

Energy Statement

20 Watford Road & 1 Brookdene Drive,
Northwood
London
HA6 3NT

Prepared for: Clearview Homes

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CONTENTS

1. Executive Summary	2
1.1. Results Summary	2
2. Introduction	3
3. Development Site	4
4. Planning Policy	5
4.1. National Policy	5
4.2. The London Plan	5
4.3. Local Policy	9
5. Building Regulations - England	10
5.1. Assessment Methodology	10
6. Be Lean	12
6.1. Building Fabric	12
6.2. Building Services	13
6.3. Summertime Overheating	14
6.3.1. Common Causes	14
6.3.2. Mitigation	15
6.3.3. Quantifying Overheating Risk	17
7. Be Clean	19
7.1. District Heating	19
7.2. Network Creation	19
7.3. Combined Heat and Power (CHP)	22
7.4. Summary	22
8. Be Green	24

8.1. Solar Photovoltaics	24
8.2. Technology Analysis – Solar Photovoltaics	24
9. Carbon offsetting	25
10. Conclusions	26
10.1. Be Lean – Energy Efficiency	26
10.2. Be Clean – Decentralised Energy and CHP	26
10.3. Be Green – Renewable and Low Carbon Technology	26
11. Summary	27
12. Appendices	28

1. Executive Summary

This Energy Statement has been produced to support the planning application for the site at 20 Watford Road & 1 Brookdene Drive. The proposed scheme comprises of 12no. residential apartments over three storeys.

A fabric-first approach to energy performance has been specified in order to create inherent efficiency and minimise demand. Carbon Dioxide emissions will be further reduced by a series of solar photovoltaic arrays.

Initial calculations show that CO₂ savings using individual gas boilers and 14.4 kWp of PV would achieve approximately 35.5% below the current (2013) regulatory baseline. This approach should be reviewed by a PV specialist and the Distribution Network Operator (DNO) at the earliest opportunity to ensure that the system is specified correctly and compatible with the local infrastructure.

Further to these CO₂ savings, the site will need to meet the London Plan (2015) requirements for all major developments to be Zero Carbon. As of the 1st October 2016 a minimum CO₂ reduction of 35% must be achieved on site, with residual emissions calculated to provide a cash in lieu contribution. This financial contribution is to be ring fenced by the local authority and spent within that borough.

1.1. Results Summary

	Regulated domestic carbon dioxide savings			
	Carbon dioxide emissions (Tonnes CO ₂ per annum)	Stage savings (Tonnes CO ₂ per annum)	Stage CO ₂ savings (%)	Cumulative savings (%)
Baseline: Part L 2013 of the Building Regulations Compliant Development	16.01	–	–	–
Be Lean: After energy demand reduction	15.96	0.05	0.3%	0.3%
Be Clean: After network/CHP	15.96	0.00	0.0%	0.3%
Be Green: After renewable energy	10.27	5.69	35.7%	35.9%

Table 1. CO₂ reduction summary

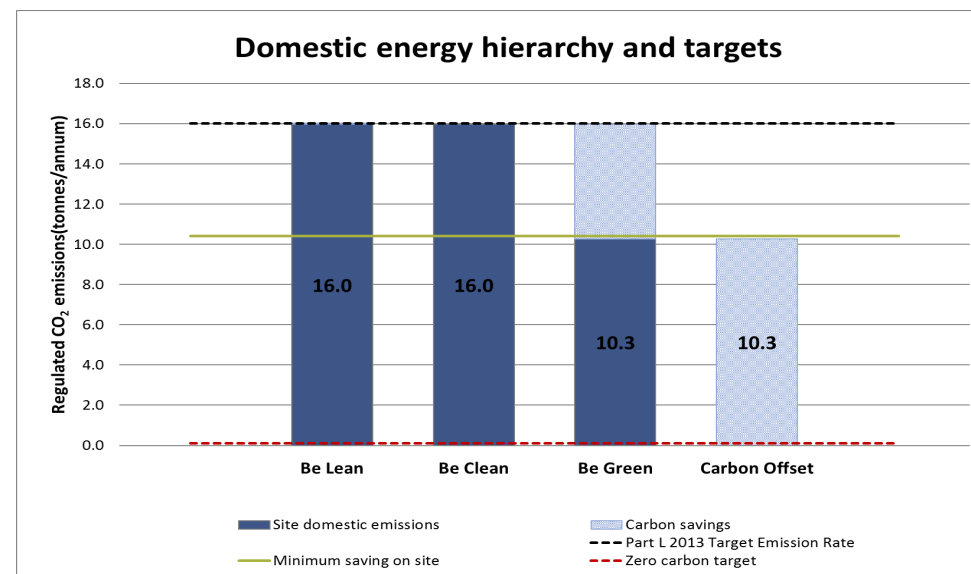


Figure 1. Predicted annual CO₂ emissions

2. Introduction

Stroma Built Environment has been commissioned by Clearview Homes to prepare an Energy Statement in support of the planning application for the proposed residential development at the junction of 20 Watford Road and 1 Brookdene Drive, London.

The proposed development is located within the London Borough of Hillingdon and will therefore need to meet the requirements of the Hillingdon Local Plan (revised proposed submission version, October 2015) and the London Plan 2016. The Hillingdon Local Plan: Part 2 Development Management Policies DMEI 2 and DMEI 3 focus on Sustainable Design Standards.

In accordance with the established energy hierarchy and good practice, a fabric-first approach has been taken prior to the consideration of connected heat and renewable energy technology.

The energy strategy for the proposed development is as follows:

1. Specification of a high-performance thermal envelope comprising, low thermal U-values, minimal thermal bridging and low levels of uncontrolled air infiltration (permeability).
2. Energy efficient building services including high efficiency individual gas-boilers.
3. Solar photovoltaic panels (PV) to the roof areas that offer good solar access.



Figure 2. **Energy hierarchy**

3. Development Site

The development site is located within the London Borough of Hillingdon, comprising of an existing site that contains two houses. The site will be re-developed to create 6 no. one bedroom apartments and 6 no. two bedroom apartments with associated parking and amenity space.



Figure 3. Google maps satellite image of the development site (highlighted)



Figure 4. Development site street view of 1 Brookdene Drive



Figure 5. Development site street view of 20 Watford Road

4. Planning Policy

4.1. National Policy

The Department for Communities and Local Government (DCLG) released the National Planning Policy Framework (NPPF) in March 2012. In revising this framework, the Government's objective is to streamline the process encouraging sustainable development and promoting the needs and priorities of local communities.

This framework is to be used as the base by councils to develop their own local planning policy. Section 10 of the framework addresses climate change, flooding and coastal change. Considerations include;

- Minimising CO₂ emissions.
- Vulnerability of fuel supply.
- A promotion of decentralised, low carbon and renewable energy sources wherever viable.
- Convergence towards existing 'zero carbon' policy targets.

4.2. The London Plan

The spatial development strategy plan for London was revised on 10th March 2015, and replaced the London Plan (July 2011) first published in February 2008.

POLICY 5.2 MINIMISING CARBON DIOXIDE EMISSIONS

- A. Development proposals should make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy:
 1. Be lean: use less energy
 2. Be clean: supply energy efficiently
 3. Be green: use renewable energy
- B. The Mayor will work with boroughs and developers to ensure that major developments 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 leading to zero carbon residential buildings from 2016 and zero carbon non-domestic buildings from 2019.

Residential buildings:

Year	Improvement on 2010 Building Regulations
2010 – 2013	25 per cent (Code for Sustainable Homes level 4)
2013 – 2016	40 per cent (equivalent to 35% against 2013 Regulations)
2016 – 2031	Zero carbon

Table 2. **London Plan targeted CO₂ saving for residential development**

POLICY 5.5 DECENTRALISED ENERGY NETWORKS

Strategic

- A. The Mayor expects 25 per cent of the heat and power used in London to be generated through the use of localised decentralised energy systems by 2025. In order to achieve this target, the Mayor prioritises the development of decentralised heating and cooling networks at the development and area wide levels, including larger scale heat transmission networks.

LDF preparation

- B. Within LDFs boroughs should develop policies and proposals to identify and establish decentralised energy network opportunities. Boroughs may choose to develop this as a supplementary planning document and work jointly with neighbouring boroughs to realise wider decentralised energy network opportunities. As a minimum boroughs should:
- a. identify and safeguard existing heating and cooling networks
 - b. identify opportunities for expanding existing networks and establishing new networks. Boroughs should use the London Heat Map tool and consider any new developments, planned major infrastructure works and energy supply opportunities which may arise
 - c. develop energy master plans for specific decentralised energy opportunities which identify:
 - major heat loads (including anchor heat loads, with particular reference to sites such as universities, hospitals and social housing)
 - major heat supply plant
 - possible opportunities to utilise energy from waste
 - possible heating and cooling network routes

- implementation options for delivering feasible projects, considering issues of procurement, funding and risk and the role of the public sector
- d. require developers to prioritise connection to existing or planned decentralised energy networks where feasible.

POLICY 5.6 DECENTRALISED ENERGY IN DEVELOPMENT PROPOSALS

Planning decisions

- A. Development proposals should evaluate the feasibility of Combined Heat and Power (CHP) systems, and where a new CHP system is appropriate also examine opportunities to extend the system beyond the site boundary to adjacent sites.
- B. Major development proposals should select energy systems in accordance with the following hierarchy:
1. Connection to existing heating or cooling networks;
 2. Site wide CHP network;
 3. Communal heating and cooling;
- C. Potential opportunities to meet the first priority in this hierarchy are outlined in the London Heat Map tool. Where future network opportunities are identified, proposals should be designed to connect to these networks.

POLICY 5.7 RENEWABLE ENERGY

Strategic

- A. The Mayor seeks to increase the proportion of energy generated from renewable sources, and expects that the projections for installed renewable energy capacity outlined in the Climate Change Mitigation and Energy Strategy and in supplementary planning guidance will be achieved in London Planning decisions.

- B. Within the framework of the energy hierarchy (see Policy 5.2), major development proposals should provide a reduction in expected carbon dioxide emissions through the use of on-site renewable energy generation, where feasible.

LDF preparation

- C. Within LDFs boroughs should, and other agencies may wish to, develop more detailed policies and proposals to support the development of renewable energy in London – in particular, to identify broad areas where specific renewable energy technologies, including large scale systems and the large scale deployment of small scale systems, are appropriate. The identification of areas should be consistent with any guidelines and criteria outlined by the Mayor.
- D. All renewable energy systems should be located and designed to minimise any potential adverse impacts on biodiversity, the natural environment and historical assets, and to avoid any adverse impacts on air quality.

POLICY 5.9 OVERHEATING AND COOLING

Strategic

- A. The Mayor seeks to reduce the impact of the urban heat island effect in London and encourages the design of places and spaces to avoid overheating and excessive heat generation, and to reduce overheating due to the impacts of climate change and the urban heat island effect on an area wide basis.

Planning decisions

- B. Major development proposals should reduce potential overheating and reliance on air conditioning systems and demonstrate this in accordance with the following cooling hierarchy:
 1. minimise internal heat generation through energy efficient design
 2. reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls
 3. manage the heat within the building through exposed internal thermal mass and high ceilings
 4. passive ventilation
 5. mechanical ventilation
 6. active cooling systems (ensuring they are the lowest carbon options).
- C. Major development proposals should demonstrate how the design, materials, construction and operation of the development would minimise overheating and also meet its cooling needs. New development in London should also be designed to avoid the need for energy intensive air conditioning systems as much as possible. Further details and guidance regarding overheating and cooling are outlined in the London Climate Change Adaptation Strategy.

LDF preparation

- D. Within LDFs boroughs should develop more detailed policies and proposals to support the avoidance of overheating and to support the cooling hierarchy.

ZERO CARBON HOMES

Standard 35 within the Housing Supplementary Planning Guide (SPG) for London outlines the timescales for the introduction of 'Zero Carbon'. From 1st October 2016, applicable Stage 1 schemes will be required to demonstrate compliance with this standard. An on-site saving of at least 35% against Part L1a: 2013 should be achieved. Zero Carbon status is then demonstrated through off-setting the balance of regulated CO2 emissions via a payment to the respective borough. This carbon off-set payment will contribute to a fund which is then invested into other projects where equivalent CO2 savings can be realised.

4.3. Local Policy

The Hillingdon Local Plan is outlined in two policy documents, the first of which is for Strategic Policies (Adopted November 2012), and the second covers Development Management Policies (Revised proposed submission version, October 2015). The Development Management Policies contain frameworks for Sustainable Design and Carbon Reduction. This Energy Strategy must address the following policies within the Local Plan¹:

Policy DMEI 2: Reducing Carbon Emissions

- A. All developments are required to make the fullest contribution to minimising carbon dioxide emissions in accordance with London Plan targets.
- B. All major development proposals must be accompanied by an energy assessment showing how these reductions will be achieved.
- C. Proposals that fail to take reasonable steps to achieve the required savings will be resisted. However, if the Council is minded to approve the application despite not meeting the carbon reduction targets, then it will seek an off-site contribution to make up for the shortfall. The contribution will be sought at a flat rate of £/tonne over the lifetime of the development. In accordance with the current 'allowable solutions cost'.

Policy DMEI 3: Decentralised Energy

- A. All major developments are required to be designed to be able to connect to a Decentralised Energy Network (DEN).
- B. Major developments located within 500 metres of an existing DEN, and minor new-build developments located within 100 metres, will be required to connect to that network, including provision of the means to connect to that network and a reasonable financial contribution to the connection charge, unless a feasibility assessment demonstrates that connection is not reasonably possible.
- C. Major developments located within 500 metres of a planned future DEN, which is considered by the Council likely to be operational within 3 years of a grant of planning permission, will be required to provide a means to connect to that network and developers shall provide a reasonable financial contribution and a commitment to connect via a legal agreement or contract, unless a feasibility assessment demonstrates that a connection is not reasonably possible.
- D. The Council will support the development of DENs and energy centres in principle, subject to meeting the wider policy requirements of this plan and in particular on design and air quality.

¹ Hillingdon Local Plan: Part 2 Development Management Policies, Sept 2014

5. Building Regulations - England

APPROVED DOCUMENT PART L

Approved document L1a – *Conservation of fuel and Power* sets the standard for energy performance for new dwellings and was last revised in April 2014 (Part L1a: 2013). The proposed dwellings will need to comply with the criteria set out in the Approved Document, as follows:

1. The predicted Dwelling CO₂ Emission Rate (DER) must be no greater than the Target CO₂ Emission Rate (TER).
2. The performance of the building fabric and fixed building services should be no worse than the design limits set out in Table 2 of the Approved Document.
3. The dwellings will have appropriate passive control measures to limit the effect of solar gains on indoor temperatures in summer.
4. That the performance of dwellings as-built comply with the DER values achieved, including site testing of a representative sample of dwellings demonstrating that the 'air permeability' rate achieved is as per that specified, or better.
5. The necessary provisions for energy efficient operation of dwellings are put in place, including operation and maintenance instructions aimed at achieving economy in the use of fuel and power in a way that householders can understand.

Compliance with the Approved Document Part L1a should be demonstrated at detailed design stage, prior to construction.

5.1. Assessment Methodology

The Standard Assessment Procedure (SAP) is the Government's approved methodology for assessing the predicted energy consumption and carbon dioxide emissions of new buildings. Results are derived in respect of floor area and consider energy use (kWh/m²/yr) and associated CO₂ emissions (kg.CO₂/m²/yr) from the following:

- Space heating
- Domestic hot water
- Ventilation
- Lighting
- Ancillary pumps and fans
- Energy generating technology

SAP is compliant with the EU Energy Performance of Buildings Directive and is carried out using approved software. A trained and accredited Stroma Energy Assessor has used Stroma FSAP 2012 software 1.0.4.8 to assess compliance and generate the necessary results data.

**BE LEAN:
USE LESS ENERGY**

6. Be Lean

This section outlines the proposals for specifying building fabric and services beyond the requirements of Building Regulations (the baseline).

Fundamental to achieving energy efficiency in any new building is a suitably designed and specified thermal envelope. Passive design features such as **appropriate orientation, balancing solar gain** and limiting heat loss through high levels of **insulation**, minimising **thermal bridging** and controlling **air infiltration** are all proven techniques to reduce energy consumption and CO₂ emissions.

6.1. Building Fabric

Limited assumptions have been made on this development in order to meet the fabric efficiency targets for Building Regulations 2013 as the majority of the specification has been provided by Clearview Homes. Compliance has been attained by targeting values closer to the notional u-values set out within *Table 4: Summary of concurrent notional dwelling specification, Approved Document L1A*. The Target Fabric Energy Efficiency (TFEE) has been achieved by incorporating Accredited Construction Details (ACDs) into the calculations to reduce heat losses via thermal bridging.

Table 3 shows the proposed building fabric specification applied to the SAP calculations with respect to the upper limits stipulated by Part L: 2010. It can be seen that the values represent in some areas a significant bettering of the mandatory requirements set out in the current Building Regulations.

Element	ADL1a: 2013 Limiting U-value (W/m ² .K)	Proposed U-value (W/m ² .K)	Improvement (%)
Ground floor	0.25	0.11	56%
Exposed floor over unheated space	0.25	0.15	40%
External walls	0.30	0.21	30%
Corridor Walls	0.30	0.26	13%
Party Walls	0.20	0.00	100%
Dormer Walls	0.30	0.19	37%
Flat Roof	0.25	0.11	56%
Pitched Roof	0.25	0.14	44%
Ceiling to loft space	0.25	0.08	68%
Windows	2.00	1.20 (g value 0.42)	40%
Doors	2.00	1.20	40%
γ-value (thermal bridging)	0.15	Porotherm and Accredited Construction Details	N/A
Air permeability (m³/h.m² @ 50 Pa)			
All dwellings (tested separately)	10.0	5.0	50%

Table 3. **Proposed building fabric specification**

6.2. Building Services

Space heating and domestic hot water will be provided by high efficiency gas-fired boilers. Boilers will utilise variable speed circulators and output modulation minimise overall energy consumption.

Individual heating controls will be installed in each dwelling which will incorporate a programmer with independent time and temperature zone controls in line with the Domestic Building Service Compliance Guide (DBSCG). Further to this Thermostatic Radiator Valves (TRVs) will be utilised throughout.

Low energy lighting will be specified throughout. In line with the DBSCG this means having a having a luminous efficacy of greater than 45 lumens per circuit watt and an output of greater than 400 lamp lumens. Typically, this is achieved with LEDs or compact fluorescent lights.

Element	Specification
Boiler	Energy efficient Alpha E-Tec 33 gas-fired boilers
Heating emitter	Radiators
Heating control	Time and temperature zone control.
Domestic hot water	From main heating system
Water consumption	≤105 litres/person/day
Internal fixed lighting	100% low energy
Ventilation	Natural Ventilation with intermittent extract fans to kitchens, bathrooms and utility rooms

Table 4. Building services specification

	Regulated domestic carbon dioxide savings			
	Carbon dioxide emissions (Tonnes CO ₂ per annum)	Stage savings (Tonnes CO ₂ per annum)	Stage CO ₂ savings (%)	Cumulative savings (%)
Baseline: Part L 2013 of the Building Regulations Compliant Development	16.01	–	–	–
Be Lean: After energy demand reduction	15.96	0.05	0.3%	0.3%
Be Clean: After network/CHP	–	–	–	–
Be Green: After renewable energy	–	–	–	–

Table 5. CO₂ reduction summary at Be Lean stage

6.3. **Summertime Overheating**

Effects of overheating have been well documented over recent years, often cited to result from climate change and modern materials and construction techniques.

Although guidance exists across the industry to forecast the risk of overheating, design considerations are often required at concept stage to provide adequate mitigation.

6.3.1. **Common Causes**

The Zero Carbon Hub which undertook considerable research into overheating in buildings stated three factors associated with overheating risk; location, building design and the occupants.

Site Location

The climate or, microclimate is subject to the geographic site location. Sun, wind and rain intensity are dependent upon where the development is situated and as such the design approach will vary accordingly - for example, average summertime temperatures are higher in the south east of England compared to the north east therefore, increased ventilation levels may be less effective.

Dense urban development with minimal open green space may present risk associated with the 'urban heat island' effect. This comprises of heat absorbed by heavy man-made structures which is then radiated at night increasing the local temperature.

Building Design

There are several elements of building design that effect overheating performance. Fundamentally, the orientation of a building together with the proportion and location of glazing areas will determine the level of transmitted solar gain. Where solar gain cannot be absorbed or, removed, internal

temperature levels will increase. Although there is benefit in utilising 'free' solar energy to heat a building, the amount of energy must be controlled.

Due to increasing energy efficiency standards, modern structures are often well insulated and constructed to high levels of air tightness. In addition to lower levels of thermal mass, this often results in a reduced ability to absorb or, purge heat compared to that of older buildings.

Building Use

Although the exact occupant use cannot generally be controlled for new construction projects, the setting out of a building should consider the impact of room use type and location in the context of solar and other incident heat gains. Overheating risk is affected by both the occupant density and anticipated activity type in a zone.

6.3.2. Mitigation

For new-build construction projects, reducing the risk of overheating should be given consideration at the earliest possible opportunity. Although certain measures can be incorporated at later stages, the most robust and effective techniques are often inherent to a buildings design.

The 'cooling hierarchy', referred within Policy 5.9 of The London Plan indicates the preferred approach to reducing overheating risk and a reliance upon mechanical cooling. The hierarchal steps are;

1. Minimise heat generation through energy efficient design.
2. Reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls.
3. Manage the heat within the building through exposed thermal mass and high ceilings.
4. Passive ventilation.
5. Mechanical cooling.

Further to appropriate siting and orientation, there are several properties or, functions that influence overheating performance.

Glazed Proportion and Specification

The location, proportion and specification of glazing should aim to balance natural light and 'beneficial' solar gain whilst ensuring that levels of are not excessive. Glass manufacturers offer a broad variety of products including solar control coatings to enable the level of transmitted solar gain (denoted by the glass 'g-

value') to be reduced with minimal impact upon visual performance. Certain glass specifications may be more appropriate for certain orientations, e.g. a lower g-value to a south/west façade than the north/east.

Solar Shading

In a similar vein to solar control glass coatings, external solar shading can be used to prevent the direct transmission of solar gain whilst enabling glazed areas to be maintained or, maximized. Horizontal overhangs are usually more appropriate for south facing windows due to higher sun angles. Conversely, vertical fins are more appropriate for east and west facing windows where sun angles are lower.



Figure 6. External solar shading²

² <http://levolux.com/tag/timber-fins/>

Thermal Mass

Thermal mass is a physical property which defines the ability of an object or, construction to absorb heat energy; the greater the mass, the greater the heat absorption potential. Higher thermal mass construction enables heat to be absorbed during the day then released at night. This can reduce daytime temperatures and improve the thermal stability of a building. However, as greater energy is also then required to 'heat' the fabric, overall consumption can increase. Therefore, as with all of these approaches, a balance must be struck. Thermal mass can be increased by exposing dense fabric or increasing the physical connection between finishing materials, e.g. plaster, and the structural core, e.g. blockwork. Lighter-weight structures which do not offer high levels of energy-absorption potential are often at greater risk of suffering summertime overheating.

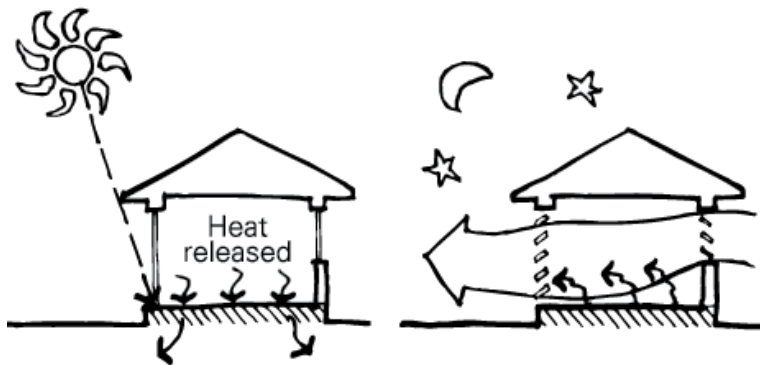


Figure 7. **Principles of thermal mass**³

The ventilation strategy is critical to overheating performance. Background ventilation levels are low compared to the airflow rates generally required to purge heat. Therefore, the ventilation strategy must enable the greatest volume of air possible to be moved should the requirement arise. The potential rate of ventilation is determined by a number of factors including;

- Opening type, size and duration.
- Building height and exposure.
- The number of storeys and opportunity for cross-ventilation.

Ventilation openings should enable the greatest possible opening for the greatest duration without compromising security and water ingress protection.

³ <http://www.yourhome.gov.au/passive-design/thermal-mass>

6.3.3. Quantifying Overheating Risk

Several guidance documents exist which define overheating risk assessment and acceptable thresholds, these include; CIBSE Guide A, BB101 (schools), TM52 and SAP. The first three methods predominantly concern non-domestic development and require a Dynamic Simulation Modelling (DSM) exercise to be undertaken to calculate predicted internal temperatures against standard regional weather data. Predicted temperatures are compared against recommended limits to determine whether they are acceptable or, excessive.

The SAP assessments process is used for new residential developments and incorporates a summer overheating risk calculation. Similarly, to the other methods, SAP calculations consider heat gain from regional weather data, site exposure, solar and internal heat gains. The calculation determines a mean internal temperature which can be compared against the following thresholds. In order to comply with the SAP and Part L1a criteria, 'the likelihood of high internal temperatures during hot weather' must be less than 'high'.

Compliance with the SAP criteria will be assessed at detailed design stage when accurate information is available however the indicative results show the development to comply with the Part L1a criteria as all spaces have a likelihood of either a 'slight' or 'medium' risk of high internal temperatures.

**BE CLEAN:
SUPPLY ENERGY EFFICIENTLY**

7. Be Clean

7.1. District Heating

Where location and development permits; the opportunity of connecting to existing district heating networks or the creation of new district heating networks should be considered. District heating networks have the potential to offer significant energy, carbon and cost savings over localised alternatives. District heating networks often utilise low-carbon energy generation/harnessing technologies such as Anaerobic Digestion (AD), Combined Heat and Power (CHP) and waste heat recovery. District networks also enable heat loads to be balanced between sites and therefore plant to operate more continuously and efficiently.



Figure 8. District heating pipework⁴

Clearly, district energy networks are only generally feasible where there is a high density of heat demand. Capital costs and distribution losses must be relatively insignificant to support their viability. Where an opportunity exists, the network operator should be contacted to assess the viability and costs of current or, future connection.

In London, there is a desire to generate at least 25% of heat and power through localised decentralised energy systems by 2025. As such, the London Boroughs were commissioned to identify the energy loads and energy densities within their region. This information has been used to develop **The London Heat Map** which shows the potential, proposed and existing district heat networks.

The London Heat Map has been investigated for the development site (see figure 9). This shows there to be no existing (yellow) or, proposed (red) district heating networks within the vicinity of the development. The nearest proposed network is 8.66km from the site within the Uxbridge and Brunel University energy centre, which is outside the 500m radius stipulated in policy DMEI 3.

7.2. Network Creation

The proposed development is relatively low-rise and comprises of 10no. residential apartments. In addition to a high-performance specification, the predominant annual heating load is likely to be from Domestic Hot Water (DHW) and limited to one or two peak periods during the day. In addition to capital costs, the thermal losses and circulation energy are likely to make a district or, community network technically and economically unviable.

⁴ <https://www.vitalenergi.co.uk/technologies/district-heating-and-cooling/>

The **UK National Heat Map** (see figure 10) shows there to be a relatively low density of heat demand in the site vicinity

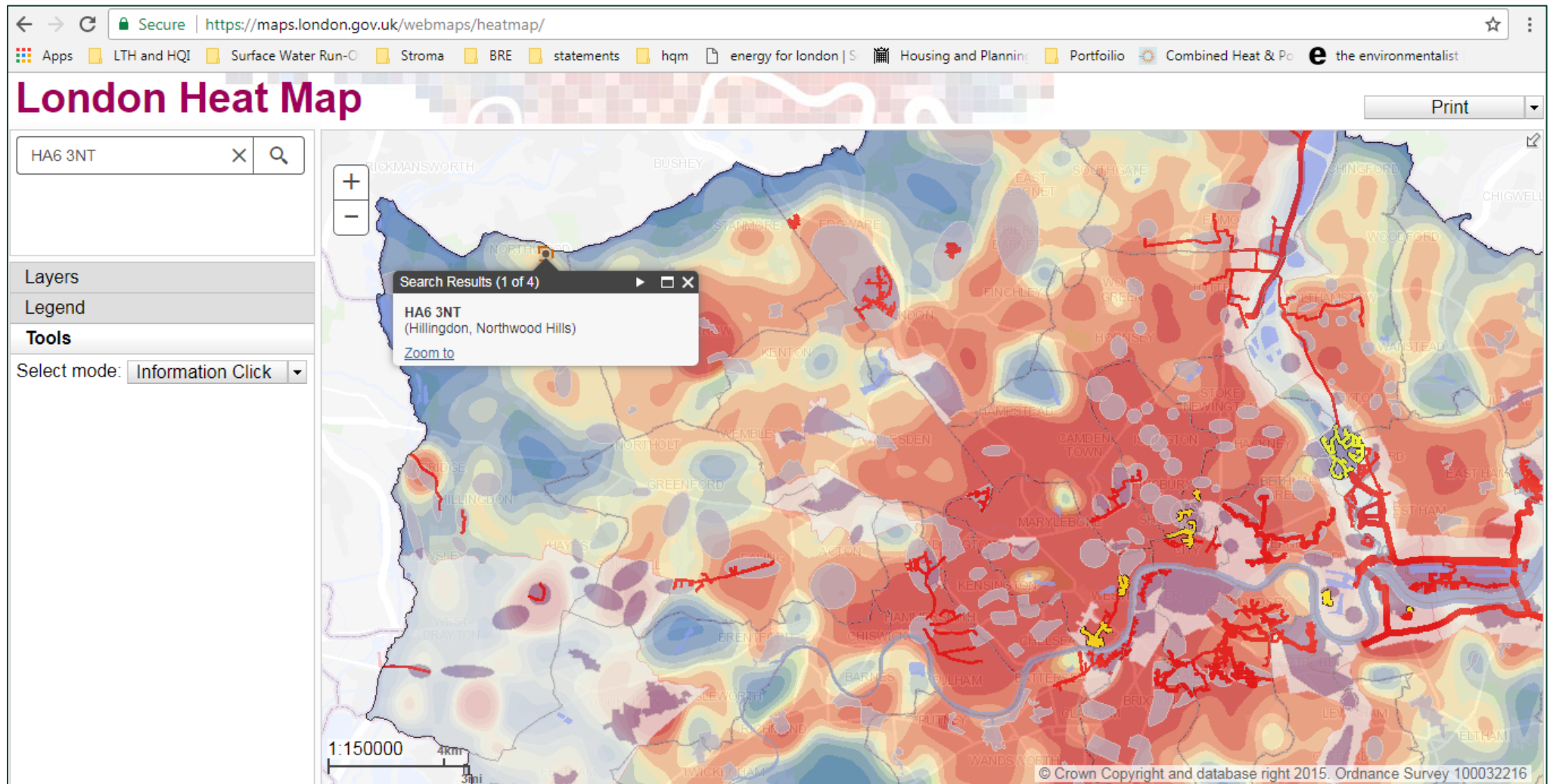


Figure 9. London heat map

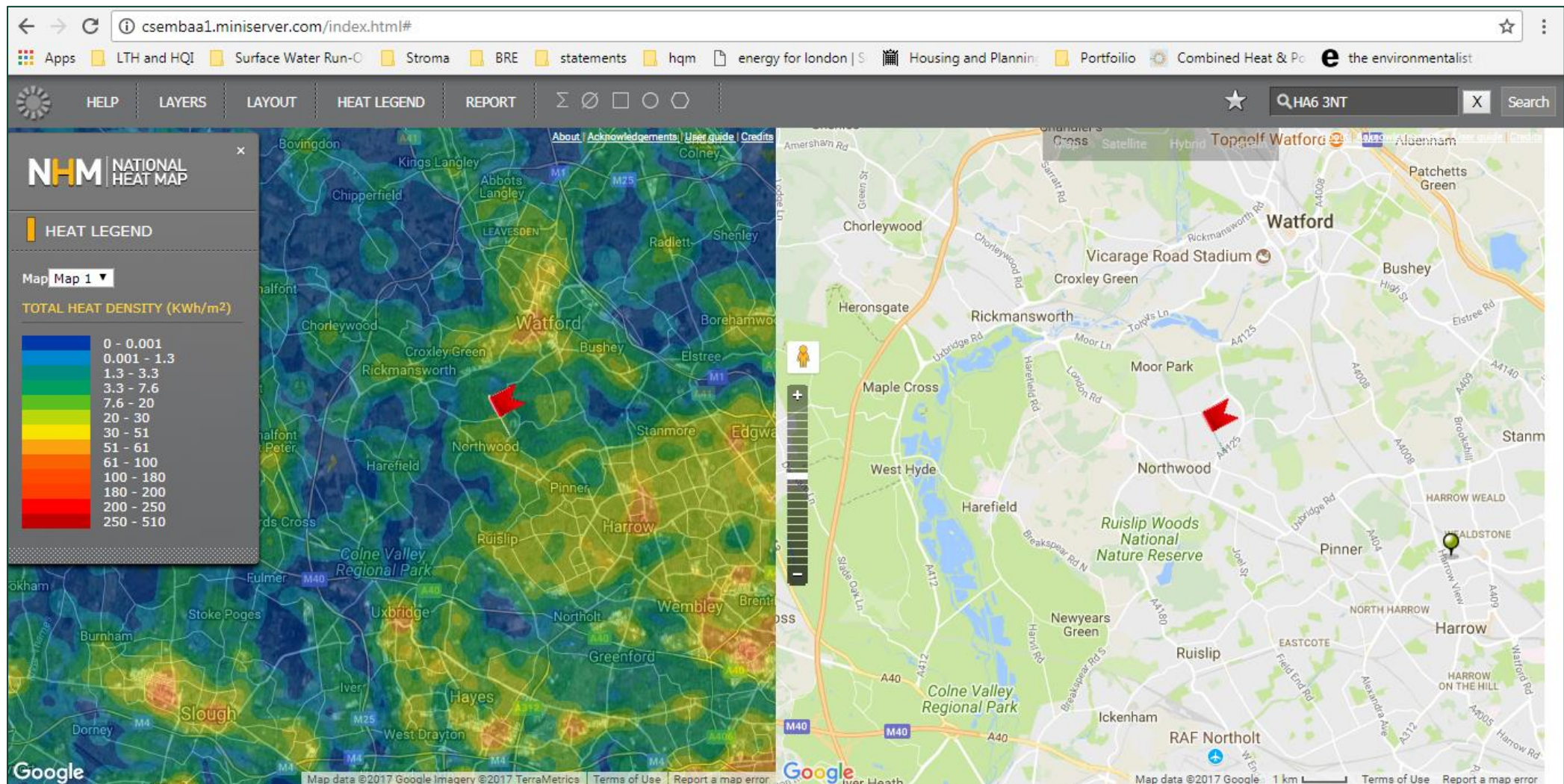


Figure 10. UK National Heat map

7.3. Combined Heat and Power (CHP)

Combined Heat and Power (CHP) units typically comprise of a reciprocating engine, electrical generator and a series of heat exchangers fitted to the oil circuit, coolant circuit and the exhaust.

Electricity generated displaces power that would otherwise be sourced from the Grid and the thermal by-product is made useful to realise CO₂ and cost savings. As such and in order to be economically and technically feasible, a base heating load should exist to support regular and constant operation. The current rule of thumb calls for a minimum run hour of 5000 per annum (approx. 60%).

CHP engines are most ideally suited to developments which require significant and regular heat, e.g. swimming pools, care homes and hotels. They are not generally suited to developments where the heat load is sporadic or, infrequent, e.g. residential, offices and schools.

It is considered, that where residential developments are large, i.e. circa 500+ units, CHP may be an economic solution⁵. Viability may also exist in smaller mixed-use developments (circa. 350 unit) where additional heat loads are present. In smaller residential developments, heat loads are likely to be too low and infrequent to support CHP without small engines and large buffer vessels. In addition to higher relative distribution losses, a smaller CHP system is also likely to offer a lower electrical efficiency and higher resulting NOx emissions.

7.4. Summary

There are no existing or proposed district heating networks within the vicinity of the development site. Furthermore, the CHP development map confirms the heat density within the region to be low. Therefore, connection to an existing network is not an option nor does the energy profile support development of a new network.

Integration of CHP to this development would not be technically or economically viable due to a low and infrequent heat demand and high relative distribution losses.

	Regulated domestic carbon dioxide savings			
	Carbon dioxide emissions (Tonnes CO ₂ per annum)	Stage savings (Tonnes CO ₂ per annum)	Stage CO ₂ savings (%)	Cumulative savings (%)
Baseline: Part L 2013 of the Building Regulations Compliant Development	16.01	–	–	–
Be Lean: After energy demand reduction	15.96	0.05	0.3%	0.3%
Be Clean: After network/CHP	15.96	0.00	0.0%	0.3%
Be Green: After renewable energy	–	–	–	–

Table 6. CO₂ reduction summary at Be Clean stage

⁵ ENERGY PLANNING, Greater London Authority guidance on preparing energy assessments, The London Mayor, March 2016.

**BE GREEN:
USE RENEWABLE ENERGY**

8. Be Green

The CO₂ emissions after 'Be Lean' and 'Be Clean' measures have been assessed against the baseline CO₂ emissions. Reductions have been recorded after each stage in the energy hierarchy; this will help demonstrate the impact that renewable energy generation has on whole site CO₂ emissions.

8.1. Solar Photovoltaics

Solar photovoltaic (PV) panels comprise of a number of inter-connected cells that utilise semi-conductor technology to convert solar energy into electricity. High voltage, direct current is converted to alternating current and phased into the mains supply via an inverter. PV panels are most effective where mounted on exposed, south-facing areas, at an inclination close to 30° from the horizontal.

The technology is well proven and requires little maintenance; most panels are designed to be self-cleaning when mounted at appropriate angles and the design life of a panel typically exceeds the likely pay-back period by a considerable margin. PV has the significant advantage of reducing energy use and costs on site for residents whilst also reducing demand from the national grid and even contributing to grid energy.

A specialist designer and the Distribution Network Operator (DNO) must be consulted at the earliest opportunity to ensure that the system is specified correctly and compatible with the local infrastructure.

8.2. Technology Analysis – Solar Photovoltaics

The potential for CO₂ savings from solar PV has been assessed using the Governments approved SAP: 2012 (Standard Assessment Procedure) methodology. This methodology considers UK solar irradiance data, collector pitch, orientation and over-shading to determine the expected annual energy yield.

In order to represent a semi-optimal installation, it is taken that a Solar PV array of **40no. 360 Watt panels can be installed in total**. Initial calculations show that an array with an installed capacity of 14.4 kWp made up of 40no. 360 Watt panels can be installed horizontally to the flat roof areas. Alternately a lower wattage panel could be used utilising the pitched roof on the south elevation to supplement the flat roof array.

On this basis, calculations show that a total installed PV capacity of 14.4 kWp (kilo-Watt peak) would be expected to generate 10,951 kWh per annum. Applying the current CO₂ emissions factor for grid-displaced electricity (0.519 kg.CO₂/kWh), this generation corresponds to a CO₂ abatement of 5,684 kg.CO₂ per annum; to meet the target of 35% reduction from baseline site emissions.

	Regulated domestic carbon dioxide savings			
	Carbon dioxide emissions (Tonnes CO ₂ per annum)	Stage savings (Tonnes CO ₂ per annum)	Stage CO ₂ savings (%)	Cumulative savings (%)
Baseline: Part L 2013 of the Building Regulations Compliant Development	16.01	–	–	–
Be Lean: After energy demand reduction	15.96	0.05	0.3%	0.3%
Be Clean: After network/CHP	15.96	0.00	0.0%	0.3%
Be Green: After renewable energy	10.27	5.69	35.7%	35.9%

Table 7. CO₂ reduction summary at Be Green stage

9. Carbon offsetting

As of the 1st October 2016 it is a requirement of the London Plan policy 5.2 that all major residential development must achieve the Zero Carbon Standard. This is done by meeting a minimum onsite CO₂ reduction of 35% against a Building Regulations L1a (2013) baseline, and then offsetting the remaining emissions via a cash in lieu contribution to the relevant borough.

Contributions to the carbon off-set fund are to be spent within the vicinity of the named development and used for retrofitting existing buildings, decentralised energy networks, renewable energy or any other programme that achieves a calculable reduction in carbon emissions.

Further to significant passive savings, the only viable addition to reducing grid-sourced energy consumption and CO₂ emissions at this stage is through the application of solar PV.

Results show that a Solar PV array with a total capacity of 14.4 kWp would be sufficient in meeting the required 35% target. In line with the Zero Carbon requirement the development would need to provide a cash in lieu contribution of £18,486 in accordance with Table 8

	Regulated domestic carbon dioxide savings			
	Carbon dioxide emissions (Tonnes CO ₂ per annum)	Stage savings (Tonnes CO ₂ per annum)	Stage CO ₂ savings (%)	Cumulative savings (%)
Baseline: Part L 2013 of the Building Regulations Compliant Development	16.01	–	–	–
Be Lean: After energy demand reduction	15.96	0.05	0.3%	0.3%
Be Clean: After network/CHP	15.96	0.00	0.0%	0.3%
Be Green: After renewable energy	10.27	5.69	35.7%	35.9%
Carbon off-set (Tonnes CO ₂)				
Cumulative on site savings	5.74			
Savings required to meet Zero Carbon requirement	10.27			
Carbon Off-set Cost Details	£/tonneCO2		Years	
	£60.00		30	
Cumulative savings for off-set payment	308.10			
Total Carbon Offset Cost (£)	£18,486.00			

Table 8. table showing carbon offset contribution

10. Conclusions

This Energy Statement has outlined the proposed specification for the development and the resulting savings against each stage of the energy hierarchy. A fabric-first approach realises considerable savings against the current Building Regulations baseline.

The opportunity for connected heat and CHP has been assessed though found to be technically and economically unfeasible. Additional energy and CO₂ savings will then be achieved through the application of renewable energy technology.

10.1. Be Lean – Energy Efficiency

A high-performance building envelope has been specified comprising of low U-values, thermally efficient construction details and low air permeability. Performance values demonstrate improvement against that of the 2013 Notional dwelling used for comparison in compliance assessment.

10.2. Be Clean – Decentralised Energy and CHP

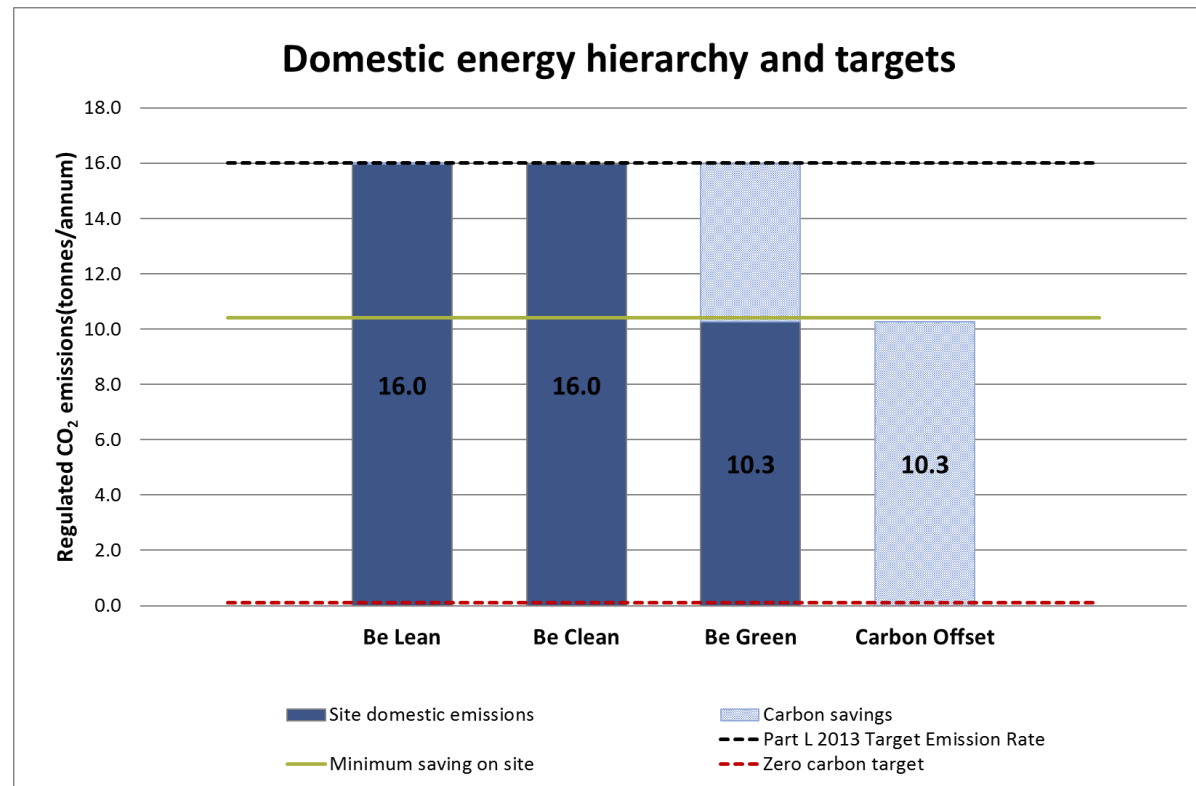
There are no existing or proposed district heating networks in the vicinity of the site. The development size and type does not offer a suitable base heat load to support the technical or economic viability of Combined Heat and Power (CHP). The London CHP map shows the heat density to be relatively low in the site vicinity due to the low-rise nature of the residential surroundings. Therefore, there is little/no value in establishing a new network for the region.

10.3. Be Green – Renewable and Low Carbon Technology

A PV installer shall need to be appointed at the earliest opportunity to verify that these savings are achievable, and a roof plan showing the array should be provided once this is confirmed.

11. Summary

This statement has set out how the development will incorporate an energy efficient design which exceeds the required standards of Building Regulations ADL1a (2013) and, with the application of solar PV to the roof, can achieve a 35% reduction Carbon Dioxide emissions as required by The London Plan 2015 and the London Borough of Hillingdon. A fabric-first approach to design has been adopted, which is fundamental to achieving a high level of energy performance. The opportunities for district heat and CHP have been appraised though found to be unavailable and technically/economically unviable. Solar PV will be installed to roof areas offering excellent solar access with a total installed capacity of 14.4 kWp.



Appendices