ME7

9 HARLEY ROAD,
LONDON
NW3 3BX

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

JB/607: July 2015

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INTRODUCTION

Our client is applying for planning permission to fully refurbish and add an extension to this family home and as part of the process; he is taking the opportunity to significantly enhance its sustainability; including the potential for renewable technologies. Harley Road 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 (SAP2012) 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 25.9% (Cumulative), which is very good result for an existing/refurbished property.
- Corresponding NOx emission reduction and inclusion of new efficient heating plant.
- 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 to the basement area – 90% 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 C (73) and the CO_2 impact rating is Grade B (64).

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 Ground Source Heat Pump System will be suitable for providing to some of the occupied areas and low NOX high efficiency gas fired boilers hot water production, with gas boilers for
back up and domestic hot water production/main load

Cooling is proposed to some parts of the house and only at peak times, this will be provided by vertical borehole GSHP and VRF system based on high efficiency water cooled condensers with nominal COP up to 5.78 and EER up to 5.4.

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 L1B 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, the National Planning Policy Framework, Camden's Development Plan/ City Plan : Strategic Policies; for new dwellings and Building Regulations.

ME7

Section 1.0

RENEWABLE ENERGY STATEMENT

9 HARLEY ROAD,
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ENERGY STATEMENT

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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 06/07/2015

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

I N D E X

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 9 Harley Road; 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 on Energy Efficiency and Renewable Energy will be met through a combination of passive design features, energy efficient building services and low carbon energy sources. The target is to achieve maximum practically feasible CO2 emissions. This is to comply fully with the London Plan Policies, and to ensure, that the "Energy Hierarchy" is followed. This document has been prepared in line with the GLA Energy Team Guidance on Planning Energy Assessments. There is no Code for Sustainable Homes or BREEAM requirement.

Baseline and all estimated energy consumptions have been calculated using full SAP 2012 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.

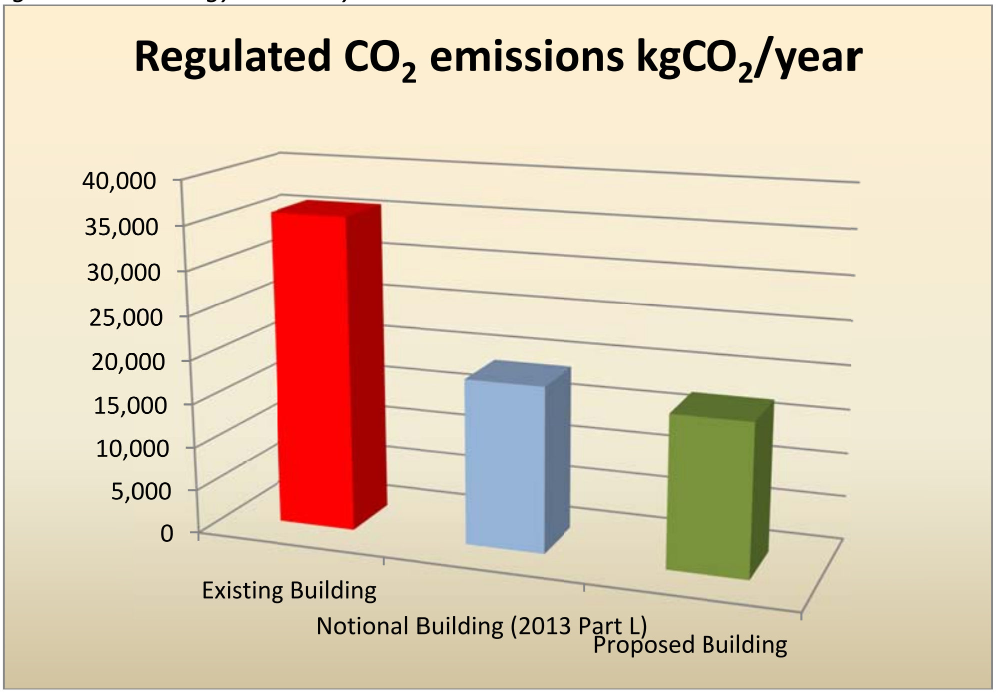
Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy

	Carbon dioxide emissions (kg CO2 per annum)		
	Regulated	Unregulated	Total
Existing Building	35,805	3,740	39,545
Notional Building (2013 Part L compliant)	18,902	4,199	23,101
Proposed Building	17,290	4,199	21,489

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 bringing the building to 2013 Part L1B	16,903	16,444	47.2	41.6
Savings from additional energy efficiency measures	1,612	1,612	8.5	7.0
Total Cumulative Savings	18,516	18,056	51.7	45.7

Figure 1: The Energy Hierarchy



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

1. Enhanced fabric and materials of exposed thermal elements which can be upgraded exceeding Part L1B requirements:

   New external walls: 0.25 W/m^{2}K

   New basement walls: 0.20 W/m^{2}K

   Roofs: 0.16 W/m^{2}K

   New basement floor: 0.15 W/m^{2}K

   Windows and rooflights: 1.5 W/m^{2}K

2. Efficient services, including:

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

   High efficiency condensing boilers, minimum 89% SEDBUK 2009 seasonal efficiency

   Heating with time and temperature zone control and weather compensation control

The above specification will achieve 25.9% reduction in total CO2 emissions compared to the existing house.

1. INTRODUCTION

1.0 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.

1.1 Description of the Site

The proposals include full refurbishment and partial extension of the existing house comprising of: lower ground, ground, first and second floor.

2. PLANNING FRAMEWORK

3.1 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.

3.2 The London Plan

The London Plan 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.

3. Strong, diverse long term economic growth
4. Social inclusivity to give all Londoners the opportunity to share in London's future success
5. Fundamental improvements in London's environment and use of resources.

Specific requirements on development sustainability are set out in policy 5.2 of the London Plan :

Development proposals should make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy:

Be lean: use less energy
Be clean: supply energy efficiently
Be green: use renewable energy

From 2013 it is required that new developments achieve 35% reduction in emission rates against the 2013 building regulations TER (target emission rate)

3. EXISTING HOUSE ENERGY CONSUMPTION AND CO_2 EMISSIONS

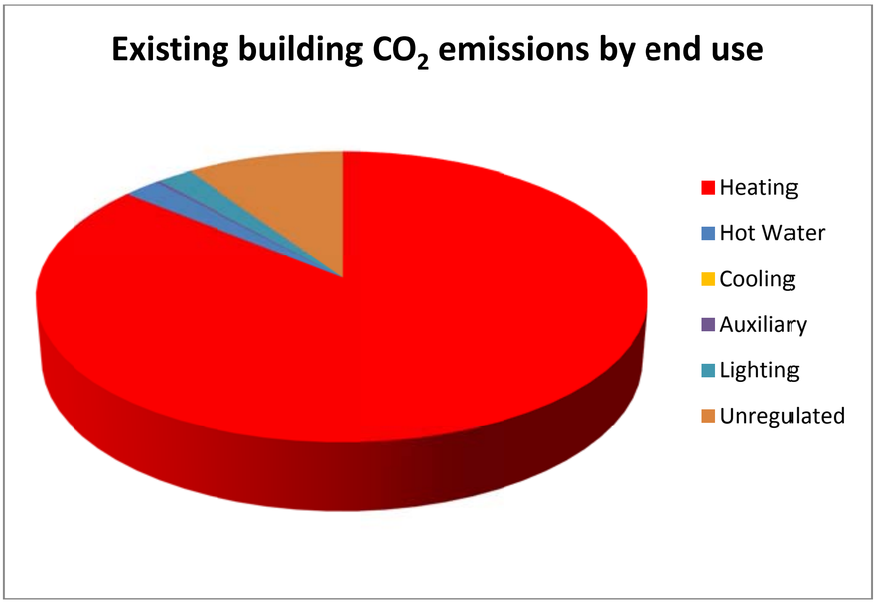
Energy assessment using SAP 2012 has been carried out for the existing house with the following input data:

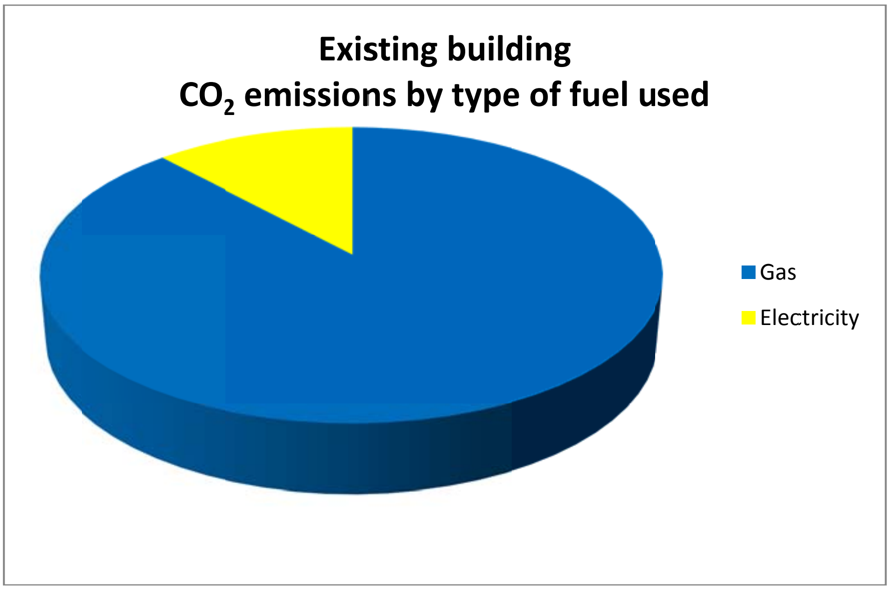
Parameter:	Existing Building
Existing external walls:	2.10
New external walls:	-
New basement walls:	-
Existing Roofs:	2.30
Existing ground floor:	0.67
New basement and ground floor:	-
Existing Windows	4.80
New Windows and Rooflights	-
Main Space Heating	Existing non-condensing gas boiler, programmer, room thermostat and TRV's
DHW System	600 L indirect DHW cylinder
Space Cooling System	-
Ventilation System	Natural
Energy Efficient Lighting	25%

As a result of the existing house assessment, the following values of energy and CO_2 emissions have been obtained. SAP 2012 carbon emission factors have been used for CO_2 emissions calculation.

Existing building energy consumption and CO_2 emissions by end use

	Delivered Energy		Emissions
	kWh/annum	Fuel	kgCO_2/annum
Heating	157,421	Gas	34,003
Hot Water	3,993	Gas	863
Cooling		Electricity	0
Auxiliary	165	Electricity	86
Lighting	1,646	Electricity	854
Unregulated	7,205	Electricity	3,740
Total:	170,431		39,545


Existing building CO_2 emissions by end use
Heating
Hot Water
Cooling
Auxiliary
Lighting
Unregulated


Existing building
CO_2 emissions by type of fuel used
Gas
Electricity

4. NOTIONAL BASELINE ENERGY CONSUMPTION AND CO_2 EMISSIONS

Notional baseline has been calculated for the proposed house including the new extension using the following specification compliant with 2013 Part L1B:

Parameter:	**Notional Baseline**
Existing external walls:	2.10
New external walls:	0.28
New basement walls:	0.28
Existing Roofs:	0.18
Existing ground floor:	0.25
New basement and ground floor:	0.22
Existing Windows	4.80
New Windows and Rooflights	1.60
Main Space Heating	Condensing boiler, 88% seasonal efficiency, time and temperature zone control
DHW System	600 L indirect DHW cylinder
Space Cooling System	GSHP with SEER of 4
Ventilation System	Natural
Energy Efficient Lighting	75%

Notional baseline energy consumption and CO_2 emissions by end use

	Delivered Energy		Emissions
	kWh/annum	Fuel	$kgCO_2$/annum
Heating	80,439	Gas	17,375
Hot Water	3,485	Gas	753
Cooling	0	Electricity	0
Auxiliary	165	Electricity	86
Lighting	1,327	Electricity	689
Unregulated	8,091	Electricity	4,199
Total:	170,431	0	23,101

5. PASSIVE DESIGN MEASURES AND EFFICIENT SERVICES (BE LEAN)

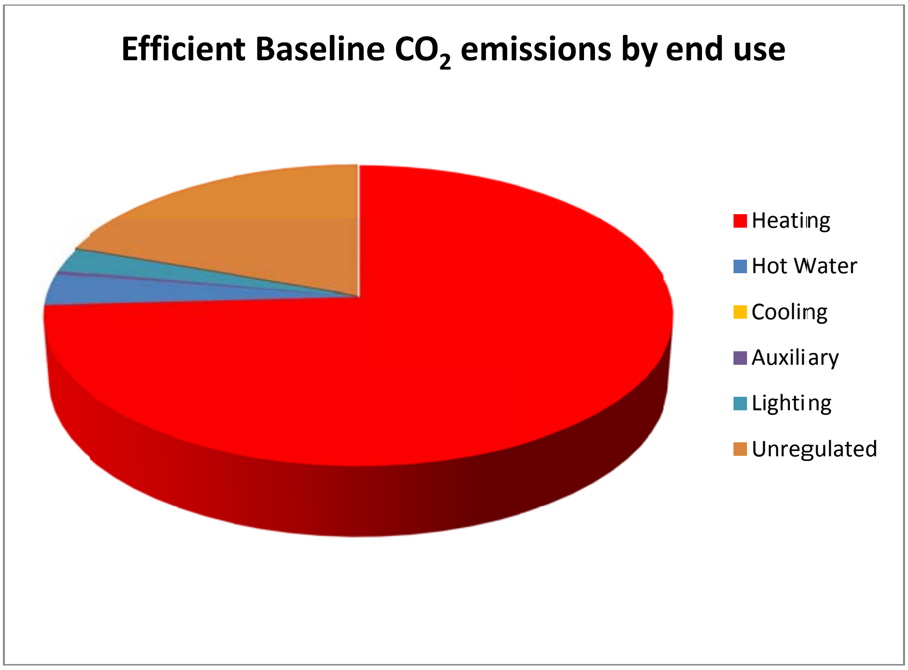
Number of passive design measures and measures improving energy efficiency of building services are proposed for the refurbished house to help to reduce the CO2 emissions:

Parameter:	Efficient Baseline
Existing external walls:	2.10
New external walls:	0.25
New basement walls:	0.20
Existing Roofs:	0.16
Existing ground floor:	0.20
New basement and ground floor:	0.15
Existing Windows	4.80
New Windows and Rooflights	1.50
Main Space Heating	High efficiency condensing boiler, 89% seasonal efficiency, time and temperature zone control, delayed start thermostat and weather compensation control
DHW System	600 L indirect DHW cylinder
Space Cooling System	GSHP with SEER of 4
Ventilation System	Natural
Energy Efficient Lighting	100%

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

Efficient baseline building energy consumption and CO_2 emissions by end use

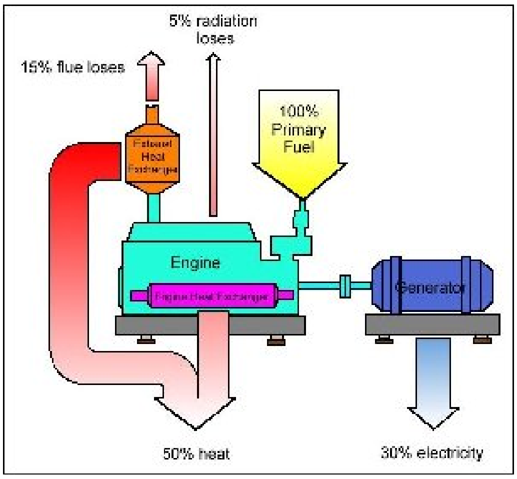
	Delivered Energy		Emissions
	kWh/annum	Fuel	$kgCO_2$/annum
Heating	73,765	Gas	15,933
Hot Water	3,332	Gas	720
Cooling	0	Electricity	0
Auxiliary	165	Electricity	86
Lighting	1,062	Electricity	551
Unregulated	8,091	Electricity	4,199
Total:	86,415		21,489



6. 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**

The proposed building is considered too small to make a CHP feasible. CHP is therefore not recommended.

7. ON-SITE RENEWABLE ENERGY SOURCES (BE GREEN)

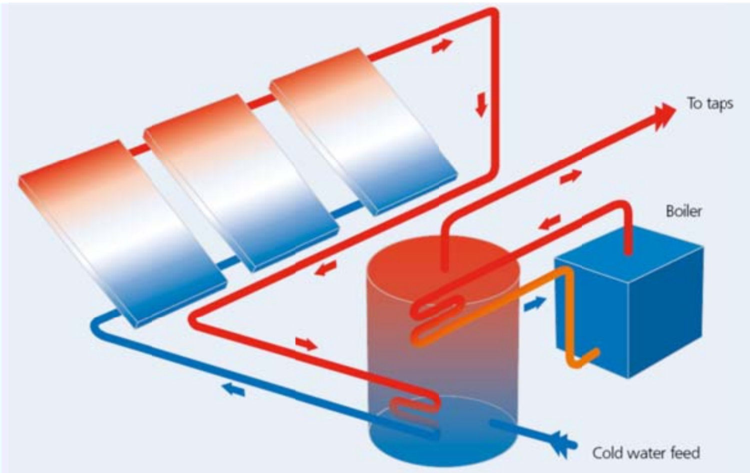
Following systems have been considered:

7.1. 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



- **Recommendations specific to this development**

  Solar hot water panels are not possible due to insufficient roof space and conservation restrictions.

7.2. 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**

  Air source heat pump is not recommended as it may not be able to cover high estimated heating loads caused by uninsulated retained walls and windows for conservation reasons. ASHP would not achieve significant CO2 improvement compared to gas boiler.

7.3. 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**

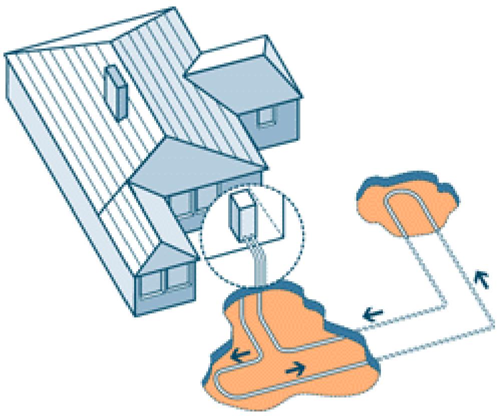
  Photovoltaic system is not possible due to insufficient roof space and conservation restrictions.

7.4. GROUND SOURCE HEAT PUMPS (GSHP)

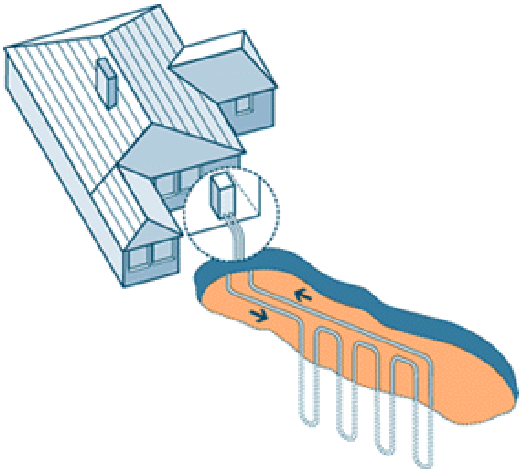
- **General information**

  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**

  Ground source heat pump is not recommended as it may not be able to cover high estimated heating loads caused by uninsulated retained walls and windows for conservation reasons. ASHP would not achieve significant CO2 improvement compared to gas boiler.

7.5. 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.

7.6. 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.

Section 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 (2013)

The current part 'L1A' of the Building Regulations (2013), 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 2013), 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 proposals for Part L 2014 are also included, specifically that DER/TER CO2 reduction to achieve >40%.

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 and utilised only at peak times.

2.4 HEATING

The main space heating system will be via high efficiency condensing boilers with ultra low NOX levels (eg Broag Remeha Quinta Pro).

The 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). Radiators to secondary areas and towel rails to bathrooms will be served a separate summer circuit. LTHW supplies will also provide the heat for the HWS system.

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

All flues to terminate above the lower ground level by balanced flues/separate flues.
Fresh air and plantroom cooling via louvers at lower ground 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.

2.5.1 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 back washing and filling, primary source via rainwater recovery.

A full base exchange water softener will be provided within the main lower ground 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).

2.5.2 DOMESTIC HOT WATER

Hot water cylinder/generators located in the lower ground plantroom will be provided with boosted and softened cold water. The hot water generators shall be hot water cylinders and be complete with a pumped return system.

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.

2.6. RECYCLED RAINWATER

The rainwater recycling drainage system (see 2.21), will provide recycled rain water for irrigation supplies. This will reduce the reliance on treated mains water.

Filters shall be provided to the system.

2.7 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.

2.8 FRESH AIR SYSTEMS

Some habitable rooms located within the lower ground area with no windows will be provided with mechanical ventilation. Mechanical ventilation system will be fully compliant with Part ‘F’ of the Building Regulations. Ductwork to be pre-insulated PVC and galvanised steel with insulation or Kool duct.

2.9 BATHROOMS, CLOAKROOMS, STORE AND KITCHEN VENTILATION

Mechanical Extract Ventilation (MEV) units will be provided for the purposes of sanitary accommodation, kitchen 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.

2.10 COMFORT 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 vertical borehole GSHP system with water cooled VRF system (4.40 COP).

The type of cooling for each room will be provided by fancoils 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.

2.11 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.

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.

2.12 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.

2.13 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.

2.14 UNDERGROUND DRAINAGE

Underground rainwater harvesting tanks will be provided within the surface water drainage system to collect water from the main roof areas for recycling for 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.

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 site (RWP's and gullies), to the retention tank, 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, natural percolation to grassed/soft areas.

All external drainage shall be Upvc or clayware, cast iron under the building.

Section 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.
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.

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:

- Lighting control and management via user-friendly wireless/hardwired touch screen visual display panels located throughout building to occupiers requirement.
- Building energy monitoring via touch screen panels with scope for split monitoring of various loads e.g. lighting & power.
- Heating, comfort cooling and ventilation control via touch screen panels.
- 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.
- Hardwired broadband and telephone service in CAT 5e/6 cabling.
- CCTV security monitoring around the vicinity of the building in CAT 5e/6 cabling with digital recording facility.
- 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.

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 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.

3.12 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

4.1 DAYLIGHTING

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

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.

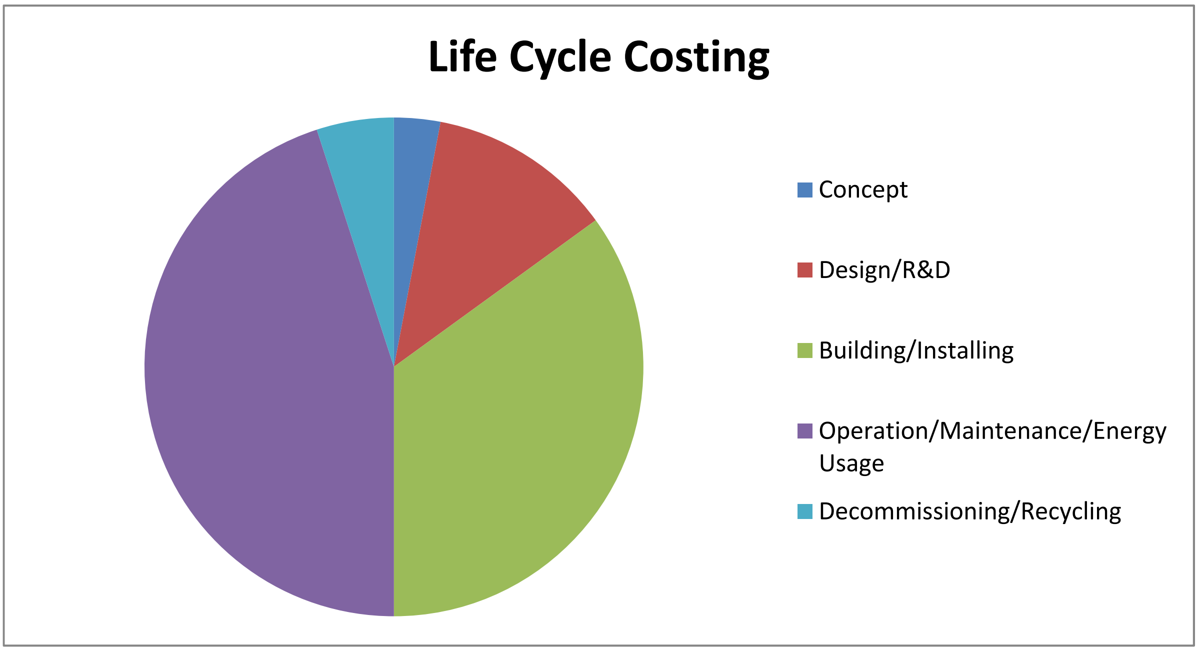
Reuse will have priority over salvage; an economic, viability and safety assessment will be made for each item/material.

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.

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

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 2013 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.

Section 5.0

DISCLAIMER

This non-assignable report has been prepared solely for the client as a pre-planning report for the proposed development. The contents and views expressed in this report remain the copyright and opinion of ME7 Ltd. The client is to check and verify the contents with no admission of liability, duty of care or warranty to any Third Party.

This report is based on the information provided/available at the time of production.

ME7 July 2015

APPENDIX (i)

SAP L1A 2013 REGULATIONS COMPLIANCE REPORT

(SAP WORKSHEET)

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Ondrej Gajdos	**Stroma Number:**	STRO006629
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.1.21

Property Address: 9, Harley Road

Address : 9, Harley Road, LONDON, NW3 3BX

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	143.1	(1a) x	2.7	(2a) =	386.37	(3a)
Ground floor	255.3	(1b) x	3.7	(2b) =	944.61	(3b)
First floor	121.8	(1c) x	3.3	(2c) =	401.94	(3c)
Second floor	84.1	(1d) x	2.9	(2d) =	243.89	(3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	604.3	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		1976.81	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							13	x 10 =	130	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	130	÷ (5) =	0.07	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			15	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.82	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.69	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

SAP WorkSheet: New dwelling design stage

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

	0.88	0.87	0.85	0.76	0.75	0.66	0.66	0.64	0.69	0.75	0.78	0.81

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.89	0.88	0.86	0.79	0.78	0.72	0.72	0.71	0.74	0.78	0.8	0.83	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.89	0.88	0.86	0.79	0.78	0.72	0.72	0.71	0.74	0.78	0.8	0.83	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.21	x	1.8	=	3.978			(26)
Doors Type 2			2.21	x	1.8	=	3.978			(26)
Windows Type 1			0.47	x1/[1/(1.5)+ 0.04]		=	0.67			(27)
Windows Type 2			5.36	x1/[1/(1.5)+ 0.04]		=	7.58			(27)
Windows Type 3			2.25	x1/[1/(1.5)+ 0.04]		=	3.18			(27)
Windows Type 4			2.25	x1/[1/(1.5)+ 0.04]		=	3.18			(27)
Windows Type 5			0.78	x1/[1/(1.5)+ 0.04]		=	1.1			(27)
Windows Type 6			2.92	x1/[1/(1.5)+ 0.04]		=	4.13			(27)
Windows Type 7			4.7	x1/[1/(1.5)+ 0.04]		=	6.65			(27)
Windows Type 8			1.08	x1/[1/(1.5)+ 0.04]		=	1.53			(27)
Windows Type 9			4.5	x1/[1/(1.5)+ 0.04]		=	6.37			(27)
Windows Type 10			2.89	x1/[1/(1.5)+ 0.04]		=	4.09			(27)
Windows Type 11			1.63	x1/[1/(1.5)+ 0.04]		=	2.31			(27)
Windows Type 12			4.33	x1/[1/(1.5)+ 0.04]		=	6.13			(27)

Windows Type 13			1.71	x1/[1/(1.5)+ 0.04] =	2.42			(27)
Windows Type 14			1.71	x1/[1/(1.5)+ 0.04] =	2.42			(27)
Windows Type 15			2.3	x1/[1/(1.5)+ 0.04] =	3.25			(27)
Windows Type 16			0.64	x1/[1/(1.5)+ 0.04] =	0.91			(27)
Windows Type 17			1.31	x1/[1/(1.5)+ 0.04] =	1.85			(27)
Windows Type 18			1.31	x1/[1/(1.5)+ 0.04] =	1.85			(27)
Windows Type 19			2.42	x1/[1/(1.5)+ 0.04] =	3.42			(27)
Windows Type 20			2	x1/[1/(1.5)+ 0.04] =	2.83			(27)
Windows Type 21			8.9	x1/[1/(1.5)+ 0.04] =	12.59			(27)
Windows Type 22			7.48	x1/[1/(1.5)+ 0.04] =	10.58			(27)
Windows Type 23			14.88	x1/[1/(1.5)+ 0.04] =	21.06			(27)
Windows Type 24			0.78	x1/[1/(1.5)+ 0.04] =	1.1			(27)
Rooflights Type 1			9	x1/[1/(1.5) + 0.04] =	13.5			(27b)
Rooflights Type 2			13.13	x1/[1/(1.5) + 0.04] =	19.695			(27b)
Rooflights Type 3			4.34	x1/[1/(1.5) + 0.04] =	6.51			(27b)
Floor Type 1			143.1	x 0.15 =	21.465			(28)
Floor Type 2			141.4	x 0.2 =	28.28			(28)
Walls Type1	294.74	19.76	274.98	x 2.1 =	577.46			(29)
Walls Type2	261.56	93.05	168.51	x 0.25 =	42.13			(29)
Walls Type3	88.29	0	88.29	x 0.2 =	17.66			(29)
Walls Type4	12.1	8.62	3.48	x 0.25 =	0.87			(29)
Roof Type1	18.3	0	18.3	x 0.16 =	2.93			(30)
Roof Type2	111.7	26.47	85.23	x 0.16 =	13.64			(30)
Roof Type3	4.1	0	4.1	x 0.16 =	0.66			(30)
Roof Type4	149.9	0	149.9	x 0.16 =	23.98			(30)
Roof Type5	11.5	0	11.5	x 0.16 =	1.84			(30)
Total area of elements, m²			1236.69					(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)...(30) + (32) =	943.6	(33)
Heat capacity Cm = S(A x k)	((28)...(30) + (32) + (32a)...(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		185.5	(36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss	(33) + (36) =	1129.1	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	581.11	571.21	561.51	515.93	507.4	467.71	467.71	460.36	483	507.4	524.65	542.69	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	1710.21	1700.31	1690.61	1645.03	1636.51	1596.81	1596.81	1589.46	1612.1	1636.51	1653.76	1671.79

Average = $Sum(39)_{1...12}$ /12= 1644.99 (39)

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Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

(40)m=	2.83	2.81	2.8	2.72	2.71	2.64	2.64	2.63	2.67	2.71	2.74	2.77

Average = Sum(40)$_{1...12}$ /12= 2.72 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 3.53 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 117.98 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	129.78	125.06	120.34	115.62	110.9	106.18	106.18	110.9	115.62	120.34	125.06	129.78	

Total = Sum(44)$_{1...12}$ = 1415.74 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	192.45	168.32	173.69	151.43	145.3	125.38	116.19	133.33	134.92	157.23	171.63	186.38

Total = Sum(45)$_{1...12}$ = 1856.26 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	28.87	25.25	26.05	22.71	21.8	18.81	17.43	20	20.24	23.59	25.74	27.96	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 600 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 3.78 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 2.04 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 2.04 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	63.28	57.15	63.28	61.24	63.28	61.24	63.28	63.28	61.24	63.28	61.24	63.28	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	63.28	57.15	63.28	61.24	63.28	61.24	63.28	63.28	61.24	63.28	61.24	63.28	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	278.99	246.49	260.23	235.18	231.84	209.13	202.73	219.87	218.67	243.77	255.38	272.92	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	278.99	246.49	260.23	235.18	231.84	209.13	202.73	219.87	218.67	243.77	255.38	272.92	

Output from water heater (annual)$_{1...12}$ 2875.2 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	133.22	118.5	126.98	117.35	117.54	108.69	107.86	113.56	111.86	121.51	124.07	131.2	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	211.65	211.65	211.65	211.65	211.65	211.65	211.65	211.65	211.65	211.65	211.65	211.65	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	150.28	133.48	108.55	82.18	61.43	51.86	56.04	72.84	97.77	124.14	144.89	154.46	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	1006.38	1016.82	990.5	934.48	863.76	797.29	752.89	742.45	768.76	824.79	895.51	961.97	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	59.69	59.69	59.69	59.69	59.69	59.69	59.69	59.69	59.69	59.69	59.69	59.69	(69)

Pumps and fans gains (Table 5a)

(70)m=	10	10	10	10	10	10	10	10	10	10	10	10	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-141.1	-141.1	-141.1	-141.1	-141.1	-141.1	-141.1	-141.1	-141.1	-141.1	-141.1	-141.1	(71)

Water heating gains (Table 5)

(72)m=	179.06	176.34	170.68	162.98	157.99	150.96	144.98	152.64	155.36	163.32	172.31	176.35	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	1475.96	1466.88	1409.98	1319.89	1223.42	1140.35	1094.15	1108.17	1162.13	1252.49	1352.95	1433.02	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	4.7	x	11.28	x	0.63	x	0.7	=	64.83	(75)
Northeast 0.9x	0.77	x	1.71	x	11.28	x	0.63	x	0.7	=	5.9	(75)
Northeast 0.9x	0.77	x	1.71	x	11.28	x	0.63	x	0.7	=	17.69	(75)
Northeast 0.9x	0.77	x	0.64	x	11.28	x	0.63	x	0.7	=	4.41	(75)
Northeast 0.9x	0.77	x	2.42	x	11.28	x	0.63	x	0.7	=	8.34	(75)

Northeast 0.9x	0.54	x	7.48	x	11.28	x	0.63	x	0.7	=	18.09	(75)
Northeast 0.9x	0.54	x	14.88	x	11.28	x	0.63	x	0.7	=	35.98	(75)
Northeast 0.9x	0.77	x	4.7	x	22.97	x	0.63	x	0.7	=	131.96	(75)
Northeast 0.9x	0.77	x	1.71	x	22.97	x	0.63	x	0.7	=	12	(75)
Northeast 0.9x	0.77	x	1.71	x	22.97	x	0.63	x	0.7	=	36.01	(75)
Northeast 0.9x	0.77	x	0.64	x	22.97	x	0.63	x	0.7	=	8.98	(75)
Northeast 0.9x	0.77	x	2.42	x	22.97	x	0.63	x	0.7	=	16.99	(75)
Northeast 0.9x	0.54	x	7.48	x	22.97	x	0.63	x	0.7	=	36.82	(75)
Northeast 0.9x	0.54	x	14.88	x	22.97	x	0.63	x	0.7	=	73.24	(75)
Northeast 0.9x	0.77	x	4.7	x	41.38	x	0.63	x	0.7	=	237.74	(75)
Northeast 0.9x	0.77	x	1.71	x	41.38	x	0.63	x	0.7	=	21.62	(75)
Northeast 0.9x	0.77	x	1.71	x	41.38	x	0.63	x	0.7	=	64.87	(75)
Northeast 0.9x	0.77	x	0.64	x	41.38	x	0.63	x	0.7	=	16.19	(75)
Northeast 0.9x	0.77	x	2.42	x	41.38	x	0.63	x	0.7	=	30.6	(75)
Northeast 0.9x	0.54	x	7.48	x	41.38	x	0.63	x	0.7	=	66.34	(75)
Northeast 0.9x	0.54	x	14.88	x	41.38	x	0.63	x	0.7	=	131.96	(75)
Northeast 0.9x	0.77	x	4.7	x	67.96	x	0.63	x	0.7	=	390.44	(75)
Northeast 0.9x	0.77	x	1.71	x	67.96	x	0.63	x	0.7	=	35.51	(75)
Northeast 0.9x	0.77	x	1.71	x	67.96	x	0.63	x	0.7	=	106.54	(75)
Northeast 0.9x	0.77	x	0.64	x	67.96	x	0.63	x	0.7	=	26.58	(75)
Northeast 0.9x	0.77	x	2.42	x	67.96	x	0.63	x	0.7	=	50.26	(75)
Northeast 0.9x	0.54	x	7.48	x	67.96	x	0.63	x	0.7	=	108.94	(75)
Northeast 0.9x	0.54	x	14.88	x	67.96	x	0.63	x	0.7	=	216.72	(75)
Northeast 0.9x	0.77	x	4.7	x	91.35	x	0.63	x	0.7	=	524.83	(75)
Northeast 0.9x	0.77	x	1.71	x	91.35	x	0.63	x	0.7	=	47.74	(75)
Northeast 0.9x	0.77	x	1.71	x	91.35	x	0.63	x	0.7	=	143.21	(75)
Northeast 0.9x	0.77	x	0.64	x	91.35	x	0.63	x	0.7	=	35.73	(75)
Northeast 0.9x	0.77	x	2.42	x	91.35	x	0.63	x	0.7	=	67.56	(75)
Northeast 0.9x	0.54	x	7.48	x	91.35	x	0.63	x	0.7	=	146.44	(75)
Northeast 0.9x	0.54	x	14.88	x	91.35	x	0.63	x	0.7	=	291.32	(75)
Northeast 0.9x	0.77	x	4.7	x	97.38	x	0.63	x	0.7	=	559.52	(75)
Northeast 0.9x	0.77	x	1.71	x	97.38	x	0.63	x	0.7	=	50.89	(75)
Northeast 0.9x	0.77	x	1.71	x	97.38	x	0.63	x	0.7	=	152.68	(75)
Northeast 0.9x	0.77	x	0.64	x	97.38	x	0.63	x	0.7	=	38.1	(75)
Northeast 0.9x	0.77	x	2.42	x	97.38	x	0.63	x	0.7	=	72.02	(75)
Northeast 0.9x	0.54	x	7.48	x	97.38	x	0.63	x	0.7	=	156.12	(75)
Northeast 0.9x	0.54	x	14.88	x	97.38	x	0.63	x	0.7	=	310.58	(75)
Northeast 0.9x	0.77	x	4.7	x	91.1	x	0.63	x	0.7	=	523.42	(75)
Northeast 0.9x	0.77	x	1.71	x	91.1	x	0.63	x	0.7	=	47.61	(75)
Northeast 0.9x	0.77	x	1.71	x	91.1	x	0.63	x	0.7	=	142.83	(75)
Northeast 0.9x	0.77	x	0.64	x	91.1	x	0.63	x	0.7	=	35.64	(75)

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Northeast 0.9x	0.77	x	2.42	x	91.1	x	0.63	x	0.7	=	67.38	(75)
Northeast 0.9x	0.54	x	7.48	x	91.1	x	0.63	x	0.7	=	146.05	(75)
Northeast 0.9x	0.54	x	14.88	x	91.1	x	0.63	x	0.7	=	290.54	(75)
Northeast 0.9x	0.77	x	4.7	x	72.63	x	0.63	x	0.7	=	417.28	(75)
Northeast 0.9x	0.77	x	1.71	x	72.63	x	0.63	x	0.7	=	37.95	(75)
Northeast 0.9x	0.77	x	1.71	x	72.63	x	0.63	x	0.7	=	113.86	(75)
Northeast 0.9x	0.77	x	0.64	x	72.63	x	0.63	x	0.7	=	28.41	(75)
Northeast 0.9x	0.77	x	2.42	x	72.63	x	0.63	x	0.7	=	53.71	(75)
Northeast 0.9x	0.54	x	7.48	x	72.63	x	0.63	x	0.7	=	116.43	(75)
Northeast 0.9x	0.54	x	14.88	x	72.63	x	0.63	x	0.7	=	231.62	(75)
Northeast 0.9x	0.77	x	4.7	x	50.42	x	0.63	x	0.7	=	289.69	(75)
Northeast 0.9x	0.77	x	1.71	x	50.42	x	0.63	x	0.7	=	26.35	(75)
Northeast 0.9x	0.77	x	1.71	x	50.42	x	0.63	x	0.7	=	79.05	(75)
Northeast 0.9x	0.77	x	0.64	x	50.42	x	0.63	x	0.7	=	19.72	(75)
Northeast 0.9x	0.77	x	2.42	x	50.42	x	0.63	x	0.7	=	37.29	(75)
Northeast 0.9x	0.54	x	7.48	x	50.42	x	0.63	x	0.7	=	80.83	(75)
Northeast 0.9x	0.54	x	14.88	x	50.42	x	0.63	x	0.7	=	160.8	(75)
Northeast 0.9x	0.77	x	4.7	x	28.07	x	0.63	x	0.7	=	161.26	(75)
Northeast 0.9x	0.77	x	1.71	x	28.07	x	0.63	x	0.7	=	14.67	(75)
Northeast 0.9x	0.77	x	1.71	x	28.07	x	0.63	x	0.7	=	44	(75)
Northeast 0.9x	0.77	x	0.64	x	28.07	x	0.63	x	0.7	=	10.98	(75)
Northeast 0.9x	0.77	x	2.42	x	28.07	x	0.63	x	0.7	=	20.76	(75)
Northeast 0.9x	0.54	x	7.48	x	28.07	x	0.63	x	0.7	=	45	(75)
Northeast 0.9x	0.54	x	14.88	x	28.07	x	0.63	x	0.7	=	89.51	(75)
Northeast 0.9x	0.77	x	4.7	x	14.2	x	0.63	x	0.7	=	81.57	(75)
Northeast 0.9x	0.77	x	1.71	x	14.2	x	0.63	x	0.7	=	7.42	(75)
Northeast 0.9x	0.77	x	1.71	x	14.2	x	0.63	x	0.7	=	22.26	(75)
Northeast 0.9x	0.77	x	0.64	x	14.2	x	0.63	x	0.7	=	5.55	(75)
Northeast 0.9x	0.77	x	2.42	x	14.2	x	0.63	x	0.7	=	10.5	(75)
Northeast 0.9x	0.54	x	7.48	x	14.2	x	0.63	x	0.7	=	22.76	(75)
Northeast 0.9x	0.54	x	14.88	x	14.2	x	0.63	x	0.7	=	45.28	(75)
Northeast 0.9x	0.77	x	4.7	x	9.21	x	0.63	x	0.7	=	52.94	(75)
Northeast 0.9x	0.77	x	1.71	x	9.21	x	0.63	x	0.7	=	4.82	(75)
Northeast 0.9x	0.77	x	1.71	x	9.21	x	0.63	x	0.7	=	14.45	(75)
Northeast 0.9x	0.77	x	0.64	x	9.21	x	0.63	x	0.7	=	3.6	(75)
Northeast 0.9x	0.77	x	2.42	x	9.21	x	0.63	x	0.7	=	6.81	(75)
Northeast 0.9x	0.54	x	7.48	x	9.21	x	0.63	x	0.7	=	14.77	(75)
Northeast 0.9x	0.54	x	14.88	x	9.21	x	0.63	x	0.7	=	29.39	(75)
Southeast 0.9x	0.77	x	0.78	x	36.79	x	0.63	x	0.7	=	8.77	(77)
Southeast 0.9x	0.77	x	2.92	x	36.79	x	0.63	x	0.7	=	32.83	(77)
Southeast 0.9x	0.77	x	4.33	x	36.79	x	0.63	x	0.7	=	48.69	(77)

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Southeast 0.9x	0.77	x	1.31	x	36.79	x	0.63	x	0.7	=	14.73	(77)
Southeast 0.9x	0.77	x	0.78	x	36.79	x	0.63	x	0.7	=	8.77	(77)
Southeast 0.9x	0.77	x	0.78	x	62.67	x	0.63	x	0.7	=	14.94	(77)
Southeast 0.9x	0.77	x	2.92	x	62.67	x	0.63	x	0.7	=	55.93	(77)
Southeast 0.9x	0.77	x	4.33	x	62.67	x	0.63	x	0.7	=	82.94	(77)
Southeast 0.9x	0.77	x	1.31	x	62.67	x	0.63	x	0.7	=	25.09	(77)
Southeast 0.9x	0.77	x	0.78	x	62.67	x	0.63	x	0.7	=	14.94	(77)
Southeast 0.9x	0.77	x	0.78	x	85.75	x	0.63	x	0.7	=	20.44	(77)
Southeast 0.9x	0.77	x	2.92	x	85.75	x	0.63	x	0.7	=	76.52	(77)
Southeast 0.9x	0.77	x	4.33	x	85.75	x	0.63	x	0.7	=	113.48	(77)
Southeast 0.9x	0.77	x	1.31	x	85.75	x	0.63	x	0.7	=	34.33	(77)
Southeast 0.9x	0.77	x	0.78	x	85.75	x	0.63	x	0.7	=	20.44	(77)
Southeast 0.9x	0.77	x	0.78	x	106.25	x	0.63	x	0.7	=	25.33	(77)
Southeast 0.9x	0.77	x	2.92	x	106.25	x	0.63	x	0.7	=	94.82	(77)
Southeast 0.9x	0.77	x	4.33	x	106.25	x	0.63	x	0.7	=	140.6	(77)
Southeast 0.9x	0.77	x	1.31	x	106.25	x	0.63	x	0.7	=	42.54	(77)
Southeast 0.9x	0.77	x	0.78	x	106.25	x	0.63	x	0.7	=	25.33	(77)
Southeast 0.9x	0.77	x	0.78	x	119.01	x	0.63	x	0.7	=	28.37	(77)
Southeast 0.9x	0.77	x	2.92	x	119.01	x	0.63	x	0.7	=	106.2	(77)
Southeast 0.9x	0.77	x	4.33	x	119.01	x	0.63	x	0.7	=	157.49	(77)
Southeast 0.9x	0.77	x	1.31	x	119.01	x	0.63	x	0.7	=	47.65	(77)
Southeast 0.9x	0.77	x	0.78	x	119.01	x	0.63	x	0.7	=	28.37	(77)
Southeast 0.9x	0.77	x	0.78	x	118.15	x	0.63	x	0.7	=	28.16	(77)
Southeast 0.9x	0.77	x	2.92	x	118.15	x	0.63	x	0.7	=	105.44	(77)
Southeast 0.9x	0.77	x	4.33	x	118.15	x	0.63	x	0.7	=	156.35	(77)
Southeast 0.9x	0.77	x	1.31	x	118.15	x	0.63	x	0.7	=	47.3	(77)
Southeast 0.9x	0.77	x	0.78	x	118.15	x	0.63	x	0.7	=	28.16	(77)
Southeast 0.9x	0.77	x	0.78	x	113.91	x	0.63	x	0.7	=	27.15	(77)
Southeast 0.9x	0.77	x	2.92	x	113.91	x	0.63	x	0.7	=	101.65	(77)
Southeast 0.9x	0.77	x	4.33	x	113.91	x	0.63	x	0.7	=	150.74	(77)
Southeast 0.9x	0.77	x	1.31	x	113.91	x	0.63	x	0.7	=	45.6	(77)
Southeast 0.9x	0.77	x	0.78	x	113.91	x	0.63	x	0.7	=	27.15	(77)
Southeast 0.9x	0.77	x	0.78	x	104.39	x	0.63	x	0.7	=	24.88	(77)
Southeast 0.9x	0.77	x	2.92	x	104.39	x	0.63	x	0.7	=	93.16	(77)
Southeast 0.9x	0.77	x	4.33	x	104.39	x	0.63	x	0.7	=	138.14	(77)
Southeast 0.9x	0.77	x	1.31	x	104.39	x	0.63	x	0.7	=	41.79	(77)
Southeast 0.9x	0.77	x	0.78	x	104.39	x	0.63	x	0.7	=	24.88	(77)
Southeast 0.9x	0.77	x	0.78	x	92.85	x	0.63	x	0.7	=	22.13	(77)
Southeast 0.9x	0.77	x	2.92	x	92.85	x	0.63	x	0.7	=	82.86	(77)
Southeast 0.9x	0.77	x	4.33	x	92.85	x	0.63	x	0.7	=	122.87	(77)
Southeast 0.9x	0.77	x	1.31	x	92.85	x	0.63	x	0.7	=	37.17	(77)

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Southeast	0.9x	0.77	x	0.78	x	92.85	x	0.63	x	0.7	=	22.13	(77)
Southeast	0.9x	0.77	x	0.78	x	69.27	x	0.63	x	0.7	=	16.51	(77)
Southeast	0.9x	0.77	x	2.92	x	69.27	x	0.63	x	0.7	=	61.81	(77)
Southeast	0.9x	0.77	x	4.33	x	69.27	x	0.63	x	0.7	=	91.66	(77)
Southeast	0.9x	0.77	x	1.31	x	69.27	x	0.63	x	0.7	=	27.73	(77)
Southeast	0.9x	0.77	x	0.78	x	69.27	x	0.63	x	0.7	=	16.51	(77)
Southeast	0.9x	0.77	x	0.78	x	44.07	x	0.63	x	0.7	=	10.51	(77)
Southeast	0.9x	0.77	x	2.92	x	44.07	x	0.63	x	0.7	=	39.33	(77)
Southeast	0.9x	0.77	x	4.33	x	44.07	x	0.63	x	0.7	=	58.32	(77)
Southeast	0.9x	0.77	x	1.31	x	44.07	x	0.63	x	0.7	=	17.64	(77)
Southeast	0.9x	0.77	x	0.78	x	44.07	x	0.63	x	0.7	=	10.51	(77)
Southeast	0.9x	0.77	x	0.78	x	31.49	x	0.63	x	0.7	=	7.51	(77)
Southeast	0.9x	0.77	x	2.92	x	31.49	x	0.63	x	0.7	=	28.1	(77)
Southeast	0.9x	0.77	x	4.33	x	31.49	x	0.63	x	0.7	=	41.67	(77)
Southeast	0.9x	0.77	x	1.31	x	31.49	x	0.63	x	0.7	=	12.61	(77)
Southeast	0.9x	0.77	x	0.78	x	31.49	x	0.63	x	0.7	=	7.51	(77)
South	0.9x	0.77	x	2.25	x	46.75	x	0.63	x	0.7	=	64.3	(78)
South	0.9x	0.77	x	2.25	x	76.57	x	0.63	x	0.7	=	105.3	(78)
South	0.9x	0.77	x	2.25	x	97.53	x	0.63	x	0.7	=	134.13	(78)
South	0.9x	0.77	x	2.25	x	110.23	x	0.63	x	0.7	=	151.6	(78)
South	0.9x	0.77	x	2.25	x	114.87	x	0.63	x	0.7	=	157.98	(78)
South	0.9x	0.77	x	2.25	x	110.55	x	0.63	x	0.7	=	152.03	(78)
South	0.9x	0.77	x	2.25	x	108.01	x	0.63	x	0.7	=	148.54	(78)
South	0.9x	0.77	x	2.25	x	104.89	x	0.63	x	0.7	=	144.26	(78)
South	0.9x	0.77	x	2.25	x	101.89	x	0.63	x	0.7	=	140.12	(78)
South	0.9x	0.77	x	2.25	x	82.59	x	0.63	x	0.7	=	113.58	(78)
South	0.9x	0.77	x	2.25	x	55.42	x	0.63	x	0.7	=	76.21	(78)
South	0.9x	0.77	x	2.25	x	40.4	x	0.63	x	0.7	=	55.56	(78)
Southwest	0.9x	0.77	x	0.47	x	36.79		0.63	x	0.7	=	5.28	(79)
Southwest	0.9x	0.77	x	5.36	x	36.79		0.63	x	0.7	=	120.54	(79)
Southwest	0.9x	0.77	x	1.63	x	36.79		0.63	x	0.7	=	73.32	(79)
Southwest	0.9x	0.77	x	2.3	x	36.79		0.63	x	0.7	=	25.86	(79)
Southwest	0.9x	0.54	x	2	x	36.79		0.63	x	0.7	=	15.77	(79)
Southwest	0.9x	0.77	x	0.47	x	62.67		0.63	x	0.7	=	9	(79)
Southwest	0.9x	0.77	x	5.36	x	62.67		0.63	x	0.7	=	205.33	(79)
Southwest	0.9x	0.77	x	1.63	x	62.67		0.63	x	0.7	=	124.88	(79)
Southwest	0.9x	0.77	x	2.3	x	62.67		0.63	x	0.7	=	44.05	(79)
Southwest	0.9x	0.54	x	2	x	62.67		0.63	x	0.7	=	26.87	(79)
Southwest	0.9x	0.77	x	0.47	x	85.75		0.63	x	0.7	=	12.32	(79)
Southwest	0.9x	0.77	x	5.36	x	85.75		0.63	x	0.7	=	280.94	(79)
Southwest	0.9x	0.77	x	1.63	x	85.75		0.63	x	0.7	=	170.87	(79)

Southwest0.9x	0.77	x	2.3	x	85.75		0.63	x	0.7	=	60.28	(79)
Southwest0.9x	0.54	x	2	x	85.75		0.63	x	0.7	=	36.76	(79)
Southwest0.9x	0.77	x	0.47	x	106.25		0.63	x	0.7	=	15.26	(79)
Southwest0.9x	0.77	x	5.36	x	106.25		0.63	x	0.7	=	348.1	(79)
Southwest0.9x	0.77	x	1.63	x	106.25		0.63	x	0.7	=	211.72	(79)
Southwest0.9x	0.77	x	2.3	x	106.25		0.63	x	0.7	=	74.69	(79)
Southwest0.9x	0.54	x	2	x	106.25		0.63	x	0.7	=	45.54	(79)
Southwest0.9x	0.77	x	0.47	x	119.01		0.63	x	0.7	=	17.09	(79)
Southwest0.9x	0.77	x	5.36	x	119.01		0.63	x	0.7	=	389.9	(79)
Southwest0.9x	0.77	x	1.63	x	119.01		0.63	x	0.7	=	237.14	(79)
Southwest0.9x	0.77	x	2.3	x	119.01		0.63	x	0.7	=	83.65	(79)
Southwest0.9x	0.54	x	2	x	119.01		0.63	x	0.7	=	51.01	(79)
Southwest0.9x	0.77	x	0.47	x	118.15		0.63	x	0.7	=	16.97	(79)
Southwest0.9x	0.77	x	5.36	x	118.15		0.63	x	0.7	=	387.08	(79)
Southwest0.9x	0.77	x	1.63	x	118.15		0.63	x	0.7	=	235.43	(79)
Southwest0.9x	0.77	x	2.3	x	118.15		0.63	x	0.7	=	83.05	(79)
Southwest0.9x	0.54	x	2	x	118.15		0.63	x	0.7	=	50.65	(79)
Southwest0.9x	0.77	x	0.47	x	113.91		0.63	x	0.7	=	16.36	(79)
Southwest0.9x	0.77	x	5.36	x	113.91		0.63	x	0.7	=	373.19	(79)
Southwest0.9x	0.77	x	1.63	x	113.91		0.63	x	0.7	=	226.98	(79)
Southwest0.9x	0.77	x	2.3	x	113.91		0.63	x	0.7	=	80.07	(79)
Southwest0.9x	0.54	x	2	x	113.91		0.63	x	0.7	=	48.83	(79)
Southwest0.9x	0.77	x	0.47	x	104.39		0.63	x	0.7	=	14.99	(79)
Southwest0.9x	0.77	x	5.36	x	104.39		0.63	x	0.7	=	342	(79)
Southwest0.9x	0.77	x	1.63	x	104.39		0.63	x	0.7	=	208.01	(79)
Southwest0.9x	0.77	x	2.3	x	104.39		0.63	x	0.7	=	73.38	(79)
Southwest0.9x	0.54	x	2	x	104.39		0.63	x	0.7	=	44.75	(79)
Southwest0.9x	0.77	x	0.47	x	92.85		0.63	x	0.7	=	13.34	(79)
Southwest0.9x	0.77	x	5.36	x	92.85		0.63	x	0.7	=	304.2	(79)
Southwest0.9x	0.77	x	1.63	x	92.85		0.63	x	0.7	=	185.02	(79)
Southwest0.9x	0.77	x	2.3	x	92.85		0.63	x	0.7	=	65.27	(79)
Southwest0.9x	0.54	x	2	x	92.85		0.63	x	0.7	=	39.8	(79)
Southwest0.9x	0.77	x	0.47	x	69.27		0.63	x	0.7	=	9.95	(79)
Southwest0.9x	0.77	x	5.36	x	69.27		0.63	x	0.7	=	226.93	(79)
Southwest0.9x	0.77	x	1.63	x	69.27		0.63	x	0.7	=	138.02	(79)
Southwest0.9x	0.77	x	2.3	x	69.27		0.63	x	0.7	=	48.69	(79)
Southwest0.9x	0.54	x	2	x	69.27		0.63	x	0.7	=	29.69	(79)
Southwest0.9x	0.77	x	0.47	x	44.07		0.63	x	0.7	=	6.33	(79)
Southwest0.9x	0.77	x	5.36	x	44.07		0.63	x	0.7	=	144.38	(79)
Southwest0.9x	0.77	x	1.63	x	44.07		0.63	x	0.7	=	87.81	(79)
Southwest0.9x	0.77	x	2.3	x	44.07		0.63	x	0.7	=	30.98	(79)

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Southwest	0.9x	0.54	x	2	x	44.07		0.63	x	0.7	=	18.89	(79)
Southwest	0.9x	0.77	x	0.47	x	31.49		0.63	x	0.7	=	4.52	(79)
Southwest	0.9x	0.77	x	5.36	x	31.49		0.63	x	0.7	=	103.16	(79)
Southwest	0.9x	0.77	x	1.63	x	31.49		0.63	x	0.7	=	62.74	(79)
Southwest	0.9x	0.77	x	2.3	x	31.49		0.63	x	0.7	=	22.13	(79)
Southwest	0.9x	0.54	x	2	x	31.49		0.63	x	0.7	=	13.5	(79)
West	0.9x	0.77	x	2.25	x	19.64	x	0.63	x	0.7	=	27.01	(80)
West	0.9x	0.77	x	2.25	x	38.42	x	0.63	x	0.7	=	52.84	(80)
West	0.9x	0.77	x	2.25	x	63.27	x	0.63	x	0.7	=	87.02	(80)
West	0.9x	0.77	x	2.25	x	92.28	x	0.63	x	0.7	=	126.91	(80)
West	0.9x	0.77	x	2.25	x	113.09	x	0.63	x	0.7	=	155.53	(80)
West	0.9x	0.77	x	2.25	x	115.77	x	0.63	x	0.7	=	159.21	(80)
West	0.9x	0.77	x	2.25	x	110.22	x	0.63	x	0.7	=	151.58	(80)
West	0.9x	0.77	x	2.25	x	94.68	x	0.63	x	0.7	=	130.2	(80)
West	0.9x	0.77	x	2.25	x	73.59	x	0.63	x	0.7	=	101.2	(80)
West	0.9x	0.77	x	2.25	x	45.59	x	0.63	x	0.7	=	62.7	(80)
West	0.9x	0.77	x	2.25	x	24.49	x	0.63	x	0.7	=	33.68	(80)
West	0.9x	0.77	x	2.25	x	16.15	x	0.63	x	0.7	=	22.21	(80)
Northwest	0.9x	0.77	x	1.08	x	11.28	x	0.63	x	0.7	=	7.45	(81)
Northwest	0.9x	0.77	x	4.5	x	11.28	x	0.63	x	0.7	=	15.52	(81)
Northwest	0.9x	0.77	x	2.89	x	11.28	x	0.63	x	0.7	=	9.97	(81)
Northwest	0.9x	0.77	x	1.31	x	11.28	x	0.63	x	0.7	=	4.52	(81)
Northwest	0.9x	0.54	x	8.9	x	11.28	x	0.63	x	0.7	=	21.52	(81)
Northwest	0.9x	0.77	x	1.08	x	22.97	x	0.63	x	0.7	=	15.16	(81)
Northwest	0.9x	0.77	x	4.5	x	22.97	x	0.63	x	0.7	=	31.59	(81)
Northwest	0.9x	0.77	x	2.89	x	22.97	x	0.63	x	0.7	=	20.28	(81)
Northwest	0.9x	0.77	x	1.31	x	22.97	x	0.63	x	0.7	=	9.19	(81)
Northwest	0.9x	0.54	x	8.9	x	22.97	x	0.63	x	0.7	=	43.81	(81)
Northwest	0.9x	0.77	x	1.08	x	41.38	x	0.63	x	0.7	=	27.32	(81)
Northwest	0.9x	0.77	x	4.5	x	41.38	x	0.63	x	0.7	=	56.91	(81)
Northwest	0.9x	0.77	x	2.89	x	41.38	x	0.63	x	0.7	=	36.55	(81)
Northwest	0.9x	0.77	x	1.31	x	41.38	x	0.63	x	0.7	=	16.57	(81)
Northwest	0.9x	0.54	x	8.9	x	41.38	x	0.63	x	0.7	=	78.93	(81)
Northwest	0.9x	0.77	x	1.08	x	67.96	x	0.63	x	0.7	=	44.86	(81)
Northwest	0.9x	0.77	x	4.5	x	67.96	x	0.63	x	0.7	=	93.46	(81)
Northwest	0.9x	0.77	x	2.89	x	67.96	x	0.63	x	0.7	=	60.02	(81)
Northwest	0.9x	0.77	x	1.31	x	67.96	x	0.63	x	0.7	=	27.21	(81)
Northwest	0.9x	0.54	x	8.9	x	67.96	x	0.63	x	0.7	=	129.63	(81)
Northwest	0.9x	0.77	x	1.08	x	91.35	x	0.63	x	0.7	=	60.3	(81)
Northwest	0.9x	0.77	x	4.5	x	91.35	x	0.63	x	0.7	=	125.62	(81)
Northwest	0.9x	0.77	x	2.89	x	91.35	x	0.63	x	0.7	=	80.68	(81)

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Northwest 0.9x	0.77	x	1.31	x	91.35	x	0.63	x	0.7	=	36.57	(81)
Northwest 0.9x	0.54	x	8.9	x	91.35	x	0.63	x	0.7	=	174.24	(81)
Northwest 0.9x	0.77	x	1.08	x	97.38	x	0.63	x	0.7	=	64.29	(81)
Northwest 0.9x	0.77	x	4.5	x	97.38	x	0.63	x	0.7	=	133.93	(81)
Northwest 0.9x	0.77	x	2.89	x	97.38	x	0.63	x	0.7	=	86.01	(81)
Northwest 0.9x	0.77	x	1.31	x	97.38	x	0.63	x	0.7	=	38.99	(81)
Northwest 0.9x	0.54	x	8.9	x	97.38	x	0.63	x	0.7	=	185.76	(81)
Northwest 0.9x	0.77	x	1.08	x	91.1	x	0.63	x	0.7	=	60.14	(81)
Northwest 0.9x	0.77	x	4.5	x	91.1	x	0.63	x	0.7	=	125.29	(81)
Northwest 0.9x	0.77	x	2.89	x	91.1	x	0.63	x	0.7	=	80.46	(81)
Northwest 0.9x	0.77	x	1.31	x	91.1	x	0.63	x	0.7	=	36.47	(81)
Northwest 0.9x	0.54	x	8.9	x	91.1	x	0.63	x	0.7	=	173.78	(81)
Northwest 0.9x	0.77	x	1.08	x	72.63	x	0.63	x	0.7	=	47.94	(81)
Northwest 0.9x	0.77	x	4.5	x	72.63	x	0.63	x	0.7	=	99.88	(81)
Northwest 0.9x	0.77	x	2.89	x	72.63	x	0.63	x	0.7	=	64.15	(81)
Northwest 0.9x	0.77	x	1.31	x	72.63	x	0.63	x	0.7	=	29.08	(81)
Northwest 0.9x	0.54	x	8.9	x	72.63	x	0.63	x	0.7	=	138.54	(81)
Northwest 0.9x	0.77	x	1.08	x	50.42	x	0.63	x	0.7	=	33.28	(81)
Northwest 0.9x	0.77	x	4.5	x	50.42	x	0.63	x	0.7	=	69.34	(81)
Northwest 0.9x	0.77	x	2.89	x	50.42	x	0.63	x	0.7	=	44.53	(81)
Northwest 0.9x	0.77	x	1.31	x	50.42	x	0.63	x	0.7	=	20.19	(81)
Northwest 0.9x	0.54	x	8.9	x	50.42	x	0.63	x	0.7	=	96.18	(81)
Northwest 0.9x	0.77	x	1.08	x	28.07	x	0.63	x	0.7	=	18.53	(81)
Northwest 0.9x	0.77	x	4.5	x	28.07	x	0.63	x	0.7	=	38.6	(81)
Northwest 0.9x	0.77	x	2.89	x	28.07	x	0.63	x	0.7	=	24.79	(81)
Northwest 0.9x	0.77	x	1.31	x	28.07	x	0.63	x	0.7	=	11.24	(81)
Northwest 0.9x	0.54	x	8.9	x	28.07	x	0.63	x	0.7	=	53.54	(81)
Northwest 0.9x	0.77	x	1.08	x	14.2	x	0.63	x	0.7	=	9.37	(81)
Northwest 0.9x	0.77	x	4.5	x	14.2	x	0.63	x	0.7	=	19.52	(81)
Northwest 0.9x	0.77	x	2.89	x	14.2	x	0.63	x	0.7	=	12.54	(81)
Northwest 0.9x	0.77	x	1.31	x	14.2	x	0.63	x	0.7	=	5.68	(81)
Northwest 0.9x	0.54	x	8.9	x	14.2	x	0.63	x	0.7	=	27.08	(81)
Northwest 0.9x	0.77	x	1.08	x	9.21	x	0.63	x	0.7	=	6.08	(81)
Northwest 0.9x	0.77	x	4.5	x	9.21	x	0.63	x	0.7	=	12.67	(81)
Northwest 0.9x	0.77	x	2.89	x	9.21	x	0.63	x	0.7	=	8.14	(81)
Northwest 0.9x	0.77	x	1.31	x	9.21	x	0.63	x	0.7	=	3.69	(81)
Northwest 0.9x	0.54	x	8.9	x	9.21	x	0.63	x	0.7	=	17.58	(81)
Rooflights 0.9x	1	x	9	x	26	x	0.63	x	0.7	=	92.87	(82)
Rooflights 0.9x	1	x	13.13	x	26	x	0.63	x	0.7	=	135.49	(82)
Rooflights 0.9x	1	x	4.34	x	26	x	0.63	x	0.7	=	44.79	(82)
Rooflights 0.9x	1	x	9	x	54	x	0.63	x	0.7	=	192.89	(82)

Rooflights 0.9x	1	x	13.13	x	54	x	0.63	x	0.7	=	281.41	(82)
Rooflights 0.9x	1	x	4.34	x	54	x	0.63	x	0.7	=	93.02	(82)
Rooflights 0.9x	1	x	9	x	96	x	0.63	x	0.7	=	342.92	(82)
Rooflights 0.9x	1	x	13.13	x	96	x	0.63	x	0.7	=	500.28	(82)
Rooflights 0.9x	1	x	4.34	x	96	x	0.63	x	0.7	=	165.36	(82)
Rooflights 0.9x	1	x	9	x	150	x	0.63	x	0.7	=	535.81	(82)
Rooflights 0.9x	1	x	13.13	x	150	x	0.63	x	0.7	=	781.69	(82)
Rooflights 0.9x	1	x	4.34	x	150	x	0.63	x	0.7	=	258.38	(82)
Rooflights 0.9x	1	x	9	x	192	x	0.63	x	0.7	=	685.84	(82)
Rooflights 0.9x	1	x	13.13	x	192	x	0.63	x	0.7	=	1000.57	(82)
Rooflights 0.9x	1	x	4.34	x	192	x	0.63	x	0.7	=	330.73	(82)
Rooflights 0.9x	1	x	9	x	200	x	0.63	x	0.7	=	714.42	(82)
Rooflights 0.9x	1	x	13.13	x	200	x	0.63	x	0.7	=	1042.26	(82)
Rooflights 0.9x	1	x	4.34	x	200	x	0.63	x	0.7	=	344.51	(82)
Rooflights 0.9x	1	x	9	x	189	x	0.63	x	0.7	=	675.13	(82)
Rooflights 0.9x	1	x	13.13	x	189	x	0.63	x	0.7	=	984.94	(82)
Rooflights 0.9x	1	x	4.34	x	189	x	0.63	x	0.7	=	325.56	(82)
Rooflights 0.9x	1	x	9	x	157	x	0.63	x	0.7	=	560.82	(82)
Rooflights 0.9x	1	x	13.13	x	157	x	0.63	x	0.7	=	818.17	(82)
Rooflights 0.9x	1	x	4.34	x	157	x	0.63	x	0.7	=	270.44	(82)
Rooflights 0.9x	1	x	9	x	115	x	0.63	x	0.7	=	410.79	(82)
Rooflights 0.9x	1	x	13.13	x	115	x	0.63	x	0.7	=	599.3	(82)
Rooflights 0.9x	1	x	4.34	x	115	x	0.63	x	0.7	=	198.09	(82)
Rooflights 0.9x	1	x	9	x	66	x	0.63	x	0.7	=	235.76	(82)
Rooflights 0.9x	1	x	13.13	x	66	x	0.63	x	0.7	=	343.95	(82)
Rooflights 0.9x	1	x	4.34	x	66	x	0.63	x	0.7	=	113.69	(82)
Rooflights 0.9x	1	x	9	x	33	x	0.63	x	0.7	=	117.88	(82)
Rooflights 0.9x	1	x	13.13	x	33	x	0.63	x	0.7	=	171.97	(82)
Rooflights 0.9x	1	x	4.34	x	33	x	0.63	x	0.7	=	56.84	(82)
Rooflights 0.9x	1	x	9	x	21	x	0.63	x	0.7	=	75.01	(82)
Rooflights 0.9x	1	x	13.13	x	21	x	0.63	x	0.7	=	109.44	(82)
Rooflights 0.9x	1	x	4.34	x	21	x	0.63	x	0.7	=	36.17	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m ...(82)m

(83)m=	933.25	1765.46	2841.7	4168.5	5211.77	5399.91	5113.06	4308.74	3301.56	2070.05	1150.82	776.77	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	2409.21	3232.34	4251.67	5488.38	6435.2	6540.26	6207.21	5416.9	4463.69	3322.54	2503.77	2209.79	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.98	0.94	0.87	0.78	0.83	0.95	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	17.89	18.12	18.57	19.24	19.89	20.45	20.73	20.66	20.16	19.34	18.53	17.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	18.84	18.85	18.85	18.9	18.9	18.94	18.94	18.95	18.93	18.9	18.89	18.87	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.96	0.9	0.75	0.53	0.62	0.89	0.98	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	14.92	15.27	15.93	16.92	17.84	18.58	18.86	18.82	18.25	17.07	15.89	14.95	(90)

fLA = Living area ÷ (4) = 0.2 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	15.51	15.83	16.45	17.38	18.25	18.95	19.23	19.18	18.63	17.52	16.41	15.53	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	15.36	15.68	16.3	17.23	18.1	18.8	19.08	19.03	18.48	17.37	16.26	15.38	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.95	0.88	0.74	0.56	0.63	0.87	0.97	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	2400	3205.27	4165.74	5200.67	5640.95	4856.76	3449.79	3434.37	3891.44	3232.48	2487.3	2203.32	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	18910.68	18326.36	16574.39	13703.55	10466.31	6706.11	3960.79	4187.4	7054.73	11078.25	15143.05	18685.54	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	12283.95	10161.37	9232.03	6122.07	3590.07	0	0	0	0	5837.26	9112.14	12262.78	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 68601.67 (98)

Space heating requirement in kWh/m²/year 113.52 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	12283.95	10161.37	9232.03	6122.07	3590.07	0	0	0	0	5837.26	9112.14	12262.78	
(211)m = {[(98)m x (204)] + (210)m } x 100 ÷ (206)													(211)
	13208.55	10926.21	9926.92	6582.87	3860.29	0	0	0	0	6276.62	9798	13185.78	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 73765.23 (211)

SAP WorkSheet: New dwelling design stage

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] + (214) m } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

278.99	246.49	260.23	235.18	231.84	209.13	202.73	219.87	218.67	243.77	255.38	272.92

Efficiency of water heater 79.3 (216)

(217)m=	89.73	89.71	89.67	89.55	89.27	79.3	79.3	79.3	79.3	89.52	89.67	89.74	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	310.92	274.75	290.22	262.61	259.71	263.72	255.64	277.26	275.74	272.32	284.8	304.14

Total = Sum(219a)$_{1...12}$ = 3331.84 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		73765.23	
Water heating fuel used		3331.84	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	120		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)...(230g) =		165	(231)
Electricity for lighting		1061.59	(232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211) x	3.48	x 0.01 =	2567.03	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	3.48	x 0.01 =	115.95	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	21.76	(249)

(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a

Energy for lighting	(232)	13.19	x 0.01 =	140.02	(250)
Additional standing charges (Table 12)				120	(251)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost (245)...(247) + (250)...(254) = 2964.77 (255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.92	(257)
SAP rating (Section 12)		73.25	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

SAP WorkSheet: New dwelling design stage

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	15933.29	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	719.68	(264)
Space and water heating	(261) + (262) + (263) + (264) =				16652.97	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	85.64	(267)
Electricity for lighting	(232) x		0.519	=	550.97	(268)
Total CO2, kg/year		sum of (265)...(271) =			17289.57	(272)
CO2 emissions per m²		(272) ÷ (4) =			28.61	(273)
El rating (section 14)					64	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		1.22	=	89993.59	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		1.22	=	4064.85	(264)
Space and water heating	(261) + (262) + (263) + (264) =				94058.43	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	506.55	(267)
Electricity for lighting	(232) x		0	=	3259.09	(268)
'Total Primary Energy		sum of (265)...(271) =			97824.08	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			161.88	(273)

APPENDIX (ii)

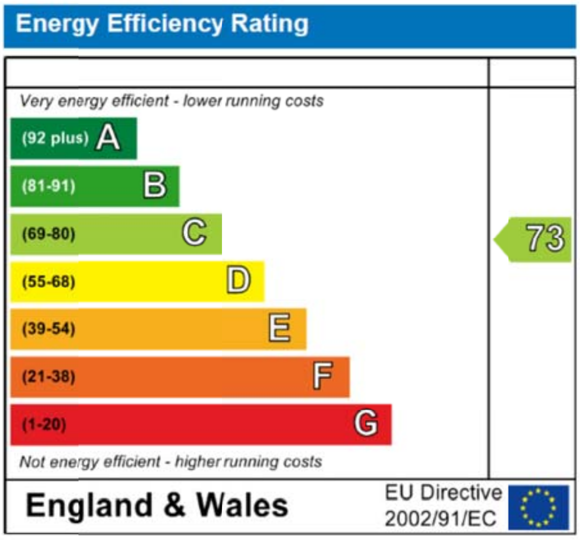
PEA – PREDICTED ENERGY ASSESSMENT (PRE-EPC)

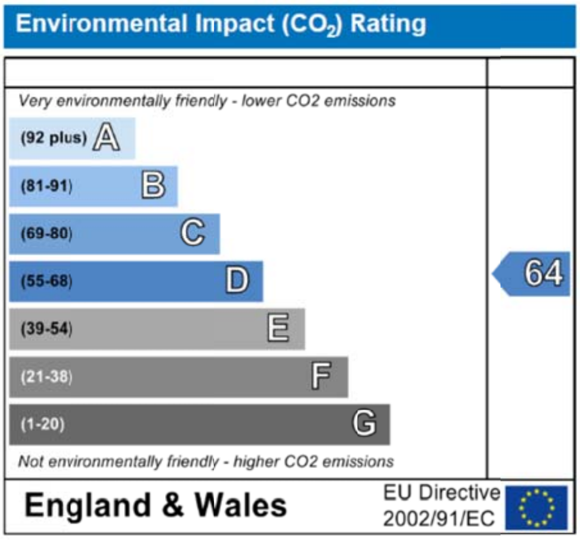
Predicted Energy Assessment

9, Harley Road LONDON NW3 3BX		Dwelling type: Date of assessment: Produced by: Total floor area:	Detached House 22 June 2015 Ondrej Gajdos 604.3 m²

This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO_2) emissions.



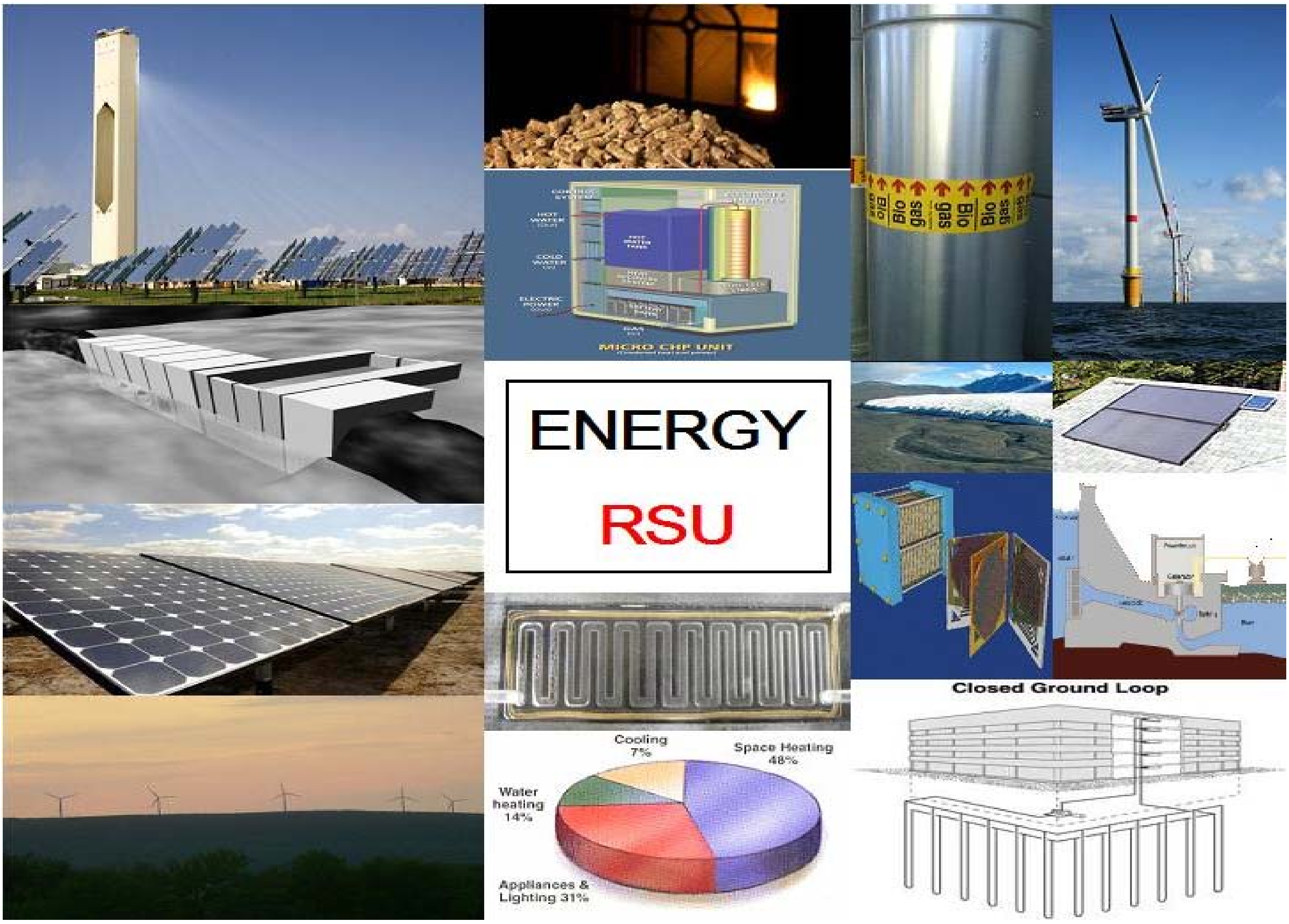


The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbonn dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

APPENDIX (iii)

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 New Build and Refurbishment (BRE certified)
- Solar Shading/Sun Studies

LOW CARBON ENERGY ASSESSORS CIBSE Certification Ltd. breglobal THE CODE FOR SUSTAINABLE HOMES ace member NHER Accreditation Scheme Registered Member

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