

## Energy Statement

Ref: Z68644 rev A

Proposed 1No. Dwelling

at

Fells Farm,  
Slaidburn

for

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## Executive Summary

This Energy Statement has been developed in support of the planning application for the proposed development of 1No. dwelling, located at Fells Farm in Slaidburn. This statement will evaluate the technical and economic feasibility of using both passive and low and zero carbon technologies and will assess the practical levels of CO<sub>2</sub> reduction possible for this development to comply with the following planning requirements:

- National Planning Policy Framework (2025)
- Ribble Valley Borough Council Core Strategy (2008-2028)
  - Key Statement EN3
  - Policy DMG1
  - Policy DME5

The following low and zero carbon technologies have been evaluated:

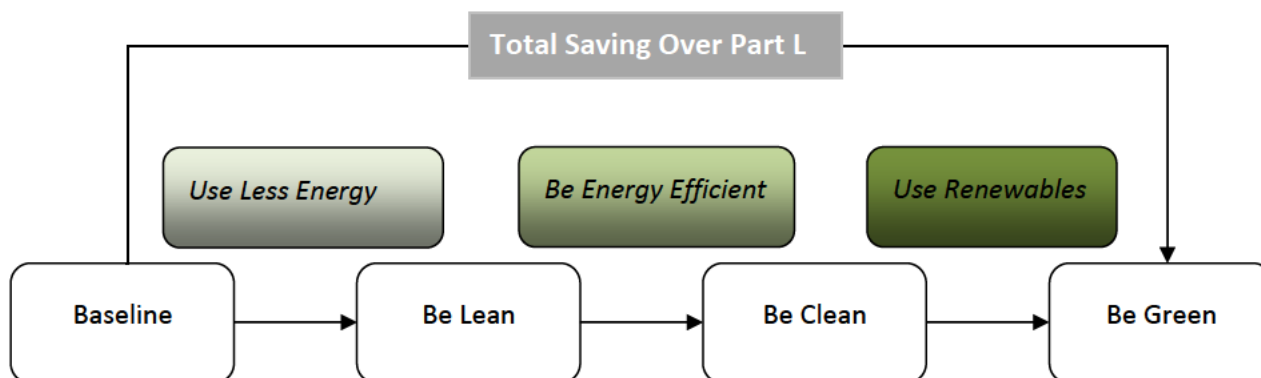
- Biomass
- Wind
- Biogas
- Air Source Heat Pumps & Exhaust Air Heat Pumps
- Geothermal
- Combined Heat & Power (CHP)
- Solar Hot Water
- Solar Photovoltaic

The approach for the residential development is to embed sustainability into the heart of the development through a range of design measures based on the 'Be Lean, Be Clean, Be Green' design hierarchy. Measures will include:

- 1) Enhanced building fabric to meet the new Building Regulation ADL1B 2021 (15/06/2021).
- 2) Enhanced air tightness.
- 3) Highly efficient decentralised mechanical extract ventilation with low specific fan powers (SFPs) to all wet rooms within the dwelling.
- 4) Heating and Hot water to be provided by highly efficient ground source heat pump.
- 5) Efficient lighting strategy primarily using LED type fittings.
- 6) Photovoltaic (PV) panel array with a battery store.

## Summary

The development has been provided with energy savings through the use of passive improvement measures such as improved energy efficiency. This passive approach to compliance will complement the integrated approach to the sustainable energy objectives of the national and local policies. The use of ground source heat pumps for heating and hot water in the dwelling along with PV and battery storage achieves the necessary levels of carbon reduction.



The principles of a Be Lean, Be Clean, Be Green philosophy have been applied, resulting in a **107.92%** carbon emissions improvement and a **97.97%** primary energy improvement over Building Regulations Part L1B 2021, as indicated in Table 1. A full design specification that confirms inputs used within the SAP calculations is provided within the appendices of this report.

Table 1 - Proposed development CO<sub>2</sub> emissions against Building Regulations Part L1B 2021

	Total CO <sub>2</sub> Emissions (kgCO <sub>2</sub> /yr)	Total Primary Energy (kWh/yr)
Target Dwelling Performance	2,345	12,381
Proposed Dwelling Performance	-186	251
<b>Total Reduction</b>	<b>2,531</b>	<b>12,130</b>
<b>Percentage Improvement (above ADL1B 2021)</b>	<b>107.92%</b>	<b>97.97%</b>

## 1. Introduction

The proposed development consists of 1No. dwelling located at Fells Farm, Slaidburn. The development is required to achieve compliance under Building Regulations Approved Document Part L1b (2021) and meet Ribble Valley Borough Council Core Strategy (2008-2028) planning policies.

Supporting information is provided within this report for the proposed energy strategy to be considered on site in accordance with the following planning policies:

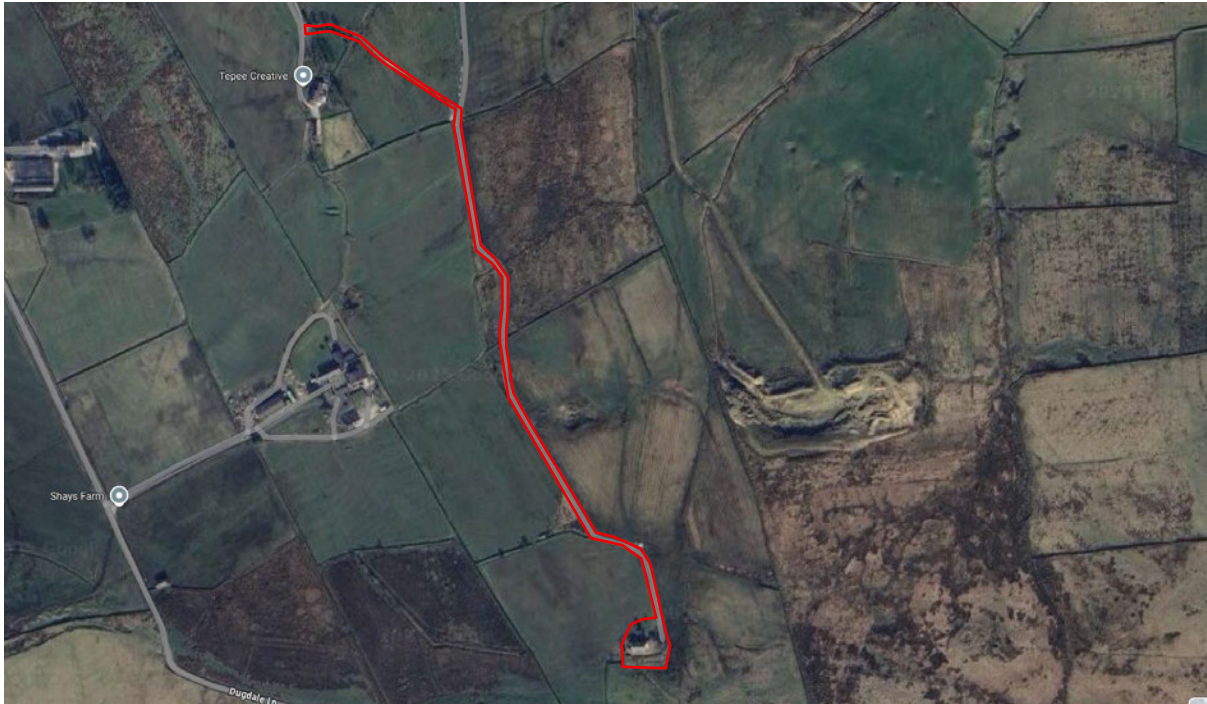
- National Planning Policy Framework (2025)
- Ribble Valley Borough Council Core Strategy (2008-2028)
  - Key Statement EN3
  - Policy DMG1
  - Policy DME5

Throughout this report, passive design techniques, energy efficient equipment and appropriate low carbon technologies will be appraised in line with the 'Be Lean, Be Clean, Be Green' philosophy of relevant planning documents and the Energy Hierarchy.

An assessment of CO<sub>2</sub> emissions will be made based on the calculation methodology dictated by the Standard Assessment Procedure (SAP 10) and in line with the requirements of Ribble Valley Borough Council Core Strategy (2008-2028).

## 1.1. Location

The proposed development at Fells Farm, Slaidburn is highlighted by the red line boundary shown in Figure 1.



**Figure 1 - Location of proposed development.**

The site will be accessed from via a private lane which adjoins the B6478 road to the north of the site.



**Figure 2 – Site plan for the proposed development.**

The proposed development consists of 1No. dwelling, as indicated in Figure 2 above. The existing site consists of a 1-bedroom, single-storey dwelling with attached 2-storey barn and detached single-storey chicken shed. The barn will be converted to a 3 bed 2 storey barn conversion dwelling.

## Floor Plans

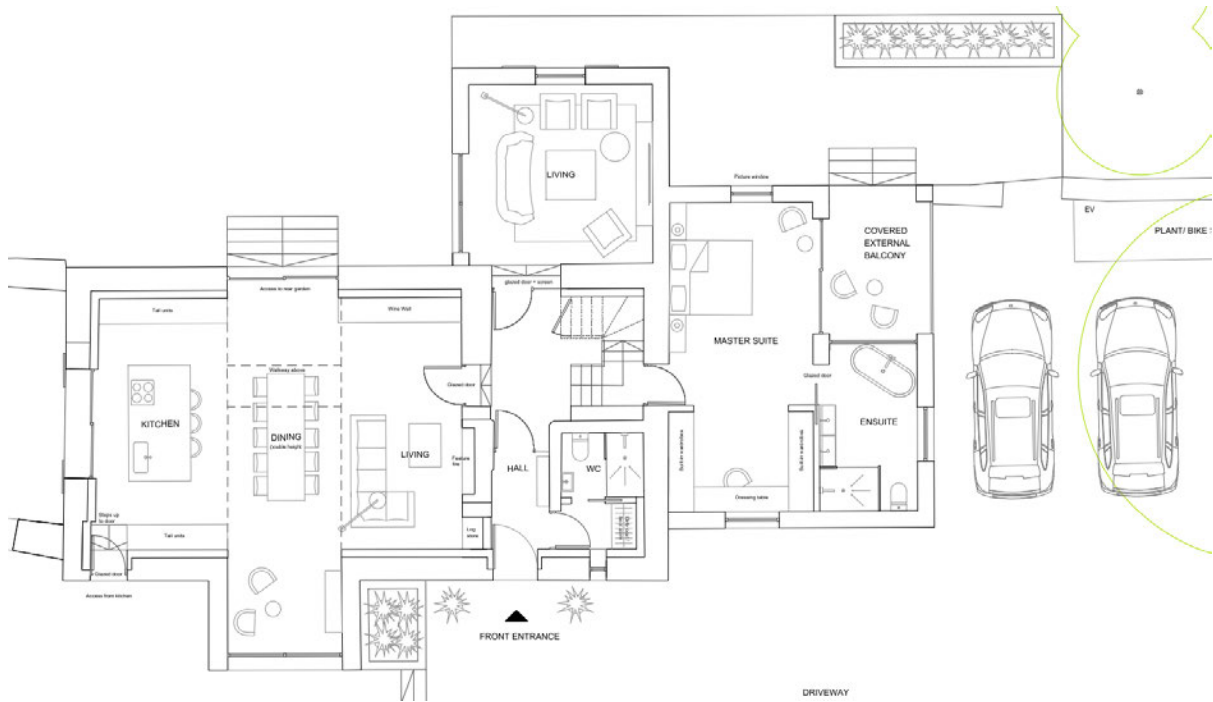


Figure 3 – Ground Floor Plan

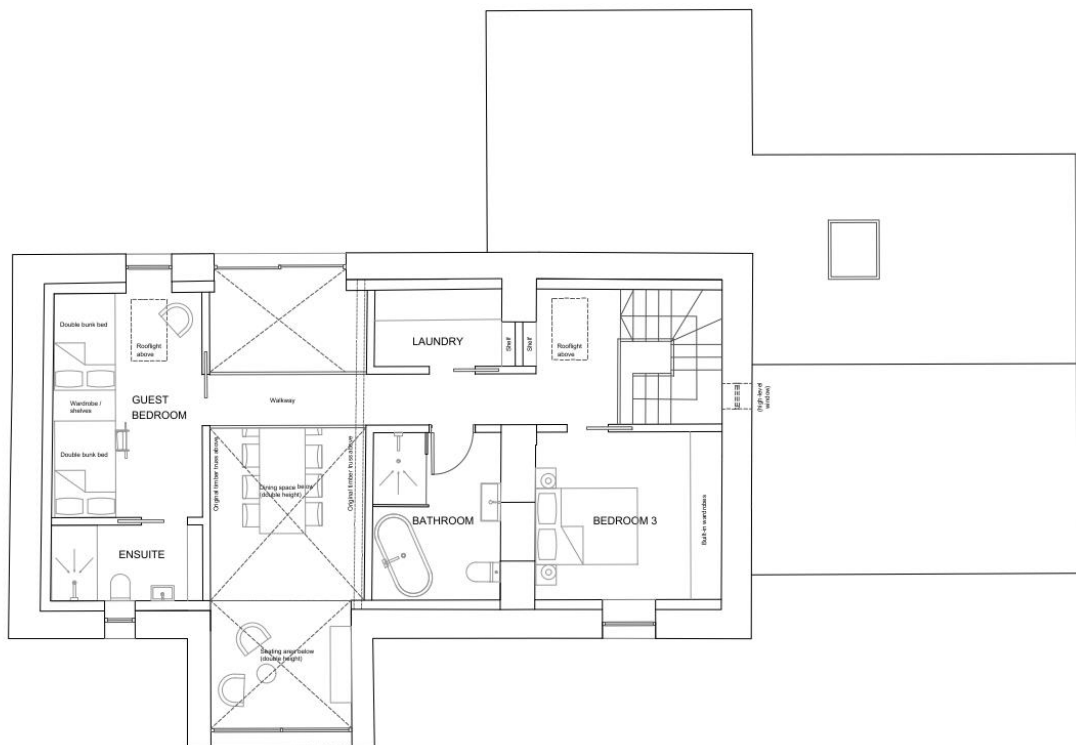


Figure 4 – First Floor Plan

## 2. Policy Drivers for Energy Efficiency and Renewable Energy

This section presents a range of planning policy that is applicable to the development, at both a national and a local level.

### 2.1. National Policy

The National Planning Policy Framework was published in July 2021 (amended in 2025) and sets out the government’s planning policies for England and they should be applied. Table 2 sets out the relevant energy standards for new developments and provides an indication of the design response to be provided.

**Table 2 – Key National Planning Policy Requirements and Design Responses**

Section	Policy Requirements	Design Response
14. Meeting the challenge of climate change, flooding and coastal change	<p>The planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change.</p> <p>It should help to:</p> <p>Shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure.</p>	<p>This development will follow the principles set out in the Ribble Valley Borough Council Core Strategy (2008-2028) using a ‘Be Lean, Be Clean, Be Green’ approach in reducing operational carbon emissions.</p> <p>An overview of current decentralised energy schemes in Slaidburn and an assessment on the potential for future schemes in relation to this development is provided in Section 6 of this report.</p> <p>This sustainability and renewable energy statement appraises site specific information to determine the most appropriate approach to minimise energy consumption.</p>

## 2.2. Local Policy

The Ribble Valley Borough Council Core Strategy (2008-2028) provides a set of guidelines for new development within Slaidburn. All relevant energy policy within these documents is provided within this section together with a design response.

Table 3 – Key Local Planning Policy Requirements and Design Responses

Ribble Valley Borough Council Core Strategy (2008-2028)		
Section	Policy Requirements	Design Response
<p><b>Key Statement</b></p> <p><b>EN3:</b></p> <p><b>SUSTAINABLE DEVELOPMENT AND CLIMATE CHANGE</b></p>	<p>The Council will seek to ensure that all development meets an appropriate recognised sustainable design and construction standard where viable to do so, in order to address both the causes and consequences of climate change. In particular, all development will be required to demonstrate how it will contribute towards reducing the Borough's carbon footprint.</p> <p>The Council will assess applications against the current Code of Sustainable Homes, Lifetime Homes and Buildings for Life and BREEAM standards, or any subsequent nationally recognised standards. Proposals for the development of new renewable energy generation facilities, including onshore wind turbine technologies, will be considered.</p> <p>This will require the consideration of many factors including the need to reduce the area's carbon footprint whilst also recognising its exceptional environmental and landscape context. In adapting to the effects of climate change it is expected that proposals for development will demonstrate how sustainable development principles and sustainable construction methods, such as the use of sustainable drainage systems, will be incorporated.</p> <p>New development in vulnerable areas should ensure that risks can be managed through suitable measures, including through the conservation of biodiversity, improvement of ecological networks and the provision of green infrastructure. All development should optimise energy efficiency by using new technologies and minimising the use of energy through appropriate design, layout, material and landscaping and address any potential issues relating to flood risk. Ribble Valley Borough Council will liaise with the County Council over</p>	<p>The proposed development will follow the principles of the Energy Hierarchy by adopting a passive fabric-first approach to design rather than adopting the use of renewable technologies.</p> <p>A full energy strategy is provided in Section 8 of this report, following an appraisal of a range of site-specific measures in line with the 'Be Lean, Be Clean, Be Green' approach.</p> <p>A fabric first approach to the development is a much-preferred method with the use of highly efficient ground source heat pumps to provide heating and hot water to the dwelling with a photovoltaic PV panels array with a battery store.</p>

	<p>development within Mineral Safeguarding Areas (MSAs) in both proposing future site allocations and in determining planning applications. This liaison will include consideration of the issue of preventing the unnecessary sterilisation of mineral resources within MSAs and, where feasible and practicable, the prior extraction of mineral resources.</p> <p>On larger schemes, planning permission will only be granted for developments on sites that deliver a proportion of renewable or low carbon energy on site based on targets elaborated within the relevant Development Management policy and also incorporate recycled or reclaimed materials or minimise the use of energy by using energy efficiency solutions and technologies. Where developments fail to achieve any of these, it must be demonstrated why this cannot be achieved.</p>	
<p><b>POLICY DMG1: GENERAL CONSIDERATIONS</b></p>	<p>10.4 IN DETERMINING PLANNING APPLICATIONS, ALL DEVELOPMENT MUST: DESIGN 1. BE OF A HIGH STANDARD OF BUILDING DESIGN WHICH CONSIDERS THE 8 BUILDING IN CONTEXT PRINCIPLES (FROM THE CABE/ENGLISH HERITAGE BUILDING ON CONTEXT TOOLKIT.</p> <p>2. BE SYMPATHETIC TO EXISTING AND PROPOSED LAND USES IN TERMS OF ITS SIZE, INTENSITY AND NATURE AS WELL AS SCALE, MASSING, STYLE, FEATURES AND BUILDING MATERIALS.</p> <p>3. CONSIDER THE DENSITY, LAYOUT AND RELATIONSHIP BETWEEN BUILDINGS, WHICH IS OF MAJOR IMPORTANCE. PARTICULAR EMPHASIS WILL BE PLACED ON VISUAL APPEARANCE AND THE RELATIONSHIP TO SURROUNDINGS, INCLUDING IMPACT ON LANDSCAPE CHARACTER, AS WELL AS THE EFFECTS OF DEVELOPMENT ON EXISTING AMENITIES.</p> <p>4. USE SUSTAINABLE CONSTRUCTION TECHNIQUES WHERE POSSIBLE AND PROVIDE EVIDENCE THAT ENERGY EFFICIENCY, AS DESCRIBED WITHIN POLICY DME5, HAS BEEN INCORPORATED INTO SCHEMES WHERE POSSIBLE.</p> <p>5. THE CODE FOR SUSTAINABLE HOMES AND LIFETIME HOMES, OR ANY SUBSEQUENT NATIONALLY RECOGNISED EQUIVALENT STANDARDS, SHOULD BE INCORPORATED INTO SCHEMES.</p>	<p>An overview of the site in relation to current decentralised networks in the region is provided in Section 6.1 along with a review of district heating opportunities and proximity of the site to the centralised network system.</p> <p>Due to the relatively small scale of the development, the creation of an energy centre would not be a feasible design solution.</p>
<p><b>POLICY DME5: RENEWABLE ENERGY</b></p>	<p>10.16 THE BOROUGH COUNCIL WILL SUPPORT THE DEVELOPMENT OF RENEWABLE ENERGY SCHEMES, PROVIDING IT CAN BE SHOWN THAT SUCH DEVELOPMENTS WOULD NOT</p>	<p>Low carbon technologies have been specified for the development, including ground</p>

	<p>CAUSE UNACCEPTABLE HARM TO THE LOCAL ENVIRONMENT OR LOCAL AMENITY. IN ASSESSING PROPOSALS, THE BOROUGH COUNCIL WILL HAVE PARTICULAR REGARD TO THE FOLLOWING ISSUES:</p> <ol style="list-style-type: none"> <li>1. THE IMMEDIATE AND WIDER IMPACT OF THE PROPOSED DEVELOPMENT ON THE LANDSCAPE, INCLUDING ITS VISUAL IMPACT AND THE CUMULATIVE IMPACTS OF DEVELOPMENT.</li> <li>2. THE MEASURES TAKEN TO MINIMISE THE IMPACT OF THE PROPOSALS ON RESIDENTIAL AMENITY</li> <li>3. THE POTENTIAL BENEFITS THE PROPOSALS MAY BRING</li> <li>4. THE VISUAL IMPACT OF THE PROPOSALS, INCLUDING DESIGN, COLOUR AND SCALE</li> <li>5. THE DEGREE TO WHICH NUISANCE CAUSED BY NOISE AND SHADOW FLICKER TO NEARBY RESIDENTIAL AMENITIES, AGRICULTURAL OPERATIONS, RECREATIONAL AREAS OR THE FUNCTION OF THE COUNTRYSIDE CAN BE MINIMISED</li> <li>6. NATIONAL OR LOCAL TARGETS FOR GENERATING ENERGY FROM RENEWABLE SOURCES AND FOR REDUCING CARBON EMISSIONS AS SPECIFIED WITHIN POLICY DMG1</li> <li>7. THE POTENTIAL IMPACT ON BIODIVERSITY.</li> </ol> <p>THE COUNCIL WILL REQUIRE DECENTRALISED AND RENEWABLE OR LOW CARBON ENERGY IN NEW DEVELOPMENTS TO MEET NATIONAL STANDARDS DEVELOPMENT PROPOSALS WITHIN OR CLOSE TO THE AONB, SITES OF SPECIAL SCIENTIFIC INTEREST, SPECIAL AREAS OF CONSERVATION AND SPECIAL PROTECTION AREAS, NOTABLE HABITATS AND SPECIES, LOCAL NATURE RESERVES, BIOLOGICAL HERITAGE SITES OR DESIGNATED HERITAGE ASSETS AND THEIR SETTING WILL NOT BE ALLOWED UNLESS:</p> <ol style="list-style-type: none"> <li>1. THE PROPOSALS CANNOT BE LOCATED OUTSIDE SUCH STATUTORY DESIGNATED AREAS</li> <li>2. IT CAN BE DEMONSTRATED THAT THE OBJECTIVES OF THE DESIGNATION OF THE AREA OR SITE WILL NOT BE COMPROMISED BY THE DEVELOPMENT</li> <li>3. ANY ADVERSE ENVIRONMENTAL IMPACTS AS FAR AS PRACTICABLE HAVE BEEN MITIGATED</li> </ol>	<p>source heat pump system to provide efficient heating and hot water with a photovoltaic PV panel array to the roof to further reduce the carbon emissions.</p>
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	<p>Outside these areas renewable energy schemes will be considered to be appropriate in principle subject to other policies in the plan.</p> <p>NOTE THAT ANY DEVELOPMENT THAT IMPACTS A SCHEDULED ANCIENT MONUMENT WILL ALSO REQUIRE SCHEDULED MONUMENT CONSENT – SEE POLICY DME 4 ABOVE. The delivery of renewable energy contributes to measures in support of climate change adaption and securing sustainable development. It is important that renewable energy is facilitated in a way that protects the quality of the local area yet recognises the need to support climate change adaption. This policy serves to identify where such schemes are likely to be considered acceptable.</p>	
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### 3. Methodology

The first step of the full energy strategy assessment has been to undertake a baseline energy assessment. The baseline energy assessment consists of calculating the total CO<sub>2</sub> emissions of the development to meet Building Regulations and then compare the proposed improvement measures against this baseline. Building Regulations Part L1B 2021 (SAP 10) applies to the dwelling and provides carbon emissions from regulated energy.

The building can then be benchmarked/ thermally modelled using the energy hierarchy:

<p><b>1. Be Lean</b></p> <p><i>A reduction in energy use as a result of passive design and energy efficiency</i></p>
<p>Thermal performance of envelope (U values) Glazing design Airtight construction Efficient mechanical ventilation Variable speed fans and pumps Efficient lighting</p>
<p><b>2. Be Clean</b></p> <p><i>A focus on supplying energy to the development through efficient means</i></p>
<p>Connect to low carbon heat networks Develop site wide heat network from single energy centre On site district heating network Provide energy efficient individual heating</p>
<p><b>3. Be Green</b></p> <p><i>The installation of renewable technologies to meet energy demand where possible</i></p>
<p>Consider the feasibility of renewable energy technologies Assess the integration of renewable technologies based on the above measures</p>

The development must be provided with energy savings through the use of thermal improvements to fabric (a 'fabric first' approach), followed by other clean energy solutions (energy efficiency improvements, district heating, etc.) and finally the use of renewable energy technologies, where practical. This hierarchy complements the integrated approach to the sustainable energy objectives of the energy hierarchy.

The planning policies require a full review of the technical and economic feasibility of the following renewable technologies:

- Biomass heating
- Biomass combined heat and power
- Solar hot water
- Solar photovoltaic
- Ground source heat pumps
- Air source heat pumps / exhaust air heat pumps
- Wind power

To achieve the targets set the development must achieve a balance between fabric, heating and control, ventilation and air leakage improvements, the amount of zero or low carbon technology installed and the capital, life cycle and running costs, maintenance, and operation, etc.

Feasible renewable energy technologies have been considered during the assessment to ensure the most suitable renewable energy is chosen for the demands of this scheme. The pros and cons of each technology with respect to this site are considered as part of this statement.

## 4. Baseline Energy Assessment

Energy Counsel have based the analysis on current Building Regulations ADL1B 2021 (SAP 10), taking into account solutions that must not only be energy efficient but also practical, reliable and user friendly. Energy Counsel have carried out preliminary SAP 10 calculations for the proposed dwelling. Under Building Regulations Part L1B 2021, dwellings must comply with all metrics set by the notional building shown below.

- Dwelling Emissions Rate (DER) must be lower than or equal to the Target Emissions Rate (TER) for the dwellings, and the Building Emissions Rate (BER) must be lower than or equal to the Target Emissions Rate (TER).
- Dwelling Primary Energy Rate (DPER) must be lower than or equal to the Target Primary Energy Rate (TPER) for the dwellings and Building Primary Energy Rate (BPER) must be lower than or equal to Target Primary Energy Rate (TPER).

SAP 10 is the Governments Standard Assessment Procedure (SAP) for calculating the energy aspects of a dwelling. SAP is a measure of fuel costs for heating, hot water and lighting for a dwelling. SAP 10 can also be used to ascertain the energy requirements of a development.

To assess the baseline carbon emissions, we must make an estimation of the energy demands through Building Regulations in order to set a target upon which the actual development can be compared.

### 4.1. Predicted Baseline Energy Requirements

The predicted baseline CO<sub>2</sub> emission and primary energy demand for the development.

Table 4 - Baseline dwelling area carbon emissions and primary energy

Our Ref	Dwelling Type	No. of Type	Floor Area m <sup>2</sup>	TER (Kg CO <sub>2</sub> /yr/m <sup>2</sup> )	TPER (kWh/yr/m <sup>2</sup> )	Total Target Carbon Emissions (Kg CO <sub>2</sub> /yr)	Total Target Primary Energy (kWh/yr)
Z68644	Proposed Dwelling	1	241.25	9.72	51.32	2,345	12,381
<b>Total</b>		<b>1</b>				<b>2,345</b>	<b>12,381</b>

The baseline carbon emissions rate for the development is 2,345 KgCO<sub>2</sub>/yr and the baseline primary energy rate is 12,381 kWh/yr.

## **5. Passive Design and Energy Efficiency**

The approach of the development is to embed sustainability into the heart of the design from the outset of the project design process. The design will be developed with sustainable solutions, taking into account the relevant policies and strategies set out in the Ribble Valley Borough Council Core Strategy (2008-2028). The development will seek to consider all aspects and principles of sustainable development, taking into account environmental, social and economic impacts.

### **5.1. Passive Design Measures**

The philosophy for the site is to achieve as much of the necessary reduction in carbon emissions through the use of passive design techniques and energy efficient measures as possible, before resorting to the use of LZCs. This ensures that the highest standards of building fabric and energy efficiency are achieved, rather than offsetting a poorer performance with LZC contributions.

This will be undertaken through a fabric first energy efficient design approach with high levels of thermal efficiency and a reduction in energy demand through efficient lighting design.

### **5.2. Energy Efficient Systems**

Options have been reviewed for improving the energy efficiency of the development by installing an efficient heating and hot water system. The dwelling will benefit from high efficiency ground source heat pump to deliver heating and hot water, metering scheme based on their electricity usage, highly efficient ventilation system, and photovoltaic array with a battery store.

## 6. District & Communal Heating Networks

This section outlines how consideration of energy supplied efficiently from a district heating network can be provided to the dwelling in line with the energy hierarchy.

### 6.1. Decentralised Heating Networks

The energy policy reaffirms the view that energy generated by centralised power stations and transmitted through the national grid is highly inefficient and wasteful.

One of priorities for reducing CO<sub>2</sub> emissions is to reduce the reliance on centralised power stations. This means increasing the use of local, low-carbon energy supplies through de-centralised energy systems.

Decentralised plant generally means any heating and hot water and/or electricity generation provided on a district wide (DHN) or site wide (CHN) basis. DHN and CHN can typically include combined heat and power equipment (CHP). CHP is an engine which, when running, generates electricity and heats water which can then be distributed around a development.

A number of heat network opportunities across the region are at various stages of development. Benefits of district heating networks can include:

- Provision of low carbon / lower cost heat to domestic and commercial customers
- Diversification of the energy mix
- Reductions in region-wide carbon emissions
- Targeting and reduction of fuel poverty
- Potential long-term revenue streams for local authorities
- Alignment with regeneration programmes
- Driving the growth of the low carbon services sector

There are currently no existing district heating networks within proximity to the site. The nearest district heating network is just over 21 miles Southwest of the site.

### 6.2. New Heating Networks – Options

Consideration has been given to adopting a centralised or decentralised energy strategy. A decentralised energy option would typically be an energy centre distributing heat, hot water and electricity to the development from a single source either as a DHN or CHN. This typically would include boilers and a CHP type unit or district heat pumps, sized to provide the whole development.

Sometimes multiple energy centres are used to split the loads, provide resilience and to serve different buildings.

The proposed heating and hot water demand from the development is not sufficient to justify a DHN or CHN. The existing site is spatially constrained, there is insufficient space to locate the equipment and associated plant, and connection to a DHN would be cost prohibitive.

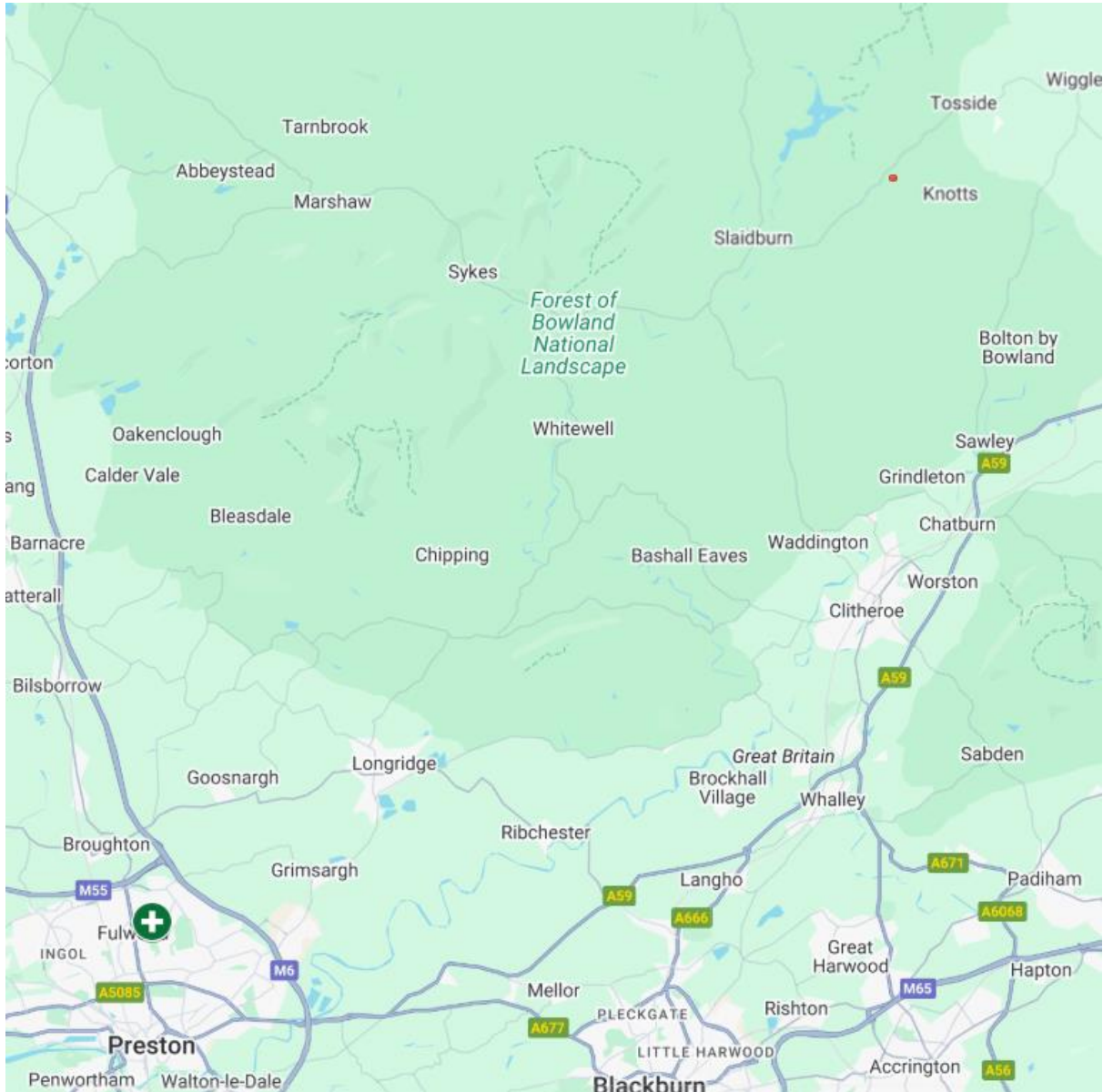


Figure 5 - District heating networks nearby site (site indicated by red dot, DHN indicated by "plus" symbol)

## 7. Renewable Energy Technologies

Energy Counsel have reviewed options for the use of on-site renewable energy/ Low or Zero Carbon Technology (LZT) in line with the Ribble Valley Borough Council Core Strategy (2008-2028).

This renewable energy statement/strategy reviews the technical and economic feasibility of the following technologies –

- Solar Photovoltaic
- Solar Hot Water
- Ground Source Heat Pumps
- Air Source Heat Pumps / Exhaust Air Heat Pumps
- Micro Wind Power
- Biomass

### 7.1. Photovoltaics (PV)

Photovoltaic panels convert sunlight into electricity to run lights and appliances. Photovoltaic panels use cells to convert light into electricity. A PV cell normally consists of 1 or 2 layers of a semi conducting material such as silicon. When light shines on a cell it generates energy causing electricity to flow, the higher the light intensity is, the more electricity flows.

The amount of energy PV cells generate is referred to as Kilowatt Peak (KWp). PV arrays now come in a variety of shapes and colours, ranging from grey 'solar tiles' that look like roof tiles to panels and transparent cells that you can use on conservatories and glass to provide shading as well as generating electricity. The roof must be strong enough to take the weight of the panels, especially if the panel is placed on top of existing tiles. For flat roofs the panels can be mounted on A-frames to give the optimum angle.

The optimum panel inclination for solar collection is 35°, oriented due south; however panels that are inclined between 35° and 45° and oriented south of west or east are generally suitable. If solar

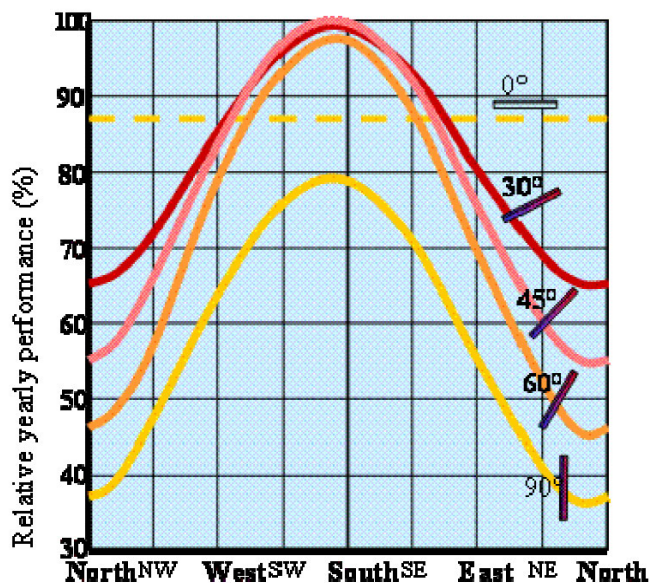


Figure 6 - Performance of photovoltaic panel orientation

collectors are oriented away from due south then a larger surface area will be required to generate a set amount of energy. The effect of non-optimal orientation is illustrated by the graph to the right:

The cost to install PV is typically £1,500 – 2,000 per kWp for ‘on-roof’ panel systems.

Photovoltaic (PV) panels will be installed on the main roof which will be fed directly into the dwelling with a battery store.



Figure 7 - Photovoltaic array on a pitched roof

## 7.2. Solar Thermal HW Panels

Solar panel heating uses the radiant energy from the sun to heat hot water, most commonly for domestic hot water needs. There are two types of collectors used for solar water heating – flat plate collectors and evacuated tubes collectors. The systems function successfully in all parts of the UK, as they can work in diffuse light conditions. The collector should be mounted on a 10-60 degrees pitch facing south, although other variations can be used, south is the most efficient.

The cost of installing the system is dependent on the distance between the solar collector and the hot water storage and therefore costs vary. The closer the collectors are to the hot water storage; the less pipe work is required. Annual maintenance checks are recommended. The solar collectors are connected to a condensing boiler via a HW cylinder with twin coil.

A typical installation in the UK has a panel size of 3-5m<sup>2</sup> which is used in conjunction with a HW storage tank of 180-300litres, of which a minimum of 90-150 litres must be dedicated to solar hot water storage.

They are a ‘simple’ and guaranteed technology which will act as a pre-heat for the Hot Water and Heating usage. Payback between capital cost and energy saving can normally be achieved within 12 – 20 years, subject to usage and dwelling type.

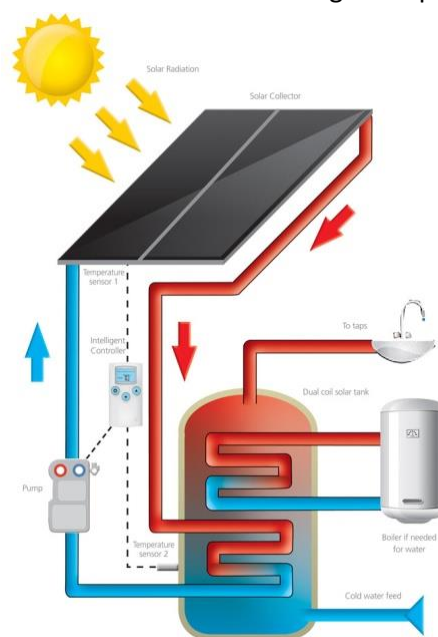


Figure 8 - The principles of a solar thermal system

The use of solar thermal panels are applied best in conjunction with individual heating systems for each dwelling. The orientation of the development is fine for the utilisation of solar water heating to provide domestic hot water however it will not achieve significant carbon savings. Carbon savings of approximately 4-5% are achievable with this technology. The dwelling is unlikely to require sufficient hot water storage to deem solar thermal a feasible technology for this site. For the reasons aforementioned, and due to the fact we are utilising as much of the roof space as possible for solar PV panels, we do not consider this a viable option for this scheme.

### 7.3. Ground Source Heat Pump (GSHP)

GSHPs have been developed specifically for the housing market and are now considered to be an established reliable technology. The GSHP would be sized to cater for the heating and domestic hot water requirements. Typically, they are more suited to apartments as a centralised system would be installed with multiple bore holes to a depth of up to 125 metres depending on the ground conditions. GSHPs use a heat exchanger to extract heat from the earth.

The efficiency of ground source heat pumps is measured by Co-efficient of Performance (CoP), this is the ratio of units of heat output for each unit of electricity used to drive the compressor and pump for the ground loop. Average CoP is around 2-4 although some systems may produce a greater rate of efficiency. This means that for every unit of electricity used to pump the heat, 2-4 units of heat are produced, making it an efficient way of heating a building.

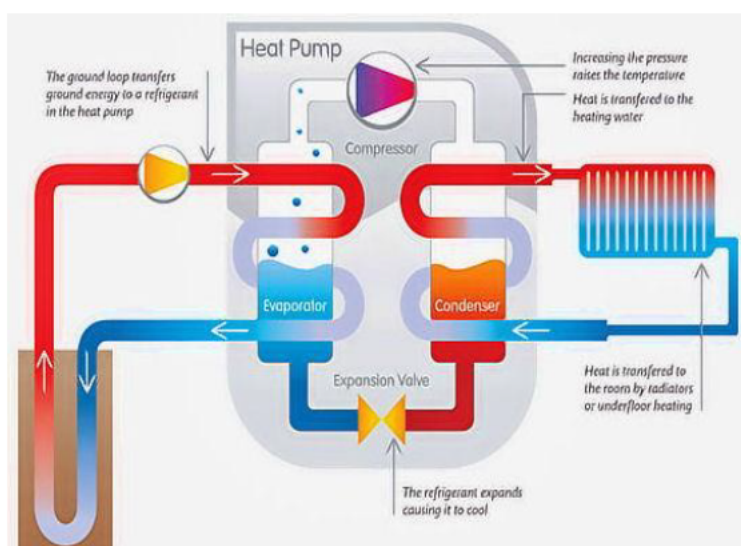


Figure 9 - Principles of a GSHP system

and pump, then there is the opportunity to consider a range of energy suppliers to benefit from the lowest running costs, for example by choosing an economy 10 or economy 7 tariff.

Given the scale of the dwelling and the extensive land available around the property, GSHPs are considered an appropriate and effective design solution. This technology has therefore been selected as the

preferred method for providing heating and hot water.

#### 7.4. Air Source Heat Pump/Exhaust Air Heat Pump/ Hot Water Heat Pumps

Air source heat pumps (ASHP), exhaust air heat pumps (EAHP) and Hot Water Heat Pumps (HWHP) work in a similar way to GSHP. Air source heat pumps can be fitted on the external façade or in the roof space. An air source heat pump uses small amounts of electricity to take in large quantities of air and extract heat. The efficiency of ASHP is measured by Coefficient of Performance (CoP); this is the ratio of units of heat output for each unit of electricity used to drive the system. Average CoP is around 2-4 although some systems may produce a greater rate of efficiency.

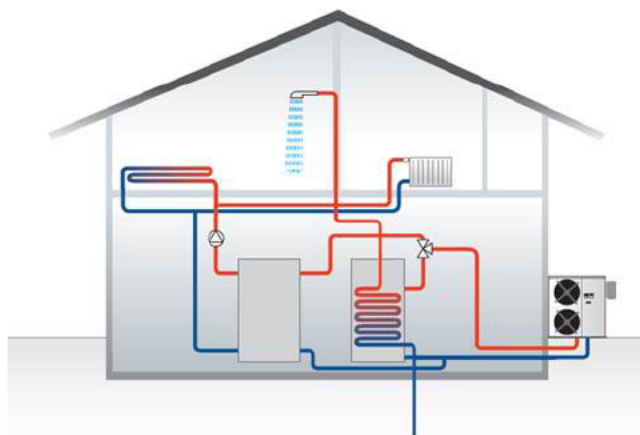


Figure 10 - Principles of an ASHP system

Exhaust air heat pumps (EAHP) such as the NIBE F370 work in a similar manner to ASHP units but have only indoor units (no outdoor compressors) and in addition they also recover heat from their integral exhaust air ventilation system. These units work well on apartment blocks and dwelling where mains gas is unavailable or unsuitable for a development. They are expensive in terms of capital cost of the equipment, installation and the enhanced structural requirements.

Air Source Heat Pumps (ASHP) are considered an appropriate technology for this scheme and could provide efficient heating and hot water throughout the dwelling. However, Ground Source Heat Pumps (GSHP) have been selected as they deliver greater carbon emissions reductions, ensuring compliance with the sustainability objectives set out in the Ribble Valley Borough Council Core Strategy (2008–2028)

#### 7.5. Micro Wind Power

Wind power is one of the cleanest and safest methods of generating electricity. However, wind power is unfeasible due to the fact the development is in an urban area and local wind conditions would not be sufficient to provide enough power. 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 into Alternating Current (AC) which is mains electricity.

There are two types of wind turbine available:

- Roof mounted – These are mounted on the roof of dwelling

- Mast mounted – Which are free standing

Important issues to consider when using wind turbines are:

- Wind speed increases with height so it's best to have the turbine high on a mast or tower.
- The ideal site is a smooth top hill with a flat, clear exposure, free from excessive turbulence and obstructions such as large trees, dwellings or other buildings.
- Small scale wind power is particularly suitable for remote off grid locations where conventional methods of supply are expensive or impractical.
- Where the local annual average wind speed is 6 m/s or more.
- Where there are no significant nearby obstacles such as buildings, trees or hills that are likely to reduce the wind speed or increase turbulence



Figure 11 - Mounted wind turbine

As this development is in a rural area there will be opportunity to utilise wind turbines. The average wind speed in this area is 6.2 m/s at a height of 10 metres, which is more than the 6 m/s required. Therefore, micro wind is a viable technology for this development. Please refer to section 9.1 for more details.

## 7.6. Biomass

Biomass is a generic name for any fuel produced from organic sources and falls into mainly two categories:

- Woody biomass- forest products, untreated wood products, energy crops and wood pellets
- Non-wood biomass – liquid biofuels (such as biodiesel, bioethanol) or animal waste industrial municipal products and high energy crops such as rape seed, sugar cane and maize.

For domestic properties the fuel used is normally wood pellets, wood chips or wood logs. For larger applications, biomass boilers replace conventional fossil fuel boilers and come with an automated feed by screw drives from hoppers.

Biomass systems require more cleaning than gas or oil boilers and they must be capable of being taken out of service for cooling and cleaning whilst maintaining the building heating supply particularly in

communal heating systems. Centralised gas boilers are therefore still required to support the biomass boiler, which would be the lead boiler. The size of the dedicated plant rooms is substantial. Fuel availability, delivery and storage are also important issues to consider.

Air quality issues are also an important factor when looking to install biomass. The cost of the fuel depends on the type, delivery distances and whether it is obtained as simple waste product or from another organisation. The cost of wood pellets is currently a little more expensive than mains gas, and woodchip is approx. 30% cheaper, however prices are fluctuating rapidly in the bio-fuel market at the present time creating uncertainty over their take up.



**Figure 12 - Biomass boiler and hopper**

Biomass CHP is still relatively new to the UK market and is more suitable to large developments where energy demand does not require significant modulation. There are technical issues with small scale Biomass CHP and until these can be resolved and proven the take up of these systems in the UK and Europe has been slow.

Overall carbon savings of 40%+ are achievable with biomass technology. Biomass is more suited to a communal heating system; there is insufficient space to accommodate the equipment and fuel storage to facilitate a biomass boiler. Furthermore, there are noise and air quality issues associated with this type of technology. For this reason, biomass is discounted.

## 8. Energy Assessment of Proposed Scheme

The Fells Farm development has adopted the principles of the ‘Be Lean, Be Clean, Be Green’ approach. The most practical and economically feasible solution for the development is a good quality thermally insulated fabric, air-tight envelope, passive improvements, highly efficient ground source heat pumps and the use of a photovoltaic panel array with a battery store supported by efficient ventilation extract system.

Table 5 - Proposed Carbon Emissions from the development

Ref	Dwelling Type	No.	TER	DER	TPER	DPER	Total Carbon Emissions (Kg CO <sub>2</sub> /yr)	Total Primary Energy (kWh/yr)
Z68644	Proposed Dwelling	1	9.72	-0.77	51.32	1.04	-186	251
			107.92%		97.97%			
<b>Total</b>		<b>1</b>	<b>107.92%</b>		<b>97.97%</b>		<b>-186</b>	<b>251</b>

The predicted carbon emissions for the proposed development is -186 kgCO<sub>2</sub>/yr. This is a total CO<sub>2</sub> emission reduction of 2,531 kgCO<sub>2</sub>/yr from the baseline emissions of 2,345 kgCO<sub>2</sub>/yr. This equates to a 107.92% CO<sub>2</sub> emission reduction.

The predicted primary energy rate for the proposed development is 251 kWh/yr. This is a primary energy reduction of 12,130 kWh/yr from the baseline primary energy rate of 12,381 kWh/yr. This equates to an 97.97% primary energy reduction.

## 9. Conclusion

Following the 'Be Lean, Be Clean, Be Green' hierarchy, the proposed design solutions on the development are predicted to:

- 1) Reduce the total carbon emissions by 107.92% compared to new Building Regulations ADL1B 2021.
- 2) Ground source heat pumps are the proposed renewables/ low carbon technology. Their contribution to the overall energy reduction under the 'be green' energy hierarchy is approx. 50%.
- 3) Reduce the total primary energy by 97.97% compared to new building regulations ADL1B 2021. This is a new metric under Part L 2021.
- 4) There are no DHN within a 500m radius of the site for consideration of connection. The nearest district heating network is located just over 21 miles Southeast of the site.

The approach for the development is to embed sustainability into the heart of the development through a range of design measures based on the 'Be Lean, Be Clean, Be Green' design hierarchy. Measures will include:

- 1) Enhanced building fabric to meet the new Building Regulation ADL1B 2021 (15/06/2021).
- 2) Enhanced air tightness.
- 3) Highly efficient decentralised mechanical extract ventilation with low specific fan powers (SFPs) to all wet rooms within the dwelling.
- 4) Heating and Hot water to be provided by highly efficient ground source heat pump.
- 5) Efficient lighting strategy primarily using LED type fittings.
- 6) Photovoltaic (PV) panel array with a battery store.

### 9.1. Low/ Zero Carbon Technologies (LZT) Chosen

- Ground Source Heat Pumps are considered a viable solution for this development, as the dwelling sits within extensive land ownership that provides sufficient space for the installation of ground loops. This allows the system to be accommodated without spatial constraints, while offering a highly efficient, low-carbon, and cost-effective renewable heating solution for the site.
- Solar Photovoltaic panels (PV) are a viable option as they further reduce the CO<sub>2</sub> emissions following the good thermal fabric and ground source heat pump.

## 9.2. Low/ Zero Carbon Technologies (LZT) Discounted

- Micro-wind is a viable option for the proposed scheme, however has been discounted due to the high associated cost to install.
- Solar Thermal Hot Water is viable however it is discounted as the dwelling will have a HW cylinder but solar thermal is not proposed as the heating and hot water is being supplied from an efficient heat pump. PV is already proposed using up the available roof space.
- Biomass has been discounted as it poses problems in terms of air quality, delivery of fuel, storage, and transportation for deliveries etc.
- Air Source Heat Pumps (ASHP) are a viable option for the proposed scheme, offering efficient heating and hot water with associated carbon savings. However, they are not being utilised in this design as the preference is to install Ground Source Heat Pumps (GSHP), which provide greater long-term efficiency and make effective use of the extensive land available around the dwelling.

A more detailed overview of LZT technologies is provided in the appendices of this report.

### 9.3. Summary Headlines

- A fabric-first approach to meeting Ribble Valley Borough Council Core Strategy (2008-2028) energy policy has been undertaken for the proposed development, defined within the ‘Be Lean, Be Clean, Be Green’ energy hierarchy. The proposed design provides compliance with Building Regulations ADL1B 2021, and with the application of heat pumps for heating and hot water to the dwelling with PV panels and battery storage ensures reductions, which meets Ribble Valley Borough Council Core Strategy (2008-2028)
- The use of high-efficiency heat pumps and PV reduces carbon emissions by 107.92% and provides a primary energy reduction of 97.97% when compared to new Building Regulations Part LB 2021.

An overall **107.92%** improvement in CO<sub>2</sub> emissions and a **97.97%** improvement in primary energy above the Building Regulations baseline is proposed to support our application.

	Total CO <sub>2</sub> Emissions (kgCO <sub>2</sub> /yr)	Total Primary Energy (kWh/yr)
Target Dwelling Performance	2,345	12,381
Proposed Dwelling Performance	-186	251
<b>Total Reduction</b>	<b>2,531</b>	<b>12,130</b>
<b>Percentage Improvement (above ADL1 2021)</b>	<b>107.92%</b>	<b>97.97%</b>

## 10. Appendices

### 10.1. LZT Feasibility Table

Technology	Technical Feasibility	Carbon Savings	Estimated Costs	Financial Viability
Solar photovoltaics	A photovoltaic array is considered viable for the dwelling. Further details provided within section 9.1 of this report.	A 1kWp system could save around 213 kg of CO <sub>2</sub> / year per dwelling	Average cost for such a system is around £1.5K per dwelling.	Current potential income generation is around £120 minimum per annum per dwelling with a fuel cost saving of around £40 / year per dwelling.
Wind	Average wind speeds on the site according to the <u>NOABL</u> Wind Speed Database are 6.2m/s. To be technically feasible a minimum of 6m/s is required, therefore this site is considered feasible.	N/A	N/A	N/A
Micro Hydro	There is no capacity for micro hydro on this site since there are no local water courses available.	N/A	N/A	N/A
District Heating	There are no existing or planned district heating networks to facilitate connection at this stage.	N/A	N/A	N/A
Solar Hot Water	This technology has been discounted as the level of hot water usage in each dwelling does not merit a storage system, which poses space issues.	Around 270 kg of CO <sub>2</sub> / year per dwelling.	£3-5K per dwelling	Income generation from RHI in a 4-person household would be in the region of £340 / year (per dwelling) with a fuel saving of around £65 / year per dwelling
Heat Pumps	GSHP: Provided to the dwelling for efficient heating and hot water.  ASHP: viable option for the dwelling to provide heating and hot water	GSHP: 2,100 to 3,300 kg CO <sub>2</sub> / year per dwelling  ASHP: 1,700 to 2,700 kg CO <sub>2</sub> / year per dwelling.  HWHP: 1,700 to 2,700 kg CO <sub>2</sub> / year per dwelling.	GSHP @ £13-20K per dwelling  ASHP: £7-11K / dwelling  ASHP: £3K / dwelling	GSHP: £2,590 minimum annual RHI income generation per dwelling with fuel saving of £440 / year minimum per dwelling  ASHP: RHI removed. Fixed £5000 grant fund per property.  HWHP: N/A
Biomass	The small scale of this development would not facilitate the installation of biomass boilers due to the space required for pellet storage.	N/A	N/A	N/A

## 10.2. Specification for Energy Assessments (ADL1B 2021 – SAP 10)

Item	Brief Description	Notes	Confirm
	<b>The following information is required for the design submission (as per requirements of AD L1B).</b>	Please note submission is in two stages. A) <b>Design</b> , B) As installed	
<b>1. Dwelling Type</b>			
1.1	Building Regulations Part L1B 2021 apply.	The Contractor is responsible for meeting Building Regs 2021 compliance including part L (energy), F (ventilation), O (overheating), G (water consumption), E (sound) and S (Elec Vehicle Charging).	
1.2	Full address and Post code of site to be provided from Royal Mail.		
1.3	Electricity is supplied by standard tariff rather than economy 7, 10 or 24.	<i>Assumed Standard tariff</i>	
1.4	It is assumed that the dwelling have a medium thermal mass parameter.	<i>Masonry Construction</i>	
<b>2. Floor Construction Details</b>			
2.1	New build ground floor is to be insulated to achieve the u-value opposite.	U-Value = 0.11 W/m <sup>2</sup> K	
2.2	Upgraded existing ground floor to be insulated to achieve the u-value opposite.	U-Value = 0.11 W/m <sup>2</sup> K	
2.3	Exposed floor to unheated garage to be insulated to achieve the u-value opposite.	U-Value = 0.18 W/m <sup>2</sup> K	
<b>3. Wall Construction Details</b>			
3.1	New build external walls to be insulated to achieve the U-value stated opposite.	U-Value = 0.15 W/m <sup>2</sup> K	
3.2	Upgraded existing external walls to be insulated to achieve the U-value stated opposite.	U-Value = 0.18 W/m <sup>2</sup> K	
<b>4. Roof Construction Details</b>			
4.1	New build roofs are insulated to achieve the U-value indicated opposite.	U-Value = 0.10 W/m <sup>2</sup> K	
4.2	Upgraded existing roofs are insulated to achieve the U-value indicated opposite.	U-Value = 0.15 W/m <sup>2</sup> K	
<b>5. Openings</b>			
5.1	All external doors to achieve the U-value stated opposite.	U-Value = 1.00 W/m <sup>2</sup> K	
5.2	All windows, rooflights and patio type doors/windows with Low-e glass hard coating to achieve the U-Value stated opposite.	U-value = 1.00 W/m <sup>2</sup> K. G-value = 0.35	
<b>6. Ventilation</b>			
6.1	Design stage SAP calculation presumes an air permeability of 5m <sup>3</sup> /m <sup>2</sup> /hr at 50pa will be achieved.	5m <sup>3</sup> /m <sup>2</sup> /hr at 50pa dwelling to be tested	
6.2	Decentralised Mechanical extract ventilation installed to all wet rooms within dwelling.	Greenwood Unity CV2.1 or equal and approved.	
6.3	Open wood log fireplace is present in the main living area.		
<b>7. Space Heating</b>			
7.1	Main heating is provided via radiators fed from a ground source heat pump	Ground source heat pump to be confirmed	
7.2	The heating system within the dwelling has an time and temperature zone control.		
7.3	Open wood log fire as secondary heating.	<i>Main living space</i>	
<b>8. Water Heating</b>			
8.1	Hot water is provided by a ground source heat pump.		
8.2	Hot water cylinder storage is provided to the dwelling from the mains heating system.	Storage volume = 250 litres Heat losses 1.41 kWh/24hrs Heat transfer area = 2.4m <sup>2</sup>	

		Fully insulated primary pipework.	
8.3	Independent time control and cylinder stat is provided to the hot water cylinder.		
8.4	Water usage per person per day is $\leq 105$ Litres.	To exceed Part G. Requires good specification of flow rates on all water consuming appliances – taps, showers, etc	
<b>9. Renewables</b>			
9.1	PV panels have been included on the flat roof, orientated South	12kWp based on 30 panels on the south face with each panel @400W	
<b>10. Other</b>			
10.1	Thermal bridging has been set to default.		
10.2	Low energy (LE) lights are installed throughout.	All lighting must be specified with efficacy of 80 lumens/circuit watt or more.	
10.3	Showers will be supplied from the hot water cylinder from the ground source heat pump system	Flow regulated 9l/min@3bar	

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