ME7

1 RADLETT PLACE
LONDON NW8

RENEWABLE ENERGY STATEMENT AND SUSTAINABILITY REPORT FOR THE M&E SERVICES

JB/507 : October 2012

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M&E Consultants Energy Consultants

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INTRODUCTION

Our client is applying for planning permission to re-construct this family home and as part of the process, he is taking the opportunity to significantly enhance the sustainability of the rest of the house; including the potential for renewable technologies. 1 Radlett Place is proposed to be a new residential building which is to be constructed as a sustainable low carbon residential development, finished to a high quality and standard.

This report has been prepared by ME7 Ltd, to demonstrate how the development will achieve a low carbon status and covers the proposed sustainable design measures related to the building fabric and mechanical and electrical services.

The proposed building has been modelled using an accredited calculation methodology (SAP2009) and by an accredited energy assessor. Through use of appropriate passive and building fabric design as key points/measures below and energy saving measures, it is shown that the building will release lower net annual CO_2 emissions against baseline levels and satisfies the current Building Regulation Part L and The London Plan requirements.

Key points/measures proposed:

- A CO_2 reduction of 35.3% for the site over the baseline; confirming that the proposed dwelling exceeds the requirements of The London Plan 2011 and the National Planning Policy Framework.
- A 25.6%DER/TER improvement over the minimum Part L Building Regulations.
- 56.95 KW/Hr/M2 FEE – Fabric Energy Efficiency rating.
- Corresponding NOx emission reduction and inclusion of new efficient heating plant.
- A Code Sustainable Homes score of 70.18% - achieving Level 4 Design Stage certification from BRE; confirming the proposed house is a very sustainable dwelling.
- Reusing/recycling and salvage existing materials where possible.
- Reducing water consumption through rainwater harvesting and flow restrictors.
- Utilisation of natural shading, orientation and planting.
- Fully insulating the building and providing double glazed windows to all windows – low U values.
- Increase in air tightness to the building fabric – figure of 5M3/M2/Hr@50Pa.
- Heat recovery ventilation throughout – thermal wheel 85% efficiency.
- New materials to be responsibly sourced and life cycle reviewed.
- Inclusion of a renewable energy system.
- Data logging/internal digital metering/control for efficient management of the building.

Owing to the above improvements over the minimum Part L requirements, the PEA (Predicted Energy Assessment – Outline EPC), the efficiency rating is Grade B (84) and the CO_2 impact rating is Grade B (87).

Included within the report is an appraisal of various renewable technologies, demonstrating their viability and appropriateness to the environment and nature of the development.

It is proposed that a gas fired combined heat and power (CHP) system will be suitable for providing lead heating and electricity to some of the occupied areas, with gas boilers for back up and domestic hot water production and main load. Coupled with renewable energy photo electric panels (PV) array as a further CO_2 reduction. This combination will significantly reduce CO2 emissions and be well matched to the building.

The CHP and PV systems will reduce the CO_2 emissions, thereby increasing the PEA. All renewable and heat technologies are eligible for government backed FIT (Feed In Tariffs) payments for a period of 20 years. RHI details TBC.

Cooling is proposed to some parts of the house, this will be provided by highly efficient GSHP (Ground Source Heat Pump) with efficiencies of 5.78COP/5.40EER via vertical closed loop boreholes.

A detailed description of the proposed electrical and mechanical systems is also included within the report, detailing the energy efficient and sustainable design measures to be incorporated.

Full assessment modelling/calculations/reports demonstrating compliance, including energy statement, SAP L1A and PEA (Pre-EPC); can be found in the main sections and appendices of this report.

The M&E proposals outlined in this report are in line with the London Plan Plan 2011 and the National Planning Policy Framework, Camden's Development Control DPD Policies; DP22 and DP23, Core Strategy document CS13 and CPG3, for new dwellings. The proposals also have regard to the guidance contained within CPG Sustainability (April 2011).

Section 1.0

RENEWABLE ENERGY STATEMENT

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RENEWABLE ENERGY STATEMENT

OG: October 2012

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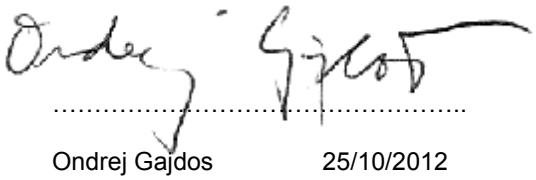
RENEWABLE ENERGY STATEMENT

This Document has been prepared to confirm the Energy and Sustainability solutions for the related M&E Building Services.

For details of the proposed Development refer to Architect drawings and details.



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Ondrej Gajdos 25/10/2012

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ME7 Ltd are committed to providing Sustainable and
Environmental solutions for Building Engineering Services

I N D E X

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DISCLAIMER

The findings, conclusions and recommendations of this report are based on the information supplied. ME7 Ltd disclaims responsibility in respect of incorrect information imparted to them or for the actual performance of any of the building services installations.

This Report is prepared for the use of 1 Radlett Place; a duty of care is not owed to other parties.

EXECUTIVE SUMMARY

ME7 Ltd have been appointed to provide an Energy Statement for the proposed development.

This statement covers possible active and passive measures including renewable energy sources to make this development sustainable and environmentally friendly.

Specific requirements of London Plan 2011 and the National Planning Policy Framework on Energy Efficiency and Renewable Energy will be met through a combination of passive design features, energy efficient building services and renewable energy sources. The target is to achieve reduction in regulated CO2 emissions of at least 25% against 2010 Part L1A to meet mandatory credits for CSH Level 4 under Ene1. Another target is to maximise the CO2 reductions by on-site renewable sources towards. This is to comply fully with the London Plan Policies and ensure they are following the "Energy Hierarchy". This document has been prepared in line with the GLA Energy Team Guidance on Planning Energy Assessments dated September 2011.

Baseline and all estimated energy consumptions have been calculated using full SAP 2009 assessment of the development in accordance with Part L procedures.

The table below shows a summary of energy requirements for baseline scheme and reduction proposed to be achieved by passive measures, efficient services and on-site renewable energy sources.

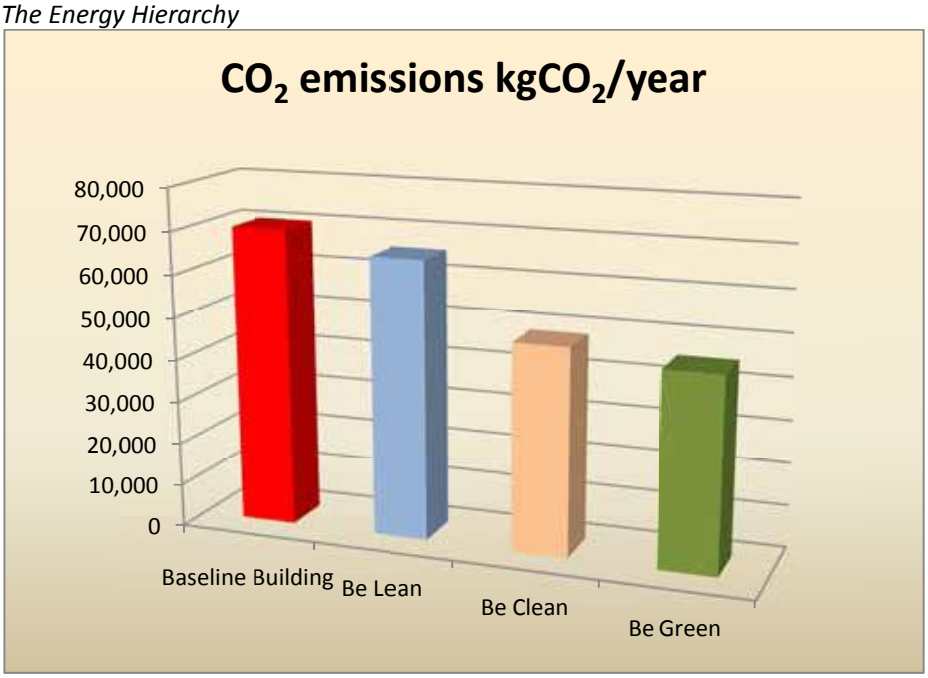
Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy

	Carbon dioxide emissions (kg CO2 per annum)		
	Regulated	Unregulated	Total
Baseline Building	57,529	12,659	70,187
After energy demand reduction	52,831	12,659	65,490
After CHP	35,822	12,659	48,480
After renewable energy	32,779	12,659	45,438

Table 2: Carbon Dioxide Savings from each stage of the Energy Hierarchy

	Carbon dioxide savings (kg CO2 per annum)		Carbon dioxide savings (%)	
	Regulated	Total	Regulated	Total
Savings from energy demand reduction	4,698	4,698	8.2	6.7
Savings from CHP	17,009	17,009	32.2	26.0
Savings from renewable energy	3,042	3,042	8.5	6.3
Total Cumulative Savings	24,749	24,749	43.0	35.3

Figure 1: The Energy Hierarchy



Recommended passive design measures and energy efficiency measures to reduce CO_2 emissions will include:

- Enhanced fabric and materials of exposed thermal elements. The thermal efficiency of the building is a major consideration by the applicants and designers. It is intended that the U-values of the external thermal elements shall be targeted toward following values:

External walls: 0.21 W/m^2K

Basement walls: 0.11 W/m^2K

Lower GF walls: 0.19 W/m^2K

Flat roof ground floor exterior: 0.16 W/m^2K

Other roofs: 0.18 W/m^2K

Basement floor: 0.17 W/m^2K

Windows, rooflights and external doors: 1.5 W/m^2K

Air Permeability Rate: 5 $m^3/h/m^2$ (@50 Pa)

Enhanced and Accredited construction details where applicable

- Efficient services, including:

Heat recovery ventilation with demand control, where applicable (PIR and CO2 sensors)

High efficiency condensing boilers, minimum 95% seasonal efficiency (e.g. Quinta Pro Eco)

Heating with time and temperature zone control and weather compensation control

Further reduction in CO2 emissions will be achieved by gas CHP (1 No Vitobloc 200 Module EM-18/36) and roof positioned PV array with 7 kWp output.
The above specification will achieve 25.6% reduction in DER against TER.

1.1 INTRODUCTION

Background

ME7 Ltd have been appointed to provide an Energy Statement for the proposed development.

This statement covers possible active and passive measures including renewable energy sources to make this development sustainable and environmentally friendly.

Description of the Site

The proposals include the demolition of the existing structures on site, and the erection of a new, high quality single family 8-bedroom dwelling with basement, lower ground, ground, first and second floor.

1.2 PLANNING FRAMEWORK

National Policy

Joining over 170 other nations the UK has committed to reduction of carbon dioxide emissions, with consequent constraints to its energy policy. The UK produced four percent of the world's greenhouse gases as of 2003. The long term reduction goal for carbon emissions is 60 percent decrease by the year 2050. According to Energy Review issued by Government in 2002 it was recommended that renewable sources should contribute 20% of energy generation by 2020. These figures were incorporated in Planning Policy Statement Note 22: Renewable Energy (2004) which became a base for local planning policies and is now the National Planning Policy Framework.
Relevant to the development are also Camden's Core Strategy CS13 and Development Management Policy DP22 plus the CPG3.

The London Plan 2011

The London Plan 2011 is the name given to the Mayor's spatial development strategy. The aim is to develop London as an exemplary sustainable world city, based on three interwoven themes.
2 Strong, diverse long term economic growth
3 Social inclusivity to give all Londoners the opportunity to share in London's future success
4 Fundamental improvements in London's environment and use of resources.

Specific requirements on development sustainability are set out in following hierarchy within section 5:

- **Using less energy**

Sustainable design and construction

This policy requires to meet the highest standards of sustainable design and construction including effective use of land and existing buildings, flexible use of buildings throughout their lifetime, avoiding internal overheating and other measures to reduce energy demand of buildings.

- **Supplying energy efficiently**

Decentralised Energy: Heating, Cooling and Power

This policy requires that major developments demonstrate that their heating, cooling and power systems have been selected to minimise carbon dioxide emissions. The need for active cooling systems should be reduced as far as possible through passive design including ventilation,

appropriate use of thermal mass, external summer shading and vegetation on and adjacent to developments.

- **Using renewable energy**

Renewable Energy

This policy requires that major developments show how the development would generate a proportion of the site's electricity or heat needs from renewable sources, wherever feasible.

1.3 BASELINE ENERGY CONSUMPTION AND CO_2 EMISSIONS

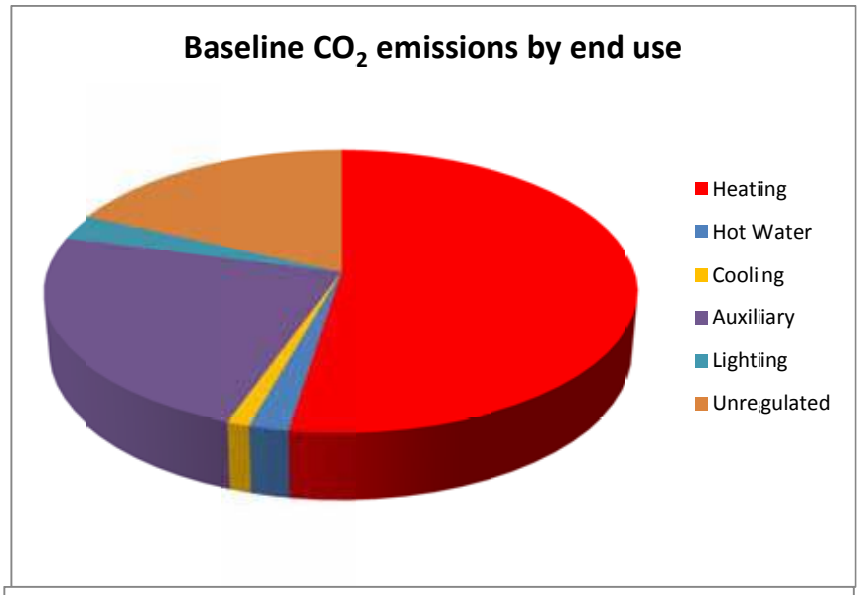
Energy assessment using SAP 2009 has been carried out with following input data:

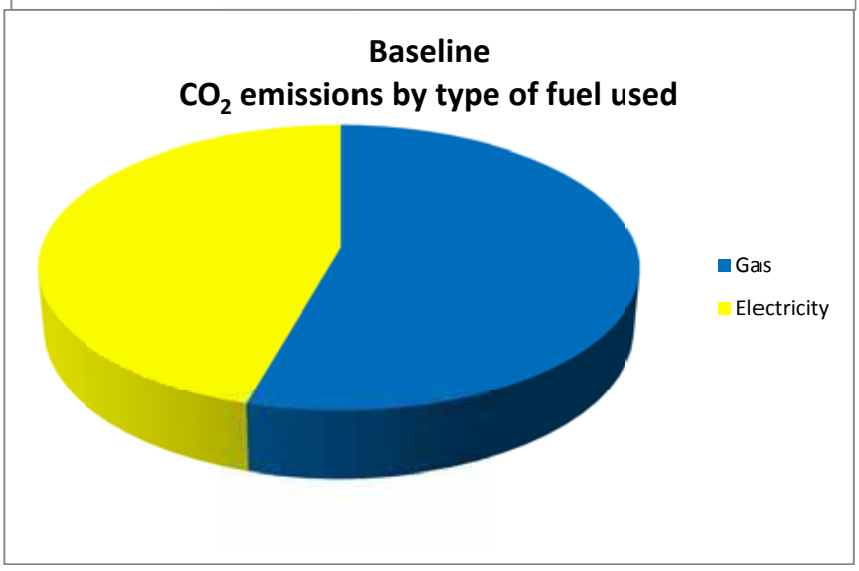
External walls:	0.25
Basement walls:	0.25
Lower GF walls:	0.25
Flat roof ground floor exterior:	0.25
Other roofs:	0.25
Basement floor:	0.25
Windows, rooflights and external doors:	1.60
Enhanced and Accredited construction details where applicable	Yes
Air Permeability	7
Space Heating and DHW System	High efficiency condensing boilers, minimum 95% seasonal efficiency, time and temperature zone control and weather compensation control
Space Cooling System	Ground source cooling with high EER 5.4 (Mitsubishi WR2 PQRY-P400)
Ventilation System	Heat recovery ventilation with demand control, where applicable
Energy Efficient Lighting	100%

As a result of baseline energy calculation, following values of energy and CO_2 emissions have been obtained. SAP 2009 carbon emission factors have been used for CO_2 emissions calculation.

Baseline energy consumption and CO_2 emissions by end use

	Delivered Energy		Emissions
	kWh/annum	Fuel	$kgCO_2$/annum
Heating	185,960	Gas	36,820
Hot Water	6,698	Gas	1,326
Cooling	1,448	Electricity	749
Auxiliary	32,158	Electricity	16,626
Lighting	3,884	Electricity	2,008
Unregulated	24,485	Electricity	12,659
Total:	254,633		70,187





1.4 PASSIVE DESIGN MEASURES AND EFFICIENT SERVICES (BE LEAN)

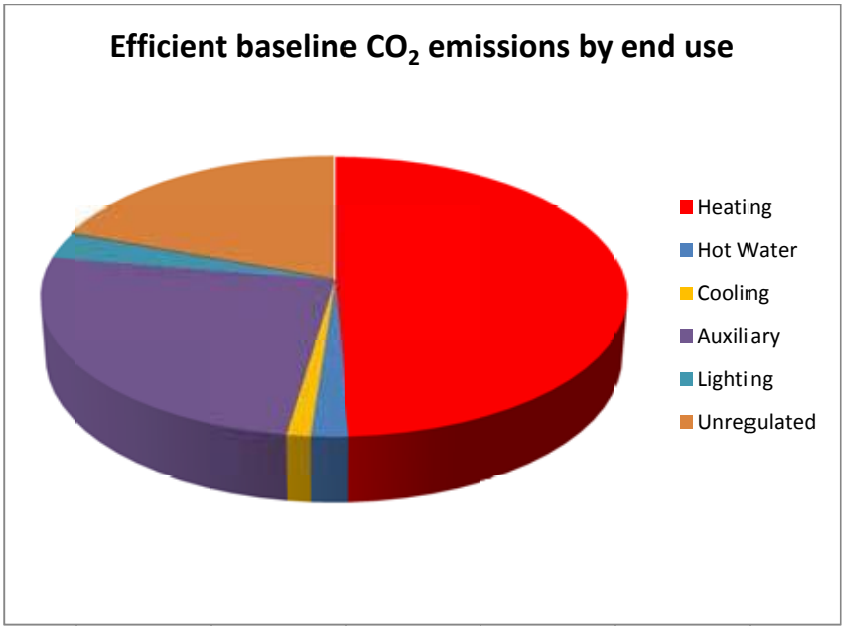
Number of passive design measures and measures improving energy efficiency of building services are proposed to help to reduce the CO2 emissions by 6.7%:

External walls:	0.21
Basement walls:	0.11
Lower GF walls:	0.19
Flat roof ground floor exterior:	0.16
Other roofs:	0.18
Basement floor:	0.17
Windows, rooflights and external doors:	1.50
Enhanced and Accredited construction details where applicable	Yes
Air Permeability	5
Space Heating and DHW System	High efficiency condensing boilers, minimum 95% seasonal efficiency, time and temperature zone control and weather compensation control
Space Cooling System	Ground source cooling with high EER 5.4 (Mitsubishi WR2 PQRY-P400)
Ventilation System	Heat recovery ventilation with demand control, where applicable
Energy Efficient Lighting	100%

Following figures have been obtained as a result of modelling the building with all the above mesures incorporated:

Efficient Baseline energy consumption and CO_2 emissions by end use

	Delivered Energy		Emissions
	kWh/annum	Fuel	$kgCO_2$/annum
Heating	162,916	Gas	32,257
Hot Water	6,346	Gas	1,256
Cooling (GSHP)	1,448	Electricity	749
Auxiliary	32,033	Electricity	16,561
Lighting	3,884	Electricity	2,008
Unregulated	24,485	Electricity	12,659
Total:	231,111		65,490

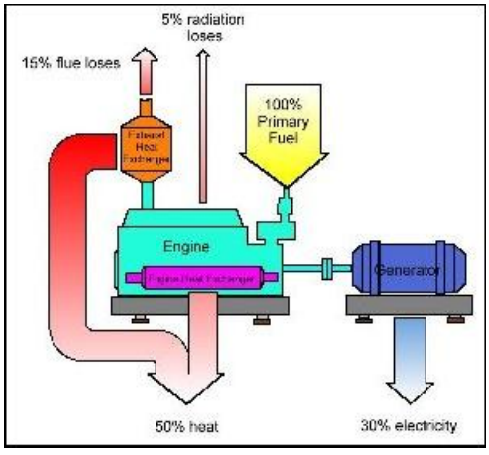


1.5 ON-SITE RENEWABLE ENERGY SOURCES (BE GREEN)

COMBINED HEAT AND POWER (BE CLEAN)

- **General information**

Although not using any renewable energy source, gas CHP helps to reduce CO2 emissions by delivering heat and electricity locally and reducing the losses that normally occur by conventional power plants. Produced electricity can be exported to grid if the on-site demand is lower than production.



- **Recommendations specific to this development**

A lead CHP which will provide heat for space heating and DHW will represent the best solution to reduce the CO2 emissions. Highest CO2 reduction will be achieved with 1 No Vitobloc 200 Module

EM-18/36 gas CHP which will be installed as the main heat source and will be capable of providing at least 66% of space heating and DHW energy demand across the year.

This solution will achieve a 26% reduction in CO2 compared to efficient baseline.

CHP Baseline energy consumption and CO_2 emissions by end use

	Delivered Energy		Emissions
	kWh/annum	Fuel	$kgCO_2$/annum
Heating	216,687	Gas	42,904
Hot Water	8,440	Gas	1,671
Cooling (GSHP)	1,448	Electricity	749
Auxiliary	32,033	Electricity	16,561
Lighting	3,884	Electricity	2,008
Unregulated	24,485	Electricity	12,659
CHP Electricity offset	-53,064	Electricity	-28,071
Total:	286,976		48,480

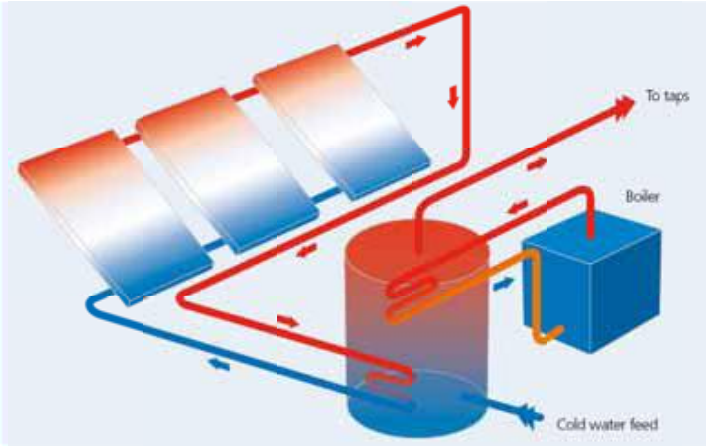
Following systems have been considered:

SOLAR HOT WATER (SHW)

- **General information**

Solar hot water systems for dwellings use collector which provides a separate heating circuit for hot water cylinder. This is usually backed up by electric immersion heater or other source of heat.
Two types of collectors are available:

- Flat Plate – less expensive, less efficient
- Evacuated Tube – more expensive and more efficient
- Hybrid PVT – Combined PV panels with SHW collector and or heat pump



- **Recommendations specific to this development**

Solar hot water panels are possible, however PV panels will be preferred due to lower maintenance requirements and higher CO2 savings per installed area. The proposed CHP is alos a more efficient and full use of heat and electrical energy.

AIR SOURCE HEAT PUMPS (ASHP)

- **General information**

An air source heat pump extracts heat from the outside air in the same way that a fridge extracts heat from its inside. It can extract heat from the air even when the outside temperature is as low as minus 15° C.

On 17 December 2008, the European Parliament adopted the EU Directive on promoting the use of energy from renewable sources. For the first time however, in addition to geothermal energy, aerothermal and hydrothermal energy are also recognised as renewable energy sources.

There are two main types of ASHP:

- **Air-to-water system** uses the heat to warm water. Heat pumps heat water to a lower temperature than a standard boiler system would, so they are more suitable for underfloor heating systems than radiator systems. Although some ASHP systems are capable of heating the water to the higher temperature, the efficiency is higher when using low temperature underfloor heating or low temperature fan convectors.

- **Air-to-air system** uses the heat to warm the indoor air. The air is heated through individual fan-coils or centrally and then distributed to rooms via ductwork

- **Recommendations specific to this development**

It is not advisable to use heat pumps along with CHP as these two low carbon technologies would "compete". CHP will achieve much higher CO2 savings than potential air source heat pump.

SOLAR PHOTOVOLTAICS (PV)

- **General information**

This system uses semi-conductor cells to convert solar energy into electricity. Two main types of PV panels are available:

- Monocrystalline – More expensive and more efficient
- Polycrystalline – Less expensive and less efficient

Depending on type, the output of 1 kWp (kilowatt peak) can be achieved by panels with area between 8 and 20 m^2.
The use of PV panels generally requires relatively large unshaded roof area where they can be mounted facing south, ideally having between 30° and 40° inclination.
The cost per tonne of CO_2 saved would be between £550 and £1,100

- **Recommendations specific to this development**

PV array with total installed output of at least 7 kWp is proposed for the roof installation on garage block. This system will produce 5,751.2 kWh of electricity per year.

Proposed Building energy consumption and CO_2 emissions by end use

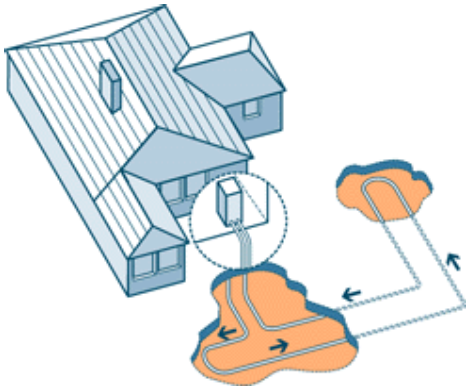
	Delivered Energy		Emissions
	kWh/annum	Fuel	kgCO_2/annum
Heating	216,687	Gas	42,904
Hot Water	8,440	Gas	1,671
Cooling (GSHP)	1,448	Electricity	749
Auxiliary	32,033	Electricity	16,561
Lighting	3,884	Electricity	2,008
Unregulated	24,485	Electricity	12,659
CHP Electricity offset	-53,064	Electricity	-28,071
PV Electricity offset	-5,751	Electricity	-3,042
Total:	286,976		45,438

GROUND SOURCE HEAT PUMPS (GSHP)

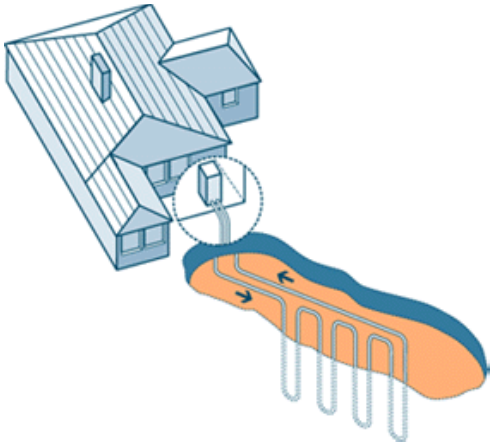
- **General information**

Ground source heat pumps use a buried ground loop which transfers heat from the ground into the building through heating distribution system. GSHP technology can be used both for heating and cooling. Two main types of GSHP are available:

- Horizontal loop is suitable for applications where sufficient area is available to accommodate horizontally buried pipes.



- Vertical loop system can be used where ground space is limited, but will require boreholes typically 15-150m deep, and is consequently more expensive to install than horizontal systems.



- **Recommendations specific to this development**

It is not advisable to use heat pumps along with CHP for heating as these two low carbon technologies would “compete”. CHP will achieve much higher CO2 savings than potential air source heat pump.

Ground source technology will however be used for this development to deliver high efficiency space cooling. High efficiency unit Mitsubishi WR2 PQRY-P400 will be used which will achieve seasonal cooling EER of 5.4. The use of the GSHP in heat recovery mode was explored but achieved less efficient results than the proposed CHP.

BIOMASS / BIOFUELS

- **General information**

Producing energy from biomass has both environmental and economic advantages. It is a carbon neutral process as the CO_2 released when energy is generated from biomass is balanced by that absorbed during the fuel's production.
There are two main ways of using biomass to heat a domestic property:

- Stand alone stoves providing space heating for a room. These can be fuelled by logs or pellets but only pellets are suitable for automatic feed. Generally they are 6-12 kW in output, and some models can be fitted with a back boiler to provide water heating.
- Boilers connected to central heating and hot water systems. These are suitable for pellets, logs or chips, and are generally larger than 15 kW.

- **Recommendations specific to this development**

Biofuels have been considered, but are ruled out due to negative impact on air quality and environmental issues surrounding liquid biofuels as currently there are no established standards relating to the sustainability of biofuels. Also, lorry movements to this particular site for deliveries is not ideal.

Owing to the above constraints a Biomass/biofuel system has been discounted for the proposed development.

WIND ENERGY

- **General information**

Wind power is a clean, renewable source of energy which produces no carbon dioxide emissions or waste products. The turbines can have horizontal or vertical axis (Darrieus type). Wind turbines use the wind's lift forces to rotate aerodynamic blades that turn a rotor which creates electricity. Most small wind turbines generate direct current (DC) electricity and are not connected to the national grid. A special inverter and controller is required to convert DC electricity to AC at a quality and standard acceptable to the grid if the turbine is to be connected to national grid.

- **Recommendations specific to this development**

Wind energy systems will not be considered due to negative visual effects, interference, flicker and noise risk. Exposure to wind would be limited by surrounding buildings/trees.

FUEL CELLS

- **General information**

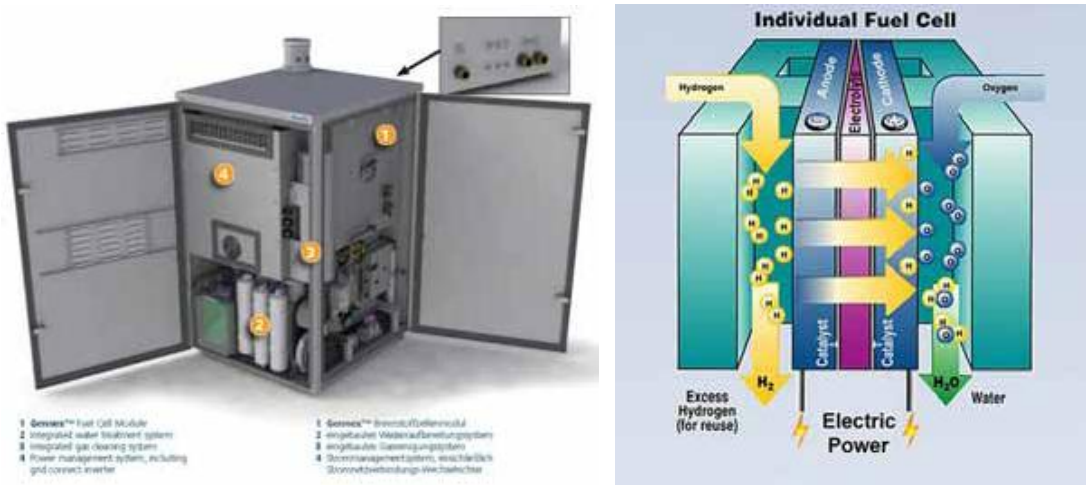
The cleanest way of using hydrogen and oxygen to produce power is by the use of fuel cells. The technology is over 150 years old since the first fuel cell was demonstrated by Sir William Grove in 1839.

Fuel cells are electro-chemical devices that operate at a high level of efficiency with little noise or air pollution. There are many potential applications for them, including electricity generation in stationary applications and provision of motor force for a new generation of transportation vehicles.

All fuel cells operate by converting chemical energy directly into electricity and heat, rather than oxidize (burn) a fuel. In most, but not all fuel cells, the source of the fuel's chemical energy is hydrogen. In some cases, the fuel may need to be processed, or reformed before it can be used in the fuel cell.

Fuel cells are currently very expensive. The small-scale Bluegen Ceramic Fuel cells costs £24,000 for a 2KWe unit with 1 KWh output and monthly maintenance/fuel stack warranty.

They can run on mains gas but this may not be classed renewable, LPG/biogas versions are more difficult to adapt and clog the stack and are not readily available. LPG or mains gas are not considered a renewable source of gas, even some parts of the gas network now utilise 10% renewable bio gas.



Small-scale fuel cells

- **Recommendations specific to this development**

This is discounted due to high costs and the number required to equate to the proposed CHP system.

Section 2.0

MECHANICAL SERVICES

2.0 MECHANICAL SERVICES

2.1 Incoming Utility Services

New gas and water utility supplies/meters will be provided to the building. The gas meter will be external to the building in a ventilated space and the water meter externally in an underground pit. (Soil conditions will confirm the water pipe material).

These will be sized to meet the demands of the building.

An additional KW/Hr gas sub-meter will be provided with a remote visual display installed to assist in energy monitoring and management as part of the audio visual system.

An additional water flow meter (L/S) will be provided with a remote visual display installed to assist in water monitoring and management as part of the audio visual system.

2.2 Design Conditions

External temperatures:

Winter -8°C saturated
Summer 32°C (DB) 20°C (WB)

Internal Temperatures:

Living Rooms	22°C
Kitchen/Dining	21°C
Bedrooms	19°C
Bathrooms	22°C
Hall/Circulation	19°C
Stores/Plant	16°C

2.3 Building Regulations Part L1A (2010)

The current part 'L1A' of the Building Regulations (2010), consists of minimum requirements for dwellings, briefly consisting of the following:

- Walls, roofs and ceilings need to have adequate resistance to loss of heat.
- Sufficient control needs to be provided for occupants to vary lighting levels, to avoid unnecessary energy use and maximise natural daylight.
- Adequate user control should be available for heating and cooling to avoid unnecessary energy use and maximise passive measures.

Part 'L1A' of the Building Regulations (April 2010), is also concerned with the conservation of fuel and power and its aim is to maximum the possible contribution that can be made to the Government's target for reducing CO_2 production whilst allowing flexibility for designers. This philosophy will be followed in our designs.

The measures to be implemented/investigated to reduce energy consumption are:

- Specifying an efficient heating system and if gas boilers utilised, these are to be high efficiency condensing boilers with very low NOX levels.
- Optimising the boiler selection for the building occupancy and reducing energy consumption through controls and management.
- Installing responsive controls and sub-zoning of the building to allow the part load, low energy and economical use of the system. (Adaptive to user occupancy).
- Review of thermal insulation techniques, limits and air tightness.
- Review of renewable energy sources to comply with the limits dictated by The Local Planning Authority and The London Plan.
- Minimising the effect of solar gain in a passive manner, to provide comfort conditions.
- Limiting fan power usage to noted requirements.
- Reviewing extract fan systems and utilising heat recovery and passive natural ventilation where possible.

- If cooling is utilised, to provide through a very efficient system.

2.4 Heating

The main lead space heating system will be a gas fired CHP with thermal store to enhance run times. The secondary system will be high efficiency condensing boilers with ultra low NOX levels (eg Broag Remeha Quinta Pro).

The CHP/boiler system will serve LTHW pressurised supplies to the majority of underfloor heating systems in the principal living and bedroom areas (High thermal mass floors). AHU heater batteries, radiators to secondary areas and towel rails to bathrooms will be served a separate summer circuit. LTHW supplies will also provide the secondary backup heating medium for the HWS system (Initial primary source is via the CHP unit. The CHP will provide 66% of the yearly space heating and HWS requirements.

The swimming pool water and environment will also be heated from the main boiler plant. (Lead/part load pre-heating to be provided by the CHP plant.

The CHP will be the lead unit – ensuring maximum run time and electricity production, with the boilers being arranged on a load sharing/part duty basis to ensure efficient use of fuel (eg. one boiler will be fully utilised for demand before another boiler is energised, thus ensuring optimum performance and condensing action with limited boiler starts). Controls will also be weather compensated and user occupation closely programmed and managed. Valved connections will be included for a future Camden wide heat network.

All pipework to be copper insulated and pex to underfloor systems.

All flues to pass directly to roof level via balanced flues/separate flues.
Fresh air and plantroom cooling via louvers at garage and ground/roof level.

All heating zones/spaces will be provided with zone valves, re-heaters, thermostat control or TRV's (Thermostatic radiator valves), to ensure efficient energy use.

All heating zones/spaces will also be controlled by user interface controls to programme occupancy, holiday periods and set back times; again to ensure efficient energy use.

2.5 Water Services

A fully pressurised water system will be provided throughout the property to ensure continuity of supply. If after testing a mains water pressure system is acceptable; this will be adopted. The system is to be installed in copper pipework to the sanitary/kitchen appliances.

The general pressure available throughout the system will be approximately 3 bar at the mixers/taps with flow rates accommodated to the sanitary appliances and shower mixer valves in accordance with the Part 'G' calculator and Code for Sustainable Homes; low flow/restrictors.

The system will operate on a variable speed pump principle to maintain a constant pressure throughout the system and limit energy use. Pressure regulating devices will be required to some areas. All sanitary fittings/plant will be individually and zone valved. All pipework to be copper insulated.

Consideration will be given to a leak detection system to provide early warning of any leaks in the systems, to minimise any water loss.

2.6 Domestic Cold Water

Sufficient cold water will be stored and boosted to provide continuity of supply. Filtered mains drinking water will be provided to the main kitchens and the basins within each principle en-suite bathroom.

Back up cold water mains supplies will be provided to the plantrooms for general swimming pool filter back washing and filling, primary source via rainwater recovery.

A full base exchange water softener will be provided within the main basement plantroom providing softened water to the hot water generator/cylinder, as well as all the baths and shower

accommodation. (Softened water will ensure optimum energy performance due to limiting scale build up in plant/pipework).

2.7 Domestic Hot Water
Hot water cylinder/generators located in the basement plantroom will be provided with boosted and softened cold water. The hot water generators shall be hot water cylinders complete with a small buffer storage cylinder, hot water cylinder system to be complete with a pumped return system. This combination of system minimises energy losses by not storing a large amount of hot water, yet has the advantage of ensuring that all peak demands will still be met from the CHP plant – maximising efficiency and CHP run time.

Hot water production shall be strictly controlled by weather compensation, timeclock control for occupancy holiday times and maximisation of plant duty. (Softened water will ensure optimum performance due to limiting scale build up in plant/pipework).

All basins, baths and sinks will be protected by TMV2 valves (Thermostatic mixing valves), above the minimum Part 'G' requirements.

2.8 Recycled Rainwater
The rainwater recycling drainage system (see 2.21), will provide recycled rain water for pool back washing and irrigation supplies. This will reduce the reliance on treated mains water.

Filters shall be provided to the system.

2.9 Natural Ventilation
Background habitable room ventilation is generally to be provided by trickle vents incorporated into windows or walls for some of the building.

Rapid ventilation to spaces will be provided by openable windows/continuous ventilation.

Consideration will be given to a PSV (Passive stack ventilation), system to bathrooms (wet areas), with humidity controlled trickle vents to habitable spaces.

2.10 Fresh Air Systems
Fresh air fan units (AHU's) with thermal wheel heat recovery (85%), are to be provided.
To provide ducted fresh air/extract to spaces, to fully comply with Part 'F' of the Building Regulations.
Ductwork to be pre-insulated PVC and galvanised steel with insulation or Kool duct.

The main kitchen is being considered for specialist supply and extract ventilation.

2.11 Bathrooms, Cloakrooms and Kitchen Ventilation
MVHR supply and extract ventilation units will be provided for the purposes of sanitary accommodation and utility ventilation. These dedicated fan systems shall comprise of isolated (low noise) ducted fan units located either within plant areas and discharge to the main roof areas.
Ductwork to be pre-insulated PVC and galvanised steel with insulation or Kool duct.

The main kitchen is being considered for specialist supply and extract ventilation.

2.12 Wine Cellar Environment
Due to the specialist nature of these rooms/cabinets and the contents stored within these rooms, there are very specific requirements when it comes to temperature/humidity. This is mainly for the protection of the room/cabinet contents and therefore dedicated equipment sized to cater for the required temperature and humidity loads will be provided.

2.13 Art Store Ventilation
The underground art store will be provided with heat recovery/humidity supply and extract ventilation.

The system is to be 3 – stage control for background (trickle), normal and smoke extract; controlled by sensors, timeclock and interlinked to the smoke detection system.

Due to the high thermal mass of the underground space and heat recovery ventilation, minimal heating load is expected.

2.14 Plantroom/Store Ventilation
The plantroom will be provided with MVHR supply and extract ducts from roof level and or fans suitably sized to provide fresh air and control heat build up.

2.15 Cooling
Firstly, the building has been designed to limit heat gains by; orientation, thermal mass, provision of green roofs, tree shading, semi underground spaces and overhanging slabs/roofs.

Cooling may also be considered to rooms/spaces.

This is proposed to be via a very high efficiency ground source (vertical borehole and horizontal sections) underground collector system (closed loop), This to be tied to WR2 Mitsubishi water cooled condensing plant in the basement plantroom serving internal DX AHU coils.

This system would operate at a COP of 5.7 COP.

The type of cooling for each room will be provided by a mixture of systems including cooling coils and horizontal re-cooling units mounted either within joinery or false wall/ceiling details.

Pre-insulated discharge ductwork will be attached to these units to discharge through high induction linear grilles incorporated within joinery and wall finishes at high level. The system will have very low noise levels, which is generally to be targeted at NR30 throughout the building.

A refrigerant gas sensor system will be incorporated to provide safety/protection in accordance with FGAS requirements, to all bedrooms and other rooms/spaces.
Internal pipework to be copper insulated, externally PE pipework.

Each room/space will have individual control via a remote room controller to each fan coil, controlled via a discrete room sensor for operation or modification to the set point of the controllers. Cooling and heating will be automatically controlled to ensure no system fighting and undue energy use (interlocked). Overall occupancy and holiday controls to also be provided to ensure efficient energy use and management.

2.16 Swimming Pool Environment and Water Treatment Plant
The swimming pool plantroom shall be constructed below the proposed pool below the terrace. This plantroom shall have mains water, LPHW heating mains, and electric mains routed via the service ducts from the mains and main plantroom to serve the plant within this area. The main equipment in this plantroom shall be dedicated to filter and condition the main pool water. In addition the pool hall environmental control unit (heat recovery/de-humidification), shall also be located in the plantroom. This unit shall provide heating as well as humidity control to the pool hall room. Conditioned air shall be ducted from this plantroom to distribution grilles located in the floor/ceiling of the pool hall via concealed ductwork. Exhaust air shall be ducted from high level via concealed ductwork back to the plantroom. Fresh air and exhaust air will be ducted to the plantroom from the garage roof via attenuators.

Pool water will be filtered and treated via ‘UV’ disinfection unit and trace dosing.

Pipework to be rigid PVC.

To minimise heat losses and energy use, the pool may be equipped with a thermal cover.

Energy efficient pre-heating of the pool water will be provided from the CHP system, depending on demand.

2.17 Automatic Controls
Automatic control systems will be provided for all of the mechanical services. It is anticipated this will be installed as a complete DDC electronic system supervised by a touch screen control/PC positioned within the basement plantroom of the main house with a mimic panel in the staff accommodation.

The client will also have the facility for zoned overrun of various systems and time switch control separate to the main plantroom, via a PC interlink situated within the study.

Full remote off site access will also be provided via a modem to this system enabling an ongoing maintenance contract to be provided with the system installers and for the occupiers to efficiently control the systems.

The system will have remote interface modules which will allow the client operation of the heating and cooling, lighting and other systems via the audio visual keypads. Where this is not provided, individual room control will be provided with more basic visual/manual controls.

Controls are to be zoned to provide more efficiency, occupancy control and management.

2.18 Above Ground Drainage
The above ground drainage system shall be provided to serve all the sanitaryware accommodation.

It is anticipated that either HDPE acoustic pipe or cast iron pipework will be provided, fully insulated for both thermal and acoustic reasons, with individual local run-outs individual to the sanitary accommodation being in good quality UPVC drainage pipework.
Installation of leak detection systems will be considered to detect leaking water hidden in areas such as voids and shower trays etc. This is being considered to protect the building fabric and internal fixtures and fittings.

2.19 Rainwater Drainage
All rainwater pipes will be routed from roof level to drain points at ground/lower ground floor levels. All roof outlets will be sized to take a rainfall intensity of 108 mm per hour. All pipes shall have access before connecting to underground drains. All external rainwater stacks are to be either aluminium or cast iron and where installed internally, the stacks shall be thermally/acoustically insulated.

Underground rainwater harvesting tanks will be provided within the surface water drainage system to collect water from the main roof areas for recycling for pool back washing and external irrigation.

The surface rainwater system will not only include these reservoir retention devices but also provide sufficient SUDS storage to limit the outfall to a level of rainwater discharge that currently exists for the site.

Green roofs are also proposed to be incorporated for the reduction of surface water runoff, increasing passive cooling by thermal mass and to encourage ecology.

Section 3.0

ELECTRICAL SERVICES

3.0 ELECTRICAL SERVICES

3.1 Incoming Utility Supply
A new main incoming TP&N supply connection will be provided to serve the new property which will be sized to suit the anticipated maximum building load.
UKPN have confirmed a sub-station is required for the development and future local supplies.
The incoming supply will be grid tied with the CHP and photovoltaic (PV) installations, allowing excess power to be exported to the grid network when not being utilised. The clients' Energy Supplier will install a suitable meter to facilitate energy export of the generated electricity.
The energy usage at the incoming position will be measured and inter-linked to the AV system providing the end-user with accurate power consumption data displayed on a visual display screen. This facility will provide the owner with a user-friendly interface for energy monitoring and management within the house.

3.2 Sub-main Distribution
Sub-main distribution boards will be installed to serve various areas within the building. This will reduce cable material costs and installation time.
The local sub-distribution boards will incorporate suitably rated MCBs and RCBOs to suit the circuit type and loading.
Separate dedicated feeds will be supplied to life safety systems, such as fire alarm equipment in suitable fire rated cabling.
Sub-main distribution cabling will be multi-core armoured with XLPE outer sheath and LSF inner sheath with copper conductors.
Adequate spare capacity will be provided within the distribution network for any future expansion of the system, avoiding the need for any significant re-modification works at a later period.

3.3 Final Circuit Distribution
Final circuit distribution cabling will be multi-core flat twin & earth XLPE/LSF sheathed copper conductors and will not be of the PVC/PVC type.
The XLPE (cross-linked polyethylene) cable material offers superior electrical performance to PVC and the LSF insulation produces 'low smoke and fumes' when exposed to fire.
RCBOs will be used which combine Residual Current and Overcurrent protection within a single device. Consequently each circuit will be individually RCD protected avoiding any nuisance tripping of unaffected circuits as would be the case if a split load distribution arrangement were adopted whereby many circuits are protected by a single RCD.

Either a battery backed UPS system or generator for minor supplies will be installed.

3.4 Small Power Installations
Single and twin 13A Switched Socket outlets will be provided at various positions within the property for general purpose use and to serve fixed electrical equipment.
The outlets will be positioned to offer the greatest flexibility for different interior space planning options and will be mounted at a suitable height for ease of access conforming to the Building Regulation Part M requirements.
Where the room/spaces are used as 'home offices' (e.g. where computers, printers etc. are installed causing potential earth leakage currents) then socket outlets will be of the Dual Earth connection type.
13A switched/un-switched fused connection units with neon lamps will be installed to serve various fixed items of electrical equipment.
All small power faceplate outlets will be sourced from a reputable manufacturer such as 'MK Electric' incorporating the required electrical safety standards and allowing ease of installation.

3.5 Interior Lighting Installations
The lighting scheme will utilise the latest low energy compact fluorescent and long life LED/CFL lighting technologies in order to achieve a minimum of 100% low energy lighting throughout the property, exceeding the requirement as stipulated in the Building Regulations Part L.
Dimming control will be provided to the majority of the lighting systems in the form of pre-set scene setting controlled from individual wall plates in each room/space and via a wireless/ hardwired visual display screen as part of the AV control system.
Consideration is also being given to allow energy usage from the lighting system to be monitored via the AV system.

In room/spaces with sufficient natural lighting, day-linked control of the artificial lighting is also being evaluated. Computational daylight investigation will be carried to principle living areas to ascertain the benefit of day-linked dimming controls.

Room/spaces which are not lit by natural daylight, in particular escape routes, will incorporate emergency standby lighting with up to 3hr battery back-up. Consideration for additional emergency lighting to all escape routes/pool side will be taken.
Special attention will be made to bathrooms and the pool area lighting scheme, ensuring the correct level of Ingress Protection (IP) rating is provided in accordance with the 'zoning' requirements of the IEE Regulations.

3.6 Exterior Lighting Installations
The external lighting installation will comprise of a combination of low energy compact fluorescent, LED, and Metal Halide lamp lighting. (Light outputs will not exceed Regulations).
Luminaires will be building facade mounted for night time perimeter security lighting and will be of the wall-wash type to avoid direct light pollution into the neighbouring community.
Ground recessed and low level ground mounted garden and pool amenity lighting will also be provided which will be limited in numbers to avoid excessive lighting and light pollution.
All external lighting will be daylight-linked via an adjustable external photocell and only switch on during periods of insufficient daylight. Manually adjustable time-clock control will also be provided to allow the occupier to adjust the time period and to switch off the lighting when not required.

3.7 Audio Visual Systems
The Audio Visual installation will generally include the following systems:

1. Lighting control and management via user-friendly wireless/hardwired touch screen visual display panels located throughout building to occupiers requirement.

2. Building energy monitoring via touch screen panels with scope for split monitoring of various loads e.g. lighting & power.

3. Heating, comfort cooling and ventilation control via touch screen panels.

4. Terrestrial and Satellite TV installation and control. For signal reception each TV will receive a single CAT 5e/6 cable input allowing multi-service viewing. Conventional coax cabling will not be installed saving on material and installation cost.

5. Hardwired broadband and telephone service in CAT 5e/6 cabling.

6. CCTV security monitoring around the vicinity of the building in CAT 5e/6 cabling with digital recording facility.

7. Audio and visual access control system to main building entrance(s)

3.8 Security System
A wired intruder alarm system will be provided comprising suitable room/space movement detectors, magnetic contacts to perimeter doors and window/door break glass detection. The system will be linked to a 24hr central monitoring station via a dedicated BT Redcare line and GSM. The design and installation will conform to ACPO policy and DD243 requirements for police response service.

3.9 Fire Detection and Alarm System
The building may come under the requirements of BS5839 Part 6. The final installation design will be agreed with the relevant parties, including the Local Fire Office (Fire Brigade) and Local Council District Surveyor.

To provide the highest degree of life and property protection a 'Type L1' category system may be employed and be appropriately zoned, allowing the local fire brigade to promptly identify the location/source of fire occurrence.

The system will have the appropriate level of standby battery back-up to operate under mains power failure.
All cabling will be fire rated to the appropriate required standard.
Generally smoke detectors, incorporating base sounder units will be installed throughout the premises except within the kitchen area, plant spaces and gallery – these will be heat detectors; to avoid nuisance alarm conditions. The plant room/kitchen areas will also have carbon monoxide (CO) detectors installed.
The gallery air extract system will be interfaced with the fire detection system, such that upon fire detection within the space, the extract system will run on full output to dissipate the heat/smoke build up. The gallery smoke extract system will be fed from a back-up supply power supply system.

Consideration will be given to an 'Ion' based (Air sampling), detection system in some principal areas.

3.10 Earthing & Bonding
All extraneous conductive parts will be bonded to the main building earth terminal with main equipotential and supplementary earth bonds as required.
Supplementary earth bonding will be provided to areas of increased electric shock risk including bathrooms, shower rooms, swimming pool area and plant rooms.
A separate additional earth electrode system will be provided for earth bonding of the swimming pool areas as required by the IEE Regulations.

3.11 Lift Installation
Provision for future goods and passenger lift shafts are proposed.

3.12 Lightning Protection
A lightning protection system will be installed to prevent damage to the building structure and mitigate; injury to people, physical damage (e.g. fire, explosion) and failure of internal electrical systems.
The system will be designed to intercept the lightning strike and safely discharge the high voltage current to earth via a network of lightning rods and metal conductors connected to an earth electrode designed to provide a low resistance path to earth.
To protect sensitive electronic equipment within the property from damage and failure resulting from transient over voltages (surges), caused by lightning strikes; a suitable surge arrester will be installed at the main supply intake and on data/phone lines and for sensitive equipment.

3.13 Electrical Appliances & Mechanical System Equipment
Most 'white goods', including the refrigerator/freezer, cooker, microwave oven, washing machine/dryer and dishwasher will be 'A' rated (or higher) energy efficient items under the EU energy label classification.
Other major electrical plant, including condenser units and water booster pumps sets will be selected where available and or practicable to incorporate energy efficient motors and intelligent energy saving controls.

Section 4.0

M&E SUSTAINABILITY ITEMS

4.0 M&E SUSTAINABILITY ITEMS

The main sustainable items are covered under the Code for Sustainable Homes pre-assessment in Appendix (i)

4.1 Daylighting

The proposed house has high levels of natural daylighting due to the glazing areas.

This is specifically covered in the Code for Sustainable Homes (CSH) pre-assessment in Appendix (i), HEA1 (Health and Well Being).

All main habitable rooms (Living rooms, kitchen and study), will achieve the minimum daylight factors and view of the sky for CSH.

4.2 Recyclable Materials

Each product/material for the M&E services shall be evaluated against Environmental impacts and life cycle costing. The following is a typical list of proposed M&E materials/products that will be utilised;

- Water pipework - Copper (Recyclable).
- Valves - Brass (Recyclable).
- Electrical cables - PVC twin & earth (XLPE/LSF) (Recyclable)
- Pipework insulation - Rock wool (Recyclable)
- Pipework Insulation - Phenolic foam – (Recyclable)
- Concrete - Portland cement based - (Recyclable)
- Light fittings – LED's/compact fluorescent - (Recyclable)

4.3 Salvage/Reuse of Existing Materials

Each existing material/product will be evaluated for possible salvage/reuse when existing items/materials are removed for the proposed works.

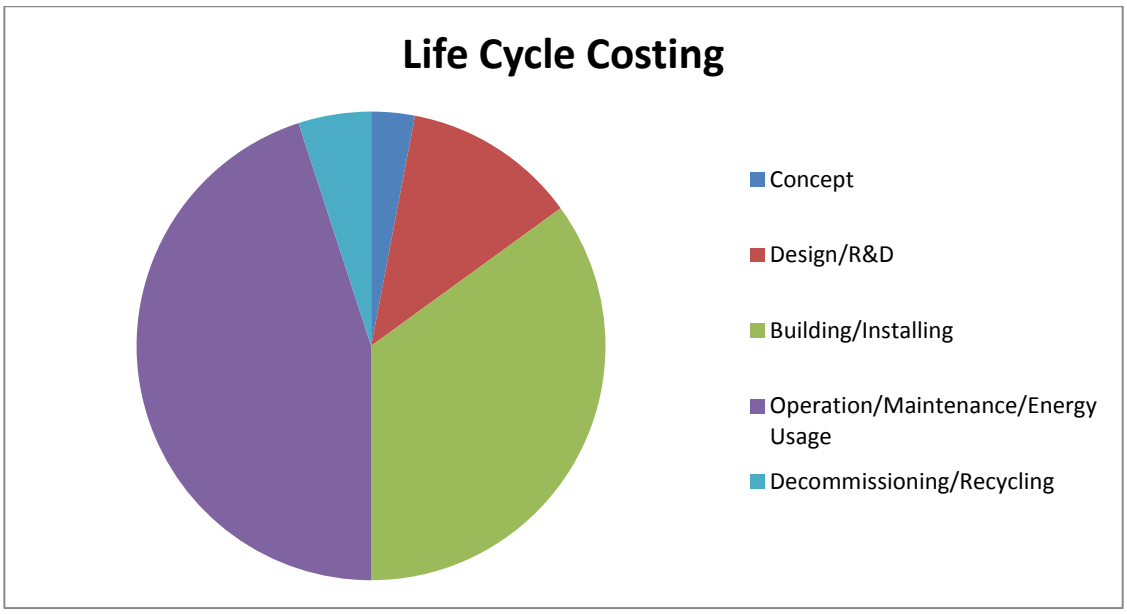
Reuse will have priority over salvage; an economic, viability and safety assessment will be made for each item/material.

4.4 Life Cycle Costing

Each product/material proposed shall be evaluated on a life cycle costing basis. Recyclable materials shall be utilised where possible in preference to non-Recyclable.

The particular areas of the life cycle to be addressed for M&E Services are:
Building & Installing the system/product, Operation/Maintenance, Energy Usage and finally, Decommissioning/Recycling.

Below is a graph indicating the lift cycle phases;



Typically the majority of the life of a material/product is spent in the Operation/Maintenance phase. It is in this phase that it creates the value contribution but also absorbs the vast proportion of the costs through maintenance and energy usage.

Products/materials shall be selected on the basis of particularly reducing the impact of this phase, for example, a pump, by selecting long term reliability and low energy usage over initial cost.

The ease and speed of building/installing different products/systems shall also be compared to reduce this phase.

4.5 Noise & Vibration

Noise and vibration associated with moving mechanical services plant, e.g. Pumps, fans, condensers, pipes/ducts, lifts and boilers shall be limited to acceptable levels as follows;

Pumps: Inverter drives providing slow low impact start/stop cycles, intelligent controls, anti-vibration couplings/supports, dense block wall constructed plantrooms.

Fans: Low speed intermittent ventilation fans, flexible duct connections, remote plantroom/cupboard mounting, attenuators and anti-vibration fixings.

CHP/GSHP units: Low noise units, internally mounted within plant areas with acoustic enclosures, anti-vibration mounts and wall/ceiling acoustic lining.

Boilers: Low noise units and internally mounted within plant areas.

Lifts: Inshaft motor rooms, Shafts constructed of concrete or dense block walls, low impact/operational noise selected lift installations, intelligent controls to reduce operations.

Pipes: Anti-vibration/flexible couplings to plant, expansion joints/anchors and smooth bends/straight lines.

Ducts: Inline attenuators, anti-vibration/flexible couplings to plant, and smooth bends/straight lines.

An Acoustic Consultant shall further advise on noise, vibration and acoustic items.

4.6 Solar Gains

In compliance with the new Part 'L' of the Building Regulations (April 2010 edition) solar gains shall be reduced by the building being designed to limit heat gains by; orientation, thermal mass, provision of green roofs, tree shading, semi underground spaces, overhanging slabs/roofs and higher performance double or triple glazed windows with solar tinting/low emissivity coating and Argon gas filled cavities to the South, East & West Elevations.

Additionally, internal blinds to the South, East & West Elevations may be provided as part of the development for occupiers to assist in compliance with Solar Gains.