the CHP engine and controls is also relevant.

Combined heat and power (CHP) integrates the production of usable heat and power (electricity), in one single, highly efficient process. CHP generates electricity whilst also capturing usable heat that is produced in this process. The key technical challenge in designing a CHP system is to balance the thermal and electrical loads. Systems are usually designed to match the base load heat requirement for the communal heat network, with top-up boilers supplying the remainder as required to meet the peak thermal load.

Dwelling density is key to minimising distribution network costs and heat losses and so community schemes economically feasible. The cost effectiveness increases with scale and population density, since the average district heating network costs are less per dwelling.

To enable consideration of the inclusion of CHP in this development, an approach has been made to ENER-G Combined Power Ltd, UK market leaders in small scale CHP systems, who were recommended by the Combined Heat and Power Association (CHPA). The advice of ENER-G was that the size of plant room required for a CHP system in this development would be too large for the space available. Additionally, the London Renewables Toolkit was referenced, which concluded that electricity could not be supplied to the flats unless a private wire system is used and, as flat owners would need to be given the choice of where to purchase electricity, the CHP system would possibly feed only the landlord's areas; this would make the system unviable.

4.3.3 Results

The development is not suitable for connection to a decentralised energy network and is also not suitable for the inclusion of a Combined Heat and Power system.

4.4 Renewable Energy Technologies

- **Step 3 – Be Green**

The third step of the hierarchy involves the incorporation of renewable energy technology in order to reduce the carbon dioxide emissions of the development (after any improvements achieved in steps 1 and 2) by at least 20%, through the installation of on-site renewable energy technologies.

A number of renewable technologies have been considered:

- Wind Generators
- Biomass Heating
- Biomass CHP
- Ground Source Heat Pumps
- Ground Source Cooling
- Solar Water Heating
- Photovoltaic (Energy from sunlight)

The London Renewables Toolkit, together with resources from the Energy Saving Trust and other relevant associations, has been used to guide the considerations.

4.4.1 Wind Generators

The UK is the windiest of any country in Europe, with approximately 40% of the total on and off shore resource. The majority of this is available only to large-scale wind farms, although in some locations generation on a domestic scale is feasible.

Various issues have been taken into consideration including:

- The average wind speed at the site. Currently the British Wind Energy Association (BWEA) suggests a large wind turbine should be viable where wind speed is 7m/s or above.
- The uneven and turbulent wind patterns that occur near buildings and other obstacles. Turbulence will decrease performance and may reduce expected equipment life.
- The need to maintain adequate access for maintenance and initial installation.
- Possible noise from the turbines (although modern turbines without gearboxes are quiet and are said to be drowned out by a passing car).
- The available space for a turbine, as they must be placed a minimum distance from residential and school buildings due to noise, reflected light and shadow flicker, which varies according to their height

The development site is not considered suitable for wind generation for the following reasons:

- The average wind speed at the location is 4m/s, which is insufficient for viable performance. Wind speed would be improved by siting the turbine at a higher level, but this would be detrimental to other residential dwellers in the immediate vicinity in terms of noise, reflected light and flicker, and would have a limited affect on performance. It is considered that other renewable technologies would be more beneficial.
- This is an infill site surrounded by dense urban development; the nature of surrounding development will cause wind patterns and turbulence which would decrease performance.
- The external walls of proposed building will fall immediately within the site boundary, creating difficulties for adequate access for installation and maintenance.

4.4.2 Solar Photovoltaic Electricity Generation

Photovoltaic (PV) cells convert solar radiation directly into electricity through the interaction of light with electrons in a semiconductor material. Solar cells are built using layers of semiconductors which create a small potential difference between the layers. When exposed to solar radiation, an array of cells connected together (called a module) creates a usable amount of direct current (DC). This is usually converted to alternating current (AC) for household use or for export to the National Grid. A system of Feed-In Tariffs (FITs) is in place whereby payment is made to the owner of the PV system for electricity exported to the grid.

A typical system consists of several modules, an AC/DC inverter, fuse box, isolator and an import/export meter. The performance ratio of a solar PV system describes the actual energy yield as a proportion of the theoretically expected yield. System losses can be caused by deviation from module nominal efficiency, module soiling and inverter and wiring losses. The performance ratio is typically 0.7 to 0.75. Ideally photovoltaics should face between south-east and south-west, at an elevation of about 30-40°. However, in the UK even flat roofs receive 90% of the energy of an optimum system

The size of a photovoltaic installation is expressed by its kilowatt peak (kWp) potential, which is an indication of how much electricity the system could generate at peak or optimum conditions. A modern high performance 1kWp system in London might be expected to produce a maximum of 850kWh/yr; at this level of production the capital cost payback period could be reduced by around 25%. The performance depends more on location, orientation and whole system design than it does on cell type. Photovoltaic cells come in a number of types with varying operating efficiencies and therefore different areas of panel are required to produce the same output. A 15+% efficiency system would require approximately 6.50m^2 generating module area per 1kWp output in optimum conditions and orientation.

Issues that have been taken into consideration include:

- Panels should ideally face between south-east and south-west, at an elevation of about 30-40° although arrays pointing east or west are acceptable (albeit at lower performance) especially for roofs inclined at a low angle to the horizontal.
- Arrays should not be horizontal as the rain will be unable to wash them clean.
- Systems should be in locations that will be unshaded at all times of day if possible. Gable roofs, chimneys, cables, TV aerials, trees and other buildings in the vicinity should be identified as potentially shading the modules, particularly in the early morning or early afternoon. The performance of a whole panel will be affected even if only part of it is shaded.
- The panels need to be ventilated (behind the modules) so that they do not heat up - their efficiency decreases as their temperature rises. Suitable ventilation is easier to ensure for bolt-on systems.
- PV systems are straightforward to install as they are modular and light, and electrical connections are part of the construction of the building
- PV systems are technically reliable - they are generally guaranteed to last between 20-25 years but are expected to last longer.
- The Climate Change Levy can be avoided for the retail unit.
- Marketing impact - a clear statement about using renewable energy.
- Excess electricity can be sold to the grid.

The development site is considered suitable for photovoltaics for the following reasons:

- The building is physically very tight to the site boundaries, making most other forms of renewable technologies unviable.
- The cost to benefit ratio (in terms of carbon dioxide reduction) is very positive.
- There is a fairly large roof area available for mounting panels, which can be fixed to face south.
- The height of the roof level will be such that there will be little or no shading.
- Connections to each of the units will be fairly straightforward.
- Unit owners will be able to sell excess electricity to the grid.
- Metering can and will be installed for monitoring the system. Good monitoring of performance in the running of a PV system is assisted by a good sub-metering strategy – that is, a meter to monitor the electrical output from each array.

This renewable technology has been chosen and the resulting energy and carbon dioxide emission reduction of **20.04%** (after steps 1 and 2 of the hierarchy) is illustrated in Table 1 on page 6. The total carbon dioxide emissions reduction is **37.45%** against the Baseline scheme. The full figures are included in Table 7 on page 26.

An additional benefit will be the use of a green (sedum) roof, which will increase panel efficiency by creating cooler temperatures.

4.4.3 Solar Water Heating

Similarly to photovoltaic (PV) cells, solar water heating systems use the energy from the sun, in this case to heat water, most commonly in the UK for hot water needs. The systems use a heat collector, generally mounted on the roof in which a fluid is heated by the sun. This fluid is used to heat up water that is stored in either a separate hot water cylinder or a twin coil hot water cylinder inside the building. The systems work very successfully in all parts of the UK, as they can work in diffuse light conditions.

There are two types of collectors used for solar water heating applications - flat plate collectors and evacuated tube collectors. The flat plate collector is the predominant type used in domestic systems as they tend to be cheaper. Evacuated tube collectors are generally more expensive due to a more complex manufacturing process (to achieve the vacuum), but manufacturers generally claim better winter performance.

Ideally the collectors should be mounted on a south-facing roof, although south-east/south-west will also function successfully, at an elevation of between 10 and 60°.

The panels can be bolted onto the roof or integrated into the roof with lead flashings. They look similar to rooflights. Solar water heating systems are suitable for any building type that has sufficient year round hot water needs (ideally during the day) and a suitable south-facing roof of sufficient size. This technology is particularly suitable for low-density housing developments.

Although the capital cost is cheaper than PV, case studies by The Carbon Trust have shown that when comparing CO2 reductions against capital investment, PVs can compare favourably to solar hot water (and ground source heat pumps).

It has been decided not to incorporate solar hot water heating as the benefits of a photovoltaic system (an overall reduction in electricity demand from the grid, and comparable cost benefits) outweigh the benefits of such a system, which only reduces emissions from hot water generation.

4.4.4 Other Renewable Technologies

The following technologies have not been considered:

- Biomass Heating
- Biomass CHP
- Ground Source Heat Pumps
- Ground Source Cooling

The reasons are:

- Lack of plant room space (biomass systems)
- Lack of storage for fuels (biomass systems)
- Lack of external ground space (ground source heating and cooling)
- Cost constraints in a small development (biomass systems)

4.5 Conclusions and Proposal

The development is sited on the footprint of an existing building and suffers from a lack of space both outside, and within the building. It is therefore not possible to consider biomass, or ground source heating and cooling, or combined heat and power. The site is also too far from existing and potential district heating schemes. This has resulted in the inability to include energy sources outlined in Step 2 of the Energy Hierarchy.

To mitigate this, the design has been made as efficient as possible and feasible in Step 1 of the Hierarchy, to include not only excellent fabric characteristics, but also the incorporation of an Air Source Heat Pump which will provide heating and cooling for the retail unit and Mechanical Ventilation with Heat recovery in the flats.

Renewable technologies were limited in feasibility, but a fairly large roof area has enabled the inclusion of highly efficient Photovoltaic panels, to feed the residential and retail areas. Depending on the efficiency of the chosen system, approximately 65 to 70m2 of panel area, mounted south facing at 30^{o}, will be required. The resulting energy and emissions savings have enabled the proposed development to meet the requirements of the London Plan and Camden's sustainability plans.

ELEMENT or SYSTEM	BASELINE VALUE	DESIGN IMPROVEMENT VALUE
External Walls	Flats: U = 0.35 W/m2K Retail: U = 0.2 W/m2K	Flats: U = 0.18 W/m2K (Sheltered 0.17) Retail: U = 0.2 W/m2K
Floors	Flats: U = 0.25 W/m2K Retail: U = 0.2 W/m2K	Flats: U = 0.18 W/m2K (0.09 over retail unit) Retail: U = 0.2 W/m2K
Roofs	U = 0.16 W/m2K	U = 0.13 W/m2K
Party Walls	U = 0 W/m2K	U = 0 W/m2K
Windows	Flats: U = 2.0 W/m2K (adj. to 1.85 for TER) Retail: U = 1.5 W/m2K	U = 1.4 W/m2K Retail: U = 1.5 W/m2K (with Solar Shading)
Doors	Flats: U = 2.0 W/m2K Retail: U = 1.5 W/m2K	U = 1.2 W/m2K Retail: U = 1.5 W/m2K
Opening Areas	25% of Total Floor Area	As Designed; Average Overshading
Air Permeability	Flats: 10 M3/h per m2 (@ 50 Pa) Retail: 5 M3/h per m2 (@ 50 Pa)	Flats: 3 M3/h per m2 (@ 50 Pa) Retail: 5 M3/h per m2 (@ 50 Pa)
Thermal Mass	Medium (TMP = 250 kJ/m2K)	Medium (TMP = 250 kJ/m2K)
Shading and Orientation	Glazing E/W; Average Overshading	As Designed; Average Overshading
Number of Sheltered Sides	2	As Actual
Thermal Bridging	0.11 x Surface Area (W/K)	ACDs - Approx. 0.08
Ventilation	Natural with Extract Fans	Flats: MVHR Retail: Air Conditioning and Extract Fan
Boiler (Flats)	SEDBUK (2009) 78% Room-sealed, Fanned Flue On-Off Burner Control	Combi; SEDBUK (2009) 90% Room-sealed, Fanned Flue On-Off Burner Control
Retail Unit heating and Cooling	Gas Boiler SEDBUK (2009) 86% Split System Cooling	Air Source heat Pump
Heating System Controls	Programmer, Room Thermostat, TRVs Boiler Interlock	Time and Temperature Zone Control Boiler Interlock
Hot Water Cylinder	150 litre with 35mm Insulation	No Cylinder
Primary Water Heating Losses	Pipework Not Insulated Thermostat Temperature Control	Thermostat Temperature Control
Water Usage	> 125 l/p/d	< 125 l/p/d
Secondary Space Heating	10% - Provided by Electric Panel heaters	N/A
Proportion of Energy Efficient Light Fittings	30% of Fixed Fittings	100% of Fixed Fittings

Table 4: Comparison of Key Values and Standards used in the Notional Baseline Scheme and the Design Improvements for the Flats

	Predicted Energy Requirement for Electricity		Building Regulations Target for Electricity (see Note 1)	Predicted Energy Requirement for Gas		Building Regulations Target for Gas (see Note 1)	Total Baseline Energy Requirement	Baseline Carbon Emissions		Total Baseline Carbon Emissions
	Regulated	Unregulated		Regulated	Unregulated			Regulated	Unregulated	
Unit	**kWh/Year**	**kWh/Year**	**kWh/Year**	**kWh/Year**	**kWh/Year**	**kWh/Year**	**kWh/Year**	**Kg/CO2/Year**	**Kg/CO2/Year**	**Kg/CO2/Year**
Retail	**13641.53**	**3222.05**	**11748.01**	**0.00**	**0.00**	**0.00**	**11748.01**	**5756.73**	**1359.71**	**7116.43**
Common Areas	**0.00**	**1612.24**	**1612.24**	**0.00**	**0.00**	**0.00**	**1612.24**	**0.00**	**680.37**	**680.37**
Flat 1	**1254.92**	**3276.41**	**4060.74**	**9594.17**	**0.00**	**5996.36**	**10057.09**	**2390.85**	**1382.65**	**3773.49**
Flat 2	**1455.41**	**3622.73**	**4532.36**	**11051.12**	**0.00**	**6906.95**	**11439.31**	**2758.10**	**1528.79**	**4286.89**
Flat 3	**1186.55**	**2998.24**	**3739.83**	**8480.09**	**0.00**	**5300.06**	**9039.89**	**2145.86**	**1265.26**	**3411.12**
Flat4	**1303.08**	**3246.36**	**4060.79**	**9172.90**	**0.00**	**5733.06**	**9793.85**	**2329.44**	**1369.96**	**3699.41**
Flat5	**1186.55**	**2998.24**	**3739.83**	**8480.09**	**0.00**	**5300.06**	**9039.89**	**2145.86**	**1265.26**	**3411.12**
Flat6	**1303.08**	**3246.36**	**4060.79**	**9172.90**	**0.00**	**5733.06**	**9793.85**	**2329.44**	**1369.96**	**3699.41**
Flat7	**1187.95**	**3012.99**	**3755.46**	**8495.67**	**0.00**	**5309.79**	**9065.25**	**2149.47**	**1271.48**	**3420.96**
Flat8	**1376.05**	**3485.60**	**4345.63**	**9992.07**	**0.00**	**6245.04**	**10590.68**	**2519.15**	**1470.92**	**3990.08**
Flat9	**1597.03**	**3948.82**	**4946.96**	**11979.65**	**0.00**	**7487.28**	**12434.25**	**2998.00**	**1666.40**	**4664.40**
Totals	**25492.15**	**34670.04**	**50602.63**	**86418.66**	**0.00**	**54011.66**	**104614.30**	**27522.91**	**14630.76**	**42153.66**

Note 1: Current regulations require the design energy demand and emissions to be reduced by approximately 37.5% in order to meet the TER; the figures in this table have been discounted accordingly to illustrate the Baseline Emissions

Note 2: Unregulated (cooking and electrical appliances) figures are calculated according to SAP conventions

Table 5: Site Baseline Energy Demand and Carbon Dioxide Emissions

Unit	Building Regulations Target for Electricity	Building Regulations Target for Gas	Total Baseline Energy Requirement	Total Baseline Carbon Emissions	Step 1 Improved Design Electricity	Step 1 Improved Design Gas	Step 1 Total Design Energy Requirement	Step 1 Total Design Carbon Emissions
	kWh/Year	kWh/Year	kWh/Year	Kg/CO2/Year	kWh/Year	kWh/Year	kWh/Year	Kg/CO2/Year
Retail	11748.01	0.00	11748.01	7116.43	9734.228	0.00	9734.23	5032.60
Common Areas	1612.24	0.00	1612.24	680.37	1612.24	0.00	1612.24	833.53
Flat 1	4060.74	5996.36	10057.09	3773.49	3911.36	4763.48	8674.84	2965.34
Flat 2	4532.36	6906.95	11439.31	4286.89	4341.73	5180.55	9522.28	3270.42
Flat 3	3739.83	5300.06	9039.89	3411.12	3668.40	4157.43	7825.83	2719.73
Flat4	4060.79	5733.06	9793.85	3699.41	3984.15	4147.73	8131.88	2881.06
Flat5	3739.83	5300.06	9039.89	3411.12	3668.40	4157.43	7825.83	2719.73
Flat6	4060.79	5733.06	9793.85	3699.41	3984.15	4147.73	8131.88	2881.06
Flat7	3755.46	5309.79	9065.25	3420.96	3683.15	4201.09	7884.24	2736.00
Flat8	4345.63	6245.04	10590.68	3990.08	4223.39	4941.99	9165.38	3162.01
Flat9	4946.96	7487.28	12434.25	4664.40	4741.12	6695.35	11436.47	3776.84
Totals	50602.63	54011.66	104614.30	42153.66	47552.32	42392.78	89945.10	32978.32

Note 1: Unregulated (cooking and electrical appliances) figures are included in the Electricity Columns

Table 6: Energy Demand and Carbon Dioxide Emissions from Baseline and Efficiency Design Measures (Step 1)

	Building Regulations Target for Electricity	Building Regulations Target for Gas	Total Baseline Energy Requirement	Total Baseline Carbon Emissions	Step 1 Improved Design Electricity	Step 1 Improved Design Gas	Step 1 Total Design Energy Requirement	Step 1 Total Design Carbon Emissions	Step 3 Photovoltaic Panels Electricity	Step 3 Photovoltaic Panels Gas	Step 3 Total PV Energy Requirement	Step 3 Total PV Carbon Emissions
Unit	kWh/Year	kWh/Year	kWh/Year	Kg/CO2/Year	kWh/Year	kWh/Year	kWh/Year	Kg/CO2/Year	kWh/Year	kWh/Year	kWh/Year	Kg/CO2/Year
Retail	11748.01	0.00	11748.01	7116.43	9734.228	0.00	9734.23	5032.60	7787.38	0.00	7787.38	4026.08
Common Areas	1612.24	0.00	1612.24	680.37	1612.24	0.00	1612.24	833.53	1289.79	0.00	1289.79	666.82
Flat 1	4060.74	5996.36	10057.09	3773.49	3911.36	4763.48	8674.84	2965.34	2623.76	4763.48	7387.24	2299.65
Flat 2	4532.36	6906.95	11439.31	4286.89	4341.73	5180.55	9522.28	3270.42	3054.13	5180.55	8234.68	2604.73
Flat 3	3739.83	5300.06	9039.89	3411.12	3668.40	4157.43	7825.83	2719.73	2595.40	4157.43	6752.83	2164.99
Flat 4	4060.79	5733.06	9793.85	3699.41	3984.15	4147.73	8131.88	2881.06	2911.15	4147.73	7058.88	2326.32
Flat 5	3739.83	5300.06	9039.89	3411.12	3668.40	4157.43	7825.83	2719.73	2595.40	4157.43	6752.83	2164.99
Flat 6	4060.79	5733.06	9793.85	3699.41	3984.15	4147.73	8131.88	2881.06	2911.15	4147.73	7058.88	2326.32
Flat 7	3755.46	5309.79	9065.25	3420.96	3683.15	4201.09	7884.24	2736.00	2610.15	4201.09	6811.24	2181.26
Flat 8	4345.63	6245.04	10590.68	3990.08	4223.39	4941.99	9165.38	3162.01	2935.79	4941.99	7877.78	2496.32
Flat 9	4946.96	7487.28	12434.25	4664.40	4741.12	6695.35	11436.47	3776.84	3453.52	6695.35	10148.87	3111.15
Totals	50602.63	54011.66	104614.30	42153.66	47552.32	42392.78	89945.10	32978.32	34767.62	42392.78	77160.40	26368.63

Table 7: Energy Demand and Carbon Dioxide Emissions from Baseline, Efficiency Design Measures (Step 1) and Renewable Technology (Step 3)

Appendices:

A Code for Sustainable Homes Pre-Assessment Results Page

B BREEAM Pre-Assessment Estimator Results Page

C SAP Code for Sustainable Homes Energy Credits Reports

D SBEM Output Reports

i BRUKL Output Documents (Hierarchy Steps 1 and 3 – Notional figures included)

ii SBEM Main Calculation Output Documents (Hierarchy Steps 1 and 3)

E Proposed Development Site Layout and Floor Plans

F Air Quality Assessment

G Noise and Vibration Assessment

SUSTAINABILITY, ENERGY
and ENVIRONMENTAL REPORT

PROPOSED MIXED USE DEVELOPMENT
ON THE SITE OF

THE FINCHLEY BELL and 3one7 BAR
317 FINCHLEY ROAD
CAMDEN
LONDON NW3 6EP

Project No.:	**B0771**
Document No.:	**B0771 / Rev. C**
Date:	**August 2014**

REPORT COMPILED BY

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Glenn Shewan, NDEA (for SBEM calculations)

Project No.	Revision	Date	Prepared By	Status
B0771	A	Mar-13	CJB	Planning
B0771	B	Dec-13	CJB	Revised Planning
B0771	C	Aug-14	CJB	Revised Planning

Code for Sustainable Homes (November 2010)

Design - Draft

This report details the calculations and results for Ene 1, 2 and 7 of the Code For Sustainable Homes.

This Design Assessment has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed. Code calculations are from the Technical Guide (November 2010).

Assessor name	Mr Cliff Bull	Assessor number	1978
Client	Caldecotte Consultants	Last modified	03/08/2014
Address	Flat 1, Finchley Bell, 317 Finchley Road, London, NW3 6EP		

Building regulation assessment - criterion 1

	kg/m²/yr
DER	7.98
TER	20.17

Assessment of zero carbon home and low or zero carbon technologies

		Credits	Level
Dwelling emission rate (Ene 1)	CO_2 reduction = 60.4 %	6.1	4
Fabric Energy Efficiency	FEE = 50.5	No credits	
Low or zero carbon technologies (Ene 7)	CO_2 reduction = 24 %	2	

Ene 1 - dwelling emission rate

	%	kWh/m²	$kgCO_2/m^2/yr$	
Assessment of Ene 1 (level 1-5)				
DER from SAP 2009 DER worksheet			7.98	
Additional allowable generation		0.00		
CO_2 emissions offset from generation			0.00	
CO_2 emissions offset from community biofuel CHP systems			0.00	
Total CO_2 emissions offset from SAP section 16 allowances			**0.00**	
DER accounting for SAP section 16 allowances			**7.98**	
CO_2 reduction compared to TER			12.19	
CO_2 reduction as % of TER	60.4			
Assessment of Ene 1 (level 6)				
DER from SAP 2009 DER worksheet			7.98	(ZC1)
CO_2 emissions from appliances (equation L14)			16.48	(ZC2)
CO_2 emissions from cooking (equation L16)			2.37	(ZC3)
Total CO_2 emissions			26.83	(ZC4)
Additional allowable generation and its CO_2 emissions offset		0.00		(ZC6)
CO_2 emissions offset from additional allowable generation			0.00	(ZC7)
CO_2 emissions offset from community biofuel CHP systems			0.00	(ZC5)
Net CO_2 emissions			**26.83**	(ZC8)

Ene 1 - dwelling emission rate - level 6

There is no Zero Carbon Home definition in the current technical guide

	Criterion	Value	Pass/Fail
FEE	<= 39	50.5	Fail
Net CO_2 emissions	<= 0.00	26.83	Fail

Result: Not level 6

Number of credits for Ene 1	**6.1**

Ene 2 - Fabric Energy Efficiency

FEE	50.5
Number of credits for Ene 2	**No credits**

Ene 7 - low or zero carbon technologies

	Emissions $kgCO_2/yr$	Reduction $kgCO_2/yr$
Standard case		
Space and water heating (265)	1007.15	
Mechanical cooling (266)	0.00	
Pumps and fans (267)	160.25	
Lighting (268)	168.01	
Appliances and cooking	1394.89	
Total CO_2	**2730.30**	
Actual case		
Space and water heating (265) or (376)	1007.15	
Space and water heating from LZCT considered in SAP 2009		0.00
Pumps and fans (267) or (378)	160.25	
Pumps and fans		0.00
Electricity generated by LZCT (269) + (380))		-681.14
Additional allowable electricity generation considered in SAP 2009 section 16		0.00
Offset from biofuel CHP [-1 x [(363)..(366) + (368)...(372)]]		0.00
LZCT electricity generation		-681.14
LZCT thermal generation		0
Total from specified LZCT		**-681.14**

Reduction in CO_2 Emissions		Emissions $kgCO_2/m^2/yr$
Standard Case CO_2		36.90
Actual Case CO_2		27.69
% Reduction in CO_2	24	
Number of credits for Ene 7	**2**	

Code for Sustainable Homes (November 2010)
Design - Draft

This report details the calculations and results for Ene 1, 2 and 7 of the Code For Sustainable Homes.

This Design Assessment has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed. Code calculations are from the Technical Guide (November 2010).

Assessor name	Mr Cliff Bull	Assessor number	1978
Client	Caldecotte Consultants	Last modified	03/08/2014
Address	Flat 2, Finchley Bell, 317 Finchley Road, London, NW3 6EP		

Building regulation assessment - criterion 1

	kg/m²/yr
DER	8.00
TER	19.24

Assessment of zero carbon home and low or zero carbon technologies

		Credits	Level
Dwelling emission rate (Ene 1)	CO_2 reduction = 58.4 %	5.9	4
Fabric Energy Efficiency	FEE = 46.8	3.4	
Low or zero carbon technologies (Ene 7)	CO_2 reduction = 22 %	2	

Ene 1 - dwelling emission rate

	%	kWh/m²	kgCO_2/m²/yr	
Assessment of Ene 1 (level 1-5)				
DER from SAP 2009 DER worksheet			8.00	
Additional allowable generation		0.00		
CO_2 emissions offset from generation			0.00	
CO_2 emissions offset from community biofuel CHP systems			0.00	
Total CO_2 emissions offset from SAP section 16 allowances			**0.00**	
DER accounting for SAP section 16 allowances			**8.00**	
CO_2 reduction compared to TER			11.24	
CO_2 reduction as % of TER	58.4			
Assessment of Ene 1 (level 6)				
DER from SAP 2009 DER worksheet			8.00	(ZC1)
CO_2 emissions from appliances (equation L14)			15.72	(ZC2)
CO_2 emissions from cooking (equation L16)			2.03	(ZC3)
Total CO_2 emissions			25.75	(ZC4)
Additional allowable generation and its CO_2 emissions offset		0.00		(ZC6)
CO_2 emissions offset from additional allowable generation			0.00	(ZC7)
CO_2 emissions offset from community biofuel CHP systems			0.00	(ZC5)
Net CO_2 emissions			**25.75**	(ZC8)

Ene 1 - dwelling emission rate - level 6

There is no Zero Carbon Home definition in the current technical guide

	Criterion	Value	Pass/Fail
FEE	<= 39	46.8	Fail
Net CO_2 emissions	<= 0.00	25.75	Fail

Result: Not level 6

Number of credits for Ene 1	**5.9**

Ene 2 - Fabric Energy Efficiency

FEE	46.8
Number of credits for Ene 2	**3.4**

Ene 7 - low or zero carbon technologies

	Emissions $kgCO_2/yr$	Reduction $kgCO_2/yr$
Standard case		
Space and water heating (265)	1083.94	
Mechanical cooling (266)	0.00	
Pumps and fans (267)	174.87	
Lighting (268)	196.85	
Appliances and cooking	1588.94	
Total CO_2	**1437.91**	
Actual case		
Space and water heating (265) or (376)	1083.94	
Space and water heating from LZCT considered in SAP 2009		0.00
Pumps and fans (267) or (378)	174.87	
Pumps and fans		0.00
Electricity generated by LZCT (269) + (380))		-681.14
Additional allowable electricity generation considered in SAP 2009 section 16		0.00
Offset from biofuel CHP [-1 x [(363)..(366) + (368)...(372)]]		0.00
LZCT electricity generation		-681.14
LZCT thermal generation		0
Total from specified LZCT		**-681.14**

		Emissions $kgCO_2/m^2/yr$
Reduction in CO_2 Emissions		
Standard Case CO_2		34.01
Actual Case CO_2		26.40
% Reduction in CO_2	22	
Number of credits for Ene 7	**2**	

Code for Sustainable Homes (November 2010)

Design - Draft

NHER

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Assessor name	Mr Cliff Bull	Assessor number	1978
Client	Caldecotte Consultants	Last modified	03/08/2014
Address	Flat 3, Finchley Bell, 317 Finchley Road, London, NW3 6EP		

Building regulation assessment - criterion 1

	kg/m²/yr
DER	7.48
TER	16.70

Assessment of zero carbon home and low or zero carbon technologies

		Credits	Level
Dwelling emission rate (Ene 1)	CO_2 reduction = 55.2 %	5.6	4
Fabric Energy Efficiency	FEE = 39.7	6.6	
Low or zero carbon technologies (Ene 7)	CO_2 reduction = 20 %	2	

Ene 1 - dwelling emission rate

	%	kWh/m²	$kgCO_2/m^2/yr$	
Assessment of Ene 1 (level 1-5)				
DER from SAP 2009 DER worksheet			7.48	
Additional allowable generation		0.00		
CO_2 emissions offset from generation			0.00	
CO_2 emissions offset from community biofuel CHP systems			0.00	
Total CO_2 emissions offset from SAP section 16 allowances			**0.00**	
DER accounting for SAP section 16 allowances			**7.48**	
CO_2 reduction compared to TER			9.22	
CO_2 reduction as % of TER	55.2			
Assessment of Ene 1 (level 6)				
DER from SAP 2009 DER worksheet			7.48	(ZC1)
CO_2 emissions from appliances (equation L14)			16.18	(ZC2)
CO_2 emissions from cooking (equation L16)			2.22	(ZC3)
Total CO_2 emissions			25.88	(ZC4)
Additional allowable generation and its CO_2 emissions offset		0.00		(ZC6)
CO_2 emissions offset from additional allowable generation			0.00	(ZC7)
CO_2 emissions offset from community biofuel CHP systems			0.00	(ZC5)
Net CO_2 emissions			**25.88**	(ZC8)

Ene 1 - dwelling emission rate - level 6

There is no Zero Carbon Home definition in the current technical guide

	Criterion	Value	Pass/Fail
FEE	<= 39	39.7	Fail
Net CO_2 emissions	<= 0.00	25.88	Fail

Result: Not level 6

Number of credits for Ene 1	**5.6**

Ene 2 - Fabric Energy Efficiency

FEE	39.7
Number of credits for Ene 2	**6.6**

Ene 7 - low or zero carbon technologies

		Emissions $kgCO_2/yr$	Reduction $kgCO_2/yr$
Standard case			
Space and water heating (265)		880.15	
Mechanical cooling (266)		0.00	
Pumps and fans (267)		166.38	
Lighting (268)		180.09	
Appliances and cooking		1481.00	
Total CO_2		**1208.23**	
Actual case			
Space and water heating (265) or (376)		880.15	
Space and water heating from LZCT considered in SAP 2009			0.00
Pumps and fans (267) or (378)		166.38	
Pumps and fans			0.00
Electricity generated by LZCT (269) + (380))			-567.62
Additional allowable electricity generation considered in SAP 2009 section 16			0.00
Offset from biofuel CHP [-1 x [(363)..(366) + (368)...(372)]]			0.00
LZCT electricity generation			-567.62
LZCT thermal generation			0
Total from specified LZCT			**-567.62**

		Emissions $kgCO_2/m^2/yr$
Reduction in CO_2 Emissions		
Standard Case CO_2		33.64
Actual Case CO_2		26.59
% Reduction in CO_2	20	
Number of credits for Ene 7	**2**	

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Assessor name	Mr Cliff Bull	Assessor number	1978
Client	Caldecotte Consultants	Last modified	03/08/2014
Address	Flat 4, Finchley Bell, 317 Finchley Road, London, NW3 6EP		

Building regulation assessment - criterion 1

	kg/m²/yr
DER	6.83
TER	15.70

Assessment of zero carbon home and low or zero carbon technologies

		Credits	Level
Dwelling emission rate (Ene 1)	CO_2 reduction = 56.5 %	5.7	4
Fabric Energy Efficiency	FEE = 34.7	8.1	
Low or zero carbon technologies (Ene 7)	CO_2 reduction = 19 %	2	

Ene 1 - dwelling emission rate

	%	kWh/m²	$kgCO_2/m^2/yr$	
Assessment of Ene 1 (level 1-5)				
DER from SAP 2009 DER worksheet			6.83	
Additional allowable generation		0.00		
CO_2 emissions offset from generation			0.00	
CO_2 emissions offset from community biofuel CHP systems			0.00	
Total CO_2 emissions offset from SAP section 16 allowances			**0.00**	
DER accounting for SAP section 16 allowances			**6.83**	
CO_2 reduction compared to TER			8.87	
CO_2 reduction as % of TER	56.5			
Assessment of Ene 1 (level 6)				
DER from SAP 2009 DER worksheet			6.83	(ZC1)
CO_2 emissions from appliances (equation L14)			15.53	(ZC2)
CO_2 emissions from cooking (equation L16)			1.97	(ZC3)
Total CO_2 emissions			24.33	(ZC4)
Additional allowable generation and its CO_2 emissions offset		0.00		(ZC6)
CO_2 emissions offset from additional allowable generation			0.00	(ZC7)
CO_2 emissions offset from community biofuel CHP systems			0.00	(ZC5)
Net CO_2 emissions			**24.33**	(ZC8)

Ene 1 - dwelling emission rate - level 6

There is no Zero Carbon Home definition in the current technical guide

	Criterion	Value	Pass/Fail
FEE	<= 39	34.7	Pass
Net CO_2 emissions	<= 0.00	24.33	Fail

Result: Not level 6

Number of credits for Ene 1	**5.7**

Ene 2 - Fabric Energy Efficiency

FEE	34.7
Number of credits for Ene 2	**8.1**

Ene 7 - low or zero carbon technologies

	Emissions $kgCO_2/yr$	Reduction $kgCO_2/yr$
Standard case		
Space and water heating (265)	877.07	
Mechanical cooling (266)	0.00	
Pumps and fans (267)	178.17	
Lighting (268)	203.27	
Appliances and cooking	1627.46	
Total CO_2	**2885.97**	
Actual case		
Space and water heating (265) or (376)	877.07	
Space and water heating from LZCT considered in SAP 2009		0.00
Pumps and fans (267) or (378)	178.17	
Pumps and fans		0.00
Electricity generated by LZCT (269) + (380))		-567.62
Additional allowable electricity generation considered in SAP 2009 section 16		0.00
Offset from biofuel CHP [-1 x [(363)..(366) + (368)...(372)]]		0.00
LZCT electricity generation		-567.62
LZCT thermal generation		0
Total from specified LZCT		**-567.62**

Reduction in CO_2 Emissions		Emissions $kgCO_2/m^2/yr$
Standard Case CO_2		31.03
Actual Case CO_2		24.93
% Reduction in CO_2	19	
Number of credits for Ene 7	**2**	

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Assessor name	Mr Cliff Bull	Assessor number	1978
Client	Caldecotte Consultants	Last modified	03/08/2014
Address	Flat 5, Finchley Bell, 317 Finchley Road, London, NW3 6EP		

Building regulation assessment - criterion 1

	kg/m²/yr
DER	7.48
TER	16.70

Assessment of zero carbon home and low or zero carbon technologies

		Credits	Level
Dwelling emission rate (Ene 1)	CO_2 reduction = 55.2 %	5.6	4
Fabric Energy Efficiency	FEE = 39.7	6.6	
Low or zero carbon technologies (Ene 7)	CO_2 reduction = 20 %	2	

Ene 1 - dwelling emission rate

	%	kWh/m²	$kgCO_2/m^2/yr$	
Assessment of Ene 1 (level 1-5)				
DER from SAP 2009 DER worksheet			7.48	
Additional allowable generation		0.00		
CO_2 emissions offset from generation			0.00	
CO_2 emissions offset from community biofuel CHP systems			0.00	
Total CO_2 emissions offset from SAP section 16 allowances			**0.00**	
DER accounting for SAP section 16 allowances			**7.48**	
CO_2 reduction compared to TER			9.22	
CO_2 reduction as % of TER	55.2			
Assessment of Ene 1 (level 6)				
DER from SAP 2009 DER worksheet			7.48	(ZC1)
CO_2 emissions from appliances (equation L14)			16.18	(ZC2)
CO_2 emissions from cooking (equation L16)			2.22	(ZC3)
Total CO_2 emissions			25.88	(ZC4)
Additional allowable generation and its CO_2 emissions offset		0.00		(ZC6)
CO_2 emissions offset from additional allowable generation			0.00	(ZC7)
CO_2 emissions offset from community biofuel CHP systems			0.00	(ZC5)
Net CO_2 emissions			**25.88**	(ZC8)

Ene 1 - dwelling emission rate - level 6

There is no Zero Carbon Home definition in the current technical guide

	Criterion	Value	Pass/Fail
FEE	<= 39	39.7	Fail
Net CO_2 emissions	<= 0.00	25.88	Fail

Result: Not level 6

Number of credits for Ene 1	**5.6**

Ene 2 - Fabric Energy Efficiency

FEE	39.7
Number of credits for Ene 2	**6.6**

Ene 7 - low or zero carbon technologies

	Emissions $kgCO_2/yr$	Reduction $kgCO_2/yr$
Standard case		
Space and water heating (265)	880.15	
Mechanical cooling (266)	0.00	
Pumps and fans (267)	166.38	
Lighting (268)	180.09	
Appliances and cooking	1481.00	
Total CO_2	**1208.23**	
Actual case		
Space and water heating (265) or (376)	880.15	
Space and water heating from LZCT considered in SAP 2009		0.00
Pumps and fans (267) or (378)	166.38	
Pumps and fans		0.00
Electricity generated by LZCT (269) + (380))		-567.62
Additional allowable electricity generation considered in SAP 2009 section 16		0.00
Offset from biofuel CHP [-1 x [(363)..(366) + (368)...(372)]]		0.00
LZCT electricity generation		-567.62
LZCT thermal generation		0
Total from specified LZCT		**-567.62**

		Emissions $kgCO_2/m^2/yr$
Reduction in CO_2 Emissions		
Standard Case CO_2		33.64
Actual Case CO_2		26.59
% Reduction in CO_2	20	
Number of credits for Ene 7	**2**	

This report details the calculations and results for Ene 1, 2 and 7 of the Code For Sustainable Homes.

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Client	Caldecotte Consultants	Last modified	03/08/2014
Address	Flat 6, Finchley Bell, 317 Finchley Road, London, NW3 6EP		

Building regulation assessment - criterion 1

	kg/m²/yr
DER	6.83
TER	15.70

Assessment of zero carbon home and low or zero carbon technologies

		Credits	Level
Dwelling emission rate (Ene 1)	CO_2 reduction = 56.5 %	5.7	4
Fabric Energy Efficiency	FEE = 34.7	8.1	
Low or zero carbon technologies (Ene 7)	CO_2 reduction = 19 %	2	

Ene 1 - dwelling emission rate

	%	kWh/m²	kgCO₂/m²/yr	
Assessment of Ene 1 (level 1-5)				
DER from SAP 2009 DER worksheet			6.83	
Additional allowable generation		0.00		
CO_2 emissions offset from generation			0.00	
CO_2 emissions offset from community biofuel CHP systems			0.00	
Total CO_2 emissions offset from SAP section 16 allowances			**0.00**	
DER accounting for SAP section 16 allowances			**6.83**	
CO_2 reduction compared to TER			8.87	
CO_2 reduction as % of TER	56.5			
Assessment of Ene 1 (level 6)				
DER from SAP 2009 DER worksheet			6.83	(ZC1)
CO_2 emissions from appliances (equation L14)			15.53	(ZC2)
CO_2 emissions from cooking (equation L16)			1.97	(ZC3)
Total CO_2 emissions			24.33	(ZC4)
Additional allowable generation and its CO_2 emissions offset		0.00		(ZC6)
CO_2 emissions offset from additional allowable generation			0.00	(ZC7)
CO_2 emissions offset from community biofuel CHP systems			0.00	(ZC5)
Net CO_2 emissions			**24.33**	(ZC8)

Ene 1 - dwelling emission rate - level 6

There is no Zero Carbon Home definition in the current technical guide

	Criterion	Value	Pass/Fail
FEE	<= 39	34.7	Pass
Net CO_2 emissions	<= 0.00	24.33	Fail

Result: Not level 6

Number of credits for Ene 1	**5.7**

Ene 2 - Fabric Energy Efficiency

FEE	34.7
Number of credits for Ene 2	**8.1**

Ene 7 - low or zero carbon technologies

	Emissions $kgCO_2/yr$	Reduction $kgCO_2/yr$
Standard case		
Space and water heating (265)	877.07	
Mechanical cooling (266)	0.00	
Pumps and fans (267)	178.17	
Lighting (268)	203.27	
Appliances and cooking	1627.46	
Total CO_2	**2885.97**	
Actual case		
Space and water heating (265) or (376)	877.07	
Space and water heating from LZCT considered in SAP 2009		0.00
Pumps and fans (267) or (378)	178.17	
Pumps and fans		0.00
Electricity generated by LZCT (269) + (380))		-567.62
Additional allowable electricity generation considered in SAP 2009 section 16		0.00
Offset from biofuel CHP [-1 x [(363)..(366) + (368)...(372)]]		0.00
LZCT electricity generation		-567.62
LZCT thermal generation		0
Total from specified LZCT		**-567.62**

Reduction in CO_2 Emissions		Emissions $kgCO_2/m^2/yr$
Standard Case CO_2		31.03
Actual Case CO_2		24.93
% Reduction in CO_2	19	
Number of credits for Ene 7	**2**	