Sustainability Statement

Garages to the south of 27a West End Lane, NW6 4QJ

Our Ref: West End Lane – BE0596
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Executive Summary

It is our opinion that sufficient design works have been carried out at this early stage to demonstrate that the proposal is successfully addressing the requirements of policy 5.2 of the London Plan and the local sustainability policies of Camden Borough Council.

The *energy hierarchy* has been adopted to follow a *Be Lean, Be Clean, Be Green* methodology.

The preferred energy strategy is to *reduce energy demand* and consequently the amount of conditioning and renewable energy contribution needed. This starts with a fabric first approach to improve thermal elements and controlled fittings.

Further example calculations demonstrate the effect of passive measures together with increased levels of air tightness. In addition building services have been optimised for efficiency. These gains produce a CO_2 reduction of **7.59%** over the baseline.

The feasibility of CHP systems and decentralised energy networks have been considered within the *Be Clean* case but found to not be feasible.

The final *Be Green* improvements have additionally explored the adoption and effect of adding renewable energy. The most appropriate renewable energy source has been identified as solar photovoltaic panels which produce a CO_2 reduction of **28.16%** meeting the required target of **20%** reduction in CO_2 emissions through renewable energy. The total reduction in emissions is **35.75%**, meeting the required target of **35%** reduction in CO_2 under baseline emissions.

The calculations provided draw upon the detailed SAP 2012 assessment of three sample dwellings under various scenarios. This gives an accurate representation to the energy usage of the final development in operation.

The behaviour of the occupants arguably has the largest part to play in terms of energy demand. Guidance for the future occupants will be provided on the operations of all systems within the building to encourage efficient use of energy generally and with particular attention to optimal use of energy generated by the suggested renewable system.

A proposal for installations for achieving a water use of less than 105 litres per person per day has also been provided.

It is important to note that this document forms an analysis of a proposed solution provided by BE. This includes fabric performance and building services. BE do take any responsibility for the integration of the technologies into the planning and design of the building. A full mechanical and electrical design, along with a review of plant, equipment and spatial requirements will need to be carried out to ensure the solutions discussed in this document are practicable. Likewise utility loads will need to be assessed and applications may need to be made to suppliers to verify the details of existing utlities in and around the site.

Introduction

This report has been prepared in accompaniment to a planning application for 6 proposed new build dwellings at the garages to the South of 27a West End Lane, NW6 4QJ. This report seeks to address policy 5.3 of the London Plan as well as local Camden policies CS13 and DP22. The extract below outlines the approach for producing energy assessments as per '***Energy Planning – Greater London Authority guidance on preparing energy assessments April 2015'***.

"On 6 April 2014 the 2013 changes to Part L of the Building Regulations came into effect. Part L 2013 delivers an overall reduction in CO2 emissions for new residential and new non domestic buildings, with the targets for individual buildings being differentiated according to building type. This reduction in CO2 emissions affected the percentage reduction necessary above the Part L 2013 regulations to meet the Mayor's targets in the London Plan.

As outlined in the Sustainable, Design and Construction SPG, since 6 April 2014 the Mayor has applied a 35 per cent carbon reduction target beyond Part L 2013 of the Building Regulations - this is deemed to be broadly equivalent to the 40 per cent target beyond Part L 2010 of the Building Regulations, as specified in Policy 5.2 of the London Plan for 2013-2016.

"Detailed energy statements should be submitted as part of major applications. This should demonstrate the predicted energy and associated carbon dioxide emission savings achieved through the incorporated of energy efficiency measures, decentralised energy and low/zero carbon technologies. This should be demonstrated in line with policy 5.2 of the London Plan, which requires a 25% reduction in CO_2 emissions above 2010 Building Regulations covering the period up to October 2013 and 40% thereafter."

The client has received detailed pre-application planning advice from the relevant London Borough of Camden planning officer (Case ref. 2015/2841/PRE). This report seeks only to address those energy requirements relating to the proposed new build residential dwellings (6 no.).

The Proposal

The proposed redevelopment of the site is to provide a two to four storey block of 6 residential flats following demolition of the existing garages.

Energy Strategy

The development will adopt a hierarchical approach to reducing energy, as per the London Plan (April 2015) and Figure 1 below.

The first step is energy reduction ('Be Lean') and the minimising of energy use wherever possible through reduction of demand through passive design. Building services will then be considered where active design can be incorporated to further reduce demand.

Following this, the focus will then turn to heating and cooling infrastructure ('Be Clean').

The third stage ('Be Green') will approach low or zero carbon technologies which may be incorporated within the scheme.

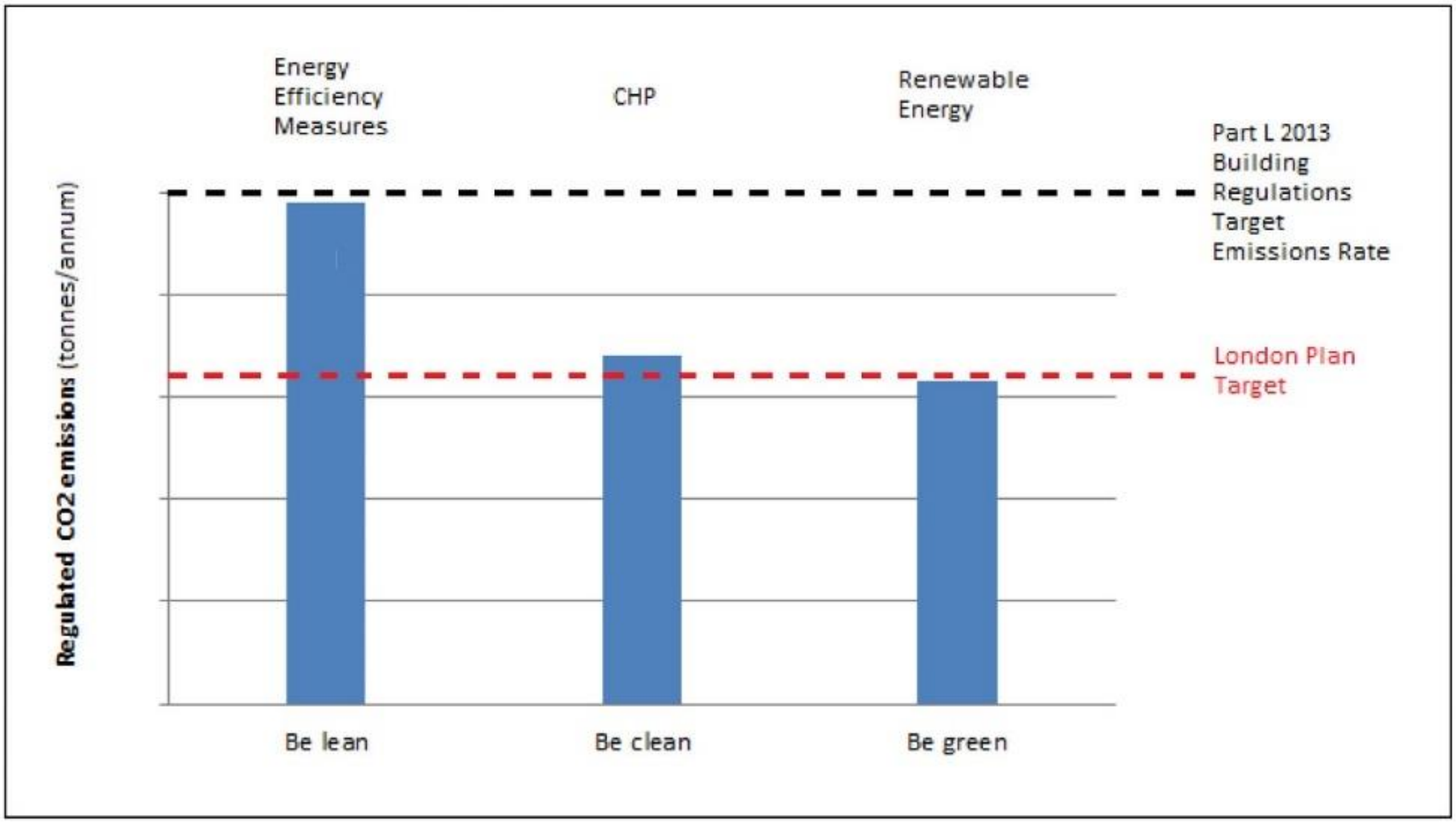


Figure 1: The Energy Hierarchy concept

Baseline Energy Demand

The following Table 1 represents the baseline energy consumption for a compliant dwelling under the latest Part L1A 2013 regulations. Regulated emissions have been calculated with a SAP methodology using a selection of three sample plots. These are Flat 1 (ground floor), Flat 4 (1st floor) and Flat 5 (2nd and 3rd floor), and were chosen to best represent a variety of size and built form across the proposed development.

Whilst regulated emissions were calculated through SAP 2012 calculations by multiplying the DER (Dwelling Emission Rate) by the floor area (see Appendices A, B and C), unregulated emissions have been calculated using the relevant BRE tools for the Code for Sustainable Homes (see Appendix J) and amount to **1.198** tonnes of CO_2 per annum for Flat 1, **0.825** tonnes of CO_2 per annum for Flat 4 and **1.276** tonnes of CO_2 per annum for Flat 5.

Baseline Regulated CO_2 Emissions (tonnes CO_2 per annum)			
Flat 1	**Flat 4**	**Flat 5**	**Average**
1.760	1.066	1.890	1.572

Table 1: Baseline Regulated CO_2 Emissions for Part L1A 2013 regulations compliance.

Demand Reduction: "Be Lean"

Improved Fabric Energy Efficiency

To assist with the achievement of a 35% reduction in CO_2 emissions it is the developers intention to significantly improve upon the limiting fabric parameters with Part L1A 2013 Building Regulations. Elements such as walls, floors, roofs and windows will be improved to enhance the building's overall thermal efficiency, and reduce heating and cooling requirement through passive methodology, as per Table 2:

Thermal Element	Proposed U-value (W/m^2K)	Maximum L1A U-value (W/m^2K)
Walls	0.17	0.30
Roofs	0.13	0.20
Floors	0.13	0.25
Glazing	1.4	2.0

Table 2: Comparison between proposed U-values of thermal elements and the maximum allowed values from Building Regulations 2013 L1A

Passive Design Measures

Site layout and orientation have been optimised to make use of positive solar gains. Shading has been carefully considered to reduce the effects of overheating.

The baseline case has been specified with the use of ACDs (Accredited Construction Details) and ECDs (Enhanced Construction Details) for the top floor to reduce the heat loss through thermal bridging. In the improved, proposed construction, ACDs and ECDs will be applied to all possible junctions. This provides a significant improvement resulting in y-values of **0.053 W/mK** for Flat 1, **0.136 W/mK** for Flat 4 and **0.094 W/mK** for Flat 5.

The maximum accepted air permeability for new build dwellings is $10m^3/hm^2$ at a building pressure of 50 Pascals. By developing an air tightness strategy, the proposed design aims to achieve an air permeability of **4.0 m^3/hm^2**.

On completion air testing will be carried out by a suitably qualified BINDT / ATTMA / iATA test engineer to ensure these targets are met.

Active Design Measures - Efficient Building Services

In addition to building fabric, the building services will be highly efficient. The dwellings will also be provided with 100% low energy lighting.

Building services are generally installed in buildings to provide comfort conditions or protect life safety. The services that provide comfort conditions are most efficient when they are accurately sized to match the load that they need to provide. Therefore both the efficiency of the items of equipment and their level of control affects overall CO_2 emissions performance.

Each flat has been specified with a combination boiler, which will have efficiencies of 90%. These will provide the space and water heating for the dwellings. The high efficiency will reduce the amount of gas required for heating and therefore the CO_2 emissions. The use of time and temperature zone controls and delayed start thermostats have also been proposed as they reduce the heating of time periods and areas that are not required.

Resulting Improvements from Demand Reduction Measures

Table 3 below demonstrates the reduction in carbon dioxide emissions gained through the measures outlined above. These are expressed as measures of emissions of CO_2 in kilograms per year. The relevant SAP documents are provided in Appendices D, E and F.

	Regulated CO_2 Emissions (tonnes CO_2 per annum)			
	Flat 1	**Flat 4**	**Flat 5**	**Average**
Baseline	1.760	1.066	1.890	1.572
After 'Be Lean' measures	1.564	0.983	1.811	1.453
Reduction	0.196	0.083	0.079	0.119
% Reduction	11.14	7.79	4.18	**7.59**

Table 3: Reduction in carbon dioxide emissions in as a result of 'Be Lean'/Demand Reduction Measures

Heating and Cooling Infrastructure: "Be Clean"

Additional Energy Efficiency Measures

The order of preference specified in Policy 5.6 of The London Plan has been examined as follows:

1. Connection to existing heating or cooling networks

2. Site wide CHP network

3. Communal heating and cooling

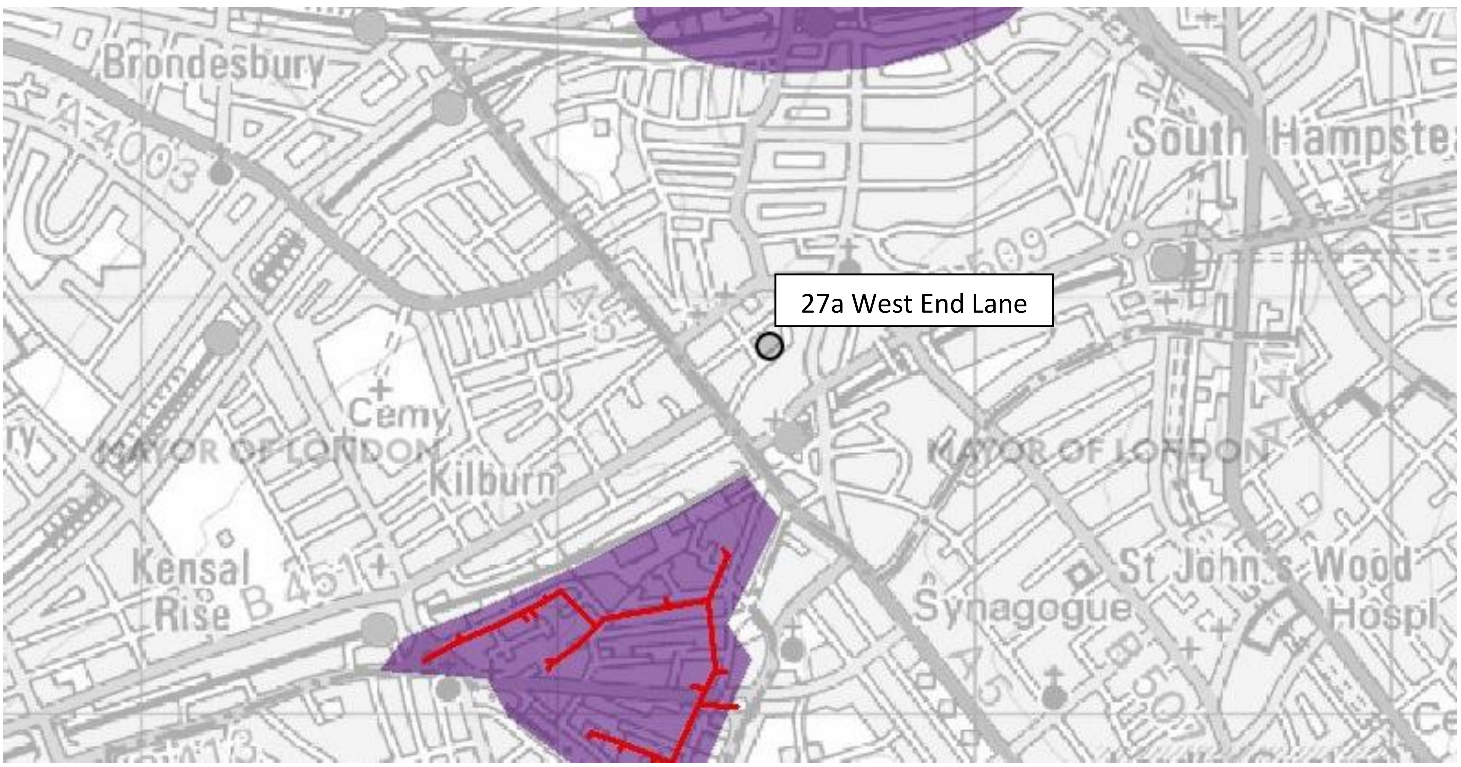
Connection to existing heating or cooling networks

Within its 2011 strategy, The London Plan places great emphasis on decentralised energy generation (DE) using such technologies as CHP. Decentralised Energy networks have been identified as a principal method for Camden meeting its 27% by 2017 and 40% by 2020 carbon reduction targets.

All of the London Boroughs have over the course of several years been producing or commissioning heat map studies to explore the viability of decentralised heat networks. Camden has completed a heat mapping exercise in 2015 although a final report is not yet available.

BE has consulted The 2007 report 'Camden Large Scale CHP Pilot Site Identification' as well as the 'London Heat Map Manual' April 2014. BE has also taken note of guidance and information from http://www.camden.gov.uk/ccm/content/environment/green/supplying-low-carbon-energy.en and http://www.londonheatmap.org.uk/Mapping/

This second website displays potential networks (shown in red) and potential areas for decentralised energy (shown in purple). A snapshot is shown below. There are no exisiting networks close enough to be shown. The development is around 450m from the nearest potential network, and therefore the costs involved in extending the network would outweigh the advantages from a connection due to the small size of the development. Because the site lies outside the potential areas for decentralised energy, this also shows the site would be unfeasible to connect to the network.



In addition to the lack of of connection potential, the required floorspace for plant and heat exchangers (likely to be 10 – 15m^2) would render this option technically unfeasible.

Site wide CHP network

CHP systems require a significant infrastructure and a substantial heat demand. In order to obtain maximum efficiency there must be sufficient demand for the waste heat produced. For newly built housing, with high standards of thermal efficiency, there is a small demand for heat and hot water, with demand for space heating also being seasonal.

CHP systems are therefore most suitable for mixed use schemes, with for example a leisure centre or hospital which require a high and consistent heat supply. This usage profile does not match that of the proposed development.

The cost of the central plant and distribution and heat interface units is likely to be in excess of a combi boiler and gas installation to each flat.

The running costs are also likely to be higher due to the standing losses, management and maintenance of the central plant.

Commercial CHP will be oversized for this number of dwellings. The CHP will need to run for approx. 5000 hours to provide an economic return and even this is questionable as the electricity output is unlikely to be used on site, and the exported energy is not likely to attract a good price.

Furthermore, the London Plan guidance states;

"*The following types of development need not install on-site CHP…. residential developments containing fewer than 500 apartments. At this scale it is generally not economic to install CHP as the lead heat source….*".

For these reasons, a site wide CHP network has been discounted on this scheme.

Communal heating and cooling

A community system is going to be uneconomic both in terms of the capital cost and the revenue costs. The latter will of course impact on the residents through their heating bills.

As per the previous comments re. heat networks, communal heating would also require approximately 10 to 15 m^2 for the heating plant which is technically and economically unfeasible.

Overheating

Internal heat generation will be minimized through energy efficient design: For example, heat distribution infrastructure within buildings will be designed to minimise pipe lengths, particularly lateral pipework in corridors of apartment blocks, and adopting pipe configurations which minimise heat loss e.g. twin pipes.

The amount of heat entering the building in summer will be minimized, for example, through use of carefully designed shading measures, including balconies, louvres, internal or external blinds, shutters, trees and vegetation.

Use of thermal mass will be used to manage the heat within the building: Increasing the amount of exposed thermal mass can help to absorb excess heat within the building.

The SAP calculations demonstrate that compliance has been achieved with minimum overheating requirements, assuming light coloured curtains or roller blinds are installed in front of windows.

Energy Production “Be Green”

This section looks at how the development can reduce overall energy usage and demand by sourcing heating and hot water entirely from renewable energy sources.

A variety of systems have been considered before concluding that the use of solar PV is most appropriate for this development. This is in line with the clients stated aim of surpassing the target of a 35% reduction in emissions stipulated by the London Plan, with a 20% reduction through renewable tehnologies.

Consider Appropriate Renewable Energy Technologies

Many other renewable energy technologies exist which may be appropriate for the setting of the development. The feasibility of each technology is approached below and why they are or are not appropriate for deployment at 27a West End Lane.

- Wind
- Heat pumps (Ground-source & Air-source)
- Photovoltaic Panels
- Solar hot water systems
- Biomass heating

<u>Wind</u>

The first consideration for this technology is local wind speed. According to the Department of Energy and Climate Change, the average wind speed at 27a West End Lane is 5.0 metres per second at 10m above ground level. Wind speeds of less than 5 metres per second are unlikely to provide a cost effective source of electricity (based on current technologies). At this wind speed, a wind turbine alone would not be enough to make signifcant enough reduction in emissions to be feasible.

A solution may be to mount the turbine beyond the zone of turbulence which may be 25m or more in the air – there may be planning concerns from both an aesthetic and noise perspective for residential and urban areas. Turbines also carry high capital costs upwards of £35,000 for a 12 kW turbine.

- ***A small scale wind turbine would not be suitable for this development, as it is unlikely to be cost effective or make a signigicant enough reduction on carbon emissions.***

Heat pumps

Heat pumps take in heat at a certain temperature and release it at a higher temperature, using the same process as a refrigerator. In the case of a ground source heat pump, fluid is circulated through pipes buried in the ground and passes through a heat exchanger in the heat pump that extracts heat from the fluid.

The heat pump raises the temperature of the fluid via the compression cycle to supply hot water to the building as from a normal boiler. Air source heat pumps work in the same way but use the air as the heat source rather than the ground.

- ***If the dwellings were to be fitted with heat pumps, this would greatly reduce the carbon emissions, though the heating demand for the flats is too low for one heat pump per flat to be cost effective. Alternatively a communal scheme where a small number of heat pumps are shared between the flats could be considered.***

Photovoltaic Panels

Photovoltaic panel systems convert energy from the sun into electricity through semi-conductor cells mounted in collector panels. The panels are connected to an inverter to turn the DC output into AC for use in the building to which they are attached and to be fed back into the grid when not required.

The current Feed-in Tariff scheme yields guaranteed payments for 20 years for all electricity generated by the system and payment for electricity exported back to the grid. Typical cost for around 4kWp array is around £7,000+ with a payback period of around 10 years (allowing for Feed-in Tariff benefits).

Photovoltaic arrays provide a quiet and effective renewable energy source with a relatively low aesthetic impact. The major benefit of PV systems is the significant reductions they can achieve in comparison to other technologies, in terms of CO_2 and energy use.

- ***The development has a large amount of flat roof space. It is proposed that photovoltaic panels be used to help meet the CO_2 emissions reduction target. The three assessed flats need an average of 1.125kWp of PV to achieve an average CO_2 reduction of 35%. This assumes the panels are horizontal with very little shading. This equate to a total of 6.75kWp installed for all 6 flats.***

Solar hot water systems

Solar water heating systems use the energy from the sun to heat water stored in a hot water cylinder inside the building.

Typical cost for 4m^2 of flat plate solar hot water is approximately £2,800 with a payback period of around 6-10 years. This could also benefit from the Renewable Heat Incentive.

- ***A solar thermal system has not be considered as it would requirer roof space on which solar PV is being proposed.***

Biomass heating

Domestic scale boilers such as woodchip-fed systems remain very costly and the requirements for siting both the boiler and the fuel source were considered impractical for this development.

There are also some concerns on current availability of suitable fuel within a reasonable distance of the development as well as the additional traffic that would be associated with it.

- ***The use of biomass is not considered to be feasible for this development.***

Recalculated emissions with Renewable Energy

All other improvements in demand reduction have been carried forward, and this forms the basis of the calculations which follow (see Appendices G, H and I). The effect is demonstrated by the improved figures in table 4 as follows:

	Regulated CO_2 Emissions (tonnes CO_2 per annum)			
	Flat 1	**Flat 4**	**Flat 5**	**Average**
Baseline	1.760	1.066	1.890	1.572
After 'Be Lean' measures	1.564	0.983	1.811	1.453
After 'Be Green' measures	1.112	0.539	1.371	1.010
Total reduction	0.640	0.527	0.519	0.562
% Reduction	36.37	49.44	27.45	**35.75**

Table 4: Reduction in carbon dioxide emissions in as a result of 'Be Lean'/Demand Reduction Measures and 'Be Green'/Renewable energy

This represents an average reduction in CO_2 emissions of **35.75%** per year across the three samples modelled, and has been achieved through energy efficiency measures, using improved building fabric, passive measures, increasing the efficiency of the building services and finally installation of a renewable energy source.

A reduction in CO_2 emissions of more than 35% has been achieved over the *baseline* model thus satisfying the requirement of London Plan policies 5.2, 5.3, 5.7, 5.9, 5.10, 5.11, 5.12, 5.13, 5.14 and 5.15 and Development Strategy policies 1.1(k) and 1.2(f).

Table 3 shows that a **7.59%** reduction was achieved through 'Be Lean' measures. Because the total reduction in emissions amounts to **35.75%**, this means that there is a **28.16%** reduction through solar PV. Therefore, the required target of 20% reduction in CO_2 emissions through renewable energy (as stated it the pre-application advice letter) has been achieved.

Water Use

The dwellings are required to achieve a maximum internal water use of 105 litres per person per day, as stated in the pre-application advice letter.

Appendix K shows a water calculation proposal for an example flat that meets this maximum value, achieving a figure of **104.6** litres per person per day. It does not take into account any water saving technologies, such as rainwater collection and use. Using these could reduce water consumption further or allow installations with a greater water use.

Conclusion

The sustainability requirements of the development are to achieve a water energy use of less than 105 litres per person per day and achieve a CO_2 emission reduction of 35% below the baseline, 20% which is required to be from renewable technologies.

The 'Be Lean'/energy demand reduction measures include the use of high efficiency (90%) combi boilers, with energy saving heating controls, Enhanced Junction detailing and air tightness. These measures produce a CO_2 reduction of **7.59%** below the baseline.

There were no feasible options found as part of the 'Be Clean'/heating ifnrastructure measures.

The 'Be Green'/renewable energy measures are the use of 6.75kW of solar PV, which provides a CO_2 emission reduction of **28.16%**, making a total reduction of **35.75%.** A proposal for installations for achieving a water use of **104.6** litres per person per day has also been provided. As a result, all of the required targets given in the pre-application advice mentioned above have been met.

Appendix

Appendix A – DER Worksheet – Flat 1 – Baseline Specification

Appendix B – DER Worksheet – Flat 4 – Baseline Specification

Appendix C – DER Worksheet – Flat 5 – Baseline Specification

Appendix D – DER Worksheet – Flat 1 – Lean Specification

Appendix E – DER Worksheet – Flat 4 – Lean Specification

Appendix F – DER Worksheet – Flat 5 – Lean Specification

Appendix G – DER Worksheet – Flat 1 – Green Specification

Appendix H – DER Worksheet – Flat 4 – Green Specification

Appendix I – DER Worksheet – Flat 5 – Green Specification

Appendix J – BRE Tool Demonstrating Non-Regulated Emissions

Appendix K – Water Calculation