# RESIDENTIAL

# ENERGY STRATEGY

# For

# 6 NUTLEY TERRACE

# LONDON

**CONSULTANT:**

**SLENDER WINTER PARTNERSHIP LTD**
**THE OLD SCHOOL**
**LONDON ROAD**
**WESTERHAM**
**KENT**
**TN16 1DN**

**ARCHITECT:**

**KSR Architects LLP 14**
**Greenland Street**
**London**
**NW1 0ND**

**DOCUMENT ISSUE RECORD**

| ISSUE | PREPARED BY | | | CHECKED BY | | |
|---|---|---|---|---|---|---|
| | PREPARED | DATE | SIGNATURE | CHECKED | DATE | SIGNATURE |
| 01 | D.Vardill | 09.04.15 | | P.Bushell | 09.04.15 | |
| 02 | D.Vardill | 10.04.15 | | P.Bushell | 10.04.15 | |
| 03 | D.Vardill | 27.05.15 | | P.Bushell | 27.05.15 | |

Issue 01: Planning Issue
Issue 02: Planning Issue, Minor amendments
Issue 03: Planning Issue, Minor amendments

## Contents

## 1. EXECUTIVE SUMMARY

This document outlines both the energy savings and energy efficiency measures and possible renewable technologies that have been evaluated for the proposed re-development of this building. A total of 6 self-contained apartments are to be created within the new building, all works will adhere to the 2013 building regulation requirements specifically 'Part L1A' utilising 'SAP 2012' assessments to demonstrate compliance. The 6 apartments are to exceed the Level 4 Standard set within the 'Code For Sustainable Homes' (CfSh) guidelines and will have a minimum 20% of the total delivered energy usage provided by on-site low and zero carbon technologies as required by the London borough of Camden's core policy.

This document shall be read in conjunction with all related information submitted for the application. This document relates to the energy use and carbon emissions reduction required under Local, regional and national policy.

Policy and guidance includes:

The London Plan 2011 (Draft Further Alterations to the London Plan 2014)
The Mayor's Supplementary Planning Guidance – Revised Sustainable design and Construction (2014)
London Borough of Camden Core Policy CS13 (2010)
UK National sustainable development policy
Planning Guidance 3 – Sustainability (April 2011)

The proposed development has been assessed and a site wide energy strategy produced in accordance with the Mayor's Energy Hierarchy:

1. Be lean: minimise energy use
2. Be clean: supply energy efficiently
3. Be green: use of renewable energy

This document demonstrates that the London Borough of Camden Planning policies relevant to sustainable energy including CS13 have been addressed in a structured and comprehensive manner by the proposals in the Planning Application.

The energy strategy demonstrates that regulated carbon dioxide emissions for the proposed scheme have been reduced by more than 20% over Part L 2013 compliant baseline requirements by maximising the contribution of each step of the energy hierarchy.

### 1.1. LONDON PLAN SUMMARY

**Be lean:** The following bulleted items are key efficiency measures that have been factored into the design stage assessment;

- Improved building fabric, better than the limiting standards of the Building Regulations
- Ventilation systems with low specific fan powers
- High efficiency boilers
- Domestic Hot Water (not specified and therefore defaulted to immersion type due to the inclusion of heat exchangers within the 'Be Clean' stage)
- Low energy lighting and, where appropriate, automatic lighting control systems
- Measures to reduce the space cooling demand

These energy efficiency measures result in the building's carbon emissions being **17.39%** better than the Base building regulation standards.

**Be clean:** A number of energy efficiency improvements are being made to reduce the energy requirement. The proposed communal 'Gas Boiler System' heating system and improved energy efficient lighting is considered. SAP 2012 assessments have been carried out to compare the energy consumption and subsequent $CO_2$ emissions of the 2013 Building regulation baseline building against those of the proposed building respectively. This proposed building has been specifically assessed in terms of predicted carbon emissions.

The following key technologies were deemed as the most viable options for the proposed site are:

- It is proposed to install communal gas fired boilers that will operate in conjunction with the individual whole house ventilation strategies.
- Domestic hot water shall be provided via the main heating system using local high efficiency heat exchangers within each dwelling to avoid storage losses.
- Low energy lighting shall be utilized throughout the development.

Additional information has been provided to show the energy efficiency of the combined extension and refurbished building. The results show the energy performance and $CO_2$ emissions of the proposed building improve significantly when compared to the Baseline building. These improvements are made through energy efficient plant and controls, good quality components within the new roofs and extension together with achieving a lower air leakage rate.

In line with Council Policy, SWP have investigated the local infrastructure for the possibility of district/communal heating networks being available within the Camden areas. Although primary heating networks are present in the borough, the systems are not available for domestic development at this time. For this reason a district heating solution has not been considered further in this proposal, however plant space and pipe routes will be provided to enable future connection into the Camden network.

The carbon emissions reductions from the 'be clean' stage are an additional **13.32%** reduction.

**Be green:** An assessment has been carried out of current low and zero carbon technologies. The most suitable options for this site are photovoltaic panels which shall reduce the grid electricity reliance. The PV array will be approximately 56 panels yielding 12kWp and located on the highest roof.

The carbon emissions reduction from the 'be green' stage are an additional **20.47%.**

The total reduction in regulated carbon emissions for the proposed development is **51.18%** over the baseline values.

Although the above percentages progressively show the steps taken to improve and reduce the energy consumption along with the total percentage, it is important to recognise that the building regulation compliant figures within the final stage 'Green' shows an improvement of **26% (DER<=TER)** which on its own shows a significant improvement over the notional target and achieves a level 4 CfSh.

In accordance with the Camden Core Policy stating that a minimum of 20% of the total energy consumption be LZC. It is estimated that over **30%** of the primary energy will come from the onsite renewables on this development and the figures are confirmed within the SAP 2012 worksheets attached separately.

## 2. ENERGY STRATEGY

### Methodology

A thorough review has been undertaken of the energy technology options for the site to ensure the most appropriate energy strategy is implemented. This energy strategy has been developed in accordance with requirements of the London Plan and specifically the GLA Energy Team's Guidance Note 'Guidance on Planning Energy Assessments October 2010'.

Accordingly, the Mayor's Energy Hierarchy (Use Less Energy - 'Be Lean', Supply Energy Efficiently -'Be Clean' and Use Renewable Energy - 'Be Green') has been applied to energy considerations for the site, starting with a robust 'baseline' energy demand assessment. A final energy strategy consisting of the introduction of an air source heat pump (ASHP) and highly efficient communal gas fired boilers has been evaluated as the most appropriate to serve the energy demand profile of the site whilst ensuring optimal energy efficiency and $CO_2$ emission reductions.

### Baseline Energy *Demand* Assessment

The 6 Nutley Terrace development is assessed under Building Regulations Part L 2013 as requested by the London Borough of Camden. The results in the report are assessed based on SAP 2012.

In establishing the energy profile of the building, consideration has been given to the various ways in which the building in use will consume energy, and means of making reasonable estimates or calculations of the likely energy use. Appropriate non-regulated loads (small power, equipment, external and common areas lighting, cooking and appliances etc.) have also been established and incorporated in the assessment.

The baseline used for this document relies on a simple tailored mechanical design and utilisation of minimum compliant U-Values as displayed within the Approved Document L1A, 2013 Edition Page 15 Table 2.

### Energy Hierarchy Step 1 - 'Be Lean' - Reduce Energy Demand

A range of measures have been adopted in the building fabric and services design to reduce the energy demand of the scheme, relative to what would be permissible solely to satisfy the Building Regulations.

- Improved building fabric, better than the limiting standards of the Building Regulations
- Ventilation systems with low specific fan powers, including EC motors on the fan coil units
- High efficiency boilers
- Domestic hot water (software defaulted to immersion heaters as Heat exchangers are accounted for within the 'Be Clean Stage')
- Low energy lighting and, where appropriate, automatic lighting control systems
- Measures to reduce the space cooling demand

These energy efficiency measures result in the building's carbon emissions being **17.39%** better than the calculated baseline value.

**Energy Hierarchy Step 2 - 'Be Clean' - Supply Energy Efficiently**

In line with Council Policy, SWP have investigated the local infrastructure for the possibility of district/communal heating networks being available within the Camden areas.

Although primary heating networks are present in the borough, the systems are not available for domestic development at this time. Therefore a communal high efficiency 'Gas Boiler' heating system and improved energy efficient lighting is considered.

For this reason a district heating solution has not been considered further in this proposal, however plant space and pipe routes will be provided to enable future connection into the Camden network

These clean measures result in the building's carbon emissions reducing by a further **13.32%** better than the calculated baseline value.

**Energy Hierarchy Step 3 - 'Be Green' - Renewable Energy**

The use of renewable energy technologies has been considered. The provision an array of photovoltaic collectors will result in a further reduction of **20.47%** reduction in regulated carbon emissions for this final step.

**Summarised Results following the 3 Steps**

It is estimated that the project as a whole (new build) will achieve **51.18%** reduction in carbon dioxide emissions from the calculated baseline.

Although the above percentages progressively show the steps taken to improve and reduce the energy consumption along with the total percentage, it is important to recognise that the building regulation compliant figures within the final stage 'Green' shows an improvement of **26% (DER<=TER)** which on its own shows a significant improvement over the notional target and achieves a level 4 CfSh.

In accordance with the Camden Core Policy stating that a minimum of 20% of the total energy consumption be LZC. It is estimated that over **30%** of the primary energy will come from the onsite renewables on this development and the figures are confirmed within the SAP 2012 worksheets attached separately.

## 2.1. Summary Graph and Tables

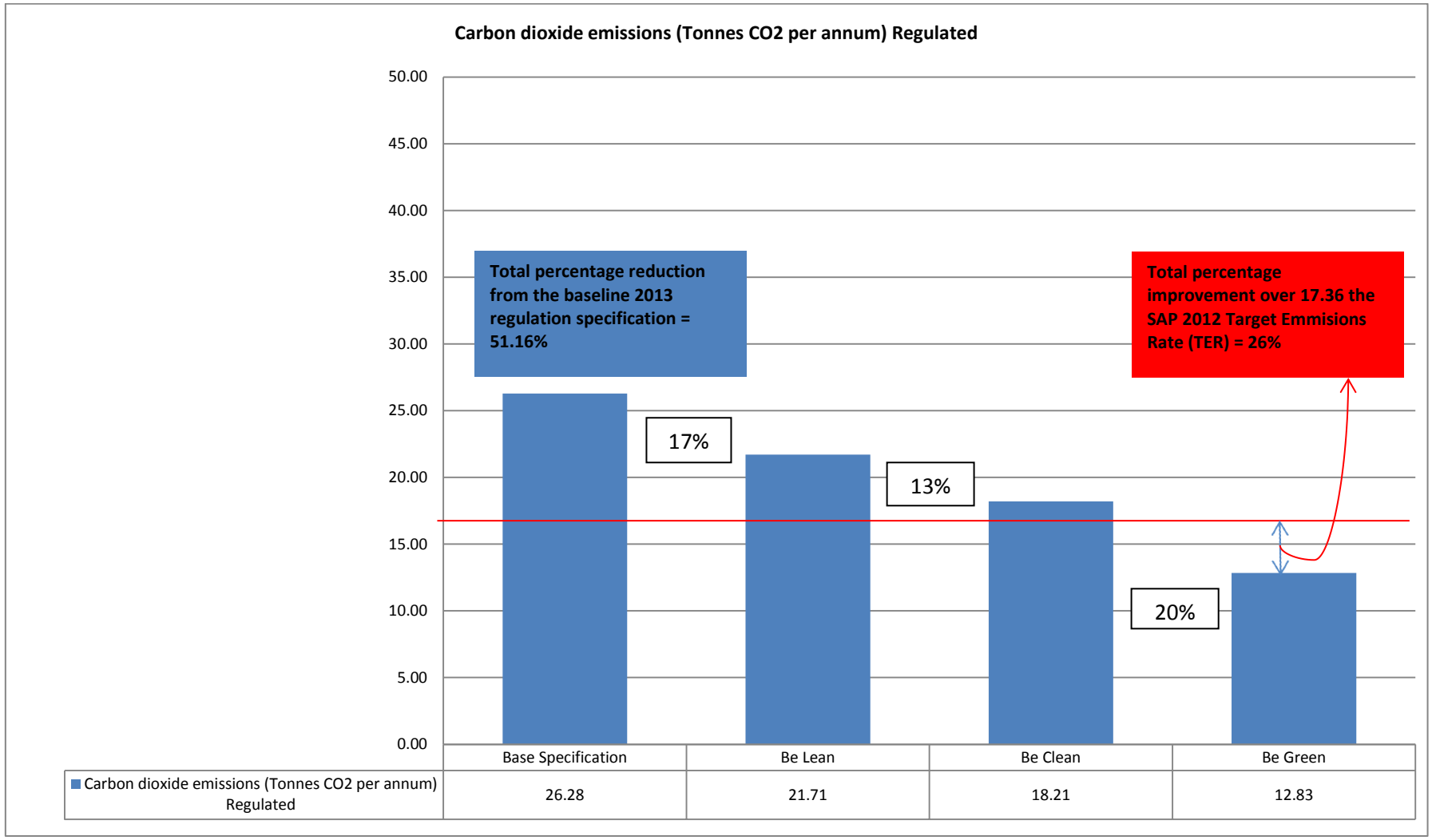


**Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy**

| | Carbon dioxide emissions (Tonnes $CO_2$ per annum) | |
|---|---|---|
| | Regulated | Unregulated[1] |
| **Base Specification[2]** | 26.28 | 13.14 |
| **After energy demand reduction** | 21.71 | 7.60 |
| **After communal heating** | 18.21 | 7.60 |
| **After renewable energy** | 12.83 | 7.60 |

**Table 2: Regulated carbon dioxide savings from each stage of the Energy Hierarchy**

| | Regulated Carbon dioxide savings | |
|---|---|---|
| | (Tonnes $CO_2$ per annum) | (%) |
| **Lean Savings** | 4.57 | 17.39% |
| **Clean Savings** | 3.5 | 13.32% |
| **Green Savings** | 5.38 | 20.47% |
| **Total Cumulative Savings** | 13.45 | 51.18% |
| **Total Target Savings[3]** | 3.95 | 20% |
| **Annual Surplus** | 0.58 | 6% |

[1] Unregulated Energy has been accounted for and is estimated as 50% for residential spaces of the total regulated energy. This reduces to 35% after the demand reduction step.
[2] This Base level is established using the minimum regulations standards and is not to be confused with the Target set by SAP 2012
[3] This is calculated from the targeted improvement over the SAP 2012 TER and not the base calculation as table 1

**Carbon Dioxide Emissions savings from each stage of the Energy Hierarchy**

The proposed strategy for the development shows $CO_2$ savings from 'be Lean' measures of **4,570kg$CO_2$/year** (**17.39%** of regulated emissions), 'be clean' measures of **3,500kg$CO_2$/year** (**13.32%** of regulated emissions), and 'be Green' measures of **5,380kg$CO_2$/year** (**20.47%** of regulated emissions).

This is a total saving of **13,450kg$CO_2$/year** (**51.18%** of regulated emissions)

Although the above figures show the steps taken to improve and reduce the energy consumption and design and they represent the reductions during these steps, it is important to recognise that the building regulation compliant figures within the final stage 'Green' show an improvement of 26% (DER<=TER) which on its own shows a significant improvement over the notional target and achieves a level 4 CfSh.

A thorough consideration has been made of the energy technology options for the site to ensure the most appropriate energy strategy is implemented. This report provides an assessment of the issues under consideration, and has demonstrated that the London Borough of Camden's energy policies are generally met or exceeded.

## 3. OVERVIEW

### Objective

The purpose of this energy strategy is to demonstrate that energy consumption and climate change mitigation measures have been fully considered and appropriately selected and specified as part of the building's design.

In accordance with the guidance note 'Guidance on Planning Energy Assessments' after establishing the baseline energy demand and profile for the site, the strategy for the project follows the Mayor's Energy Hierarchy (Use Less Energy - 'Be Lean', Supply Energy Efficiently - 'Be Clean' and Use Renewable Energy - 'Be Green') in appraising appropriate measures to reduce carbon emissions and other climate impacts from the development.

The following sections provide more details on each of the steps of the Energy Strategy following the London Plan's Energy Hierarchy.[4]

### General Methodology

The Guidance Note provides further detail on addressing the London Plan's energy hierarchy through the provision of an energy assessment to accompany strategic planning applications. Importantly, the Guidance Note acknowledges its requirements should be adapted for different scales of development.

The Guidance Note has been used to structure the appraisal and reporting of energy strategies for this Energy Statement.

[4] All analysis in this document adopts the Building Regulations Part L 2010 $CO_2$ fuel factors.

## 4. BASELINE ENERGY ASSESSMENT

**Objective**

Before energy efficiency measures are investigated, it is important to establish the baseline energy consumption of the scheme, for comparison and evaluation of energy proposals.

**Scope**

For energy assessments being undertaken under the London Plan, the appropriate baseline case against which to assess potential carbon savings is a new development designed to conform to the current Building Regulations Part L (2013[5]); effectively the 'do minimum' case. This baseline case represents a typical building arrangement; where electricity for the development is imported from the grid and space and heating water are provided by standard mains gas-fired boilers.

All energy uses, and not just the conventional building services loads (lighting, heating, cooling and ventilation) and energy loads associated with the function of the site should be considered in the establishment of the energy profile, and especially in the selection of a building services strategy and any renewable energy technology.

The following 'regulated' energy uses are considered in the baseline energy analysis:

- Space Heating/Cooling
- Water Heating
- Ventilation
- Fans, Pumps and Controls
- Lighting (internal)

The regulated energy uses can be established using the robust and well-established calculation methodology of Part L of the Building Regulations Part L 2013 (SAP, SBEM and DSM via the NCM)[6].

[5] 2013 regulations to be adhered to as per the GLA guidance

[6] Standard Assessment Procedure (SAP), Simplified Building Energy Model (SBEM), Dynamic Simulation Modelling (DSM), National Calculation Method (NCM)

# 5. BE LEAN

**Objective**

The first step in pursuing energy efficient and low-carbon design under the energy Hierarchy is to minimise the development's energy demand. This is achieved both by passive measures and the introduction of more energy efficient plant and services. Any measures implemented at this stage will reduce the extent of measures or size of plant needed to address the subsequent 'be clean' and 'be green' stages.

**Scope**

The building services strategy has been developed in response to the following drivers for the project:

Maximising the potential of the building to satisfy market expectations (balancing of scope of works with value to create the optimal specification) achieving environmental comfort condition and occupant wellbeing and avoiding unnecessary costs of construction

**Methodology**

In establishing the proposed energy strategy and servicing strategy for the development, the requirement to minimise energy consumption through improved building fabric and building services measures has been considered a priority.

As part of this assessment the London Plan's 'Cooling Hierarchy' has been considered in the design process, to reduce where possible the extent and installed capacity of cooling plant.

- Passive strategies and measures that have been considered include:
- Improving building (thermal and air leakage) performance.
- Use of thermal mass.
- Use of natural daylighting

**THERMAL ELEMENTS**

The proposed new building's fabric elements shall be in compliance with the Approved Building Regulations Part L1A 2013.

The proposed 'U' values for 6 Nutley Terrace are as below:

| Element | Design U-Values ($W/m^2K$) |
|---|---|
| **New External Walls** | 0.16 |
| **New Roof** | 0.13 |
| **Floor** | 0.13 |
| **Windows & Doors** | 1.3 |

Table 7: Design U-Values

A design air permeability rate has been set at **3 $m^3/m^2$/hr at 50Pa**.

**HEATING**

The residential units will primarily utilise communal heating with sequenced high efficiency gas fired boilers.

The communal system will serve all dwellings with space heating utilising underfloor or radiant emitters.

**DOMESTIC HOT WATER (DHW) SERVICES**

The hot water generation within the software is defaulted to local immersion heaters at this stage. The proposed high efficient heat exchangers within each dwelling are accounted for within the 'Be Clean' stage.

## COMFORT COOLING

The demand for comfort cooling has been minimised by means of minimising heat gains to the space. This has been achieved by a combination of design considerations. These considerations are such as controlled ventilation and mechanical heat recovery systems with summer bypass and boost, improved performance of the building fabric and high performance glazed elements, openable windows, natural shading from structure, low energy lighting, etc.

## ARTIFICIAL LIGHTING

The provision of natural daylight is considered an important factor in the design in order to minimise the use of artificial light within the building. Floors from ground level upward have access to natural light with high specification glazing being specified to maximise day lighting levels and minimise associated heat loss. High efficiency lamps will be considered in conjunction with the client's preferences and facilities for automatic switching and dimming systems shall also be incorporated where possible.

| | Carbon dioxide emissions after 'Be Lean' Demand Reduction (Tonnes CO2 per annum) | |
|---|---|---|
| | Regulated | Unregulated[7] |
| **Base Specification** | 26.28 | 13.14 |
| **Be Lean** | 21.71 | 7.60 |

The 'Be Lean' demand reduction results in a **17.39%** reduction in regulated carbon emissions.

[7] Unregulated Energy has been accounted for and is estimated as 50% for residential spaces of the total regulated energy reducing to 35% after the demand reduction step.

## 6. BE CLEAN

**Objective**

The next step in the Energy Hierarchy, 'be clean', is to investigate the options for the efficient supply of energy to the development. This stage follows the incorporation of all practicable energy efficiency measures.

**Scope**

Potential approaches include connecting the scheme to existing CHP-led district energy networks, or if no existing schemes exist investigating whether such networks are planned in the area and designing systems with the flexibility to connect to these in the future. Opportunities to provide a communal heating system across buildings/uses within a multiple building scheme should also be pursued.

**Review**

We have investigated the Camden District Heating who generate the network in the area. Although primary heating networks are present in the borough, the systems are not available for domestic development at this time.

At this stage we have allowed for communal gas fired heating systems and included high efficiency heat exchangers within each dwelling to produce hot water via the communal system. Connections points for connection to district schemes that become available in the future can be provided.

| | **Carbon dioxide emissions after 'Be Clean' Communal Heating (Tonnes CO2 per annum)** | |
|---|---|---|
| | Regulated | Unregulated[8] |
| **Baseline: Part L 2013 of the Building Regulations Compliant Development** | 26.28 | 13.14 |
| **After energy demand reduction** | 21.71 | 7.60 |
| **Be Clean** | 18.21 | 7.60 |

The 'Be Clean' demand reduction results in a **13.32%** reduction in regulated carbon emissions.

[8] Unregulated Energy has been accounted for and is estimated as 50% for residential spaces of the total regulated energy. This reduces to 35% after the demand reduction step.

## 7. BE GREEN - INCORPORATION OF RENEWABLE TECHNOLOGIES

**Objective**

The third and final stage of the energy hierarchy is to 'be green'. The potential of a range of renewable energy systems that can contribute on-site generation to serve the energy requirements of the site, and thereby further reductions in $CO_2$ emissions for the proposed development.

**Methodology**

This assessment has been undertaken using the methods laid out in the London Energy Partnership's 'integrating renewable energy into new developments: Toolkit for planners, developers and consultants' - the 'Renewables Toolkit'

**Scope**

The following renewable energy technologies have been considered for application at the site as they are identified in the London Plan as being potentially technically feasible for projects in London.

- Ground Source Heat Pump
- Solar Thermal Water Heating
- Photovoltaics
- Wind Turbines
- Biomass

**ON-SITE RENEWABLE ENERGY ASSESSMENT**

A number of technologies were appraised in terms of technical, physical and financial feasibility, as potential low carbon system for use on the project.

## Ground source heat pumps

*Illustrative images only*

Heat pumps use refrigerant gases and an electrical compressor to take heat from a source and deliver it to an output. In this way they can be used to supply heating or cooling to a building. The ground acts as a huge solar collector and thermal store, which dampens fluctuations in ground temperature. The fluctuations reduce with depth and stabilise at the annual mean by about 12m below the surface; for the UK this is in the range 9–12°C.

Ground source heat pumps make use of this heat stored in the ground and raise it to a more useful temperature of around 40-50°C. It should be noted that at these temperatures, the heat produced is only useful for low temperature applications such as under floor heating installations; otherwise, a degree of top-up by conventional means is required when used for generating domestic hot water for example.

The viability of such a system and therefore costs rely almost entirely on the sub-structure build-up, the adjacency and restrictions on sub-structural service distributions and transport systems and the structural interface required to achieve thermal piles below the building.

**From the evaluation it shows that the site may have the potential for ground source geothermal heat extraction and storage below the new basement levels however there are several tunnels passing close to the site which in this instance render this option unviable when compared to other choices.**

**Air Source Heat Pumps**

***Illustrative images only***

Air source heat pumps operate using the same reverse refrigeration cycle as ground source heat pumps; however the initial heat energy is extracted from the external air rather than the ground. These heat pumps can be reversed to provide cooling to an area although this reduces the coefficient of performance of the pumps.

The heat pump connects multiple inside units with a single outside unit. The latter resembles a comfort cooling condenser unit and care must be taken to locate the unit where any noise generation is not obtrusive and the location should ensure the unit is not visually obtrusive.

**Air source heat pumps are considered for cooling although this demand is estimated to be minimal.**

**Solar Water Heating**

***Illustrative images only***

**The hot water load for the development is high due to the density of occupation and although there is useable space at roof level this is better used for PV in this project. Solar hot water heating therefore will not be progressed further.**

## Photovoltaics

*Illustrative images only*

Photovoltaic panels (PV) provide clean silent electricity and generate green power during most daylight conditions although they are most efficient when exposed to direct sunlight or are orientated to face plus or minus 30 degrees of due south.

PV panels typically have an electrical warranty of 20 – 25 years and are eligible for the Government's Feed in Tariff (FITS) incentive scheme for the 25 years after the installation.

**There is over 100m² of space to accommodate PV panels excluding associated clearances roof level, an array of panels is proposed and will minimize grid supplied power reliance. In total this equates to a PV installation of approximately 12kW peak. It is assumed that this system will be either south, southwest or southeast facing and mounted at a 30 degrees inclination.**

**Wind turbines**

***Illustrative images only***

Wind power can be used to generate electricity either in parallel with mains supplies or as standalone solutions using battery back-up.

**In order to generate worthwhile quantities of electricity, average wind speeds of between 5-6 m/s are necessary (the UK government is currently advising 5.5-6.0m/s as the threshold). However Government wind speed database predicts local wind speed within central London to be 4.6 m/s at 10 m above ground level and 4.9 m/s at 25 m above ground level thus rendering the option unviable.**

**Biomass boilers**

***Illustrative images only***

Energy from biomass is produced by burning organic matter. Organic matter is harvested and processed to create bio-energy which can take the form of liquid or solid fuels.

Although biomass is carbon-based (and hence generates carbon emissions), the carbon that is released during combustion is equal to that carbon that was absorbed during growth and so the fuel is classed as carbon neutral (the fuel generally requires treatment and transport, with associated carbon emissions however, but these effects will be ignored here).

**Deliveries of fuel for a communal biomass boiler would be considered unacceptable, suitable space for fuel storage would also prove impractical therefore this shall not be considered further.**

**Summary of Renewable Energy Feasibility**

| Technology | Feasible For This Site | Reason |
|---|---|---|
| **Photovoltaics** | **YES** | **Proposed at roof level to reduce site reliance on grid supplied electricity. Approx 12kW peak array.** |
| **Solar Water** | **No** | Dismissed since load already supplied by CHP. |
| **Ground source heat pumps** | **No** | **Ground Loops or Bore holes may not be accommodated due to the tunnels below the site.** |
| **Air Source heat pumps** | **Yes** | **Cooling demand although minimal may require ASHP.** |
| **Wind Generators** | **No** | Insufficient wind speeds and turbulence at site. |
| **Biomass Boilers** | **No** | Regular fuel deliveries would be unacceptable and require unavailable fuel storage space. |

| | Carbon dioxide emissions after 'Be Green' Renewables (Tonnes CO2 per annum) | |
|---|---|---|
| | Regulated | Unregulated[9] |
| **Baseline: Part L 2013 of the Building Regulations Compliant Development** | 26.28 | 13.14 |
| **After energy demand reduction** | 21.71 | 7.60 |
| **After communal heating** | 18.21 | 7.60 |
| **After renewable energy** | 12.83 | 7.60 |

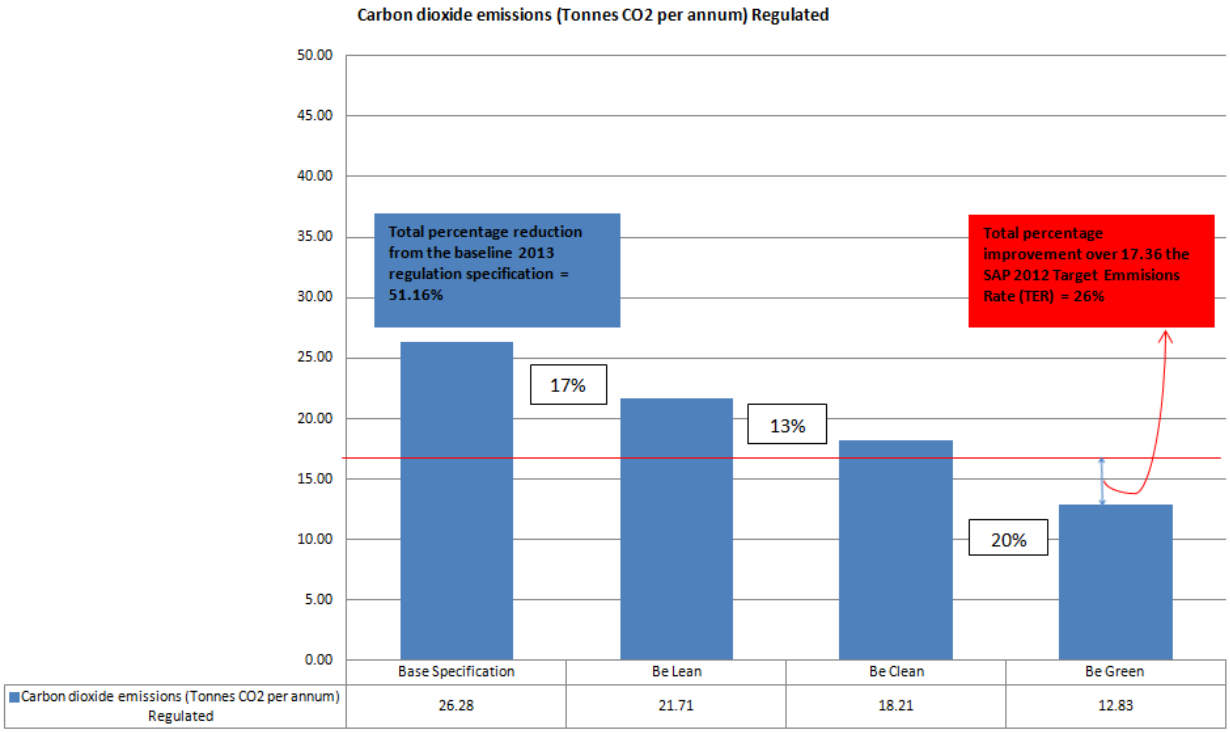
From the 'Be Green' step the result is a **20.47%** reduction in regulated carbon emissions. It is also calculated that the renewables will provide approximately 30% of the site energy requirements which exceed Camden's CS13 requirements.

[9] Unregulated Energy has been accounted for and is estimated as 50% for residential spaces of the total regulated energy. This reduces to 35% after the demand reduction step.

## 8. CONCLUSIONS

This report demonstrates how the London plan methodology has been followed and that the three key steps have been taken allowing a reduction of **51.18%** over the base specification, this equates to an improvement over building regulation compliant figures within the Green stage of **26% (DER<=TER)** and achieves a **level 4 CfSh** (see chart below for correlation between steps and final improvement).

In accordance with the Camden Core Policy stating that a minimum of 20% of the total energy consumption be LZC. It is estimated that over **30%** of the primary energy will come from the onsite renewables on this development and the figures are confirmed within the SAP 2012 worksheets attached separately.




**Graph 1: Lean, Clean and Green Stage reductions**

# APPENDIX A

## Residential Block Compliance Sheets All Stages

# Block Compliance WorkSheet: LEAN_6 NT_BLOCK Complaince

User Details

**Assessor Name:** **Stroma Number:**
**Software Name:** Stroma FSAP **Software Version:** Version: 1.0.1.21

Calculation Details

| Dwelling | DER | TER | DFEE | TFEE | TFA |
|---|---|---|---|---|---|
| D001 | 16.88 | 13.37 | 50.2 | 51.4 | 271 |
| D002 | 16.14 | 12.69 | 48.3 | 49.4 | 310 |
| 101 | 16.35 | 12.88 | 34.7 | 39 | 140 |
| 102 | 15.8 | 12.44 | 33 | 37.3 | 143 |
| 201 | 14.56 | 11.71 | 41.1 | 44 | 280 |
| 301 | 18.85 | 14.57 | 53 | 53.9 | 186 |

Calculation Summary

| | |
|---|---|
| Total Floor Area | 1330.00 |
| Average TER | 12.88 |
| Average DER | 16.32 |
| Average DFEE | 44.75 |
| Average TFEE | 46.90 |
| Compliance | Fail |
| % Improvement DER\|TER | N/A |
| % Improvement DFEE\|TFEE | N/A |

Stroma FSAP 2012 Version: 1.0.1.21 (SAP 9.92) - http://www.stroma.com Page 1 of 1

# Block Compliance WorkSheet: CLEAN_6 NT_BLOCK Complaince

User Details

**Assessor Name:** **Stroma Number:**
**Software Name:** Stroma FSAP **Software Version:** Version: 1.0.1.21

Calculation Details

| Dwelling | DER | TER | DFEE | TFEE | TFA |
|---|---|---|---|---|---|
| D001 | 14.7 | 13.37 | 50.2 | 51.4 | 271 |
| D002 | 14.22 | 12.69 | 48.3 | 49.4 | 310 |
| 101 | 12.27 | 13.33 | 34.7 | 39 | 140 |
| 102 | 11.81 | 12.89 | 33 | 37.3 | 143 |
| 201 | 12.45 | 11.91 | 41.1 | 44 | 280 |
| 301 | 15.74 | 14.9 | 53 | 53.9 | 186 |

Calculation Summary

| | |
|---|---|
| Total Floor Area | 1330.00 |
| Average TER | 13.06 |
| Average DER | 13.69 |
| Average DFEE | 44.75 |
| Average TFEE | 46.90 |
| Compliance | Fail |
| % Improvement DER\|TER | N/A |
| % Improvement DFEE\|TFEE | N/A |

Stroma FSAP 2012 Version: 1.0.1.21 (SAP 9.92) - http://www.stroma.com Page 1 of 1

# Block Compliance WorkSheet: GREEN_6 NT_BLOCK Complaince

User Details

**Assessor Name:** **Stroma Number:**
**Software Name:** Stroma FSAP **Software Version:** Version: 1.0.1.21

Calculation Details

| Dwelling | DER | TER | DFEE | TFEE | TFA |
|---|---|---|---|---|---|
| D001 | 11.39 | 13.37 | 50.2 | 51.4 | 271 |
| D002 | 11.33 | 12.69 | 48.3 | 49.4 | 310 |
| 101 | 5.87 | 13.33 | 34.7 | 39 | 140 |
| 102 | 5.54 | 12.89 | 33 | 37.3 | 143 |
| 201 | 9.25 | 11.91 | 41.1 | 44 | 280 |
| 301 | 10.93 | 14.9 | 53 | 53.9 | 186 |

Calculation Summary

| | |
|---|---|
| Total Floor Area | 1330.00 |
| Average TER | 13.06 |
| Average DER | 9.65 |
| Average DFEE | 44.75 |
| Average TFEE | 46.90 |
| Compliance | Pass |
| % Improvement DER\|TER | 26.11 |
| % Improvement DFEE\|TFEE | 4.58 |

# APPENDIX C

## TER and DER Worksheets for all dwellings

# Block Compliance WorkSheet: LEAN_6 NT_BLOCK Complaince

## User Details

**Assessor Name:** **Stroma Number:**

**Software Name:** Stroma FSAP **Software Version:** Version: 1.0.1.21

## Calculation Details

| Dwelling | DER | TER | DFEE | TFEE | TFA |
|---|---|---|---|---|---|
| D001 | 16.88 | 13.37 | 50.2 | 51.4 | 271 |
| D002 | 16.14 | 12.69 | 48.3 | 49.4 | 310 |
| 101 | 16.35 | 12.88 | 34.7 | 39 | 140 |
| 102 | 15.8 | 12.44 | 33 | 37.3 | 143 |
| 201 | 14.56 | 11.71 | 41.1 | 44 | 280 |
| 301 | 18.85 | 14.57 | 53 | 53.9 | 186 |

## Calculation Summary

| | |
|---|---|
| Total Floor Area | 1330.00 |
| Average TER | 12.88 |
| Average DER | 16.32 |
| Average DFEE | 44.75 |
| Average TFEE | 46.90 |
| Compliance | Fail |
| % Improvement DER\|TER | N/A |
| % Improvement DFEE\|TFEE | N/A |

# Block Compliance WorkSheet: CLEAN_6 NT_BLOCK Complaince

## User Details

**Assessor Name:** **Stroma Number:**

**Software Name:** Stroma FSAP **Software Version:** Version: 1.0.1.21

## Calculation Details

| Dwelling | DER | TER | DFEE | TFEE | TFA |
|---|---|---|---|---|---|
| D001 | 14.7 | 13.37 | 50.2 | 51.4 | 271 |
| D002 | 14.22 | 12.69 | 48.3 | 49.4 | 310 |
| 101 | 12.27 | 13.33 | 34.7 | 39 | 140 |
| 102 | 11.81 | 12.89 | 33 | 37.3 | 143 |
| 201 | 12.45 | 11.91 | 41.1 | 44 | 280 |
| 301 | 15.74 | 14.9 | 53 | 53.9 | 186 |

## Calculation Summary

| | |
|---|---|
| Total Floor Area | 1330.00 |
| Average TER | 13.06 |
| Average DER | 13.69 |
| Average DFEE | 44.75 |
| Average TFEE | 46.90 |
| Compliance | Fail |
| % Improvement DER\|TER | N/A |
| % Improvement DFEE\|TFEE | N/A |

# Block Compliance WorkSheet: GREEN_6 NT_BLOCK Complaince

## User Details

**Assessor Name:** **Stroma Number:**

**Software Name:** Stroma FSAP **Software Version:** Version: 1.0.1.21

## Calculation Details

| Dwelling | DER | TER | DFEE | TFEE | TFA |
|---|---|---|---|---|---|
| D001 | 11.39 | 13.37 | 50.2 | 51.4 | 271 |
| D002 | 11.33 | 12.69 | 48.3 | 49.4 | 310 |
| 101 | 5.87 | 13.33 | 34.7 | 39 | 140 |
| 102 | 5.54 | 12.89 | 33 | 37.3 | 143 |
| 201 | 9.25 | 11.91 | 41.1 | 44 | 280 |
| 301 | 10.93 | 14.9 | 53 | 53.9 | 186 |

## Calculation Summary

| | |
|---|---|
| Total Floor Area | 1330.00 |
| Average TER | 13.06 |
| Average DER | 9.65 |
| Average DFEE | 44.75 |
| Average TFEE | 46.90 |
| Compliance | Pass |
| % Improvement DER\|TER | 26.11 |
| % Improvement DFEE\|TFEE | 4.58 |