HARLEY
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Tybalds Estate, Camden - Underbuilds

Energy Strategy
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1.0 Introduction

1.1 General

Harley Haddow have been appointed to undertake a pre-implementation design-stage review and to work with the project team to deliver the energy strategy for the underbuilds at Tybalds Estate, Camden. This report has been compiled in line with the TGA Energy and Sustainability Statement revision four, dated January 2022. The proposed development comprises of 3 new residential blocks of flats, 2 blocks of mews houses and underbuild flats beneath 3 existing residential blocks.

Harley Haddow have prepared this report for the 10 underbuild dwellings, created by change of use, proposed within the Tybalds Estate. These conversion plots are to be created within the under-builds of three buildings which currently comprise a mixture of unheated storage, temporary office spaces and communal areas. The additional dwellings have been proposed across the three buildings as follows:

- Richbell – 2 additional under-build dwellings
- Falcon – 3 additional under-build dwellings
- Blemundsbury – 5 additional under-build dwellings

Figure 1. Site Plan of Development

This report summarises the carbon and energy performance of the underbuild development.

This is a live document based on current information, as of November 2022. It can be updated when further elements of the consented scheme come forward, to address the performance associated with their delivery.

1.2 Compliance Targets

In England, new build dwellings are currently required to meet the following if the planning application has been submitted before the 15th of June when changes to the building regulations are due to take effect:

- 2016 Building Regulations (Domestic), Part L1A requires the Dwelling Emission Rate (DER) to meet or better the Target Emission Rate (TER).

- 2016 Building Regulations (Domestic), Part L1A requires the Dwelling Fabric Energy Efficiency (DFEE) to meet or better the Target Fabric Energy Efficiency (TFEE).

As the proposed dwellings are to be created by change of use within an existing building, compliance with the above is not a requirement. However, the U-values in Table 1.1 below should be met where economically, technically, and functionally feasible.

Element	**Building Regulations - Part L1 (2016) – Existing Domestic**	
	Threshold U-value (W/m²K)	**Improved U-value (W/m²K)**
Wall – cavity insulation	0.70	0.55
Wall – internal or external insulation	0.70	0.30
Floor	0.70	0.25
Window	3.3	1.6
Door	3.3	1.8

Table 1. Part L1B (2018) and Part L2B (2016) U-values for retained thermal elements

The key energy targets for the whole development are set out in the TGA Energy and Sustainability Statement are:

- Achieve a 35% reduction in carbon over Part L Building Regulations (2013)
- Provide energy for the development from low carbon sources

The underbuilds will form part of the overall energy and sustainability strategy and will minimise energy use.

The Clean Growth Strategy (2018) sets out the target for all fuel poor homes, and as many privately rented homes as possible, to be upgraded to an Energy Performance Rating (EPC) rating of C by 2030.

1.3 The Energy Strategy Approach

Harley Haddow have followed the TGA strategy to address the energy and renewable technologies used on the scheme and how they will be adopted on the proposed development.

The energy strategy will incorporate the following energy hierarchy:

- **"Lean"** Measures through Energy Efficiency & Passive measures including building fabric performance improvements.
- **"Clean"** Measures through energy efficiency plant, low energy lighting and heat recovery systems. Viability of CHP and connection to district heating.
- **"Green"** Measures including the inclusion of renewable technology.

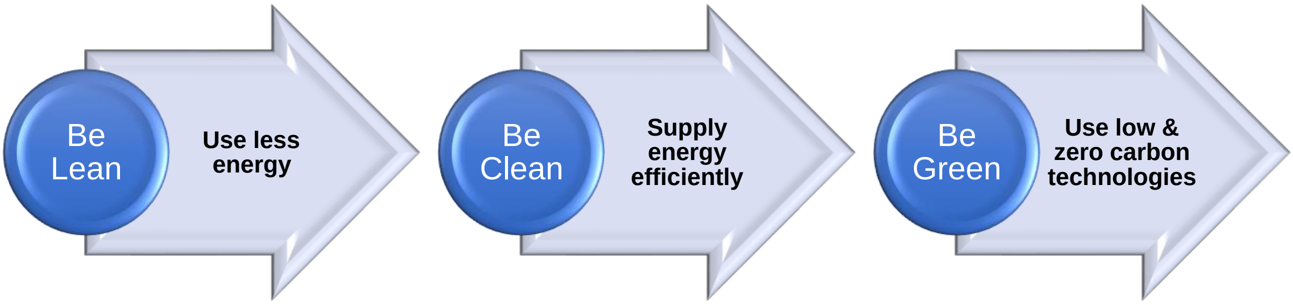

Figure 1. Energy Strategy Compliance Methodology

1.4 Underbuilds Assessment

The Standard Assessment Procedure (SAP) is the approved methodology for assessing and comparing the energy and environmental performance of dwellings. Its purpose is to provide accurate and reliable assessments of dwelling energy performances that are needed to underpin energy and environmental policy initiatives.

SAP works by assessing how much energy a dwelling will consume and how much carbon dioxide (CO_2) will be emitted in delivering a defined level of comfort and service provision, based on standardised occupancy conditions. This enables a like for like comparison of dwelling performance.

SAP quantifies a dwelling's performance in terms of:

- Energy use per unit floor area.
- A fuel-cost based energy efficiency rating (the SAP rating).
- Emissions of CO_2.

These indicators of performance are based on estimates of annual energy consumption for the provision of space heating, domestic hot water, lighting, and ventilation. SAP 2012 software has been used as required under the Part L Building Regulations.

1.5 Design Development

This report is a live document based on current information, as of November 2022 and will be updated as any design development occurs.

2.0 “Be Lean” Energy Efficiency Measures

The ‘Be Lean’ measures proposed will reduce the energy consumption and CO_2 emissions for the proposed development so that a substantial reduction beyond Part L2 can be achieved without the reliance on ‘Be Green’ measures. The proposed development shall focus on ‘lean’ design measures first maximising the opportunities available in energy efficient design.

The ‘Be Lean’ measures shall include:

- Improved levels of fabric insulation with U-values to meet Part L1B (2018) Existing Domestic regulations.

2.1 U-Values

The below table has been included for the dwellings as part of the route to compliance with Part L1B.

Building Fabric Element	Minimum Part L1B U-Value (W/m²K)	Proposed Target U-Value (W/m²K)
External Wall	0.55	0.30
Floor	0.25	0.25
Glazing	1.6	1.4
Doors	1.8	1.4

Table 2. Proposed U-Value Levels

3.0 “Be Clean” Energy Efficiency Measures

Be “Clean” measures shall be incorporated in order to reduce the building energy consumption and the associated carbon emissions, these will include but are not limited to the following:

- Utilisation of high efficiency heating plant
- The use of low energy variable speed drives and motors.
- The installation of automated controls to limit plant and lighting operation where practical.
- Installation of low energy lighting schemes throughout.

3.1 Ventilation

Natural ventilation will be provided through openable windows with local extract fans present in kitchens and toilets.

3.2 Cooling

No cooling will be provided.

3.3 Lighting

It is recommended that all light fittings are specified as dedicated energy efficient lights only (LED- 100% of fittings).

3.4 Heating Generation and Distribution

It is currently proposed that the space heating and hot water requirements of the building are met via an existing CHP District Heating System with a heating efficiency of 64%. Heat interface units installed in each dwelling serving radiators and DHW will be connected to this existing network.

The existing system has a Building Management System (BMS) installed and this monitors the buildings heating plant use continually.

3.5 Energy Efficient Building Services

The building will be designed to maximise energy efficiency through the appropriate design of high efficiency systems. The following measures will be employed to reduce the overall energy consumption:

- Energy Efficient Light Fittings
- Local Heating Controls
- Energy Efficient White Goods
- Energy Metering with smart meters installed

4.0 "Be Green" Energy Efficiency Measures

4.1 General

A range of technologies have been appraised in order to generate renewable energy in relation to the development. These include:

- Site mounted wind turbines
- Roof mounted wind turbines
- Solar Photovoltaics (PV)
- Solar Hot Water
- Ground Source Heat Pumps
- Biomass
- Biomass CHP
- Air Source Heat Pumps
- Fuel cells

A renewable energy options assessment has been undertaken to evaluate which of these technologies would be feasible.

4.2 Unfeasible Renewable Technologies

A desktop study has discounted the following technologies for this project:

4.2.1 Biomass

Biomass systems differ from other renewable sources because they emit carbon dioxide when they burn fuel. However, the amount is equal to the carbon absorbed when the biomass material was growing. For large scale projects there are three types of wood fuel that are generally used: logs, pellets, and woodchip.

A biomass boiler is not considered appropriate for this scheme for the following reasons:

- High cost of heat generation and distribution system.
- Air quality / pollution issues.
- Fuel delivery and storage issues.
- Maintenance heavy

4.2.2 Fuel Cells

Fuel cells could potentially have a massive impact on the future UK energy market. Current research indicates that although the technology is developing commercially, viable equipment and reliable sources of non-fossil fuel hydrogen are not yet available, on a commercial scale.

4.2.3 Site mounted large wind turbines

Due to the scheme's location and poor associated wind speeds in urban environments, the technology is deemed unsuitable in this instance.

The associated noise with large scale wind turbines could have a potential impact with adjacent residential developments.

A 300 kW turbine could potentially reach a sound level of 100 dB at 8 m/s wind speed.

4.2.4 Roof mounted wind turbines

The feasibility of roof mounted wind turbines has been studied in terms of:

- Size and visual impact on the building
- Power output
- Noise generation

Wind turbines extract energy from the wind using a rotor which usually comprises of two or three blades similar in profile to the wing of an aeroplane. Most small wind turbines generate direct current (DC) electricity. Systems that are not connected to the national grid require battery storage and an inverter to convert DC electricity to AC.

Wind systems can also be connected to the national grid. A special inverter and controller convert DC electricity to AC at a quality and standard acceptable to the grid, hence no expensive battery storage is required. Any unused or excess electricity may be able to be exported to the grid and sold to the local electricity supply company.

The average on site wind speed is 3.4 m/s at 10m. For a turbine to be feasible a wind speed of at least 6m/s is required to produce a satisfactory energy output.

Due to low wind speeds, aesthetic impact and potential detrimental impact on wildlife, roof mounted wind turbines are not considered suitable for this application.

4.2.5 Solar Hot Water

Solar hot water uses a heat collector, usually as panels on the roof, in which liquid is heated by the sun.

In a typical system, a heat transfer medium (generally a water/antifreeze mixture) travels through a series of heat conducting tubes known as a heat collector. During its circulation through the tubes, the fluid picks up heat from the sun which is then transferred to the domestic hot water supply as it passes through a coil in an appropriate storage cylinder.

These systems do not generally provide space heating and are often described as ‘solar thermal’ systems. They are among the most cost-effective renewable energy systems that can be installed to developments in urban environments.

A basic solar thermal collector comprises of a translucent cover, an absorption plate, and the heat transfer system. In the UK, there are two main types of collectors, known as evacuated tube and flat plate.

Consideration must be given to the final plant solution for the development for example if PV is deemed an appropriate solution, the carbon benefit from PV may be more beneficial to the development compared to solar hot water.

4.2.6 Ground Source Heat Pumps (GSHPs)

GSHP's provide extracted heat from the ground or water during the winter months and via a heat pump and circulates hot water into a building to provide space-heating and pre-heated domestic hot water.

In the summer months the process can be reversed to provide cooling.

GSHPs can potentially be reviewed at the more detailed design stages of the project, however they are likely to be unfeasible for the site due to the following factor:

- A substantial amount of land, either via slinky or bore holes would be required to offset the required CO_2 reduction, which results in the technology becoming cost prohibited.

4.3 Feasible Renewable Technology

An initial desktop study has appraised and has considered the following technologies as potentially suitable technologies:

4.3.1 Solar Photovoltaics

The incorporation of Solar Photovoltaic (PV) panels has been assessed as a viable renewable technology to reduce the carbon emissions for the proposed development.

PV uses energy from light to create electricity for the running of appliances and lighting. The PV cell consists of one of the two layers of a semi conducting material, usually silicon (normally Monocrystalline, Polycrystalline and Amorphous silicon).

When light shines on the cell it creates an electric field across the layers causing electricity to flow. The greater the light intensity, the greater the flow of electricity.

Individually PV cells only provide a small amount of electricity, and they are generally grouped together into a module for convenience and higher output.

PV is most suitable where electricity is generated at the point of use and the energy loss and costs with transmission and distribution are avoided.

A key advantage of PV in the urban environment is their potential to be integrated into the fabric of the building.

No extra land space is required, and the visible aesthetics of a building can be altered – either to be unobtrusive, or to give a clear indication of 'green' credentials.

A $105m^2$ array of monocrystalline photovoltaic panels has been proposed to be located on the roofs of the above blocks of flats to generate electricity for the underbuilds. The PV will be monitored via a separate metering system to monitor the energy produced and carbon emissions saved by the installation.

4.3.2 Air Source Heat Pumps

An Air Source Heat Pump (ASHP) could be installed to meet the building's space heating demands. The technology works by extracting available heat from the air and boosting this to a higher temperature which can be used in the building for heating using compressor technology. ASHPs are more cost effective to install than ground source systems as they do not involve expensive ground works. An example ASHP is shown in Figure 3.

Figure 2. Example ASHP System

ASHPs require evaporator units to be exposed to ambient air. This is most effectively achieved by mounting the units external to the building. Any planning implications would have to be assessed prior to installing external units. The ASHP Coefficient of Performance (CoP) is 3 therefore assuming that each 1 kW of electricity used to drive the ASHP, generates 3 kW of heat energy from the outside air to heat the building.

An ASHP installation would be appropriately sized and designed to meet the heating requirements of the building. The domestic hot water load of the buildings may also be met by the ASHP, but the CoP of the system may reduce due to the higher temperatures required for DHW. However, newer technologies with high temperature heat pumps can help to reduce the impact on performance with seasonal efficiencies between 3 and 4 now possible.

Colder climates will result in a reduction in efficiency and the achievable seasonal coefficient of performance (SCoP) of Air Source Heat Pump technology. However, ASHP technology has advanced in recent years and through consideration of the specification of a system with key design features so that the negative impact on their performance when the outside air is cold can be reduced.

The seasonal efficiency of the heat pump is greatly affected by the building/heating system it serves, thus efficient levels of fabric insulation and the specification of a heating system which can operate effectively at lower temperatures will improve the performance of the unit throughout the year. Good quality heat pumps can provide hot water above 52°C when the outside air is as cold as -16°C.

A key consideration for an ASHP system is the acoustic performance of the external unit. The typical noise rating of a small external unit is up to 60dBA at 1m which equates to a similar noise level of a conversation or background music. Depending on the location of the heat pump, acoustic measures such as an acoustic enclosure will be required to minimise noise pollution to nearby occupied spaces or dwellings.

4.3.3 Combined Heat and Power (CHP)

Although CHP is not strictly a renewable source of energy, it produces both heat and electricity from a single heat source using a highly efficient process. CHP generates electricity and captures heat that is produced in this process. The captured heat can be used to pre-heat Domestic Hot Water used for a centralised heating network.

This system can be used in a centralised plant network serving multi-residential units. However, it is not considered feasible due to the single building application on this project which would have an insufficient base load to allow efficient operation, fuel delivery, storage issues and air quality issues.

The existing scheme has a communal district heating system. This district heating network will be utilised to provide heating and hot water to the proposed underbuilds. Within each underbuild flat, a heat interface unit (HIU) will connect to the existing district network. The underbuild flats will be designed to utilise low grade heat which will enable a future connection to the London Low Carbon Heat Network district network at the boundary of the site.

5.0 Results Summary

5.1 Proposed parameters

Following a review of all feasible options and the proposed strategy for the proposed development, the following performance parameters have been included within the SAP calculations and demonstrate how the development can meet the compliance requirements.

System	Performance Parameters
Glazing	Glazing: U-Value 1.4 W/m^2K Transmittance Factor “g”: 0.7 Frame Factor: 0.7
Fabric	External Wall: U-Value 0.30 W/m^2K Ground/Exposed Floor: U-Value 0.25 W/m^2K Doors: U-Value 1.4 W/m^2K Party Walls: U-Value 0.0 W/m^2K Indicative thermal mass = Medium 2 sheltered sides across the development. *External walls refer to all exposed walls. This includes walls to communal unheated spaces within the apartment blocks.*
Air Permeability	Assumed to achieve 5 m^3hr/m^2 @ 50Pa, Pressure test recommended.
Accredited Construction Details	y-value of 0.15 assumed for dwellings.
Artificial Lighting	100% Dedicated Energy Efficient lighting throughout.
Ventilation	Natural ventilation provided via openable windows. Local extract ventilation within kitchens and toilets.
Heating	Radiators served by existing CHP district heating system. CHP assumed efficiencies – Heat efficiency = 64%; Electrical efficiency = 32% Flat rate charging, programmer and TRVs.
Domestic Hot Water	Hot water served by main heating system.

Table 3. Proposed Design Parameters

With the proposed parameters, detailed in Table 3, the predicted results for each dwelling can be seen in table 4. All dwellings are shown to comply with Part L1A building regulations Emission Rate with an average pass margin of approximately **12.2%**

However, none of the dwellings comply with the Fabric Energy Efficiency requirements of Part L1A. This is likely down to the air tightness that has been assumed for the SAP calculations. It is suggested that pressure testing be carried out, as well as a detailed calculation of thermal bridging and improving u-values as much as possible where possible.

An EPC rating of '**C**' has been predicted for all of the proposed dwellings.

Building	Apartment	Dwelling Emission Rate (DER) ($kgCO_2/m^2$)	Target Emission Rate (TER) ($kgCO_2/m^2$)	% Reduction	DFEE	TFEE	% Reduction
Richbell Underbuild	01	11.96	16.79	9.1	63.6	48.5	-89.3
	02	11.89	16.65	8.9	63.5	48.4	-88.8
Falcon Underbuild	01	12.96	18.66	11.9	64.7	47.9	-96.9
	02	12.8	18.49	12.3	63.4	47	-96.8
	03	10.68	14.92	8.5	61.1	47.7	-82.4
Blemundsbury Underbuild	01	12.25	17.91	13.8	63.8	49.1	-87.2
	02	11.54	17.24	16.2	58.4	46.1	-82.4
	03	11.57	17.07	14.7	57.6	44.4	-89.6
	04	11.57	17.07	14.7	57.6	44.4	-89.6
	05	13.24	19.01	11.9	68.8	51.6	-91.3

Table 4. Dwelling results

Apartment	EPC rating
Richbell Underbuild 01	C – 78
Richbell Underbuild 02	C – 78
Falcon Underbuild 01	C – 78
Falcon Underbuild 02	C – 78
Falcon Underbuild 03	C – 80
Blemundsbury Underbuild 01	C – 79
Blemundsbury Underbuild 02	C – 80
Blemundsbury Underbuild 03	C – 80
Blemundsbury Underbuild 04	C – 80
Blemundsbury Underbuild 05	C – 78

Table 5. Dwelling EPC ratings

With the includsion of a portion of the total site PV availability, the EPC ratings of the underbuilds can be improved as shown in table 6 below. It has been assumed that 21m^2 of PV panels is used for the block of underbuilds. Each underbuild has been assigned 0.735 kWp of PV, which is approximately 2 panels.

Apartment	EPC rating
Richbell Underbuild 01	B – 86
Richbell Underbuild 02	B – 86
Falcon Underbuild 01	B – 86
Falcon Underbuild 02	B – 86
Falcon Underbuild 03	B – 86
Blemundsbury Underbuild 01	B – 86
Blemundsbury Underbuild 02	B – 87
Blemundsbury Underbuild 03	B – 87
Blemundsbury Underbuild 04	B – 87
Blemundsbury Underbuild 05	B – 86

With the added PV, the EPC ratings become a ‘**B**’ rating for all underbuild flats.

6.0 Conclusions

The table below highlights the recommended strategy associated with the proposed Underbuild dwellings on The Tybalds Estate.

This preferred strategy utilises each of the energy hierarchy stages measures to demonstrate compliance with most of the required sustainability standards.

Energy Hierarchy Stage	Proposed Measures
“Be Lean” – Use Less Energy	Improved Building Fabric Performance – as below External Wall: U-Value 0.30 W/m^2K Floor: U-Value 0.25 W/m^2K Doors: U-Value 1.4 W/m^2K Glazing: U-Value 1.4 W/m^2K
‘**Be Clean’ – Supply Energy Efficiently**	▪ CHP district heating system ▪ 100% Dedicated Energy Efficient lighting throughout Resulting in a 38% saving using SAP 10 factors
‘Be Green’ – Low or Zero Carbon Generating Technology	▪ 21m^2 of PV Resulting in a 52% reduction using SAP 10 factors

Table 7. Final Recommended Energy Strategy

The proposed strategy approach has focused initially on the reduction of energy through passive means. This includes improvement of the building fabric levels in excess of most of the minimum requirements of the building standards for this development.

Heating via a CHP district heating system will be delivered to the dwellings, providing efficient heat.

21m^2 of Photovoltaic panels will be installed on the roofs of the apartment blocks directly above the underbuilds to provided low/zero carbon generated electricity to the dwellings.

Post construction several review measures will be undertaken once the development is built and prior the residential units occupation. These reviews will include photographs, installation information, and ensuring the as-built SAP calculations are undertaken and achieve the measures and targets within the energy efficiency and renewable energy plan for the underbuilds and will be maintainable in the development’s future management and occupation. These review measures will be undertaken by an appropriately qualified and recognised independent professional in respect of the property.

This document is a live document and will be updated and re-submitted to the Council for approval should there be any changes to the energy strategy and in advance of delivery of any further buildings on the Estate.

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