Energy & Sustainability Statement

22 Lancaster Grove, London, NW3 4PD

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ENERGY RATING SERVICES

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EXECUTIVE SUMMARY

Energy Rating Services (ERS) has been appointed to prepare an Energy & Sustainability Statement for the proposed development at 22 Lancaster Grove, London, NW3 4PD.

The proposal is to build a residential unit with lower ground, two storeys above and loft space located in an urban residential area in London. The development aims to achieve high levels of sustainability and energy efficiency, by incorporating building fabric enhancement, sustainable design strategies and renewable technologies.

This energy and sustainability report outlines the key measures to be incorporated in the design, in regards to sustainability, carbon emissions, renewable energy and environmental Impact of the development, in accordance with:

- CS13 - Tackling climate change through promoting higher environmental standards
- DP22 - Promoting sustainable design and construction
- DP23 – Water
- Camden Planning Guidance: Sustainability CPG3
- London Plan; Chapter 5, policies 5.2 to 5.8

MAIN CONSIDERATION

The above documents set out the Council's sustainable design and construction requirements. The Camden Planning Guidance specifies that new residential developments need to deliver Code for Sustainable Homes (CSH) Level 4 as a minimum requirement.

Moreover, a 35% reduction improvement on 2013 Building Regulations levels of carbon dioxide emissions is required, unless it can be demonstrated that such provision is not feasible.

Based on that, the development requires achieving CSH Level 4, to satisfy CPG3 requirement, as well as installing renewable technology to reduce the carbon emissions by 35%.

Based on the incorporation of the 'good practice' energy efficiency measures "be lean", "be clean" & "be Green" included in the sustainability statement, the development's energy consumption and resulting carbon emissions are presented in Figure 1 & Table 1. Those measures correspond to the accumulated 35% reduction in CO2 emissions above Part L 2013 level, as required by the LP.

The LP reduction target and CSH level 4 target, could be achieved a combination of energy efficiency measures of fabric improvements and air tightness, moreover, ASHP with under floor heating for space heating and 8 kWp of solar PV panels.

The range of possible on-site renewable (also referred as low or zero carbon (LZC) energy sources) are outlined and assessed in this report, in terms of the feasibility, given site constraints and expected demand profiles. The estimated CO_2 savings are calculated based on the most feasible LZC options. Finally, the energy efficiency, renewable and other sustainability options are summarised with reference to the requirements of the planning guidance document.

All calculations within the report, analysing the proposed residential development, are based on SAP NHER, Plan Assessor approved software 6.1.

Energy & Carbon Demand Summary

Table 1 Energy and Carbon Reductions

	Energy demand (kWh)	Energy demand savings (%)	CO_2 Emissions (kg/yr)	CO_2 Emissions savings (%)
Proposed baseline scheme (Be lean)	96,179		20,484	
Proposed scheme after further energy efficiency measures (Be clean)	88,484	8%	17,780	13.2%
Proposed scheme after renewable savings (Be green)	75,958	14%	12,841	27.8%
Total		**22%**		**41%**

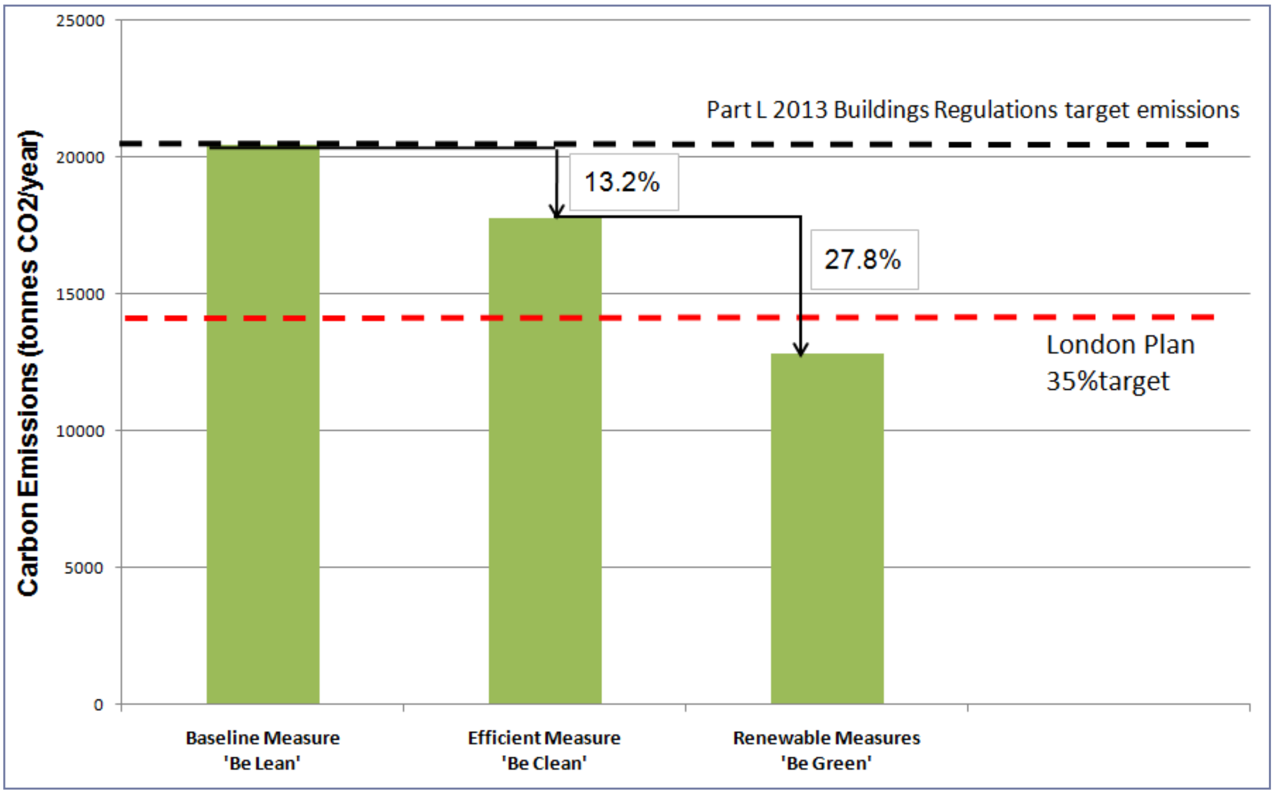

Figure 1 Carbon Emissions Reductions

As shown in Table 1, the provisional baseline annual energy consumption of the proposed development has been estimated to be 96,179 KWh/yr. The resulting annual carbon dioxide emission is 20,484 CO2Kg/yr.

The incorporation of energy saving measures and renewable energy sources, following a hierarchy of measures based on the priority given to different carbon reduction techniques, would reduce the energy requirement and CO2 emissions to 88,484 kWh/year and 17,780 kgCO2/year respectively. The total reduction with clean and green measures would result in a total of 41% reduction that is in comparison to the Part L 2013 Building regulations baseline as shown in Figure 1, achieving the CPG3 & LP target.

The primary importance was given to the reduction of the energy requirement. This was firstly achieved by the incorporation of good practice energy saving techniques ("be lean"). Then with the reduction of the losses associated with the supply of energy ("be clean"). Finally, when all the previous measures are incorporated, renewable technologies are considered ("be green") to achieve the optimum reduction.

The following energy saving strategies will be incorporated where possible to minimise the development's energy requirement (Energy Efficiency Measures):

- Low air permeability of facade
- Improved U-value
- High performance Low E glazing
- Highly efficient heating system
- Heat recovery system
- Energy efficient lighting

SECTION 1 INTRODUCTION

OBJECTIVE

This document has been prepared with reference to the **Camden Planning Guidance: Sustainability (CPG3)**, London Plan Policy Chapter 5 and DP22, it seeks to address at a preliminary level the requirements in terms of sustainability and renewable energy.

The proposed development has been treated to be self contained in terms of heating and hot water supply. However the potential for using distributed heating from a central energy centre has been considered.

SUMMARY

The proposed development comprises of a four storey residential development. The development is located in London. The development is in close proximity to Swiss Cottage Underground Station (approx 0.5miles) and to Belsize Park Underground Station (approx 0.4miles). The site is within the London Borough of Camden.

The key sustainability measures to be incorporated in the design are outlined in Section 2 below. Those correspond with the project's aspiration to achieve the best practically possible for this residential development, in terms of sustainability and energy.

Based on the incorporation of the 'good practice' energy efficiency measures included in the sustainability statement, the development's energy consumption and resultant carbon emissions are presented. For clarity these figures have been broken down by fuel type (electricity and fossil fuel, assumed in this case to be natural gas). The range of possible on-site renewables (also referred as low or zero carbon (LZC) energy sources) is then outlined and assessed in terms of the feasibility given site constraints and expected demand profiles. The estimated CO_2 savings are calculated based on the most feasible LZC options.

CALCULATION METHODOLOGY

All energy figures have been calculated using approved software NHER, SAP Plan Assessor calculator to provide evidence of compliance with the Building Regulations as well as amount of improved carbon emissions for the development. Report available in appendices.

The carbon emissions factors used in all calculations in this document are those published in Table 2 of Part L2A of the Building Regulations. The relevant factors are reproduced in Table 2.

Table 2 Carbon emissions factors by fuel type

Fuel	CO_2 emission factor ($kgCO_2/kWh$)
Natural Gas	0.194
Biomass	0.025
Grid supplied electricity	0.422
Grid displaced electricity	0.568

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SECTION 2 SUSTAINABILITY STATEMENT

2.1 INTRODUCTION

This section expands on the sustainability issues outlined in CPG3 planning requirement, Core Strategy Policy 8 LDF and the Development Management Policies.

The hierarchy followed in this project:

- Using less energy, in particular by adopting sustainable design and construction measures;
- Supplying energy efficiency, in particular by prioritising decentralised energy generation; and
- Using renewable energy.

Based on the hierarchy the project is following, sustainability and energy efficiency measures are the base of the design and applied as first step to achieve the carbon and energy reductions.

2.1.1 The unit Configuration

Table 3: Building specifications

Building Element	Proposed Specification
External Walls U-value	0.23
Floor U-value	0.15
Window units (whole window) U-value	1.4 Double glazing
Rooflight U-value	1.4 Double glazing
Roof U-value	0.13
Door U-value	1.4
Air Permeability m3/(h.m2) at 50 Pa	5
Low Energy Lighting	100%

2.2 CODE FOR SUSTAINABLE HOMES

This development is required to achieve Level 4 of the Code of Sustainable Homes assessment, to satisfy both the CPG3 and Core Strategy Policy 8 requirements. Achieving Level 4 of the Code for Sustainable Homes will result in satisfying all the sustainability requirements of CPG3. Please refer to the CSH pre assessment document in the appendices.

2.2.1 Energy efficiency

The energy efficiency targets stated in the planning guidance are expressed in terms of improvements over and above the requirements of building regulations 2013 Part L1A. For a development of this nature at least a 6% improvement, in excess of 'Pass' level, is likely to be achieved with consideration of the following energy efficiency measures:

- Building Fabric Energy efficiency & air tightness
- High efficient boiler
- Efficient lighting
- Low energy heating
- Heat recovery
- Variable speed drives
- Building energy management systems

2.2.2 Water

Reducing the daily water consumption to125 litre/person/day is one of the requirements of the Building Regulations, and 105 litre/ person for the CSH. This can be achieved by applying various water efficiency and reclamation / recycling measures.

Water Efficiency Measures

The following measures can be used to reduce the quantity of water demand to satisfy end users:

- Dual or low flush WCs
- Spray or aerating taps
- Water efficient appliances
- Low flow showers
- Smaller size bath

Water Reclamation / Recycling Measures

- Rainwater collection

Water collected from roofs or hard surfaces such as car parks can be harvested for storage and use for non-potable uses such as watering gardens and WC flushing.

Sustainable Drainage Systems (SUDS)

Sustainable drainage systems (SUDS) is an approach to manage surface water, aiming to reduce problems of flooding and pollution associated with traditional drainage systems. The basic principles are the reduction and attenuation of run-off from the site. This is achieved by exploiting or enhancing existing natural drainage systems and/or techniques modelled on them. Additional benefits such as increased amenity space or natural habitats can also accrue from the use of such systems.

The selection and design of SUDS is a multidisciplinary process that will involve above and below-ground drainage engineers and landscape architects working in consultation with the Environment Agency or other appropriate authority to determine specific requirements for reducing site run-off.

The planning guidance for 'Pass' level usually requires that 50% of the development's hard surfaces and conveyance systems are permeable.

2.2.3 Building Materials

The key issues to be addressed in the selection of materials and equipment are:

- Use of materials and equipment from sustainable sources
- Minimisation of in-use environmental impacts
- Minimisation of embodied environmental impacts
- Use of materials and equipment with high recycled content

2.2.4 Waste

A site waste management plan that provides details of waste minimisation, sorting, reuse and recycling procedures is required for all levels in the planning guidance. Sustainable waste management should follow the hierarchy described in *BS 5906: Waste management in buildings. Code of practice*. This outlines the following principles in decreasing order of desirability:

- Reduce waste
- Re-use materials and equipment (and facilitate future reuse)
- Recycle waste (and facilitate recycling)
- Compost biodegradable waste
- Recover energy from waste (and facilitate energy recovery from waste)
- Disposal

SECTION 3 ENERGY STATEMENT

3.1 OVERALL SITE ENERGY CONSUMPTION AND CARBON EMISSIONS

The development's overall carbon emissions will depend on the mixture of fuels used. Electricity generates zero carbon at the point of use but has a relatively high carbon emission factor due to the inefficiencies of generation (principally from natural gas and coal) and distribution. Natural gas has a lower carbon factor, even when on-site boiler efficiency and distribution losses are considered.

The carbon emission factors used for the calculations in this section are as follows:

- Grid Supplied Electricity 0.422 $kgCO_2$ / kWh
- Natural Gas 0.194 $kgCO_2$ / kWh

Total baseline annual energy consumption of this development has been calculated to be 96,179 kWh/yr and 20,484 kgCO2/yr of CO2 emissions.

By following the principals of be lean, be clean and be green, a high efficient condensing fired boiler in addition to PV panels, have been incorporated. Due to that, the total CO2 emissions was reduced to 12,841 kgCO2/yr, resulting in 41% reduction. As shown in Figure 1.

3.1.1 LOW CARBON ENERGY SOURCES (DISTRICT HEATING SCHEME/CHP)

DISTRICT HEATING SYSTEM

Policy 5.5 'Decentralised Energy Networks' of The London Plan requires the prioritising of connection to existing or planned decentralised energy networks where feasible. In addition Design and Construction SDP also states: Major development which is located within 500 m of an existing decentralised energy network should aim to connect to the network.

A district heating option has been considered as one of the first LZC technologies options as an opportunity of using waste heat which would be otherwise rejected into the atmosphere, this option is usually applied for large scale developments. Investigation was carried out to identify existing district heating schemes in local area of the development.

A study has been completed into the availability of existing heat networks in the vicinity of the development, onto which the development could potentially be connected. The London Heat Map Tool has been used to determine this. In addition to that, we have been in contact with Veolia to establish the feasibility of the connection. The feasibility of connecting the development to district heating or having its own CHP plant has been assessed alongside the London Heat Map Study for Camden Council.

The London Heat Map was used to plot the development site in relation to the available networks. The site of 22 Lancaster Grove does not show a current potential for a District Heating Transmission line, as there is no nearby decentralized energy network available , as shown in the image below.

Nevertheless, to future proof the scheme, space provision has been allowed in the proposed energy centre for heat exchangers, should a suitable area wide district scheme be realised in the vicinity of the site.

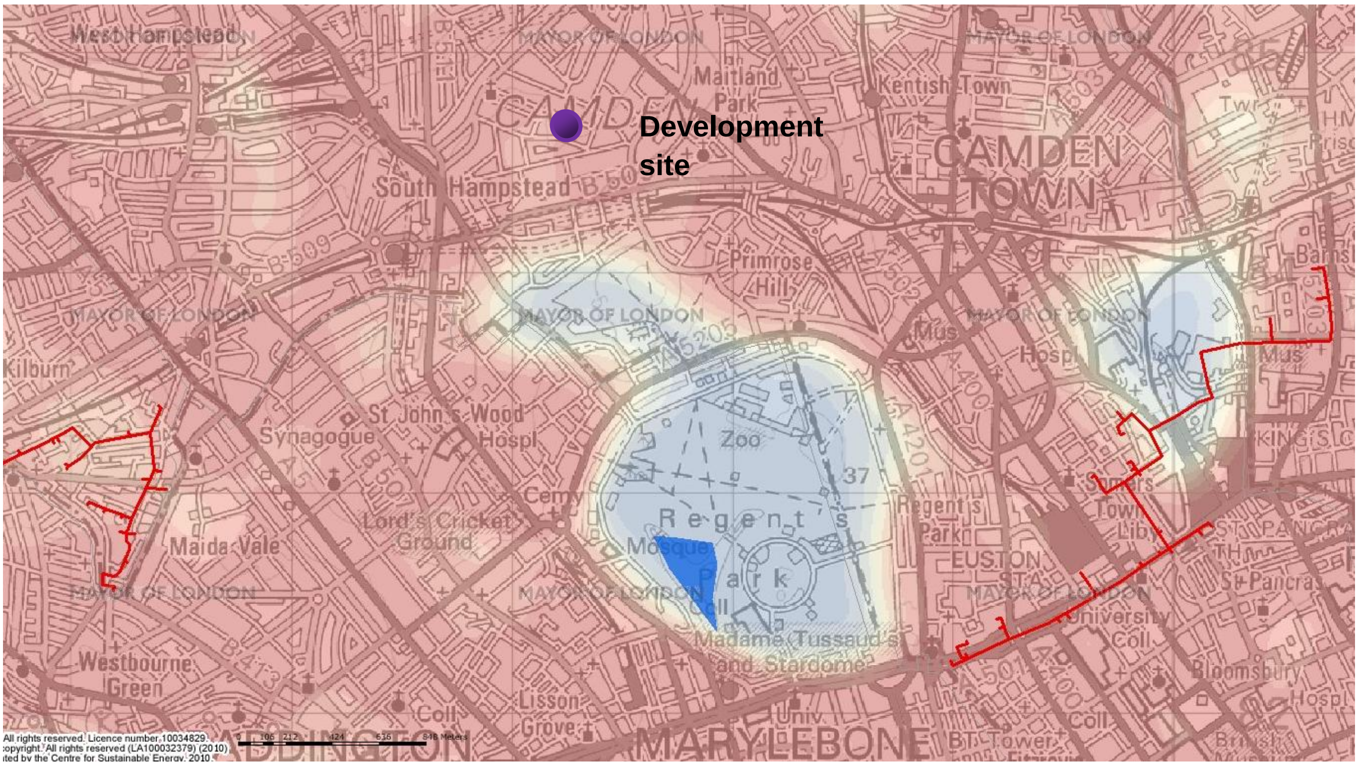


Figure 2 Site location on the London Heat Map

Combined Heat and Power (CHP)

Communal heating and hot water with gas fired CHP (Combined Heat & Power) plant is considered not to be an appropriate system to be used for this small scale development. To run efficiently the CHP requires to be constantly running, which would require a large heat sink/ buffer tank.

3.1.2 Renewable Energy Sources

Introduction

This section provides an overview of the technologies considered, a brief assessment of their feasibility, a proposed mixture of suitable technologies and finally an estimate of the achievable carbon reductions due to LZC energy sources.

Demand Profiles

The balance of technologies chosen will depend on the development's energy demand patterns. Dynamic thermal simulation will be necessary to provide the level of detail required for a more advanced LZC energy strategy. The renewable energy required for space heating and hot water might be supplied to the whole development. However, the renewable thermal energy might need to be topped up by conventionally generated space heating/ hot water to cover peak demands.

Keeping in mind that the space heating energy demand changes according to the season. While hot water energy demand will provide a significant base load throughout the year.

Electrical demand is likely to be moderate throughout the year. Lighting loads will be highest during the evening but will continue at reduced levels throughout the night and during the day.

FEASIBILITY

At this early stage in the design, it is possible only to outline the likely feasibility of specific technologies. A more advanced LZC energy strategy will be developed by the design team in conjunction with the client. Further descriptions of the LZC technologies below are included in Appendix C.

BIOMASS

Reliability of fuel supply, typically wood chips or pellets, has traditionally been an issue but increasing demand is improving the supply situation. Storage of fuel is also a potential issue, the volume of storage required will depend on the frequency of delivery and the fuel's energy density (pellets contain less moisture and have a higher packing density than chips, so their energy density is higher).

A biomass installation will be sized to meet the demand for baseline heating load and hot water. Biomass boilers however would need to be connected to hot water tank acting as a buffer to smooth peak hot water demand and also allows operating a boiler in optimal conditions. It is suggested that the LZC strategy includes sufficient biomass boiler capacity to meet the majority of the annual heat demand. In addition sufficient gas fired condensing boiler capacity can be installed to provide back up.

Nowadays, emissions of biomass boilers (particularly NOx and particulate matters) are a big issue especially in Central London.

Due to the site restriction to build an energy centre with adequate size storage space this proposal has not been considered to be feasible.

GROUND OR AIR SOURCE HEAT PUMP

Ground or air source is commonly used technique to provide buildings with heating and cooling via heat pumps. Closed vertical boreholes or active thermal piles are the main two ways feasible of extracting heat/"coolth" from ground. The system works most efficiently if annual heat and cooling energy supply by the system is in balance, so the ground will not become either too hot or cold resulting in loosing heating/ cooling potential over years. Bearing this in mind the ground source heating and cooling system needs to be carefully sized and designed.

Due to the complexity of design & high cost of installation of a Ground Source Heat Pump, this option has not been considered.

On the other hand, Air Source Heat Pump (ASHP) proves to be a feasible option for this development, due to the easy installation and the overall carbon reduction associated to it.

SOLAR THERMAL COLLECTORS

Solar thermal collectors (flat plate or evacuated tubes) convert solar thermal energy into heat for hot water generation. These are usually located on a roof oriented south facing in an ideal slope of 45 degree. Solar collectors in properly sized and designed provide approx 40% of annual hot water.

However, should a CHP unit be used for hot water generation then solar collectors will be redundant. As this option generate only hot water only for a period of time, it is unlikely to generate required energy to meet the planning policy and therefore hasn't been considered as an option.

PHOTOVOLTAIC

Solar photovoltaic (PV) technology price is declining in the recent years. It is an attractive option due to government FIT incentives which came into effect from April 2010. It can provide a guaranteed, but modest, contribution to the development's electrical demand. PV technology will form part of the LZC strategy. 1 kWp, of PV panels can produce approximately 850 kWh/ year of electricity in this region, reducing the grid energy requirement and CO2 emissions.

For this project 24 solar Photovoltaic panels are added (8 Kwp) for electricity generation, with a $38m^2$ of roof area requirement.

For this development, The PV option in conjunction with ASHP can reduce the CO2 emissions by 27.8%. Therefore, this is one of the beneficial and preferred options for this development.

WIND ENERGY

Small scale wind turbines, building integrated wind power, are proven and viable technology, the average surface roughness in built-up areas is high, leading to both reduced wind speeds and increased turbulence.

Due to insufficient open area for installation of a stand-alone wind turbine and planning issues this option has not considered in this development.

SECTION 4 CONCLUSION

Based on the results and outline figures, the proposed development of 22 Lancaster Grove, London, NW3 4PD, will satisfy both the Camden Planning Guidance CPG3 planning requirements and the London Plan requirements of sustainability, energy consumption and carbon emissions.

The energy demand and carbon emissions, could be reduced by introducing a combination of energy efficiency measures and on-site renewable. Based on the calculations and results achieved when those measures were applied, the development achieved a reduction of 41% in CO2 emissions based on the 2013 Regulations (Figure 1).

The new development will be designed with a high level of insulation and low air permeability to reduce heat loss as much as is practically possible, also the use of low energy lighting and A – Rated White goods are essential for the reduction of energy consumption.

Moreover, the control strategy throughout must be carefully designed to ensure the most economical operation of all equipment throughout the development.

To achieve the required reduction of carbon emissions and CSH level 4 target, several options were considered, the best option in regards to site location and the development size, was the Air Source Heat Pump, in conjunction with 8 Kwp solar Photovoltaic panels (about 24 panels) for electricity generation, with a $40m^2$ of roof area requirement.

These measures and options proved to satisfy the requirements of CPG3 planning requirement in regards to renewable energy and sustainability.

The baseline annual energy consumption of this development has been estimated to be 96,179kWh/yr and 20,484kg/yr of CO2 emissions. By incorporating on-site renewable/ LZC technologies the total CO2 emissions will be reduced to 75,958kg/year resulting in 41% reduction.

However, different possible renewable energy options have been identified, bearing in mind that selection is a complex process which requires a more detailed estimation of energy demand patterns. Therefore, further analysis will be undertaken as the design progresses.

APPENDICES

LOW OR ZERO CARBON ENERGY SOURCES

BIOMASS

Biomass is an alternative solid fuel to the conventional fossil fuels. In theory it is carbon neutral as the carbon emitted by burning is offset by the carbon absorbed during the growth of the plant. In reality, biomass fuel is not completely carbon neutral; there is a small carbon factor due to the energy used in processing and delivery.

Various types of biomass fuel are in use, the most common being the woody biomass, which includes forest residues such as tree thinnings, and energy crops such as willow short rotation coppice. Biomass is converted into a manageable form that can be directly fed to the heat or power generation plant, thus replacing fossil fuel. As a result, applications can range from large-scale heating boilers to individual house room heaters to combined heat and power generation (CHP). For building applications, the fuel usually takes the form of wood chips, logs and pellets. Wood pellets are essentially compacted high-density wood with low moisture content, thus having a higher calorific value per unit volume or weight.

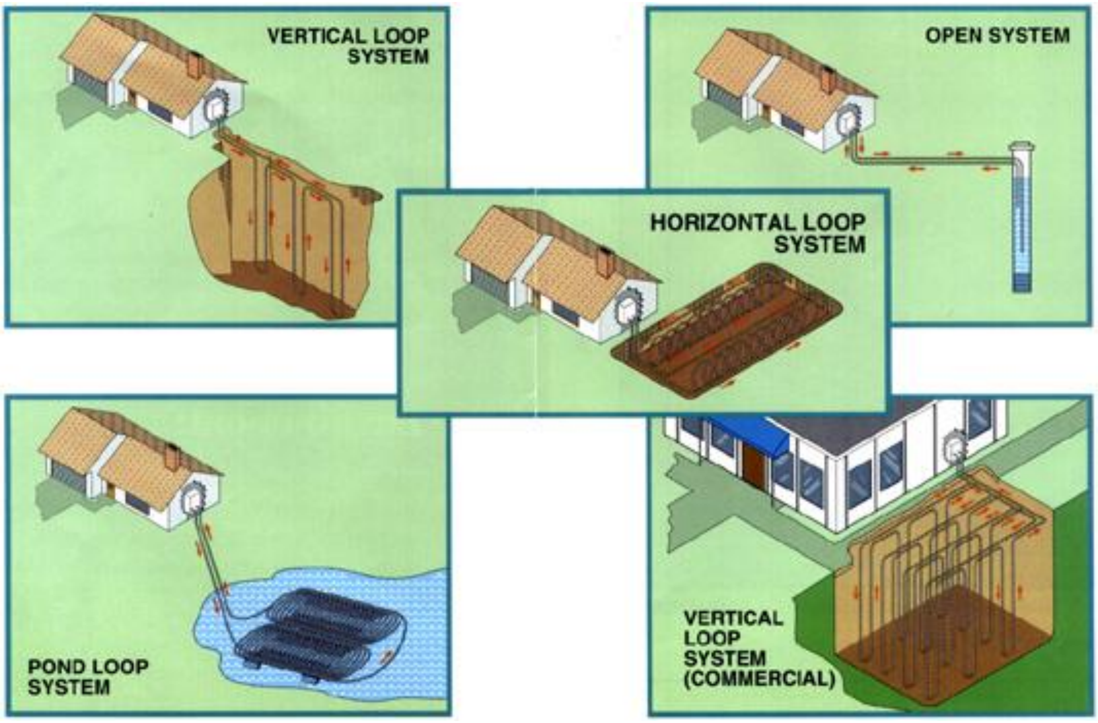
GEOTHERMAL ENERGY

Geothermal energy technologies use the heat energy stored in ground; either for direct-use applications: such as using the grounds' heat to defrost a driveway or the indirect use with additional equipment such as a geothermal heat pump. Most commercial installations couple a heat pump with the ground to upgrade the low-grade heat from the ground or ground water to a higher grade heat, where it can be used for heating purposes.

The suitability of a ground source system depends heavily on the type of earth coupling heat exchange system used:

GROUND SOURCE EARTH COUPLING OPTIONS

The right choice of appropriate heat exchanger depends on several factors such as: size of space heating/hot water system, available site area for the heat exchangers, and local ground conditions. Due to the specialist nature of this technology we recommend that a specialist is employed to size the heat exchangers based on a desk-top study of the site's geological conditions – this normally being required in advance of any other contractor appointment.



The main types of ground source heat exchanger

VERTICAL CLOSED LOOP SYSTEM

A frequently used and simple ground source heat exchanger, for a small to medium size project, is a closed loop vertical system. The system comprises of vertically drilled boreholes, usually up to 100 m deep, into which are inserted two polyethylene pipes with a U-shape connector at the base of the hole – effectively providing a flow down to the bottom of the hole and return back up to the surface. All the flow and return loops are connected together across the site - completing the entire heat exchange loop. Water is pumped around the loop and is then circulated around the heat pump to achieve the required heat exchange. The distance between boreholes is dependent on ground conditions but is typically a minimum of a 6mx6m grid, to prevent overlapping of the heat exchange process between loops.

HORIZONTAL CLOSED LOOP SYSTEM

Horizontal closed loop heat exchangers are usually applied to small projects such as individual houses, which usually require a relatively low heat output. Consisting of horizontal trenches 1.5-2m deep, with either straight pipes or ‘slinky’ coiled pipes, these require significant excavation work and significant site area to achieve appreciable outputs as such are not normally suited to medium to large projects.

VERTICAL OPEN BOREHOLES SYSTEM

A further option is a vertical open borehole system. The system involves the abstraction and discharge of natural ground water using boreholes; into which pumps are inserted, connected to collapsible pipework. Each borehole pump abstracts ground water, circulates it around the heat pump and then discharges the water back to the ground via an absorbing well, some distance from the original abstraction borehole. The system is capable of providing very high rates of heat exchange for a relatively small number of boreholes, which makes it very efficient in terms of site area required. However, this depends greatly on the availability of ground water, which in turn varies according to location. A major downside of this system is that the extraction of water from deep boreholes via pumps consumes a lot of energy, as the water has to be physically lifted to the surface by the pump – this in effect reduces the carbon emissions saved by this system as a whole.

Ground source heat exchange options in summary:

VERTICAL LOOP SYSTEM - CLOSED BOREHOLES

- moderate heat capacity
- relatively low installation cost

VERTICAL OPEN SYSTEM - OPEN BOREHOLES

- high heat capacity
- high running energy
- high installation cost

HORIZONTAL LOOP SYSTEM – STRAIGHT PIPES

- low capacity,
- high installation cost
- extensive ground excavation work

HORIZONTAL COILED LOOP SYSTEM – 'SLINKY' PIPES

- good capacity
- low installation cost
- extensive ground excavation work

HEAT PUMPS

Heat pumps are basically refrigeration units which work in reverse – instead of cooling being produced and heat rejected, the unit produces heat and rejects cooling. Conventional heat pumps use air as the medium to reject this 'coolth' to atmosphere. Ground source units use the ground as a means of improving the unit efficiency because the ground is a constant 11-13 °C at depths of 50m down – this suits the heat pump much better during the coldest weather than the extremes of air temperature. Reversible heat pumps can also be used for cooling, however this is not being considered further for this project.

A heat pump consumes electrical power to drive the compressor and other ancillary elements. The ratio between total energy input and heat energy output of the heat pump is a measure of its efficiency – usually referred to as 'Coefficient of Performance' - COP. A ground source heat pump has a higher COP than an air cooled heat pump – this additional energy effectively being the grounds' natural contribution to the system.

The heat produced by a heat pump is usually used to either provide space heating say to underfloor heating or radiators or the heat is used to generate domestic hot water via a storage vessel.

CHP

Combined heat and power (CHP) is a process involving simultaneous generation of heat and electricity, where the heat generated in the process in harnessed via heat recovery equipment. CHP at the large commercial size is now fairly common in premises which have a simultaneous demand for heating and electricity for long periods, such as hospitals, recreational centres and hotels. In addition, small CHP systems are now becoming available for individual houses, group residential units and small non-domestic premises. Compared with using centrally generated electricity supplied via the grid, CHP can offer a more efficient and economic method of supplying energy demand, if installed and operated appropriately, owing to the utilisation of heat which is normally rejected to the atmosphere from central generating stations, and by reducing network distribution losses due to local generation and use.

A small CHP unit – similar to the size of unit investigated

Heat generated will be used for space and water heating, and additional heat storage may be used to lengthen use periods, to assist in warm-up and to improve overall energy efficiency. For overall good energy efficiency, as with all CHP, usage must be heat demand led. Thus, a sophisticated control system is required and users should be made aware of efficient operating practices.

SOLAR THERMAL COLLECTORS

Solar thermal collectors (flat plate or evacuated tubes) convert solar thermal energy into heat for hot water generation. These are usually located on a roof oriented south facing in an ideal slope of 45 degree. Solar collectors properly sized and designed provide approx 50% of annual hot water demand.

For example approx. 35m2 flat plate solar collectors at cost of £24,000 generates around 11MWh of hot water resulting in 10% carbon savings.

However, should a CHP unit is used for hot water generation when solar collectors will be redundant.

PHOTOVOLTAIC

Photovoltaic modules convert sunlight directly into DC electricity and can be integrated into buildings. Photovoltaics (PVs) are distinct from other renewable energy technologies since they have no moving parts to be maintained and are silent. PV systems can be incorporated into buildings in various ways: on sloped roofs and fl at roofs, in façades, atria and shading devices. Modules can be mounted using frames or they can be fully incorporated into the actual building fabric; for example, PV roof tiles are now available which can be fitted in place of standard tiles.

Currently, a PV system will cost between £1500 and £2500 per kWp, and frequently part of this cost can be offset owing to the displacement of a conventional cladding material. Costs have fallen significantly since the first systems were installed (1980s) and are predicted to fall further still.

While single crystal silicon remains the most efficient flat plate technology (15–16% conversion efficiency); it also has the least potential for cost reduction. PV cells made from poly-crystalline silicon have become popular as they are less expensive to produce, although they have a slightly lower efficiency.

Thin film modules are constructed by depositing extremely thin layers of photosensitive materials on a low-cost backing such as glass, stainless steel or plastic. As much less semiconductor material is required as for crystalline silicon cells, material costs are potentially much lower. Efficiencies are much lower, around 4–5%, although this can be boosted to 8–10% by depositing two or three layers of thin film material. Thin film production also requires less handling as the films are produced as large, complete modules and not as individual cells that have to be mounted in frames and wired together. Hence, there is the potential for significant cost reductions with volume production.

Since PVs generate DC output, an inverter and other equipment is needed to deliver the power to a building or the grid in an acceptable AC form. The cost of the inverter and these 'Balance Of System' (BOS) components can approach 30% of the total cost of a PV system. Hence, simplification and cost reductions in these components over the coming years will also be necessary to make PV systems affordable.

WIND ENERGY

Wind power is the most successful and fastest spreading renewable energy technology in the UK with a number of individual and group installations of varying size, capacity and location. Traditionally, turbines are installed in non-urban areas with a strong trend for large offshore wind farms. In parallel with the design and development of ever-bigger machines, which are deemed to be more efficient and cost-effective, it is being increasingly recognised that smaller devices installed at the point of use, i.e. urban settings, can play an important role in reducing carbon emissions if they become mainstream.

At present there is a wide range of available off-the-shelf wind products, many manufactured in the UK and EU with proven good performance and durability. The dominant type is horizontal axis wind turbines (HAWT), which are typically ground mounted. Vertical axis wind turbines (VAWT) have limited market presence and there is a trade-off between lower efficiency and potentially higher resistance to extreme conditions. Capacity ranges from 500W to more than 1.5MW, but, for practical purposes and in built-up areas in particular, machines of more than 1kW and below 500kW are likely to be considered.

Wind technology is also currently one of the most cost-effective renewable energy technologies, which is attributable to the large scale of installations reducing the unit output cost. Individual building or community wind projects, although smaller, have the advantage of feeding electricity directly into the building's electricity circuit, thus sparing costly distribution network development and avoiding distribution losses. The downside is the still high capital cost per kW installed for smaller turbines, plus location constraints, such as visual intrusion and noise. The wind regime in urban areas is also a concern owing to higher wind turbulence which reduces the potential electricity output.

In most cases, wind turbines are connected to the electricity grid and all generated energy is used regardless of the building demand fluctuations. The output largely depends on the wind speed and the correlation between the two is a cube function. This means that in short periods of above-average wind speeds the generation increases exponentially. As a result, it is difficult to make precise calculations of the annual output of a turbine, but average figures can provide useful guidance to designers and architects. In reasonably windy areas (average wind speed of 6m/s) the expected output from 1kW installed is about 2500kWh annually.

The cost per kW installed varies considerably by manufacturer and size of machine with an indicative bracket of £2,500–£5,000. With a lifespan of more than 20 years, wind turbines can save money if design and planning are carried out in a robust way.

Building-integrated wind turbines are starting to be a reality in the UK, but potential projects may face difficulties with obtaining planning permission. There are a few examples now of permitted development rights for certain rooftop turbines in some local councils. A number of horizontal axis devices specifically designed for building integration are now available commercially, having design and reliability parameters relevant to the urban context. Building-mounted vertical axis devices are under development.

At present, turbines installed near buildings, as well as community installations for groups of buildings, should be regarded as the larger wind energy source related to buildings, when they contribute to the carbon emissions from these premises using 'private wire' networks. However, the contribution of several building-integrated turbines in a development is likely to become significant in the next few years.

L1A 2013 - Regulations Compliance Report

Design - Draft

This design draft submission provides evidence towards compliance with Part L of the Building Regulations, in accordance with Appendix C of AD L1A. It has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the 'as built' property. This report covers only items included within the SAP and is not a complete report of regulations compliance.

Assessor name	Mr Iraj Maghounaki	Assessor number	3611
Client		Last modified	15/09/2015
Address	22 Lancaster Grove, London, NW3 4PD		

Check	Evidence	Produced by	OK?
Criterion 1: predicted carbon dioxide emission from proposed dwelling does not exceed the target			
TER (kg CO_2/m^2.a)	Fuel = N/A Fuel factor = 1.55 TER = 16.44	Authorised SAP Assessor	
DER for dwelling as designed (kg CO_2/m^2.a)	DER = 10.52	Authorised SAP Assessor	
Are emissions from dwelling as designed less than or equal to the target?	DER 10.52 < TER 16.44	Authorised SAP Assessor	Passed
Is the fabric energy efficiency of the dwellling as designed less than or equal to the target?	DFEE 45.39 < TFEE 49.01	Authorised SAP Assessor	Passed
Criterion 2: the performance of the building fabric and the heating, hot water and fixed lighting systems should be no worse than the design limits			
Fabric U-values			
Are all U-values better than the design limits in Table 2?	**Element** / **Weighted average** / **Highest** Wall: 0.23 (max 0.30) / 0.23 (max 0.70) Party wall: (no party wall) Floor: 0.15 (max 0.25) / 0.15 (max 0.70) Roof: 0.13 (max 0.20) / 0.13 (max 0.35) Openings: 1.40 (max 2.00) / 1.40 (max 3.30)	Authorised SAP Assessor	Passed
Thermal bridging			
How has the loss from thermal bridges been calculated?	Thermal bridging calculated from linear thermal transmittances for each junction	Authorised SAP Assessor	
Heating and hot water systems			
Does the efficiency of the heating systems meet the minimum value set out in the Domestic Heating Compliance Guide?	Main heating system: Heat pump - wet system from database, Electricity Glow-worm Envirosorb2 12kW Secondary heating system: None	Authorised SAP Assessor	
Does the insulation of the hot water cylinder meet the standards set out in the Domestic Heating Compliance Guide?	Cylinder volume = 500.00 litres Declared cylinder loss = 2.58kWh/day Maximum permitted cylinder loss = 3.92kWh/day Primary hot water pipes are insulated	Authorised SAP Assessor	Passed
Do controls meet the minimum controls provision set out in the Domestic Heating Compliance Guide?	Space heating control: Time and temperature zone control - plumbing circuit Hot water control: Boiler interlock (main system 1) Cylinder thermostat Separate water control	Authorised SAP Assessor	Passed

Check	Evidence	Produced by	OK?
Fixed internal lighting			
Does fixed internal lighting comply with paragraphs 42 to 44?	Schedule of installed fixed internal lighting Standard lights = 0 Low energy lights = 40 Percentage of low energy lights = 100% Minimum = 75 %	Authorised SAP Assessor	Passed
Criterion 3: the dwelling has appropriate passive control measures to limit solar gains			
Does the dwelling have a strong tendency to high summertime temperatures?	Overheating risk (June) = Not significant Overheating risk (July) = Not significant Overheating risk (August) = Not significant Region = Thames Thermal mass parameter = 250.00 Ventilation rate in hot weather = 8.00 ach Blinds/curtains = None	Authorised SAP Assessor	Passed
Criterion 4: the performance of the dwelling, as designed, is consistent with the DER			
Design air permeability ($m^3/(h.m^2)$ at 50Pa)	Design air permeability = 5.00 Max air permeability = 10.00	Authorised SAP Assessor	Passed
Mechanical ventilation system Specific fan power (SFP)	Not applicable	Authorised SAP Assessor	
Have the key features of the design been included (or bettered) in practice?	Thermal bridging y value (0.031) is less than 0.04 Use of the following low carbon or renewable technologies: • Photovoltaic array	Authorised SAP Assessor	

Code for Sustainable Homes
TG November 2010 Addendum 2014 EN - Full Technical Guide
Pre-Assessment Report

Report Reference:	**PR2750**
Site Registration:	**005937-150902-52-2345**
Site Name:	**Lancaster Grove**
Assessor Number:	**STRO005937**
Company:	**Energy Rating Services.com Ltd**
Assessor:	**Iraj Maghounaki**

Site Details	
Site Name:	Lancaster Grove
Site Registration:	005937-150902-52-2345
Site Address:	22 Lancaster Grove
	Camden
City/Town:	London
County:	Greater London
Postcode:	NW3 4PD
No. of Dwellings:	1
No. of Dwelling Types:	2
Planning Authority:	Camden Council
Funding Body:	

Assessor Details	
Company:	Energy Rating Services.com Ltd
Assessor Name:	Iraj Maghounaki
Cert Number:	STRO005937
Address:	Second Floor
	27-31 High Street
	Kidlington
City/Town:	Oxford
County:	Oxfordshire
Postcode:	OX5 2DH
Tel:	01865378885
Email:	info@energyratingservices.com

Client Details	
Company:	
Contact Name:	XXX
Job Title:	
Email:	
Tel:	
Address:	
City/Town:	
County:	
Postcode:	

Architect Details	
Company:	
Contact Name:	XXX
Job Title:	
Email:	
Tel:	
Address:	
City/Town:	
County:	
Postcode:	

Developer Details	
Company:	
Contact Name:	XXX
Job Title:	
Email:	
Tel:	
Address:	
City/Town:	
County:	
Postcode:	

Dwelling ID	Plot No.	Address	Social Unit
1	1	22 Lancaster Grove	No

Development Summary & Ratings

Dwelling ID	Dwelling Type	Description	Level	Score
1	Houses		4	71.77

Deviations from Standard
No deviations from standard

Score Sheet for Lancaster Grove

	ENE									WAT		MAT			SUR		WAS			POL		HEA				MAN				ECO					Summary	
Dwelling ID	1	2	3	4	5	6	7	8	9	1	2	1	2	3	1	2	1	2	3	1	2	1	2	3	4	1	2	3	4	1	2	3	4	5	Score	Level
1	4.3	6	2	1	2	2	2	2	1	4	1	15	4	3	0	2	4	1	1	1	0	3	4	1	4	3	0	2	0	1	0	1	2	0	71.77	4

Summary Score Sheet

Dwelling Type: Houses

Dwelling ID: 1

	Credit Score	Credits Available	Score Assessment Sub Total	Credits Available	%	Weighting Factor	Points Score
Energy & CO2 Emissions							
ENE 1 Dwelling Emission Rate	4.3	10	22.3	31	71.94	36.4	26.18
ENE 2 Fabric Energy Efficiency	6	9					
ENE 3 Energy Display Device	2	2					
ENE 4 Drying Space	1	1					
ENE 5 Energy Labelled White Goods	2	2					
ENE 6 External Lighting	2	2					
ENE 7 Low or Zero Carbon Energy Technologies	2	2					
ENE 8 Cycle Storage	2	2					
ENE 9 Home Office	1	1					
Water							
WAT 1 Internal Water Use	4	5	5	6	83.33	9	7.5
WAT 2 External Water Use	1	1					
Materials							
MAT 1 Environmental Impact of Materials	15	15	22	24	91.67	7.2	6.6
MAT 2 Responsible Sourcing (Basic Building Elements)	4	6					
MAT 3 Responsible Sourcing (Finishing Elements)	3	3					
Surface Water Run-off							
SUR 1 Management of Surface Water Run-Off from Site	0	2	2	4	50	2.2	1.1
SUR 2 Flood Risk	2	2					
Waste							
WAS 1 Household Waste Storage and Recycling Facilities	4	4	6	8	75	6.4	4.8
WAS 2 Construction Site Waste Management	1	3					
WAS 3 Composting	1	1					
Pollution							
POL 1 Global Warming Potential of Insulants	1	1	1	4	25	2.8	0.7
POL 2 NOx Emissions	0	3					
Health & Wellbeing							
HEA 1 Daylighting	3	3	12	12	100	14	14
HEA 2 Sound Insulation	4	4					
HEA 3 Private Space	1	1					
HEA 4 Lifetime Homes	4	4					
Management							
MAN 1 Home User Guide	3	3	5	9	55.56	10	5.56
MAN 2 Considerate Constructors Scheme	0	2					
MAN 3 Construction Site Impacts	2	2					
MAN 4 Security	0	2					
Ecology							
ECO 1 Ecological Value of Site	1	1	4	9	44.44	12	5.33
ECO 2 Ecological Enhancement	0	1					
ECO 3 Protection of Ecological Features	1	1					
ECO 4 Change of Ecological Value of Site	2	4					
ECO 5 Building Footprint	0	2					
	Level Achieved: 4		Total Points Scored: 71.77				

Evidence for ENE 1 (Dwelling Emission Rate) - Houses
Improvement above Part L Building Regulations 2010. 4.3 credits allocated
Energy ENE 1
Assumptions for ENE 1

Evidence for ENE 2 (Fabric Energy Efficiency) - Houses
Detached 6 credits allocated
Assumptions for ENE 2

Evidence for ENE 3 (Energy Display Device) - Houses
Default Case: Electricity is the primary heating and current electricity. This will be displayed on a correctly specific device.
Assumptions for ENE 3

Evidence for ENE 4 (Drying Space) - Houses
Compliant internal drying space
Assumptions for ENE 4

Evidence for ENE 5 (Energy Labelled White Goods) - Houses
A+ rated fridge & freezers or fridge/freezer A rated washing machine and dishwasher, AND EITHER a tumble dryer (a washer-dryer would be an acceptable alternative to a standalone tumble dryer) with a B rating or where a tumble dryer is not provided, the EU Energy Efficiency Labelling Scheme Information will be provided.
Assumptions for ENE 5

Evidence for ENE 6 (External Lighting) - Houses
Compliant space lighting Compliant security lighting
Assumptions for ENE 6

Evidence for ENE 7 (Low or Zero Carbon Energy Technologies) - Houses
Contribution of low or zero carbon technologies greater than or equal to 15%
Assumptions for ENE 7

Evidence for ENE 8 (Cycle Storage) - Houses
4 bedrooms or more - Storage for 4 cycles per dwelling
Assumptions for ENE 8

Evidence for ENE 9 (Home Office) - Houses
Compliant home office
Assumptions for ENE 9

Evidence for WAT 1 (Internal Water Use) - Houses
Internal water use less than or equal to 90 litres per person per day
Assumptions for WAT 1

Evidence for WAT 2 (External Water Use) - Houses
Compliant individual rainwater collection system
Assumptions for WAT 2

Evidence for MAT 1 (Environmental Impact of Materials) - Houses
Mandatory requirements met: At least 3 elements rated A+ to D, 15 credits scored
Assumptions for MAT 1

Evidence for MAT 2 (Responsible Sourcing (Basic Building Elements)) - Houses
4 credits scored
Assumptions for MAT 2

Evidence for MAT 3 (Responsible Sourcing (Finishing Elements)) - Houses
3 credits scored
Assumptions for MAT 3

Evidence for SUR 1 (Management of Surface Water Run-Off from Site) - Houses
Mandatory Met: Peak rate of run-off and annual volume of run-off is no greater for the developed than for the pre-development. The system has also been designed for local drainage system failure.
Assumptions for SUR 1

Evidence for SUR 2 (Flood Risk) - Houses
Low flood risk - zone 1
Assumptions for SUR 2

Evidence for WAS 1 (Household Waste Storage and Recycling Facilities) - Houses
Mandatory requirements met: Adequate storage of household waste with accessibility in line with checklist WAS 1. Local authority collection: After collection sorting with appropriate internal storage of recyclable materials
Assumptions for WAS 1

Evidence for WAS 2 (Construction Site Waste Management) - Houses
Compliant site waste management plan containing appropriate benchmarks, commitments and procedures for waste minimisation in line with the criteria and with Checklist WAS 2a, 2b & 2c
Assumptions for WAS 2

Evidence for WAS 3 (Composting) - Houses
Individual compositing facility/facilities Local authority green waste collection scheme

Assumptions for WAS 3

Evidence for POL 1 (Global Warming Potential of Insulants) - Houses
All insulants have a GWP of less than 5
Assumptions for POL 1

Evidence for POL 2 (NOx Emissions) - Houses
Credit(s) not sought
Assumptions for POL 2

Evidence for HEA 1 (Daylighting) - Houses
Kitchen: Average daylight factor of at least 2% Living room: Average daylight factor of at least 1.5% Dining room: Average daylight factor of at least 1.5% Home office: Average daylight factor of at least 1.5% All rooms (kitchen, living, dining and where applicable the home office) have 80% of the working plane with direct light from the sky
Assumptions for HEA 1

Evidence for HEA 2 (Sound Insulation) - Houses
Detached property
Assumptions for HEA 2

Evidence for HEA 3 (Private Space) - Houses
Individual private space provided
Assumptions for HEA 3

Evidence for HEA 4 (Lifetime Homes) - Houses
All criteria of Lifetime Homes in line with all 16 principals of Lifetime Homes
Assumptions for HEA 4

Evidence for MAN 1 (Home User Guide) - Houses
All criteria inline with checklist MAN 1 Part 1 - Operational Issues will be met All criteria inline with checklist MAN 1 Part 2 - Site and Surroundings will be met
Assumptions for MAN 1

Evidence for MAN 2 (Considerate Constructors Scheme) - Houses
Credits not sought
Assumptions for MAN 2

Evidence for MAN 3 (Construction Site Impacts) - Houses
Monitor, report and set targets for CO2 production or energy use from site related transport Adopt best practise policies in respects to air (dust) pollution from site activities Adopt best practise policies in respects to water (ground and surface) pollution 80% of timer reclaimed, re-used or responsibly sourced
Assumptions for MAN 3

Evidence for MAN 4 (Security) - Houses
Credit not sought or no secure by design undertaken
Assumptions for MAN 4

Evidence for ECO 1 (Ecological Value of Site) - Houses
Land of low ecological value, achieved through checklist ECO 1. Development site has been identified as low ecological value by a suitably qualified ecologist
Assumptions for ECO 1

Evidence for ECO 2 (Ecological Enhancement) - Houses
Credit not sought or no compliant enhancement
Assumptions for ECO 2

Evidence for ECO 3 (Protection of Ecological Features) - Houses
Ecological features will be adequately protected and maintained
Assumptions for ECO 3

Evidence for ECO 4 (Change of Ecological Value of Site) - Houses
Neutral: Greater than -3 and less than or equal to +3
Assumptions for ECO 4

Evidence for ECO 5 (Building Footprint) - Houses
Credit not sought
Assumptions for ECO 5

Assessor Declaration

I Iraj Maghounaki, can confirm that I have compiled this report to the best of my ability, I have based all findings on the information that is referenced within this report, and that this report is appropriate for the registered site.

To the best of my knowledge all the information contained within this report is correct and accurate. I have within my possession all the reference material that relates to this report, which is available for inspection by the client, the clients representative or Stroma Certification for Quality Assurance monitoring.

Signed:

Iraj Maghounaki
Energy Rating Services.com Ltd
16 September 2015

Core 1.0.0.236

Information about Code for Sustainable Homes

The Code for Sustainable Homes (the Code) is an environmental assessment method for rating and certifying the performance of new homes. It is a national standard for use in the design and construction of new homes with a view to encouraging continuous improvement in sustainable home building. The Code is based on EcoHomes©.

It was launched in December 2006 with the publication of 'Code for Sustainable Homes: A stepchange in sustainable home building practice' (Communities and Local Government, 2006), and became operational in England from April 2007.

The Code for Sustainable Homes covers nine categories of sustainable design. Each category includes a number of environmental issues. Each issue is a source of impact on the environment which can be assessed against a performance target and awarded one or more credits. Performance targets are more demanding than the minimum standards needed to satisfy Building Regulations or other legislation. They represent good or best practice, are technically feasible, and can be delivered by the building industry. The issues and categories are as follows:

- Energy & CO2 Emissions
    - Dwelling Emission Rate
    - Building Fabric
    - Internal Lighting
    - Drying Space
    - Energy Labelled White Goods
    - External Lighting
    - Low or Zero Carbon Technologies
    - Cycle Storage
    - Home Office
- Water
    - Internal Water Use
    - External Water Use
- Materials
    - Environmental Impact of Materials
    - Responsible Sourcing of Materials - Basic Building Elements
    - Responsible Sourcing of Materials - Finishing Elements
- Surface Water Run-off
    - Management of Surface Water Run-off from the Development
    - Flood Risk
- Waste
    - Storage of Non-Recyclable Waste and Recyclable Household Waste
    - Construction Site Waste Management
    - Composting
- Pollution
    - Global Warming Potential of Insulants
    - NOx Emissions

- Health & Wellbeing
  - Daylighting
  - Sound Insulation
  - Private Space
  - Lifetime Homes
- Management
  - Home User Guide
  - Considerate Constructors Scheme
  - Construction Site Impacts
  - Security
- Ecology
  - Ecological Value of Site
  - Ecological Enhancement
  - Protection of Ecological Features
  - Change in Ecological Value of Site
  - Building Footprint

The Code assigns one or more performance requirements (assessment criteria) to all of the above environmental issues. When each performance requirement is achieved a credit is awarded (with the exception of the four mandatory requirements which have no associated credits). The total number of credits available to a category is the sum of credits available for all the issues within it.

Mandatory minimum performance standards are set for some issues. For four of these, a single mandatory requirement is set which must be met, whatever Code level rating is sought. Credits are not awarded for these issues. Confirmation that the performance requirements are met for all four is a minimum entry requirement for achieving a level 1 rating. The four un-credited issues are:

- Environmental Impacts of Materials
- Management of Surface Water Run-off from Developments
- Storage of Non-Recyclable Waste and Recyclable Household Waste
- Construction Site Waste Management

If the mandatory minimum performance standard is met for the four un-credited issues, four further mandatory issues need to be considered. These are agreed to be such important issues that separate Government policies are being pursued to mitigate their effects. For two of these, credits are awarded for every level of achievement recognised within the Code, and minimum mandatory standards increase with increasing rating levels.

The two issues with increasing mandatory minimum standards are:

- Dwelling Emission Rate
- Indoor Water Use

For one issue a mandatory requirement at Level 5 or 6:

- Fabric Energy Efficiency

The final issue with a mandatory requirement for Level 6 of the Code is:

- Lifetime Homes

Further credits are available on a free-choice or tradable basis from other issues so that the developer may choose how to add performance credits (converted through weighting to percentage points) achieve the rating which they are aiming for.

The environmental impact categories within the Code are not of equal importance. Their relative value is conveyed by applying a consensus-based environmental weighting factor (see details below) to the sum of all the raw credit scores in a category, resulting in a score expressed as percentage points. The points for each category add up to 100.

The weighting factors used in the Code have been derived from extensive studies involving a wide range of stakeholders who were asked to rank (in order of importance) a range of environmental impacts. Stakeholders included international experts and industry representatives.

It is also important to note that achieving a high performance in one category of environmental impact can sometimes result in a lower level of performance for another. For instance, if biomass is used to meet heating demands, credits will be available for performance in respect of energy supplied from a renewable source, but credits cannot be awarded for low NOX emission. It is therefore impossible to achieve a total percentage points score of 100.

The Code uses a rating system of one to six stars. A star is awarded for each level achieved. Where an assessment has taken place by where no rating is achieved, the certificate states that zero stars have been awarded:

Code Levels	Total Points Score (Equal to or Greater Than)
Level 1 ★☆☆☆☆☆	**36 Points**
Level 2 ★★☆☆☆☆	**48 Points**
Level 3 ★★★☆☆☆	**57 Points**
Level 4 ★★★★☆☆	**68 Points**
Level 5 ★★★★★☆	**84 Points**
Level 6 ★★★★★★	**90 Points**

Formal assessment of dwellings using the Code for Sustainable Homes may only be carried out using Certified assessors, who are qualified ‘competent persons’ for the purpose of carrying out Code assessments.

Energy & CO2 Emissions
ENE 1: Dwelling Emission Rate **Available Credits:**10 **Aim:**To limit CO2 emissions arising from the operation of a dwelling and its services in line with current policy on the future direction of regulations.
ENE 2: Fabric Energy Efficiency **Available Credits:**9 **Aim:**To improve fabric energy efficiency performance thus future-proofing reductions in CO2 for the life of the dwelling.
ENE 3: Energy Display Device **Available Credits:**2 **Aim:**To promote the specification of equipment to display energy consumption data, thus empowering dwelling occupants to reduce energy use.
ENE 4: Drying Space **Available Credits:**1 **Aim:**To promote a reduced energy means of drying clothes.
ENE 5: Energy Labelled White Goods **Available Credits:**2 **Aim:**To promote the provision or purchase of energy efficient white goods, thus reducing the CO2 emissions from appliance use in the dwelling.
ENE 6: External Lighting **Available Credits:**2 **Aim:**To promote the provision of energy efficient external lighting, thus reducing CO2 emissions associated with the dwelling.
ENE 7: Low or Zero Carbon Technologies **Available Credits:**2 **Aim:**To limit CO2 emissions and running costs arising from the operation of a dwelling and its services by encouraging the specification of low and zero carbon energy sources to supply a significant proportion of energy demand.
ENE 8: Cycle Storage **Available Credits:**2 **Aim:**To promote the wider use of bicycles as transport by providing adequate and secure cycle storage facilities, thus reducing the need for short car journeys and the associated CO2 emissions.
ENE 9: Home Office **Available Credits:**1 **Aim:**To promote working from home by providing occupants with the necessary space and services thus reducing the need to commute.

Water
WAT 1: Indoor Water Use **Available Credits:**5 **Aim:**To reduce the consumption of potable water in the home from all sources, including borehole well water, through the use of water efficient fittings, appliances and water recycling systems.
WAT 2: External Water Use **Available Credits:**1 **Aim:**To promote the recycling of rainwater and reduce the amount of mains potable water used for external water uses.

Materials
MAT 1: Environmental Impact of Materials **Available Credits:**15 **Aim:**To specify materials with lower environmental impacts over their life-cycle.
MAT 2: Responsible Sourcing of Materials - Basic Building Elements **Available Credits:**6 **Aim:**To promote the specification of responsibly sourced materials for the basic building elements.
MAT 3: Responsible Sourcing of Materials - Finishing Elements **Available Credits:**3 **Aim:**To promote the specification of responsibly sourced materials for the finishing elements.

Surface Water Run-off
SUR 1: Management of Surface Water Run-off from developments **Available Credits:** 2 **Aim:** To design surface water drainage for housing developments which avoid, reduce and delay the discharge of rainfall run-off to watercourses and public sewers using SuDS techniques. This will protect receiving waters from pollution and minimise the risk of flooding and other environmental damage in watercourses.
SUR 2: Flood Risk **Available Credits:** 2 **Aim:** To promote housing development in low flood risk areas, or to take measures to reduce the impact of flooding on houses built in areas with a medium or high risk of flooding.

Waste
WAS 1: Storage of non-recyclable waste and recyclable household waste **Available Credits:** 4 **Aim:** To promote resource efficiency via the effective and appropriate management of construction site waste.
WAS 2: Construction Site Waste Management **Available Credits:** 3 **Aim:** To promote resource efficiency via the effective and appropriate management of construction site waste.
WAS 3: Composting **Available Credits:** 1 **Aim:** To promote the provision of compost facilities to reduce the amount of household waste send to landfill.

Pollution
POL 1: Global Warming Potential of Insulants **Available Credits:** 1 **Aim:** To promote the reduction of emissions of gases with high GWP associated with the manufacture, installation, use and disposal of foamed thermal and acoustic insulating materials.
POL 2: NOx Emissions **Available Credits:** 3 **Aim:** To promote the reduction of nitrogen oxide (NOX) emissions into the atmosphere.

Health & Wellbeing
HEA 1: Daylighting **Available Credits:** 3 **Aim:** To promote good daylighting and thereby improve quality of life and reduce the need for energy to light the home.
HEA 2: Sound Insulation **Available Credits:** 4 **Aim:** To promote the provision of improved sound insulation to reduce the likelihood of noise complaints from neighbours.
HEA 3: Private Space **Available Credits:** 1 **Aim:** To improve quality of life by promoting the provision of an inclusive outdoor space which is at least partially private.
HEA 4: Lifetime Homes **Available Credits:** 4 **Aim:** To encourage the construction of homes that are accessible and easily adaptable to meet the changing needs of current and future occupants.

Management
MAN 1: Home User Guide **Available Credits:**3 **Aim:**To promote the provision of guidance enabling occupants to understand and operate their home efficiently and make the best use of local facilities.
MAN 2: Considerate Constructors Scheme **Available Credits:**3 **Aim:**To promote the environmentally and socially considerate, and accountable management of construction sites.
MAN 3: Construction Site Impacts **Available Credits:**2 **Aim:**To promote construction sites managed in a manner that mitigates environmental impacts.
MAN 4: Security **Available Credits:**2 **Aim:**To promote the design of developments where people feel safe and secure- where crime and disorder, or the fear of crime, does not undermine quality of life or community cohesion.

Ecology
ECO 1: Ecological value of site **Available Credits:**1 **Aim:**To promote development on land that already has a limited value to wildlife, and discourage the development of ecologically valuable sites.
ECO 2: Ecological enhancement **Available Credits:**1 **Aim:**To enhance the ecological value of a site.
ECO 3: Protection of ecological features **Available Credits:**1 **Aim:**To promote the protection of existing ecological features from substantial damage during the clearing of the site and the completion of construction works.
ECO 4: Change in ecological value of site **Available Credits:**4 **Aim:**To minimise reductions and promote an improvement in ecological value.
ECO 5: Building footprint **Available Credits:**2 **Aim:**To promote the most efficient use of a building’s footprint by ensuring that land and material use is optimised across the development.

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