Energy Statement

Mixed use development

30a Highgate Road

London

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Report prepared for:

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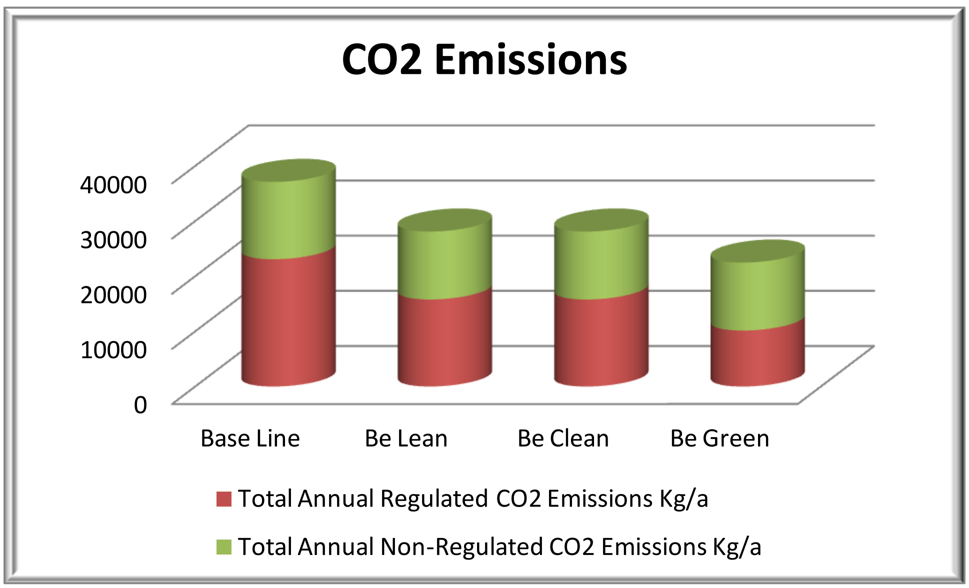
Executive Summary

The development comprises 9 new domestic units with a total of 779m2 of living space and 593m2 of non domestic space for as a 'Shell & Core' building for future Type B1 office and workshop businesses

The energy strategy follows the GLA guidance which first looks at energy demand reduction measures (Be Lean), then at community heating and CHP (Be Clean), then finally, on site renewable technologies.

The energy savings for each stage were calculated using SAP software modeling for the domestic properties and iSBEM software modeling for the non-domestic element. The results are summarised in the table below.



Emissions	Tonnes CO_2 per annum		
	Regulated	Unregulated	Total
Building Regulations 2010 Notional	23090	14024	37114
After Demand Reduction (Be Lean)	15787	12324	28110
After CHP (Be Clean)	15787	12324	28110
After Renewables (Be Green)	10158	12324	22482

Savings	Carbon Dioxide Savings (Tonnes CO2 per annum)		% Carbon Dioxide Savings	
	Regulated	Unregulated	Regulated	Total
After Demand Reduction (Be Lean)	7303	1700	32%	24%
After CHP (Be Clean)	0	0	0%	0%
After Renewables (Be Green)	5629	0	36%	20%
Total Cumalative Savings	12932	1700	56%	39%

The proposed combination of passive building design measures, fabric measures, lighting and communal heating system provided by a Gas Absorption Heat Pump technology achieves a 32% reduction in CO2 emissions on the baseline case.

Making optimum use of the unshaded South East facing roof areas of both building blocks for a combination of solar thermal and solar PV technology achieves the required additional 20% contribution to a reduction in CO2 emissions based on SAP 2009 emissions figures for gas and electricity.

The proposed development therefore complies with the following policy requirements specified for new developments of this type

- Government's Planning Policy Statement 22
- London Plan Policy 4A.3, London Plan Policy 4A.6 & London Policy 4A.7
- Camden Council's CPG3 Sustainability;
  - 50% un weighted credits being achieved in the Code for Sustainable Homes Energy Category for the domestic element.
  - 60% unweighted credits being achieved in the BREEAM Energy Category for the non domestic element

The overall reduction achieved over the baseline CO2 emissions for the whole development is 39% therefore making a significant contribution to local and London wide CO2 emission reduction targets for new developments.

Introduction

1.1. The development is proposed for the site of 30a Highgate Road a collection of existing Victorian brick built building previously used as light industrial/commercial units. The existing site will be demolished and cleared for the proposed new build properties.

1.2. The proposed new development comprises two buildings facing each other over a courtyard area orientated South East/North West. It will be a mixed development of domestic and non-domestic units.

1.3. For the domestic units, the buildings above are divided internally into one block of flats comprising 6 individual dwelling units set over two floors and the second block is split between 3 individual dwelling units occupying the second floor of a the mixed use block.

1.4. The floor areas of each unit are as follows:

Unit	Area M^2
Unit 1 (Mews House)	113
Unit 2	76
Unit 3	76
Unit 4 (mews House)	100
Unit 5	71
Unit 6	71
Unit 7	97
Unit 8	97
Unit 9	78
Average	**84**
Total	753

1.5. The non domestic unit is to be built as a ‘Shell & Core’ building with building services provided to accommodate Type B1 Offices and Workshop businesses. The total floor area is 593m2 set over 2 floors with the ground incorporating a loading bay area and stairwell access to the upper floors.

2. Policy and Guidance

2.1. National planning policy requirements relevant to this energy statement are given in the Government's Planning Policy Statement 22:

'Local planning authorities and developers should consider the opportunity for incorporating renewable energy projects in all new developments.'

2.2. More local guidance on energy is also relevant and is available in the London Plan. This report will follow the London Plan hierarchy of 'Be Lean, Be Clean, Be Green', to demonstrate the CO2 emissions reduction strategy for the site.

2.3. Improvements to the building fabric 'U' values, air tightness and detailing will lower the total energy demand below that of a building which just conforms with Approved Documents L1A (ADL1A) and L2A (ADL2A) of the 2006 Building Regulations (cf. London Plan Policy 4A.3) Consideration is then given to the decentralised provision of energy as a means of further reducing the carbon dioxide emissions of the development (cf. London Plan Policy 4A.6).

2.4. Finally, the potential for the use of renewable energy technologies is investigated in line with the London Plan Policy 4A.7 which states that: *'…developments will achieve a reduction in carbon dioxide emissions of 20% from on-site renewable energy generation unless it can be demonstrated that such a provision is not feasible.'*

2.5. The London Borough of Camden planning guidance policy document CPG3 Sustainability follows the format of the London plan but in addition requires this development to achieve Level 3 of the Code for Sustainable Homes in relation to the domestic dwelling units with a minimum of 50% un weighted credits being achieved in the energy category. The commercial/industrial space is to achieve a minimum of BREEAM 'Very Good' with a minimum of 60% unweighted credits being achieved in the energy category.

3. Baseline Energy Demand and CO_2 Emissions

3.1. In order that an energy assessment can be conducted, a baseline energy demand calculation has to be made as follows:

a. A Building Regulations (2010) baseline of energy demand and CO_2 emissions for the residential units

b. A baseline for electricity consumption relating to the communal areas which equates to an assessment of the internal and external communal lighting

c. An iSBEM baseline of energy demand and CO_2 emissions for the non-domestic space.

3.2. The baseline is then used as a basis to demonstrate the reductions in energy use and associated CO_2 emissions that will result from the improvements to the building specification using the hierarchy of ‘BE LEAN’ ‘BE CLEAN’, ‘BE GREEN’.

3.3. When the designed emission rate from the development as a whole has been calculated, the non-regulated electricity use of the residential units is assessed using the Code for Sustainable Homes ENE7 calculation tool. The non-regulated energy use for the non-domestic space is taken from the CIBSE Guide A. The figure used was that for standard commercial office space of 27 kWh/m2/yr. The total figures for domestic and non-domestic non-regulated energy consumption are added to the designed energy consumption to provide a total on which the viability of a 20% contribution of renewable energy systems can be assessed. Non-regulated energy consumption is always assumed to be grid supplied electricity and a carbon emission factor 0.517 is used for a calculation of the consequent carbon dioxide emissions.

3.4. Assumptions

3.4.1. For each dwelling a baseline energy use and carbon emissions level are derived using the process detailed in the Approved Document L1A 2010 edition. The energy and carbon emissions figures are calculated automatically using the Stroma FSAP 2009 software. The reference values for fabric efficiency standards and controlled service and fittings are detailed in SAP 2009 Appendix R. On this basis, total energy for hot water, space heating, fixed electrical items and appliances has been calculated for the residential units using SAP software (Stroma FSAP2009). From this total energy demand for heating, hot water and fixed electrical appliances, and the consequent CO2 emissions (or Target Emission Rate) have been calculated for the residential development as a whole.

3.4.2. Using iSBEM software a baseline energy usage assuming Type B1 usage pattern and a gas fired wet central heating system has been used to calculate space heating, hot water, cooling, auxiliary and lighting energy demand. From this the total energy demand and the consequent CO2 emissions have been calculated for the proposed non-domestic development as a whole.

3.5. Communal Areas

3.5.1. Heating

All the communal areas (entrance lobbies and stairwells) are unheated therefore no calculation of energy consumption is required. The external walls of properties adjacent to the common area areas all have fabric U values that exceed the minimum requirements set out in ADL1A.

3.5.2. External Lighting Ground Floor

Use: (Entrances & External Stairwells)

No units: 9 (1 per external stairwell floor and 1 above external entrances)
Lighting regime: PIR sensors (average dusk-dawn night cycle 12hours@30% = 3.6hrs)
Unit energy rating: 100W
Estimated energy consumption kWh/yr: 1182.6 (11*0.1*3.6*365)

3.5.3. Car Park

Use: Parking bays and bike storage areas
No units: 3
Lighting regime: PIR sensors (average dusk-dawn night cycle 12 hours@30% = 3.6hrs)
Unit energy rating: 100W
Estimated energy consumption kWh/yr: 394 (15*0.1*3.6*365)

3.5.4. External Lighting First Floor

Use: (Entrances & External Stairwells)
No units: 6 (1 per external stairwell floor and 1 above external entrances)
Lighting regime: PIR sensors (average dusk-dawn night cycle 12hours@30% = 3.6hrs)
Unit energy rating: 100W
Estimated energy consumption kWh/yr: 788.4 (6*0.1*3.6*365)

3.5.5. External Lighting Second Floor

Use: (Entrances & External Stairwells)
No units: 2 (1 per external stairwell floor and 1 above external entrances)
Lighting regime: PIR sensors (average dusk-dawn night cycle 12hours@30% = 3.6hrs)
Unit energy rating: 100W
Estimated energy consumption kWh/yr: 262.8 (2*0.1*3.6*365)

Total annual estimated communal lighting consumption = 2627 kWh/yr
(Daily estimated communal lighting consumption = 7.2 kWh)

The total number of lighting units, their exact lighting regime and the specific power output of the units has not been specified in detail at this stage of the development. Therefore the figures used in the above assessment of communal lighting demand have been estimated based on the architectural drawings, the accompanying specification guidance and standard practice in terms of communal lighting provision.

4. Measures to Reduce Energy Demand

4.1. The following improvements have then been made to the buildings fabric and services to reduce energy demand.

specification item	unit of calculation	baseline value	as designed value
building fabric			
external walls	U value	0.35	0.15
roofs	U value	0.16	0.13
exposed floor slabs	U value	0.25	0.15
glazing	U value	2.0	1.60
entrance doors	U value	2.00	1.0
Thermal Mass	TMP kJj/M2K	250	250
Thermal Bridging	Y value	0.11	0.08
Airtightness			
air permeability	m^3/hm^2	10	3
lighting			
low energy light fittings (domestic)	percentage	30	100
Non-domestic lighting	Type	N/A	T5 fluorescent lamps/LED’s & occupancy sensors
Heating & Hot Water	**Before**	**After**	
Heating	Individual gas condensing boiler 78% efficiency	LT Communal Gas Absorption Heat pump 165% efficient	

DHW	Individual Hot water cylinders	HT communal gas absorption heat pump with communal cylinders 150mm insulation

5. Communal systems and efficient energy supply

5.1. In accordance with the London Plan policy 5.6, the application of decentralized energy infrastructure has be considered in the following hierarchy;

- Connection to existing heating or cooling networks
- Site wide CHP network
- Communal heating/cooling systems on site

5.2. Community Heating (not selected)

In reference to the available London heat maps, unfortunately no suitable existing energy network exists within 1km of the proposed development. It is therefore considered not economical or practical to connect the site to an existing heat network. In addition there is are no new heating networks proposed within 500m of the development within the next 3 years that could provided sufficient heating capacity. Community heating has therefore been eliminated from this strategy, however the heating systems will be designed is such a way that such the central heating plant can be fitted with a plate heat exchanger fed from future district heating should it become available.

5.3. CHP (not selected)

The annual energy demand pattern for a development which is predominantly residential with one commercial/light industrial unit is not suitable for CHP due to the absence of viable and constant base load. There are no other adjacent developments which could contribute to a more balanced annual demand. In addition the site is constrained and the available space for the required plant is limited. CHP is therefore not considered viable for this site.

5.4. Communal Heating

A high density residential development is however ideally suited to a communal heating system and we have therefore considered such a system with the lowest achievable CO_2 emissions bearing in mind the outcome of the renewable energy technology assessment below.

The preferred system is a highly efficient Robur Gas Absorption Heat Pump with a seasonal efficiency of 165% for space heating and 152% for domestic hot water. Individual heat pumps operating on low temperature flow circuit will optimize efficiency and supply of space heating via wet underfloor heating circuits for both the domestic and non-domestic areas. Individual heat metering and separate charging facilities will be supplied to each property with the option of further sub-metering for the non-domestic areas.

The energy calculations have considered this heating system in the first be lean energy demand reduction stage of the process for ease of presentation of the results.

6. Renewables

6.1. Having reduced the baseline energy consumption through orientation, form, insulation, airtightness, efficient building services – and having investigated the feasibility of community heating power, we have considered the following range of renewable energy technologies to further reduce the carbon emissions resulting from the usage of the proposed buildings.

- Solar Thermal Domestic Hot Water
- Biomass Boilers
- Aerogenerators (Wind Turbines)
- Ground Source/Air source electric heat pump
- Photovoltaics

6.2. Solar Thermal DHW (selected)

Solar Thermal is considered a viable technology for this site. We propose using 22.5m2 of evacuated tube solar thermal roof mounted panels to supplement the hot water provision. The exact size and location and of a solar thermal panel system would be determined on final production specification during construction phase and may vary marginal from this preliminary assessment.

6.3. Biomass Boilers

The site is deemed too constrained to allow;

- for access & turning of large wood fuel delivery vehicles,
- suitable location of wood fuel store or transfer of fuel from store to boiler,

In addition other concerns were;

- at present no guaranteed local supply of wood fuel (chip or pellet).
- the future rising cost and sustainability of potentially imported biomass (this is most sustainable when a local supply is available)
- concerns over reliability and maintenance of plant
- issues over air quality in a dense urban environment

For the reasons cited above biomass boilers were deemed to be unsuitable.

6.4. Aerogenerators

Low average wind speeds (<5m/s) within Greater London together with turbulence and sheltering from adjacent tall residential buildings surrounding the site will make turbine output too low for economic or environmental viability.

6.5. Ground source heat pumps (GSHP - not selected)

GSHP are often considered a good solution for providing an efficient heating source for new developments and are classified as a renewable energy system. However site restrictions and unviable economics eliminate the viability of a GSHP solution. Gas Absorption Heat Pumps (GAHP) however, although very little used in the UK, have lower CO_2 emissions and overall a lower environmental impact unless a renewable source of electricity is available to power GSHP installations.

6.6. Electric Air Source Heat Pumps

Despite their excellent local operating efficiencies, all electric heat pumps contribute to global warming on two fronts, directly through the gradual leakage of greenhouse gas refrigerants (HFCs) from the plant and indirectly through the CO2 emissions resulting from the use of fossil fuels burned to generate the electricity required to operate the device. Estimates attribute 13% of the entire world's Global Warming to released or leaked refrigerants in the atmosphere.

The operating seasonal efficiency of air source heat pumps is highly dependent on temperature of input air, typically the external air temperature. Low temperatures, especially winter temperatures of <5 ^{0}C drastically reduce the operating efficiency of the heat pumps and also impose an additional requirement to pre warm the heat exchanger plate to prevent icing. Even the most efficient air source heat pumps in extreme cold conditions will be operating with efficiency close to 100% effectively acting as direct electrical heaters. The paradox being that when demand for space heating is at its highest the technology is at its least efficient.

These issues are completely eliminated by using a Gas Absorption Heat Pump. See section 6.9 for a discussion of the advantages of GAHP over electric ASHP.

6.7. Photovoltaic Panels (Selected)

Preliminary analysis shows there is approximately 100m2 of unshaded roof area with a favorable SE orientation that could accommodate Photovoltaic Panels. We propose 10.2kWp PV installation providing ~ 8462 kWh/year of electricity. This would equate to installing a system of~80m2 of panels split between the two buildings with one bank of 40m2 on the SE roof slope of the block containing the 6 dwelling units. The second bank of panels would be located on the SE roof slope of the non-domestic building. Standard figures on collector efficiency and kWh output have been used in this assessment. The exact location, area of required panels and generation output would be dependent on the specific make and model of panel used and results of in depth PV shading and output analysis.

6.8. Gas Absorption Heat Pumps vs Electric Air Source Heat Pumps

GAHPs, are not considered a renewable technology under the London Plan. The reasons are not entirely clear when compared with electric air source heat pumps which are considered a ‘renewable technology’ despite the fact both technologies use primarily energy generated from fossil fuels (mains gas and grid electricity) as their input energy. The advantages of using GAHP over air source heat pumps are;

- An environmentally friendly refrigerant. The natural ammonia/water “pair” used as the refrigerant has no environmental impact whatsoever.

- Minimal reduction in operating efficiencies in cold weather. GAHP efficiency are also dependant on external temperature conditions however they can operate down to -20 ^{0}C with no appreciable decline in performance values which is adequate for the UK winter climate.

- Lower local operating efficiency but higher overall carbon savings. The direct use of gas at the point of source means that the CO2 emissions associated with the use of GAHP will be much lower than those of equivalent alternatives when operating, power generation and transmission efficiencies are taken into account. This is reflected in the carbon lower carbon emission factors assigned to gas in comparison with electricity used within the government’s approved SAP and iSBEM calculation methodology. The following example demonstrates the potential carbon savings of GAHP compared with conventional gas condensing boilers and electric air source heat pumps.

Robur GAHP-A Air Source Heat Pump providing 36.2kW of heating, operating for 60 hours per week / 6 months per year.

Gas Absorption Heat Pump (seasonal operating COP of 1.65)
= 1560 (hrs) x 25.7 (kW gas) x 0.198* (kgCO2/kWh gas)
= 7.9 Tonnes of CO2 per year

Gas-Fired Condensing Boiler (with a seasonal operating efficiency of 90%)
= 1560 (hrs) x 40 (kW gas) x 0.198* (kgCO2/kWh gas)
= 12.4 Tonnes of CO2 per year

Electric Air Source Heat Pump (seasonal operating COP of 2.95)
= 1560 (hrs) x 12.27 (kW electricity) x 0.517* (kgCO2/kWh elec)
= 9.9 Tonnes of CO2 per year

This shows typically that a Gas Absorption Heat Pump can produce Carbon Savings of;

- 36% over the most efficient condensing boiler

- 25% over current generation electric heat pumps

*CO2 emissions figures for gas (0.198kg/kWh) and electricity (0.517kg/kWh) throughout this report are taken from SAP 2009.

This demonstrates that our proposed choice of main space heating and hot water heating system will provide significant savings over the use of an electric air source heat pump. As an air source heat pump could have been specified as a system to provide

6.9. Conclusion

Given the nature of the site and the proposed development, a combination of solar thermal and solar PV provides the optimum provision of renewable energy, achieving a 20% reduction in CO_2 emissions based on SAP 2009 emission figures for gas and electricity. We believe that the combination of measures recommended above provides a satisfactory response to the requirements of both the London Plan and Camden Councils SPG3. The table below shows the overall carbon emissions and savings from each stage including the renewable element.

Emissions	Tonnes CO_2 per annum		
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After Renewables (Be Green)	5629	0	36%	20%
Total Cumalative Savings	12932	1700	56%	39%

In addition, the example detailed in section 6.8 demonstrates that our proposed choice of main space heating and hot water heating system (Gas Absorption Heat Pump) will provide significant savings over the use of an electric air source heat pump. As an air source heat pump could have been specified as a system to provide the 20% renewable contribution, the proposed system described here (GAHP and a combination of solar thermal and solar PV) will provide a greater overall reduction in CO_2 emissions for the development as a whole.