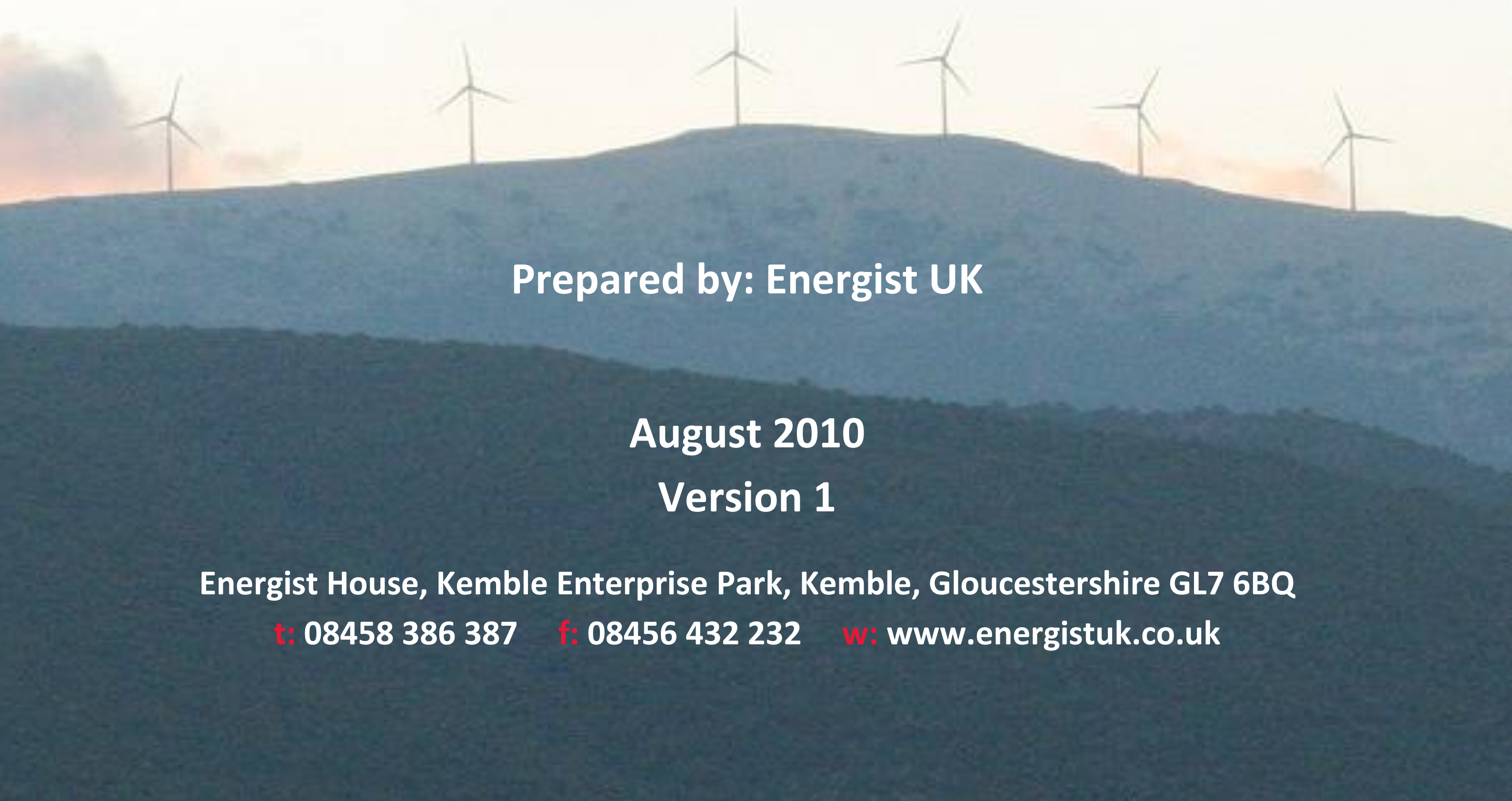
81-91 Fortess Road, London, NW5

--- Energy Statement ---

Prepared for:

Andrew Scott Associates



Prepared by: Energist UK

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Version 1

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Table of Contents

If you require further information as evidence for this Energy Statement,
please do not hesitate to contact us on 08458 386 387

1. Executive Summary

Andrew Scott Associates has appointed Energist UK to compile a report which examines the feasibility of producing 10% of the development's energy consumption at 81-91 Fortess Road, LONDON, NW5, by using renewable technology.

This Energy Statement has been written in accordance with the planning requirements of London Borough of Camden, Town Hall, Judd Street, LONDON, WC1H 9JE, as part of the borough's local sustainable framework. More information is located at www.camden.gov.uk

This document will use various calculation methods to compare the available savings, expected costs and payback times, and the overall feasibility of up to seven types of renewable technology for this site.

'The Mayor will, and boroughs should, in their [Development Plan Documents] adopt a presumption that developments will achieve a reduction in carbon dioxide emissions… from on site renewable energy generation (which can include sources of decentralised renewable energy) unless it can be demonstrated that such provision is not feasible.' The London Plan (Greater London Authority)

This report summarizes the work done under this study and concludes with specific energy saving measures and proposals as to best meet the local authority's required reduction.

Comparisons will be drawn to signify the improvements the site will undergo given the renewable options which are available. It is worth noting Policy 4A.6 of The London Plan: *'Supplying energy efficiently, in particular by prioritising decentralised electricity generation.' (GLA).* Other councils have a similar priority list. If a number of renewable technologies are considered feasible, devices which generate electricity will be prioritised over other forms of renewable technology.

A complete Part L Standard Assessment Procedure (SAP2005) calculation has been performed using NHER Plan Assessor version 4.5 to assess the initial compliance and to estimate the annual carbon emissions of the development.

A review of potential renewable energy technologies is then conducted using Energist's own calculation software to assess the technical, environmental and financial viability.

It is important to realize this document is not a design tool and should be used for guidance only. The content is intended for the use of our client and their council planning department, bearing in mind the advice contained is based on methodology only and should not be taken as a definitive answer.

2. Context

In 1992, the UK government signed The Kyoto Protocol committing itself to cut emissions of various greenhouse gases, the most significant being carbon dioxide.

For instance, London consumes in a year as much energy as Greece or Portugal; this means that large towns and cities must not only save energy, but also produce it from renewable sources. Taking the lead from national targets, London set its own targets in The London Plan, which aims to reduce the city's carbon dioxide emissions by 23 percent by 2016 (based on 1990 figures). Other local authorities are now following this lead and working to match the commitment made by London.

'If the world does not take rapid and sustained action to reduce greenhouse gas emissions, then we risk leaving out children and grandchildren to cope with potentially catastrophic global warming.' Ken Livingstone

To reach these challenging – yet achievable – targets, an 'Energy Hierarchy' has been defined to help organisations involved in building new developments contribute towards sustainable energy. When each stage of the hierarchy is applied in turn to an activity, it will help ensure that the energy needs of each proposed site are met in the most efficient way:

i. Be Lean:

- Use less energy – This will minimise the demand for fuel.

ii. Be Clean:

- Supply energy efficiently – Where it is not practical to use renewable energy, the energy should be supplied as efficiently as possible. For example from combined heat and power (CHP), so that the use of fossil fuels are minimised, further reducing overall carbon dioxide emissions.

iii. Be Green:

- Use renewable energy – As much energy as possible should come from zero-carbon sources, so climate change is reduced, and natural resources conserved.

Although Energy Statements are currently not required as part of a Building Regulations Part L assessment, a local authority can request this study is carried out to satisfy their own targets on lowering emissions from new developments and renovations.

3. Assessment Methodology

This assessment is based on the following steps, and has been calculated using software created by NHER for the purposes of completing Part L energy calculations, and the Energy Statement Feasibility Tool, produced by Energist UK.

i) Standard SAP Calculation in line with Part L

In order to gain an understanding of how sustainable the development is before including renewable technology, a SAP Calculation is completed on all plots, and an area weighted value calculated. The expected Design Emission Rate (DER) of the proposed development must be equal to or better than the Target Emission Rate (TER) which is established using SAP methodology.

ii) Other energy saving measures

Aside from using renewable technologies, developments can be designed, and additional features added to help minimize excessive energy use and assist in lowering carbon emissions. A summary will outline details about areas such as orientation, thermal efficiencies and lighting.

iii) Explanation of renewable technologies

A list of the various technologies that can be assessed as part of this report, how they work, their benefits and their disadvantages.

iv) Check feasibilities

It is possible that some forms of renewable technology will not be appropriate for a particular development. For example, a wind turbine may not be suitable in a low-lying, urban area, or a biomass heating system could not be installed if there is insufficient space. This section will consider each technology, and whether it should be considered as a feasible option for this specific site.

v) Measure potential savings of renewable technology

Calculations will be completed on those technologies which are considered feasible, to judge the size or quantity needed in order to comply with the targets imposed by the local authority.

vi) Summary and results

Conclusions which will include recommendations, calculation summaries and cost predictions for each feasible system.

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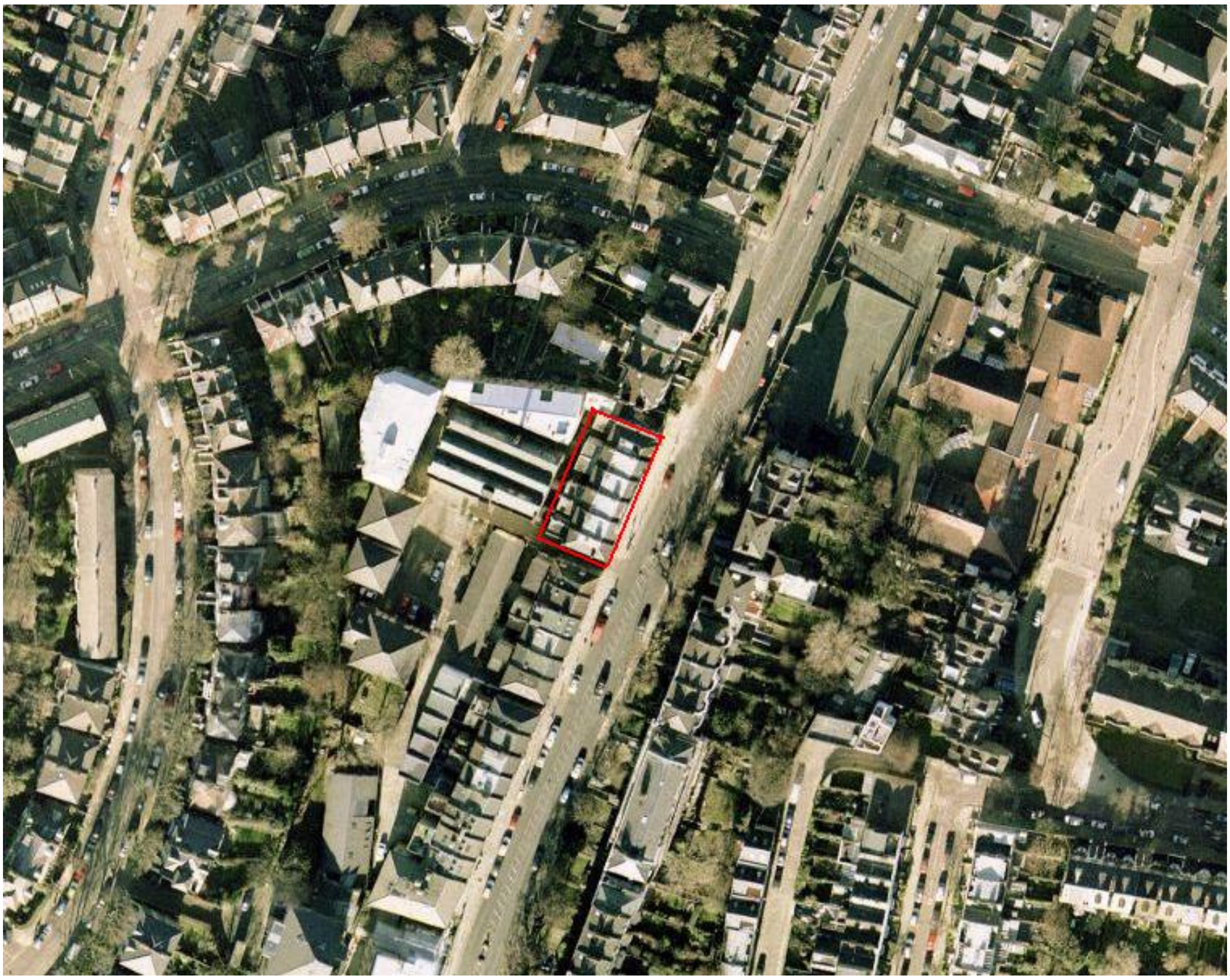
It is worth noting there can be occasions where no forms of renewable technology are considered feasible. If this is the case, explanations will be given under part (iii) and the Energy Statement will be abandoned. Our client may wish to include further feasibility arguments or recommendations in a separate report.

4. Summary of Site Proposals

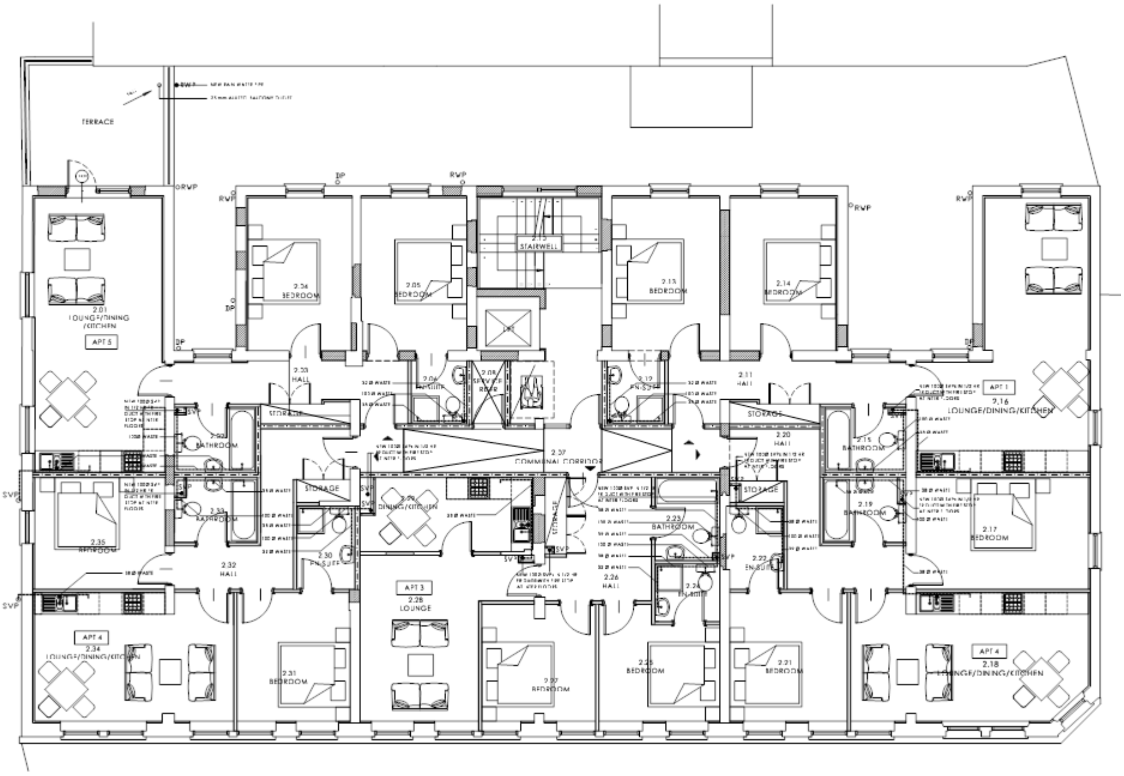
The proposed development is an existing building, which is to be refurbished, containing retail units on the ground floor (not under consideration in this report) and a total of nine flats on the first and second floors. As well as the refurbishment proposals there are to be some new build elements to the flats, which will extend the upper floors over the ground floor.

Location:

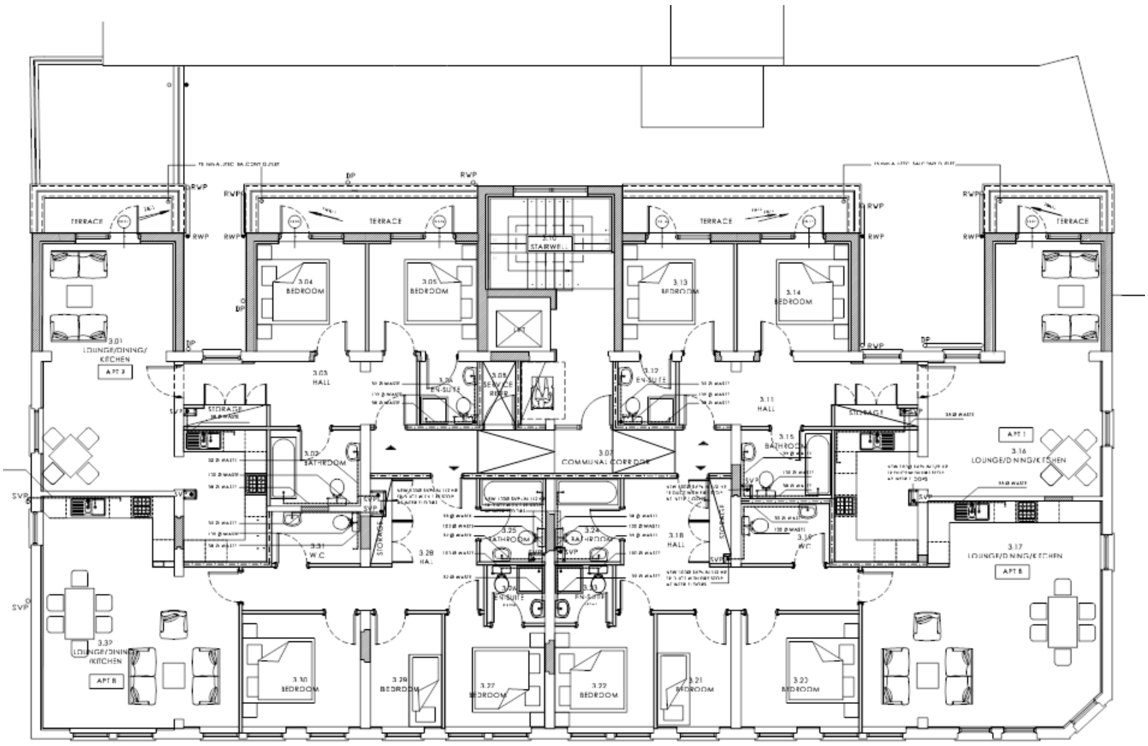


81-91 Fortess Road, LONDON NW5 (Courtesy Google Maps)

Floor plans: (supplied by client)



First Floor



Second Floor

5. Part L (SAP) Calculation

'The Standard Assessment Procedure is adopted by Government as the UK methodology for calculating the energy performance of dwellings. The calculation is based on the energy balance taking into account a range of factors that contribute to energy efficiency.' (BRE)

The first stage is to complete SAP Calculations on all plots. This is a legal requirement for new builds in the UK and measures construction materials, thermal efficiencies, ventilation, heating systems, solar gains, water heating, lighting and renewable technologies.

For the purposes of this initial calculation, any planned renewable features have not been included. These will be added later.

The SAP Worksheets for each plot will be issued as a separate PDF file, and further electronic copies are available on request.

Table 1 shows a summary of the information used in these initial calculations. In order to continue with this Energy Statement, it must be ensured that all parts of this summary sheet meet the limiting efficiencies of Part L Building Regulations.

Summary of key figures used in SAP assessment							
Average U-Values:				**Heating systems:**			
Heat loss floors:	0.250	W/m²K	✓	Main heating system:	90.1	%	✓
Heat loss walls:	0.305	W/m²K	✓	Mains Gas Boiler			
Heat loss roofs:	0.174	W/m²K	✓	Hot water system:	90.1	%	✓
Openings:	1.520	W/m²K	✓	Mains Gas From Main			
Lighting:				Secondary heating system:			☐
Low energy lighting:	25	%	✓	None			
Ventilation rates:				**Area weighted results:**			
Predicted air leakage:	10.0	m³/hm²	✓	**SAP2005 Design Emission Rate:**	22.86	$kgCO_2/m^2/yr$	
				SAP2005 Target Emission Rate:	24.22	$kgCO_2/m^2/yr$	
					Passed		✓

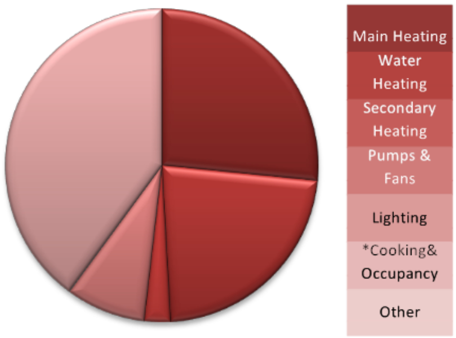
Table 1 – Summary of key figures used in SAP assessment (site average)

The SAP methodology can also be used to show the energy use and emissions for the various activities expected in a dwelling. This has been illustrated in Table 2.

Breakdown of expected energy use

Annual figures:	kWh	$kgCO_2$
Main heating system:	33,658.5	6,529.8
Water heating (DHW):	28,563.3	5,541.3
Secondary Heating:	0.0	0.0
Pumps & Fans:	1,575.0	664.7
Lighting:	4,811.3	2,030.4
Cooking & Occupancy:	N/A*	9,803.1
Other:	0.0	0.0
Totals:	68,608.2	24,569.1

Chart based on emissions from site ($kgCO_2$)



*Cooking and occupancy figures only apply when calculation based on emissions

Table 2 – Breakdown of expected energy use (site total)

The Cooking & Occupancy calculation is assessed using Section ENE7 of the Code for Sustainable Homes, as this is not currently a feature of SAP methodology.

The details shown in Table 2 give the total amount of both energy use (kWh) and emissions (kgCO2) which are expected from the site before renewable technology is considered. The pie chart gives a visual representation of these figures, based on emissions in line with the requirements of Harrow Council.

As this authority requires the Energy Statement to show feasibility of renewables based on a 10% reduction, Table 3 indicates how much of a saving will be required.

Council information and required reduction

London Borough of Camden	Required reduction: 10 %
Town Hall, Judd Street, LONDON, WC1H 9JE	Based on energy use
www.camden.gov.uk	Total emissions on site: 68608.18 kWh
(020) 7974 4444	10 % of reduction equals: 6860.8 kWh
To comply with local authority targets, the consumption on site must be reduced to:	61747.4 kWh

Table 3 – Council information

In order to comply with the requirements of Camden Council, 10% of energy consumption should come from on-site renewables. Any technology which cannot demonstrate this, or is deemed to be unfeasible for the site, will not be recommended in this report.

6. Onsite Energy Saving Measures

'Your goal is to build an efficient house that requires very little energy, [as an alternative to installing] expensive technology to provide energy for a conventional, wasteful house.' (EnergyBooks.com)

This section investigates the possibility of creating a more energy efficient development by targeting the build and design of a site as an alternative to installing renewable technologies.

It may be a possibility for the local authority to accept the recommendations within this chapter as an alternative method of reaching the required reduction, without the need for using the technologies as listed later in this report. This may also be an option to consider if the report concludes that no renewables technologies are feasible for this development.

It is reasonable to suggest that best practice and appropriate measures will be factored into the design of this development to minimise the environmental impact on the site. The following descriptions outline areas which may assist in the reduction of energy use, aside from the use of renewable technologies.

Orientation & Day Lighting

Building design is a compromise between the relative high U-value of windows compared to the lower values of walls, having a large area of glass allows more daylight into the building at the cost of losing heat during the winter and gaining excess solar radiation during the summer. Window orientation also has an effect e.g. north facing windows will only transmit a small level of daylight and have relatively high heat losses in the winter. Conversely south facing windows allow higher levels of daylight into the building but also admit higher solar gains in the summer.

The building is orientated with glazing mainly to the south east. This is a reasonable orientation when utilizing solar gains in winter; however care should be taken not to create a 'greenhouse' effect in summer, where cooling systems may be required in order to keep the dwelling at a sensible temperature. This could be achieved by incorporating external shutters to the property. In this development, the orientation and areas of glazing to the south east may promote high levels of solar gain. The developers have been careful to plan the specification of the glazing to result in a u value (1.6) that is well within the requirements of current building regulations maximum of 2.2 so reducing excessive solar gains and a demand by building users for energy hungry cooling systems.

Air Tightness

All of the thermal elements have been assessed and will be built with adequate amounts of insulation to comply with or improve on the Part L building regulations minimum standards in order to reduce heat loss as much as possible. See Table 1 (above) for additional information.

Under current legislation, a proportion of all new builds are required to have an air leakage test completed. This proves how air tight a particular building is – this figure can either be assumed for similar house types, or tests can be carried out on all plots for a more accurate reading overall.

Air leakage tests are measured in h^3/hm^2 at a standard of 50 Pascal's – the lower reading recorded shows the building is more air tight.

The predicted air permeability rate for this development has been set at ten. This is the highest value allowed under current regulations. We would suggest the site is constructed to achieve a value less than eight.

Glazing and Doors

It is important to ensure all external doors, glazing and roof lights are installed correctly to avoid large thermal bridges between the building structure and opening frames.

Poorly fitted windows and low-quality glazing specification can easily channel warm air out of a home and undo energy saving measures created by lower u-values and air tightness.

The windows will have a specification set to achieve a u value of 1.6. Entrance doors to the flats are situated adjacent to unheated corridors and are treated as being semi-exposed. They have been assessed in this report as having a u value of 1.0.

These u-values are acceptable under current building regulations.

Picture credits:
Air Leakage Test in process, Energist UK; Glazing Credit unknown

Ventilation & Extraction

Generally, ventilation within the flats will be by natural means. However, local mechanical exhausts will be installed in every wet room to extract stale or humid air. The fans throughout will be low energy and comply with the ventilation requirements outlined in Part F.

Lighting

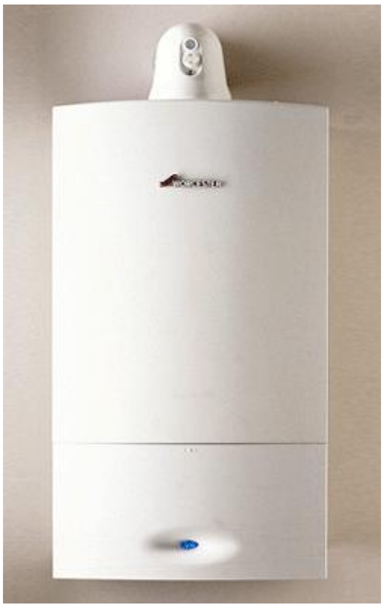
The amount of low energy lighting within these dwelling is 25% and complies with Part L.

Large savings in both emission rates and in fuel bills can be achieved simply by installing as many fluorescent and LED bulbs within a property as feasible. As standard tungsten and halogen bulbs are phased out in the United Kingdom, the use of CFLs and LEDs will become standard practice over the coming years.

If installing security lighting, it is good practice for the circuit to contain a daylight detector and motion sensors. This ensures the light is not using energy unnecessarily. External lights on dwellings should be no greater than 150W in the case of security lighting, and have a lumen per watt ratio no less than 40 in the case of safety lighting.

Picture credits:
Greenwood Ventilation; Osram lighting

Heating and Hot Water



The amount of energy required by the heating and hot water systems of a dwelling far outweigh the consumption from lighting and appliances, so it is important to ensure that heating systems are efficient, installed correctly and fit for purpose.

Note: The following text is based on the original emission calculation on this development. The heating system may be altered due to recommendations made later in this assessment.

It is proposed the development is fitted with a boiler to fuel both the heating and hot water supply. This appliance will be SEDBUK A rated having an efficiency of 90.1 %. This efficiency is acceptable under current Building Regulations.

The heating system will be fitted with the following control functions to assist in keeping energy use low, and will help to make the most of the efficiency of the system.

- Programmer/Timer. This device allows the heating to be automatically timed and can be set by the house user to work around their personal daily timetables
- Thermostat. This monitors the temperature within the dwelling and will cut off the heating system if the house is too warm
- Thermostatic Radiator Valves (TRVs). These are additional devices attached to each radiator which control the flow of hot water through the heat emitter according to the temperature of the room.

Secondary Heating Systems

Installing secondary heating systems can be beneficial under SAP2005 methodology as homes without a second system are assumed to use more electric heating as back-up during extreme cold spells.

No secondary heating is to be installed in these dwellings.

Picture credits:
Worcester boiler; Fireplaces Are Us

7. Renewable Energy Technologies

Renewable energy is defined as *'those energy flows that occur naturally and repeatedly in the environment – from the wind, the fall of water, the movement of oceans, from the sun and also from biomass.'* The London Plan (Greater London Authority)

This definition has been widened by the UK government by the use of the term 'Low or Zero Carbon Energy Technologies" (LZCs) within the revised ADL documents. The carbon emissions reduction from applying these technologies when compared to conventional technologies has also been accepted as 'renewable energy' under the GLA methodology.

The feasibility of seven technologies will be considered for the purposes of this Energy Statement, by using renewable means as described in the previous section.

The technologies to be assessed are as follows:

- Photovoltaic panels*
- Wind turbine technology*
- Combined Heat and Power system*
- Solar Thermal Systems
- Biomass Heating System
- Ground Source Heat Pump
- Air Source Heat Pump^

*If feasible, these technologies will be prioritised when conclusions are made regarding the recommendations report, as these systems produce electricity by converting sunlight, wind power and waste heat into power.

^ Geothermal heat pump systems pull warmth from natural sources. As Air Source Heat Pumps do not work in this way, some local authorities do not consider ASHPs to be a renewable form of power. Any recommendations made for the installation of an ASHP system may be over-ruled.

The Department of Energy and Climate Change (DECC) published a raft of documents under the heading *'UK Low Carbon Transition Plan'*. These included a renewable energy strategy and a consultation on financial incentives for renewable energy. The measures outlined in the consultation have the potential to provide a big boost to small-scale renewable power.

Process

Over the following pages, each technology will be assessed by incorporating the system into the existing SAP assessment.

This document will also consider the feasibility of the system on the site, any cost implications and savings from this installation and whether the suitable is suitable or not. A brief definition of each system will also be included.

The calculations will be completed using Energist UK's Energy Statement Calculation Tool.

On a site featuring more than one building, this statement will refer to the site overall and measure any energy reductions based on the complete development. This will give designers the option of including more renewable technologies on particular plots than others, on the understanding that the required level of savings will be made overall.

Offsite renewable systems and schemes to offset emission use elsewhere will not be considered as part of this assessment.

8. Photovoltaic Panelling

Solar photovoltaic arrays (PVs) convert energy from daylight into electricity using a semiconductor material such as silicon. When light hits the semiconductor, the energy in the light is absorbed, 'exciting' the electrons in the semiconductor so that they break free from their atoms. The resultant flow of electrons through the semiconductor material produces electricity.

Photovoltaic arrays can be installed retrospectively on existing buildings (above), and can also be incorporated into new-build roofs. PV tiling systems are available on the current market, although these systems are not as common.

Most developments can benefit from the use of a PV system.

☑Positives:

Low to zero maintenance

No noise or movement disturbance

Produces electricity without direct sun

Planning will not be required in most cases providing the array is within 200mm of the roof tiles.

☒Negatives:

Cannot be used on fragile or delicate roofs

Possibility of glare or sunlight dazzle

Will not function if in a heavily shaded area

Planning permission would probably be rejected for buildings of historical importance or in areas of Outstanding Natural Beauty

Cost

Installation costs will vary countrywide. On average, you would expect to pay around £1,000 per square metre of panelling – although the more you install on a site, the cheaper this figure would become. Additional scaffolding costs would also be required.

Maintenance costs are practically zero, although it is recommended that the arrays are cleaned on occasion to maintain a good efficiency.

There are no longer grants available for the installation of photovoltaic panels. Instead, a Feed-In Tariff has been introduced. The user of the home can expect to receive money back from their electricity company for the energy they produce and export back onto the National Grid. This is currently set at 41p per kilowatt.

Calculation for Photovoltaic

The following information assesses whether photovoltaic panels are a feasible option for this development, considering roof space, orientation and over shading.

Feasibility of Photovoltaic Panels on this site		
Is there sufficient roofspace for the panels?	Yes	✓
What is the preferred orientation?	South	✓
Will there be a risk of overshading?	None	✓
All indicators suggest Photovoltaic Panels will be feasible for this development		

As photovoltaic panels can be considered as a feasible option on this site, savings have been calculated as follows:

Requirement of Photovoltaic Panels on this site

Collector orientation:	South		Collector pitch:	0	°
Overshading factor:	None		SAP2005 Table H2 (Orientation Factor)	933	kWh/m² (S)
Required generation:	6,861	kWh	SAP2005 Table H3 (Overshading Factor)	1.00	(ZPV)
kWh/(0.8(S*ZPV))	9.19	kWp	Estimated Area of PV panels	74	m²

Revised annual figures:	**kWh**	**$kgCO_2$**	Energy Use:	
Main heating system:	33,658.5	6,529.8	Original total	68,608.2 kWh
Water heating (DHW):	28,563.3	5,541.3	New total	61,747.4 kWh
Secondary Heating:	0.0	0.0	Saving of:	10.00 %
Pumps & Fans:	1,575.0	664.7	COMPLIES	
Lighting:	4,811.3	2,030.4	Emissions:	
Cooking & Occupancy:	N/A*	9,803.1	Original total	24,569.1 kg/CO_2
Other:	0.0	0.0	New total	20,672.2 kg/CO_2
Renewable Technology:	-6,860.8	-3896.9	Saving of:	15.86 %
Totals:	61,747.4	20,672.2		

In order to achieve a 10% contribution to the development's energy usage using photovoltaic panels, a large enough array should be installed to produce 6,861 kilowatt hours of power annually. This equates to approximately 74 m^2 of PV, giving 9.19 kilowatt peak. These figures should be confirmed by a certified installer for the development.

9. Wind Turbines

Wind turbines are a modern, high-technology descendant of the windmills that have been around for centuries. In modern windmills the kinetic energy of the wind is used to turn a turbine to generate electricity as opposed to moving water or turning a grist mill wheel.

There are two types of wind turbine, the horizontal-axis type (pictured) which faces up or downstream of the wind and where the rotational movement of the blade is connected to a generator to create electricity. The other is the vertical-axis design, which is by far the most flexible type of wind turbine being best suited to more urban sites as it is more cost effective and operates with wind coming from any direction.

Turbines are best suited to hilltop, rural locations. Small scale turbines are not considered in this assessment as they only produce small levels of power. An average annual wind speed of 6 m/sec is recommended for efficient electricity production from a turbine.

☑Positives:	☒Negatives:
Produces free electricity	High maintenance costs
Suited to high, open ground	Strobing from shadows can be a nuisance
Benefits from UK wind patterns	Difficult to obtain planning approval
No bi-products or waste	Not suitable for urban, dense areas

Cost

Installation costs will vary countrywide and will depend on the size of turbine required. Generally, you can expect to pay around £20,000 to have a suitable wind turbine installed.

It is recommended that wind turbines are serviced regularly, which will lead to further additional costs. Because of this, it may not be considered financially viable to install a small or medium sized wind turbine.

As with photovoltaic panelling, the Feed-In Tariff is used on wind turbines as an alternative scheme to applying for a grant. The owner of the turbine can expect to receive money back from their electricity company for the energy they produce and export back onto the National Grid. This is currently set at 41p per kilowatt.

Calculation for Wind Turbines

The following information assesses whether wind turbines are a feasible option for this development, considering wind speed, surroundings and safety.

Feasibility of Wind Turbines on this site		
What is the average wind speed?	4.9 m/s	?
Any there any potential obstructions?	Yes	✗
Does blade dip below the eaves of the house?	No	✓
Average wind speed is considered too low in this urban situation for an efficient turbine installation		

Average wind speed for this site is too low for a wind turbine to be considered feasible. Calculations for installing wind turbines have been terminated in this instance.

Wind speed data available from:
http://old.berr.gov.uk/windspeed-database/page27326.html

10. Combined Heat and Power

Combined Heat and Power (CHP) is the simultaneous production of heat and electricity. Using a reliable internal combustion engine fed from a single source of fuel, such as natural gas or LPG, a CHP system can produce usable amounts of both heat and electricity.

The Government's Micro-generation Strategy has identified Micro-CHP as one of the key technologies which offers a realistic alternative to centrally generated electricity.

Previously, CHP systems have only been suitable for large developments due to the size and complexity of the systems available.

Small scale CHP systems are now on the market for individual dwellings (pictured). These systems are not much larger than a typical gas boiler, and have a built-in turbine to produce electricity for the home.

It is recommended that CHP is not installed in newly built dwellings for one key reason: The system only produces electricity when the boiler is producing heat. In a new build the heating demand will be considerably less due to a tighter build quality and better U-Values of heat loss elements. The system would not be able to generate enough power to be considered financially viable.

☑Positives:	☒Negatives:
Low maintenance	Unsuitable for newly built dwellings
Produces power from waste heat	Technology is still expensive
Planning is not required	Tight-fit for small houses
Ideal for renovations	Only works while heating system is on

Cost

As micro-CHP technology is still relatively new, the costs of purchasing the equipment is still quite high – around £1,500 per unit. Maintenance costs can be expected as with any boiler system.

Savings can be made in electricity bills as the CHP system will produce some of the required power for the dwelling. Feed-in tariffs apply to any energy which is exported onto the National Grid.

Picture credits: Kelcroft

Calculation for CHP

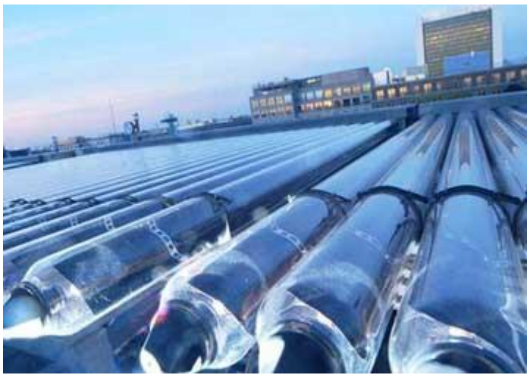
The following information assesses whether CHP is a feasible option for this development, considering age of building and boiler usage

Feasibility of Combined Heat and Power on this site		
Is the development new build?	No	✕
Will the boiler be running frequently?	No	✕
Is there provision for plant?	No	✕
Micro CHP is usually only recommended on buildings with a higher demand for heating		

Combined heat and power unit are best utilised and at their most efficient where there is a constant demand for both heat and electricity. Therefore, in an individual, domestic situation they are, at present, not considered a feasible option. Larger, units may be installed to service a large block of flats as whole for instance but in this development there is no available space for the relatively large plant involved.

Calculations for CHP have been terminated in this case.

11. Solar Thermals



Solar water heating systems convert solar radiation to heat carried by water for use in space heating or the provision of domestic hot water.

They normally operate with a back-up source of heat, such as a gas condensing boiler. The solar water heating preheats the incoming water, which is topped up by the back-up heat source when there is insufficient solar energy to reach the target water temperature.

Before a solar system can be considered, care must be taken to ensure the orientation and over shading of the chosen roof is able to provide enough direct sunlight to make the system feasible. A newly installed system is expected to provide around two thirds of a dwelling's annual hot water needs if it has been sized correctly.

Solar systems are becoming quite popular, as they can be fitted to properties retrospectively for not much more cost than if they were fitted to a new build. As technology improves and our houses are built to an ever increasing standard, the panels are becoming more useful in providing us with heating and hot water without any bills.

☑Positives:

Produces free heating and hot water
Competitive installation market
Low maintenance charges
Good return on investment

☒Negatives:

Performs poorly if facing north, east or west
Effected by shading from trees and buildings
Prone to damage from hail / wear and tear
Can struggle on dull, overcast days

Cost

It is difficult to predict the cost of installing a solar thermal system, as the price will be dependent on the location, area of panels, complexity of heating system, type of panels and whether there would be any additional costs because of difficulties on site. A typical, standard installation would cost in the region of four to five thousand pounds.

Financial savings are also difficult to pinpoint, as this will depend on the type, size, orientation and location of the panels and the efficiency of the heating system. Payback on a new solar system is expected to be around 10-15 years.

Picture credits: Gallagher Boilers

energist sustainable energy solutions

Calculation for Solar

The following information assesses whether solar panels are a feasible option for this development, considering roof space, orientation and potential over shading.

Feasibility of Solar Thermal Panels on this site

Is there sufficient roofspace for the panels?	*Yes*	✓
What is the preferred orientation?	*South*	✓
Will there be a risk of overshading?	*None*	✓

All indicators suggest Solar Panels will be feasible for this development

As solar panels can be considered as a feasible option on this site, savings have been calculated as follows:

Requirement of Solar Thermal Panels on this site

Solar panel type:	*Flat plate*		Efficiency of collector:	*80.3*	%
Orientation:	*South*		Heat loss coefficient:	*3.56*	
Energy for heating and DHW:	*62,221.9*	kWh/year	Useful panel area:	*5.80*	m²
Energy produced by solar:	*7,044.8*	kWh/year	Estimated solar array size:	*6*	m²

Revised annual figures:	**kWh**	**$kgCO_2$**
Main heating system:	33,658.5	6,529.8
Water heating (DHW):	28,563.3	5,541.3
Secondary Heating:	0.0	0.0
Pumps & Fans:	1,650.0	696.3
Lighting:	4,811.3	2,030.4
Cooking & Occupancy:	N/A*	9,803.1
Other:	0.0	0.0
Input from solar system:	-7,044.8	-1366.7
Totals:	61,638.4	23,234.1

Energy Use:		
Original total	68,608.2	kWh
New total	61,638.4	kWh
Saving of:	10.16	%
COMPLIES		
Emissions:		
Original total	24,569.1	kg/CO_2
New total	23,234.1	kg/CO_2
Saving of:	5.43	%

In order to achieve a 10% contribution to this development's energy consumption using solar thermal, a total of 7,044.8 kWh annually will be required form the panels. This may be achievable by using 6 m^2 of flat plate panels. In this case a horizontal (south) aspect has been assessed. There may be planning/aesthetic issues which require that the panels are installed horizontally. However, production will be increased (and therefore carbon emissions reduced) if the panels are tilted up by about 30 degrees. A specialist solar panel installer will be able to produce a more site specific feasibility study if this option is accepted.

12. Biomass Heating System

Biomass boilers are an alternative to conventional fossil fuel heating. They burn woodchip, wood pellets, cereal waste or a combination of organic fuels, and are a virtually carbon neutral option.

Using biomass as an energy source creates a 'closed carbon cycle' – i.e. as a biomass energy source grows it absorbs CO_2 from the atmosphere. When it is burnt the CO_2 stored by the biomass is released, making it carbon neutral. Emission factors are only added to take into account production and transportation of the pellets.

Biomass is usually installed with a standard gas or oil boiler as a back-up in case the occupier runs out of fuel.

They are coming down in size, but are still big enough to require a dedicated room – storage space for the fuel will also be required. It is therefore usually only recommended to consider biomass heating systems for large dwellings, or for use as a community heating system.

It is possible to consider biomass for new builds, existing renovations and extensions, but it is always worth checking that you have a biomass supplier in the region.

☑Positives:

Virtually carbon neutral fuel
Can be used for heating and hot water
Does not affect the external look
Ideal for large houses/as a community system

☒Negatives:

Pellets / chips can be difficult to source
Large amount of space required
Storage space required for pellets / chips
Expensive to install

Cost

Depending on the size of the biomass boiler, the cost can be between six and twelve thousand pounds including installation. This figure will vary based on the complexity of the development, size of the boiler and the cost of local installers. Grants may be available.

The cost of the fuel will vary on the site location – as suppliers are relatively few at present. Suppliers from Ireland and mainland Europe are currently exporting biomass into the UK in order to meet demand. It is expected the cost of biomass pellets will begin to fall when the UK is able to meet its own demand for the fuel.

Picture credits: unknown

Calculation for Biomass

The following information assesses whether a biomass system is a feasible option for this development. It is important to note that biomass boilers are not currently as efficient as gas or oil boilers, so the calculation will show the biomass system will use more energy, even though a dramatic reduction in emissions will be shown.

If this report is being viewed by a Planning Authority which requires a reduction in kWh, we recommend this fact is considered, and that biomass should be treated as an emission saving option instead.

Feasibility of Biomass Heating on this site		
Is there room for a biomass boiler?	No	✕
Is there a reliable supply of pellets?	Yes	✓
Is biomass efficiency better than original boiler?	No	✕
Biomass should only be considered to show a reduction in emissions, not energy use		

Calculations for a biomass system have been terminated in this instance as it is considered there is no suitable space for the plant.

13. Ground Source Heat Pumps

Ground source heating takes advantage of the stable ground temperature of 12ºC to heat either air or water to provide energy efficient heating (and optional comfort cooling) to a building.

The energy flow is driven by the temperature difference between the ground and the circulating fluid which can then be used to deliver heating and cooling to the building.

There are two main types of installations for ground source heat pumps. The first is the closed loop system (pictured). Elements are laid underground on land adjacent to the dwelling – usually underneath the garden or driveway but alternatively, they can be placed in the ground under the proposed building before building construction takes place.

For properties which are short on space, a second option is to use the coils vertically by installing them in several boreholes. This type of installation usually requires 100 metre long boreholes spaced out at six metre intervals. Because of the difficulties with installing a system in this way, the initial cost is much more expensive.

The more efficient heat pumps are now able to deliver 90% of the home's heating and hot water needs, although the majority of systems will require an electric immersion back-up system to keep up with demand in the winter.

☑Positives:

Typically requires three times less power compared to standard heating systems

Can also provide cooling in summer

Uses geothermal energy

Is not visible once building is complete

☒Negatives:

Installation can be expensive, particularly if a borehole installation is required.

Maintenance and repairs can be very costly

Can be damaged by weak ground or tree roots

May struggle to meet demand in winter months

Cost

On average, a heat pump with horizontal elements which can produce 6 kilowatts of heat and can be expected to cost between seven and twelve thousand pounds depending on the site. The use of vertical elements will double this estimate.

Savings will be seen through lower heating and hot water bills, especially during spring and summer. If the system is equipped with cooling, this will be an additional power source in the summer months which will lead to higher bills.

If the system uses an electric immersion back-up, this would be charged at your standard electricity tariff.

Picture credits: Rain Wind Sun.co.uk

Calculation for Ground Source Heat Pumps

The following information assesses whether a ground source heat pump could be considered a feasible option for this development, considering the earthworks and size of the development.

Feasibility for a Ground Source Heat Pump on this site		
Is there room to install underground coils?	*No*	✕
Is there access to dig boreholes?	*No*	✕
Is the ground suitable?	*Yes*	✓
In this instance, a Ground Source Heat Pump can not be installed		

Calculations for a ground source heat pump system have been terminated in this instance as it is considered that there is not enough ground area for the installation of collector elements

14. Air Source Heat Pumps

Air conditioning systems procide full control of air temperature, humidity, freshness and cleanliness. Modern ASHPs are usually 'split systems' which are made up of two major components, an indoor unit and an external unit (pictured) joined by pipes which transport refridgerants between them.

ASHPs can provide heating as well as cooling, they can also be combined with mechanical ventilation and heat recovery systems. They can work effectively with external temperatures as low as -15ºC.

It is important to be aware that some council do not consider Air Source Heat Pumps to be a viable renewable technology for the purposes of an Energy Statement, as they do not create energy from natural elements. They do, however, use fuel in a far more efficient way than other forms of electric heating. Because of this, we recommend consulting with your planning department before opting for this system.

For the purposes of this calculation, we have assumed a standard ASHP without hot water, ventilation or heat recovery options. These additions are likely to make even greater savings.

☑Positives:

Easy to install on a new building
Can heat, cool and ventilate
Can be fitted with anti-allergy filters
Emitters can be disguised as artwork

☒Negatives:

Outside space required – not suitable for flats
External boxes can be damaged by passers-by
External boxes may emit an annoying hum
Will struggle to heat larger buildings

Cost

Air Source Heat Pumps are cheaper to install and more reliable than Ground Source versions. A basic heating will cost around £4,000 excluding fitting. It is also possible to tie the hot water demand into the system, as an alternative to relying on grid electricity for hot water. This larger system would cost double for a standard installation.

The current price of electricity means that payback times on these systems can be as little as five to ten years – modern houses which are well insulated will see a greater financial benefit from using this technology.

Picture credits: Mitsubishi

Calculation for Air Source Heat Pumps

The following information assesses whether an air source heat pump could be considered as a feasible option for this development, considering house design and council approval.

Feasibilityfor an Air Source Heat Pump on this site		
Will design allow for ASHP units?	*No*	✕
Is the house too large for an ASHP?	*No*	✓
Does the LA recognise ASHPs as renewable?	*No*	✕
Air Source Heat Pumps should not be considered for this report.		

Calculations for an air source heat pump system have been terminated in this instance as the units are considered not to be suitable for flats as there is no external space and for noise consideration to neighbours.

15. Final Conclusions

Various technologies have been considered in this report in order to satisfy the requirement of Camden Council that 10% of the energy usage for the development at 81-91 Fortess Road be provided by renewables.

Wind turbines, combined heat and power, biomass, ground and air source heat pumps have been rejected as either not being suitable for this refurbishment development or unfeasible technologically.

However, installation of solar technologies such as solar thermal or photovoltaics would satisfy the council's requirement.

Of the two solar technologies we would recommend that solar thermal as a preferred option as this would easily provide the required 10% contribution to the development's energy usage, is a well known 'tried and tested' technology and would be a less expensive option than PV.