Energy Statement

18No. Dwellings

Allcroft Road, London Borough of Camden

For

Telford Homes Plc

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Contents

1.0 Introduction

This energy statement has been developed in support of the planning application by Telford Homes Plc for the Allcroft Road development in Camden, London. The proposal consists of 18No. new build apartments.

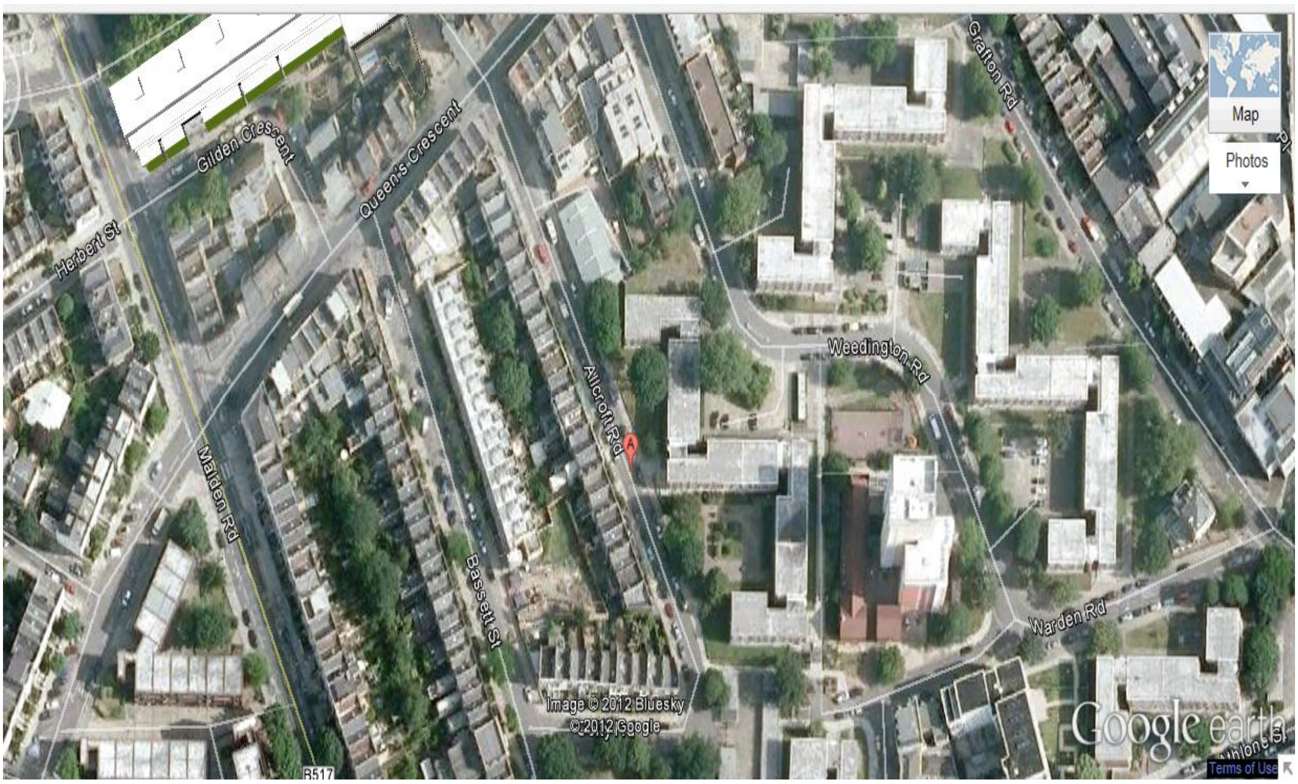
This renewable energy study provides supporting information for the proposed Renewable and Low or Zero Carbon (LZC) technologies considered on site in accordance with London Borough of Camden and the Code for Sustainable Homes guidance November 2010 edition.

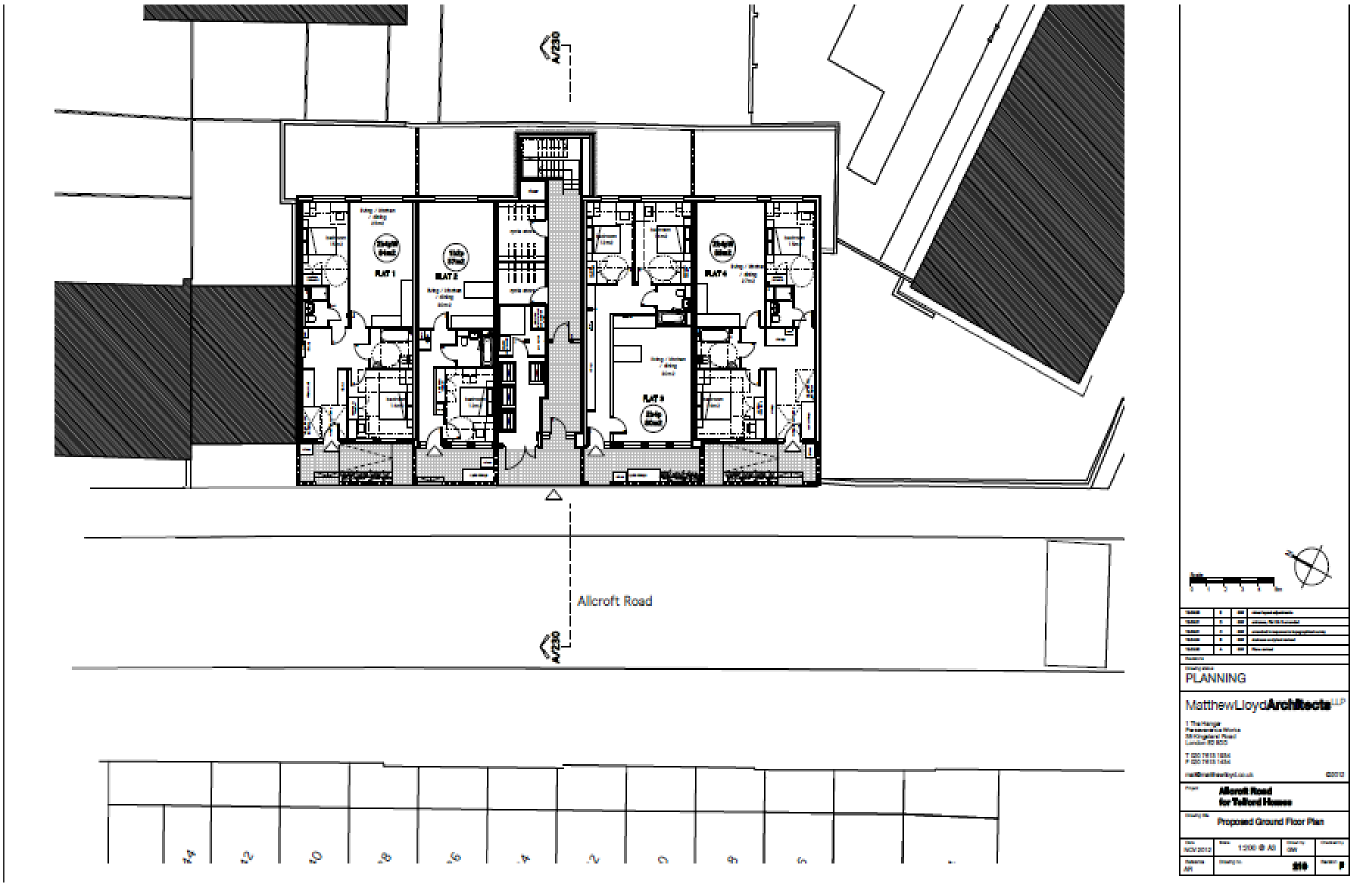
In response to both the London Plan and London Borough of Camden Local Development Framework, this assessment has been undertaken to strategically look at the technical and economical feasibility of Renewable Energy sources.

As a result we are proposing to provide the development with on-site renewable and low carbon technologies to offset a proportion of the developments carbon emissions.

Location

The Allcroft Road development is located within London Borough of Camden.





Accommodation Schedule

The accommodation schedule used as a basis for the feasibility study is as follows:

Description	No. of Type
1 Bed Apartment	5
2 Bed Apartment	11
3 Bed Apartment	2
Total	**18**

1.1 Executive Summary

This Energy Statement has been developed to evaluate the technical and economic feasibility of using low and zero carbon technologies. The following technologies have been evaluated: –

- Biomass
- Wind
- Biogas
- Geothermal
- Air Source Heat Pumps
- Combined Heat & Power (CHP)
- Solar Hot Water
- Solar Photo-voltaic

In line with the London plan energy hierarchy the strategy will consider the need to reduce energy use first, then use clean, efficient non-renewable systems and finally use renewable technologies for the remaining energy requirements –

BE LEAN, BE CLEAN, BE GREEN

Use energy efficiently – 'Be Lean'

Improve the energy efficiency of the scheme

- The development will be designed and constructed to a high quality to improve on Building Regulations Part L including improved building fabric and air-tightness
- High performance low–e glazing will maximise day lighting and winter sun solar gain whilst reducing heat loss through the glazed areas

Supply energy efficiently – 'Be Clean'

Supply as much of the remaining energy from low carbon technologies such as district heating, MVHR or CHP

- High efficiency mechanical ventilation with heat recovery (MVHR) will be provided throughout.
- Heating & Hot water will be provided to the apartments by Individual Boilers with Flue Gas Heat Recovery. Note the site is very tight and there is no space designated for a communal heating system.

Use renewable energy – 'Be Green'

Offset a proportion of the remaining carbon emissions using renewable energy sources such as PV, solar etc.

- Approximately 7.25kWp of PV will be installed to the un-shaded roof area of the building to service the apartment's communal circulation space.

The carbon saving from the suggestions above will be calculated based on SAP 2009, the government's approved method of calculating energy and CO_2 emissions for dwellings. It is much more accurate than applying a kWh/m2 estimate as SAP thermally models each dwelling type in 3 dimensions. SAP is used to show compliance with Building Regulations Part L1A 2010. Carbon emissions from unregulated energy are to be included in the assessment and will be estimated using the BRE Code for Sustainable Homes ENE 7 tool.

For the purpose of the assessment we will be evaluating 9No. dwelling types to provide an accurate representation of the Total Energy used on site.

Summary

The development will be provided with energy savings through the use of renewable technologies. Other improvement measures such as improved energy efficiency will complement the integrated approach to the sustainable energy objectives of the London Plan and London Borough of Camden and reflect the aspirations of the regional and national policies. The Energy Hierarchy principle is as follows:

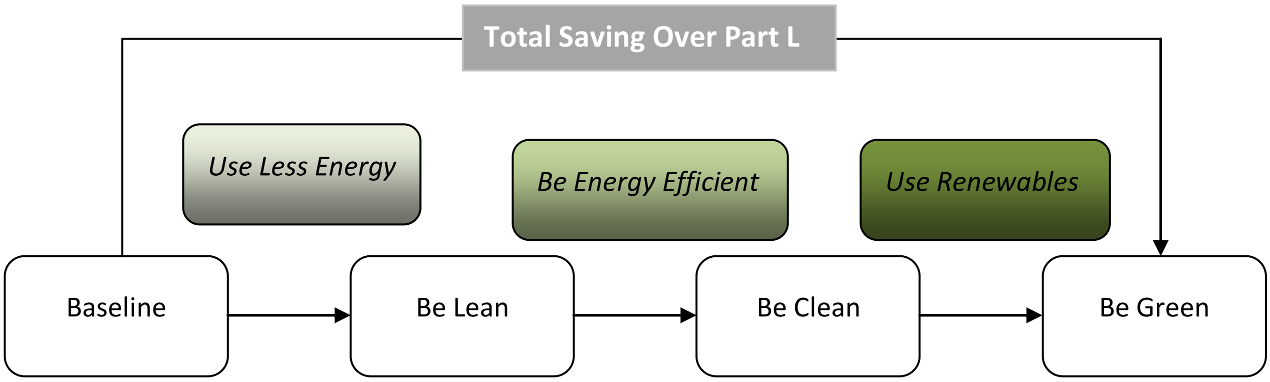


Table 1: The Energy Hierarchy

GLA Table 1 - Carbon Savings After Each Stage of the Energy Hierarchy		Regulated CO_2 kg/yr		Unregulated CO_2 kg/yr		Total CO_2 kg/yr
Building Regs Part L compliant Development						
Residential		17671		18473		36144
Non - Residential		4196		0		4196
Total	A=	21867	B=	18473	C=	40340
Be Lean						
Residential		17501		18473		35974
Non - Residential		3669		0		3669
Total	D=	21169	E=	18473	F=	39642
Be Clean						
Residential		15684		18473		34157
Non - Residential		3302		0		3302
Total	G=	18986	H=	18473	I=	37459
Be Green						
Residential		12502		18473		30975
Non - Residential		3137		0		3137
Total	J=	15638	K=	18473	L=	34111

Table 2: CO2 emissions Regulated and Unregulated

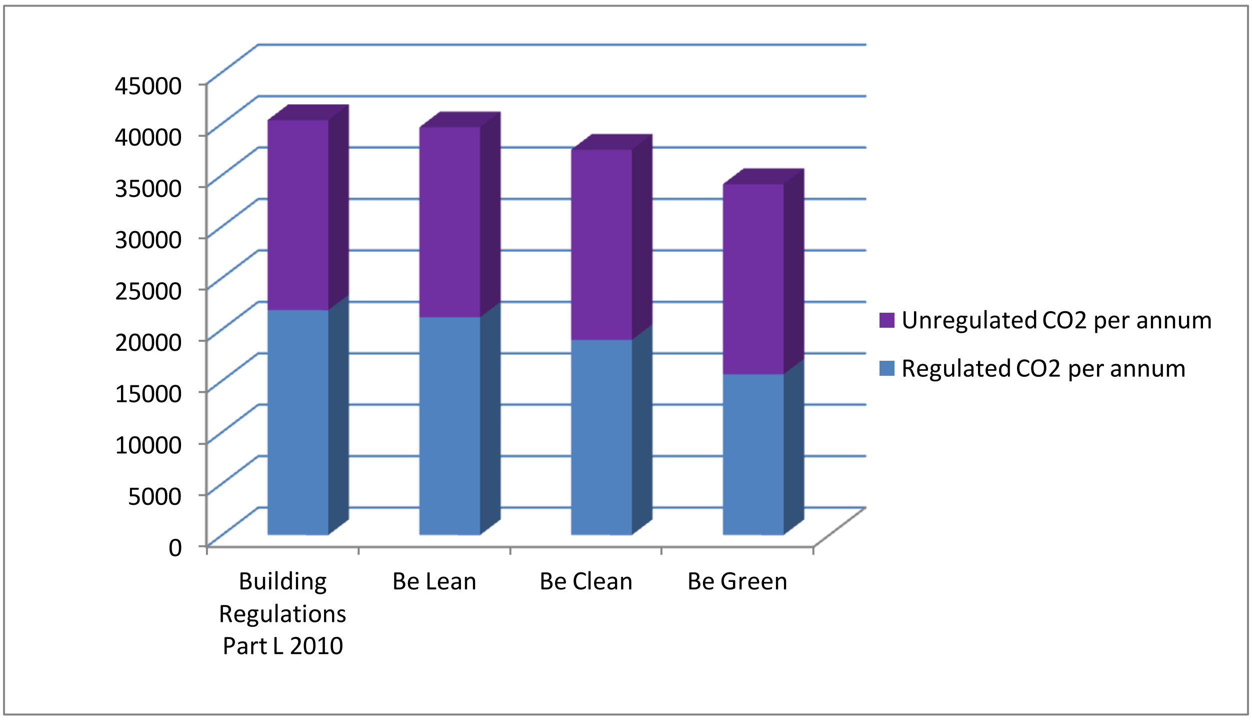


Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy

Table 3 - Carbon Savings from Each Stage of the Energy Hierarchy				%age improvement				%age improvement
A-D	regulated saving from be lean		698	3.2%				
D-G	regulated saving from be clean		2184	10.3%				
G-J	regulated saving from be green		3348	17.6%				
C-F	total saving from be lean						698	1.7%
F-I	total saving from be clean						2184	5.5%
I-L	total saving from be green						3348	8.9%
A-J/A*100	total cummulative regulated saving			28.5%				
C-L/C*100	total cummulative saving							15.4%

The Be Lean, Be Clean & Be Green solutions are predicted to reduce the total carbon emissions by 6,229 kg CO_2 per annum from the baseline energy assessment of 40,340kg CO_2. This is a 28.5% reduction from the Baseline regulated energy emissions and 15.4% reduction in the total carbon emissions from the baseline assessment.

The energy efficiency ‘BE LEAN, BE CLEAN & BE GREEN’ measures will include:

1) Enhanced thermal efficiency of building fabric as set out in Appendix 1 of this report.
2) Efficient ventilation systems with heat recovery
3) Low air leakage
4) Individual boilers with flue gas heat recovery.
5) Efficient lighting strategy
6) PV array of 29No. 250Wp panels provided 7.25kWp to support the electricity demand for the apartments. The PV will be mounted horizontally.

1.2 UK Policy Drivers for Energy Efficiency and Renewable Energy

National Policy

National Planning Policy Framework March 2012

National Planning Policy Framework March 2012 section 10 –'Meeting the challenge of climate change, flooding and coastal change' sets out the following relevant standards for new developments:

● when setting any local requirement for a building's sustainability, do so in a way consistent with the Government's zero carbon buildings policy and adopt nationally described standards.

● comply with adopted Local Plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable

● take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption. Achieve an overall sustainability rating of at least 'Level 3' according to the Code.

Regional Policy

Greater London Authority Relevant Planning Policy on Renewable Energy and Energy Efficiency 2011

The first London Plan was published in 2004. Since then, three sets of alterations have been made to it, and an updated version, bringing these alterations together, was published in July 2011.

The London Plan aims to ensure London becomes an exemplary, sustainable world city whilst allowing London to grow in a responsible and considered socio-economic manner. As buildings are responsible for 80% of London's CO_2 emissions, building energy use reduction is seen as the primary method to reduce emissions in London.

The London Plan July 2011 includes the following separate policies on which the energy strategy for the Scheme is based:

- Policy 4A.3: Sustainable design and construction;
- Policy 4A.4: Energy assessment;
- Policy 4A.5: Provision of heating and cooling networks;
- Policy 4A.6: Decentralised energy; and
- Policy 4A.7: Renewable energy.

The Mayor of London's energy policy promotes the following 3 tiered energy hierarchy:

1. Energy efficiency – BE LEAN, i.e. use less energy;
2. Efficient supply and conversion – BE CLEAN, i.e. use energy efficiently;
3. Renewable energy sources – BE GREEN, i.e. use renewable energy.

The London Plan 2011 also requires the commitment to deliver 20% of the CO_2 reduction of the scheme from on-site renewable energy sources.

Policy 4A.7 Renewable Energy:

'The Mayor will, and boroughs should, in their DPDs, adopt 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 decentralised 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 by:

- *Requiring the inclusion of renewable energy technology and design, 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.*

- *Facilitating and encouraging the use of all forms of renewable energy where appropriate, and giving consideration to the impact of new development on existing renewable energy schemes. '*

- *'Boroughs in their DPDs should identify broad areas where the development of specific renewable energy technologies is appropriate. These should encourage the fullest realisation of the potential for renewable energy having regard to the environmental and transport policies of the London Plan.*

These should include:

- *identifying sites for zero carbon development;*
- *identifying suitable locations for wind turbines in developments;*
- *encouraging at least one large wind power scheme in London;*
- *encouraging applications for new street appliances (such as bus shelters, bus stops, parking ticket machines and road signs) to incorporate off-grid solar power and other renewable energy sources where feasible.'*

Under this policy, reference is made to the London Renewable Energy Toolkit which has been developed to assist in assessing the feasibility and viability of renewable technologies. *Integrating energy into new developments: Toolkit for planners, developers and consultants September 2004* is a document to be used to assist the development and delivery of renewable energy into new developments. Under Section 2.6 it considers the question 'what is Feasible?' In response, the text states that the delivery of renewable source may depend on technical issues, financial issues, or both. It goes on to say that *"strong justification from developers will be required if they do not think they can provide the required proportion. If it is believed not to be feasible to provide the applicable* *target proportion of renewable energy in a particular development, developers will be expected to explain their reasoning to planners and to include in their proposals the proportion they judge is feasible. "*

The document acknowledges that feasibility is likely to vary, particularly as energy prices fluctuate, costs of the technologies change, and as new grants or legislation comes in.

Factors listed under the toolkit as affecting the cost of renewable energies:

- technology price changes;
- economies of scale, i.e. bulk purchases;
- grants and their current predicted life spans;
- VAT issues;
- impact of legislation;
- fossil fuel price changes; and
- marketing the benefits of renewable energy.

The London Plan Policy 4A.2 – 4A.16 states that the "*Mayor and boroughs need to have regard to the costs and feasibility of measures to tackle climate change within developments"*. It is emphasised that dealing with climate change is an essential part of the development process and developers should see it as a core responsibility.

It is presumed that the targets will be met in full, except where developers can demonstrate that, in the particular circumstances of a proposal, there are compelling reasons for the relaxation of the targets. In all cases, the most important contribution will be the achievement of reductions in carbon dioxide emissions.

Policy 4A.3: Sustainable design and construction;

Policy 4A.3 of the London Plan requires all major planning applications to include a statement on the potential implications of the development on a wide range of sustainable construction and design considerations, including the 'essential' and 'preferred' standards set out in the Mayor's SPG and any relevant standards set at the Borough level through the local development plan.

The London Plan - 2011

London elected a new Mayor in May 2008. Shortly after his election, he consulted on 'Planning for a Better London' (July 2008), which outlined his intended approach to planning. Consultees argued strongly that rather than changing the Plan incrementally over his term of office, he should move straight to a full review leading to a replacement London Plan.

With this in mind, the Mayor announced an immediate full review of the London Plan in 2008, with a consultation process leading up to formal publication of the new London plan in July 2011.

The new plan suggests that *'As a minimum, all major development proposals should meet the following targets for carbon dioxide emissions reduction in buildings.*

These targets are expressed as minimum improvements over the Target Emission Rate (TER) outlined in the national Building Regulations 2010 leading to zero carbon residential buildings from 2016 and zero carbon non-domestic buildings from 2019.

Changes to CO_2 targets in buildings

Year	**Targets -** Improvement on 2010 Building Regulations
Residential	
2010 – 2013	25 %
2013 – 2016	40 %
2016 – 2031	Zero Carbon
Non-Residential	
2010 – 2013	25 %
2013 – 2016	40%
2016- 2019	As per building regulations requirements
2019 -2031	Zero Carbon

The new Plan also states that *'The carbon dioxide reduction targets should be met onsite. Where it is clearly demonstrated that the specific targets cannot be fully achieved onsite, any shortfall may be provided offsite or through a cash in lieu contribution to the relevant borough to be ring fenced to secure delivery of carbon dioxide savings elsewhere'.*

The GLA's most recent monitoring information shows that, on average, development proposals approved by the Mayor since September 2007 have achieved typical savings of between 30 and 40 per cent above building regulation requirements, with about a quarter of applications meeting or exceeding 40 per cent savings. The targets outlined apply to all major development proposals. The highest level of carbon dioxide emissions reduction will be sought in every proposal, and the Mayor will actively encourage zero carbon development where appropriate. Overall carbon dioxide emission reductions should reflect the context of each proposal, taking into account its size, nature, location, accessibility and expected operation.

Every major development proposal should be accompanied by an energy assessment demonstrating how the minimum targets for carbon dioxide emissions reduction will be met within the framework of the energy hierarchy.

Local Policy

The Development falls within the London Borough of Camden, which has a Local Development Framework and Core Strategy. The Core Strategy and DPD's state the following :

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.*

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.*

DP22 – Promoting sustainable design and construction

Designing to adapt to climate change

22.15 *It is predicted that in the future we will experience warmer and wetter winters and hotter and drier summers. These changes could lead to more intense rainfall and local flooding; subsidence due to increased shrinking and expanding of Camden's clay base; poorer air quality; a hotter microclimate; and increased summer electricity use due to increased demand for cooling. Alongside the measures to reduce the effects of climate change set out above, we will require developments to incorporate appropriate measures to enable occupants to adapt and cope with climatic changes. Measures include:*
- *natural ventilation;*
- *summer shading;*
- *planting trees and vegetation;*
- *openable windows;*
- *the provision of external space; and*
- *the inclusion of pervious surfaces to enable water to infiltrate the ground to reduce clay shrinking and flooding.*

22.16 *The Council will discourage the use of air conditioning and excessive plant equipment. In addition to increasing the demand for energy, air conditioning and plant equipment expel heat from a building making the local climate (microclimate) hotter. Where the use of this equipment is considered acceptable by the Council, for example where sterile internal air is required, we will expect development to make a contribution towards cooling the local environment. This could be through the provision of green or brown roofs, green walls and the planting of trees and vegetation, on or off-site. For further details on the methods that can be incorporated within a development to enable it and its occupants to adapt to climate change and on green and brown roofs and green walls, please refer to our Camden Planning Guidance supplementary document. For further details on how to consider microclimate see policy DP26 – Managing the impact of development on occupiers and neighbours and Camden Planning Guidance.*

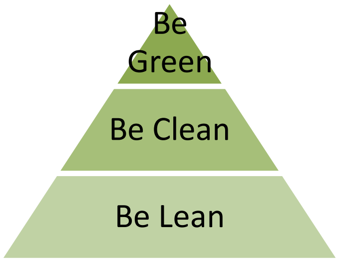
The Core Strategy document of the Local Development Framework also contains a key aim to encourage renewable energy within the Borough and linked into a wider network for London.

1.3 Methodology

The methodology for calculating regulated and unregulated carbon emission improvements for the development will be that detailed within the London Plan July 2011.

The first step of the full energy strategy assessment will be to undertake a Baseline energy assessment. The baseline energy assessment consists of calculating the total CO_2 emissions of the development. This will be done by assessing dwellings against Building Regulations Part L 2010 using SAP 2009 (the Standard Assessment Procedure (SAP) for the residential dwellings. This gives the carbon emissions from Regulated energy. An estimation of the carbon emissions from unregulated energy use will also be included.

The same buildings will then be benchmarked/ thermally modelled with the inclusion of the energy hierarchy –



- **Be Lean** - through design by first reducing energy use;
- **Be Clean** – supply energy efficiently.
- **Be Green** - utilising renewable energy technologies where feasible

At each stage a percentage reduction in carbon emissions can be estimated and compared to the baseline to ensure the planning policy targets are achieved.

The development must be provided with energy savings through the use of thermal improvements to fabric (a 'fabric first' approach), followed by other clean energy solutions (energy efficiency improvements, district heating etc) and finally the use of renewable energy technologies, where practical. This hierarchy complements the integrated approach to the sustainable energy objectives of the London Plan and Camden Borough Council and reflects the aspirations of the regional and national policies.

The Energy Hierarchy principle is detailed in GLA's Energy Guidance Document as follows:

Figure 1: The Energy Hierarchy

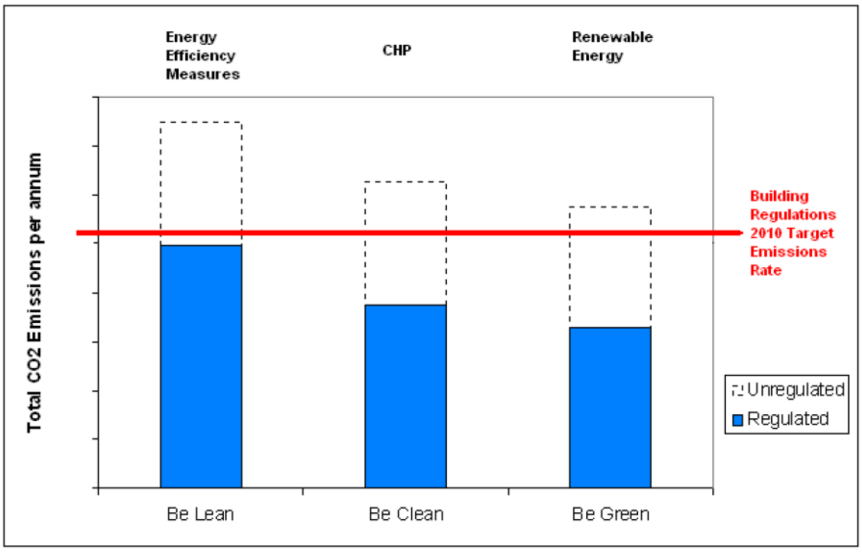


Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy

	Carbon dioxide emissions (Tonnes CO_2 per annum)		
	Regulated	Unregulated	Total
Building Regulations 2010 Part L Compliant Development	A	B	C = A + B
After energy demand reduction	D	E	F = D + E
After CHP	G	H	I = G + H
After renewable energy	J	K	L = J +K

Table 2: Carbon Dioxide Savings from each stage of the Energy Hierarchy

	Carbon dioxide savings (Tonnes CO2 per annum)		Carbon dioxide savings (%)	
	Regulated	Total	Regulated	Total
Savings from energy demand reduction	A - D	C - F	(A – D)/A * 100	(C-F)/C*100
Savings from CHP	D - G	F - I	(D – G)/D * 100	(F-I)/F*100
Savings from renewable energy	G - J	I - L	(G – J)/G*100	(I-L)/I*100
Total Cumulative Savings			**(A – J)/A*100**	**(C – L)/C*100**

The planning policies require a full review of the technical and economic feasibility of the following renewable technologies –

- Biomass Heating
- Biomass Combined Heat and Power
- Solar Hot Water
- Solar Photo-voltaic
- Ground Source Heat Pumps
- Air Source Heat Pumps
- Wind Power

To achieve the targets set the development must achieve a balance between fabric, heating and control, ventilation and air leakage improvements, the amount of zero or low carbon technology installed and the capital, life cycle and running costs, Maintenance & Operation etc.

Renewable energy technologies will be considered during the assessment to ensure the most suitable renewable energy is chosen for the demands of this scheme. The pros and cons of each technology with respect to this site require listing as part of this statement.

An appraisal of the likelihood of summertime overheating has also been undertaken and any cooling requirements will be included in the carbon calculations.

2.0 A Baseline Energy Assessment

Energy Council have reviewed the planning requirements and will base their analysis on current Building regulations Part L 2010 (SAP 2009). As a result, various renewable schemes will be investigated. We will take into account solutions that must not only be energy efficient but also practical, reliable and user friendly.

Energy Council have carried out preliminary SAP 2009 calculations for the new-build dwellings. To meet compliance with Building Regulations Part L1 2010, the Dwelling Emissions Rate (DER) must be lower than the Target Emissions Rate (TER). SAP 2009 is the Governments Standard Assessment Procedure (SAP) for calculating the energy aspects of a dwelling. SAP is a measure of fuel costs for heating, hot water and lighting for a dwelling. SAP 2009 can also be used to ascertain the CO_2 emissions of a development.

To assess the baseline energy we must make an estimation of the dwellings carbon emissions based on current Building regulations. An estimation of the unregulated energy is also required.

Predicted Carbon Emissions

The predicted CO_2 emission results of the development **without LCT or renewable technologies or energy efficient measures** included are detailed below. These are the baseline emissions based on achieving Building regulations 2010 compliance.

BASELINE - Part L 2010							
Dwelling ref	Floor area	No.	TER	DER	Regulated Total per type	Unregulated Total per type	Total CO2 kg/yr
2 Bed Ground Floor Flat	84	2	18.78	17.76	2530.42	2328	4858
1 Bed Ground Floor Flat	57	1	21.59	19.8	969.08	893	1862
2 Bed Ground Floor Flat	80	1	18.05	17.12	1157.56	1134	2292
2 Bed Mid Floor Flat	74	2	15.36	15.75	1963.12	2168	4131
1 Bed Mid Floor Flat	50	4	16.07	16.85	2896.28	3176	6072
2 Bed Mid Floor Flat	76	2	13.72	14.25	1815.7	2202	4018
3 Bed Mid Floor Flat	89	2	14.68	14.81	2204.34	2392	4596
2 Bed Top Floor Flat	70	2	18.17	17.72	2120.2	2090	4210
2 Bed Top Floor Flat	70	2	16.81	16.99	2014.5	2090	4105
		18			17671	18473	
Communal circulation space	215				4196		4196
					4196	0	
Total					**21867**	**18473**	**40340**

3.0 Identify Fabric Efficiency Design Measures – 'Be Lean'

Telford Homes Plc are keen to ensure that all their projects achieve high environmental and energy efficiency credentials.

Sustainable Design and Construction

The Allcroft Road Scheme will be developed to a high standard and will be designed in accordance with at least Code level 4. In order to achieve these levels, a number of sustainable design and construction techniques will need to be explored and where feasible incorporated into design:

- energy display metering;
- using natural ventilation techniques to avoid the need for comfort cooling night cooling etc;
- minimising internal gains through good specification of lighting and low energy consuming equipment.
- procuring materials sustainably using local suppliers;
- using materials which are responsibly sourced and have a low embodied impact;
- controlling unwanted ventilation and draughts by minimising air leakage;
- ensuring residential building designs make the most of natural systems both within and around the building;

- The Health and Wellbeing sections within the CSH assessment will be prioritised and, where feasible, achieved.
- managing flood risk to residential buildings, through sustainable drainage systems (SUDS) and flood resilient design for infrastructure and residential properties;
- ensuring buildings are comfortable and secure for occupants;
- conserving and enhancing the natural environment, particularly in relation to biodiversity and enabling easy access to open spaces;
- avoiding creation of adverse local climate conditions;
- reducing the thermal transmittance of the building envelope by adding high performance insulation and use of medium/high thermal mass;
- optimising window design through the type of glazing specified, along with the shape, location and functionality of the building.
- Analysis of SAP 2009 calculations based current drawings dated September 2011, coupled with the ventilation strategy and solar shading strategy confirms that the dwellings should not have a propensity to overheat in summer. This will be confirmed at the detailed planning application stages. There is currently no requirement to provide cooling.

Adaption to Climate Change

Much current practice in designing more sustainably relates to mitigating (preventing or slowing) our impact on climate change. However, climate change is still happening and it is expected that temperatures will increasingly rise over time and weather will continue to become more unsettled and more extreme. With this in mind, the Development will be designed to adapt to these potential changes in climate. The strategies described below provide a sample of ideas that will be considered in order to future-proof the Development from such climatic extremes:

- Designing buildings to survive extreme winds. This increases the longevity of the building and reduces the frequency of replacing materials. This therefore reduces the embodied impacts of these materials and in turn the entire buildings.

- Specifying building materials and designs that can withstand flooding to ensure that, should a significant flood event occur, the time taken to return buildings to use will be minimal.

- In urban and suburban areas, maintaining solar access for buildings.

- The Energy Statement includes reference to the London Plan July 2011. Policy 5.9 will be adhered to. The accredited energy calculations (SAP) carried out on a selection of flat types confirm that the dwellings do not have a propensity to overheat in line with ADL1A 2010 criteria 3 – "Limiting the effects of solar gains in summer". This check is sufficient to comply with building regulations ADL1A 2010.

- Incorporating rainwater harvesting to capture and reuse rainwater run-off for irrigation to the courtyards and other areas.

- Planting native, climatically appropriate trees and other vegetation.
- Plumbing buildings with water-conserving fixtures in mind.
- Designing cooling-load-avoidance measures into buildings.
- Designing for robustness. Increasing the longevity of a building decreases the embodied energy.

Post-construction Sustainable Living

A number of design principles have been included in the sustainable design and construction section above to target future building occupants' 'sustainable living' behaviours such as:

- Ensuring buildings are safe and secure for occupants to reduce the need for unnecessary noise and lighting when occupants are absent.
- Promoting sustainable waste behaviour, including support for local integrated recycling schemes.
- Influencing occupant behaviour to reduce, reuse and recycle resources throughout the building operation.

There are numerous design principles that often fail or become redundant when building occupants move into new buildings and purposefully and/or unintentionally use the systems in ways that reduce the efficiencies originally designed in. Occupants of buildings have been found to be confused by new heating and cooling controls, for example, and there is increasing evidence of (often unintentional) 'sabotaging' behaviours, which can be targeted by initial and ongoing interventions.

Strategy for Building Occupants

A strategy will be put into place to ensure that a 'sustainable living' ethos in adopted by the occupants to ensure that the houses and their sustainable technologies will be operated to their maximum efficiency throughout their life cycle. Telford Homes Plc are in a strong position to ensure this happens effectively. This strategy will include measure to enforce and promote 'sustainable living' among occupants.

An additional 5-10% saving in CO_2 emissions can be saved through behavioural change techniques over the life cycle of the building. This aspiration will be explored further, throughout the design stages, construction and post-construction. Much of this saving will reduce the Un-regulated emissions of the development.

Passive Design

Energy requirements at Allcroft Road will be lowered through passive design features such as-

- improving insulated fabric of the main construction materials will reduce energy demand thus flattening space heating peaks
- keeping air-leakage levels as low as possible with quality air tight construction using accredited construction details
- reducing other energy demands - in the case of lighting, by the maximisation of day lighting levels and solar gain (in winter) and the fitment of low energy fittings where practicable

Ventilation

Ventilation will be designed to meet Building Regulations Part F. Adequate ventilation is necessary for good health and removal of odours and excess moisture vapour.

Energy Efficient Appliances and Residents Guidance

The development will -

- encourage the use of low energy appliances (fridges, freezers, washing machines, etc.) through information and education
- provide guidance on efficient use and operation of the buildings and building services

As is typical of dense urban locations, the development site places significant constraints on the potential for employing good practise passive design as a result of physical restrictions such as over-looking and rights of lights issues. Those spaces which will benefit most from the solar gain and daylight e.g. living spaces have been placed on the building perimeters to optimise the passive design.

Energy Assessment of Fabric Efficiency Scheme – 'Be Lean'

The predicted CO_2 emission results of the dwellings **with fabric efficiency methods** have been calculated using SAP 2009. These calculations were then compared against the baseline calculations.

Dwelling with 'Be Lean' Improvements

		BE LEAN			
		Fabric and Passive Improvements			
EC Ref	Dwelling ref	DER	% Improvement on ADL1A 2010	Regulated Total per type	Total CO2 kg/yr
57700	2 Bed Ground Floor Flat	17.65	6.02	2514	4842
57701	1 Bed Ground Floor Flat	19.64	9.03	961	1854
57702	2 Bed Ground Floor Flat	16.99	5.87	1148	2282
57703	2 Bed Mid Floor Flat	15.63	-1.76	1948	4116
57704	1 Bed Mid Floor Flat	16.68	-3.80	2867	6043
57705	2 Bed Mid Floor Flat	14.13	-2.99	1801	4003
57706	3 Bed Mid Floor Flat	14.56	0.82	2165	4557
57707	2 Bed Top Floor Flat	17.87	1.65	2126	4216
57708	2 Bed Top Floor Flat	16.65	0.95	1971	4061
Total No Dwellings				17501	
Communal circulation space	Communal circulation space			3669	3669
Total non-residential				3669	
Total	Total			21169	39642

As can be seen from the table, the effect of the energy efficiency measures is to reduce the carbon emissions by 698 kg per annum (3.2%) from the baseline assessment of 40,340kg CO_2.

4.0 Identify Energy Efficiency Design Measures – 'Be Clean'

This section outlines how energy will be supplied efficiently to the elements of the houses in line with the Mayor's Energy Hierarchy.

De-Centralised/District GLA Heating Networks 'Be Clean' Options

The GLA's energy policy reaffirms the view that energy generated by centralised power stations and transmitted through the national grid is highly inefficient and wasteful.

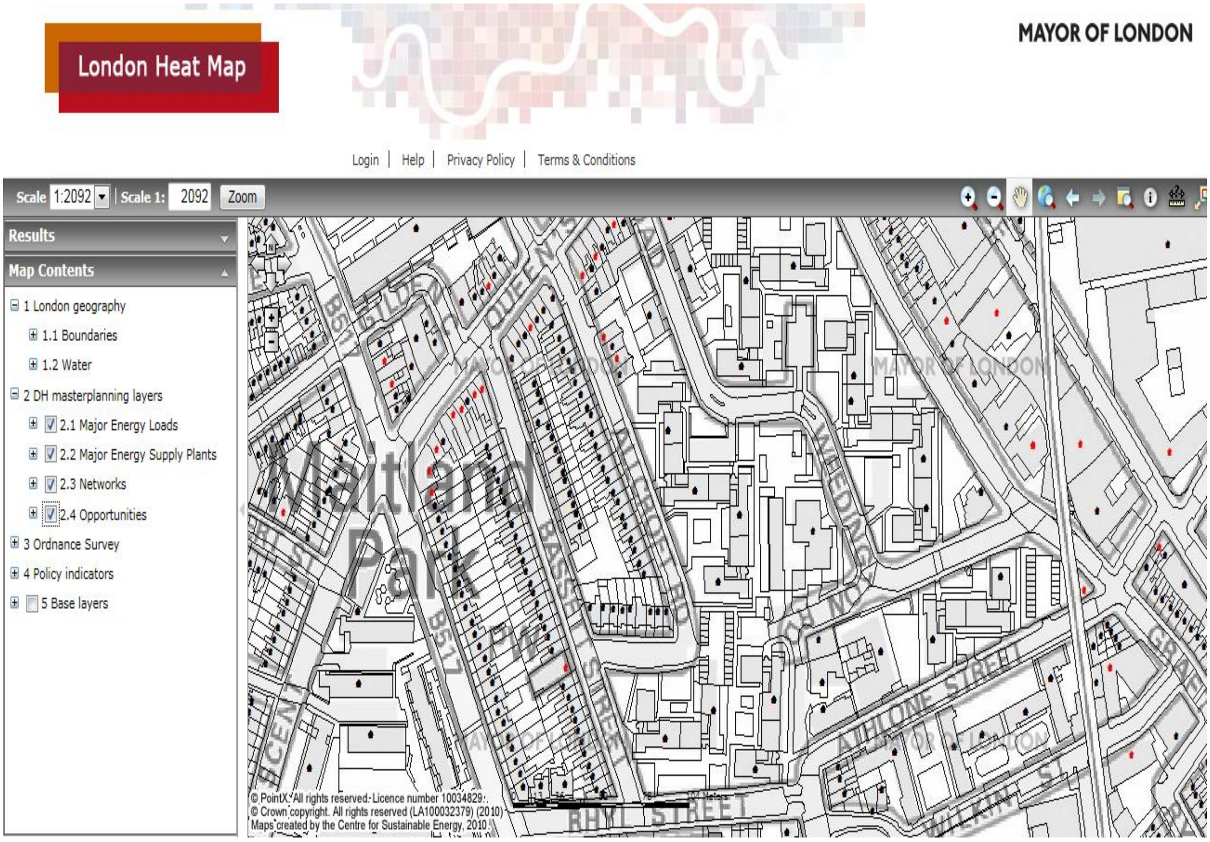
One of GLA's top priorities for reducing London's CO2 emissions is to reduce the capital's reliance on centralised power stations. This means increasing the use of local, low-carbon energy supplies through de- centralised energy systems.

Decentralised plant generally means any heating and hot water and/or electricity generation provided on a site or district wide basis. District heating is generally provided from Combined Heat and Power equipment (CHP). CHP is an engine which, when running, generates electricity and heats water which can then be distributed around a development.

The diagram below is the current heat map and analysis of proposed and existing district heating networks in the Camden area. The Allcroft Road development is not located near any district heating plants. The site is not sufficiently close enough to connect into an existing or proposed heating network.

Other risk factors with respect to future connection include –

- long distances from existing network to development
- major roads will be very difficult (and potentially costly) to cross with services
- timescales



New Heating Networks – 'Be Clean' Options

Consideration has been given to adopting a centralised or decentralised energy strategy. The recommended energy strategy has taken into account the numbers of properties to be connected, GLA/ Camden carbon and renewable targets, orientation, location, surrounding features – buildings, roadways, traffic etc, build quality and potential for other renewable or low carbon options.

District Heating Solutions and CHP

A de-centralised energy option would typically be an energy centre distributing heat, hot water and electricity to the development from a single source. This typically would include boilers and a CHP type unit sized to provide the whole development. This solution would suit the residential element of this development as a proven and cost heating and hot water source. Due to the size and location of the scheme a plant room is not provided therefore individual boilers with flue gas heat recovery will be provided.

Energy Efficient Heating System

Energy Council have reviewed options for improving the energy efficiency of the development by installing an above standard heating system. Dwellings will benefit from:

- Heating and hot water provided by individual boiler and flue gas heat recovery
- Under floor heating throughout
- Weather Compensation

Ventilation

A low energy high efficiency Mechanical Ventilation with Heat Recovery (MVHR) system will be provided to all dwellings to assist with acoustic and air quality issues. Specification detailed below:

- Specific Fan Power (SPF) 0.60W/l/s
- Heat exchange efficiency 92%
- Building Regs Part F 2010 will be met. A summer by-pass setting will be included on all installed MVHR systems to prevent the dwellings overheating and in line with Policy 5.9 of the London Plan July 2011.

Energy Assessment of Energy Efficiency Design Measures – 'Be Clean'

The predicted CO_2 emission results of the dwellings **Individual Boilers with Flue Gas Heat Recovery and MVHR** has been calculated using SAP 2009. These calculations were then compared against the baseline calculations.

Development with 'Be Clean' Improvements

		BE CLEAN				
		Be Lean with CHP		Total CO2 kg/yr		
EC Ref	Dwelling ref	DER	% Improvement on ADL1A 2010	Regulated CO2 emissions kg/yr	Regulated Total per type	Total CO2 kg/yr
57700	2 Bed Ground Floor Flat	15.83	15.71	1132.64	2265	4593
57701	1 Bed Ground Floor Flat	17.38	19.50	856.19	856	1749
57702	2 Bed Ground Floor Flat	15.39	14.74	1053.21	1053	2187
57703	2 Bed Mid Floor Flat	13.79	10.22	873.2	1746	3914
57704	1 Bed Mid Floor Flat	14.52	9.65	642.14	2569	5745
57705	2 Bed Mid Floor Flat	12.36	9.91	811.44	1623	3825
57706	3 Bed Mid Floor Flat	12.77	13.01	964.97	1930	4322
57707	2 Bed Top Floor Flat	15.81	12.99	946.51	1893	3983
57708	2 Bed Top Floor Flat	14.59	13.21	874.29	1749	3839
Total No Dwellings					15684	
				m2		
Communal circulation space	Communal circulation space			15	3302	3302
Total non-residential					3302	
Total	Total				18986	37459

As can be seen from the table above, the effect of installing a high efficiency gas heating system with flue gas heat recovery and with the addition of mechanical ventilation with heat recovery is to reduce the carbon emissions by 2,184 kg per annum (5.5%) from the fabric efficient measures.

This is a reduction of 2,882 kg CO_2 per annum (7.2%) from the baseline energy assessment of 40,340 kg CO_2.

5.0 Identify Renewable Energy Technologies – 'Be Green'

Energy Council have reviewed options for the use of on-site renewable energy/ Low or Zero Carbon Technology (LZT) in line with the London Plan and Camden Borough Council's policy aspirations.

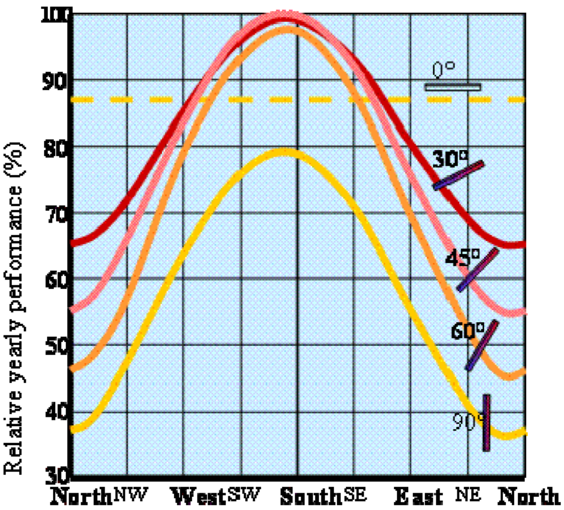
This renewable energy statement/strategy reviews the technical and economic feasibility of the following technologies –

- Solar Photo-voltaic
- Solar Hot Water
- Ground Source Heat Pumps
- Air Source Heat Pumps
- Micro Wind Power
- Biomass

Photovoltaic (PV)

Photovoltaic Panels convert sunlight into electricity to run lights and appliances. Photovoltaic panels use cells to convert light into electricity. A PV cell normally consists of 1 or 2 layers of a semi conducting material such as silicon. When light shines on a cell it generates energy causing electricity to flow, the higher the light intensity is, the more electricity flows.

The amount of energy PV cells generate is referred to as Kilowatt Peak (KWp). PV arrays now come in a variety of shapes and colours, ranging from grey 'solar tiles' that look like roof tiles to panels and transparent cells that you can use on conservatories and glass to provide shading as well as generating electricity. Solar panels are not light and the roof must be strong enough to take their weight, especially if the panel is placed on top of existing tiles. For flat roofs the panels can be mounted on A-frames to give the optimum angle. The optimum panel inclination for solar collection is 35°, oriented due south; however panels that are inclined between 35° and 45° and oriented south of west or east are generally suitable. If solar collectors are oriented away from due south then a larger surface area will be required to generate a set amount of energy. The effect of non-optimal orientation is illustrated by the graph to the right:



The cost to install PV is approximately £2,500 per kWp depending on type.

The roof area is more than sufficient to accommodate the number of panels required on the scheme. The development is located in a dense urban visually sensitive area, therefore the panels cannot be mounted on A frames, however there is very little over shading from surrounding building therefore the development can utilise the roof space to capitalize on solar gains.

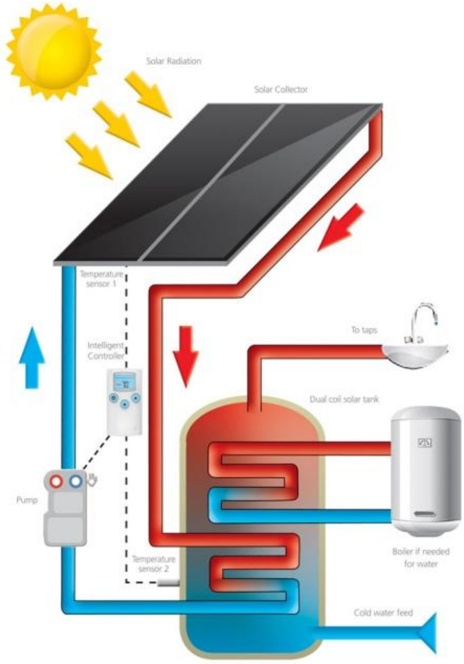
It is proposed that 7.25kWp of PV will be mounted on the roof of the development which is an array of approximately 58m^2.

Photo-Voltaic Array

Our calculations show that the PV panels will contribute to the 15.4% total carbon reduction from the baseline assessment. The PV will assist with lowering CO_2 emissions and contribution to the 'BE GREEN' agenda.

It is felt that the overall contribution from the BE GREEN contribution will be looked on favourably by London Borough of Camden considering that Code 4 emission standards are achieved.

Solar Thermal HW Panels



Solar panel heating uses the radiant energy from the sun to heat hot water, most commonly for domestic hot water needs. There are two types of collectors used for solar water heating – flat plate collectors and evacuated tubes collectors. The systems function successfully in all parts of the UK, as they can work in diffuse light conditions. The collector should be mounted on a 10-60 degrees pitch facing south, although other variations can be used, south is the most efficient.

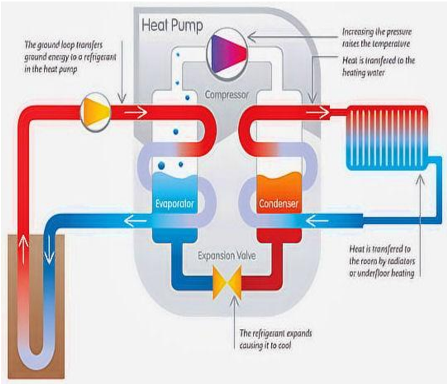
The cost of installing the system is dependent on the distance between the solar collector and the hot water storage and therefore costs vary. The closer the collectors are to the hot water storage, the less pipe work is required. Annual maintenance checks are recommended. The solar collectors are connected to a condensing boiler via a HW cylinder with twin coil.

A typical installation in the UK has a panel size of 3-5m^2 which is used in conjunction with a HW storage tank of 180-300litres, of which a minimum of 90-150 litres must be dedicated to solar hot water storage.

They are a 'simple' and guaranteed technology which will act as a pre-heat for the Hot Water and Heating usage. Payback between capital cost and energy saving can normally be achieved within 12 – 20 years, subject to usage and dwelling type.

The use of solar thermal panels, work best in conjunction with individual heating systems for each dwelling. The orientation of the development is fine for the utilisation of solar water heating to provide domestic hot water however it will not achieve the carbon savings required to meet Code 4 without additional LZCs. Carbon savings of approximately 4-5% are achievable with this technology. On an m^2 basis the carbon saving from installing a solar thermal system are a lot less than that of PV. For the reasons aforementioned this is not an appropriate option for this scheme.

Ground Source Heat Pump (GSHP)



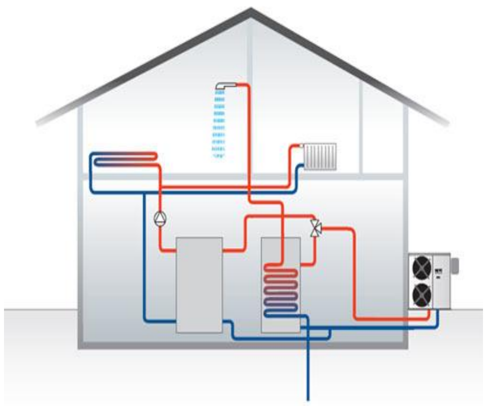
GSHP's have been developed specifically for the housing market and are now considered to be an established reliable technology. The GSHP would be sized to cater for the heating and domestic hot water requirements. Typically, they are more suited to apartments as a centralised system would be installed with multiple bore holes to a depth of up to 125 metres depending on the ground conditions. GSHP's use a heat exchanger to extract heat from the earth.

The efficiency of ground source heat pumps is measured by Co-efficient of Performance (CoP), this is the ratio of units of heat output for each unit of electricity used to drive the compressor and pump for the ground loop. Average CoP is around 2-4 although some systems may produce a greater rate of efficiency. This means that for every unit of electricity used to pump the heat, 2-4 units of heat are produced, making it an efficient way of heating a building. If grid electricity is used for the compressor and pump, then there is the opportunity to consider a range of energy suppliers to benefit from the lowest running costs, for example by choosing an economy 10 or economy 7 tariff.

Although they reduce CO_2 emissions they rely directly on electricity for power and therefore are not fuel or energy efficient. The cost and practicalities to install GSHP's on this type of scheme is also prohibitive. GSHP are typically £12k per borehole and a single GSHP would provide a Code 4 emission standard to 3 - 5 apartments. There is insufficient space at ground level to accommodate the number of boreholes to service the development, which makes this option unviable.

GSHP's are not considered appropriate for this scheme.

Air Source Heat Pump (ASHP)



Air source heat pumps work in a similar way to GSHP. Air source heat pumps can be fitted outside the each house, on the external façade or in the roof space. An air source heat pump uses small amounts of electricity to take in large quantities of air and extract heat. The efficiency of ASHP is measured by Coefficient of Performance (CoP); this is the ratio of units of heat output for each unit of electricity used to drive the system. Average CoP is around 2-4 although some systems may produce a greater rate of efficiency.

ASHP's are not considered appropriate for this scheme. The energy savings with mains electric ASHP are negligible when compared to the baseline energy analysis which uses gas as the main fuel source. This is due to the fuel factors apportioned to mains electric and mains gas. The carbon emissions are significantly higher using mains electricity compared to mains gas. ASHP are not used as a direct replacement for electric heating and therefore they are not considered as a satisfactory solution.

Micro Wind Power

Wind power is one of the cleanest and safest methods of generating electricity. However, wind power is unfeasible due to the fact the development is in an urban area and local wind conditions would not be sufficient to provide enough power. Most small wind turbines generate Direct Current (DC) electricity. Systems that are not connected to the national grid require battery storage and an inverter to convert DC electricity into Alternating Current (AC) which is mains electricity.

There are two types of wind turbine available:

- Roof mounted – These are mounted on the roof of houses
- Mast mounted – Which are free standing

Important issues to consider when using wind turbines are:

- Wind speed increases with height so it's best to have the turbine high on a mast or tower.
- Generally speaking the ideal site is a smooth top hill with a flat, clear exposure, free from excessive turbulence and obstructions such as large trees, houses or other buildings.
- Small scale wind power is particularly suitable for remote off grid locations where conventional methods of supply are expensive or impractical.
- Where the local annual average wind speed is 6 m/s or more.
- Where there are no significant nearby obstacles such as buildings, trees or hills that are likely to reduce the wind speed or increase turbulence

As this development is in an urban area and the building is 4 storeys in height, there will be obstacles which reduce wind speed. The average wind speed in this area is 4 m/s which is less than the 6 m/s required. Therefore, micro wind is not a viable technology for this development.

Biomass

Biomass is a generic name for any fuel produced from organic sources and falls into mainly two categories:

- Woody biomass- forest products, untreated wood products, energy crops and wood pellets
- Non-wood biomass – liquid biofuels (such as biodiesel, bioethanol) or animal waste industrial municipal products and high energy crops such as rape seed, sugar cane and maize.

For domestic properties the fuel used is normally wood pellets, wood chips or wood logs. For larger applications, biomass boilers replace conventional fossil fuel boilers and come with an automated feed by screw drives from hoppers.

Biomass systems require more cleaning than gas or oil boilers and they must be capable of being taken out of service for cooling and cleaning whilst maintaining the building heating supply particularly in communal heating systems. Centralised gas boilers are therefore still required to support the biomass boiler, which would be the lead boiler. The size of the dedicated plant rooms is substantial. Fuel availability, delivery and storage are also important issues to consider.

Air quality issues are also an important factor when looking to install biomass, especially in the Camden area.

The cost of the fuel depends on the type, delivery distances and whether it is obtained as simple waste product or from another organisation. The cost of wood pellets is currently a little more expensive than mains gas, and woodchip is approx. 30% cheaper, however prices are fluctuating rapidly in the bio-fuel market at the present time creating uncertainty over their take up.

Biomass CHP is still relatively new to the UK market and is more suitable to large developments where energy demand does not require significant modulation. There are technical issues with small scale Biomass CHP and until these can be resolved and proven the take up of these systems in the UK and Europe has been slow.

Overall carbon savings of 40%+ are achievable with biomass technology. Biomass is more suited to a communal heating system, there is insufficient space to accommodate the equipment and fuel storage to facilitate a biomass boiler. Furthermore, there are noise and air quality issues associated with this type of technology. For this reason biomass is discounted.

Energy Assessment of Renewable Scheme – ' Be Green'

The most practical and economically feasible solution for the Allcroft Road development is the use of PV panels in conjunction with the 'be lean' and 'be clean' measures aforementioned.

Dwellings with Renewable Technologies – PV

					BE GREEN				
					Be Clean with PV				
EC Ref	Dwelling ref	Floor area	No.	TER	DER	% Improvement on ADL1A 2010	SAP	Regulated Total per type	Total CO2 kg/yr
57700	2 Bed Ground Floor Flat	84	2	18.78	13.61	27.53	86	1897	4225
57701	1 Bed Ground Floor Flat	57	1	21.59	14.24	34.04	86	679	1572
57702	2 Bed Ground Floor Flat	80	1	18.05	13.07	27.59	86	871	2005
57703	2 Bed Mid Floor Flat	74	2	15.36	11.35	26.11	87	1393	3561
57704	1 Bed Mid Floor Flat	50	4	16.07	11.05	31.24	87	1886	5062
57705	2 Bed Mid Floor Flat	76	2	13.72	9.99	27.19	88	1273	3475
57706	3 Bed Mid Floor Flat	89	2	14.68	10.7	27.11	88	1570	3962
57707	2 Bed Top Floor Flat	70	2	18.17	13.24	27.13	86	1537	3627
57708	2 Bed Top Floor Flat	70	2	16.81	12.02	28.49	87	1395	3485
Total No Dwellings			18					12502	
Communal circulation space	Communal circulation space	215						3137	3137
Total non-residential								3137	
Total	Total							15638	34111

As can be seen from the table the effect of the renewable contribution is to reduce site wide carbon emissions by 3,348 kg per annum from the Energy Efficiency scheme. This is a 17.6% reduction from the Be Clean regulated energy and a 8.9% reduction in the Be Clean Total carbon emissions.

The Be Green solution contributes to a total reduction in carbon emissions of 6,229kg CO_2 per annum (15.4%) from the baseline energy assessment of 40,340 kg CO_2. This is a 28.5% reduction from the Baseline regulated energy emissions.

6.0 Conclusion

The energy efficiency measures and PV are predicted to reduce the carbon emissions by 6,229 kg CO_2 per annum (15.4%) from the baseline energy assessment. The results are set out in Tables 1, 2 and 3 below.

The energy efficiency 'BE LEAN, BE CLEAN & BE GREEN' measures will include:

1) Enhanced thermal efficiency of building fabric as set out in Appendix 1 of this report.
2) Efficient ventilation systems with heat recovery
3) Low air leakage
4) Individual boilers high efficiency with flue gas heat recovery.
5) Efficient lighting strategy
6) PV array of 29No. 250Wp panels providing 7.25kWp to support the electricity demand for the apartments. The PV will be mounted horizontally due to aesthetics.

Low/ Zero Carbon Technologies (LZT) Discounted

- A Community Heating with CHP scheme is not conducive to a development this nature due to the number of dwellings within the scheme and spatial constraints.
- Solar Thermal Hot Water is not a viable option as carbon savings produced by this (LZT) are insufficient to achieve Code 4, and generally a second LZC would need to be specified.
- Biomass has been discounted as it poses problems in terms of air quality, delivery of fuel, storage and transportation for deliveries etc. It would require a larger plant space for storing fuel which is not currently included.
- Micro-wind turbines are not seen to work particularly well on this type of development due to problems with wind turbulence and mounting of the units. The wind speeds in the area are not conducive to wind power electricity generation and there would be issues with shading, noise and air traffic.
- GSHP's are not viable for site because of spatial and financial costs. There is little room to fit a GSHP vertical bore, ground conditions are unknown and systems are very costly.

Low/ Zero Carbon Technology (LZT) Recommended

The decision to use PV as the renewable energy sources on the Allcroft Road Scheme has been taken for the following reasons:

- Reliability of system.
- Low maintenance and operation.
- Effective, proven technology.
- Effective, proven technology with typical guarantee of 25 years.
- Simple technology which requires little/no user interface.
- Minimal over-shading is present.
- There is sufficient space on the roof to accommodate the required amount of PV
- Units can be located on roofs in arrays to suit the dwelling numbers and arrangement and aesthetics.
- Payback – circa 12-15 years
- Ease of installation of PV and associated equipment incl inverter, generation meter
- Spacial requirements for PV kit incl. inverter and metering can be accommodated easily
- Introducing a smart meter to provide real-time electricity generation for each dwelling/tenanted area to highlight awareness and promote Telford Homes Plc green credentials.

Table 1: The Energy Hierarchy

GLA Table 1 - Carbon Savings After Each Stage of the Energy Hierarchy		Regulated CO_2 kg/yr		Unregulated CO_2 kg/yr		Total CO_2 kg/yr
Building Regs Part L compliant Development						
Residential		17671		18473		36144
Non - Residential		4196		0		4196
Total	A=	21867	B=	18473	C=	40340
Be Lean						
Residential		17501		18473		35974
Non - Residential		3669		0		3669
Total	D=	21169	E=	18473	F=	39642
Be Clean						
Residential		15684		18473		34157
Non - Residential		3302		0		3302
Total	G=	18986	H=	18473	I=	37459
Be Green						
Residential		12502		18473		30975
Non - Residential		3137		0		3137
Total	J=	15638	K=	18473	L=	34111

Table 2: CO2 emissions Regulated and Unregulated

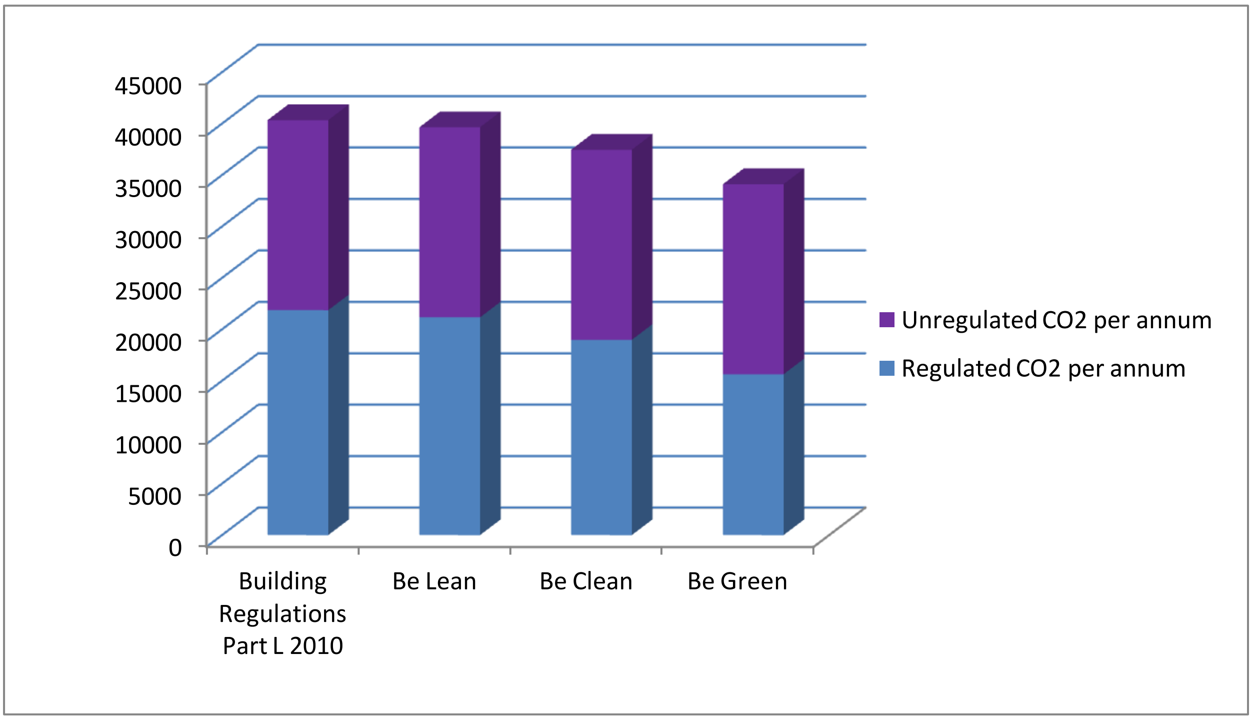


Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy

Table 3 - Carbon Savings from Each Stage of the Energy Hierarchy				%age improvement				%age improvement
A-D	regulated saving from be lean		698	3.2%				
D-G	regulated saving from be clean		2184	10.3%				
G-J	regulated saving from be green		3348	17.6%				
C-F	total saving from be lean						698	1.7%
F-I	total saving from be clean						2184	5.5%
I-L	total saving from be green						3348	8.9%
A-J/A*100	total cummulative regulated saving			28.5%				
C-L/C*100	total cummulative saving							15.4%

7.0 Appendices

Appendix 1

1) BE LEAN, BE CLEAN and BE GREEN - Energy Efficiency and Renewable Parameters

Thermal Design parameters for dwellings using the Be Lean, Be Clean and Be Green Hierarchy

Item	Brief description	Notes.
	The following information is required for the design submission (as per requirements of approved doc L1A).	Please note submission is now in two stages. A) **Design**, B) As installed
1	Building Regulations Part L1A 2010 apply	
2	Post code of site is NW5	
3	Electricity is supplied by standard tariff rather than economy 7, 10 or 24.	*Assumed Standard tariff*
4	It is assumed that the dwellings have a medium thermal mass parameter.	*This will be evaluated further once you have provided the construction details*
5	Ground floor is insulated to achieve the U-value stated opposite.	U-Value = 0.11 W/m²K
6	Main external walls are masonry construction to achieve the U-value indicated.	U-Value = 0.18 W/m²K
6A	Party walls are fully filled and sealed to achieve the U-value indicated opposite.	U-Value = 0.0 W/m²K
7	Flat roofs are insulated to achieve the U-value indicated opposite.	U-Value = 0.11 W/m²K
8	All double glazed windows and patio type doors/windows with Low-e glass soft coating. To achieve the U-Value indicated opposite.	No window will be worse than U = 1.4W/m²K
9	Individual doors to apartments are insulated to achieve the U-value indicated opposite.	U = 1.5W/m²K
10	Design stage SAP calculation presumes an air permeability of 5a/c at 50pa will be achieved.	*The air change rate opposite only applies if each dwelling is tested; if only a selection of dwellings are tested they need to achieve 3a/c at 50pa.*
11	No open flues or chimneys are present anywhere.	
12	Mechanical ventilation with heat recovery (MVHR) is installed	SPF: 0.6 W/l/s Efficiency 92%
13	Heating is provided by individual wall mounted mains gas fired combi boilers boilers.	Gas boiler efficiency: 89% Baxi Duotec 2 GA or equal and approved.
14	Boilers are fitted with a Flue Gas Heat Recovery system.	Zenex Gas Saver
15	Heating system is controlled by delayed start room thermostat, programmer and TRV's.	
16	There is no secondary heating installed.	

17	Weather compensation is provided to the boiler.	
18	Under floor heating is installed throughout.	
19	Water usage per person per day is ≤125 Litres.	
20	Hot water storage is not installed at each dwelling.	
21	PV is installed to support the electricity demand of apartments	7.25kWp of PV is installed
22	Accredited Construction Details (ACD) of limiting thermal bridging are installed at every junction in the main fabric. The defined Y value must be calculated for each dwelling	
23	Low energy (LE) lights are installed throughout.	
24	Trickle ventilators are fitted to most windows.	
25	Windows can be half opened in summer to prevent overheating.	
26	There are no cooling systems specified within the dwellings	