Condition 20 (Energy & Sustainability statement)

CONDITION

No development above ground level (excluding works of demolition) shall take place until an Energy & Sustainability Statement has been submitted to and approved in writing by the local planning authority. This Statement must include measures to maximise energy conservation through the design of the buildings. The development shall be constructed in accordance with the agreed and shall thereafter be maintained in the approved form.

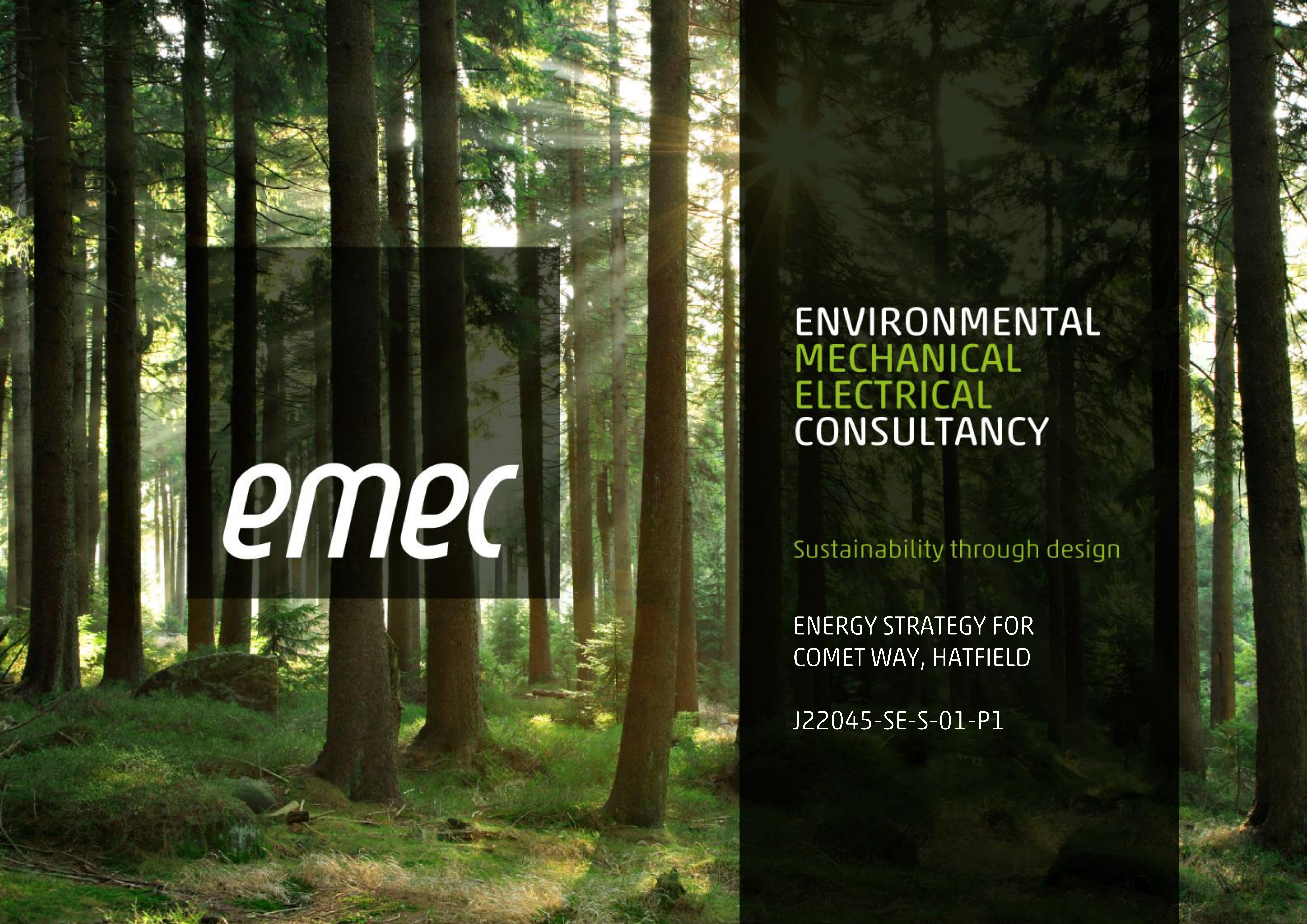
REASON

To ensure that the development contributes towards sustainable development and energy efficiency in accordance with Policy R3 of the Welwyn Hatfield District Plan 2005, Policies SP 10 and SADM 13 of the Welwyn Hatfield Borough Council Draft Local Plan Proposed Submission August 2016, and the National Planning Policy Framework.

RESPONSE

To ensure that the development contributes towards sustainable development and energy efficiency we have attached our Energy & Sustainability Statement via a report which includes measures to maximise energy conservation through the design of the buildings.

Drawing/Datasheets	Title	Rev	Date
J22045-SE-S-01-P1	Energy and sustainability report	P1	12 May 2022



emec

ENVIRONMENTAL
MECHANICAL
ELECTRICAL
CONSULTANCY

Sustainability through design

ENERGY STRATEGY FOR COMET WAY, HATFIELD

J22045-SE-S-01-P1

TABLE OF CONTENTS

ISSUE RECORD

Issue	Document prepared			Document checked by		
	Name	Signature	Date	Name	Signature	Date
P1	Zubair Ahmad	ZA	12.05.2022	Robin Taylor	RT	12.05.2022

Issue	Date	Page No's	Details
P1	12.05.2022		Planning

1.0 EXECUTIVE SUMMARY

This report has been prepared to summarise the design modelling information for a new building comprising 118No. new residential apartments at the former Volkswagen Van Centre, Comet Way, Hatfield, AL10 TF.

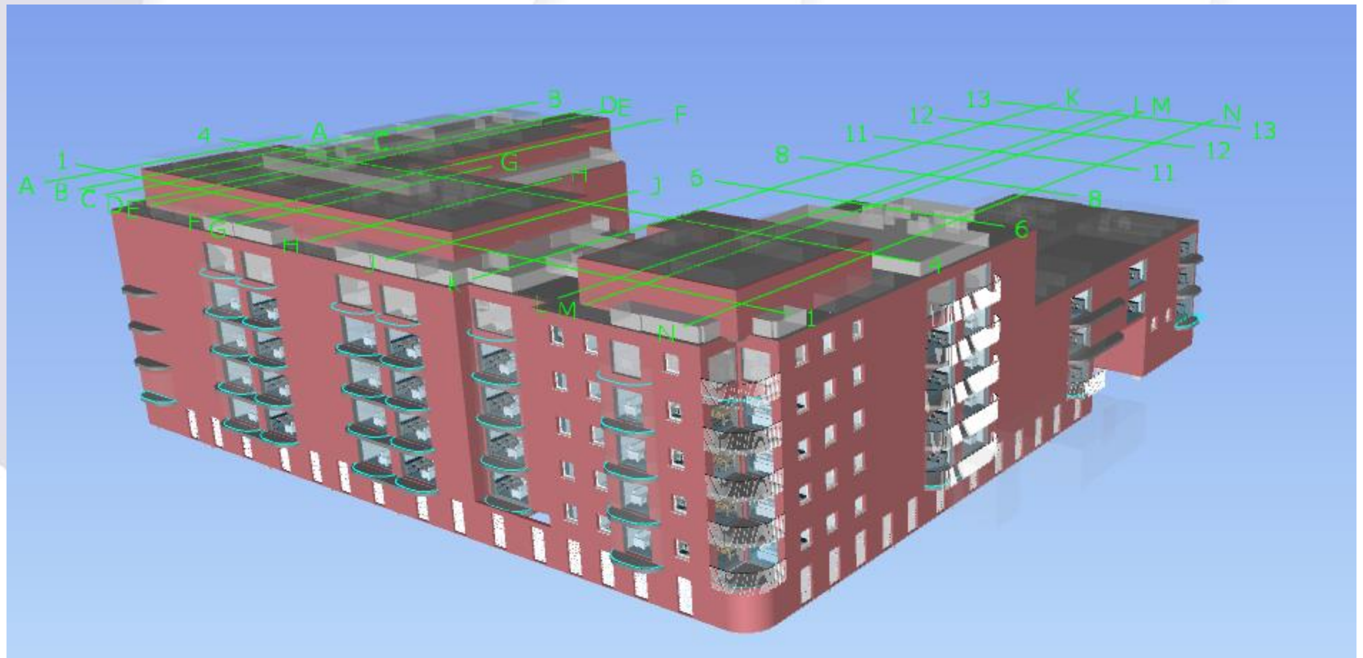
The government approved SAP methodology for domestic building has been used to demonstrate compliance with Welwyn Hatfield's Energy Efficiency and Building Regulation Part L 1A and Part L2A 2013.

The approach to this report has been to estimate the annual energy consumption and preliminary carbon footprint. The preliminary carbon footprints of the buildings have been established based on the RIBA Stage 2 Concept Design.

The outcomes of this modelling exercise are as follows:

- Employ energy efficient measures to comply with Approved Document L1A and Part L2A of the UK Building Regulation 2013 and Welwyn Hatfield District Plan Policy R3 Energy Efficiency. This is achieved by employing Energy Hierarchical approach i.e. Lean, Clean and Green
- High efficiency building services systems along with renewable energy in the form of Air Source Heat Pump (ASHP) providing hot water and Mechanical Ventilation Heat Recovery (MVHR) systems.

3D model of the building



Results Summary to comply with 2013 regulation and planning requirement

Buildings	2013 Average TER $kgCO_2/m^2$	2013 Average DER $kgCO_2/m^2$	% Improvement on TER	Part LA Pass 2013	Renewable Energy
Apartments	23.11	16.97	28.6%	Yes	Air Source Heat Pump providing hot water
Landlord circulation areas	6.7	4.3	35.8%	Yes	

Results Summary to comply with 2013 regulation and planning requirement

Buildings	2013 Average TFEE	2013 Average DFEE	% Improvement	Part L1A Pass 2013
Apartments	35.27	33.27	5.67%	Yes

2.0 INTRODUCTION

The purpose of this report is to demonstrate the feasible services strategies for a new building comprising 118No. new residential apartments at the former Volkswagen Van Centre, Comet Way, Hatfield, AL10 TF.

This report will review the possible building fabrics, building services solutions and sustainability concepts required to achieve exceptionally ambitious energy consumption and carbon emission targets.

The aim of the analysis is to arrive at a solution for the entire site in terms of technologies, which would be appropriate for this development. This will be assessed in terms of the Building Regulations 2013 and Welwyn Hatfield's Supplementary Design Guidance.

3.0 BUILDING REGULATIONS

The Building Regulations Part L (Conservation of Fuel and Power) applies to all components of the development. The current version of Part L requirements became mandatory on 1st October 2013. In order to meet the performance requirements of Part L, the design of the building must comply with the prescriptive provisions laid out in the Compliance Checklist. The Building Regulations Part L document is divided up into the following five documents: The development falls under the Building Regulations Part L category of L1A.

Criterion 1 – Achieving the TER and TFEE rate

Achieving TER

In accordance with regulation 26, the calculated CO_2 emission rate for the building (the Dwelling CO_2 Emission Rate, DER) must not be greater than the Target CO_2 Emission Rate (TER), which is determined by following the procedures set out in paragraphs 2.8 to 2.10.

Fabric energy efficiency rates

Regulation 26A states that where a dwelling is erected, it shall not exceed the target fabric energy efficiency rate for the dwelling that has been approved pursuant to regulation 25, applying the methodology of calculation and expression of the energy performance of building approved pursuant to regulation 24.

Criterion 2 – Limits on design flexibility

The performance of the individual fabric elements and the fixed building services of the building should achieve reasonable overall standards of energy efficiency, following the procedure set out in paragraphs in the building regulation documents.
NOTE: Criterion 2 is intended to place limits on design flexibility to discourage excessive and inappropriate trade-offs. For example, individual building fabric elements with poor insulation standards being offset by renewable energy systems with uncertain service lives. This emphasises the purpose of Criterion 2.

Criterion 3 – Limiting the effects of heat gains in summer

Demonstrate that the building has appropriate passive control measures to limit solar gains.
NOTE: The purpose is to limit solar gains to reasonable levels during the summer period, in order to reduce the need for, or the installed capacity of, air-conditioning systems.

Criterion 4 - Building performance consistent with TER and DER rate

The performance of the building, as built, should be consistent with the DER. Extra credits will be given in the TER/BER calculation where builders can provide robust evidence of quality-assured procedures in the design and construction phases.

Criterion 5 - Provisions for energy-efficient operation of the building

The necessary provisions for enabling energy-efficient operation of the building should be put in place. The procedures described in Section 4 can be used to show that this criterion has been met.

The aspiration for this project is to achieve compliance with Welwyn Hatfield's Energy efficiency and Building regulation requirement which would therefore generate an energy/carbon target which would exceed those of the building regulations minimum levels. Therefore the development will need to incorporate highly efficient design solutions to optimise the building's energy usage in terms of building fabric, heating, cooling and hot water and lighting efficiencies.

See section 5 for detailed calculations.

4.0 RELEVANT PLANNING POLICIES

4.1 LOCAL POLICY – WELWYN HATFIELD'S ENERGY

Policy R3 – Energy Efficiency
The council expects all developments to include measures to maximise energy conservation through the design of buildings, site layouts and provision of landscaping and incorporate the Best Practical Environmental Option for energy supply.

Policy SP10 – Sustainable Design and Construction
The development needs to be responsive and resilient to environmental risks and climate change, and seek to protect and enhance other aspects of the natural environment. This policy encourages development to re-use land and buildings; maximise energy efficiency; incorporate water conservation measures and renewable and/or low carbon technologies (such as solar panels); enhance biodiversity (the variety of plant and animal life) by incorporating new and existing habitat and landscaping into the layout and design of proposals; and create space for growing food, both at a building and wider community scale.

4.2 NATIONAL PLANNING POLICY

The Government has set out planning policy guidance in the National Planning Policy Framework (NPPF). Fundamental to this guidance is the requirement to meet sustainable development objectives. These policy guidelines and statements are used to influence the preparation of the development plans by planning authorities.

The NPPF covers a wide range of planning issues from promoting sustainable transport to facilitating the sustainable use of minerals. Climate change is covered in section 10 'Meeting the challenge of climate change, flooding and coastal change. In summary the framework advises:

To support the move to a low carbon future, local planning authorities should:

- plan for new development in locations and ways which reduce greenhouse gas emissions;
- actively support energy efficiency improvements to existing buildings; and
- When setting any local requirement for a building's sustainability, do so in a way consistent with the Government's zero carbon buildings policy and adopt nationally described standards.

In determining planning applications, local planning authorities should expect new development to:

- comply with adopted Local Plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and
- take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

5.0 ENERGY HIERARCHI, ENERGY EFFICIENCY AND SUSTAINABLE MEASURES

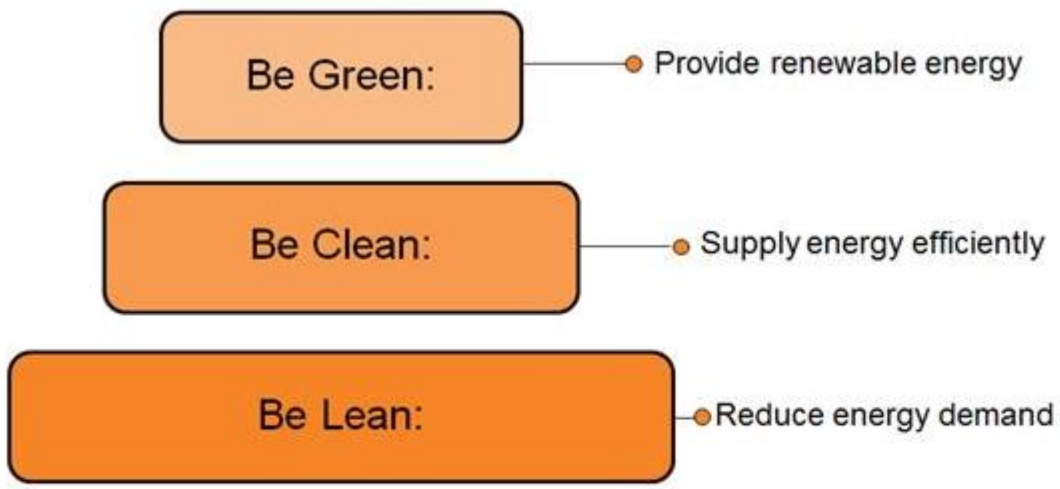


Figure 3: Shows Energy hierarchy

The strategic approach to the design of the development has been to reduce demand for energy in the first instance, prior to specifying energy efficient plant and equipment, before finally considering the integration of LZC technologies. This follows the approach of the energy hierarchy (Figure 3) and mirrors the strategy guidance of documents such as the London Plan.

5.1 BE LEAN

BUILDING REGULATION
These are measures that can influence the energy usage of a building by means of efficient design and installation methods. The table below lists the minimum requirements for the building regulations and what is likely to be required for this Project to comply with planning requirement;

ELEMENT		BUILDING REGULATIONS (2013)	TARGET FOR THIS DEVELOPMENT
U Values	Wall	0.30 $W/(m^2k)$	0.18 $W/(m^2k)$
	Roof	0.20 $W/(m^2k)$	0.12 $W/(m^2k)$
	Floor	0.20 $W/(m^2k)$	0.17 $W/(m^2k)$
	Windows	2 $W/(m^2k)$	1.4$W/(m^2k)$
	Roof light	2 $W/(m^2k)$	1.4 $W/(m^2k)$
Air Tightness		10.0 $m^3/(h.m^2)$	3 $m^3/(h.m^2)$
Ventilation **Fan SFP** **Heat Recovery**		HRU SFP 1.6 W/(l/s) Heat recovery efficiency 60%	MRXBOXAB-ECO3 SFP 0.5 W/(l/s) Extract fans 0.5 W/(/.s) Heat recovery efficiency 85%
Demand Ventilation		No	No
Air Conditioning		N/A	N/A

In addition to this thermal modelling can be utilised to ensure that the correct configuration of glazing sizes, G values and orientation can be achieved to minimise solar gains.

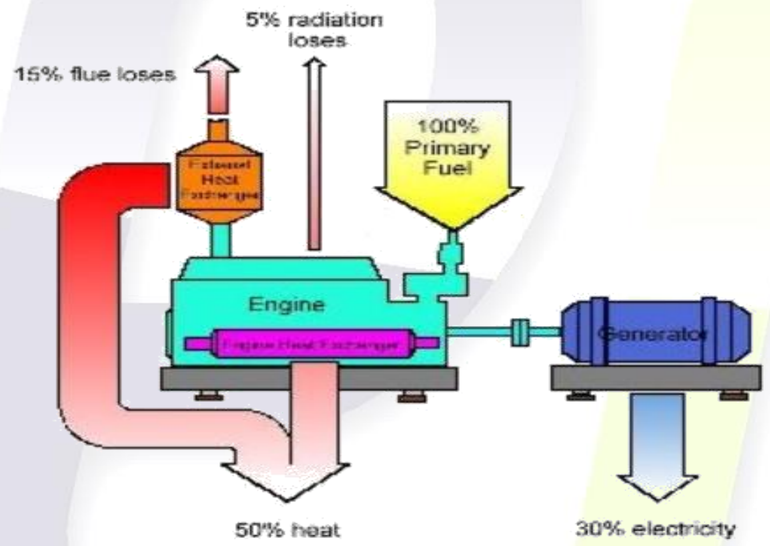
FURTHER MEASURES
In order to ascertain a base level of energy consumption the Building Regulations utilise the building services elements listed in the table below. In order to achieve an exceptionally low energy consumption rate, further measures must be taken to improve on the minimum requirements;

ELEMENT	TARGET FOR THIS DEVELOPMENT
Heating System	Electric panel heater 100%
Controls	Programmer and appliance thermostats
Hot Water	Air Source Heat pump ECOCENT, 300litre of storage
Glazing G value	0.4
Insulation	All hot and cold pipework should be thermally insulated All cylinders and vessels should be thermally insulated
Lighting	100% LED

5.2 BE CLEAN

5.2.1 COMBINED HEAT AND POWER (CHP)

Combined Heat and power is an electricity generator where the waste heat is captured and then re- used within a building. Typically, for CHP engines used within buildings, the associated electricity efficiency is between 25- 30% (depending on the size of the engine) with 40-50% of the waste heat being re-usable for heat distribution within a building (the remainder is lost heat through the flue). There are renewable CHP engines available which use wood pellets as a fuel source. However, this technology is in its infancy and is very large when compared to both gas fired engines. Biomass CHP consequently is not appropriate for this project. Gas is the fuel predominately used for CHP systems within buildings. Although this is not a renewable technology, it can provide significant carbon savings in the right application. For CHP to be effective in terms of carbon reduction and cost effectiveness it is very important that the engine operates for long periods of the day, throughout the year. For heat dominant buildings such as swimming pools, residential buildings, hotels and hospitals where there is a constant hot water demand where either large hot water storage is provided or there is a constant load.



Advantages

- Using a gas fired CHP system can produce significant savings per year if used in buildings with a significant constant heat/hot water load profile, such as hotels, leisure centres or large quantities of residential units on a central district heating system etc.

Disadvantages

- Requires predictable and constant heating/ hot water loads e.g., significant hot water storage
- Gas fired CHP is not a renewable technology

Site Specific

In recent years the grid electricity supply has been decarbonized to an extent in which the CO_2 emission associated with grid electricity is now lower than natural gas which is used by CHP. Therefore it is far more environmentally friendly to use grid electricity for heating and hot water rather than CHP which also needs regular maintenance. Therefore CHP is not feasible for this project

5.3 BE GREEN

This section of the report generally reviews a number of renewables which could potentially be suitable for this development.

5.3.1 BIOMASS

Biomass is the burning of any plant-derived organic material (such as wood) or a bio diesel (such as discarded cooking oil) that renews itself over a short period to generate energy. This fuel type is usually used for heating.

Since the CO_2 released during the burning process is offset by the CO_2 absorbed during the life of the biomass source, biomass is considered to be close to carbon neutral.

Typically a biomass system will burn wood in either a liquid, chip or pellet form instead of the conventional gas system. Biomass can save large amounts of carbon at a relatively low capital cost. Non-domestic biomass boilers mainly use either wood pellets or wood chip burners. Wood pellets are comprised of wood chips and sawdust that are compacted into smaller volumes. This means that they have lower moisture content and they can be produced in a consistent size. However, wood pellet fuel is more expensive costing around 4.5p/kWh (price varies with required load). Wood chips are a cheaper source of fuel costing around 2.5p/kWh (price varies with required load).

Advantages

- Near "Carbon neutral"
- Will provide large carbon reductions within developments with a heating load, such as this project
- Economic alternative to fossil fuels
- Wide variety of sources

Disadvantages

- Storage areas required for wood pellets
- Slower start up time compared with fossil fuel boilers
- Requires good access areas for fuel deliveries
- Concerns with quality of fuel and the impact in Air Quality
- Maintenance levels are high and can be costly.

Site Specific

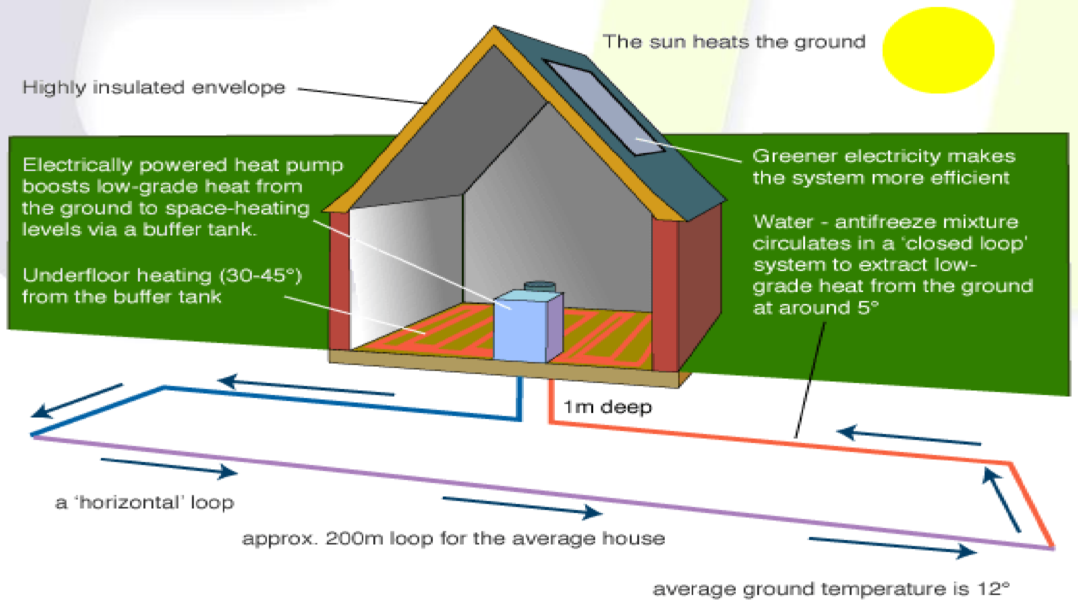
Biomass boilers would in theory provide the required on-site renewable energy contribution, however results from the thermal model shows that the building will still need another form of renewable energy to comply with building regulations and thus will increase the cost of renewable energy. Also local storage space of the solid fuel on site along with the client's brief requirements, Biomass has been discounted from being a feasible technology to implement.

5.3.2 GROUND SOURCE HEAT PUMP

GSHP transfers heat from the ground into a building to provide space heating and/or pre-heat hot water.

Closed Loop GSHP

Closed loop GSHPs are the more common systems with the technology being more readily available (for example does not need an extraction license from the Environmental Agency). A closed loop installation consists of plastic piping which is buried in the ground and connected to a pump. A mixture of water and antifreeze is passed through the looped pipes where it absorbs heat from the ground. This fluid then flows into an electrically powered heat pump before discharging back to the ground. There are two types of closed loop ground source heat pumps: vertical closed-loop and horizontal slinky Loops - all of these require large areas of land. Slinky loops are buried approximately 1-2m into the ground.



Vertical loops require bore holes to be drilled deep into the ground (typically around 100m in depth). GSHPs require extensive ground works which incur high capital costs.

Open Loop GSHP

Open loop GSHP systems work in a very similar manner to closed loop GSHPs, with the difference being that aquifer water is used as a cooling and/or heating medium. Bore holes are drilled down into the aquifer where groundwater is pumped to a heat exchanger and the energy is extracted from the water. The water is then passed back down (re-injected) to the aquifer. The direct contact of the source water through the heat exchanger makes it more efficient and the number of bore holes on an open system can be much smaller than a closed loop system for the same output capacity. Due to extracting water from the aquifer, a license is required from the Environmental Agency.

Advantages

- Can provide significant carbon savings in the correct application e.g. mixed-use schemes with significant heating and cooling loads
- Reduced running costs

Disadvantages

- Large area of land required for bore holes or loops
- Can be expensive (capital cost)
- Not generally recommended for heating only (or cooling only) systems. A site specific study is required by a bore hole specialist to determine whether soil conditions are favourable for heating only systems.

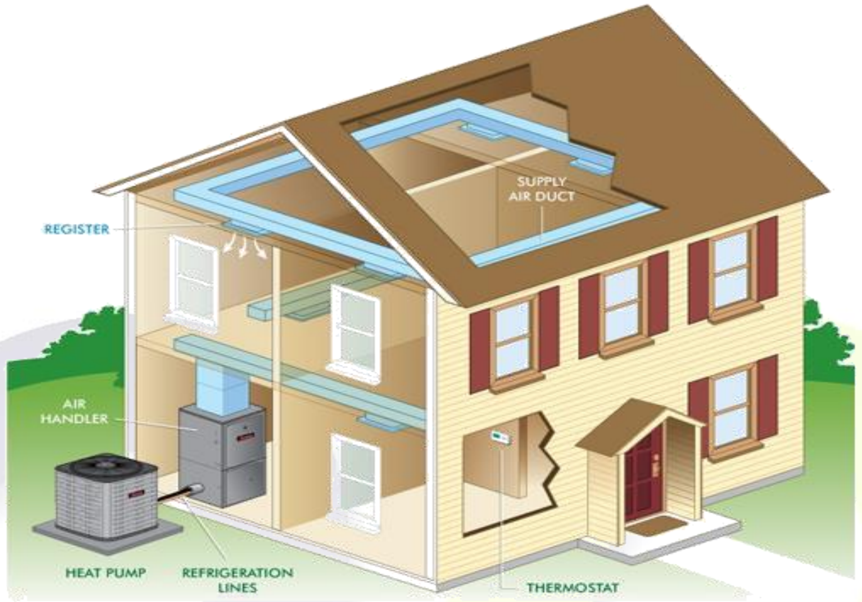
Site Specific

GSHP is not feasible due to the extensive buried services which make it far more expensive. Furthermore the site will require a feasibility study to be carried out to assess the soil and land requirement.

5.3.3 AIR SOURCE HEAT PUMP (ASHP)

An ASHP is regarded as a renewable technology in the GLA and EC guidance. An ASHP works by converting energy from the outside air into heat. This can be used for heating in the winter, but can be reversed for cooling in the summer months (although this application is not relevant to this particular project). ASHPs work by extracting heat from the outside air and passing it through a refrigeration compressor cycle, which increases its temperature. The heat is then distributed to the rooms.

An ASHP will typically have a lower COP (system efficiency) than a GSHP due to the lower temperature of outside air when compared to the earth. However, the capital cost of an ASHP is much lower, is easier to maintain than ground source, a tried and tested technology and there is no need for any extensive ground works.



Advantages

- Cost effective renewable for heat dominant buildings, such as this development
- Can be used, without any risk, within a heating only application.
- Reduced running costs
- Tried and tested technology
- Easy to maintain

Disadvantages

- COP (efficiency) is dependent on-air temperature
- Slightly lower COP than ground source heat pumps
- Cannot provide enough renewable heat to comply with planning requirements.

Site Specific

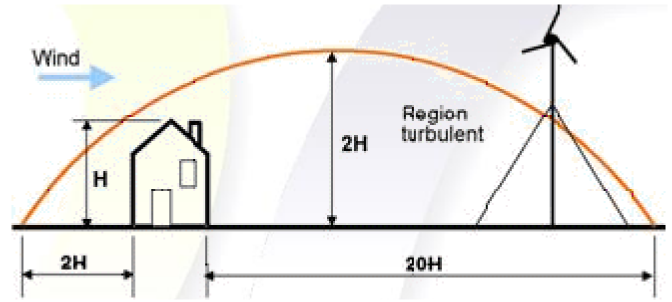
Thermal model result shows that Air source heat pumps providing hot water is a viable option and will contribute to reduce CO_2 emission and therefore has been considered for this development.

5.3.4 WIND

Wind turbines harness the power of the wind to produce electricity through circular motion. They can produce electricity without carbon dioxide emissions and range in outputs from watts to megawatts. The most common design has three blades mounted on a horizontal axis (Horizontal Axis Wind Turbine/HAWT), which is free to rotate into the wind on a mast. The blades drive a generator either directly or via a gearbox (generally for larger machines) to produce electricity. The electricity can either link to a distribution network or charge batteries. An inverter is required to convert the electricity from direct current (DC) to alternating current (AC). Alternative designs of turbine are available such as the Vertical Axis Wind Turbines (VAWT) which can have advantages aesthetically and are not reliant on a specific wind direction, but can be less efficient. Roof-mounted wind turbines are also an option, but if used structural considerations need to be taken into account due to the weight and vibrations that will be incurred. Roof-mounted wind turbines generally require an average wind speed of 3m/s to be viable, and larger, stand-alone wind turbines typically require 6m/s to be viable. Wind turbines work best in laminar flows. If turbulent wind, which is caused by obstructions etc. is being passed through the wind turbines blades then productivity can be dramatically reduced. As a general rule of thumb a distance of 7 times the rotor diameter should be allowed for between wind turbines in the prevailing wind direction. In the direction perpendicular to the prevailing wind the distance can be reduced and would be recommended to be in the order of 4 times the rotor diameter. For a 15kW wind turbine the blade diameter is approximately 9m (Proven WT15), this would mean a distance of around 63m would be recommended between turbines in the prevailing wind direction, and roughly 36m apart, perpendicular to the prevailing wind direction. If a wind turbine is placed too close to an obstruction then it can cause a lower productivity. This is because the obstruction will create turbulent air as the wind passes by, and for optimum output wind turbines require laminar flow.

As a guide, a wind turbine should be about twice the height of any obstructions in the immediate front of it (at least in the prevailing wind direction). For any obstructions in front of the wind turbine the distance between them should be approximately 10 times the height of the obstruction, as shown below.

It is also important to be aware that there should not be any obstacles too close to the wind turbine in the non-prevailing wind directions. The wind will not always be in the prevailing wind direction and as such a distance of at least 2 times the height of the nearest obstruction should be left in order to allow for reasonable electricity production.



Advantages

- Electricity generating renewable
- Zero carbon technology
- Visual statement of sustainability

Disadvantages

- Not suitable for Listed Buildings
- Planning permission can be a difficult and lengthy process
- Wind is an irregular source
- Can be noisy, especially if a gearbox is incorporated

Site Specific

Due to the likely visual and acoustic impact of this technology and likely difficulties with planning and the general sheltered nature of the site we do not propose to progress this technology further.

5.3.5 PHOTOVOLTAICS (PV)

Photovoltaics (PV) or solar cells, as they are often referred to, are semiconductor devices that convert sunlight into direct current (DC) electricity. Groups of PV cells are electrically configured into modules and arrays which can be used to charge batteries, operate motors and power any number of electrical loads.
With the appropriate power conversion equipment (inverters) PV systems can produce alternating current (AC) compatible with any conventional appliances and operate in parallel with the utility grid. PV systems require only

daylight to generate electricity (although more is produced with more sunlight). Therefore, energy can still be produced in overcast or cloudy conditions and used successfully in all parts of the UK. Ideally, PV panels should face between South- East and South-West, at an elevation of about 30-40°. However, in the UK, even flat roofs receive 90% of the energy of an optimum system. They are particularly suited to buildings that use electricity during the day and that are occupied during the summer.

Advantages

- Electricity generating renewable
- Zero carbon technology
- Visual statement of sustainability
- Electricity is generated during daylight hours
- Electricity can be stored in batteries during the day for use in the evenings.

Disadvantages

- Obstructions will have a dramatic effect on the productivity of the panels
- Best results produced when there is a clear sky and direct sunlight
- Expensive technology, requiring large areas for significant production
- Cleaning and maintenance issues, especially in areas with surrounding trees.

Site Specific

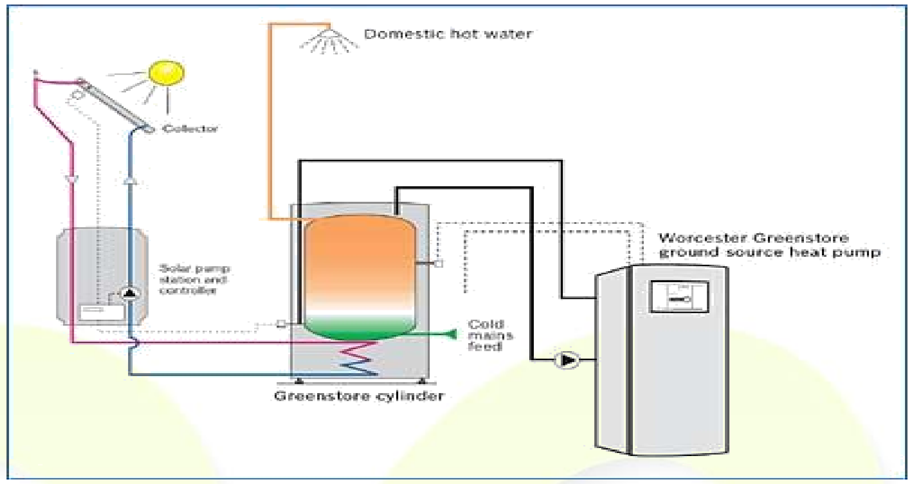
This technology could be implanted on this development. In residential development such as this one, PV is normally connected to the landlord area and therefore does not contribute directly to the individual apartment and hence does not improve the EPC rating for the apartments. Furthermore better technology such as Air Source Heat Pump has been considered for this development which makes the building achieve building regulations and planning targets. Therefore PV has not been considered for this development.

5.3.6 SOLAR THERMAL

Solar thermal technologies generate hot water from the sun's energy through the use of solar collectors. The sun's heat energy is accumulated by the solar cells and then water is pumped through these thus heating the water. The heated water is then stored or distributed for domestic use. These systems tend to be incorporated on to roof space so that they are clear of obstacles (obstructions on the roof can have an effect on the solar cell array). As with photovoltaic panels, the solar collectors are more effective if they are in a South-facing position.

There are two main types of Solar Thermal system; flat panel and thermal vacuum tubes. Flat panels consist of a flat "radiator" absorber, covered by glass and insulated. Their efficiency depends on the insulation properties and type of construction. More expensive double-glazed units have a better efficiency, so that a smaller area of solar thermal panels is required – a compromise would need to be made between efficiency and cost. Solar thermal panels are especially worth considering for new buildings, since they can be effectively built into roof structures at the construction stage.

Thermal vacuum tubes are a more recently developed technology designed for obtaining heat from the sun. These have been developed over the last thirty years into units that are now up to 90% efficient. Water is passed through an evacuated tube, which contains a black absorber plate. Vacuum tubes are more efficient and therefore a smaller area of collector is required. Solar vacuum tubes are capable of operating at higher working temperatures than flat plate collectors. Thermal losses for vacuum tubes also tend to be lower than those of flat plate collectors due to improved heat insulation. The vacuum provides insulation, and this allows the water to be heated to higher temperatures, and remain very effective even on cloudy days. The optimum generation tends to occur during the summer months.



Advantages

- Hot water is produced during daylight hours
- Water can be stored during the day for use in the evenings and following morning.

Disadvantages

- Obstructions will have a dramatic effect on the productivity of the panels
- Best results produced when there is a clear sky and direct sunlight
- A high efficiency panel comes at a high cost

Site Specific

There is not enough roof area available which can contribute the same CO_2 reduction as the Air Source Heat Pump therefore this technology has been discounted in the development.

6.0 COMPLIANCE WITH BUILDING REGULATION AND WELWYN HATFILED SPD

Following is the summary of the results from thermal models.

Results Summary to comply with 2013 regulation and planning requirement

Buildings	2013 Average TER $kgCO_2/m^2$	2013 Average DER $kgCO_2/m^2$	% Improvement on TER	Part LA Pass 2013	Renewable Energy
Apartments	23.11	16.97	28.6%	Yes	Air Source Heat Pump providing hot water
Landlord circulations	6.7	4.3	35%	Yes	

Results Summary to comply with 2013 regulation and planning requirement

Buildings	2013 Average TFEE	2013 Average DFEE	% Improvement	Part LA Pass 2013
Apartments	35.27	33.27	5.67%	Yes

As shown in the results above, the building complies with the latest building regulations.

7.0 CONCLUSION

The results in the previous section have shown that the building will comply with Part L1a 2013 of the building regulations and Welwyn Hatfield SPD's Energy efficiency requirement through the use of efficient building services and onsite renewable in the form of Air Source Pump meeting the hot water demand of the apartments.

8.0 APPENDICES

8.1 SAP BLOCK COMPLIANCE REPORT

User Details

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP
Software Version: Version: 1.0.5.51

Calculation Details

Dwelling	DER	TER	DFEE	TFEE	TFA
Type Aa se 2bed F 001	23.09	27.1	47.1	49	70.65
Type Aa se 2bed 002	14.81	23.03	31.2	35.4	70.65
Type Aa se 2bed 003	14.81	23.03	31.2	35.4	70.65
Type Aa se 2bed 004	14.81	23.03	31.2	35.4	70.65
Type Aa se 2bed R 005	18.15	24.81	37.7	41.3	70.65
Type Ab nw 2bed F 006	21.75	25.67	44.5	44.3	70.65
Type Ab nw 2bed 007	13.67	21.61	28.5	30.6	70.65
Type Ab nw 2bed 008	13.67	21.61	28.5	30.6	70.65
Type Ab nw 2bed 009	13.67	21.61	28.5	30.6	70.65
Type Ab nw 2bed R 010	17.43	23.6	36.1	37.4	70.65
Type Ac sw 2bed f 011	21.29	25.84	44	44.8	70.65
Type Ac sw 2bed 012	13.37	22.05	28.6	32.1	70.65
Type Ac sw 2bed 013	13.37	22.05	28.6	32.1	70.65
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Type Ad nw 2bed R 026	16.87	23.19	35.2	35.7	70.65

Stroma FSAP 2012 Version: 1.0.5.51 (SAP 9.92) - http://www.stroma.com Page 1 of 5

Dwelling	DER	TER	DFEE	TFEE	TFA
Type Ae nw 2bed F 027	20.5	25.03	42.3	41.9	70.65
Type Ae nw 2bed 028	13.02	21.23	27.3	29.1	70.65
Type Ae nw 2bed 029	13.02	21.23	27.3	29.1	70.65
Type Ae nw 2bed R 030	18.75	24.62	38.9	40.6	70.65
Type Ae nw 2bed R 031	18.75	24.62	38.9	40.6	70.65
Type Ae nw 2bed R 032	18.75	24.62	38.9	40.6	70.65
Type Ag se 2bed F 033	20.47	25.85	42.4	44.8	70.65
Type Ag se 2bed F 034	20.47	25.85	42.4	44.8	70.65
Type Ag se 2bed 035	13.37	22.05	28.6	32.1	70.65
Type Ag se 2bed 036	13.37	22.05	28.6	32.1	70.65
Type Ag se 2bed 037	13.37	22.05	28.6	32.1	70.65
Type Ag se 2bed 038	13.37	22.05	28.6	32.1	70.65
Type Ag se 2bed R 039	19.28	25.53	40.2	43.7	70.65
Type Ag se 2bed R 040	19.28	25.53	40.2	43.7	70.65
Type Ah nw 2bed F 041	23.14	27	47.3	48.6	70.65
Type Ai se 2bed F 042	25.71	29.2	52.3	56	70.65
Type Aj se 2bed 043	15.89	23.73	33.6	37.7	70.65
Type Aj se 2bed R 044	20.4	26.83	42.3	48.1	70.65
Type Ba nw 1bed F 045	19.62	26.69	38.4	38.3	50.5
Type Ba nw 1bed 046	12.63	22.87	23.6	24.8	50.5
Type Ba nw 1bed 047	12.63	22.87	23.6	24.8	50.5
Type Ba nw 1bed 048	12.63	22.87	23.6	24.8	50.5
Type Ba nw 1bed R 049	14.65	24	28.2	28.9	50.5
Type Bb ne 1bed F 050	19.62	26.69	38.4	38.3	50.5
Type Bb ne 1bed F 051	19.62	26.69	38.4	38.3	50.5
Type Bb ne 1bed F 052	19.62	26.69	38.4	38.3	50.5
Type Bb ne 1bed F 053	19.62	26.69	38.4	38.3	50.5
Type Bb ne 1bed F 054	19.62	26.69	38.4	38.3	50.5
Type Bb ne 1bed 055	12.63	22.87	23.6	24.8	50.5
Type Bb ne 1bed 056	12.63	22.87	23.6	24.8	50.5

Stroma FSAP 2012 Version: 1.0.5.51 (SAP 9.92) - http://www.stroma.com Page 2 of 5

Dwelling	DER	TER	DFEE	TFEE	TFA
Type Bb ne 1bed 057	12.63	22.87	23.6	24.8	50.5
Type Bb ne 1bed 058	12.63	22.87	23.6	24.8	50.5
Type Bb ne 1bed 059	12.63	22.87	23.6	24.8	50.5
Type Bb ne 1bed 060	12.63	22.87	23.6	24.8	50.5
Type Bb ne 1bed 061	12.63	22.87	23.6	24.8	50.5
Type Bb ne 1bed 062	12.63	22.87	23.6	24.8	50.5
Type Bb ne 1bed 063	12.63	22.87	23.6	24.8	50.5
Type Bb ne 1bed 064	12.63	22.87	23.6	24.8	50.5
Type Bb ne 1bed 065	12.63	22.87	23.6	24.8	50.5
Type Bb ne 1bed 066	12.63	22.87	23.6	24.8	50.5
Type Bb ne 1bed 067	12.63	22.87	23.6	24.8	50.5
Type Bb ne 1bed 068	12.63	22.87	23.6	24.8	50.5
Type Bb ne 1bed 069	12.63	22.87	23.6	24.8	50.5
Type Bb ne 1bed R 070	16.7	24.76	32.6	31.5	50.5
Type Bb ne 1bed R 071	16.7	24.76	32.6	31.5	50.5
Type Bb ne 1bed R 072	16.7	24.76	32.6	31.5	50.5
Type Bb ne 1bed R 073	16.7	24.76	32.6	31.5	50.5
Type Bb ne 1bed R 074	18.88	26.24	37	36.7	50.5
Type Be se 1bed F 075	22.4	28.97	44	46.3	50.5
Type Be se 1bed 076	14.54	24.73	28.6	31.9	50.5
Type Be se 1bed 077	14.54	24.73	28.6	31.9	50.5
Type Be se 1bed 078	14.54	24.73	28.6	31.9	50.5
Type Be se 1bed R 079	16.94	26.03	33.5	36.4	50.5
Type C se 1bed F 080	21.97	27.28	43.6	46.3	62.63
Type C se 1bed 081	13.22	22.41	26.5	29.9	62.63
Type C se 1bed 082	13.22	22.41	26.5	29.9	62.63
Type C se 1bed 083	13.22	22.41	26.5	29.9	62.63
Type C se 1bed R 084	17.64	24.28	35.4	36.3	62.63
Type D sw 1bed F 085	21.77	27.29	42.9	45.9	63.45
Type D sw 1bed 086	13.19	22.56	26.2	29.9	63.45

Stroma FSAP 2012 Version: 1.0.5.51 (SAP 9.92) - http://www.stroma.com Page 3 of 5

Dwelling	DER	TER	DFEE	TFEE	TFA
Type D sw 1bed 087	13.19	22.56	26.2	29.9	63.45
Type D sw 1bed 088	13.19	22.56	26.2	29.9	63.45
Type D sw 1bed R 089	18.02	24.87	35.8	37.7	63.45
Type E se 2bed F 090	22.29	26.23	45.6	46.8	71.6
Type E se 2bed 091	14.28	21.86	29.8	32	71.6
Type E se 2bed 092	14.28	21.86	29.8	32	71.6
Type E se 2bed 093	14.28	21.86	29.8	32	71.6
Type E se 2bed R 094	17.78	23.77	36.9	38.5	71.6
Type F sw 2bed F 095	22.75	26.49	47.2	49.5	78.18
Type F sw 2bed 096	14.18	21.76	30.7	33.8	78.18
Type F sw 2bed 097	14.18	21.76	30.7	33.8	78.18
Type F sw 2bed 098	14.18	21.76	30.7	33.8	78.18
Type F sw 2bed R 099	19.9	24.84	41.8	44	78.18
Type G ne 2bed F 100	18.31	23.94	37.7	38.3	71.65
Type G ne 2bed 101	11.19	19.93	22.8	24.5	71.65
Type G ne 2bed 102	11.19	19.93	22.8	24.5	71.65
Type G ne 2bed 103	11.19	19.93	22.8	24.5	71.65
Type G ne 2bed R 104	14.93	21.88	31	31.2	71.65
Type H nw 2bed F 105	22.94	25.99	47	47.1	72.97
Type H nw 2bed 106	14.96	21.64	31.3	32.6	72.97
Type H nw 2bed 107	14.96	21.64	31.3	32.6	72.97
Type H nw 2bed 108	14.96	21.64	31.3	32.6	72.97
Type H nw 2bed R 109	18.51	23.42	38.4	38.5	72.97
Type Ia se 1bed R 110	25.03	30.92	48.8	52.9	50.31
Type Ib se 1bed R 111	22.38	29.12	43.7	46.4	50.31
Type Ic ne 1bed R 112	20.56	27.28	40	40.4	50.31
Type Ic ne 1bed R 113	20.56	27.28	40	40.4	50.31
Type Ja nw 2bed R 114	21.98	24.57	45.7	44.5	77.82
Type Jb sw 2bed R 115	26.13	27.5	53.7	54.1	77.82
Type K se 1bed R 116	28.62	31.93	57.5	58.8	54.14

Stroma FSAP 2012 Version: 1.0.5.51 (SAP 9.92) - http://www.stroma.com Page 4 of 5

Block Compliance WorkSheet: sim 8Cont...

Dwelling	DER	TER	DFEE	TFEE	TFA
Type L nw 2bed R 117	20.45	24.56	40.1	41.2	69.72
Type O ne 1bed R 118	21.02	26.89	40	42	55.57

Calculation Summary

Total Floor Area	7514.81
Average TER	23.75
Average DER	16.90
Average DFEE	33.12
Average TFEE	35.15
Compliance	Pass
% Improvement DER|TER	28.84
% Improvement DFEE|TFEE	5.78

Stroma FSAP 2012 Version: 1.0.5.51 (SAP 9.92) - http://www.stroma.com

Page 5 of 5

8.2 BRUKL COMPLIANCE REPORT FOR LANDLORD AREAS

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Communal Corridors-Comet Way-Hatfield As designed

Date: Tue May 10 11:50:34 2022

Administrative information

Building Details

Address: Address 1, Hatfield, AL

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, kgCO_2/m².annum	6.7
Target CO_2 emission rate (TER), kgCO_2/m².annum	6.7
Building CO_2 emission rate (BER), kgCO_2/m².annum	4.3
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a-Limit}$	U_{a-Calc}	U_{i-Calc}	Surface where the maximum value occurs*
Wall**	0.35	0.18	0.18	01000026:Surf[2]
Floor	0.25	0.17	0.17	01000003:Surf[0]
Roof	0.25	0.12	0.12	02000032:Surf[0]
Windows***, roof windows, and rooflights	2.2	1.4	1.4	01000026:Surf[1]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a-Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
U_{a-Calc} = Calculated area-weighted average U-values [W/(m²K)]
U_{i-Calc} = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m³/(h.m²) at 50 Pa	10	5

Page 1 of 6

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Electric Panel heater

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.2	0	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

1- DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
01_Corridor 01	-	95	-	43
01_Corridor 02	-	95	-	166
01_Corridor 03	-	95	-	244
01_Corridor 04	-	95	-	68
01_lift lobby	-	95	-	52
01_Stair 01	-	95	-	29
01_Stair 02	-	95	-	32
01_Stair 03	-	95	-	26
02_Corridor 01	-	95	-	43
02_Corridor 02	-	95	-	166
02_Corridor 03	-	95	-	287
02_Corridor 04	-	95	-	67
02_lift lobby	-	95	-	52
02_Stair 01	-	95	-	29
02_Stair 02	-	95	-	32
02_Stair 03	-	95	-	26
03_Corridor 01	-	95	-	43
03_Corridor 02	-	95	-	166
03_Corridor 03	-	95	-	287
03_Corridor 04	-	95	-	67
03_lift lobby	-	95	-	52
03_Stair 01	-	95	-	29
03_Stair 02	-	95	-	32
03_Stair 03	-	95	-	26
04_Corridor 01	-	95	-	43
04_Corridor 02	-	95	-	166

8.3 SAP SUMMARY SHEET AND SYSTEM SELECTION

A number of calculations have been carried out using the government approved SAP methodology as shown below. Various systems have been proposed for the apartments. The calculations show that Air Source Heat Pump (ASHP) is the preferred system for this development as shown in simulation 5. With the ASHP the percentage improvement in CO_2 emission is far greater than simulation 4 which uses direct electricity for heating and hot water. However, having further investigated electric heating in conjunction with an Exhaust Air Heat Pump (EAHP ECOCENT system) as shown in simulation 6, this gives a slight improvement over Sim 5 and will be considerably less costly to install and maintain. Therefore the system in simulation 6 is the preferred system for this development because it achieves a higher percentage reduction in CO_2 emission and will cost a lot less to install and maintain.

Project Name:	Comet Way, Hatfield
Engineer:	Zubair Ahmad
Project No:	J22045
Document reference No:	J22045-01

Revision	Date	Details
R1	25.04.2022	
R2	28.04.2022	Windows U value changed from 1.39 to 1.4. External wall U value changed from 0.15 to 0.18. All 5no. Simulation has been re-run.MVHR changed to MRXBOXAB ECOE ECO 3. Further simulation added
R3	29.04.2022	All simulations were revised with low thermal mass
R4	10.05.2022	Simulation 8 has been added. The number of apartments has been reduced from 119 to 118.

Simulation 1	Heating and hot water by community gas boiler with HIU
Simulation 2	As above. 20kW of PV assigned.
Simulation 3	As sim 2. Heating system changed to electric panel heater. Hot water system changed to electric immersion heater with 140litre storage.
Simulation 4	As sim 3. PV panel contribution increased from 20kW to 40kW
Simulation 5	As sim 4. Heating system changed from electric panel heaters to community ASHP providing heat and hot water. PV panels removed.
Simulation 6	As sim 5. Heating system changed to electric panel heaters. Hot water system changed to ECOCENT air source heat pump with 300litres of storage.
Simulation 7	As sim 6. Hot water system reduced from ECOCENT 300litre to 200l.
Simulation 8	As sim 6. Number of apartments has been reduced from 119 to 118.

2013 BUILDING REGS RESULTS	Sim 1	Sim 2	Sim 3	Sim 4	Sim 5	Sim 6	Sim 7	Sim 8
Average TER $kgCO_2/m^2$	15.99	15.99	23.08	23.08	23.11	23.77	23.35	23.75
Average DER $kgCO_2/m^2$	15.67	14.54	23.00	21.88	16.64	16.97	19.26	16.90
PASS /FAIL	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
% Improvement on TER	2.0%	9.1%	0.3%	5.2%	28.0%	28.6%	17.5%	28.8%
Average DFEE	33.27	33.27	33.27	33.27	33.27	33.27	33.27	33.12
Average TFEE	35.27	35.27	35.27	35.27	35.27	35.27	35.27	35.15
PASS /FAIL	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
% Improvement DFEE/TFEE	5.67%	5.67%	5.67%	5.67%	5.67%	5.67%	5.67%	5.78%
Area of residential m^2	7587.81	7587.81	7587.81	7587.81	7587.81	7587.81	7587.81	7514.00
Total number of Apartments	119	119	119	119	119	119	119	118

Total Energy Cost (£)/sample apartment*	£308	£308	£513	£513	£309	£329	£386	£329

energy cost comparison is based on SAP assessment database. Actual cost will be dependent upon electricity supplier

BUILDING FABRIC DETAILS									SOURCE-Sim 1
Air permeability	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
External wall U value (w/m².k)	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	Assumed
External roof U value (w/m².k)	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	30mm plasterboard, 100m Knauf Ominfitstud 34,18mm OSB, 200mm Rockwool Duoslab
Ground/external floor U value (w/m².k)	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	300mm RC podium slab, 150mm Rockwool Flexi/joist/beam,30mm PIR insulation
Opaque door U value (w/m².k)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Party Wall U value (w/m².k)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Corridor Wall U value (w/m².k)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Windows (glass and frame) U value (w/m².k)	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	
Frame Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	
G value	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	
Roof light (glass and frame) U value (w/m2.k)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Roof light G value	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Accredited Construction Details (ACD)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Thermal Mass Parameter	Low	Low	Low	Low	Low	Low	Low	Low	Light frame external wall, party wall and partition wall.

THERMAL BRIDGING	psi-value	psi-value	psi-value	psi-value	`	psi-value	psi-value	psi-value	
E2- other lintels	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	Proposed
E3- Sills	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	Proposed
E4- Jamb	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	Proposed
E20- Exposed floor (normal)	0.320	0.320	0.320	0.320	0.320	0.320	0.320	0.320	Proposed
E7- Party floor between dwellings (block of flats)	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	Proposed
E9- Balcony between dwellings, wall insulation continuous	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	Proposed
E24- Eaves (insulation at ceiling level - inverted)	0.240	0.240	0.240	0.240	0.240	0.240	0.240	0.240	Proposed
E14- Flat roof with parapet	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	Proposed
E16- Corner (normal)	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.090	Proposed
E17- Corner (inverted)	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.090	Proposed
E18- Party wall between dwellings	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	Proposed
E25- Staggered party wall between dwellings	0.120	0.120	0.120	0.120	0.120	0.120	0.120	0.120	Proposed
P7- Exposed floor (normal)	0.160	0.160	0.160	0.160	0.160	0.160	0.160	0.160	Proposed

P4- Party wall- roof (insulation at ceiling level)	0.240	0.240	0.240	0.240	0.240	0.240	0.240	0.240	Proposed

HEATING SYSTEM (Community Heating system by boilers)

CHP heating efficiency	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
CHP electrical efficiency	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
CHP heating fraction	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Boiler heating source	Gas	Gas	Electric	Electric	Electric	Electric	Electric	Electric	
Boiler heating efficiency	90.0%	90.0%	100.0%	100.0%	200.0%	100.0%	100.0%	100.0%	Proposed by the design team
Boiler heat fraction	1	1	1	1	1	1	1	1	
Charging system linked to use of community heating system, TRV	Yes	Yes	Prog+thermo	Prog+thermo	Prog+ 2no. thermo	Prog+thermo	Prog+thermo	Prog+thermo	
Piping>=pre-insulated, low temp, variable flow	Yes	Yes	Yes	Yes	Yes	N/A	N/A	N/A	

COOLING SYSTEM

Fuel	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
System type	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Compressor control	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Chiller efficiency	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

HOT WATER SYSTEM (From the main system)

Source	N/A	N/A	Elect.	Elect.	Elect.	Elect.	Elect.	Elect.	
Efficiency	N/A	N/A	100%	100%	200.0%	ECOCENT	ECOCENT	ECOCENT	
Storage (litre)	N/A	N/A	145	145	N/A	300	200	300	
Storage losses (kWh/day)	N/A	N/A	1.18	1.18	N/A	2.13	1.97	2.13	

LOW AND ZERO CARBON TECHNOLOGY (LZC)

PV	Power	N/A	20kW	20kW	40kW	Non	Non	Non	Non	
	Tilt in degrees		30	30	30	Non	Non	Non	Non	
	Orientation		South east	South east	South east	Non	Non	Non	Non	
	Overshading		Non	Non	Non	Non	Non	Non	Non	
Heat pump		N/A	N/A	N/A	N/A	N/A	Yes (Hot water)	Yes (Hot water)	Yes (Hot water)	
CHP thermal efficiency		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
CHP electrical efficiency		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

CHP heat contribution	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

VENTILATION SYSTEM (MVHR)

Nuaire MRXBOXAB-ECO-3	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Proposed
SFP (w/l/s)									
Approved installation scheme	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Proposed

OVERHEATING RISK

Windows fully	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Proposed

LIGHTING

Low Energy lighting (100%)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Proposed