energy statement

2-4 Prowse Place, Camden

revision 00

november 2012

correspondence address
23-24 Smithfield Street
London
EC1A 9LF

website
www.meshprojects.co.uk

telephone
+44 20 7332 4124

email
mail@meshprojects.co.uk

registered company
Mesh Projects Limited

directors
R French
S Mildenhall

registered office
Metherells
Underhill
Lympstone
Exmouth
Devon
EX8 5HH

company no.
06825703

VAT no.
977 6990 35

document control

project

Name	2-4 Prowse Place, Camden
Number	1170.00

document

Category	report
Template	mesh.template Level 02 Report v2.0.dotx
Title	energy statement
Filename	C:\Users\Ross\Dropbox\Mesh\1000\1170\00\07 Consultants\Mesh\Reports\20121108 mesh 1170.00 energy statement 00.docx

history

date	revision	status	author
08/11/2012	00	Draft	Ching Hua Yeh

client

Representative	Paul Whitley
Organisation	European Urban Developments Limited
Address	4th Floor, Sophia House 32-35 Featherstone Street London EC1Y 8QX

disclaimer

The information contained in this document is provided for the sole use of the recipient and no reliance should be placed on the information by any other person. In the event that the information is disclosed or furnished to any other person, Mesh Projects Limited accepts no liability for any loss or damage incurred by that person whatsoever as a result of using the information.

copyright

contents

executive summary

This *Energy Statement* forms part of the applicants planning submission, demonstrating that energy consumption and CO_2 emissions have been considered, in accordance with planning policy.

The proposed development comprises two new build houses in Prowse Place, Camden

The methodology used is that set out under Policy 5.2 of the *London Plan* and the London Borough of Camden Core Strategy planning policy.

The baseline CO_2 emissions are 7,775 kg/yr.

The proposed development incorporates the following energy efficiency measures.

- Insulated building fabric with low air permeability;
- Glazing with suitable U-value, g-value and daylight transmittance;
- High efficiency condensing boiler with under floor heating
- Domestic hot water provided from boiler and insulated hot water tank;
- Mechanical ventilation with heat recovery; and
- Low energy lighting.

These measures reduce the CO_2 emissions by 8.8 %, in comparison with the baseline, to 7,410 kg/yr.

The heating systems for the proposed development have been considered in accordance with the order of preference set out in Policy 5.3 of the *London Plan*.

- At its closest, the site lies approximately 700 m, as the crow flies, from the closest existing or emerging Decentralised Energy (DE) network. Given that the capital cost of laying heat mains in London is typically in the range 1,000-1,500 £/m, connection to the closest potential network is not considered feasible.
- The low base heat load and space requirements mean that onsite CHP is not deemed economically or technically feasible.

Although the proposed arrangement would in practice improve the seasonal efficiency of the heating and cooling systems, determining the effect on CO_2 emissions relies on the manufacturer's data. For the purposes of this *Energy Statement*, it is assumed that the clean building's annual carbon emissions would be the same as those of the lean building.

The feasibility of the renewable energy technologies listed in the *London Plan* and covered by the Feed-In Tariff and Renewable Heat Incentive has been considered. Photovoltaic panels are technically feasible and therefore proposed. This technology reduces the CO_2 emissions by 10.0 %.

1 introduction

1.1 purpose of report

This report is for submission as part of a planning application for two new build houses in 2-4 Prowse Place, Camden and is intended to demonstrate that energy consumption and CO_2 emissions have been considered, in accordance with planning policy.

A basic understanding of carbon reduction technologies is assumed; further information can be found in the Technology Directory on the Carbon Trust's website.

1.2 project description

The proposed development two three-storey houses with floor area of 120m² and 108m².

1.3 development control

The planning authority is the London Borough of Camden (LBC). While regional planning policy is applicable, the proposed development is not referable to the Greater London Authority (GLA).

1.4 building control

The proposed development would be required to comply with Building Regulations. In the context of energy and CO2 emissions, the relevant documents are *Approved Document L1A: Conservation of fuel and power in new dwellings (2010 version) (ADL1A 2010).*

Compliance with L1A is demonstrated by meeting five criteria, of which the first three concern design:

1. Comparison of the calculated CO_2 emission rate with the Target Emission Rate (TER);
2. Limits on design flexibility;
3. Limiting solar gain in summer;
4. Building performance; and
5. Providing information.

1.5 energy performance certification

The requirements in respect of energy performance certification are affected by the nature of the refurbishment and the new build extension, use class, tenancies, and the new installed building services. For the purposes of this *Energy Statement* it is assumed that the proposed development will require an Energy Performance Certificate (EPC) for each house.

1.6 environmental assessment

The residential element of the proposed development will be assessed under Code for Sustainable Homes (CSH), and is targeting a Level 3 rating for all dwellings. The project will be registered under the November 2010 version of the CSH.

The preparation of this *Energy Statement* contributes evidence for the following CSH (2010) credits:

- Ene 1 – Dwelling Emission Rate;
- Ene 2 – Fabric Energy Efficiency; and
- Ene 7 – Low and Zero Carbon Technologies.

2 planning policy context

2.1 national

"The National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these are expected to be applied. It sets out the Government's requirements for the planning system only to the extent that it is relevant, proportionate and necessary to do so. It provides a framework within which local people and their accountable councils can produce their own distinctive local and neighbourhood plans, which reflect the needs and priorities of their communities.

"Planning law requires that applications for planning permission must be determined in accordance with the development plan, unless material considerations indicate otherwise. The National Planning Policy Framework must be taken into account in the preparation of local and neighbourhood plans, and is a material consideration in planning decisions. Planning policies and decisions must reflect and where appropriate promote relevant EU obligations and statutory requirements."

The NPPF was published on 27 March 2012 and replaced all Planning Policy Statements and all remaining Planning Policy Guidance.

2.2 regional

The Greater London Authority Act 1999 places responsibility for strategic planning in London on the Mayor, and requires him to produce a Spatial Development Strategy for London, which has become known as "the London Plan"; he is also required to keep it under review. The current *London Plan* was published in July 2011. Other key regional policy documents relevant to energy and CO_2 emissions are:

- *Delivering London's Energy Future (GLA, 2011)*, the Mayor's Climate Change Mitigation and Energy Strategy; and
- *Supplementary Planning Guidance on Sustainable Design and Construction (GLA, 2006).*

2.2.1 London Plan

The current *London Plan* states that *"energy issues, including resilience, security of supply and infrastructure provision are likely to be increasingly important in the years to 2031" (Mayor of London, 2011, 27)*. Chapter five presents London's response to climate change and outlines how to achieve the Mayor's vision of London as a *"city that becomes a world leader in improving the environment" (Mayor of London, 2011, 32)*. It includes two strategic targets:

- An overall reduction in London's carbon dioxide emissions of 60 % (below 1990 levels) by 2025; and
- 25 % of the heat and power used in London to be generated through the use of localised decentralised energy systems by 2025.

For the first time the *London Plan* sets specific targets for CO_2 emissions from developments, which are shown in Table 1 and Table 2. These targets should be met on-site. *"Where it is clearly demonstrated that the specific targets cannot be fully achieved on-site, any shortfall may be provided off-site or through a cash in lieu contribution to the relevant borough to be ring fenced to secure delivery of carbon dioxide savings elsewhere." (Mayor of London, 2011, 141)*

Table 1 – Target CO_2 emissions reductions for residential buildings

Year	Improvement on 2010 Building Regulations
2010 - 2013	25 % (CSH level 4)

Year	Improvement on 2010 Building Regulations
2013 – 2016	40 %
2016 - 2031	Zero carbon

Table 2 – Target CO_2 emissions reductions for non-domestic buildings

Year	Improvement on 2010 Building Regulations
2010 - 2013	25 %
2013 – 2016	40 %
2016 - 2019	As per building regulations requirements
2019 - 2031	Zero carbon

There remains *"a presumption that all major development proposals will seek to reduce carbon dioxide emissions by at least 20 per cent through the use of on-site renewable energy generation wherever feasible"*.

There are also more detailed requirements in respect of decentralised energy networks (policy 5.5) and overheating and cooling (policy 5.9).

2.2.2 Supplementary Planning Guidance on Sustainable Design and Construction

The Mayor of London's *Supplementary Planning Guidance: Sustainable Design and Construction*, published in May 2006, provides additional information to support the implementation of the *London Plan*. As Supplementary Planning Guidance (SPG), this document cannot set new policy, but has weight as a formal supplement to the *London Plan*. The 'essential' and 'preferred' standards set out in the SPG in section 2.3.2 are effectively superseded by the current *London Plan*. However Appendix D *"provides more detail on addressing the energy hierarchy through the completion of an energy statement to accompany specific planning applications" (Mayor of London, 2006, 88).*

2.3 local

2.3.1 Local Development Framework

The planning authority is the London Borough of Camden (LBC). While regional planning policy is applicable, the proposed development has not been classified as a major application and therefore is not referable to the Greater London Authority (GLA). The key regional policy documents relevant to the energy strategy are the:

- *London Plan*, published in July 2011; and
- *Supplementary Planning Guidance on Sustainable Design and Construction*, published in May 2006.

The *Core Strategy* is the primary and strategic document in the Local Development Framework (LDF). The final versions of the *Core Strategy* and *Proposals Map*, incorporating the changes arising from the Inspector's Binding Report, were approved by Cabinet and Council on 22nd and 24th November 2010 respectively for adoption under Section 23 (Adoption of local development documents) of the *Planning and Compulsory Purchase Act 2004*.

The *Core Strategy* sets out a broad spatial approach to energy.

- CS13 – Tackling climate change through promoting higher environmental standards

Under CS13 section, Clause 13.11 states:

"Once a building and its services have been designed to make sure energy consumption will be as low as possible and the use of energy efficient sources has been considered, the Council will expect developments to achieve a reduction in carbon dioxide emissions of 20% from on-site renewable energy generation (which can include sources of site-related decentralised renewable energy) unless it can be demonstrated that such provision is not feasible."

3 methodology

3.1 basis

The calculation methodology used to predict energy consumption and CO_2 emissions is the same as that approved for demonstrating compliance with Part L of the Building Regulations. For dwellings, this is the Standard Assessment Procedure (SAP). *ADL1A 2010* clauses 4.2-4.14 explain how the TER and Dwelling Emission Rate (DER) are calculated.

Part L only regulates energy consumed by "fixed building services", i.e. the following end uses: heating; hot water; cooling; fans, pumps and controls; and lighting.

- Appendix L of SAP provides a formula for calculating CO_2 emissions associated with appliances and cooking.
- The NCM defines consumption from "equipment" for the purposes of assessing heating and cooling demand, though it is excluded from the calculation of the TER and BER.

3.2 software

The software used to produce the SAP calculations used in this report is JPA Designer version 5.03a1. The software system is accredited by the Department of Communities and Local Government (DCLG).

3.3 baseline emissions

The dwelling baseline emissions are based upon the Target Emission Rate (TER) for controlled end uses. The baseline emission for the proposed development will be formed from the controlled end uses plus the CO_2 emissions from cooking and appliance, using the method detailed in the SAP 9.90 manual, 2010.

3.4 lean measures: energy efficient design

Improvements to the building fabric and building services, in comparison to the "notional" performance criteria used to calculate the TER, are tested. The preferred range of measures is selected and the CO_2 emissions for this lean design are calculated.

At this stage the performance specification would typically demonstrate compliance with *ADL1A* in respect of:

1. Calculated CO2 emission rate (i.e. it would comply with the TER without any reliance on the contribution of clean or green measures);
2. Limits on design flexibility; and
3. Limiting solar gain in summer.

Due to the limitations of the SAP calculation there are some lean measures that may be incorporated that have no impact on the reported predicted energy consumption or CO_2 emissions, for example water efficient showers and taps, and white goods that are 'A' rated for energy efficiency.

3.5 clean measures: heating and cooling systems

The technical and economic feasibility of the following heating and cooling systems are then considered sequentially:

1. Connection to existing CCHP/CHP distribution networks;
2. Site-wide CCHP/CHP or hydrogen fuel cells; and
3. Communal heating and cooling.

The highest ranking feasible option is selected.

3.6 green measures: renewable energy technologies

The technical and economic feasibility of the following renewable energy technologies is then considered:

- Biomass CCHP/CHP (subject to clean measures proposed);
- Biomass heating;
- Renewable energy from waste;
- Photovoltaic cells;
- Solar water heating;
- Wind turbines; and
- Ground-coupled heating and cooling.

Other technologies such as solar air heating and hydroelectric may be considered on a site-specific basis.

The preferred technology or combination of technologies is selected and the residual CO_2 emissions are calculated.

3.7 feasibility

A feasibility study addresses whether something is capable of being done or achieved. In contrast a viability study considers whether it is capable of success or continuing effectiveness. In other words, if something is feasible it is possible whereas if it is viable it is practical. Typically the former places more emphasis on technical aspects and the latter on economic considerations. In practice the terms are used interchangeably.

Feasibility is always project-specific and can include many aspects, e.g. legal, technical, economic. Both planning policy and building regulations[1] refer to feasibility but neither defines its scope in any detail. The CSH previously set out specific requirements for credit Ene 7 (Low or Zero Carbon Technologies) but these do not feature in the current version.

This Energy Statement will cover the following:

- Energy generated from LZC energy source per year;
- Local planning criteria, including land use and noise;
- Feasibility of exporting heat/electricity from the system;
- Any available grants;
- All technologies appropriate to the site and energy demand of the development;
- Reasons for excluding other technologies; and
- Where appropriate to the building type, connecting the proposed houses to an existing local community CHP system or source of waste heat or power OR specifying a building/site CHP system or source of waste heat or power with the potential to export excess heat or power via a local community energy scheme.

[1] In Approved Documents L1A

3.8 grants

In the UK the main grant programme, the Low Carbon Buildings Programme, was closed to new applications on 24 May 2010, to be replaced by an alternative incentive schemes, based on tariffs. The 2008 Energy Act provided the legislative framework for the development of payments to ordinary energy users for the renewable energy they generate. These schemes are the:

- Feed-In Tariffs (FITs), promoting renewable electricity generation; and
- Renewable Heat Incentive (RHI), promoting renewable heat generation.

The FITs came in to force on 1st April 2010 and have three components:

1. A payment for all electricity produced;
2. A payment for any electricity exported to the grid; and
3. A reduction in the electricity bill for any energy produced and used.

These tariffs are index-linked for inflation and should cover the initial capital cost and, according to the Government, earn a return of up to 8 % per annum. In practice the capital cost should be paid back at least two to three times over the duration of the tariffs, which is 25 years for PV and 20 years for other systems.

The design of FITs has been changed on several occasions to reflect evolving government priorities. The framework was set up to have periodic reviews, the first in 2012 (to become effective from April 2013) and then at five-yearly intervals to coincide with reviews to the Renewables Obligation. However, the first review of the scheme was brought forward by the government in a statement on 7th February 2011. In practice the so-called 'first review' comprised four reviews and one additional rule change:

- Fast-track review, comprising a tariff reduction for larger solar PV systems (> 50 kW), effective from August 2011, and a tariff increase for AD systems, effective from September 2011;
- A rule change to the way in which system extensions are treated;
- Comprehensive review phase 1, the start of the review, covering reductions in PV tariffs from 03/03/2012;
- Comprehensive review phase 2A, a control mechanism to manage future tariff reductions for solar PV systems; and
- Comprehensive review phase 2B, covering changes to the non-PV tariffs and all other aspects of the FIT mechanism.

Consultation on the Phase 2B review closed on the 26th April 2012.

The RHI finally came to force on 30/11/2011 for non-domestic systems. The RHI is not expected to be introduced for domestic systems until 2013; in the interim a Renewable Heat Premium Payment can be claimed.

The RHI operates in a similar way to the FIT, being a payment for generating heat from renewable sources.

1. Reduced consumption fuel of (typically gas or oil) saves reduces utilities bills.
2. A payment is made for the useful heat produced.

These tariffs are index-linked for inflation and should cover the initial capital cost and, according to the Government, earn a return of around 12 % per annum. In practice the capital cost should be paid back in about seven to nine years. The duration of the tariff is 20 years.

This report refers to the FIT and RHI tariffs in lieu of grants. It should be noted that the tariff applicable to systems installed in the future will decrease with time, according to the scheme's annual degression rates.

Other grants are not covered in this *Energy Statement* but may be available in some cases.

Table 3 – basis of quoted fuel prices and tariffs

Parameter	**Source**
Fuel price (dwellings)	Average annual domestic electricity bills in 2010 for selected towns and cities in the UK with average unit costs (QEP 2.2.3) and Average annual domestic gas bills in 2010 for selected towns and cities in the UK with average unit costs (QEP 2.3.3), published on DECC website. Data is based on the London average for direct debit payment.
Export tariff (floor price)	http://www.fitariffs.co.uk/FITs/principles/export/, as at 22/12/2011
Generation tariff (Feed-In Tariff)	http://www.fitariffs.co.uk/eligible/levels/, as at 22/12/2011 (refer to section 3.7.3).
Renewable Heat Incentive (dwellings)	http://www.rhincentive.co.uk/eligible/levels/, as at 22/12/2011 (since rates for dwellings have not yet been published, proposed tariff levels within the original consultation document are used (refer to section 3.7.3)).

3.9 purpose of calculations

The purpose of the SAP calculations is to demonstrate compliance. SAP prescribes design parameters for inputs such as occupancy, time scheduling, weather, internal temperatures, illuminance levels and equipment usage. Therefore the calculations presented in this *energy statement* should not be taken as a prediction of expected energy consumption and CO_2 emissions.

4 energy efficient design measures

Energy efficiency is typically a more cost effective means of achieving carbon savings than LZCT. This is particularly true of passive measures (the architecture), which are simpler and have greater longevity than active systems (the building services).

ADL1A defines the following standards for the new build dwellings:

- Total carbon emission rates;
- Limitations on the admittance of solar gain;
- Controlled fittings (window, roof window, rooflight and door units);
- Controlled services (heating and hot water systems, mechanical ventilation, mechanical cooling/air conditioning, fixed internal lighting and renewable energy systems); and
- New thermal elements (walls, roofs and floors).

The proposed development would exceed these standards.

4.1 passive design

4.1.1 fabric

Managing energy demand is only one of many design drivers of site layout and building form. Nonetheless, the proposed development is designed to passively manage energy demand. The building fabric is highly insulated and airtight. The new fenestration is designed to optimise daylighting and beneficial solar gain, while avoiding summer overheating.

4.1.2 thermal comfort

Policy 5.9 of the *London Plan* acknowledges the importance of thermal comfort in minimising energy demand and sets out a hierarchy for cooling buildings.

B. *"Major development proposals should reduce potential overheating and reliance on air conditioning systems and demonstrate this in accordance with the following cooling hierarchy:*
   a. *minimise internal heat generation through energy efficient design*
   b. *reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls*
   c. *manage the heat within the building through exposed internal thermal mass and high ceilings*
   d. *passive ventilation*
   e. *mechanical ventilation*
   f. *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*". (Mayor of London, 2011, 151)*

The proposed development has been designed in accordance with the cooling hierarchy.

- Heat gains from hot water storage, fans, pumps and controls and lighting are minimised.
- The building is orientated along a southwest-northeast axis, with openings located predominantly on the northeast and southwest elevations. Balconies to the rear elevation provide shading to south-facing glazing.
- The fenestration and building fabric balances beneficial and unwanted heat gains.
- Extensive soft landscaping includes deciduous planting that provides summer shading.
- In the dwellings, passive ventilation is provided by opening windows where possible.

Under Building Regulations the following checks are used to limiting solar gain in summer:

- For dwellings, not having a *"high risk of high internal temperatures" (HMG, 2010, 16)*, as calculated using the procedure in SAP 2009 Appendix P (Assessment of internal temperature in summer); and

For *ADL1A 2010*, preliminary checks indicate that the proposed houses would achieve compliance with openable windows.

4.2 energy efficiency measures

The energy efficiency measures incorporated into the new dwellings of the proposed development are scheduled in Table 4. In summary these comprise:

- Insulated building fabric with low thermal bridging and air permeability;
- Glazing with suitable U-value, g-value and daylight transmittance;
- High efficiency condensing boiler with under floor heating;
- Time and temperature zone control for space heating;
- Whole House Mechanical Ventilation (WHMV) with low specific fan power and high heat recovery; and
- Low energy lighting.

The heating and hot water systems are consistent with the specification assumptions under CSH credit Ene 7 (Low and Zero Carbon Technologies).

Table 4 – energy efficiency measures in the new dwellings of the proposed development

Energy efficiency measure	ADL1A reference value	Proposed development
Size and shape	Same as actual dwelling	As designed (actual dwelling)
External walls	U-value 0.35 W/m^2K	U-value 0.15 W/m^2K
Party walls	U-value 0.00 W/m^2K	U-value 0.00 W/m^2K
Floors	U-value 0.25 W/m^2K	U-value 0.15 W/m^2K
Roofs	U-value 0.16 W/m^2K	U-value 0.10 W/m^2K
Door	U-value 2.0 W/m^2K	U-value 2.00 W/m^2K
Windows and glazed doors	U-value 2.0 W/m^2K g-value 0.72	U-value 1.50 W/m^2K g-value 0.72
Thermal mass	Medium (TMP = 250 kJ/m^2K)	Medium (TMP = 250 kJ/m^2K)
Living area fraction	Same as actual dwelling	As designed (actual dwelling)
Shading and orientation	All glazing orientated E/W; average overshading	As designed (actual dwelling)
Number of sheltered sides	2	As designed (actual dwelling)
Allowance for thermal bridging	y-value 0.11	y-value 0.08
Ventilation system	Natural ventilation with intermittent extract fans	Whole house mechanical ventilation with heat recovery
Air permeability	10.0 $m^3/hr/m^2$ @ 50 Pa	5.0 $m^3/hr/m^2$ @ 50 Pa
Chimneys	None	None
Open flues	None	None
Extract fans	3 for dwellings with floor area > 80 m^2, 2 for smaller dwellings	Not applicable to dwellings with WHMV
Main heating fuel (space and water)	Electricity	Electricity
Heating system	Boiler with under floor heating pump in heated space	Boiler with under floor heating pump in heated space
Boiler	COP of 0.789	COP of 0.9
Heating system controls	Time and temperature zone control	Time and temperature zone control
Hot water system	Boiler with thermal store and separate timer for domestic hot water	Boiler with thermal store and separate timer for domestic hot water
Hot water cylinder	150 litre cylinder insulated with 35 mm of factory applied foam	210 litre cylinder with heat loss factor less than 3.2kWh/day
Primary water heating losses	Primary pipework not insulated, cylinder temperature controlled by thermostat	Primary pipework insulated, cylinder temperature controlled by thermostat
Secondary space heating	10 % electric (panel heaters)	None
Low energy light fittings	30 % of fixed outlets	100 % of fixed outlets

4.3 calculations

The lean building's energy demand is shown in Figure 2.

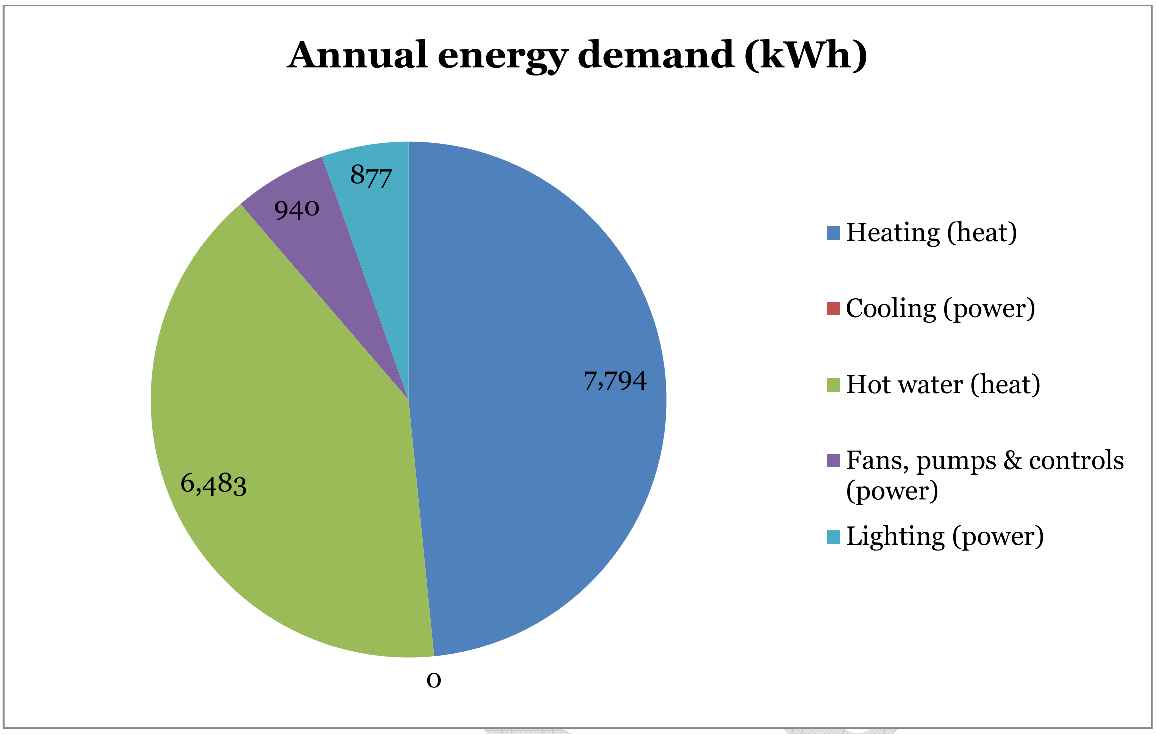

Figure 1 – the 'lean' building's annual energy demand

The lean building's annual carbon emissions are shown in Table 5.

Table 5 – 'lean' building's annual carbon emissions

Description	Dwelling/ building emissions ($kgCO_2$)	Target emissions ($kgCO_2$)	Improve over target (%)
Proposed development	3,767	4,131	8.8%

5 heating and cooling systems

5.1 options

The heating system for the proposed development has been considered in accordance with Policy 5.9 of the *London Plan*. There is no cooling system.

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." (Mayor of London, 2011, 148)*

5.1.1 connection to existing heating or cooling networks

At its closest, the site lies approximately 700 m, as the crow flies, from the closest Decentralised Energy (DE) network as shown in Figure 2. The site also lies approximately 700m from the edge of the focus zone, shown in purple.

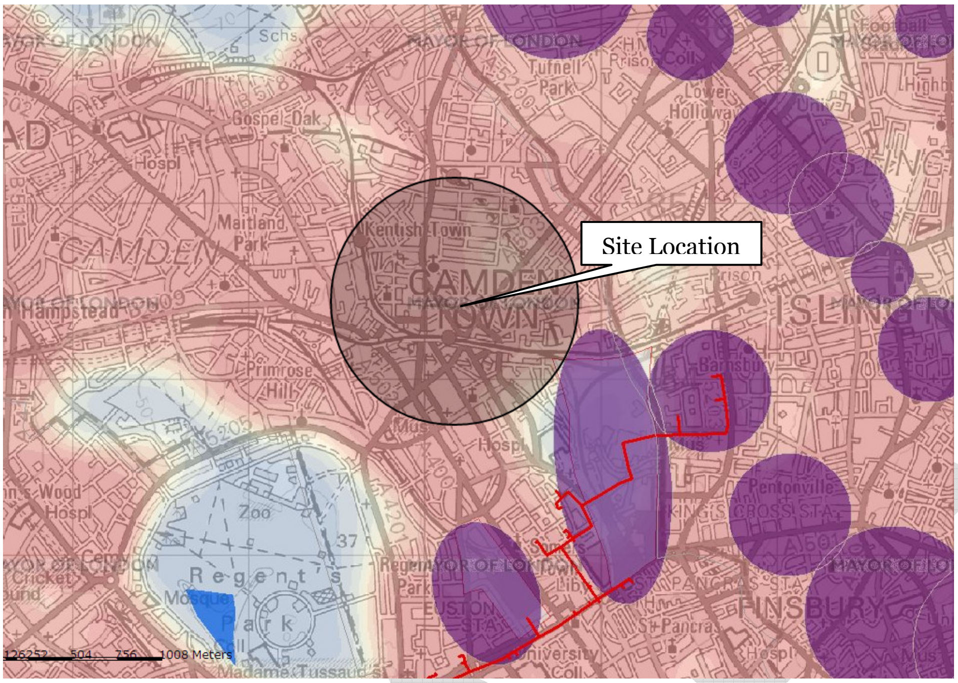

Figure 2 – excerpt from London Heat Map

Given that the capital cost of laying heat mains in London is typically in the range 1,000-1,500 £/m, connection to the network is not considered feasible.

5.1.2 site-wide CHP network

Figure 3 shows the annual profile for heat and power demand.

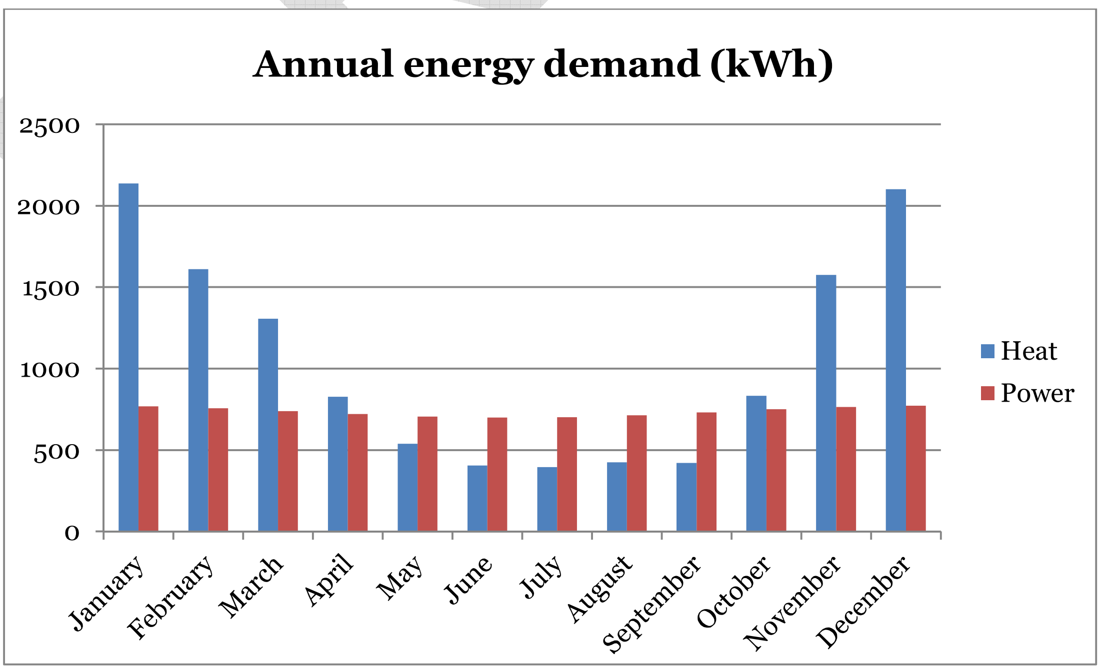

Figure 3 – annual profile for energy demand

CHP units typically generate 1-2 times as much heat as power. Carbon savings are achieved where both the power and heat is utilised. Though CHP units can often operate at part load, full load operation for long periods is preferable. The resultant supply profile is 'flat' (i.e. constant), whereas demand, particularly for heat, typically fluctuates, an imbalance that can be rectified by the use of storage. Electricity can be 'stored' via connection to the national grid, and a thermal store fulfils the same function for heat. Traditionally water is used as storage medium but more recently Phase Change Materials (PCMs) have been adopted as they store significantly more heat for a given volume.

It is rarely practical to store high-grade heat, such as that produced by CHP units, for more than 24 hours, as the size of the thermal store becomes very large. A further consideration is that between 00:00 and 07:00 electricity is available from the national grid at very low tariffs, so economic feasibility can be undermined by operating CHP plant overnight.

The base heat load is just 13 kWh per day, an average of 1.1 kW over a 12-hour period. This demand is formed of primarily from the catering and dwelling domestic hot water loads. The heating load is relatively small in comparison to the output of most CHP engines. To meet this load the CHP engine would be required to run for a shorter time period, reducing its efficiency. The hot water produced would require a thermal store of approximately 100 litres, plus additional space for pump sets and distribution risers. Due to a low demand and space restriction within the existing building this solution is not deemed economically or technically viable.

5.1.3 communal heating and cooling

Community heating and cooling systems are preferred for their capacity to integrate LZCT, either on construction or at a later date; they do not in themselves significantly reduce carbon emissions. While there are benefits in terms of load diversity facilitating reduced overall plant capacity and better plant operating efficiency, there are 'parasitic' loads: electrical demand for circulating pumps and thermal losses through distribution pipework. Due to space restrictions discussed in section 5.1.2, a communal heating system is not proposed.

6 renewable energy technologies

6.1 options

The feasibility of the renewable energy technologies listed in the London Plan has been considered.

6.1.1 biomass CCHP/CHP

There are three primary technical considerations affecting the use of biomass:

1. Air quality;
2. Fuel delivery; and
3. Fuel storage.

In 2002 LBH declared several Air Quality Management Area (AQMA) orders, later extended to cover the whole of the borough, on account of elevated levels of Nitrogen Dioxide (NO_2) and PM_{10} particulate matter (PM_{10}). Biomass combustion typically releases relatively high level of Nitrous Oxides (NO_x) emissions. Therefore an air quality impact assessment would be required and it is highly likely that mitigation measures would be required. Typically each item of biomass plant would need to be fitted with a catalytic converter, at a capital cost of ~ £ 50,000.

In summary, air quality is not necessarily a problem, though it does limit the number, and/or increase the cost, of products that would be suitable for this location.

A CHP unit of the size described in section 5.1.2 but fuelled with biomass rather than gas would require a large fuel store. For example a store for wood pellets, which have the highest calorific value density of the solid biomass fuels, would be ~ 0.2 m^3, based on fortnightly deliveries.

A further consideration specific to biomass CHP is its immaturity at this scale in the UK. There have been some high-profile and widely reported problems, for example at the Beddington Zero Energy Development (BedZED).

In summary, this technology is not considered feasible for the proposed development.

6.1.2 biomass heating

Biomass heating is not feasible given the proposed heating system (refer to section 6.1.1).

6.1.3 renewable energy from waste

The site is connected to the municipal sewer network. It is believed to be served by Thames Water's Beckton Sewage Treatment Works (STW), where a by-product of the process, methane, fuels CHP plant, generating renewable electricity for onsite use, with the exhaust heat being captured and used to pasteurise the sewage sludge. Therefore, strategically, there is no benefit in providing decentralised, onsite anaerobic digesters to generate biogas.

6.1.4 photovoltaic cells

Using the data from the Photovoltaic Geographical Information System (PVGIS), the optimum positioning of PV cells on the site is at an azimuth of -1 ° (almost due south) and an inclination of 36 ° (from horizontal). This arrangement maximises annual yield and, therefore, economic feasibility.

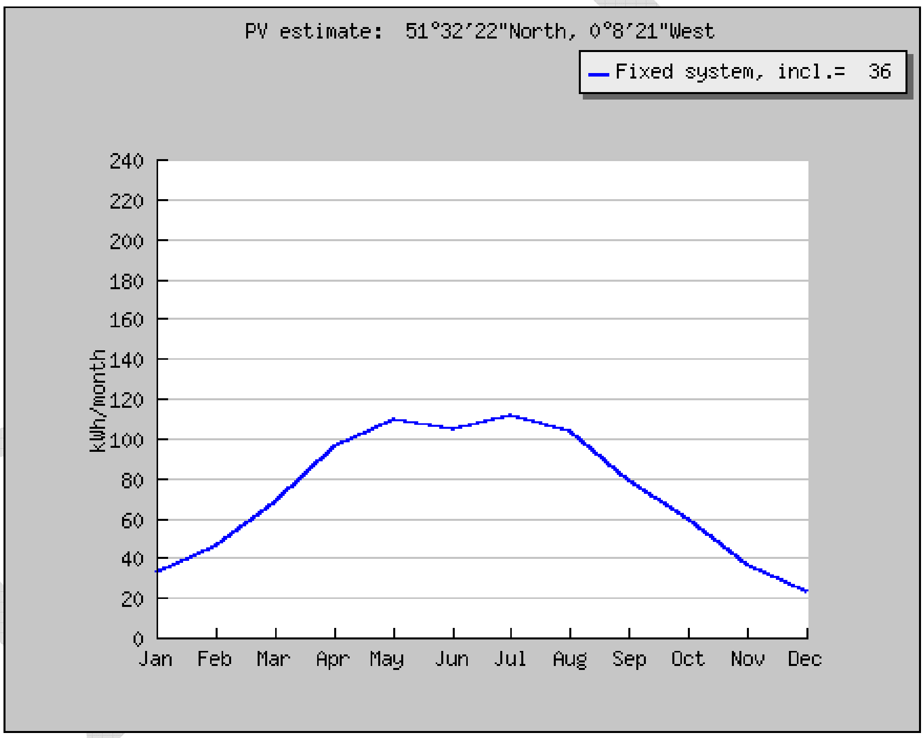

Figure 4 – typical energy output from 1 kW_{peak} PV system for the proposed development

The roof has sufficient space for a 1 kW_{peak} PV array each house (approximately $8m^2$) facing south with 36 degree tilt. The system will generate 686 kWh electricity and offset CO_2 emissions by 369 $kgCO_2$ in a year which contributes a 10.0% reduction.

Table 6 - feasibility considerations for photovoltaic

Energy generation	Electricity: 686 kWh per annum

Local planning criteria	Land use: the PV arrays would be located at roof level. Noise and vibration: Not applicable as the technology does not produce any noise and vibration.
Energy export	The electricity generated is suitable for export to the grid.
Grants	Feed-in tariff: • 16 p/kWh for 18 years for small installations (rated less than 4 kW)

6.1.5 solar water heating

Solar Water Heating (SWH) could be utilised for the catering and dwelling domestic hot water demand. This would require the provision of a thermal store, pump set and distribution risers. With limited roof space available, photo voltaic arrays are deemed preferable due to reduced space requirements and greater returns in carbon dioxide savings.

6.1.6 wind turbines

Wind turbines tend to perform poorly in urban environments, due to turbulence and low average wind speed.

- A widely reported study in 2007, by the Building Research Establishment (BRE), concluded that *"in many urban areas they are unlikely to pay back either their carbon emissions or the home owner's costs for installation and maintenance"*.
- In 2008, the Carbon Trust commissioned a review of small wind power technology from the UK Meteorological Office and Entec, which drew a similar conclusion: *"in many urban situations, roof-mounted turbines may not pay back the carbon emitted during their production, installation and operation"*.
- The Encraft Warwick Wind Trials Project, covering 168,950 hours of operation of 26 building-mounted wind turbines from five manufacturers across the UK during 2007-2008, found that the industry and technology is *"still at development stage and is likely to make a tangible contribution to energy and carbon saving only on the most exposed sites and tallest buildings"*. Excluding data from periods when turbines were switched off or broken the average capacity factor was 4.15 %, significantly lower than the 10-30 % typical for larger turbines on free standing sites in good areas.

According to the Department of Energy & Climate Change's windspeed database, the average wind speed at the site is 4.9, 5.6 and 6.1 m/s at 10, 25 and 45 m above ground level respectively. However, the data is derived from an air flow model, with a resolution of 1 km square, that simply estimates the effect of topography on wind speed, without taking in to account local thermally driven winds or topography, which can have a considerable effect on wind speed. The site lies within an urban area characterised by high density development that is generally of a similar but varying height. Consequently the average wind speed on the site is believed to be < 5 m/s, considered the lower limit for commercial viability by RenewableUK, with a wind microclimate characterised by high levels of turbulence.

Therefore this technology is not considered feasible for the proposed development.

6.1.7 ground-coupled heating and cooling

There are three types of ground-coupling. In all cases, successful application is highly dependent on geological and hydrogeological conditions, so specialist input is required at an early stage. It is not known whether the ground is contaminated; further investigation is understood to be required to confirm that remediation and/or mitigation measures would not be required. System efficiency is improved where the annual heating and cooling demand is in balance, particularly for vertical systems.

1. Horizontal, closed-loop heat exchangers are plastic pipework loops buried in the ground, typically at a depth of around 2 m.
2. Vertical, closed-loop heat exchangers are plastic pipework loops inserted in to drilled boreholes.
    a. One type is the energy pile, where one or two loops are inserted in to a structural pile. This minimises additional ground works and can be cost-effective, the reported additional cost being circa £ 400 per pile. However, there are only a limited number of piling contractors capable of this work. The capacity of energy piles in clay is typically 30-40 W/m, though it may be possible to increase this by around half by using two loops in each pile.
    b. The alternative type is deeper, dedicated boreholes, which are typically spaced on a six-metre grid to minimise their mutual impact on thermal performance.
3. Vertical, open-loop heat exchangers extract water from an aquifer, typically injecting the used water, at a different temperature, in to the same aquifer, a short distance away. The heat exchanger footprint is smaller but the yield (the sustainable flow rate, which is proportionate to system capacity) is unpredictable. Securing the relevant consents and drilling the boreholes is an expensive process, typically costing circa £ 250,000 per pair, regardless of yield. Licenses are granted by the Environment Agency, usually for a period of ten years, after which the licensee must apply for renewal.

Since the proposed development comprises the refurbishment and extension of an existing building, the footprint of which occupies most of the site, it is questionable whether ground coupling is technically feasible. Certainly the area available would be inadequate for a horizontal heat exchanger.

The inclusion of a ground source system would result in the following issues:

- Archaeology and programme risk;
- Limited headroom to accommodate a drilling rig; and
- Capital cost.

The improvement in Coefficient of Seasonal Performance (CoSP) achieved by ground-coupling over conventional air-coupling (refer to section **Error! Reference source not found.**) is limited which, given the additional capital cost, undermines the economic feasibility.

Consequently, ground-coupled heating is not considered feasible.

6.2 proposals

The proposed development incorporates 1 kWp PV panels for each house (2 kWp PV panels in total) as renewable energy technologies:

6.3 calculations

The green building's annual carbon emissions are shown in Table 6.

Table 6 – 'green' building's annual carbon emissions

Description	Dwelling/ building emissions ($kgCO_2$)	Target emissions ($kgCO_2$)	Improve over target (%)
Proposed development	3,040	4,131	26.4%

7 compliance

7.1 development control

This *Energy Statement* is intended to demonstrate compliance with planning policy, and is for submission as part of a planning application. Figure 5 illustrates the hierarchical approach adopted and the resultant reduction in overall CO_2 emissions.

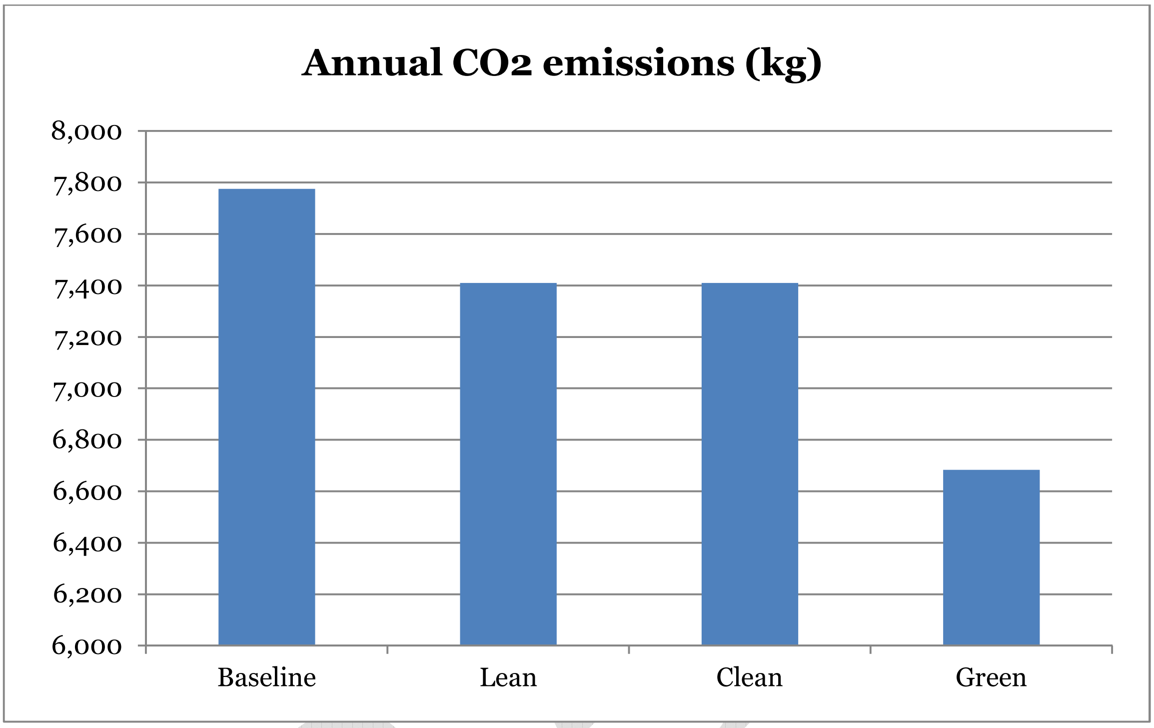

Figure 5 – hierarchical approach to energy strategy

The key metrics are listed below.

- The proposed development's overall improvement over the baseline: 26.4 %
- The carbon saving attributable to clean measures, i.e. heating and cooling systems: 0.0 %.
- The carbon saving attributable to renewable energy technologies (PV panels): 10.0 %

7.2 building control

The as-designed BRUKL output document demonstrates that the proposed dwellings would comply with *ADL1A*. In terms of CO_2 emissions, the average DER represents a 38.7 % improvement over the TER.

7.3 Energy Performance Certificates

The draft dwelling EPC shows an Energy Performance Asset Rating of 86 (BandB).

7.4 environmental assessments

The *Code for Sustainable Homes pre-assessment checklist* demonstrates how the target rating of Level 3 could be achieved. The preparation of this Energy Statement contributes evidence for the following credits.

- Ene 1 – Reduction of CO_2 emissions
    - 3 of 10

- Ene 2 – Fabric Energy Efficiency
    - 5 of 9
- Ene 7 – Low or Zero Carbon Technologies
    - 1 of 2

List of Abbreviations and Acronyms

Abbreviation or acronym	Definition
ADL1A	Approved Document L1A: Conservation of fuel and power in new dwellings
ADL2A	Approved Document L2A: Conservation of fuel and power in new buildings other than dwellings
AQMA	Air Quality Management Area
ASHP	Air Source Heat Pump
BER	Building Emission Rate
BRE	Building Research Establishment
BREEAM	Building Research Establishment Environmental Assessment Method
BS	British Standard
CCHP	Combined Cooling Heat and Power
CHP	Combined Heat and Power
CIBSE	Chartered Institution of Building Services Engineers
CO_2	Carbon dioxide
CoSP	Coefficient of Seasonal Performance
CPSU	Combined Primary Storage Unit
CSH	Code for Sustainable Homes
dBA	A-weighted decibels
DCLG	Department for Communities and Local Government
DE	Decentralised Energy
DECC	Department of Energy and Climate Change
DER	Dwelling Emission Rate
DHW	Domestic Hot Water
DPD	Development Planning Documents
DSM	Dynamic Simulation Modelling
DX	Direct Expansion
EiP	Examination in Public
EPC	Energy Performance Certificate
FEE	Fabric Energy Efficiency
FIT	Feed-In Tariff
G59	Engineering Recommendations G59/1: Recommendations for the connection of embedded generating plant to the Regional Electricity Companies' distribution systems
G83	Engineering Recommendations G83/1: Recommendations for the connection of small scale embedded generators (up to 16A per phase) in parallel with public low voltage distribution networks
GLA	Greater London Authority
GSHP	Ground Source Heat Pump
HLP	Heat Loss Parameter
HMG	Her Majesty's Government
ISO	International Organization for Standardization
LBH	London Borough of Hackney
LCC	Life Cycle Cost (also referred to as lifecycle cost)
LDF	Local Development Framework
Low-E	Low emissivity

Abbreviation or acronym	Definition
LTHW	Low Temperature Hot Water
LZC	Low or Zero Carbon
LZCT	Low or Zero Carbon Technologies
NCM	National Calculation Methodology
NO_2	Nitrogen Dioxide
NO_x	Nitrous Oxides
ODPM	Office of the Deputy Prime Minister
PCM	Phase Change Material
PFC	Power Factor Correction
PM_{10}	Particle matter of 10 μm or less
PPS 22	Planning Policy Statement 22: Renewable Energy
PV	Photovoltaic
PVGIS	Photovoltaic Geographical Information System
QEP	Quarterly Energy Prices
RHI	Renewable Heat Incentive
SAP	Standard Assessment Procedure
SCoP	Seasonal Coefficient of Performance
SEDBUK	Seasonal Efficiency of Domestic Boilers in the UK
SPD	Supplementary Planning Document
SPG	Supplementary Planning Guidance
SSEER	System Seasonal Energy Efficiency Ratio
STW	Sewage Treatment Works
SWH	Solar Water Heating
tds	Tonnes dry solids
TER	Target Emission Rating
TfL	Transport for London
TM	Technical Memorandum
TMP	Thermal Mass Parameter
UDP	Unitary Development Plan
VRF	Variable Refrigerant Flow
WEEE	Waste Electrical and Electronic Equipment
WHMV	Whole House Mechanical Ventilation
WLC	Whole Life Cost