36 AVENUE ROAD, NW8

ENERGY STATEMENT

May 2015
Revision 00

Revision History		Date	By
R00	Energy Statement – issued for sign-off	15th May 2015	KE / MB

CONTENTS

1 EXECUTIVE SUMMARY

This report summarises the energy strategy for the redevelopment of 36 Avenue Road. The proposal seeks to demolish the 1970's brown brick dwelling and replace with a new, energy efficient family residence.

The target CO_2 emissions reduction for the development is set by the minimum standard for Code for Sustainable Homes (CSH) Level 4 which requires a **19% reduction** over Building Regulations Part L 2013 (credit issue 'Ene 01 Dwelling Emission Rate'). Credits under 'Ene 02 Fabric Energy Efficiency' are also sought to assist in achieving a Level 4 rating and to ensure the building fabric performance is optimised as far as practicable.

As required by Camden Council, this strategy follows the Mayor's energy hierarchy and reports the savings achieved after each stage of the hierarchy. It sets out the commitment to energy reduction measures as well as the feasibility studies undertaken in developing the strategy.

ENERGY HIERARCHY

BE LEAN – REDUCE ENERGY DEMAND

The following demand reduction measures have been applied to the development:

Passive Measures

- Building fabric performance (i.e. U-values) has been greatly improved over Part L minimum standards.
- A more stringent building air permeability of $3m^3/m^2h@50Pa$ has been adopted.
- All windows are openable allowing for natural ventilation and most spaces have cross ventilation.

Active Measures

- Mechanical ventilation with heat recovery units will be provided to support a healthy internal environment.
- Low energy LED lighting will be provided throughout.
- An energy display device will enable monitoring of consumption.

BE CLEAN – SUPPLY ENERGY EFFICIENTLY

There are at present no existing heat networks within a feasible distance of the Dwelling and an onsite system would not be appropriate. As such, there is no contribution to the CO_2 reduction target from 'Clean' measures.

BE GREEN – USE RENEWABLE ENERGY

Following a review and assessment of various renewable energy technologies, the use of air source heat pumps is proposed to provide heating and hot water to the Dwelling.

OVERALL CARBON SAVINGS

The CO_2 emissions for the Dwelling have been evaluated against Building Regulations Part L 2013 using SAP software STROMA FSAP 2012 version 1.0.1.21.

Figure 1.1 and Table 1.1 demonstrate the emissions reduction after each stage of the energy hierarchy following the energy reduction measures as summarised above.

Figure 1.1 – Development Energy Hierarchy Regulated CO_2 Emissions

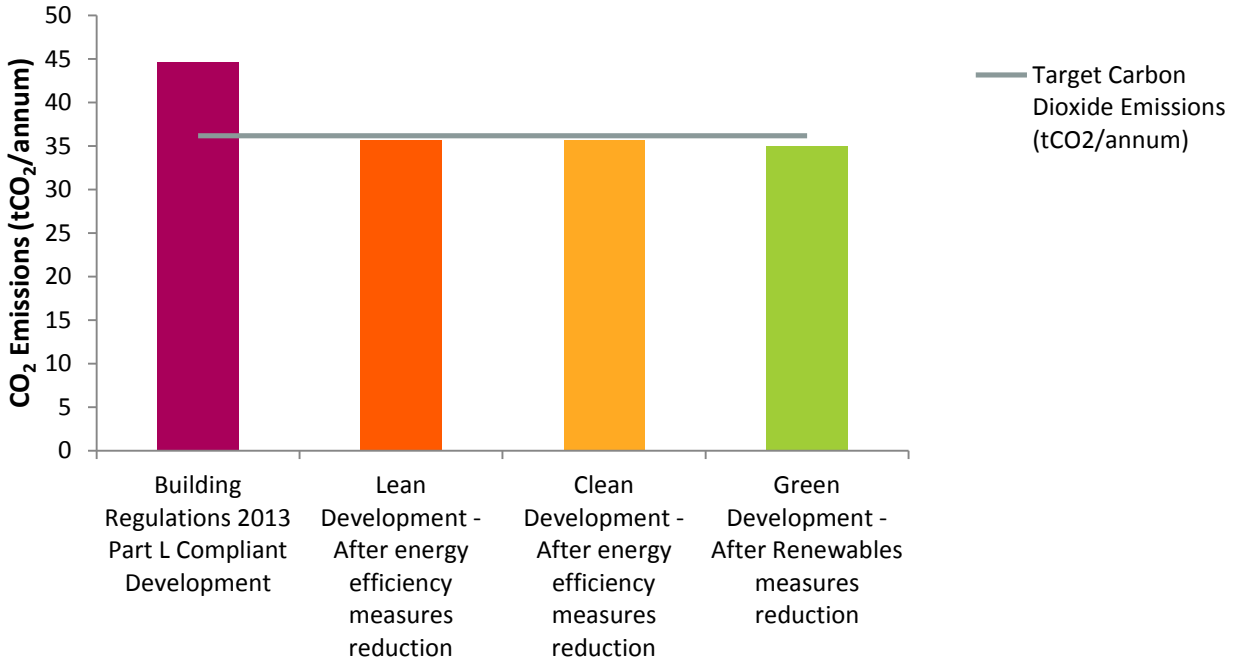


Table 1.1 – Dwelling CO_2 emissions and percentage savings after each stage of the Energy Hierarchy

	Annual Regulated CO_2 Emissions (tCO_2/annum)	Regulated CO_2 Emission Savings (tCO_2/annum)	% Reduction over Baseline
Baseline: **Part L 2013 of the Building Regulations Compliant Dwelling**	44.67	-	-
Lean: **After Energy Demand Reduction**	35.63	9.04	20%
Clean: **After Heat Network / CHP measures**	35.63	9.04	20%
Green: **After Renewable Technology measures**	34.93	0.70	22%

CONCLUSION

Table 1.2 provides a summary of how the proposed new dwelling achieves compliance with Building Regulations Part L, Code for Sustainable Homes minimum standard for Level 4, and credits for improvements to the building fabric performance.

Table 1.2 –Summary of energy targets achieved by the Dwelling

Energy Target	Compliance
Building Regulations 2013 Part L	Compliance achieved
Code for Sustainable Homes Level 4 – Ene 01 Dwelling Emission Rate	19% CO_2 emission reduction target achieved
Code for Sustainable Homes – Ene 02 Fabric Energy Efficiency	3 of 9 credits available achieved

2 INTRODUCTION

2.1 BACKGROUND

This Energy Statement details the proposed design strategies that have been adopted for the redevelopment of 36 Avenue Road, NW8 (hereafter referred to as the Dwelling) to minimise primary energy consumption and carbon dioxide emissions to the atmosphere. This report details the outcomes of analysis and calculations performed for a number of energy efficiency measures that have been considered for the Dwelling and describes the resulting energy strategy.

This document should be read in conjunction with all other documents submitted in support of the application.

2.2 DEVELOPMENT OVERVIEW

The site is situated close to Primrose Hill and Regents Park amongst a collection of large residential properties. The site is within the Elsworthy Conservation Area, but the existing building is not identified as a positive contributor and is out of character with the surrounding neighbourhood.

The proposal seeks to demolish the 1970's brown brick dwelling and replace with a family residence that is more in keeping with the surrounding architecture. Careful attention has been paid to the scale and materials of the surrounding buildings. The proposal will improve the existing streetscape and make a positive contribution to the conservation area.

The proposals will deliver a high quality single family dwelling that will contain the following:

- Ground Floor: reception, dining room and kitchen, family room, guest WC and study.
- First Floor: three bedrooms and lounge / study.
- Second Floor: four bedrooms and lounge.
- Lower Ground Floor: family lounge, staff accommodation, laundry, gymnasium, games room and swimming pool
- Basement: Cinema, wine cellar, salon, changing rooms, kitchen and larder, sauna and steam rooms and plant rooms.

The proposals provide a floor space of approximately 2,100 sqm (22,800sq.ft)

2.3 CARBON EMISSION FACTORS

The carbon emission factors used in this report are based on those within the Governments Standard Assessment Procedure (SAP) 2012 and referenced within Building Regulations Part L 2013 and are detailed in the Table 2.1.

Table 2.1 – Carbon emission factors (DECC, 2012)

Fuel	Emission Factor ($kgCO_2/kWh$)
Natural Gas	0.216
Grid Supplied Electricity	0.519
Grid Displaced Electricity	0.519

2.4 POLICY DRIVERS

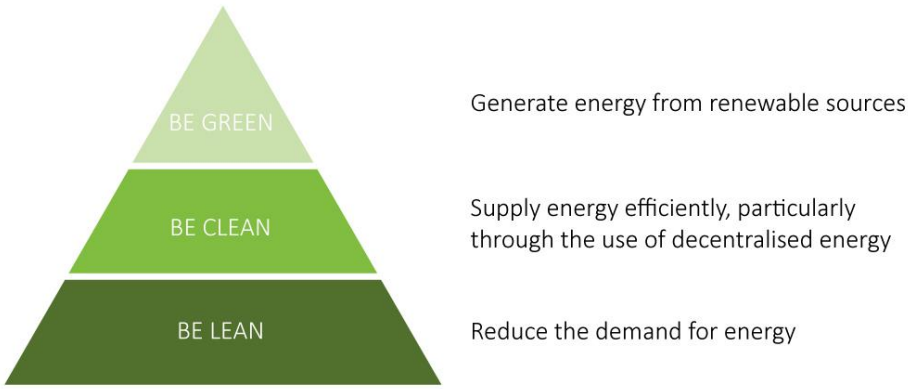
The planning policies that are addressed by this Energy Statement are as follows:

2.4.1 LOCAL PLANNING POLICY –CAMDEN COUNCIL

The London Borough of Camden's adopted Core Strategy sets out the criteria that should be taken into account for all developments within the Borough. The specific policy relating to energy and CO_2 emissions is Policy CS13 – Tackling climate change through promoting higher environmental standards. The relevant policy states:

> *The council will require all developments 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 Kings Cross, Gower Street, Bloomsbury and proposed Euston Road decentralised energy networks;***
> ***3. Generating renewable energy on-site;***
> *d) Ensure buildings and spaces are designed to cope with, and minimise the effects of, climate change.*

To meet these criteria the Dwelling has adopted the energy hierarchy methodology:



2.4.2 THE CODE FOR SUSTAINABLE HOMES

In accordance with the London Borough of Camden document 'Promoting sustainability and tackling climate change' Policy DP22, the Dwelling is expected to achieve a Code for Sustainable Homes (CSH) Level 4 rating. To support achievement of the overall score and minimum standards required for Level 4, credits are being sought under 'ENE 01 – Dwelling Emission Rate' (which requires a minimum **19% improvement** on the Part L 2013 notional dwelling) and 'ENE 02 – Fabric Energy Efficiency'.

3 'BASELINE' DWELLING EMISSIONS

3.1 'BASELINE' DWELLING EMISSIONS

The 'baseline' dwelling is a representative model in which the Dwelling meets the minimum requirements for CO_2 emissions reduction, but goes no further. This is equal to the Target Emissions Rate (TER) defined in Building Regulations Part L 2013.

Regulated energy use and the associated CO_2 emissions have been calculated using STROMA FSAP 2012 version 1.0.1.21 for the Dwelling.

3.1.1 BREAKDOWN OF CO_2 EMISSIONS BY USE

Table 3.1 provides a breakdown by use of the regulated energy demand of the Dwelling.

Table 3.1 – Energy demand and CO_2 emissions analysis of the Building Regulations 2013 Part L Compliant Dwelling

	Energy Demand (kWh/annum)	CO_2 Emissions ($kgCO_2$/annum)
Space Heating	124,373	41,640
Hot Water	4,001	1,340
Auxiliary Power	75	39
Lighting	3,174	1,647
TOTAL REGULATED	67,294	44,666

3.1.2 BASELINE DWELLING CO_2 EMISSIONS

Table 3.2 provides the total annual CO_2 emissions for the target Building Regulations compliant dwelling based on the TER values generated by the SAP assessment.

Table 3.2 – Total energy demand and CO_2 emissions analysis of Building Regulations 2013 Part L Compliant Dwelling

	TER ($kgCO_2/m^2$)	Total Annual CO_2 Emissions (tCO_2/annum)
Building Regulations 2013 Part L Compliant Dwelling	20.27	44.67

3.2 TARGET DWELLING EMISSIONS

Table 3.3 shows the target CO_2 emissions rate that is needed to comply with the minimum standard for a CSH Level 4 rating against the CO_2 emissions rate of the Part L compliant dwelling.

Table 3.3 – Target CO_2 Emissions Rate for Level 4 Compliance

	Carbon dioxide emissions (tCO_2/annum)
Building Regulations 2013 Part L Compliant Development	44.67
19% CO_2 Emission Reduction Target	36.18

4 DEMAND REDUCTION (BE LEAN)

4.1 OVERVIEW

The Dwelling has been designed from the outset with energy efficiency as a key driver. The project team recognises the need to reduce the energy demand of the building as far as practicable through the use of both passive and active design measures.

4.2 PASSIVE DEMAND REDUCTION MEASURES

Passive design features incorporate the use of the dwelling structure and façade to minimise heating, cooling and lighting demand. There is no energy consumption associated with the use of these measures.

4.2.1 BUILDING FABRIC PERFORMANCE

Building fabric standards are important in reducing heat demand and Building Regulations have successively improved insulations standards. Table 4.1 sets out the U-values that have been applied to the Dwelling and show an improvement on the minimum standards defined in Building Regulations Part L 2013.

Table 4.1 – Dwelling U-value summary

Element	Part L1A 2013 SAP reference standard (W/m²K)	36 Avenue Road target value (W/m²K)
Roof	**0.13**	**0.11**
External Wall	**0.18**	**0.15**
Ground Floor	**0.13**	**0.13**
Windows	**1.40**	**1.40**

4.2.2 AIR TIGHTNESS

A second key fabric performance parameter is air permeability, i.e. the rate at which air moves through the building envelope to the outside. Part L 2013 sets a limit of 10 m^3/hm^2 at 50 Pa and a reference value of 5 m^3/hm^2 at 50 Pa. A more stringent standard has been adopted for the Dwelling of 3 m^3/hm^2 at 50 Pa. This greatly reduces the heat loss associated with air infiltration.

4.2.3 NATURAL VENTILATION

The Dwelling has been designed with openable windows and the provision of good cross ventilation where rooms are dual aspect. This will enable a natural ventilation approach to be adopted when preferred by the occupant.

4.3 ACTIVE DEMAND REDUCTION MEASURES

4.3.1 MECHANICAL VENTILATION WITH HEAT RECOVERY

In order to deliver a healthy indoor environment and occupant comfort during periods when it's not favourable to open windows (cold, noisy, night time security), a mechanical ventilation unit with high heat recovery will be provided. This will be particularly beneficial to the occupied subterranean areas. The unit incorporates a summer bypass that provides tempered fresh air and mechanical extract.

4.3.2 LOW ENERGY LIGHTING AND CONTROLS

Low energy LED lighting will be specified throughout the building to minimise the electrical demand for lighting and additional summer cooling load. It is anticipated that external lighting will be controlled by PIR and daylight sensors.

4.3.3 ENERGY MONITORING

An energy display device will be provided to monitor and report on the consumption of energy, both current and historic. The device will allow the occupant to review their patterns of usage and identify opportunities for reducing energy consumption.

4.4 'LEAN' DWELLING CO_2 EMISSIONS

The 'lean' dwelling takes into account all of the passive and active energy design features outlined above and represents the likely performance of the Dwelling using only 'be lean' measures.

The following tables summarise the CO_2 emissions of the Dwelling at this stage and the savings achieved as a result of 'Lean' measures.

Table 4.2 - Comparison of CO_2 emissions savings after 'Lean' measures

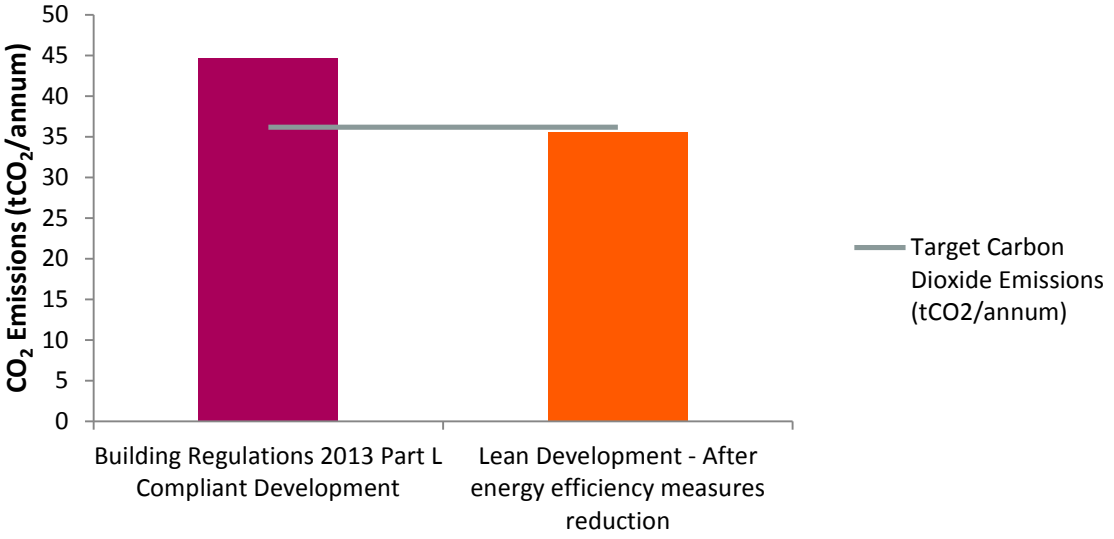
	CO_2 Emissions (tCO_2/year)
Building Regulations 2013 Part L Compliant Dwelling	44.67
After 'Lean' measures	35.63

Table 4.3 – CO_2 emissions savings from 'Lean' measures

	CO_2 Emissions (tCO_2/year)	(%)
Savings from 'Lean' measures	9.04	20%

Figure 4.1 shows the regulated CO_2 emission reduction achieved as a result of Lean measures.

Figure 4.1 – Comparison of Building Regulations 2013 Part L Compliant Dwelling and the 'Lean' Dwelling



5 HEATING INFRASTRUCTURE (BE CLEAN)

5.1 CONNECTION TO EXISTING DISTRICT HEATING NETWORKS

In accordance with Camden Core Strategy 2010 Policy CS13 an assessment of the current and proposed heat networks in the area has been carried out to establish the feasibility of connecting the Dwelling to a district heating network. With reference to the London Heat Map it has been determined that there are no networks in close enough proximity of the Dwelling.

The map below shows the Dwelling location and the heat networks in the area, obtained from the London Heat Map and the site location.

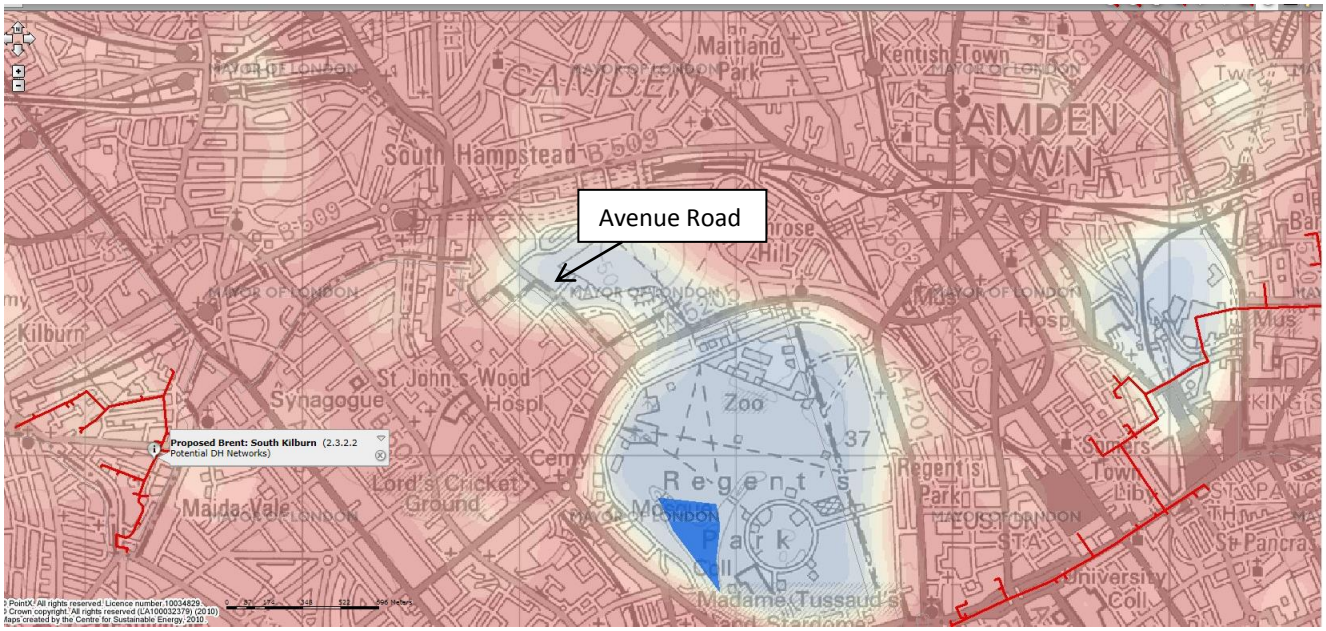


Figure 5 – Heat network data for area surrounding 36 Avenue Road (The London Heat Map)

5.2 ON SITE HEATING NETWORK

CHP systems rely on a diversity of loads and a consistent demand for both heat and electricity in order to operate at optimum efficiency. For this reason an on-site CHP system is not suitable for the Dwelling.

5.3 'CLEAN' DWELLING CO_2 EMISSIONS

Since 'Clean' measures are not applicable in this instance (it is not feasible to connect to an existing district heating network or to provide an on-site CHP system) the modelling carried out for the 'Clean' Dwelling results in the same energy performance as the 'Lean' Dwelling.

For consistency, the following tables summarise the CO_2 emissions of the Dwelling at this stage and the savings achieved as a result of 'Clean' measures.

Table 5.1 - Comparison of CO_2 emissions savings after 'Clean' measures

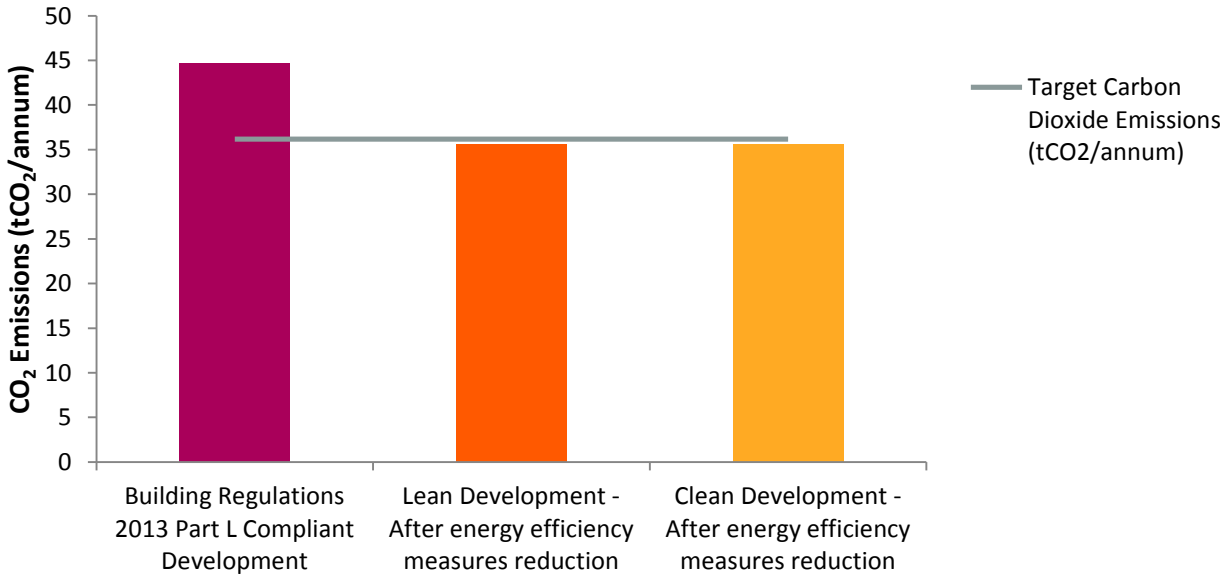
	CO_2 Emissions (tCO_2/year)
Building Regulations 2013 Part L Compliant Dwelling	44.67
After 'Lean' measures	35.63
After 'Clean' measures	35.63

Table 5.2 – CO_2 emissions savings from 'Clean' measures

	(tCO_2/year)	(%)
Savings from 'Lean' measures	9.04	20%
Savings from 'Clean' measures	0.00	0%

Figure 5.1 shows the regulated CO_2 emission reduction achieved as a result of Lean and Clean measures.

Figure 5.1 – Comparison of Building Regulations 2013 Part L Compliant Dwelling and the 'Lean'& 'Clean' Dwelling



6 RENEWABLE ENERGY (BE GREEN)

A feasibility study has been carried out to assess the suitability of various renewable technologies. The following renewable energy sources have been considered:

- Wind turbines
- Solar water heating
- Solar photovoltaics (PV)
- Biomass
- Ground source heat pumps (GSHP)
- Air source heat pumps (ASHP)

6.1 WIND TURBINES

Wind turbines harness the power in the wind to generate electricity, which can then be fed to the building or exported to the national grid. There are two main types of wind turbines: horizontal axis and vertical axis. Horizontal turbines are more suited to rural areas with high wind speeds to operate at optimal efficiency. Vertical turbines are generally much smaller and can be sited on buildings; however they are typically more expensive and less efficient.

Due to the close proximity of trees and other residential buildings, plus considerations for the Elsworthy Conservation Area, wind turbines have been discounted as a potential renewable energy technology for the Dwelling.

6.2 SOLAR WATER HEATING

Solar water heating uses solar energy to heat water as it slowly passes either through evacuated tubes or over a flat plate collector and are an effective renewable technology in the UK as they work in diffused light conditions. The water provided by solar water heating systems is generally used for domestic hot water only and not for space heating. The most efficient type of solar water heating system is the evacuated tube, however these are generally more expensive and as a result the flat plate collector systems are more widely used.

The requirement for hot water by the Dwelling may be enough to justify a solar hot water system, however the availability of a suitable area of roof space is low due to the close proximity of mature trees casting shadow. Visual consideration would also need to be taken into account given the Conservation Area location.

On the basis of these constraints solar water heating is not considered an appropriate option for the Dwelling.

6.3 SOLAR PHOTOVOLTAICS

Solar Photovoltaics (PV) have a well-established record in the UK as a reliable source of renewable electricity. PV output can be estimated with reasonable accuracy, and is generally guaranteed for 15 years or more. They operate by exploiting the band gap present in semiconductors to generate electricity.

The constraints to installing PV at 36 Avenue Road are the same as those for solar thermal. On the basis of these constraints solar PV is not proposed for the Dwelling.

6.4 BIOMASS

A biomass boiler could be used to provide the Dwelling's space heating and hot water demand in place of gas fired boilers and water heaters. Biomass boilers have a reasonably established track record in the UK and modern technologies are resulting in heat generation efficiencies approaching those of natural gas boilers.

Biomass boilers require a solid fuel, usually in the form of wood chips or wood pellets for which a reliable supply would need to be identified. Due to its size, deliveries to the dwelling would likely be regular via a large delivery vehicle (adding to the indirect emissions associated with the Dwelling). This is unlikely to be desirable given the quiet residential location and potential impact on the Conservation Area.

On the basis of this constraint biomass is not considered an appropriate option for the Dwelling.

6.5 GROUND SOURCE HEAT PUMPS

Ground source heat pumps take heat from the ground and raise it to a higher temperature. This enables the heat pump to have a greater thermal output than the electrical energy input and typically the heat output from a GSHP is three or four times greater than the electrical input. This can result in large energy cost savings and carbon savings. The cost savings are tariff dependent and the carbon savings are dependent on the generation method.

As a single residential development, the upfront exploratory cost together with the capital costs of equipment and installation would be disproportionate to the overall construction cost.

On the basis of these constraints ground source heat pumps are not considered a viable option for the Development.

6.6 AIR SOURCE HEAT PUMPS

Air source heat pumps extract heat from the outside air to provide heat to internal spaces. This heat can be used to heat radiators, underfloor heating and hot water in the case of air to water heat pumps, or to a warm air convector in the case of air to air heat pumps. ASHPs could be used to offset some or all of the heating and potentially cooling demands (if required) of the Development. Unlike ground source heating and cooling ASHPs do not rely on a balanced heat transfer to and from the air as there is an essentially unlimited source of heat. This makes them more flexible and allows them to cater more effectively for unbalanced heating and cooling demands.

As the majority of the predicted CO_2 emissions are as a result of space heating and hot water ASHPs offer an applicable and effective method of reducing CO_2 emissions. They must be sited outside to extract heat from the outside air and as such require a dedicated plat enclosure that should be acoustically treated.

As the Dwelling proposes to provide heating via underfloor heating an air to water heat pump system would be compatible. Air to water heat pumps are generally more efficient than their air to air counterparts and they work best with a large surface area to emit heat, this is because they provide lower grade heat than that produced by conventional boilers.

For the reasons provided above air to water heat pumps are proposed for the Dwelling.

6.7 'GREEN' BUILDING CO_2 EMISSIONS

As a result of applying an air to water ASHP system, additional CO_2 savings have been made. The following tables summarise the CO_2 emissions of the Dwelling at this stage and the savings achieved as a result of 'Green' measures.

Table 6.1 - Comparison of CO_2 emissions savings after 'Green' measures

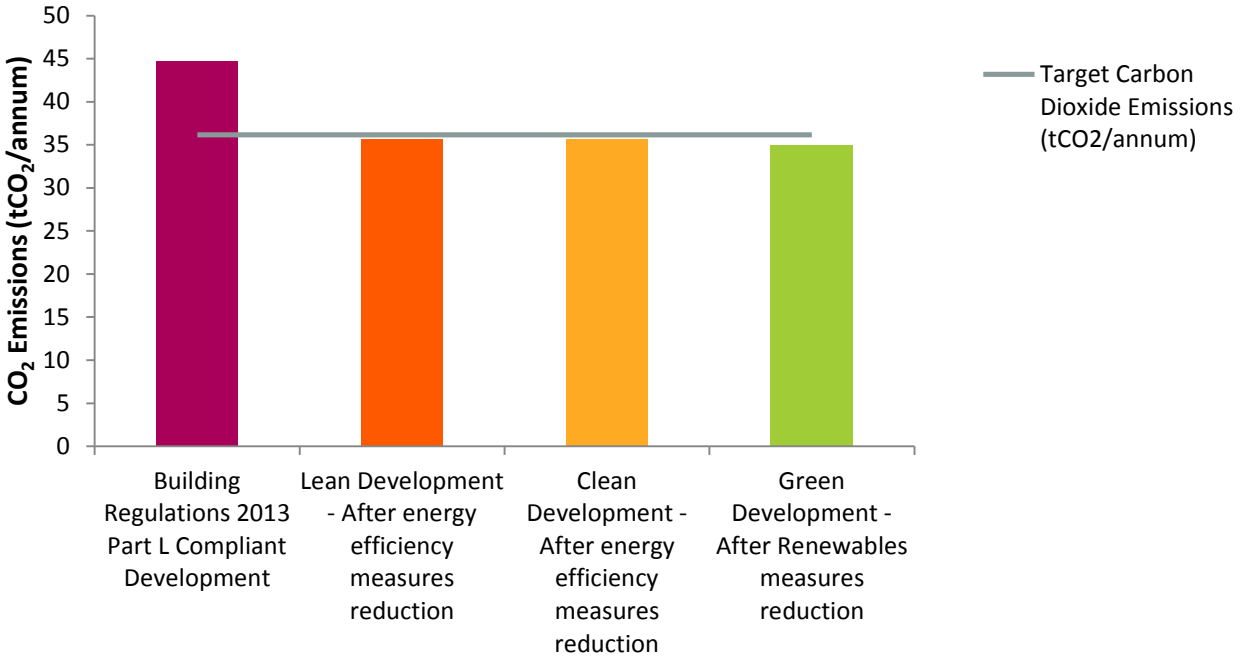
	CO_2 Emissions (tCO_2/year)
Building Regulations 2013 Part L Compliant Dwelling	44.67
After 'Lean' measures	35.63
After 'Clean' measures	35.63
After 'Green' measures	34.93

Table 6.2 – CO_2 emissions savings from 'Green' measures

	(tCO_2/year)	(%)
Savings from 'Lean' measures	9.04	20%
Savings from 'Clean' measures	0.00	0%
Savings from 'Green' measures	0.70	2%

Figure 4.1 shows the regulated CO_2 emission reduction achieved as a result of 'Lean', 'Clean' and 'Green' measures.

Figure 5.1 – Comparison of Building Regulations 2013 Part L Compliant Dwelling and the 'Lean', 'Clean' & 'Green' Dwelling


50
45
40
35
30
25
20
15
10
5
0
CO_2 Emissions (tCO_2/annum)
Building Regulations 2013 Part L Compliant Development
Lean Development - After energy efficiency measures reduction
Clean Development - After energy efficiency measures reduction
Green Development - After Renewables measures reduction
Target Carbon Dioxide Emissions (tCO2/annum)

7 CONCLUSION

By far the largest user of energy (and hence contributor of CO_2 emissions) in the existing building is the space heating. As such this area has been targeted to achieve the desired reduction in CO_2 emissions.

Energy demand reduction measures are the most effective method of reducing CO_2 emissions. Through the application of a variety of active and passive measures a carbon emissions reduction of 20% is achieved when compared to the Part L notional building.

In order to further reduce the CO_2 emissions from the Dwelling a system of air to water heat pumps are proposed to be provided. As the majority of the predicted CO_2 emissions are as a result of space heating and hot water air source heat pumps offer an effective method of reducing CO_2 emissions. Through the application of this system an additional reduction of 2% is achieved, taking the total CO_2 reduction to 22% when compared to the Part L notional building.

As a result of these measures the Dwelling achieves the minimum standard required for a Code for Sustainable Homes Level 4 rating, and achieves 3 credits under Ene 02 Fabric Energy Efficiency. See Table 7.1.

Table7.1 –Summary of energy targets achieved by the Dwelling

Energy Target	Compliance
Building Regulations 2013 Part L	Compliance achieved
Code for Sustainable Homes Level 4 – Ene 01 Dwelling Emission Rate	19% CO_2 emission reduction target achieved
Code for Sustainable Homes – Ene 02 Fabric Energy Efficiency	3 of 9 credits available achieved

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