ME7

9 TEMPLE WOOD AVENUE, HAMPSTEAD, LONDON, NW3 7UY

M&E SERVICES AND SUSTAINABILITY REPORT

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M&E SERVICES AND
SUSTAINABILITY REPORT

CONTENTS

Section	Description	Page No
	Executive Summary	4
1.0	SAP 2009 Assessment & Renewable energy appraisal	5
	Summary	6
1.1	Part L SAP 2009 Assessment & PEA	6
1.2	On-Site Renewable Energy Sources	7
1.2.1	Air Source Heat Pump (ASHP)	7
1.2.2	Ground Source Heat Pumps (GSHP)	8
1.2.3	Combined Heat and Power (CHP)	9
1.2.4	Solar Hot Water (SHW)	10
1.2.5	Solar Photovoltaics (PV)	11
1.2.6	Biomass / Biofuels	12
1.2.7	Wind Energy	13
1.2.8	Fuel Cells	14
2.0	Mechanical Services	15
2.1	Incoming Utility Services	16
2.2	Design Conditions	16
2.3	Building Regulations Part L1A/B (2010)	16
2.4	Heating	17
2.5	Water Services	17
2.6	Domestic Cold water	17
2.7	Domestic Hot Water	18
2.8	Recycled Rainwater	18
2.9	Natural Ventilation	18
2.10	Fresh Air Systems	18
2.11	Bathrooms, Cloakrooms & Kitchen Ventilation	18
2.12	Plantroom Ventilation	18
2.13	Automatic Controls	18
2.14	Above Ground and Foul Drainage	19
2.15	Rainwater Drainage	19
2.16	Comfort Cooling	19
3.0	Electrical Services	21
3.1	Incoming Utility Supply	22
3.2	Sub – Main Distribution	22
3.3	Final Circuit Distribution	22
3.4	Small Power Installations	22
3.5	Interior Lighting Installations	23
3.6	Exterior Lighting Installations	23
3.7	Audio Visual Systems	23
3.8	Security System	24
3.9	Fire Detection and Alarm System	24
3.10	Earthing and Bonding	24
3.11	Electrical Appliances and Mechanical System Equipment	24
3.12	Access Control	24

Section	Description	Page No
4.0	M&E Sustainability Items	26
4.1	Daylighting	27
4.2	Recyclable Materials	27
4.3	Salvage/Reuse of Existing Materials	27
4.4	Life Cycle Costing	27
4.5	Noise and Vibration	28
4.6	Solar Gains	28
5.0	Energy RSU	29
6.0	Disclaimer	31

Appendices:

A.	Part L1B Compliance Checklist	32
B.	SAP Worksheet - Existing Dwelling	36
C.	Existing PEA - Predicted Energy Assessment (Outline EPC)	52
D.	SAP Worksheet - Proposed Dwelling.	54
E.	Proposed PEA - Predicted Energy Assessment (Outline EPC)	71
F.	SAP Worksheet - Notional Dwelling for modelling	73
G.	Notional PEA - Predicted Energy Assessment (Outline EPC)	90
H.	Underground/Aboveground drainage/SUDS/RW Recycling	92
I.	ASHP plantroom/Attenuation	96

EXECUTIVE SUMMARY

Our client is applying for planning permission to extend 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. 9 Temple Wood Avenue is an existing residential building which is to be refurbished into a sustainable low carbon residential development finished to a high end quality standard.

This report has been prepared by ME7 Ltd to demonstrate how the development will achieve a good 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 requirements.

Key points/measures proposed:

- 45% increase in relative building energy efficiency;
  (Existing 260.72 KWHr/M2/PA - Proposed 170.80 KWHr/M2/PA).
- 45% decrease in relative building CO2 emissions.
  (Existing 49.57 KG/M2 - Proposed 32.45 KG/M2).
- Corresponding NOx emission reduction and inclusion of new efficient heating plant.
- Greater than 50% reduction in surface water runoff from the site to the local sewer.
- 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 existing building and providing double glazed windows to all new windows.
- Increase in air tightness to the building fabric.
- Natural ventilation/openable window provision.
- New materials to be responsibly sourced and life cycle reviewed.
- Inclusion of a renewable energy system.
- Data logging/internal digital metering for efficient management of the building.

Owing to the above improvements, the PEA (Predicted Energy Assessment – Outline EPC), efficiency rating has increased from Grade E (46) to Grade D (64) and the CO_2 impact rating from Grade E (41) to Grade D (58).

Included within the report is an appraisal of various renewable technologies, demonstrating their viability and appropriateness to the environment and nature of the development. Note that on-site renewable technologies are not required under planning approval.

It is proposed that an air source heat pump (ASHP) system will be suitable for providing heating and cooling to some of occupied areas, with gas boilers for other areas, back up and domestic hot water production. The ASHP system will reduce the CO_2 emissions, thereby increasing the PEA. All renewable heat technologies are also eligible for government backed RHI (Renewable Heat Incentive) payments for a period of 20 years.

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 calculations/reports demonstrating compliance, including L1B compliance, SAP L1A for modelling and PEA (Pre-EPC's); can be found in the Appendices of this report.

The M&E proposals outlined in this report are in line with the London Plan, Camden's Development Control DPD Policies; DP22 and DP23, Core Strategy document CS13 and CPG3, for an existing dwelling being refurbished and extended. The proposals also have regard to the guidance contained within CPG Sustainability (April 2011).

SECTION 1.0

SAP 2009 BUILDING REGULATION PART L 2010 ASSESSMENT

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RENEWABLE ENERGY APPRAISAL

SUMMARY

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

CO_2 reduction emission targets will be met through a combination of passive design features and energy efficient building services with further reductions through on-site renewable energy source. Feasibility of various on-site renewable energy sources has been investigated.

The target is to achieve a reduction in CO_2 emissions and satisfy Building Regulation Part L 2010 requirements. Although not forming part of the planning approval requirement, this development aims to achieve a good sustainability rating.

After assessing the potential fabric improvements and possible energy saving M&E systems, the building achieves an energy efficiency rating of 64 (Grade D) and a CO_2 impact of 58 (Grade D).

After assessing various potential renewable energy sources, the most appropriate system for this house an air source heat pump providing partial heating to the occupied places.

1.1 PART L SAP 2009 ASSESSMENT & PEA

Baseline annual predicted energy consumption and CO_2 emissions have been calculated using the full SAP2009 residential assessment in accordance with 2010 Part L procedures.

The SAP assessment for the existing dwellings achieves an energy efficiency rating of 46 (Grade E) and an environmental CO_2 impact of 41 (Grade E). See Appendix B & C for details.

Through improvements in building fabric and efficient services the proposed dwelling now achieves an energy efficiency rating of 64 (Grade D) and an environmental CO_2 impact of 58 (Grade D). See Appendix D & E for details.

The complete checklist of proposed building fabric improvements including U-values and efficient M&E systems are listed in the Appendices.

1.2 ON-SITE RENEWABLE ENERGY SOURCES

In order to achieve further CO_2 emission reductions along with the sustainability measures, the following renewable energy systems have been considered:

1.2.1 Air Source Heat Pump (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, aero thermal 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.

- **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.

ASHP system

- **Recommendations specific to this development**

  This option is feasible. Proposed air-to-air system could supply some space heating and cooling via ASHP system to the spaces.

  The relatively new SHW ASHP collector panels are relatively new and have not been considered.

  Heat pumps use significantly less energy than gas fired boilers, they deliver also relatively high CO_2 savings compared to gas boilers. This is due to electricity being more carbon intensive than gas. Therefore this system will provide a reduction in overall CO_2 emissions. The system will also receive financial income under the government backed RHI scheme.

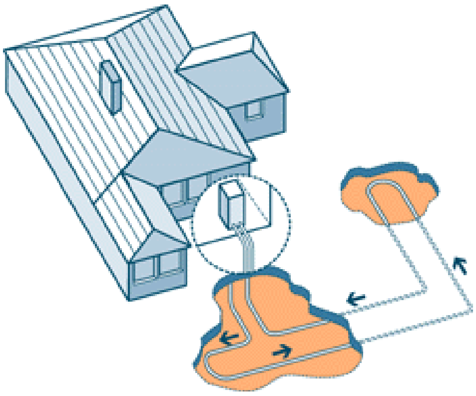
  An ASHP system is considered an appropriate choice for the building. The local building density is low and heat dissipation is not considered an issue, horizontal ASHP fan discharge will be provided within an attenuated enclosure. The electrical supply will be metered.

1.2.2 Ground Source Heat Pumps (GSHP)

- **General information**
  Ground source heat pumps use buried ground loops which transfer heat from the ground or water into the building through the heating distribution system. GSHP technology can be used both for heating and cooling and can provide high efficiencies. The system can be used all year round as the temperature below the ground remains fairly constant.

  Two main types of GSHP are available:

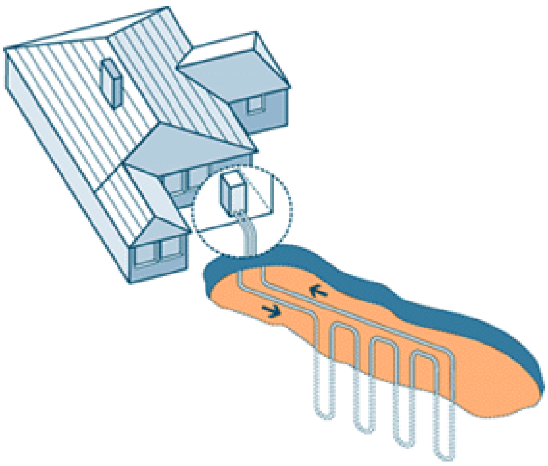
- **Horizontal loop system** is suitable for applications where sufficient area is available to accommodate horizontally buried pipes. This system is not feasible due to limited external land area and the high cost.



Horizontal loop system

A lake/pond based loop or drop in core heat exchanger system has even higher efficiencies (COP 8-10.0), than ground based systems (COP 5-6.0). Natural un-salted water with replenishing water supplies are superior but require regular de-silting/de-weeding for the core heat exchanger option. This option is quite non-intrusive as coils are placed in the lakes/ponds.

- **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. A slinky horizontal system is typically 50-60% lower in cost than a borehole system. Vertical boreholes are one of the most expensive renewable solutions.



Vertical loop system

- **Recommendations specific to this development**

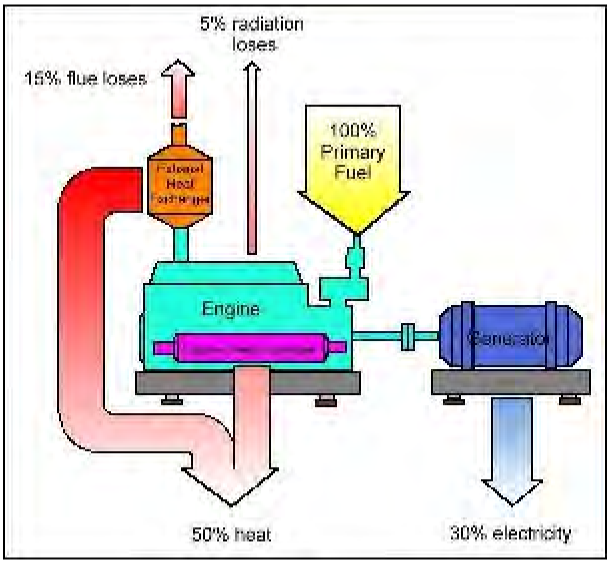
- Owing to limited land area for a horizontal system and the high capital costs of the alternative borehole system, GSHPs are not considered to be a suitable choice for this project.

1.2.3 Combined Heat and Power (CHP)

- **General information**

  CHP running on mains gas or LPG is not considered a renewable energy source, although it helps to reduce CO_2 emissions by delivering heat and electricity locally and reducing the losses that normally occur by conventional power plants. Onsite generated electricity can be exported to grid if the on-site demand is lower than production, tariffs for production and export are available.

  Biofuel CHP's (Biogas, Biodiesel or other Biofuels) are considered renewable sources and are one of the most efficient carbon saving renewable technologies, but are suitable only for limited types of buildings. Small scale biodiesel CHP's with electrical output from 5 kWe are available on the market. Where a renewable source is not required, normal main gas or diesel can be utilised.



CHP energy flow chart

- **Recommendations specific to this development**

To make the CHP most economic it is ideal that it runs at least 5,000 hours per year. This means that for at least 5,000 hours there should be an appropriate demand for heat which is generated by the CHP.

For this residential development there will be a year round hot water heating base load and a winter space heating load which can act as a heat sink for the 'waste' heat produced by the CHP plant. However the HW base load is relatively small and there will still be under utilisation of the CHP plant during the summer months.

The demand for heating and hot water would therefore not provide a sufficient year-round heat sink for the 'waste' heat produced by the CHP.

Small-scale biofuel and gas/LPG CHP's are still developing technologies compared to the more established large-scale systems. Additional lorry movements/CO_2 emissions for biogas deliveries would also be seen. Bio-diesel are also not considered to now be environmentally friendly due to the use of crop production. LPG is also not considered to be a renewable source. Mains gas CHP could provide CO2 reduction.

Owing to the above, a small scale natural gas CHP system for this development is considered financially unfeasible compared to the benefits offered by other systems and there is insufficient all year round heat load to quantify; therefore has been discounted.

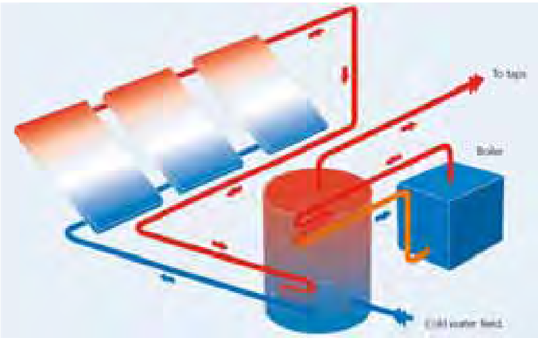
1.2.4 Solar Hot Water (SHW)

- **General information**

  Solar hot water systems use collectors to absorb the suns energy to heat water via a separate heating circuit linked to the hot water cylinder. This is usually backed up by an electric immersion heater and/or a conventional boiler. The system will provide hot water all year round and can meet most of the DHW (domestic hot water) demand during the summer months.

  Two types of collectors are available;

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



Solar DHW System diagram

Evacuated tube collectors

Hybrid PVT System

- **Recommendations specific to this development**

  The main roof spaces to the building could be used for a solar hot water array to provide most of the hot water demand for the occupied areas and reduce the CO_2 emissions and energy costs. The system would also receive financial income under the government backed RHI scheme.

  The system DHWS demand is deemed to be low/medium and the CO_2 savings would not be substantial.

  Owing to above and general visual aesthetics of the roof and that the main roof is within another ownership, this option has been discounted.

1.2.5 Solar Photovoltaics (PV)

- **General information**
  Solar electricity systems use photovoltaic (PV) cells to capture the suns energy which is then converted into electricity to run household electrical appliances and lighting. The PV cells do not require direct sunlight to operate and will generate electricity during cloudy days. Excess power can be exported into the local supply grid.

  Three main types of PV panels are available:

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

Roof mounted PV Panels

Solar PV System diagram

- **Recommendations specific to this development**

  Similarly to the solar hot water, roof level PV panels are obtrusive to accommodate and require a reasonable south facing surface area to provide CO_2 emission reductions. Specific extent of unshaded south facing roof area not sufficient and would be prominent in townscape.

  Government backed FiT (feed-in tariff) incentive payments are available, but initial capital costs can still be high.

  The main roof is also within another ownership.

  Owing to the above a PV system has been discounted.

1.2.6 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.

Wood Burning Stove

- **Recommendations specific to this development**

- A wood pellet burning boiler may be feasible but will require sufficient space for plant and fuel storage. The systems operation will rely on regular deliveries of the intended fuel source. If life cycle costs are considered then the carbon emissions from fuel delivery and biomass fuel production (e.g. re-growing crops, cutting wood etc.) must also be factored.

  When burning the fuels, there can also be a negative impact on air quality in the local vicinity.

  Biomass or biodiesel boiler can be considered, however, more energy would have to be produced to achieve the same CO_2 reduction target, compared to GSHP/ASHP heating systems with limited total energy use/flexibility.

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

1.2.7 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 force to rotate aerodynamic blades that turn a rotor which creates electricity. Most small-scale wind turbines generate direct current (DC) electricity and may be interconnected with the local power grid. A special inverter and controller is required to convert DC electricity to AC at a quality and standard acceptable to the grid company.
A good level of un-turbulent and consistent wind speed of at least 5 m/s (average) is required for a wind-turbine installation to be feasible.

Small-scale horizontal axis wind turbine

- **Recommendations specific to this development**

A wind turbine system for the site has been reviewed but it is considered the expected output yield will be limited owing to site obstructions such as trees, the site position - all affecting wind speed levels and wind flow patterns (turbulence).
Wind exposure at the site in general is considered to be insufficient for the system to be cost-effective when compared to other more reliable renewable technologies.

Owing to the above as well as other factors including negative visual effects, electrical interference (flicker) and noise pollution risk a wind turbine system has been discounted.

1.2.8 Fuel Cells

➢ **General information**

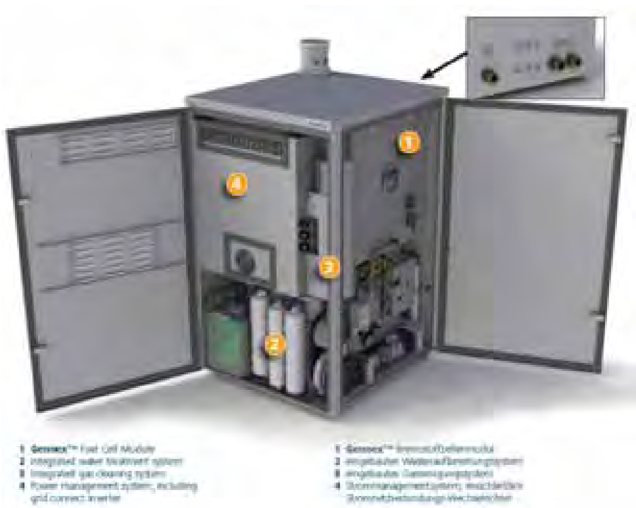
The cleanest way of using hydrogen and oxygen to produce power is by the use of fuel cells. The technology is over 150 years old since the first fuel cell was demonstrated by Sir William Grove in 1839.

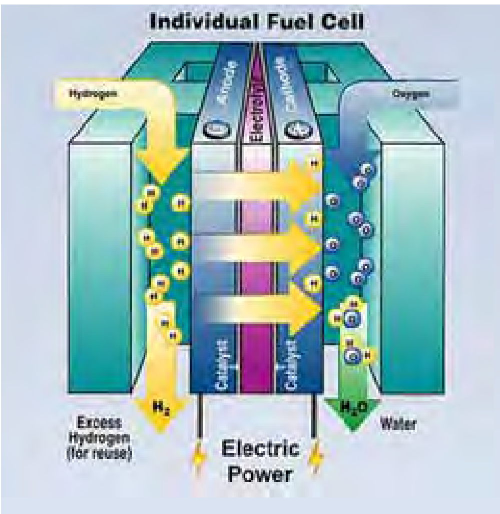
Fuel cells are electro-chemical devices that operate at a high level of efficiency with little noise or air pollution. There are many potential applications for them, including electricity generation in stationary applications and provision of motor force for a new generation of transportation vehicles.

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 £30,000 for a 2KWe unit with 1 KWh output.

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 as commercial small scale products are still at R&D stage.

SECTION 2.0

MECHANICAL SERVICES

2.0 MECHANICAL SERVICES

2.1 Incoming Utility Services

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

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

An additional gas sub-meter (KW/Hr) will be provided with a remote visual display installed to assist in energy monitoring and efficient 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 efficient 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
Utility	16°C
Plant area	Background heating by unrecovered waste heat from plant/pipes

2.3 Building Regulations Part L1A/B (2010)

The current part 'L1A/B' 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 unnescessary energy use and maximise natural daylight.
- Adequate user control shold be available for heating and cooling to avoid unnecessary energy use and maximise passive measures.

Part 'L1A/B' 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/heat source 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 and air tightness.
- Review of renewable energy sources to comply with the limits dictated by The Local Planning Authority.
- 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.
- Minimising the use of cooling systems for passive measures.

2.4 Heating
The occupied areas space heating system will be high efficiency gas fired condensing boilers, replacing older less efficient boilers. An ASHP system (COP 4.3), will also be utilised for certain space heating requirements and to provide backup heating, the ASHP will be metered at the main electrical distribution board.

The heating (Lower temperature) system will serve LTHW pressurised supplies to the underfloor heating systems in the occupied areas. With towel rails to bathrooms and radiators to other areas.

The main gas boilers will be provided with a buffer tank to provide continuous LTHW supplies. Controls will also be weather compensated and user occupation closely programmed and managed.

Gas boilers will be new condensing/very low NOx level units, replacing the old and inefficient gas boilers; this will significantly reduce existing CO2/NOx emissions.

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

Fresh air and plantroom cooling via louvers at basement/ground level.

All heating zones/spaces will be provided with zone valves, thermostatic control (Thimble sensors or thermostats), 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 (pumps and tanks), 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, MDPE to external pipes.

The general pressure available throughout the system will be approximately 2.5 bar at the mixers/taps with flow rates accommodated to the sanitary appliances and shower mixer valves in accordance with the Part ‘G’ calculator; 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/damage.

2.6 Domestic Cold Water
Cold water will be mains pressurised throughout. Filtered mains drinking water will be provided to the main kitchens and the basins within each principle en-suite bathroom.

Cold water mains supplies will be provided to the plantroom for general washing and filling.

A full base exchange water softener will be provided within the plantroom providing softened water to the hot water cylinders, 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 cylinders located in the plant room will be provided with boosted and conditioned cold water. The systems proposed ensure that all peak demands will still be met efficiently.

Hot water will be primarily produced by the efficient gas boilers, additional heat recovery systems are to be considered.

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

All sanitary fittings 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 2.14), provide recycled rain water for general washdown and irrigation supplies. This will reduce the reliance on treated mains water and reduce surface water runoff.

2.9 Natural Ventilation
Background habitable room ventilation is generally to be provided by trickle vents incorporated into windows, walls or roofs.

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

2.10 Fresh Air Systems
Fresh air fan units with heat recovery are to certain basement rooms to provide 90% heat recovery and improve air tightness of the fabric. The units will also incorporate a summer bypass to allow pre-cooling of the fabric/spaces over-night and during hotter periods.

This is to provide ducted fresh air/extract to all rooms, to fully comply with Part 'F' of the Building Regulations. Ductwork to be pre-insulated PVC.

2.11 Bathrooms, Cloakrooms and Kitchen Ventilation
Small intermittent/MEV extract ventilation units will be provided for the purposes of sanitary accommodation and kitchen ventilation. These dedicated fan systems shall comprise of isolated (low energy/noise) ducted fan units located either within ceiling voids/ducts and discharge to the main roof areas or locally to facades through aesthetic grilles. Ductwork to be PVC.

WHVR (Whole house heat recovery) to be utilised to some basement areas, other systems may also be considered to further increase heat recovery and energy efficiency.

2.12 Plantroom Ventilation
The plantrooms will be provided with natural supply/mechanical fans and extract grilles suitably sized to provide fresh air and control heat build up.

2.13 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 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.

2.14 Above Ground and Foul 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.

All basement area drainage will be pumped via a separate chamber.

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 and to minimise leaks/wastage of water.

All external drainage shall be Upvc or clayware.

2.15 Rainwater Drainage
All rainwater pipes will be routed from roof level to drain points at ground floor level. All roof gutters/outlets/RWP's 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. All external rainwater stacks are to be either aluminium or cast iron and where installed internal, the stacks shall be thermally/acoustically insulated.

An underground rainwater harvesting tank will be provided within the surface water drainage system to collect water from the main roof areas for recycling for washing down and irrigation.

A surface water retention tank shall be provided as part of the harvesting tank to reduce outflow to the sewer. A hydrobrake will be utilised to limit outflow. It is intended to drain the rear half of the house (RWP's and gullies), to the retention tank (10M3), to reduce peak outflows to 50% below the existing level; with 20% factor for climate change based on a 1:100 year storm.

This combined with a permeable surface to the front area drive, rear natural percolation and a peak overflow soakaway with storage for the front drive channels, subject to suitable infiltration tests.

The storage volume proposed is 10M3 within the retention tank, chambers and pipework.

All external drainage shall be Upvc or clayware.

2.16 Comfort Cooling
The building will be upgraded/designed to limit heat gains by; thermal mass, upgraded double glazed windows and fabric, internal blinds, tree shading, planting, openable windows (natural ventilation) and underground spaces.

Comfort cooling will be provided only to three basement level spaces as a peak day measure.

This is proposed to be via a very high efficiency ASHP system, the same system as used for the part primary heating/back up. This to be tied to Mitsubishi air cooled condensing plant in the rear garden plantroom (Below terrace), serving internal DX fan coils. Additional heat rejection/heat recovery will be considered to the domestic hot water system in summer conditions.

This system would operate at a COP of 3.38 COP.

The fancoils will be able to 'boost heat' rooms simultaneously to the underfloor heating, with some spaces being only fancoil (ASHP) heated.

Cooling for each room will be provided by a mixture of horizontal/vertical fan coil refrigerant R410A units mounted either within joinery or false wall/ceiling details. Pre-insulated discharge ductwork will be attached to these fan coils to discharge through high induction linear grilles incorporated within joinery/coffers and wall finishes at high level. The fan coil units will have very low noise levels, NR25-30.

A habitable room refrigerant gas sensor system will be incorporated to provide safety/protection in accordance with FGAS requirements.

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. (Fan speed/temperature).

SECTION 3.0

ELECTRICAL SERVICES

3.0 ELECTRICAL SERVICES

3.1 Incoming Utility Supply

The existing main incoming supply to the building may require upgrading in view of the additional ASHP heating loads and higher electrical consumption anticipated for a high end finished property.

The new main incoming supply connection will be sized to suit the anticipated maximum building load.

The energy usage at the incoming position will be measured and inter-linked to the control 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.

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.
External/plant points shall be suitably weather proofed/protected.

3.5 Interior Lighting Installations

The lighting scheme will utilise the latest low energy compact fluorescent and long life LED lighting technologies in order to achieve a minimum of 75% low energy lighting throughout, satisfying the requirements as stipulated in the Building Regulations Part L.

Where non-low energy lamps, such has halogen reflectors are used then the most energy efficient types will be selected. E.g. lamps incorporating IRC (infra-red coating) technology as manufactured by Osram will provide 30% energy saving and twice the life expectancy compared to a standard equivalent dichroic reflector lamp.

Dimming (energy reduction) control will be provided to the majority of the occupied areas 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 will be taken.

Special attention will be made to bathrooms and the stable ares, 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 be minimal and 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 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 and ventilation control via touch screen panels in the occupied areas.
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 buildings in CAT 5e/6 cabling with digital recording facility.

7. Audio and visual access control system.

8. Consideration could be given to re-locating the existing overhead BT lines underground for visual aesthetics – subject to discussions with BT and costs.

3.8 Security System

A wired intruder alarm system will be provided comprising suitable room/space movement detectors, magnetic contacts to perimeter doors, window/door break glass detection and panic alarms.
The system will be linked to a 24hr central monitoring station via a dedicated BT Redcare line and separate 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 buildings may come under the requirements of BS5839 Part 1&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 areas and the garage will also have carbon monoxide (CO) detectors installed.

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 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.

3.12 Access Control

All external entries to the building and external gates shall be via audio visual and Card/fob Reader with visitor access call button as required.

The system shall provide two-way audio, one-way video communication between the main entry points to the buildings to allow a visitor to communicate to allow access, or otherwise, through the entrance doors and gates.

Battery back-up power to each door/gate access system to be provided with fire alarm interface for emergency door release. The system shall be fail safe – in the event of a power failure and/or fire alarm activation, the entrance door locks shall be released.

To the requirements of BS EN 50133 and Equality Act.

SECTION 4.0

M&E SUSTAINABILITY ITEMS

4.0 M&E SUSTAINABILITY ITEMS

The main sustainable items are covered under the main renewable and M&E sections, this details some other aspects;

4.1 Daylighting

All occupied spaces (Living rooms, kitchen and study), will achieve the minimum daylight factors and view of the sky.

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.

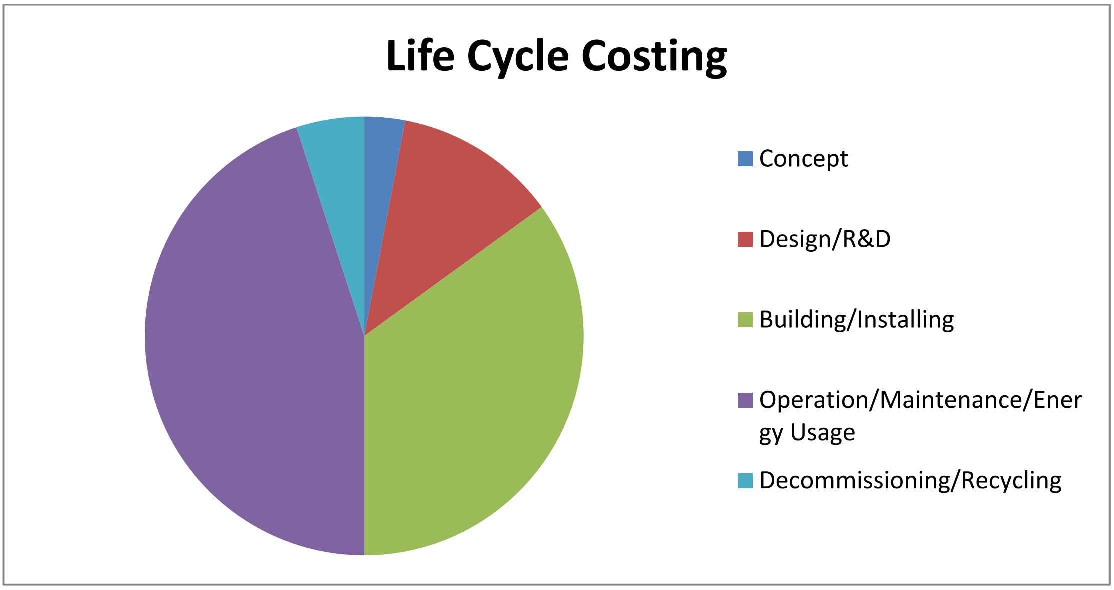
Reuse will have priority over salvage; an economic, viability and safety assessment will be made for each item/material.

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 and compare environmental impact/sustainability..

4.5 Noise & Vibration

Noise and vibration associated with moving mechanical services plant, e.g. Pumps, fans, condensers, pipes/ducts, lifts and boilers will 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.

ASHP units: Low noise units, mounted within plant areas with acoustic louvers, anti-vibration mounts and wall acoustic lining.

Boilers: High efficiency condensing boilers with low NOx emissions.

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

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

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

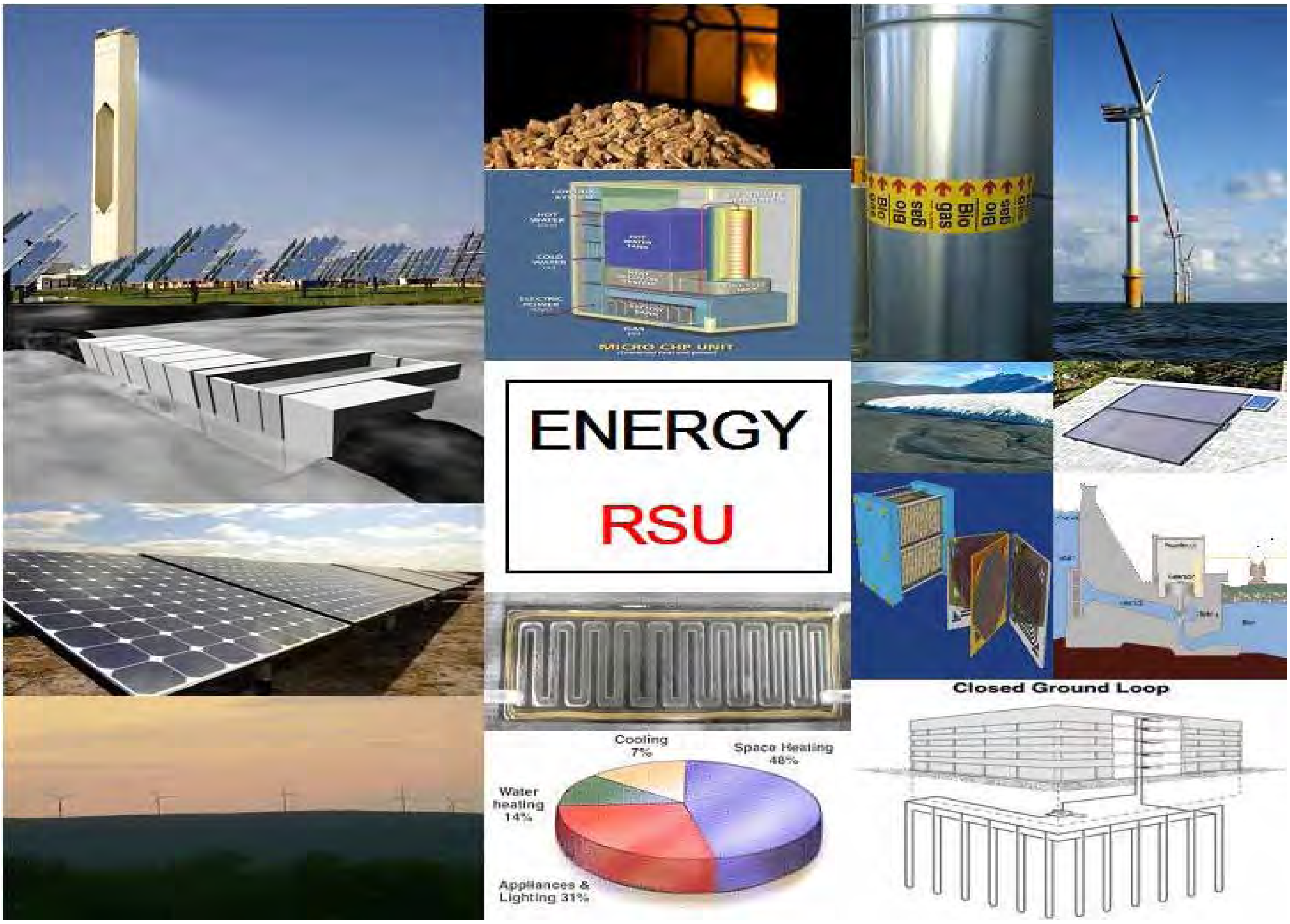
4.6 Solar Gains

In compliance with the new Part ‘L’ of the Building Regulations (October 2010 edition) solar gains shall be reduced by the building being designed to limit heat gains by; orientation, thermal mass, provision of tree shading, overhanging 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 for the occupied areas to assist in compliance with Solar Gains.

SECTION 5.0

ENERGY RSU – RENEWABLES & SUSTAINABILITY UNIT



ENERGY RSU is an integrated energy sustainability unit able to provide the following:

- SAP Calculations & Certificates - L1A&B New/Existing Buildings (NHER certified)
- SBEM Calculations & Certificates - L2A&B New/Existing Buildings (BRE certified)
- EPC & DEC Certificates – New Build (CIBSE certified)
- Rd SAP Survey EPC Certificates – Existing Buildings (NHER certified)
- Commercial EPC Survey certificates – Existing Buildings (BRE certified) - Level 3, 4 & 5
- Energy Statements & Renewable Reports for Planning
- LEED/BREEAM assessments (USGBC/BRE certified)
- Low/Zero Carbon (LZC) and Sustainability Appraisals/designs (CIBSE Low Carbon Consultant)
- Renewable Energy Appraisals and Designs
- Carbon Rating assessments
- 2D/3D CFD and Dynamic Thermal Simulations
- EPBD Air Conditioning Inspections (Article 20) and EPBD Asset Ratings & Certificates
- Energy Usage (Running Costs)
- Utility/Bill Analysis and Recommendations
- Advice on Green and Environmental Issues Relating to M&E Building Services
- Code for Sustainable Homes (BRE certified)
- Solar Shading/Sun Studies

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SECTION 6.0

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Jordan Billinton : ME7 Ltd
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