DEMARCATION
ARCHITECTURAL & PLANNING CONSULTANTS

Design & Sustainability Statement

Design ethos

With regards to the design and layout of the proposal, specific attention was paid to the location relative to the surrounding landscape and views, sightlines and approach to and from the dwelling.

A simple rectilinear form was intended with large areas of glazing to the south and west elevations to maximise the use of the view and natural daylight, with the northern and eastern aspects being shaded by mature woodland.

Flat planted roofs were decided upon, in order to minimise volume and further soften the visual impact of the building within the landscape. These served to seat the building low on the ground dominated by the surrounding woodland and subservient to surrounding nature. These had the added advantage of providing ideal locations for small terrace balconies to two of the first floor bedrooms without appearing obvious or forced.

Elevational treatments will focus on natural stone with small cladding interventions and the aforementioned large areas of glazing.

Overall, the intended appearance is of a modest (when related to the open site) modern country house providing generous open living space while relating directly with the landscape, providing unrestricted views of the open spaces within which it is set while the material selection blends the built form with the nature surrounding it.

Size comparisons;

	Footprint	Floor Area	Volume
Existing	120.6m^2 without porch 159.5m^2 with porch	193.3m^2	633m^3 without porch 727.6m^3 with porch
Approved	250m^2 without porch 273.5m^2 with porch	295.3m^2	1085m^3 without porch 1121.3m^3 with porch
Proposed	254.8m^2	315m^2	1088m^3

Surface water will be dealt with by discharge to existing drainage ditch to rear.

Foul water will be dealt with by appropriately sized 'Klargester' type biodisc Domestic Sewage Treatment Plant.

Ecology & Biodiversity

As can be seen from the submitted information, the scheme simply proposes the replacement of an existing building within an established residential curtilage with a building of similar footprint approved in exactly the same position. The site is not near any 'Sites of Special Scientific Interest' (SSSI), any 'confirmed or proposed Local Wildlife Sites', 'Local Nature Reserves' or 'local Geologically Important Sites'. The site is currently a residential garden located between mature woodland and open paddocks, both within the applicants ownership. The scheme proposes no encroachment into either of these areas.

However, the scheme proposes the use of flat 'planted' roofs. These planted areas will consist of a wildflower / sedum mix, which are found through research in London and Switzerland to provide an important habitat for foraging bees and other small scale wildlife such as moths, butterflies and grasshoppers.

In addition to the above, new hedging is proposed between lawn and track to the south of the property. This hedge will be formed through the selection of native bird friendly species, eg; Hawthorn, Blackthorn, Wild Cherry, Bird Cherry, Wild Privet and Spindle. The mix outlined is intended to encourage a wide range of species to enjoy the structural diversity provided by hedges.

As such a net gain of biodiversity is being proposed, while no net loss is envisaged at any level.

Thus the proposal is policy compliant.

Sustainability & Energy Efficiency

Introduction

The existing dwelling presents a one and a half storey pre-fabricated 'pavilion' type building of circa 1960s vintage. The structure is of timber construction with very little insulation in either walls floor or roof. Windows are single glazed timber units as are the doors. Heating is by way of a single wood burning stove in the open plan ground floor with no other form of heating. Indeed, the house is more reminiscent of a summer holiday home than a full time residence.

From the outset, the clients brief was to design a highly sustainable high quality home which respected and blended with the unique site. This desire has been adhered to and has resulted in the scheme submitted.

As set out in the following Sustainability report, the application proposal is inherently beneficial from a carbon/energy efficiency perspective on the basis that it seeks to demolish an existing dwelling of exceptionally low energy efficiency and replace it with a modern high efficiency 'eco' type home.

The proposals incorporate a range of passive and active design measures that will reduce the energy demand for space conditioning, hot water, and lighting.

The later part of this section goes into more detailed explanation of the rigorous feasibility stage of the buildings design when considering energy consumption upon completion and in future day to day use and the improved performance of the proposed building fabric beyond the Building Regulations requirements.

However, in addition to this detailed design stage, a more generalised design approach is also implemented to provide a baseline approach to sustainable design.

Passive design measures

Building materials

Where practicable, materials used will be derived from sustainable sources and sourced locally wherever possible, while traditional construction techniques allied with high quality design and workmanship will guarantee that only locally based building trades will be required.

The key issues to be addressed in the selection of materials and equipment are:

- Use of materials and equipment from sustainable sources
- Minimization of in-use environmental impacts
- Minimization of embodied environmental impacts
- Use of materials and equipment with high recycled content

Enhanced U-values

Our emphasis is towards a 'Fabric First' approach, improving the fabric of the buildings through considered design and workmanship to reduce thermal loss, and as a consequence reduce the energy requirement for heating. In addition to the required improvements in 'U' values, accredited details will be adopted that ensure a continuity of insulation, especially around window and door opening. Air leakage from the building will also be minimised by the adoptions of good detailing and responsible workmanship. By the adoption of these principles, heating demand and consequently the size of the heat source will be minimised.

The heat loss of different building fabric elements is dependent upon their U-value. A building with low U-Values provide better levels of insulation and reduced heating demand during the cooler months.

The proposed development will incorporate high levels of insulation and high-performance glazing beyond Part L 2013 targets and notional building specifications, to reduce the demand for space conditioning (heating and/or cooling).

Air tightness improvement

Heat loss may also occur due to air infiltration. Although this cannot be eliminated altogether, good construction detailing and the use of best practice construction techniques can minimise the amount of air infiltration.

The proposed development will aim to improve upon the Part L 2013 minimum standards for air tightness by targeting air permeability rates of 4.00m^3/m^2.h at 50Pa.

Reducing the need for artificial lighting

The development has been designed to maximise daylight in all habitable spaces as a way of improving the health and wellbeing of its occupants.

All of the habitable areas will benefit from large areas of glazing to increase the amount of daylight within the internal spaces where possible. This is expected to reduce the need for artificial lighting whilst delivering pleasant, healthy spaces for occupants.

The nature of the glazing and proposed lighting system is discussed in more detail below.

Waste

A site waste management plan that provides details of waste minimisation, sorting, reuse and recycling procedures is required for all levels in the planning guidance.
Sustainable waste management should follow the hierarchy described in BS 5906: Waste management in buildings. Code of practice. This outlines the following principles in decreasing order of desirability:

- Reduce waste
- Re-use materials and equipment (and facilitate future reuse)
- Recycle waste (and facilitate recycling)
- Compost biodegradable waste
- Recover energy from waste (and facilitate energy recovery from waste)
- Disposal

Active design measures

High efficacy & low energy lighting

Where artificial lighting will be needed it will low energy lighting without compensating for luminance, and will accommodate semi-automated intelligent LED systems.

This system will be handled via an automated control system, whereby, lights to unoccupied rooms are simply automatically extinguished, while rooms in use will benefit from pre-set and automated light levels tailored to use of the room at the time.

The design and use of electrochromic 'smart' glazing in the proposed dwelling, has been carefully considered to provide natural light into the core of the building envelope, providing additional passive heat gain. While the variable tinting provided by the electrochromic coating will prevent overheating in summer months, while control of this system being automated through timers and external light level sensors will prevent internal room lighting from flooding the surrounding landscape.

Both these factors having a material impact upon reducing energy use and subsequent reduction in annual energy bills.

Water

Besides the desire to reduce energy consumption there is also a necessity to reduce both the consumption and waste of water.

Proposals for new residential development are to meet the higher water efficiency standard within Building Regulations Part G2 of water consumption target of 110 litres per person per day. The Building Regulations regulation requirement, 110 litres/ person is recommended for a new development within the area. This can be achieved by applying various water efficiency and reclamation / recycling measures.

Water Efficiency Measures

The following measures can be used to reduce the quantity of water demand to satisfy end users:

- Flow restrictors fitted to all taps
- Dual or low flush WCs
- Spray or aerating taps
- Water efficient appliances
- Low flow showers

• Baths with smaller profiles, requiring less water to fill
• Water butts installed for rainwater collection, for garden and plant watering rather than hoses.

Water Reclamation / Recycling Measures

• Rainwater collection

Water collected from roofs or hard surfaces such as car parks can be harvested for storage and use for non-potable uses such as watering gardens and WC flushing.

Controls

Advanced lighting and space conditioning controls will be incorporated, specifically:

• For areas of infrequent use, occupant sensors will be fitted for lighting, whereas day lit areas will incorporate daylight sensors where appropriate;

• Heating and cooling systems controls will comprise time and temperature controls, both centrally for the whole building, and locally for each space.

Overheating Risk analysis

The potential risk of overheating was assessed via the Part L Building Regulation compliance tool SAP. All domestic areas have been found to pass Criterion 3 ‘Limiting Solar Gains’ of Part L.

With regard to reducing annual energy demand and associated carbon emissions, a ‘fabricfirst’ approach will be undertaken with the intention of utilising high levels of insulation, low U-value glazing, attention to thermal bridging, all of which will be complemented by a score of $3.00m^3/hm^2$ (@50Pa) or lower for air tightness.

The proposal will, seek to significantly improve current insulation levels and to minimise air bridging and the intention is to utilise low energy lighting and A+ rated appliances throughout so as to minimise energy usage.

Energy Efficiency

In line with most other local planning authorities requirements,, the design and construction strategy is intended to achieve at least a 40% reduction in carbon emissions compared with a Code 2013 Building Regulations compliant base case. This reduction is to be secured through renewable energy and other low carbon technologies and/or energy efficient measures.

It is to the fulfilment of this policy that this report pertains and it will initially cover measures to reduce energy use, known as the ‘lean’ approach, before covering any additional option(s) required with regards the use of on-site low and zero carbon (LZC) energy technologies to meet the stated requirement.

Calculations & Conclusion

Design Stage energy calculations to analyse energy demand for the proposed design and specification have been undertaken working alongside energy consultants. This informs the design and produces target carbon emission figures for regulated energy use for the proposed dwelling.

The proposed approach to energy reduction is already good practice, in that it complies with Part L1A minimum requirements even before the addition of LZC technology and as the scheme is further developed, additional options for improved energy efficiency will be explored.

There is no local supply of district heat or Combined Heat & Power scheme to connect to and none mooted as part of this development, so the remaining carbon offset will be met through LZC technologies. Wind technology is not considered viable and cost and design implications rule out biomass and GSHP technologies. Solar thermal technology, whilst viable, cannot come close to the offset figure required and whilst Solar Photovoltaic (PV) technology would work well on this building, it may be added into the specification once overall build costs are confirmed. Therefore, Air Source Heat Pump (ASHP) technology is proposed to deliver the carbon offset and energy generation requirements for the dwelling at this site and the installation of this technology is considered to be straight forward and issue free.

This will see the offset of carbon emissions associated with energy use improve for the proposed dwelling by 47.80% per annum against Part L1A compliant base cases. This is shown below in Table 1:

Compliant annual Carbon emissions for base case ($kgCO_2/m^2/yr$)	Annual Carbon emissions with energy efficiency, PV & ASHP ($kgCO_2/m^2/yr$)	Improvement over base case (%)
27.18	14.19	47.80

Table 1: Base line and LZC technologies added annual CO_2 emission figures

Therefore, the energy efficiency/reduction proposals outlined, along with the inclusion of ASHP technology as detailed in this report, will more than meet the energy targets for this development.

Methodology

All new residential buildings are required to meet certain standards in terms of energy efficiency and carbon emissions in order to meet Part L of the Building Regulations. This is demonstrated through a SAP calculation. The proposed dwelling for this site has been feasibility modelled using Elmhurst Design SAP 2012 v4.14 software and initial design stage, SAP calculations have been produced.

These calculations allow for the following approach to be taken in this study:

- Calculation of the energy efficiency rating: Calculate predicted energy efficiency rating from initial SAP calculations;

- Energy efficient measures: After discussion with the design team additional energy efficiency improvements may be considered;

- Decentralised energy: Determine if the site is near an existing or proposed district heat network. Consider the feasibility of CHP systems and future connections to district heating;

- Low and zero carbon technologies feasibility study: Assess technical feasibility of renewable energy technologies suitable for the site. For the feasible technologies, estimate suitable system sizes giving energy produced and CO_2 offset through their application;

- Calculate DER: Calculate the Dwelling Emission Rate to determine if the minimum requirements are met once all factors proposed are included into the scheme;

- Meeting planning requirements: Determine the best combinations of technologies to achieve the sustainable energy requirements for the site.

Fabric and Services Design Proposal – Be Lean

The client recognises the need to improve overall efficiency of the building fabric and supplied services as the first steps in achieving a sustainable energy solution for the proposed dwelling. Modelling has therefore been undertaken with the specification outlined in Table 2, below, which is a significant uplift over Part L1A minimum requirements.

Element	Specification (& U-value)	Minimum Part L1A Compliance
External walls	0.22 W/m²K for cavity all based on 125mm Knauf DriTherm 32 insulation in cavity and medium dense block inner skin. Garage walls to achieve a U-value of 0.24 W/m²K	0.30 W/m²K
Ground floor	0.12 W/m²K (beam and block floor with 150mm Celotex insulation and 50mm screed)	0.25 W/m²K
Garage roof	0.16 W/m²K (construction build up to be confirmed)	0.20 W/m²K
Flat roofs	0.11 W/m²K (400mm Rockwool or similar insulation)	0.20 W/m²K
Windows & glazed doors	1.4 & 1.50 W/m²K respectively double glazed units (g-value of 0.72)	2.00 W/m²K
Rooflights if used	1.30 W/m²K	2.00 W/m²K
Solid doors	1.20 W/m²K	2.00 W/m²K
Air Pressure test	4.50m³/h.m² @50Pa	10.00m³/h.m²@50Pa
Thermal mass	Medium	n/a
Thermal bridging	Accredited Construction Details (ACDs) and hi-therm lintels	n/a
Lights	Low energy throughout	75% to be low energy
Ventilation	Intermittent fans in all kitchens/wet rooms	n/a
Heating	Based on a Vaillant ecoFIT sustain 630 mains gas boiler *	Minimum efficiencies apply
Distribution	GF: underfloor wet system. FF: radiators	n/a
Controls	Time and temperature zone controls with compensation unit*	Requirements dependent on floor area
Cooling	None	n/a
Secondary heating	None	Minimum efficiencies apply
Hot water	From main heating with 180 litre capacity, 80mm factory lagged hot water storage tank	Minimum efficiencies apply
Showers	Non-electric	n/a

* Note: We are not heating engineers, boiler and controls are purely indicative for calculation purposes at this stage

Table 2: Modelled Part L specification and minimum Part L requirements

The proposed approach is already good practice, in that it complies with Part L1A minimum standard requirements and as the scheme is further developed, additional options for improved energy efficiency will be explored. This approach on its own, however, is short of the 40% uplift targeted so a further enhancement will be required for the dwelling through connection to a local heat network or the adoption of on-site LZC energy technologies.

District Heat Networks, Communal Heating & CHP - Be Clean

District heat networks

There are no local sources of supply that could be connected to the proposed development.

Communal heating and CHP

Communal energy systems are generally attractive where economies of scale can be exploited. Block scale CHP units could be considered on small schemes, but unless they can utilise the technology cost-effectively this is unlikely to offer significant efficiency gains over individual high efficiency gas boilers or ASHP technology.

Measures to reduce the space heating demand through improved building envelope will impact on the viability of a CHP system providing heat and power to the development since the heat density decreases and this will be the situation for this development.

Although advances in CHP technology are allowing smaller developments to benefit from the efficiencies of CHP, these small-scale CHP technologies are less efficient than their large-scale counterparts and would incur proportionally higher operation and maintenance costs for every Kg/CO2 saved.

Future proofing

As the dwelling will have a wet based heating system, the site is future proofed for a district heat network connection, should one become available in the coming years.

Emission Rate

The emissions rate for the development has not changed at this stage as no measures have been recommended.

Therefore, in order to meet the requirements for the new build element of the scheme, carbon emissions will need to be reduced through the adoption of on-site LZC energy technologies.

Low & Zero Carbon Technology Options

As already identified, the proposed development is seeking to reduce carbon emissions by over 40% against a base case Part L assessed dwelling, so to meet this, the installation of LZC technology will be required.

Feasibility Assessment

A review of the standard technologies on the market has been undertaken and their relevance to this proposed scheme has been assessed. This has been summarised in the table below.

Technology	Feasible	Reason
Wind turbines	✕	Insufficient wind speeds for installation of a wind turbine to be effective.
Solar photovoltaics (PV)	✓	Southerly facing roof space is available at a reasonable elevation and would be an easy install.
Solar thermal	✓	As above, however, the technology would make very limited impact on meeting a 40% offset.
Wood-fuel heating (Biomass)	✕	Biomass heating is feasible, however, when compared to other heating options this would be expensive to install and operate. Space for a large plant room and fuel store would need to be considered and supplied.
Ground source heat pump heating (GSHP)	✕	GSHP technology may be feasible, however, it would be expensive to install and ground tests would be required. They require oversized radiators or underfloor heating as a result of low flow temperatures.
Air source heat pump heating (ASHP)	✓	ASHP technology is feasible and works well with oversized radiators or underfloor heating as a result of low flow temperatures.

Table 3: Technical feasibility of technologies

As a result of this assessment ASHP technology has both been selected as it offers a strong offset and low carbon option for the space and water heating in this dwelling. It should be an easy install option and will work well with PV technology, which will be further considered as an additional option once/if planning permission is granted.

ASHP at the Panshill Holdings site

The use of an ASHP system at the Panshill Holdings site is considered a technically viable option as it can easily be designed and installed to feed a suitable heat distribution system such as under-floor heating on the ground floor and radiators on the first floor, or underfloor heating on all floors.

The SAP calculations for the proposed dwellings have been modelled using a Mitsubishi Ecodan 11.2kW PUZ-WM112VAA unit for the proposed house, to underfloor heating on the ground floor and radiators on the 1/F, with a time and temperature zone control system.

Along with the energy efficiency proposals, this sees the proposed dwelling exceed minimum Part L carbon emissions by 47.80%.

This particular ASHP product has been modelled as it is a potentially suitable option for houses of this size, but actual sizing is a job for an installer/heating engineer and other products are available on the market which will also deliver an uplift of similar levels in this situation.

The external unit can be installed almost anywhere around the perimeter of the house, to suit the client. An image of an Ecodan external unit is shown below.

Image of Ecodan 11.2kW PUZ-WM112VAA external unit

7.3 Post Occupancy Evaluation

As part of post construction testing and monitoring, smart meters will be installed to measure all electricity use.

In addition, heating and ventilation systems will all be designed, tested and commissioned to current approved standards.

A handover file with detailed instructions of how to operate and maintain each of the systems to their designed performance levels will be provided for the home occupiers.

Results & Conclusions

The proposed approach to energy reduction for this development is already good practice, in that it complies with Part L1A minimum requirements and as the scheme is further developed, additional options for improved energy efficiency will be explored.

There is no local supply of district heat or Combined Heat & Power scheme to connect to and none mooted as part of this development, so the remaining carbon offset will be met through LZC technologies. Wind technology is not considered viable and cost and design implications rule out biomass and GSHP technologies. Solar thermal technology, whilst viable, cannot come close to the offset figure required and whilst Solar Photovoltaic (PV) technology would work well on this building, it may be added into the specification once overall build costs are confirmed. Therefore, Air Source Heat Pump (ASHP) technology is proposed to deliver the carbon offset and energy generation requirements for the dwelling at this site and the installation of this technology is considered to be straight forward and issue free.

This will see the offset of carbon emissions associated with energy use improve for the proposed dwelling by 47.80% per annum against Part L1A compliant base cases. This is shown below in Table 4:

Compliant annual Carbon emissions for base case ($kgCO_2/m^2/yr$)	Annual Carbon emissions with energy efficiency, PV & ASHP ($kgCO_2/m^2/yr$)	Improvement over base case (%)
27.18	14.19	47.80

Table 4: Base line and LZC technologies added annual CO_2 emission figures

Therefore, the energy efficiency/reduction proposals outlined, along with the inclusion of the ASHP technology as detailed in this report, would more than comply with current guidelines and the various sustainability and energy conservation policies being adopted by other planning authorities for a development of this type.

Finally, it is recommended that specialist suppliers for LZC technology are contacted at an early stage in a project to confirm feasibility and price. In all cases it is recommended that suppliers accredited under the Renewable Energy Assurance scheme are used. Details can be found at http://www.realassurance.org.uk/.