Land at Hardwick Bank, Bromyard

Vistry Homes

Energy and Sustainability Statement

AES Sustainability Consultants Ltd

May 2023

AES Sustainability Consultants

	Author	Date	E-mail address
Produced By:	Chris MacDougall	22.05.2023	Chris.MacDougall@aessc.co.uk
Reviewed By:	Andrew McManus	22.05.2023	Andrew.McManus@aessc.co.uk

Revision	Author	Date	Comment
Rev1	Chris MacDougall	23.05.2023	Amended to reflect Part L 2021 approach

Vistry Group

This statement has been commissioned by Vistry Homes to detail the proposed approach to energy and CO_2 reduction to be employed in the development of the Land at Hardwick Bank, Bromyard. It should be noted that the details presented, including the proposed specifications, are subject to change as the detailed design of the dwellings progresses, whilst ensuring that the overall commitments will be achieved.

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1. Introduction

Preface

1.1. Written by AES Sustainability Consultants on behalf of Vistry Homes, this Energy and Sustainability Statement has been prepared in support of the application for development of the Land at Hardwick Bank, Bromyard.

Development Description

1.2. The development site is located in Bromyard, a town located between Leominster and Worcester, within the administrative boundary of Herefordshire Council.

1.3. The proposals would deliver 250 dwellings across a mix of two to four bed detached, semi-detached and terraced houses and one to two bed flats. The proposed site layout is shown in Figure 1.

Purpose and Scope of the Statement

1.4. This statement will address national and local policies relating to sustainable development, including policies within the Herefordshire Local Plan Core Strategy 2011-2031, adopted in October 2015.

1.5. The statement will demonstrate that following a fabric first approach and with the implementation of low-carbon and renewable technologies, the proposed development will deliver a level of energy performance and carbon reductions beyond a Part L 2021 baseline, which in itself presents a circa 31% reduction over previous regulatory standards.

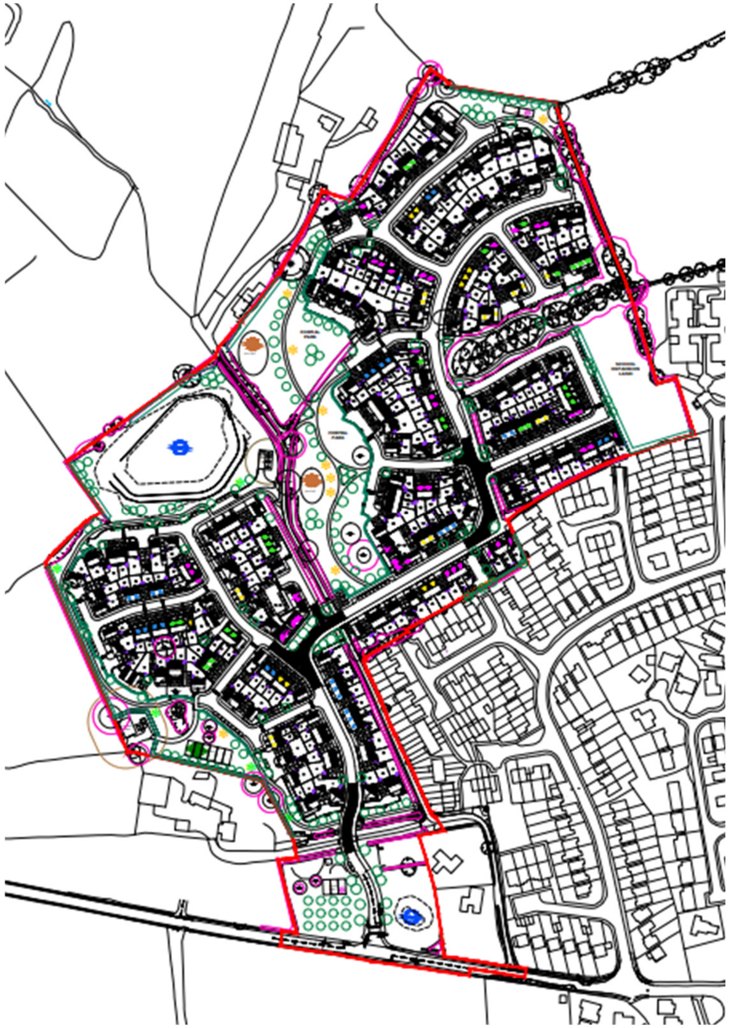

Figure 1. Proposed site layout

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2. Planning Policy and Conditions

Local Planning Policy

2.1. The Herefordshire Local Plan Core Strategy 2011-2031, adopted in October 2015, contains the following key policies relating to sustainable development:

Policy SS7 – Addressing climate change

Development proposals will be required to include measures which will mitigate their impact on climate change.

At a strategic level, this will include:

- focussing development to the most sustainable locations;
- delivering development that seeks to reduce the need to travel by private car and which encourages sustainable travel options including walking, cycling and public transport;
- designing developments to reduce carbon emissions and use resources more efficiently;
- promoting the use of decentralised and renewable or low carbon energy where appropriate;
- supporting affordable, local food production, processing and farming to reduce the county's contribution to food miles;
- protecting the best agricultural land where possible;

Key considerations in terms of responses to climate change include:

- taking into account the known physical and environmental constraints when identifying locations for development;
- ensuring design approaches are resilient to climate change impacts, including the use of passive solar design for heating and cooling and tree planting for shading;
- minimising the risk of flooding and making use of sustainable drainage methods;
- reducing heat island effects (for example through the provision of open space and water, planting and green roofs);
- reduction, re-use and recycling of waste with particular emphasis on waste minimisation on development sites; and
- developments must demonstrate water efficiency measures to reduce demand on water resources.

Policy SD1 – Sustainable design and energy efficiency

Development proposals should create safe, sustainable, well integrated environments for all members of the community. In conjunction with this, all development proposals should incorporate the following requirements:

- ensure that proposals make efficient use of land - taking into account the local context and site characteristics;
- new buildings should be designed to maintain local distinctiveness through incorporating local architectural detailing and materials and respecting scale, height, proportions and massing of surrounding development, while making a positive contribution to the architectural diversity and character of the area including, where appropriate, through innovative design;
- safeguard residential amenity for existing and proposed residents;
- ensure new development does not contribute to, or suffer from, adverse impacts arising from noise, light or air contamination, land instability or cause ground water pollution;
- where contaminated land is present, undertake appropriate remediation where it can be demonstrated that this will be effective;
- ensure that distinctive features of existing buildings and their setting are safeguarded and where appropriate, restored;
- utilise physical sustainability measures that include, in particular, orientation of buildings, the provision of water conservation measures, storage for bicycles and waste including provision for recycling, and enabling renewable energy and energy conservation infrastructure;
- where possible, on-site renewable energy generation should also be incorporated;
- create safe and accessible environments, and that minimise opportunities for crime and anti-social behaviour by incorporating secured by design principles, and consider the incorporation of fire safety measures;
- ensuring designs can be easily adapted and accommodate new technologies to meet changing needs throughout the lifetime of the development; and
- utilise sustainable construction methods which minimise the use of non-renewable resources and maximise the use of recycled and sustainably sourced materials;

All planning applications including material changes of use, will be expected to demonstrate how the above design and energy efficiency considerations have been factored into the proposal from the outset.

Policy SD3 – Sustainable water management and water resources

Measures for sustainable water management will be required to be an integral element of new development in order to reduce flood risk; to avoid an adverse impact on water quantity; to protect and enhance groundwater resources and to provide opportunities to enhance biodiversity, health and recreation. This will be achieved by ensuring that:

1. development proposals are located in accordance with the Sequential Test and Exception Tests (where appropriate) and have regard to the Strategic Flood Risk Assessment (SFRA) 2009 for Herefordshire;
2. development is designed to be safe, taking into account the lifetime of the development and the need to adapt to climate change by setting appropriate floor levels, providing safe pedestrian and vehicular access, where appropriate, implementing a flood evacuation management plan and avoiding areas identified as being subject to Rapid Inundation from a breach of a Flood Defence;
3. where flooding is identified as an issue, new development should reduce flood risk through the inclusion essential to the provision of access) will not be permitted;
4. development will not result in the loss of open watercourse and culverts should be opened up where possible to improve drainage and flood flows. Proposals involving the creation of new culverts (unless essential to the provision of access) will not be permitted;
5. development includes appropriate sustainable drainage systems (SuDS) to manage surface water appropriate to the hydrological setting of the site. Development should not result in an increase in runoff and should aim to achieve a reduction in the existi ng runoff rate and volumes, where possible;
6. water conservation and efficiency measures are included in all new developments, specifically:
    - residential development should achieve Housing - Optional Technical Standards - Water efficiency standards. At the time of adoption the published water efficiency standards were 110 litres/person/ day; or
    - non-residential developments in excess of 1,000 m^2 gross floorspace to achieve the equivalent of BREEAM 3 credits for water consumption as a minimum;
7. the separation of foul and surface water on new developments is maximised;
8. development proposals do not lead to deterioration of EU Water Framework Directive water body status;
9. development should not cause an unacceptable risk to the availability or quality of water resources; and
10. in particular, proposals do not adversely affect water quality, either directly through unacceptable pollution of surface water or groundwater, or indirectly through overloading of Wastewater Treatment Works. *(continued on next page)*

Policy SD3 – Sustainable water management and water resources (continued)

11. non-residential developments in excess of 1,000 m^2 gross floorspace to achieve the equivalent of BREEAM 3 credits for water consumption as a minimum;
12. the separation of foul and surface water on new developments is maximised;
13. development proposals do not lead to deterioration of EU Water Framework Directive water body status;
14. development should not cause an unacceptable risk to the availability or quality of water resources; and
15. in particular, proposals do not adversely affect water quality, either directly through unacceptable pollution of surface water or groundwater, or indirectly through overloading of Wastewater Treatment Works.

Development proposals should help to conserve and enhance watercourses and riverside habitats, where necessary through management and mitigation measures for the improvement and/or enhancement of water quality and habitat of the aquatic environment. Proposals which are specifically aimed at the sustainable management of the water environment will in particular be encouraged, including where they are required to support business needs such as for agriculture. Innovative measures such as water harvesting, winter water storage and active land use management will also be supported. In all instances it should be demonstrated that there will be no significant adverse landscape, biodiversity or visual impact.

National Planning Policy Framework

2.2. In July 2021, the Government published the updated National Planning Policy Framework (NPPF), which sets out the Government's planning policies for England and how these are expected to be applied.

2.3. The planning process has been identified as a system to support the transition to a low carbon future in response to climate change by assisting in the reduction of greenhouse gas emissions and supporting renewable and low carbon energy.

2.4. Paragraph 154 sets out what is expected from new developments when considering strategies to mitigate and adapt to climate change:

> 154. New development should be planned for in ways that:
>
> Avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaption measures, including through the planning of green infrastructure; and
>
> Can help to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards.

Current National Policy Standards

2.5. The NPPF requires that "local planning authorities should …when setting any local requirement for a building's sustainability, do so in a way consistent with the Government's zero carbon buildings policy and adopt nationally described standards."1

2.6. A policy announcement presented by HM Treasury as part of the July 2015 productivity plan "Fixing the Foundations"2 advised that the Government considered that energy efficiency standards introduced through recent changes to Building Regulations 'need time to become established' and will therefore persist until further notice.

2.7. This statement therefore sets out details relating to building energy performance standards and proposes an approach through which these will be achieved in a manner which improves the long-term sustainability of the dwellings.

Proposed Strategy

2.8. It is proposed that following current national policy guidance and local planning requirements as set out, the dwellings are constructed to meet - and exceed where possible - the appropriate national standards through an approach which seeks to consider a range of sustainable construction issues.

2.9. The development will be designed to meet national standards with respect to Part L 2021 requirements as a minimum, and deliver additional carbon reductions in line with local adopted policy.

2.10. This statement will therefore detail the proposed approach to delivering CO_2 emissions reductions significantly greater than those of a Part L 2021 compliant baseline, through the incorporation of Air Source Heat Pumps (ASHP) and Solar Photovoltaic Systems (PV).

2.11. The development also considers the changing future climate and seeks to build in resilience through appropriate construction techniques and materials to avoid future risks of overheating.

2.12. The proposed dwellings will therefore be constructed following a fabric first approach to meet the current Building Regulations, incorporating high standards of thermal insulation, airtightness and thermal bridging, together with efficient heating and lighting systems. In addition, where possible the dwellings will be designed in accordance with the principles of passive design, with glazing and orientation considered to take advantage of solar gain without building in potential overheating risk.

2.13. The following sections of this statement set out the sustainable design considerations which will be applied to the dwellings in order to deliver low energy, comfortable and affordable housing.

2.14. There are many other aspects of sustainability which relate to new housing development and will be considered further within this statement, including the environmental impacts of materials, construction, household waste, and water conservation measures.

[1] Department for Communities and Local Government, 2012, *NPPF, paragraph 95*

[2] HM Treasury, July 2015, *'Fixing the Foundations' Productivity Plan*

3. Energy Consumption and CO_2 Emissions

3.1. As one of the key areas of ongoing impact of any development, the energy demand of the dwellings to be constructed is a key consideration in the overall sustainability strategy.

3.2. As set out within the policy review section of this statement, it is considered that Building Regulations form the minimum requirement for new dwellings in terms of energy performance.

3.3. As shown in Table 1, the CO_2 standards contained within Part L were increased in 2010 and 2013, reducing the TER by approximately 25% and a further 6% (9% for non-residential) respectively.

3.4. Part L 2021 will be mandatory from June 2023, which constitutes a much larger step change of a 31% reduction in emissions.

Table 1. CO_2 Emissions improvements from successive Part L editions

Building Regulations	CO_2 emissions improvement over preceding regulations
L1A 2006	-
L1A 2010	25%
L1A 2013	6%
L1 2021	31%

Energy Reduction Strategy – Fabric First

3.5. The proposed construction specification and sustainable design principles to be applied to the development will ensure that each dwelling meets the CO_2 reductions mandated by Part L1 of the Building Regulations through fabric measures alone.

3.6. It is proposed that the energy demand reduction strategy for the development incorporates further improvements beyond a Part L compliant specification and initially concentrates finance and efforts on reducing energy demand as the first stage of the Energy Hierarchy.

Figure 2. The Energy Hierarchy

Be Lean – reduce energy demand

3.7. The design of a development - from the masterplan to individual building design - will assist in reducing energy demand in a variety of ways, with a focus on minimising heating, cooling and lighting loads. Key considerations include:

- Building orientation – maximise passive solar gain and daylight
- Building placement – control overshading and wind sheltering
- Landscaping – control daylight, glare and mitigate heat island effects
- Building design – minimise energy demand through fabric specification

Be Clean – supply energy efficiently

3.8. The design and specification of building services to utilise energy efficiently is the next stage of the hierarchy, taking into account:

- High efficiency heating and cooling systems
- Ventilation systems (with heat recovery where applicable)
- Low energy lighting
- High efficiency appliances and ancillary equipment

Be Green – use low carbon / renewable energy

3.9. Low carbon and renewable energy systems form the final stage of the energy hierarchy and can be used to directly supply energy to buildings, or offset energy carbon emissions arising from unavoidable demand. This may be in the form of:

- Low carbon fuel sources – e.g., biomass
- Heat pump technologies
- Building scale renewable energy systems
- Small-scale heat networks
- Development-scale heat networks

3.10. As this hierarchy demonstrates, designing out energy use is weighted more highly than the generation of low-carbon or renewable energy to offset unnecessary demand. Applied to the development, this approach is referred to as 'fabric first' and concentrates finance and efforts on improving U-values, reducing thermal bridging, improving airtightness, and installing energy efficient ventilation and heating services.

3.11. This approach has been widely supported by industry and government for some time, particularly in the residential sector, with the Zero Carbon Hub3 and the Energy Savings Trust4 having both stressed the importance of prioritising energy demand as a key factor in delivering resilient, low energy buildings.

3.12. The benefits to prospective homeowners of following the Fabric First approach are summarised in Table 2.

Table 2. Benefits of the Fabric First approach

	Fabric energy efficiency measures	Bolt-on renewable energy technologies
Energy/CO_2/fuel bill savings applied to all dwellings	✓	×
Savings built-in for life of dwelling	✓	×
Highly cost-effective	✓	×
Increases thermal comfort	✓	×
Potential to promote energy conservation	✓	✓
Minimal ongoing maintenance / replacement costs	✓	×
Significant disruption to retrofit post occupation	✓	×

Building Regulations Standards – Fabric Energy Efficiency

3.13. In addition to the CO_2 reduction targets, the importance of energy demand reduction was further supported by the introduction of a minimum fabric standard into Part L1A 2013, based on energy use for heating and cooling a dwelling. This is referred to as the 'Target Fabric Energy Efficiency' (TFEE) and expressed in kWh/m2/year.

3.14. This standard enables the decoupling of energy use from CO_2 emissions and serves as an acknowledgement of the importance of reducing demand, rather than simply offsetting CO_2 emissions through low carbon or renewable energy technologies.

3.15. The TFEE is calculated based on the specific dwelling being assessed with reference values for the fabric elements contained within Approved Document L1. These reference values are described as 'statutory guidance' as opposed to mandatory requirements, allowing full flexibility in design approach and balances between different aspects of dwelling energy performance to be struck so that the ultimate goal of achieving the TFEE is met. The proposed approach and indicative construction specifications are set out in the following sections of this Strategy.

[3] Zero Carbon Hub, Zero Carbon Strategies for tomorrow's new homes, Feb 2013

[4] Energy Savings Trust, Fabric first: Focus on fabric and services improvements to increase energy performance in new homes, 2010

Proposed Fabric Specification

3.16. In order to ensure that the energy demand of the development is reduced, the dwellings should be designed to minimise heat loss through the fabric wherever possible. Table 3 details the indicative fabric specification of the major building elements, with the first column in this table setting out the Part L1 limiting fabric parameters in order to demonstrate the improvements to be delivered.

Table 3. Indicative construction specification – main elements

	Part L1 Limiting Fabric Parameters	Design Specification
External wall – u-value	0.26 W/m²K	0.24 W/m²K
Party wall – u-value	0.20 W/m²K	0.00 W/m²K
Roof – u-value	0.16 W/m²K	≤0.11 W/m²K
Ground floor – u-value	0.18 W/m²K	0.10-0.12 W/m²K
Windows – u-value	1.60 W/m²K	1.30 W/m²K
Doors – u-value	1.60 W/m²K	1.00 W/m²K
Air Permeability	8.00 m³/h.m² at 50 Pa	≤ 4.00 m³/h.m² at 50 Pa

Thermal bridging

3.17. The significance of thermal bridging as a potentially major source of fabric heat losses is increasingly understood. Improving the U-values for the main building fabric without accurately addressing the thermal bridging will not achieve the desired energy and CO_2 reduction targets.

3.18. The specification should seek to minimise unnecessary bridging of the insulation layers, with avoidable heat loss therefore being reduced wherever possible. Accurate calculation of these heat losses forms an integral part of the SAP calculations undertaken to establish energy demand of the dwellings, and as such thermal modelling will be undertaken to assess the performance of all main building junctions.

Air leakage

3.19. After conductive heat losses through building elements are reduced, convective losses through draughts are the next major source of energy wastage. The proposal adopts an airtightness standard of 4.00m3/h.m2 at 50Pa, with pressure testing of all dwellings to be undertaken on completion to confirm that the design figure has been met.

Fabric Energy Efficiency

3.20. Table 4 demonstrates that the dwellings will exceed the uplifted Fabric Energy Efficiency targets within Part L 2021 through the proposed specification.

Table 4. Fabric Energy Efficiency of sample dwellings

	Target Fabric Energy Efficiency (kWh/m²/year)	Design Fabric Energy Efficiency (kWh/m²/year)	Improvement %
Hardwick Semi/End	36.21	34.85	3.74
Cartwright Semi/End	36.07	34.63	4.00
Elmslie Semi/End	35.08	33.52	4.44
Mountford Det	42.02	41.22	1.90
Becket Det	41.59	39.60	4.78
Mylne Semi/End	34.58	32.97	4.64
1BF	38.29	36.74	4.06
2BF	36.17	34.33	5.09

Provisions for Energy-Efficient Operation of the Dwelling

3.21. The occupant of the dwelling should be provided with all necessary literature and guidance relating to the energy efficient operation of fixed building services. Currently it is assumed that all dwellings will be provided with air source heat pumps, fully insulated primary pipework, and time and temperature zone controls to avoid unnecessary heating of spaces when not required.

4. Baseline CO_2 Emissions

4.1. The development is to be designed and constructed to meet the requirements of Part L1 of the Building Regulations 2021, therefore compliance with this standard forms the first stage in the sustainable construction approach.

4.2. Part L1 compliance is assessed through the Standard Assessment Procedure (SAP), which uses the 'Target Emission Rate' (TER) – expressed in kilograms CO_2 per meter squared of total useful floor area, per annum – as the benchmark. The calculated performance of the dwelling as designed - the Dwelling Emission Rate (DER) – is required to be lower than this benchmark level.

4.3. Calculations have been undertaken to a representative sample of house types proposed to assess the carbon dioxide emissions of the development. The Part L1 2021 compliant calculated baseline CO_2 emissions are reported in Table 5.

Table 5. Part L compliant CO_2 emissions by house type

House type	CO_2 emissions ($kgCO_2$/yr/)
Hardwick Semi/End	1,241
Cartwright Semi/End	1,199
Elmslie Semi/End	1,083
Mountford Det	1,209
Becket Det	1,175
Mylne Semi	976
1BF	1,569
2BF	1,394

4.4. Based on these calculations, the representative site-wide Part L compliant CO_2 emissions are shown in Table 6.

Table 6. Part L compliant baseline CO_2 emissions for the site

	Part L Compliant CO_2 emissions ($kgCO_2$/year/)
Site-wide emissions baseline	238,236

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5. Low Carbon and Renewable Energy Systems

5.1. A range of low carbon and renewable energy systems have been assessed for their potential to deliver suitable emission savings.

Combined Heat and Power (CHP) and District Energy Networks

5.2. A CHP unit is capable of generating heat and electricity from a single fuel source. The electricity generated by the CHP unit is used to displace electricity that would otherwise be supplied from the national grid, with the heat generated as effectively a by-product utilised for space and water heating.

5.3. The economic and technical viability of a CHP system is largely reliant on a consistent demand for heat throughout the day to ensure that it operates for over 5000 hours per year. Heat demand from mainly residential schemes is not conducive to efficient system operation, with a defined heating season and intermittent daily profile, with peaks in the morning and the evening. For this reason, the use of a CHP system is not considered feasible for this development.

5.4. There are currently no heat networks which extend near the proposed development. High network heat losses associated with distribution to individual houses, as opposed to large high-rise apartment blocks and commercial developments mean that a new heat network to serve the area is not considered viable or an environmentally preferred option. Due to these reasons, the provision for future connection to a district heating system is also not proposed.

Wind Power

5.5. Locating wind turbines adjacent to areas with buildings presents a number of potential obstacles to deployment. These include the area of land onsite required for effective operation, installation and maintenance access, environmental impact from noise and vibration, visual impact on landscape amenity and potential turbulence caused by adjacent obstacles, including the significant amount of woodland on and around the development.

5.6. A preliminary examination of the BERR wind speed database indicates that average wind speeds at 10m above ground level are around 5.3m/s 5. Wind turbines at this site are therefore unlikely to generate sufficient quantities of electrical energy to be cost effective6. For these reasons wind power is not considered feasible.

Building Scale Systems

5.7. The remaining renewable or low carbon energy systems considered potentially feasible are at a building scale. These are as follows;

- Individual biomass heating
- Solar thermal
- Solar photo-voltaic (PV)
- Air Source Heat Pumps (ASHPs)
- Ground Source Heat Pump (GSHPs)

5.8. The advantages and disadvantages of these technologies are evaluated in Tables 7-11.

[5] NOABL Wind Map (http://www.rensmart.com/Weather/BERR)

[6] CIBSE TM38:2006. Renewable energy sources for buildings.

Table 7. Individual Biomass Heating feasibility appraisal

Potential Advantages	Risks & Disadvantages
• Potential to significantly reduce CO_2 emissions as the majority of space and water heating will be supplied by a renewable fuel • Decreased dependence on fossil fuel supply	• A local fuel supply is required to avoid increased transport emissions • Fuel delivery, management and security of supply are critical • Space is required to store fuel, a thermal store and plant • A maintenance regime would be required even though modern systems are relatively low maintenance • Building users or a management company must be able to ensure fuel is supplied to the boiler as required. • Local environmental impacts potentially include increased NO_x and particulate emissions
Estimated costs and benefits	
• Cost [redacted] upwards for a wood-pellet boiler, not including cost of fuel	
Conclusions	
Biomass heating is considered technically feasible in large dwellings provided sufficient space can be accommodated for fuel supply, delivery and management. Air quality concerns in addition to increased transport emissions for fuel delivery mean that it is not a preferred technology for the development.	

Table 8. Solar Thermal systems feasibility appraisal

Potential Advantages	Risks & Disadvantages
• Mature and reliable technology offsetting the fuel required for heating water • Solar thermal systems require relatively low maintenance • Typically, ~50% of hot water demand in dwellings can be met annually	• Installation is restricted to favourable orientations on an individual building basis • The benefit of installation is limited to the water heating demand of the building • Safe access must be considered for maintenance and service checks • Buildings need to be able to accommodate a large solar hot water cylinder • Distribution losses can be high if long runs of hot water pipes are required • Visual impact may be a concern in special landscape designations (e.g. AONB)
Estimated costs and benefits	
• [redacted] for standard installation • Ongoing offset of heating fuel, minimal maintenance requirements	
Conclusions	
Solar thermal systems are considered technically feasible on all buildings with suitable roof orientations, however the contribution to carbon reduction is expected to be low and therefore it is not a preferred technology.	

Table 9. Solar Photovoltaic systems feasibility appraisal

Potential Advantages	Risks & Disadvantages
• The technology offsets grid supplied electricity used for lighting, pumps and fans, appliances and equipment • Mature and well proven technology that is relatively easily integrated into building fabric • Adaptable to future system expansion • Solar resource is not limited by energy loads of the dwelling as any excess generation can be transferred to the national grid • Income can be generated from exporting excess electricity to the national grid through Smart Export Guarantee payments • PV systems generally require very little maintenance • Service and maintenance requirement minimal, and 2-3 storey buildings should not require significant additional safety measures (fall protection systems etc) for roof access	• Poor design and installation can lead to lower-than-expected yields (e.g. from shaded locations) • Installation is restricted to favourable orientations • Safe access must be considered for maintenance and service checks • Visual impact may be a concern in special landscape designations (e.g. AONB) or conservation areas • Reflected light may be a concern in some locations
Estimated costs and benefits	
• Cost [redacted] upwards (1kWp+) and scalable • Ongoing offset of electricity fuel costs, income generation through Smart Export Guarantee payments, minimal maintenance requirements	
Conclusions	
PV panels are considered technically feasible for all buildings with suitable roof orientations. The relatively low cost and limited additional impacts mean that PV is considered a feasible option for this development.	

Table 10. Air Source Heat Pump systems feasibility appraisal

Potential Advantages	Risks & Disadvantages
• Heat pumps are relatively mature technology providing heat using the reverse vapor compression refrigeration cycle • Heat pumps are a highly efficient way of providing heat using electricity, with manufacturers reporting efficiencies from 250% • The combination of high efficiencies and the reduced carbon emissions associated with grid electricity in recent years mean that heat pumps are becoming an increasingly low carbon heating option. • Can be of increased benefit where cooling is also required, therefore particularly relevant to commercial buildings	• It is critical that heat pump systems are designed and installed correctly to ensure efficient operation can be achieved. • Users must be educated in how heat pump systems should be operated for optimal efficiency • Air source heat pump plant should be integrated into the building design to mitigate concerns regarding the visual impact of bolt-on technology • Noise in operation may be an issue particularly when operating at high output, requires good system design
Estimated costs and benefits	
• Cost [redacted] for standard installation	
Conclusions	
Air source heat pumps are technically feasible for the buildings in this scheme and due to the high carbon saving potential are considered a preferred technology.	

Table 11. Ground Source Heat Pump systems feasibility appraisal

Potential Advantages	Risks & Disadvantages
• Heat pumps are relatively mature technology providing heat using the reverse vapor compression refrigeration cycle • Heat pumps are a highly efficient way of providing heat using electricity, with manufacturers reporting efficiencies from 320% • The combination of high efficiencies and the reduced carbon emissions associated with grid electricity in recent years mean that heat pumps are becoming an increasingly low carbon heating option. • Can be of increased benefit where cooling is also required, therefore particularly relevant to commercial buildings	• Low temperature heating circuits (underfloor heating) would be required to maximise the efficiency of heat pumps • A hot water cylinder would also be required for both space and water heating • It is critical that heat pump systems are designed and installed correctly to ensure efficient operation can be achieved • Ground source heat pumps either require significant land to incorporate a horizontal looped system or significant expense to drill a bore hole for a vertical looped system
Estimated costs and benefits	
• Cost circa [redacted] • Estimated simple payback at circa 18 years (systems only) • Running cost linked to COP of heat pump, however likely to be higher than mains gas • Additional costs to upgrade electricity infrastructure currently unknown	
Conclusions	
Ground source heat pumps are considered technically feasible for buildings in this scheme. However, the cost and difficulty associated with vertical boreholes at this site means that they are not considered a preferred low carbon technology at this stage.	

Summary

5.9. Following this feasibility assessment, it is considered air source heat pump systems are likely to be the best option for the development, delivering very low carbon heating to all dwellings.

5.10. Solar Photovoltaic systems would be technically feasible for this development, further increasing carbon reductions while reducing energy demand and lowering energy bills for the dwelling occupants. PV would be implemented to dwellings with southerly facing elevations, where possible, to maximise energy production, thus increasing the efficiency of the system.

5.11. PV will be allocated to each housetype as required to achieve the desired emissions reductions.

6. As-Designed Performance

6.1. By following the strategy described, the dwellings will reduce energy demand and consequent CO_2 emissions beyond the level of a Part L compliant development.

6.2. Table 12 demonstrates the CO_2 reductions achieved through the proposed fabric measures, the specification of air source heat pumps and the addition of PV.

Table 12. CO_2 emissions of sample dwellings

House type	Target CO_2 emissions ($kgCO_2/yr/m^2$)	Designed CO_2 emissions ($kgCO_2/yr/m^2$)	% Reduction
Hardwick Semi/End	12.41	4.20	66.16%
Cartwright Semi/End	11.99	3.97	66.89%
Elmslie Semi/End	10.83	3.44	68.24%
Mountford Det	12.09	3.63	69.98%
Becket Det	11.75	3.97	66.21%
Mylne Semi/End	9.76	3.21	67.11%
1BF	15.69	4.88	68.90%
2BF	13.94	4.46	68.01%

6.3. Table 13 demonstrates the total site wide CO_2 reductions achieved through the proposed fabric measures and ASHP.

Table 13. Estimated site-wide CO_2 emissions

	CO_2 emissions **($kgCO_2/yr$)**	
Part L compliant	238,236	
After fabric measures, ASHP and PV	76,256	
	$kgCO_2/yr$	**%**
Total savings	161,980	67.99%

7. Overheating Risk and Passive Design

7.1. Dwellings constructed today may be operating in a substantially different climate over the coming decades, and therefore should be designed to ensure that they are able to adapt and reduce the risk of overheating with potentially higher summer temperatures and longer hot spells.

7.2. Key design decisions can affect the potential risk of overheating:

- Poor consideration of orientation of large glazed facades
- High density development contributing to urban heat island effects
- High glazing ratios contributing to excessive unwanted solar gain
- Inadequate ventilation strategies
- Very high levels of thermal insulation without considering heat build-up

7.3. Other factors which additionally contribute to heat build-up within homes and should be addressed where possible include:

- High levels of occupation
- Appliance use contributing to internal gains

Cooling hierarchy

7.4. In common with sustainable heating strategies, it is possible to apply a sustainable 'cooling hierarchy' which sets out the priorities to ensure overheating risk is minimised:

- Minimise internal heat gain
- Manage heat through internal thermal mass and design of spaces
- Passive ventilation strategies
- Mechanical ventilation systems
- Active cooling systems

Addressing overheating risk

7.5. The cooling hierarchy described has been considered, with passive measures of reducing overheating risk given priority. Key measures which will be taken within the development include:

- A layout which incorporates significant green space around the site and in rear gardens reducing the potential for heat build-up in enclosed and low albedo external areas such as tarmac and dark roofs
- Glazing specification which has been considered to balance the requirements for useful solar gain with unwanted summer gain
- Consideration of thermal mass of construction materials to smooth internal temperature profiles, storing excess heat during the day and releasing it at night.

7.6. The development is proposed to use traditional masonry construction, which has a relatively high thermal mass, compared with timber or steel construction. A construction with a high thermal mass can help to reduce overheating risk as it absorbs heat during the day and slowly releases it during cooler nighttime hours, effectively smoothing out temperature fluctuations within the property.

7.7. Within the development layout, orientation and massing has been considered to maximise useful passive solar gain. Glazing will be specified with a solar transmittance value (g-value) to strike the balance between useful solar gain in the winter and unwanted solar gain in the summer.

7.8. All dwellings will be able to benefit from cross-ventilation to effectively purge warm air from the properties during periods of hot weather. Window opening areas will be considered and guided by the Part O assessment, with increased opening areas being designed in as required.

Approved Document O

7.9. In order to address overheating risk more robustly, the Government has introduced a new Approved Document, 'Part O', into the Building Regulations.

7.10. This document requires a more in-depth assessment of the risk of overheating, taking into account site location, dwelling orientation, glazing proportions and openable window areas for natural ventilation.

7.11. This assessment will be undertaken at the start of detailed design and any mitigation measures that may be required will be built in.

8. Sustainable Design

8.1. This section sets out details of additional resource efficiency and sustainable design principles to be applied at the development.

Materials

8.2. The impacts of construction materials range from the depletion of natural resources to the greenhouse gas emissions and water use associated with their manufacture and installation.

8.3. Within the development choices will be made in order to reduce the consumption of primary resources and using materials with fewer negative impacts on the environment, including but not limited to the following;

- Use fewer resources and less energy through designing buildings more efficiently
- Specify and select materials and products that strike a responsible balance between social, economic and environmental factors
- Incorporate recycled content, use resource-efficient products and give due consideration to end-of-life uses
- Influence, specify and source increasing amounts of materials which can be reused and consider future deconstruction and recovery
- All insulating materials will have a Global Warming Potential (GWP) of < 5 in manufacture and installation.
- All materials used in construction will be responsibly sourced, with certification obtained wherever possible. Materials with a low environmental impact as per the BRE Green Guide will be preferred.

Waste

8.4. Sending waste to landfill has various environmental impacts, such as the release of local pollution, ecological degradation and methane emissions, in addition to exacerbating resource depletion. Waste in housing comes from two main streams; construction waste and domestic waste during occupation.

Household waste

8.5. In this respect regard has been given to the policy advice contained in the NPPF together with the Council's current guidance to ensure that the new dwellings are provided with adequate storage facilities for both waste and recyclable materials.

8.6. Herefordshire Council currently operates domestic waste collection services through which households are able to recycle materials including paper and cardboard, plastic bottles and food containers, tins, glasses and metal foils, together with garden waste.

Construction waste

8.7. The construction process will be managed to monitor and manage construction site waste effectively and appropriately. Target benchmarks for resource efficiency will be set in accordance with best practice – e.g., 5m^3 of waste per 100m^2 / tonnes waste per m^2.

8.8. Wherever possible materials will be diverted from landfill through re-use on site, reclamation for re-use, returned to the supplier where a 'take-back' scheme is in place or recovered and recycled using an approved waste management contractor.

Electric Vehicle Charging

8.9. It is recognised that there is a need to ensure that the development is adaptable to accommodate a future shift in personal transportation to electric vehicles, to promote sustainable transport and to minimise air pollution. As Electric Vehicle (EV) ownership increases, developers have an increasing responsibility to provide EV charging points for occupants.

8.10. It is proposed that one EV charger will be installed per plot, in line with the technical requirements of Approved Document S: Infrastructure for the charging of electric vehicles.

8.11. Further technical details of the charger along with locations will be provided at the appropriate time as the development progresses.

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9. Water Conservation

9.1. In line with Part G of Building Regulations and Policy SD3, water use will be managed effectively throughout the development through the incorporation of appropriate efficiency measures.

9.2. Policy SD3 encourages all new development to meet the Building Regulations optional requirement for tighter water efficiency of 110 litres/occupier/day.

9.3. Water efficiency measures including the use of efficient dual flush WCs, low flow showers and taps and appropriately sized baths will be encouraged with the aim of limiting the use of water during the operation of the development.

9.4. Table 14 shows a typical water demand calculation, and shows how the development could achieve a result less than 110 litres/occupier/day calculated in accordance with Building Regulations 17.K methodology.

Table 14. Typical water demand calculation

Installation Type	Unit of measure	Capacity/ flow rate	Litres/occupier/ day
WC (dual flush)	Full flush (l)	6	8.76
	Part flush (l)	4	11.84
Taps (excluding kitchen taps)	flow rate (l/min)	4	7.90
Bath	Capacity to overflow (l)	181	19.91
Shower	Flow rate (l/min)	8	34.96
Kitchen sink taps	Flow rate (l/min)	6	13.00
Washing Machine	Litres/kg dry load	6.8	14.28
Dishwasher	Litres/place setting	1.04	3.74
Calculated Use			114.4
Normalisation Factor			0.91
Total Internal Consumption (L)			104.1
External Use			5.0
Building Regulations 17.K			109.1

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10. Conclusions

10.1. This Energy and Sustainability Statement has been prepared by AES Sustainability Consultants on behalf of Vistry Homes to detail the proposed approach to sustainable construction to be employed at the Land at Hardwick Bank, Bromyard.

10.2. The development site is located in Bromyard, a town located between Leominster and Worcester, within the administrative boundary of Herefordshire Council. The proposals would deliver 250 dwellings across a mix of dwelling types.

10.3. A review of applicable local and national planning policy has been undertaken, concluding that energy standards should be encouraged and enforced through the applicable national regulations. Consideration will be paid to building design and site-layout to further reduce energy consumption, and a range of additional sustainable design considerations will be addressed.

10.4. This strategy sets out how the proposed development addresses relevant policies contained within the Herefordshire Local Plan Core Strategy 2011 – 2031. The strategy follows a 'fabric first' approach to constructing energy efficient buildings, with insulation standards, thermal bridging and air leakage all improved beyond the minimum compliance levels within the Building Regulations.

10.5. The 'fabric first' approach is supplemented with low-carbon and renewable technology in the form of heat pumps and solar PV to further reduce energy demand and CO_2 emissions, while reducing running costs for the dwelling occupants.

10.6. Calculations undertaken based on a sample range of house types under the approved Standard Assessment Procedure demonstrate that Part L compliant emissions would equate to an estimated 238,236 $kgCO_2$/year. Through following the energy efficiency approach described and with the implementation of low-carbon and renewable technology, the calculated as-designed emissions are reduced by 161,980 $kgCO_2$/year or 67.99% over a Part L 2021 baseline.

10.7. It has also been determined that the calculated water consumption could equate to a maximum water consumption of 109.1 litres/occupier/day, and therefore offer a significant improvement on the maximum of 125 litres/occupier/day allowable by Building Regulations and the 110 litres/occupier/day encouraged by Policy SD3.

10.8. In recognition of the need to ensure that the development is adaptable to accommodate a future shift in personal transportation to electric vehicles, EV charging points will be allocated across the development in accordance with Approved Document S: Infrastructure for charging electric vehicles.

10.9. Policies contained within the Herefordshire Local Plan Core Strategy 2011-2031 are elaborated on within the Draft Supplementary Planning Document: Environmental Building Standards, February 2022. This SPD encourages the adoption of higher building standards and provides a pathway to zero-carbon development.

10.10. This statement details the sustainability measures that have been incorporated in the development proposals in order to comply with relevant policies contained within local adopted policy and elements considered in the Environmental Building Standards Sustainability Checklist.