8.3

Squire and Partners

Twyman House, London NW1

Energy Strategy

By RES Part of Long and Partners

For CIT Developments Ltd

10003

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Twyman House

Energy Strategy Report for Planning Application

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1 Issue Register

Rev	Reason for Issue	Date	Issued By	Checked By
1.0	For Comment	11/03/11	GP	EK
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4.0	Final	21/04/11	GP	EK
5.0	Revised quantity of residential units and addition of summer overheating analysis	07/06/11	CHY	EK

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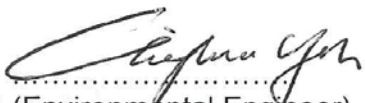

(Environmental Engineer)

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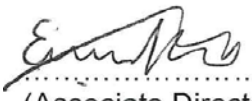


(Associate Director)

2 Contents

3 Executive Summary

This assessment and renewable feasibility study focuses on the residential part of the development (54 residential units). The estimated emissions from the proposed commercial units are also calculated in line with GLA guidelines, based however on a “shell and core” basis and specification of energy efficiency benchmarks for the subsequent tenant fit out.

This document responds to planning policy in respect of energy consumption and carbon dioxide emissions for the Development of Twyman House, NW1 London. The methodology used Part L of the Building Regulations for the new build dwellings.

The target emission for Twyman House is:

Target CO_2 emissions: 132.7 tn/year

Be Lean

Be lean refers to all the energy efficiency measures employed to improve the energy performance of the development

The Development features the following energy-saving measures to reduce the Development’s carbon emissions which are required in London Plan to be less than the total site carbon emissions established in the Base case:

- Improved U-values as detailed within Section 6;
- Service systems as detailed within Section 6; and
- All internal, external and communal lighting is to be provided through low energy lighting, wherever possible.

Be Lean CO_2 emissions **133.6 tn/year**

This figure is about 1% above the Target CO2 emissions but 24% below Part L 2006 target. Compliance with Part L 2010 will be achieved in the following stages (Be clean, Be green).

Be Clean

Be clean refers to community heating, CHP or CCHP incorporated into the building design to improve the development’s energy performance.

The Development energy strategy is to provide a centralized wet heating system (boilers) with combined heat and power (CHP) serving the hot water demand for the whole site. The combination of both CHP and community heating system will provide a CO_2 reduction of 19.4% with respect to the Be Lean stage (18.8% compared to the Target).

Be clean CO_2 emissions **107.7 tn/year**

Be Green

Be green refers to the renewable technologies incorporated into the building design to improve the development's energy performance.

The Development features PVs as the selected renewable technology. It will provide a reduction of 9.9% with respect to the Be Clean stage (26.9% compared to the target).

Be Green CO_2 emissions **97 tn/year**

Thus, the final CO_2 emissions reduction for Twyman House achieves and overcomes the 20% emissions reduction requirement as stated in London Plan.
The residential part of the development total regulated emissions (only Part L) will be 46.2% lower than the Part L target (see Figure 2). This figure meets the mandatory requirement to achieve Code for Sustainable Home level 4 for energy consumption.

The stages of this Energy Strategy and the predicted annual CO_2 emissions relative to each one of them are summarized in Figure 1 and Figure 2 on the next page.

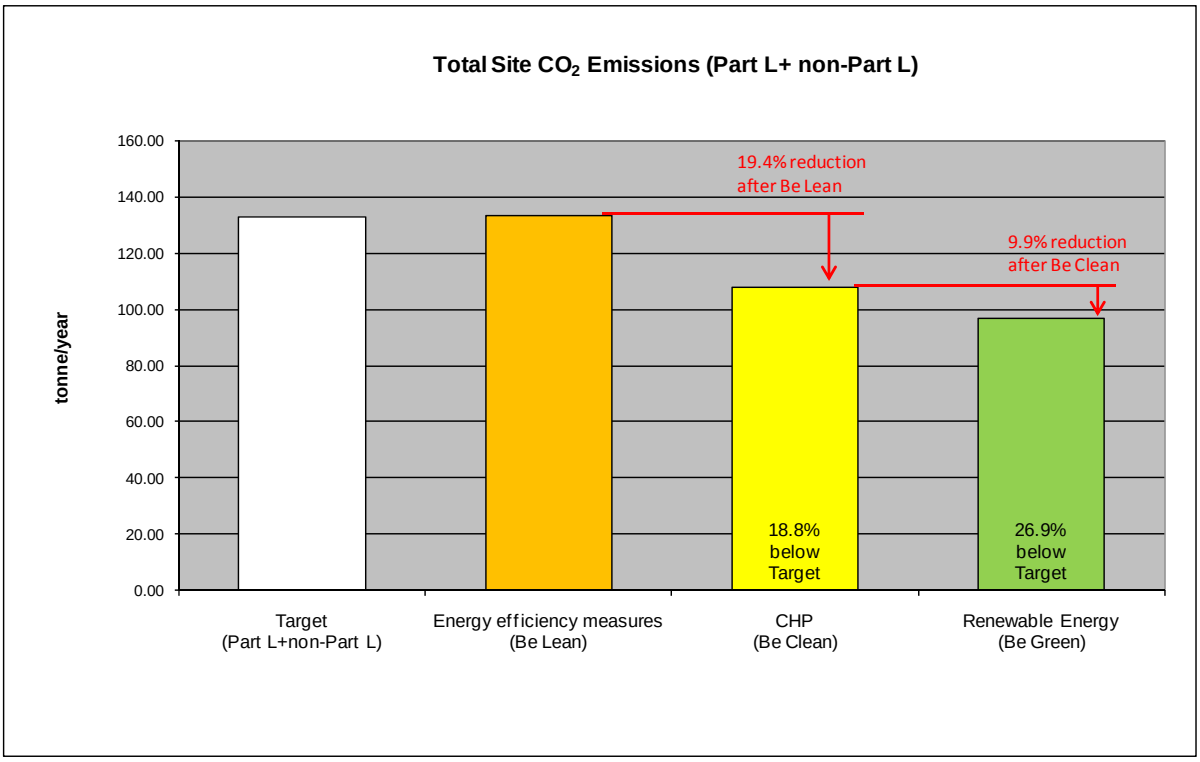


Figure 1: Twyman House emissions (Part L + non-Part L) chart.

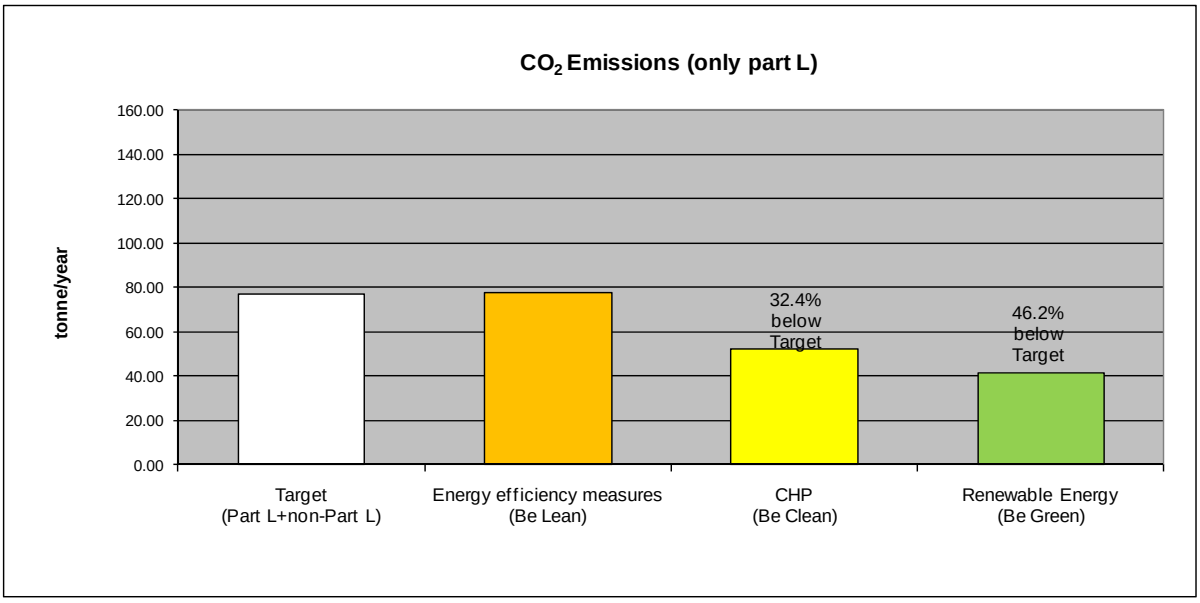


Figure 2: Twyman House emissions (only Part L) chart.

4 Introduction

4.1 Planning Policy Context

4.1.1 National policy

Climate Change Act 2008

The Climate Change Act 2008 supersedes the Energy White Paper and introduces a statutory target of reducing carbon emissions by 80% below 1990 levels by 2050, with an interim target of 34% by 2020.

Planning Policy Statement (PPS): Planning and Climate Change Supplement to PPS1 (Dec 2007)

PPS1 Supplement states that “climate change considerations should be integrated into all spatial planning decisions” (PPS1, Para 10)

EU Directive 2009/28/EC

The Government’s commitment under EU Directive 2009/28/EC is to generate 15% of UK electricity from renewable energy sources by 2020.

Planning Policy Statement 22 (PPS 22) sets out the Government’s national policy for renewable energy, in terms of both dedicated renewable generation projects (e.g. wind farms) and ‘embedded’ generation. It states that “local planning authorities may include policies in local development documents that require a percentage of the energy to be used in new residential, commercial or industrial developments to come from on-site renewable energy developments. Such policies:

(i) Should ensure that requirement to generate on-site renewable energy is only applied to developments where the installation of renewable energy generation equipment is viable given the type of development proposed, its location, and design;

(ii) Should not be framed in such a way as to place an undue burden on developers, for example, by specifying that all energy to be used in a development should come from on-site renewable generation.

4.1.2 Regional Policy

GLA London Plan (consolidated February 2008).

The following hierarchy will be used to assess applications:

• using less energy, in particular by adopting sustainable design and construction measures (Policy 4A.3)
• supplying energy efficiently, in particular by prioritizing decentralized energy generation (Policy 4A.6), and
• using renewable energy (Policy 4A.7).

Policy 4A.2 Mitigating climate change

The Mayor will work towards the long-term reduction of carbon dioxide emissions by 60 per cent by 2050. The Mayor will and boroughs and other agencies should seek to achieve the following minimum reduction targets for London against a 1990 base; these will be monitored and kept under review: 15% by 2010, 20% by 2015, 25% by 2020, 30% by 2025.

Policy 4A.4 Energy assessment

An energy assessment of the energy demand and carbon dioxide emissions is required from proposed major developments, which should demonstrate the expected energy and carbon dioxide emission savings from the energy efficiency and renewable energy measures incorporated in the development, including the feasibility of CHP/CCHP and community heating systems.

Policy 4A.6 Decentralized Energy: Heating, Cooling and Power

All developments are required to demonstrate that their heating, cooling and power systems have been selected to minimize carbon dioxide emissions. The need for active cooling systems should be reduced as far as possible through passive design including ventilation, appropriate use of thermal mass, external summer shading and vegetation on and adjacent to developments. The heating and cooling infrastructure should be designed to allow the use of decentralized energy (including renewable generation) and for it to be maximized in the future. Developments should evaluate combined cooling, heat, and power (CCHP) and combined heat and power (CHP) systems and where a new CCHP/CHP system is installed as part of a new development; examine opportunities to extend the scheme beyond the site boundary to adjacent areas.

Policy 4A.7 Renewable Energy

A presumption that developments will achieve a reduction in carbon dioxide emissions of 20% from on site renewable energy generation (which can include sources of decentralized renewable energy) unless it can be demonstrated that such provision is not feasible. This will support the Mayor's Climate Change Mitigation and Energy Strategy and its objectives of increasing the proportion of energy used generated from renewable sources, including: biomass fuelled heating, cooling and electricity generating plant, biomass heating, renewable energy from waste (Policy 4A.21) photovoltaics, solar water heating, wind, hydrogen fuel cells, and ground coupled heating and cooling in new developments wherever feasible.

4.1.3 Local Policy – London Borough of Camden

Local Development Framework (adopted November 2010)
Camden Core Strategy 2010

CS13 – Tackling climate change through promoting higher environmental standards

Reducing the effects of and adapting to climate change
The Council will require all development to take measures to minimise the effects of, and adapt to, climate change and encourage all development to meet the highest feasible environmental standards that are financially viable during construction and occupation by:
a) ensuring patterns of land use that minimise the need to travel by car and help support local energy networks;
b) promoting the efficient use of land and buildings;
c) minimising carbon emissions from the redevelopment, construction and occupation of buildings by implementing, in order, all of the elements of the following energy hierarchy:
1. ensuring developments use less energy,
2. making use of energy from efficient sources, such as the King's Cross, Gower Street, Bloomsbury and proposed Euston Road decentralised energy networks;
3. 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

Local energy generation
The Council will promote local energy generation and networks by:
e) working with our partners and developers to implement local energy networks in the parts of Camden most likely to support them, i.e. in the vicinity of:
– housing estates with community heating or the potential for community heating and other uses with large heating loads;
– the growth areas of King's Cross; Euston; Tottenham Court Road; West Hampstead Interchange and Holborn;
– schools to be redeveloped as part of Building Schools for the Future programme;
– existing or approved combined heat and power/local energy networks (see Map 4);

and other locations where land ownership would facilitate their implementation.
f) protecting existing local energy networks where possible (e.g. at Gower Street and Bloomsbury) and safeguarding potential network routes (e.g. Euston Road);

Camden's carbon reduction measures
The Council will take a lead in tackling climate change by:
j) taking measures to reduce its own carbon emissions;
k) trialling new energy efficient technologies, where feasible; and
l) raising awareness on mitigation and adaptation measures.

Energy hierarchy

Ensuring developments use less energy
13.8 A building's use, design, choice of materials and other measures can minimise its energy needs during both construction and occupation. The Council will encourage all developments to meet the highest feasible environmental standards taking into account the mix of uses, the possibility of reusing buildings and materials and the size and location of the development. In addition to design and materials, a building's internal heating and cooling design, lighting and source of energy can further reduce energy use. Policy DP22 – *Promoting sustainable design and construction* in Camden Development Policies provides further guidance on what measures can be implemented to achieve an environmentally sustainable building. The Building Research Establishment's Environmental Assessment Method (BREEAM) and the Code for Sustainable Homes provide helpful assessment tools for general sustainability. Further details on these assessment tools can be found in Development Policy DP22 and our Camden Planning Guidance supplementary document.

13.9 Camden's existing dense built form with many conservation areas and other heritage assets means that there are often limits to the contribution that orientation, height and footprint can make towards the energy efficiency of a building. This dense character, along with the varying heights of buildings in central London, can also make the installation of various technologies, including renewable energy technologies more difficult. For example, the efficient use of photovoltaics in Central London can be constrained by overshadowing from taller buildings. We will expect high quality and innovative design to help combat these constraints. Energy efficiency measures relating to heritage assets will be welcomed provided that they do not cause harm to the significance of the heritage asset and its setting. The refurbishment of some existing properties in the borough, such as Camden's EcoHouse in Camden Town and a home in Chester Road in Highgate have demonstrated how Victorian properties can be upgraded to meet Level 4 of the Code for Sustainable Homes energy performance standards. Given the large proportion of development in the borough that relates to existing buildings, we will expect proportionate measures to be taken to improve their environmental sustainability, where possible. Further details on this can be found in our Camden Planning Guidance supplementary document.

Making use of energy from efficient sources
13.10 Once a development has been designed to minimise its energy consumption in line with the approach above, the development should assess its remaining energy needs and the availability of any local energy networks or its potential to generate its own energy from low carbon technology. The Council's full approach to local energy generation and local energy networks is set out below (paragraphs 13.16 – 13.22).

Generating renewable energy on-site
13.11 Buildings can also generate energy, for example, by using photovoltaic panels to produce electricity, or solar thermal panels, which produce hot water. Once a building and its services have been designed to make sure energy consumption will be as low as possible and the use of energy efficient sources has been considered, the Council will expect developments to achieve a reduction in carbon dioxide emissions of 20% from on-site renewable energy generation (which can include sources of site-related decentralised renewable energy) unless it can be demonstrated that such provision is not feasible. Details on ways to generate renewable energy can be found in our Camden Planning Guidance supplementary document.

Adapting to climate change

13.12 It is predicted that in the future we will experience warmer, wetter winters and hotter, drier summers. In addition, Camden is likely to experience more intense rainfall and local flooding, more days with especially poor air quality, increased demand for its open spaces and outdoor pools and increased summer demand for electricity for cooling. To minimise the future need for summer cooling we will expect the design of developments to consider anticipated changes to the climate. For further details on what measures should be considered see policy DP22 – *Promoting sustainable design and construction* in Camden Development Policies. The Council is in discussions with the National Grid regarding future infrastructure improvements including, potentially, a new electricity grid supply point. To help ensure there is adequate water in the future we will require developments to be water efficient. Our overall approach to water conservation and run-off is detailed below.

13.13 Camden is fortunate that it contains Hampstead Heath, Primrose Hill and a part of Regent's Park which help reduce long term heating of the city, known as the urban heat island effect, and provide cool space in hot weather. We will continue to protect our open spaces and other green spaces, where possible, and seek to create additional open spaces. We will also continue to protect the borough's trees and encourage the creation of green and brown roofs and green walls, which help to keep local air temperatures lower. For more detail on how we are protecting and improving our open spaces and other green spaces please see policy CS15 – *Protecting and improving our parks and open spaces and encouraging biodiversity*. Policy DP24 – *Securing high quality design* in Camden Development Policies sets out how we will protect gardens, where possible.

13.14 Climatic changes will affect which plant and animal species thrive or decline. The City of London, which is responsible for Hampstead Heath, has identified potential threats to open spaces and biodiversity in its Climate Adaptation Strategy. It will therefore be important for the Council, other owners of open space and developers to consider the adaptation needs of plants and wildlife. The Council is trialling lower maintenance plant species at Waterlow Park and Cumberland Market. For more detail on our approach to biodiversity please see policy CS15.

13.15 We will also continue our strong efforts to reduce air pollution through mitigation and reducing traffic. Please see policy CS11 – *Promoting sustainable and efficient travel*. Detail on how we will expect development to take into account climate change is set out in policy DP22 – *Promoting sustainable design and construction* in Camden Development Policies.

Local energy generation and networks

13.16 The *Delivering a Low Carbon Camden* report concludes that the most cost-effective way for Camden to meet its carbon reduction targets is through a local energy generation and distribution system served by combined heat and power (CHP). CHP systems typically supply buildings with heat and power (usually electricity) generated on-site or nearby, therefore avoiding the losses which occur in transmitting electricity from plants outside London. CHP is highly efficient and can therefore make a significant contribution to goals to minimise carbon emissions. Cooling can also be incorporated in such systems where there is appropriate demand (known as combined cooling, heating and power or CCHP).

13.17 New decentralised energy networks negotiated through the planning system are most likely to begin in, and expand out from, the growth areas of King's Cross, Euston, Tottenham Court Road, West Hampstead Interchange and Holborn due to the expected scale and mix of development. A local energy network fuelled by gas-fired combined heat and power, a fuel cell and renewable sources has been approved as part of the King's Cross redevelopment. There are possibilities to expand this network beyond the border of the site, including into

Islington. Camden is also working with the London Development Agency (LDA) and land owners to establish a decentralised energy network along Euston Road and into Islington. Map 4 shows the areas considered most likely to provide development-led decentralised energy networks.

13.18 Providing a decentralised energy network in an already built up area is difficult. Although there is currently no extended CHP network in the borough, numerous Council housing estates are already on a community heating system, which can provide a starting point for a wider energy network serviced by CHP. There are also three successful local energy networks in the borough fed by CHP (two serving University College London buildings, one serving two housing developments on Eversholt Street) as well as individual systems at the Swiss Cottage Leisure Centre and the Royal Free Hospital in Gospel Oak and approved schemes at King's Cross, Regent's Place Estate, Southampton Row and Great Ormond Street Hospital. Where decentralised energy networks already exist, development in the area will be required to connect to them, unless it is proven not to be technically feasible or commercially viable.

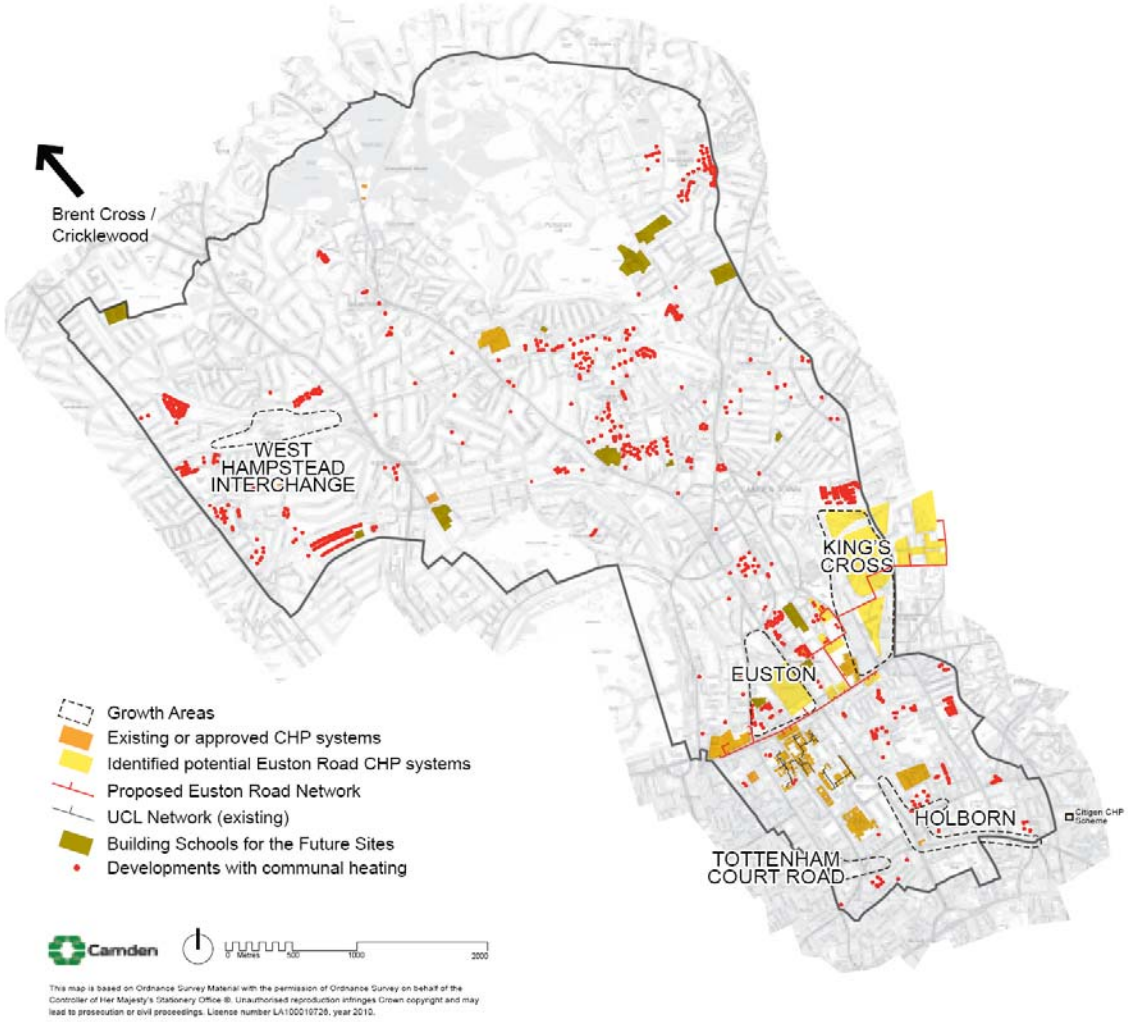
13.19 The Council will require the developers of any large scheme within proximity of a Council housing estate to speak to us about the possibilities of exporting heat to the existing homes. We will also expect developments to export heat to any willing user, where feasible and viable. The largest possible decentralised energy system fed by CHP should be implemented. Where developments in the vicinity of an existing local energy network do not connect to that network or do not include their own CHP system due to feasibility and viability, we will require them to provide the on-site infrastructure for future connection and, where reasonable, a contribution towards laying future connections. The Council is investigating setting up a local energy network fed by CHP for Camden Town Hall, Argyle Street Primary School and two existing housing developments.

13.20 We will work with adjoining boroughs to promote connections to new or existing decentralised energy networks and with the Greater London Authority and London Development Agency to provide advice on funding and linking developments and systems. It will be important to provide for future links to decentralised energy networks within developments or across roads and sites where they are likely to be needed, as providing connections later is difficult in built up places like Camden. See *Community Energy: Urban Planning for a Low Carbon Future* by the Combined Heat and Power Association and the Town and Country Association for more information on community heating, renewable energy and CHP.

13.21 There is growing technical potential to generate heat from waste. The North London Waste Plan will identify future sites for waste facilities in the area (see policy CS18). Given the environmental benefits of using waste for heat, such as less waste going to landfill and turning waste into a resource, the Council will welcome proposals for energy from waste schemes in suitable locations, where they do not cause harm to the amenity of local occupiers.

13.22 The Camden Sites Allocations document will identify any areas or sites where we consider zero carbon development can successfully be promoted. These are likely to be areas or sites near one of the likely CHP locations shown on Map 4.

Map 4: Combined Heat and Power Network



The Council's carbon reduction measures

13.28 The Council is undertaking a range of measures to reduce its own energy use and energy use throughout the borough. These include:

• fuelling 50% of the Council vehicle fleet by liquefied petroleum gas (LPG), electricity or hybrid means;

• installing energy efficiency measures in Council houses;

• using sustainable timber as standard in housing refurbishment;

• investing in cavity wall and roof insulation for Council homes and private sector housing (over 2,000 dwellings have received cavity wall insulation);

• making 'eco-grants' available for various measures, including the installation of solar panels and green roofs;

• our Small steps, Big difference campaign to raise awareness of climate change and encourage changes to behaviour to reduce the borough's environmental impact; and

• supporting the introduction of energy efficient and carbon saving technology. For example, by investing in our own hydrogen fuel cell which is also used as an education tool and by trialling biomethane in our vehicle fleet.

4.1.4 Twyman House, London NW1

The Proposed Development comprises of 54 new build apartments and 2 commercial areas that are distributed in four separate blocks:

Block A: 10 units

Block B: 27 flats, 2 commercial areas

Block C:15 flats

Block D: 2 flats

This energy strategy report will demonstrate how carbon dioxide emissions will be reduced in line with the national, regional and local requirements.

5 Methodology

5.1 Basis of Investigation

This report draws on the information and approach set out in the London Plan. The basis of the study is carbon dioxide reduction.

Be Lean (Energy Efficiency Measures)

A full scale 2010 Part L1A analysis (SAP 2009) has been conducted for the residential units to calculate carbon reduction.

The energy consumption and CO_2 emissions are separated into the following end uses: heating; hot water; cooling; fans, pumps and controls; and lighting.

Various energy-saving measures are considered in terms of technical feasibility and their effect on energy usage in section 6. A package of energy-saving measures is proposed that meets the Part L standard, without reliance on the contribution of CHP or renewables.

Be Clean (Community heating and CHP)

According to Map 4 in Camden Core Strategy 2010, there is no existing and proposed energy network available near the site.

A site wide centralized wet heating system with combined heat and power (CHP) serving the whole site is to be implemented for the Proposed Development to minimize CO_2 emissions.

The detailed calculations are presented in section 6.4

Be Green (Renewables)

A renewable energy assessment has been undertaken based upon the results above and renewable technology data from manufacturers. The strategic issues relating to each technology are also considered in the context of the Proposed Development, and two or three preferred options are short-listed. These are then considered in more detail in terms of technical feasibility and its effect on energy reduction.

The Calculations are presented in section 7.

Thermal Modeling

A simulation model of the design proposal has been constructed on the basis of the provided drawings (see section 6.1). The model aims to investigate the response of the building system to its surrounding environment with a view of optimizing the architectural and engineering building design to minimize carbon emissions required for providing and maintaining comfortable internal conditions throughout the year.

The energy use and carbon performance are calculated with IES 6.2 (Integrated Environmental Solutions) and JPA SAP calculator 4.05a0. The process proceeds as follows;

- Construction of a geometric model of the development proposal
- Definition of the construction module's fabric performance properties
- Definition of the building's energy systems

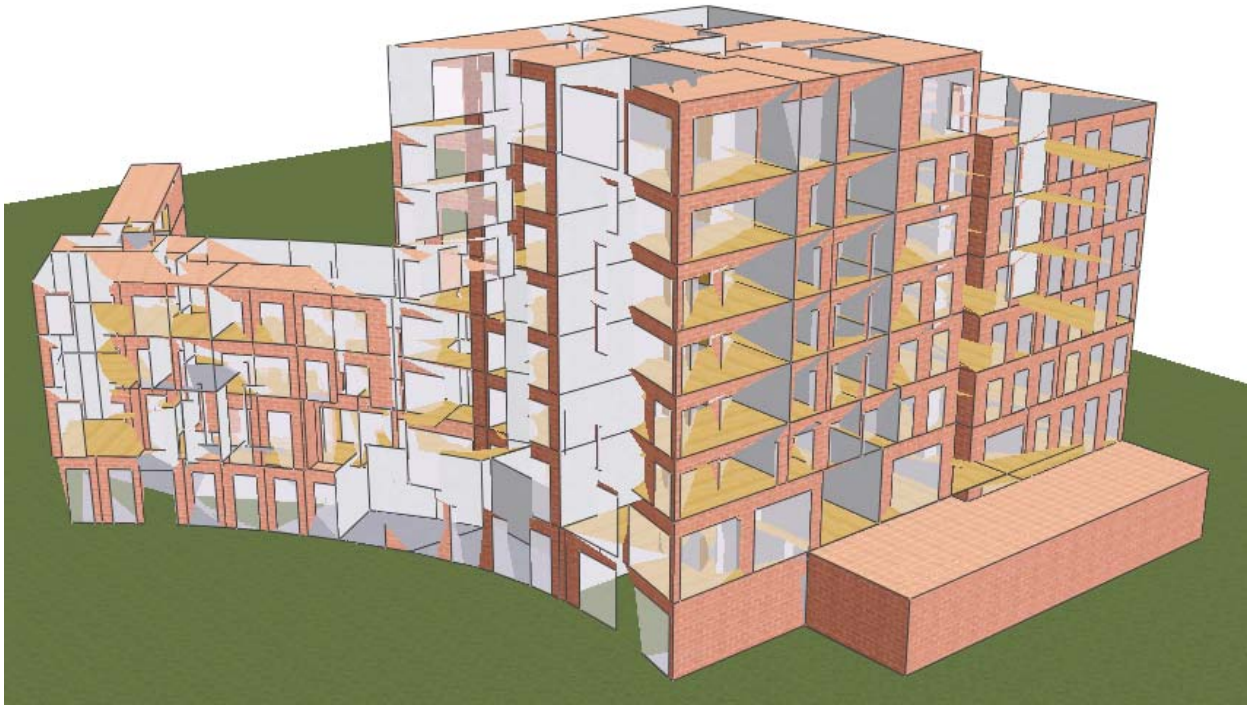


Figure 3: Twyman House IES Model.

6 Energy Demand and Carbon Emissions

The Proposed Development would feature energy saving measures in compliance with Part L1A 2010 of the Building Regulations. This will be achieved without reliance on the contribution of CHP or renewables.

6.1 References

These Planning Drawings are used as references to describe the design:

Schedule of Areas and Accommodation:
Option 2

Proposed Plans:
10003_P_00_G200_003;
10003_P_01_G200_003;
10003_P_02_G200_003;
10003_P_03_G200_003;
10003_P_04_G200_003;
10003_P_05_G200_003;
10003_P_06_G200_003;
10003_P_LG_G200_003;
10003_P_RF_G200_003.

Proposed Elevations:
10003_E_E_G200_003;
10003_E_N_G200_003;
10003_E_NE_G200_003;
10003_E_S_G200_003;
10003_E_W_G200_003.

6.2 Specifications

Part L1A calculations have been undertaken for the Proposed Development using IES 6.2 and JPA SAP calculator 4.05a0, which is accredited for this use. The requirements for compliance with Part L1A 2010 were established, and feasible improvements included to further reduce the carbon dioxide emissions. The measures outlined below have been used in the calculations which exceed the requirements of Part L1A:

- Well-insulated building fabric with:
  - External walls and the walls face communal area at 0.15 W/m²K;
  - Roof at 0.15 W/m²K;
  - Ground floor at 0.15 W/m²K;
  - Doors at 1.0 W/m²K;
  - Soft coated low-e Glazing (including frame) with area weighted U-value at 1.5 W/m²K;
  - Glazing total solar energy transmittance at 0.64;
  - Glazing light transmittance at 0.7;
  - 100% doors and windows draught stripped;
  - Air permeability of 3 m³/hr/m²;
  - Accredited construction Y=0.08
- Condensing gas-fired boilers with minimum efficiency of 90%, and low NOx emissions (for establishing Be Lean Stage energy consumption)
- Boiler with interlock
- Space heating with time and temperature zone control
- Hot water cylinder with capacity of 150 litres and 35mm factory insulation (for establishing Be Lean Stage energy consumption)
- Separate time control for hot water heating
- Whole house mechanical ventilation with heat recovery (SPF: 0.5W/l/s, heat recovery: 90%)
- 75% low energy lighting for code for Sustainable Homes

CO_2 emissions for cooking and appliance in the residential units are calculated by the methodology set up in the guidance of Code for Sustainable Homes.

6.3 Communal Areas

Assuming that the communal corridors and staircases areas are unheated, there is no requirement for Part L1A calculations for the residential Development. The CO_2 emissions associated with the following use have been included in the total site CO_2 emissions.

- External Lighting;
- Circulating areas lighting.

6.4 CHP Assessment (Be clean)

Plant sizing is fundamental to the operational efficiency of the CHP system. The initial heating load calculations indicate the development has a domestic hot water energy base load of about 139MWh/year. A 15.2kWe with 30kWheat output CHP has been selected to provide 100% of total residential hot water demand. In order to ensure the CHP performance, a buffer vessel with a total storage capacity of 6000 liters will be required.

The control of community heating system is specified as charging system linked to use of heating with TRVs.

A natural gas CHP system will require about 257MWh natural gas to provide the total hot water demand. The CHP will generate approximately 71MWh of electricity every year. Overall, this CHP plant with community heating system would lead to a further reduction of 25,880kgCO2/year, equivalent to 19.4% of the CO_2 emissions at Be Lean stage.

6.5 Carbon Performance of CHP Operation (Be clean)

The CHP system at the development has been shown to meet the CHPQA requirements below. The energy and carbon performance improvements with CHP operation are calculated using data from the baseline results and standard Part L fuel carbon intensities:

If a CHP scheme reaches the relevant threshold criteria for Good Quality CHP, as defined by the CHP Quality Assurance (CHPQA Programme) it will be possible to claim Climate Change Levy exemption for its entire fuel requirements.

The two threshold Criteria for new Good Quality CHP are:

Power Efficiency greater or equal to 20%
Quality Index greater or equal to 105

Power efficiency = Total power output / Total fuel input

For internal combustion CHP systems, quality index
QI = (200 x power efficiency) + (125 x heat efficiency)

The Development's CHP system achieves:

Power Efficiency of 27.6%

Quality Index of 123.3

Therefore the proposed CHP design meets the requirements of the Climate Change Levy exemption.

6.6 Total Energy Demand and Carbon Dioxide Emissions

Table 1 - Total Site Energy Demand and Carbon Dioxide Emissions (Residential and Commercial areas).

Residential:

Residential	Part L										Non Part L		Total site carbon emissions (tCO_2)
	Gas Demand (MWh)		Electricity Demand (MWh)					Total site energy demand (MWh)	LZC (tCO2)	Total carbon emissions (tCO_2)	Equipment (tCO_2)	communal lighting (tCO_2)	
	Space heating	Hot water	Space heating	Hot water	Cooling	Fans, pumps & controls	Lighting						
Target (Notional)	309.20	180.37	27.11	0	0	8.58	31.09	556.35	0	77.05	43.58	12.02	132.65
Be Lean - energy efficiency	109.44	138.63	10.98	0	0	21.52	23.28	303.85	0	77.96	43.58	12.02	133.57
Be Clean CHP	109.44	195.00	0.00	0	0	21.52	23.28	349.24	-31.36	52.08	43.58	12.02	107.69
Be Green (renewables, PV)	109.44	195.00	0.00	0	0	21.52	23.28	349.24	-42.02	41.42	43.58	12.02	97.03

Commercial part:

Commercial	Part L								Non Part L		Total site carbon emissions (tCO_2)
	Electricity Demand (MWh)					Total site energy demand (MWh)	LZC (tCO2)	Total carbon emissions (tCO_2)	Cooking and appliance (tCO_2)	communal lighting (tCO_2)	
	Space heating	Hot water	Cooling	Fans, pumps & controls	Lighting						
Target	6.2	27.9	15.3	2.5	18.1	70	0	20	7.28	N/A	27.3
Be Lean - energy efficiency	4.8	23.3	19.3	0.9	17.6	65.9	0	19.4	2.28	N/A	26.7

CO2 savings against 2010 Target for the whole site

	Carbon dioxide savings (Tonnes CO2 per annum) compared to the TARGET	% of carbon dioxide savings compared to the TARGET
Be Clean (CHP and community heating)	25.0	18.8%
Be Green (PV)	35.6	26.9%

7 Renewables

7.1 Preliminary Assessment

The London Renewable Toolkit (LRT) provides benchmark sizing and cost data for "renewable energy technologies". It therefore provides information to assess the various technologies at an early design stage, with initial measurements of the impact of using each technology on the building's energy reduction. Table 2 (below) outlines these technologies and the variations proposed in the LRT used in this assessment.

Table 2

Technology	End Use Demand Met
Wind	Electricity
PV Cells - rooftop	Electricity
PV Cells - cladding	Electricity
Solar Water Heating	Annual DHW (50 %)
Biomass heating (a)	Annual Space Heating +Domestic Hot Water (33%)
Biomass heating (b)	Annual Space Heating +Domestic Hot Water (50%)
Biomass heating (c)	Annual Space Heating +Domestic Hot Water (100%)
Biomass CHP (a)	Annual Space Heating +Domestic Hot Water (33%)
Biomass CHP (b)	Annual Space Heating +Domestic Hot Water (50%)
Ground sourced heat pumps (a)	Annual Space Heating +Domestic Hot Water (50%)
Ground sourced heat pumps (b)	Annual Space Heating +Domestic Hot Water (100%)
Ground sourced heat pumps (c)	Peak Space Heating (50 %) Annual Space Heating + Domestic Hot Water (85 %)
Ground cooling (a)	Annual Cooling (50%)
Ground cooling (b)	Annual Cooling (100%)

The section summarizes the details assessed for each renewable technology:
Energy generated from LZC energy source per year

- Payback
- Land use
- Local planning requirements
- Noise
- Feasibility of exporting heat/electricity from the system
- Life cycle cost/lifecycle impact of the potential specification in carbon emissions
- Grants
- All technologies appropriate to the site and energy demand of the development.
- Reasons for excluding other technologies.

On the basis of this preliminary analysis, and a review of the general advantages and disadvantages of the different technologies relative to the Proposed Development, the following technologies were not considered to be appropriate to the Proposed Development:

- Biomass
- Micro Wind Turbines
- Solar Thermal Water Heating
- Ground Source Heat Pumps

Biomass:

	Combustion of biomass as an alternative to gas for firing boilers
Energy saving	Minimal - A biomass boiler will consume similar energy as a gas fired boiler.
Carbon emission reduction	84,000 $kgCO_2$/year
Life span	20 years.
Lifecycle cost	Capital cost: £95,000 Running cost: £140 to £200 a tonne of biomass Saving: N/A
Lifecycle impact	Embodied Carbon: 99,000$kgCO_2$ Carbon reduction with 20-year operation: 1,675,000$kgCO_2$ Lifecycle impact: saving 1,995,000$kgCO_2$
Payback	N/A (due to the fuel cost)
Land use	60m^2 plant room for the boiler and fuel storage
Visual Impact	Minimal – the boiler and fuel storage are normally inside the building
Local planning requirements	Air quality assessment is required.
Noise impact	Moderate
Maintenance	Moderate
Feasibility	On the basis of concerns over air quality issues from flue discharge; concerns over transport issues relating to regular deliveries of biomass; security and cost of fuel supply; concerns over disposal of ash; and relatively high maintenance. This technology is not considered appropriate for the development. Not applicable

Micro wind turbine:

	Electro-Mechanical device that affects a momentum transfer to convert kinetic energy from wind into electrical energy
Energy saving	Moderate – 10 of 3kW wind turbines will provide 19,000 kWh/year of electricity
Carbon emission reduction	10,800 kgCO_2/year
Life span	20 years.
Lifecycle cost	Capital cost: £114,000 Saving: £2,900 per year
Lifecycle impact	Embodied Carbon: 11,400kgCO_2 Carbon reduction with 20-year operation: 215,800kgCO_2 Lifecycle impact: saving 204,420kgCO_2
Payback	40 years
Land use	Roof area with appropriate spacing between each wind turbine
Visual Impact	High – the scale of a turbine installation that would be required to generate any useful amount of power would be highly visible.
Local planning requirements	Height of the wind turbines and visual impact
Noise impact	Moderate - High
Maintenance	Moderate
Feasibility	The height of the development has been limited which restricts the utilization of wind turbines. Large stand alone wind turbines would also increase the noise levels of the development which would not be acceptable to the Environmental Health Department. Therefore, this technology is not proposed for this development. Not applicable

Solar Thermal Water Heating:

	Arrangements of collector units absorb radiant energy from the sun for the purpose of heating domestic hot water
Energy saving	Considerable – the Proposed Development will have substantial domestic hot water demand and solar water heating can provide an energy saving of 37,241kWh/year.
Carbon emission reduction	720 kgCO_2/year
Life span	25 years.
Lifecycle cost	Capital cost: £40,000 Saving: £2,000 per year
Lifecycle impact	Embodied Carbon: 21,000kgCO_2 Carbon reduction with 25-year operation: 170,000kgCO_2 Lifecycle impact: saving 149,000kgCO_2
Payback	20 years
Land use	120m^2 roof area
Visual Impact	Low – The installation of panels on the roof has a low visual impact.
Local planning requirements	N/A
Noise impact	Minimal
Maintenance	Low - Flat plate collectors have a similar cleaning interval requirement to windows.
Feasibility	The technology conflict with the CHP system which is proposed to provide all domestic hot water demand. Not Applicable

Ground Source Heat Pump Heating and Cooling:

	Closed pipe loops provide a heat exchange between A/C cooling water and the ground providing heating via heat pumps
Energy saving	Considerable - The ground source heat pump heating system will optimally save 91,000kWh/year of natural gas.
Energy export	N/A
Carbon emission reduction	9000 $kgCO_2$/year
Life span	25 years
Lifecycle cost	Capital cost: £160,000 Saving: £4,000 per year
Lifecycle impact	Embodied Carbon: 47,400$kgCO_2$ Carbon reduction with 25-year operation: 223,000$kgCO_2$ Lifecycle impact: 175,800$kgCO_2$
Payback	39 years
Land use	1,600m^2
Visual Impact	Minimal – this technology is very low profile as the bores or pipes and other equipment are within the building.
Local planning requirements	N/A
Noise impact	Minimal
Maintenance	Moderate – Low
Feasibility	Ground Source Heat Pump is more appropriate for residential properties with comfort cooling. Due to the absence of cooling demand in Twyman House, this system would not applicable.

On the basis of this preliminary analysis, and a review of the general advantages and disadvantages of the different technologies relative to the Proposed Development, photovolitaic solar energy has been considered appropriate for the Development:

Photovoltaic Solar Energy:

	Solar Collectors that convert the electromagnetic radiant energy from the sun into electrical energy
Energy saving	Moderate – The 27kWp PVs will produce 20,150 kWh of electricity.
Energy export	The electricity generated from the PVs should be used on-site to optimise the efficiency. The available roof of Block B allows approximately 27kWp PVs to be installed and the capacity is considered low for exporting the grid.
Carbon emission reduction	10,660kgCO_2/year
Life span	25 years
Lifecycle cost	Capital cost: £190,000 Saving: £3,240 per year Saving from feed-in tariff: £4,500 per year
Lifecycle impact	Embodied Carbon: 156,600kgCO_2 Carbon reduction with 25-year operation: 297,000kgCO_2 Lifecycle impact: saving 140,450kgCO_2
Payback	24.5 years
Land use	approximately 220m^2 roof area
Visual Impact	Low – The installation of panels on the roof has a low visual impact.
Local planning requirements	N/A
Noise impact	None.
Maintenance	Low - the collectors have a similar cleaning interval requirement to windows.
Feasibility	The roof is not overshadowed from any obstructions. The available roof area on block B for the panels tilted approximately 15 degree (for self cleaning) facing South with the restriction of 300mm height would accommodate 27kWp of monocrystalline PVs. Applicable

7.2 Detailed Appraisal

It is proposed that 27kWp (about 220m^2) of monocrystalline PV panels for the Development to provide energy equivalent to approximately 20,150 kWh of electricity over a year. This system will provide 9.9% of carbon emission reduction with respect to the Be Clean stage for the whole site.

Grants

The DTI's Low Carbon Buildings Programme provides grants for microgeneration technologies for householders, community organisations, schools, the public sector and businesses. The programme is managed by the Energy Saving Trust.

There are two streams of grants available:
Stream 1 - these grants apply to smaller projects for home owners and community groups among others.
Stream 2 - these grants apply to medium and large scale microgeneration projects and will available to public, not for profit and commercial organisations. Stream 2 grants were launched in September 2006.

The technologies covered by the Low Carbon Buildings Programmes are:

- Solar photovoltaics.
- Wind turbines.
- Small hydro.
- Solar thermal hot water.
- Ground source heat pumps.
- Water/air source heat pumps.
- Bio-energy.
- Renewable CHP.
- MicroCHP (Combined heat and power).
- Fuel cells.

Details of the programme and an online application system can be found at www.lowcarbonbuildings.org.uk

8 Conclusion

This document has responded to planning policy in respect of energy consumption and carbon emissions. The methodology used herein is consistent with the London Plan and Part L of the Building Regulations.

The Proposed Development features the following energy-saving measures:

- Improved U-values as detailed within Section 6;
- Service systems as detailed within Section 6; and
- All internal, external and communal lighting to be provided through low energy lighting, wherever possible.

The energy saving measures would be used to reduce the Proposed Development's energy requirements and to exceed the compliance requirements of Part L of the Building Regulations.

The Development energy strategy is to provide a centralized wet heating system and a combined heat and power (CHP) serving total residential hot water demand. This will contribute to up to 25tCO_2 saving in a year which equals to 18.8% of reduction with respect to the Target.

In addition, it is proposed that 27kWp of PV panels to provide a 9.9% of carbon emission reduction compared to the Be Clean stage for the whole site.

Overall the combination of a centralized wet heating system, a combined heat and power (CHP) serving total residential hot water demand and a 27kWp of PV plant will contribute up to 26.9% of carbon emission reduction with respect to the Target (see Figure 4).

The renewable provision is compliant with the 20% reduction requirement in the London Plan. In addition, the residential part of the development total regulated emissions (only Part L) will be 46.2% lower than the Part L target (see Figure 5). This figure meets the mandatory requirement to achieve Code for Sustainable Home level 4 for energy consumption.

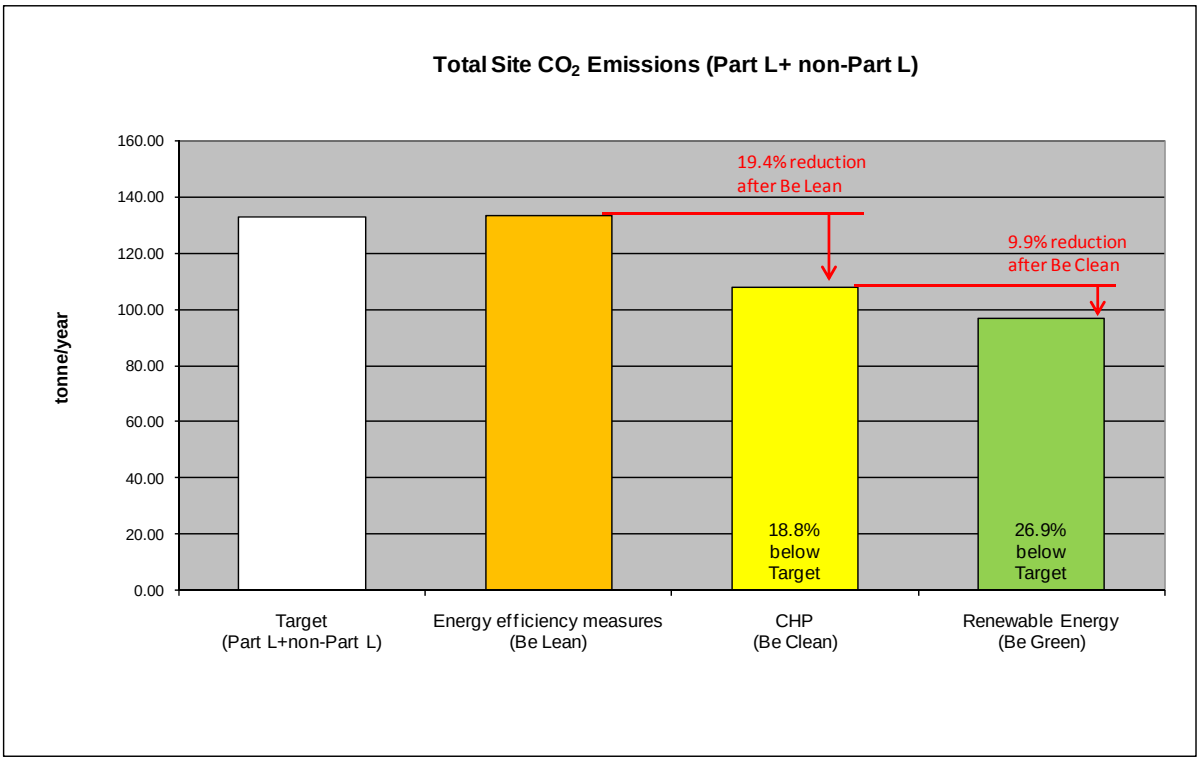


Figure 4: Twyman House emissions (Part L + non-Part L) chart.

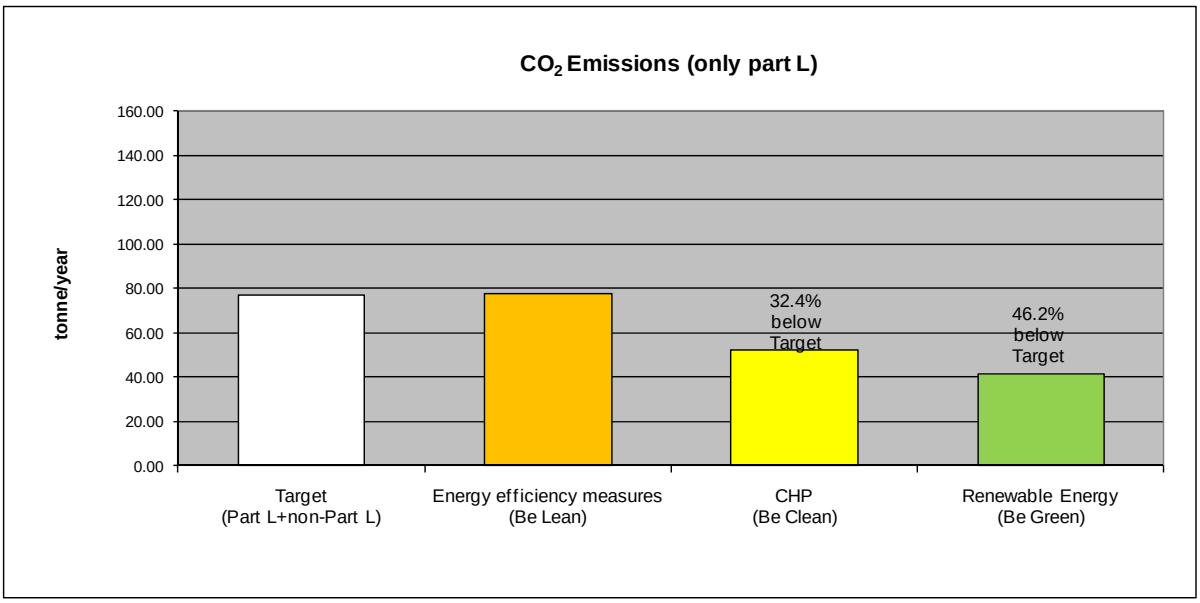


Figure 5: Twyman House emissions (only Part L) chart.

Appendix – Summer Overheating Analysis

The criterion 3 in Building Regulations Part L1A, limiting the effects of solar gains in summer, has been checked for flat A.1.2 as the flat is considered the worst case with large south-facing windows and whole house mechanical ventilation system.

SAP 2009 Appendix P has been used to demonstrate the compliance of the criterion and the result is shown in section 9 of the Part L1A compliance checklist in the following page.

The maximum flow rate of the ventilation system has been set at 325m^3/h which is approximately 1.9 ACH to the flat.

To comply with the requirement, the following measures are proposed to reduce the summer overheating risk.

- Solar control glazing with G-value of 0.42
- Light coloured blinds or curtain

Project Information
Building type Mid-floor flat

Plot number A-1-2
Reference A-1-2
Date 27 May 2011
Project Twyman House
Camden Town
London

REGULATION COMPLIANCE REPORT - Approved Document L1A, 2010 Edition
assessed by program JPA Designer version 5.01a0, printed on 27/05/2011 at 11:52:19

DWELLING AS DESIGNED

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1 TER and DER
Fuel for main heating system: Gas (mains) (fuel factor = 1.00)

Target Carbon Dioxide Emission Rate	TER = 19.28	
Dwelling Carbon Dioxide Emission Rate	DER = 19.26	OK

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2 Fabric U-values

Element	Average	Highest	
Wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Floor	0.00 (max. 0.25)	0.00 (max. 0.70)	OK
Roof	0.00 (max. 0.20)	0.00 (max. 0.35)	OK
Openings	1.50 (max. 2.00)	1.50 (max. 3.30)	OK

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3 Design air permeability

Air permeability at 50 pascals:	3.00	OK
Maximum :	10.00	

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4 Heating efficiency
Main heating system:
Boiler and radiators, mains gas
Source of efficiency: from manufacturer

Efficiency: 90.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system:
None -

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5 Cylinder insulation
Hot water storage

Calculated cylinder loss factor (kWh/day)	1.10	
Permitted by Section 6.4	1.57	OK
Primary pipework insulated	Yes	OK

6 Controls

(Also refer to "The Domestic Heating Compliance Guide" by the DCLG)

Space heating controls	Time and temperature zone control	OK
	Cylinderstat - Yes	OK
	Independent timer for DHW - Yes	OK

7 Low energy lighs

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

8 Mechanical ventilation

	Specific fan power : 0.70 Efficiency : 90.00	
	Maximum : 1.5W/(litre/sec) and efficiency not less than 70%	OK

9 Summertime temperature

Overheating risk (Thames Valley):		OK
	Medium	OK

Based on:

Thermal mass parameter :	0.00
Overshading :	Average or unknown (20-60 % sky blocked)

Orientation : North

Ventilation rate :	1.90
Blinds/curtains :	

Light-coloured curtain or roller blind with blinds/shutters closed 100.00% of daylight hours

10 Key features

Walls U-value 0.15 W/m²K

Design air permeability 3.0 m³/h.m²