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Energy Statement:

WORLDWIDE HOUSE

Residential

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4.0 TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY

Mainer Associates have been commissioned to compile an Energy Statement for the proposed 3rd Floor extension at Worldwide House, Bayham Street, London. This report has been compiled to identify strategies to meet the requirement to achieve 20% reduction in CO_2 through the installation of low or zero carbon technologies. We have also included a Code for Sustainable Homes (CSH) Pre-Assessment report in line with Camden Council's planning guidance.

Outline, high level, SAP calculations have been undertaken to establish anticipated energy demand and how the implementation of low and zero carbon technologies can contribute to reducing the CO_2 emissions by 20%, in doing so, meeting the requirements of the Local Planning Authority.

The table below show an overview of the energy modelling results. The use of photovoltaic panels or air source heating has been demonstrated to be sufficient to achieve the 20% reduction in CO_2 target.

Dwelling	SAP	DER	TER	% Improvement
Flat 1 Baseline	B 83 (82.85)	16.9	16.69	-1.26
Flat 2 Baseline	B 84 (84.03)	15.73	15.97	1.5
Flat 1 -rev A (Fabric)	B 84 (83.74)	15.37	16.69	7.91
Flat 2 -rev A (Fabric)	B 86 (85.57)	13.44	15.97	15.84
Flat 1 -rev B (Wood & Control)	B 84 (84.14)	13.59	16.69	**18.57**
Flat 2 -rev B (Wood & Control)	B 86 (85.55)	12.31	15.97	**22.92**
Flat 1 -rev C (ASHP)	C 75 (74.57)	23.41	28.12	**16.75**
Flat 2 -rev C (ASHP)	C 77 (77.28)	20.42	26.97	**24.29**
Flat 1 -rev D (PV)	B 87 (87.45)	12.73	16.69	**23.73**
Flat 2 -rev D (PV)	B 87 (87)	13.14	15.97	**17.72**

During detailed design, full calculations will be undertaken as part of a costing exercise in order to specify the most appropriate solution in terms of cost whilst achieving the 20% reduction.

A CSH Pre-Assessment report has also been undertaken and this can be found in the Appendix of this report. The assessment details how the extension of the building will meet a CSH Level 3 standard.

2.0 INTRIDUCTION

Mainer Associates have been commissioned to compile an Energy Statement for the proposed 3rd Floor extension at Worldwide House, Bayham Street, London. This report has been compiled to identify strategies to meet the requirement to achieve 20% reduction in CO2 emissions through the installation of low or zero carbon technologies.

This report will detail the various methods of achieving the percentage reduction as required by the Local Authority. The requirements for compiling Energy Statements can be found in both: Energy Planning: GLA Guidance on preparing energy assessments; and Camden Planning Guidance, Sustainability. A review of this documentation can also be found in the main body of the report.

3.0 THE SITE

The site on Bayham Street in the London Borough of Camden currently consists of a three storey block of commercial offices. The planned extension will comprise a fourth storey across the entire footplate of the existing building. As a result of the extension, the existing plant on the roof will need to be relocated to the roof of the new extension.

The new development will comprise two single storey flats across the entire floor. There will also be a large scale refurbishment of the existing commercial block, however, this is not covered within this report. This Energy Statement only refers to the new residential extension.

4.0 PLANNING POLICY CONTEXT

4.1 National

On the basis of the information from the Government's Sustainable Development Strategy, 'Securing the Future' (2005), priorities for the UK can be summarised as:

- Sustainable Consumption and Production;
- Climate Change and Energy;
- Natural Resource Protection and Environmental Enhancement;
- Sustainable Communities.

The construction of new buildings provides a real opportunity to reduce the carbon emissions associated with the built environment. New techniques and innovative technologies are allowing new build projects to achieve ever increasing levels environmental performance.

All new residential self-contained dwellings must also be assessed using the Standard Assessment Procedure (SAP) and comply with Part L of the Building Regulations. SAP assessments are undertaken to assess the energy usage and efficiency of new build dwellings. As such we have used SAP to review the options for renewable technologies within this report.

4.2 Regional

'The London Plan: Spatial Development Strategy for Greater London' outlines the broad commitment to minimising the impacts of climate change through the achievement of a Carbon reduction target. By 2025, the Mayor will seek to achieve a 60% reduction in Carbon over 1990 levels.

The built environment is considered the largest contributor to the Carbon emissions within Greater London and as such, stringent targets have been set for new developments. Not only have targets been outlined in the document but also the methodology for achieving the target. The energy hierarchy must be considered in all cases. Below is an extract from The London Plan detailing how this hierarchy should be considered.

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

'Energy Planning: GLA Guidance on preparing energy assessments' details the requirements for the compilation of Energy Statements to accompany Planning Applications within London.

Using the principles of the Energy Hierarchy, this document outlines the requirements for the production of Energy Statements for new developments within Greater London.

This document states that Energy Strategy documents should include the following:

- A target for regulated CO2 reductions.
- A target for regulated CO2 emissions savings through energy demand.
- Reduction measures.

- Commitment to communal heating infrastructure, if appropriate for the development, and evidence of investigation into the existence of any wider district networks that the development could be connected to.
- Investigations of the feasibility and, where viable, commit to the installation of CHP In the proposed development.
- Large-scale developments should provide a feasibility assessment to ensure that CHP is sized to minimise CO2 emissions.
- Identification of measures to minimise unregulated emissions.
- Where appropriate we will expect an initial feasibility test for renewable energy technologies to be undertaken with a resulting commitment to further reduce CO2 emissions through the use of onsite renewable energy generation.
- Where the required improvement on a development's Target Emission Rate is not met a commitment to ensure the shortfall is met off-site using the provision established by the borough.

4.3 Local

As with the planning documents outlined above, the Camden Core Strategy 2010 – 2025, Adoption version 2010, places an emphasis on the energy hierarchy for reducing the Carbon emissions of the borough as a whole.

Once the energy use of the building is reduced, The Core Strategy encourages the use of energy efficient and renewable technologies to meet the reduced demand. The target that has been set in The Core Strategy is for developments to achieve a reduction in carbon dioxide emissions of 20% from on-site renewable energy generation.

Camden Planning Guidance 3: Sustainability (CPG 3), provides further confirmation of what must be included within an Energy Statement. The following from CPG 3 indicates the headings that should be used:

- Baseline energy demand and carbon dioxide emissions
- Reduce the demand for energy
- Supply energy efficiently
- Conclusion

Again, referring back to the energy hierarchy, CPG 3 highlights how the hierarchy should be considered within an energy statement. Section 6 mirrors the London Plan and Core Strategy documents outlining the 20%

reduction in CO_2 through the use of renewable technologies. For clarity, the technologies outlined in CPG 3 as being 'renewable, are as follows:

- Solar/Thermal Hot Water Panels
- Photovoltaic (PVs)
- Ground Source Heat Pumps (GSHP) or geothermal
- Air source heat pumps (ASHP)
- Biomass heating and power
- Wind turbines

This Energy Statement will consider the use of the above, in addition to energy efficiency, and demonstrate options for compliance with the target of a 20% reduction in CO_2.

5.0 ENERGY STATEMENT

This Energy Statement is compiled in order to demonstrate how the savings in carbon, outlined as targets within the Core Strategy, can be achieved on the Worldwide House 3rd floor extension.

The Energy Statement must demonstrate compliance with the targets set out in the Core Strategy as outlined in the previous sections. The focus of this report is the following requirement:

"A 20% reduction in Carbon emissions must be achieved through the use of renewable and low carbon technologies."

5.1 Energy Hierarchy

Energy and Carbon reduction should be considered as part of any development in the following order starting with the action at the top:

- Energy conservation - Changing wasteful behaviour to reduce demand.
- Energy efficiency - Using technology to reduce demand and eliminate waste.
- Exploitation of renewable, sustainable resources.
- Exploitation of low-carbon technologies.
- Exploitation of conventional resources.

Government guidance for carbon performance suggests a hierarchy of good practice in low carbon design. The figure illustrates this hierarchy.

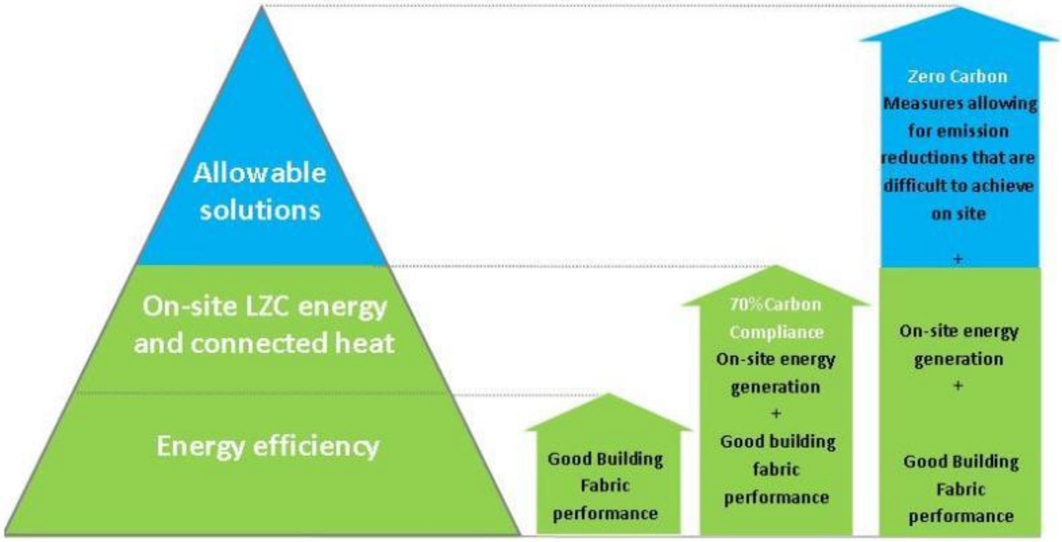


Fig 1 - Low Carbon Design Hierarchy

Whilst the building envelope is contrained to some degree by the nature of the developemnt as an extension of an existing building, consideration has been given to the integration of any proposed low and zero carbon energy sources with fixed services such as heating and hot water.

The last element of the hierarchy is the use of renewable energy solutions to generate the energy used on site. Ideally, these renewable energy sources should be installed locally.

5.2 Methodology

Given the development is an extension of an existing building, but is a new build, self-contained dwelling, we have opted to use the Standard Assessment Procedure. These calculations can then be taken forward to design stage where they will need to be finalised and issued to Building Control. Please note the calculations outlined in this report are for illustrative purposes only and further information would be required in order to finalise these for Building Regulations.

As part of this energy statement we have set the baseline as Part L compliance. We have then used this data to calculate the percentage reduction in CO2 resulting from the installation of fabric first solutions and renewable technologies. Given the building will be built to Part L of the Building Regulations, we have assumed that this will be achieved without the need for renewable technologies. This ensures compliance with the energy hierarchy as detailed in the relevant planning documentation outlined above.

Given the likely solutions for meeting the 20% reduction target, we will also demonstrate that the 'providing energy efficiently' part of the hierarchy, as well as the 'renewable energy' element will be covered using a variety of solutions.

Overall this document provides confirmation that the developer is aware of their responsibilities with respect to energy reduction, prior to the demonstration of this through detailed design and full SAP calculations.

5.3 Overview of Low & Zero Carbon Technologies

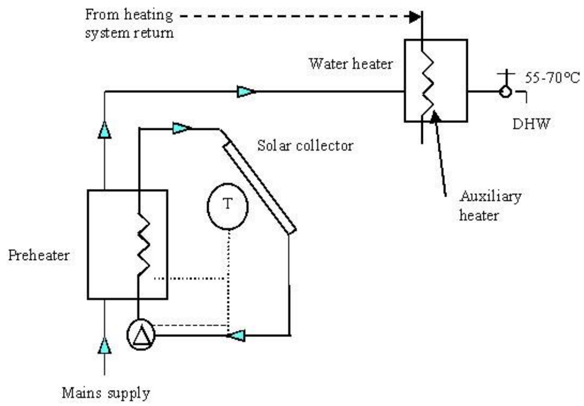
HIGH EFFICIENCY/CONDENSING BOILERS

A high efficiency condensing boiler works on the principle of recovering as much as possible of the waste heat which is normally rejected to the atmosphere from the flue of a conventional (non-condensing) boiler.

This is accomplished by using heat exchangers within the boiler which maximises heat transfer from the burner as well as recovering useful heat which would normally be lost with the flue gases. When in condensing mode (condensing boilers do not condense all of the time) the flue gases give up their 'latent heat' which is then recovered by the heat exchanger within the boiler or on top of the boiler through a Zenex Gas Saver unit. This is then used as a pre-heat for the cold feed so the boiler does not have to work to full capacity.

The result of recovering heat from the exhaust flue gas means less primary gas demand. This subsequently reduces CO2 emissions.

SOLAR COLLECTORS



Solar collectors collect both direct and diffuse solar radiation. Heat is transferred to the circulating liquid via heat exchange pipes that run through the solar collector. The circulating fluid in the solar collector is a mixture of water and glycol (antifreeze). This is to enable operation in winter and maximises efficiency similar to run around coils in a ventilation system, which use the same water and antifreeze mix. The water and antifreeze mixture is used to extract heat from the panels, so increasing the temperature of the water/circulating fluid. The water is then used to pre-heat the building domestic hot water as shown in the diagram above. The preheated water is then topped up using the a system or combination boiler.

GROUND SOURCE HEAT PUMP (GSHP)

There are a multitude of GSHP's available in the construction industry, each GSHP is installed differently and subsequently perform differently, however the principle of operation is fundamentally the same.

A GSHP removes heat from the earth or ground water in cold weather and transfers it to the building through an underground piping system. Whether ground or water is used as the source, the process remains the same and can reverse in warm weather as heat is transferred to the ground. GSHP's work by circulating water or a water/antifreeze solution, generally through a closed loop of pipe that is buried in the ground or set beneath water. The refrigerant cycle within a GSHP system comprises a two phase process, operating in the vapour and liquid phases. A GSHP can be categorised as having closed or open loops and these loops can be installed in three ways:

- horizontally,
- vertically,
- in a river / pond or lake.

The selection process for a GSHP depends on the area of the site / land, soil and rock type at the project. These factors will help determine the most economical choice for installation of the ground loop.

AIR SOURCE HEAT PUMP (ASHP)

Air source heat pump (ASHP) systems operate in a similar manner to GSHP systems, only they extract heat energy from the air, rather than the ground. They offer a simpler and cheaper alternative to GSHP's in that, generally, they offer much greater flexibility with regards to their installation and do not require the prior geological work needed by GSHP's.

With a typical SAP rated efficiency of 250%, they are not quite as efficient as GSHP's which are 320% efficient. They do, however, offer a renewable energy source to provide low grade hot water for suitable for domestic hot water or under floor heating installations.

When utilised with radiator systems it must be understood that most existing wet heating systems are sized for a water temperature of 80°C. A heat pump can usually achieve a maximum heating water flow temperature of around 45°C. This is ideally suited to under-floor heating systems, where low surface temperatures are required, but does not lend itself well to existing radiator installations without a commitment to reduce building heat losses through fabric improvement.

For this reason, radiators for a heat pump system may need to be significantly larger than those for a system served by a conventional boiler. The flow temperature of an ASHP system can be raised by the use of an electric top-up heater.

BIOMASS BOILERS

Biomass constitutes all non-fossil organic materials that have intrinsic chemical energy content. This includes all water and land-based vegetation and trees or virgin biomass, such as log wood or thinning from local forests, prunings from roadsides or parks, grasses and energy crops and in some countries, residues from agriculture or food processing e.g. nutshells or olive pits, wood chips, recycled untreated wood or palletising residues from wood processing. Also all waste biomass such as municipal solid waste, municipal bio solids (sewage) and animal wastes (manures), forestry and agricultural residues, and certain types of industrial wastes are classified as biomass. Through using these resources, a possible disposal problem can be turned into a high quality fuel and local suppliers of wood fuels will gain extra income and enhance local economic turnover.

Biomass can be used on a domestic or industrial scale. For a large scale biomass power plant, the chipped, shredded and dried fuel is fed into a boiler or gasifier, from there the gas is collected and used.

Boilers providing heat to the site could operate via biofuel. Biofuel is any fuel that derives from biomass - recently living organisms or their metabolic byproducts, such as manure from cows. It is a renewable energy, unlike other natural resources such as petroleum, coal and nuclear fuels. The carbon in biofuels was recently extracted from atmospheric carbon dioxide by growing plants, so burning it does not result in a net increase of carbon dioxide in the Earth's atmosphere.

The use of biofuel would mean the requirement for biofuel storage and regular deliveries. A hard standing is therefore required for a delivery truck or hopper, along with suitable protection from the elements. A trade-off between frequency of fuel deliveries and storage space is usually sought.

Maintenance of biomass boilers is considerably more onerous than for a conventional boiler. Ash residues mean that the plant must be shut down for cleaning on a regular basis.

WIND TURBINES

Wind turbines generate electricity from natural wind power via the rotation of their rotors. Turbines are classified as either 'small scale' (6kW to 50kW capacity), 'medium scale (between 50kW and 250kW output) or 'large scale' (250kW to 5MW output).

Large scale turbines are unlikely to be awarded planning permission in urban areas due to aesthetic and safety constraints. All turbines require clear access to wind speeds which achieve 6m/s or greater on a regular basis. The presence of buildings or variation in the local landscape can all affect the feasibility of a turbine installation.

In order to fully assess the viability of a turbine installation, local weather data at the proposed installation site should be collected for a minimum of 6 months, but ideally for 12 months, to allow accurate generation estimations to be made. This data would be collected via an anemometer on a mast to the height of the proposed turbine. This installation would also normally require planning permission.

PHOTOVOLTAIC (PV) PANELS

PV panels collect direct and diffuse solar energy and convert this into electricity which can be used on site or exported to the national electrical grid. Arrays of PV panels can be of almost any size and are normally installed on roof tops to ensure that they are cleared of any potential obstructions or shades.

The introduction of the Government's Feed-In Tariff (FIT) scheme has meant that PV is now a mainstream technology, used widely in domestic and commercial applications. As such, the cost of this technology has reduced dramatically over the last few years.

PV panels are available in monocrystalline, polycrystalline or amorphous thin-film types, which vary in efficiency and cost (monocrystalline being the more expensive and most efficient).

5.4 Feasibility Assessments

The table below provides an initial overview of the feasibility of the various technologies discussed in the previous section. A traffic light system has been adopted to represent the anticipated feasibility of these measures prior to undertaking modelling of the site.

The traffic light system should be interpreted as follows:

Red – Technology not suitable.
Amber – Technology may be suitable depending on building energy demands.
Green – Technology likely to be suitable given appropriate payback and operational constraints are met.

LZC Technology	Feasibility Comment	Feasible	Likely >20% reduction in CO2
Wind Turbines	Given the location of the site it is likely that local planning conditions and landscape features may render a turbine unviable. This should be considered as a high level assessment of feasibility only, as local site conditions and recorded wind data should be considered prior to full rejection of this proposal.	No	Yes
Photovoltaic Panels	PV panels are likely to be suitable given the facility to incorporate these into the design of the new 3rd floor roof. The effects of any shading caused by surrounding buildings would need to be considered, but it is not anticipated that this would render PV non-viable. We would propose full output modelling of the system in situ to confirm the effectiveness of this technology and confirm how much PV would be required to meet the 20% target.	Yes	Yes
Solar Collectors	Solar hot water panels are likely to be suitable given the high hot water demand for the two units. It is likely that the solar thermal system will not meet the 20% reduction in Carbon, however, we have taken this technology forward for further investigation..	Yes	No
High Efficiency/ Condensing Boilers	If conventional gas fired heating is adopted then this should be via high efficiency or condensing boilers. This could operate via a district heating system for each zone or a separate unit for each building. The status of existing gas infrastructure on the site will need to be fully examined to ensure the feasibility of this option. It is likely that the installation of this technology would be required as a minimum to achieve Building Regulation Part L compliance, therefore, it is unlikely to provide the 20% reduction.	Yes	No

CHP	CHP is unlikely to be viable as the site will not have the consistent base loads required to support the significant financial outlay for this type of technology. CHP operates most effectively if it can operate at a constant load continuously. If there is insufficient heat demand then excess heat has to be purged to the atmosphere as waste. Clearly this is not advisable. A full financial assessment of the viability of CHP is a complex and detailed procedure and, as such, it is beyond the scope of this report.	No	No
ASHP	Air source heating could be used to serve the heating and hot water demands, given sufficient space for external plant compounds where current plant for the other floors is being relocated. ASHPs must also be supported by the use of further energy saving measures such as a higher performing fabric, due to the low output temperatures produced by the heat pumps. ASHPs perform best when combined with underfloor heating due to the low output temperatures. This is also likely to be suitable for this development.	Yes	Yes
Biomass Boilers	Biomass boilers are likely to be able to provide a significant carbon saving over gas fired or electrically driven cooling. However, the operational risks, high maintenance demands and fuel storage requirements are likely to result in this being non-viable given the nature and location of the site. We have undertaken one model using a wood burning fire to show that the 20% Carbon reduction can be achieved.	No	Yes
Fabric	Far more so than renewable technologies, improvements to the fabric are a far more sustainable option. Firstly the life cycle benefits of improvements to fabric far outweigh those of renewable technologies that will require multiple replacement. Secondly, a fabric first approach is more attune to the energy hierarchy that most planning guidance is, or should be, based upon. The reduction of demand is far more important than serving a high demand with renewable and low Carbon solutions. The changing face of the UK energy grid means that a low Carbon solution now, may not be low Carbon in the future. It is safe to say that improvements to the fabric will always be low Carbon.	Yes	No
GSHP	Ground source heating could be used to serve heating and DHW demands for the site, given sufficient space and suitable ground conditions to accommodate the required slinky system or bore holes. Given the nature and location of the site it is unlikely that the required ground loops or bore holes could be created to serve such a system.	No	No

5.5 Site Energy Models

BASELINE

In order to develop the baseline from which we will calculate the percentage improvements we have undertaken high level SAP calculations. Further details on the SAPs can be found in the appendix.

Please note the assumptions below for the Baseline scenario:

- LOW thermal mass
- Thermal bridging 0.08 or better
- Wall to core 0.3 u-value
- External wall 0.2 u-value
- Roof 0.12 u-value
- Door to core 2.2 u-value
- Windows and bifold 1.6 u-vValue
- Natural ventilation
- Boiler - Netatec plus 33GA
- Time and temp zone control
- NO secondary heating
- 100% low e lights

The baseline for each flat is slightly different as we have assumed compliance with Part L as a minimum. As a result we have made each of the flats, through a process of averaging, only just pass Part L. From this point we can demonstrate the percentage improvements.

The following two baselines show how we have got them to simply pass Part L:

Flat 1 Baseline

- Air pressure test 8.1
- 3 local extract fans

Flat 2 Baseline

- Air pressure test 10
- 4 Local extract fans

The following revisions have been put together to produce a number of scenarios in order to ascertain the most appropriate means of achieving the target of a 20% reduction in Carbon. Each revision has been calculated using SAP as per the baseline models.

Flat 1 -rev A (Fabric)

- Achieving 10% using fabric first approach
- Reduce front door u-value to 1.4
- Reduce pressure test result to 4
- MVHR - (Greenwood fusion HRV2 assumed)

Flat 2 -rev A (Fabric)

- Achieving 10% using fabric first approach
- Reduce front door u-value to 1.4
- Reduce pressure test result to 4
- MVHR - (Greenwood fusion HRV2 assumed)

Flat 1 -rev B (Wood burner & Control)

- As revision A plus;
- Delayed start thermostat;
- Enhanced load compensation;
- Wood burning stove; and
- Window u-value reduced to 1.4.

Flat 2 -rev B (Wood burner & Control)

- As revision A plus;
- Delayed start thermostat;
- Enhanced load compensation;
- Wood burning stove; and
- Window u-value reduced to 1.4.

Flat 1 -rev C (ASHP)

- Walls u-value 0.3
- Roof u-value 0.18
- Thermal bridging removed - 0.15

- Door u-value 3.0
- Windows u-value 1.8
- MVHR - Greenwood fusion HRV2
- Pressure test 4
- ASHP - Mitsubishi Ecodan 5KW
- Time and temp zone control
- Water cylinder 250L losses of 1.8 kw/day

Flat 2 -rev C (ASHP)

- Walls u-value 0.3
- Roof u-value 0.18
- Thermal bridging removed - 0.15
- Door u-value 3.0
- Windows u-value 1.8
- MVHR - Greenwood fusion HRV2
- Pressure test 4
- ASHP - Mitsubishi Ecodan 5KW
- Time and temp zone control
- Water cylinder 250L losses of 1.8 kw/day

Flat 1 -rev D (PV)

- As baseline but with 1.5 kwP PV installed

Flat 2 -rev D (PV)

- As baseline but with 1.5 kwP PV installed

Flat 1 -rev E (Solar Thermal)

- As baseline but with Solar thermal

Flat 2 -rev E

- As baseline but with Solar thermal

5.6 Energy Model Results

The results of the various SAP calculations are outlined in the table below. Please also note that full SAP calculation sheets can be found in the appendices of this report:

Dwelling	SAP	DER	TER	% Improvement
Flat 1 Baseline	B 83 (82.85)	16.9	16.69	-1.26
Flat 2 Baseline	B 84 (84.03)	15.73	15.97	1.5
Flat 1 -rev A (Fabric)	B 84 (83.74)	15.37	16.69	7.91
Flat 2 -rev A (Fabric)	B 86 (85.57)	13.44	15.97	15.84
Flat 1 -rev B (Wood & Control)	B 84 (84.14)	13.59	16.69	**18.57**
Flat 2 -rev B (Wood & Control)	B 86 (85.55)	12.31	15.97	**22.92**
Flat 1 -rev C (ASHP)	C 75 (74.57)	23.41	28.12	**16.75**
Flat 2 -rev C (ASHP)	C 77 (77.28)	20.42	26.97	**24.29**
Flat 1 -rev D (PV)	B 87 (87.45)	12.73	16.69	**23.73**
Flat 2 -rev D (PV)	B 87 (87)	13.14	15.97	**17.72**
Flat 1 -rev E (Solar Thermal)	B 83 (83.49)	16	16.69	4.13
Flat 2 -rev E (Solar Thermal)	B 85 (84.58)	14.98	15.97	6.2

DER – Dwelling Emission Rate

TER – Target Emission Rate

The table above shows the percentage improvements for the different scenarios. There are a number of scenarios that will meet the 20% reduction in Carbon through low and zero Carbon technologies.

The biomass wood burning option does meet the 20% reduction in Carbon, however, there may well be issues with air quality, supply of wood and fire safety that are likely to render the option unsuitable.

Both ASHPs and PV will each provide the 20% reduction and in fact, a combination of the two technologies would be a good match. ASHPs combined with an underfloor heating system would be an ideal heating and hot water solution. PV could be installed to offset some of the daytime electricity use of the ASHP.

Whilst the fabric first option does not get the development to the 20%, this should be considered as the new baseline, as long as the Planning Authority allow this to be considered within the calculation of 20%

6.0 CONCLUSIONS

With regard to the Energy Statement, and the achievement of the 20% reduction in CO2 from renewable and low Carbon solutions, we have put forward a number of options that will need to be considered at the detailed design stage.

Should the Planning Authority allow 'fabric first' measures to considered within the calculation, we would advise that this the primary solution that is implemented. This would further improve the feasibility of other technologies. From this point (around a 10% reduction in Carbon), either PV or ASHPs should be selected to deliver the remaining 10% reduction. From a thermal comfort perspective, it is likely that, in order to get the most out of an ASHP solution, improvements to the fabric would be required.

If the Planning Authority do not accept 'fabric first' measures as part of the 20% reduction, then either ASHPs or PV cells would achieve the 20% reduction on their own. They would simply be larger systems than if the 10% was achieved through fabric measures.

Following completion of the scheme, PV panels have been installed and SAP data sheets provided which are sufficient to demonstrate the target has been met.

7.0 APPENDICES

APPENDIX A – SAP Calculations & Cover letter