Harpers Road, Ash

Bellway Homes Limited, South London

Energy and Sustainability Statement

AES Sustainability Consultants Ltd

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This statement has been commissioned by Bellway Homes Limited, South London to detail the proposed approach to energy and CO_2 reduction to be employed in the development of Harpers Road, Ash. 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 Bellway Homes Limited, South London, this Energy and Sustainability Statement has been prepared in support of the application for development at Harpers Road, Ash.

Development Description

1.2. The development site is located on the eastern edge of the town of Aldershot, Hampshire, adjacent to Harpers Road to the east and the railway line to the south. The development lies within the administrative boundary of Guildford Borough Council.

1.3. The proposal would deliver 51 dwellings across a mix of two to five bed detached, semi-detached and terraced houses and one to two bed maisonettes. Affordable dwellings are designated across the site. The proposed site layout is shown in Figure 1.

Purpose and Scope of the Statement

1.4. This statement demonstrates that by following a fabric first approach and with the implementation of renewable technology, the development will reduce carbon emissions over a Part L 2021 baseline, which in itself presents a 31% reduction over previous regulatory standards. The carbon reductions and use of renewable technologies will accord with the recently updated Policy D2 of the Guildford Borough Local Plan: Strategies and Sites 2015-2034, adopted April 2019, as well as Policy D16 of the Guildford Borough Local Plan: Development Management Policies, adopted March 2023.

Figure 1. Harpers Road, Proposed Site Layout

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2. Planning Policy

Local Planning Policy

2.1. The Guildford Borough Local Plan: Strategy and Sites 2015-2034 (adopted April 2019) contains the following key policy relating to sustainable development:

Policy D2: Climate Change, sustainable design, construction and energy

Sustainable design and construction

1) Proposals for zero carbon development are strongly supported. Applications for development, including refurbishment, conversion and extensions to existing buildings should include information setting out how sustainable design and construction practice will be incorporated including (where applicable):

(a) the efficient use of mineral resources and the incorporation of a proportion of recycled and/or secondary aggregates

(b) waste minimisation and reusing material derived from excavation and demolition

(c) the use of landform, layout, building orientation, massing and landscaping to reduce energy consumption

(d) water efficiency that meets the highest national standard and

(e) measures that enable sustainable lifestyles for the occupants of the buildings, including electric car charging points

2) When meeting these requirements, the energy and waste hierarchies should be followed except where it can be demonstrated that greater sustainability can be achieved by utilising measures further down the hierarchy.

3) Major development should include a sustainability statement setting out how the matters in this policy have been addressed. Smaller developments should include information proportionate to the size of the development in the planning application.

Policy D2: Continued...

Climate Change Adaptation

4) All developments should be fit for purpose and remain so into the future. Proposals for major development are required to set out in a sustainability statement how they have incorporated adaptations for a changing climate and changing weather patterns in order to avoid increased vulnerability and offer high levels of resilience to the full range of expected impacts.

Climate change mitigation, decentralised, renewable and low carbon energy

8) All (C)CHP* systems are required to be scaled and operated in order to maximise the potential for carbon reduction.

10) Retail units falling within Use Classes A1, A2, A3 and A4 in Guildford Town Centre are not subject to the carbon reduction requirement at paragraph (9).

11) Planning applications must include adequate information to demonstrate and quantify how proposals comply with the energy requirements at paragraphs 5-10 of this policy. For major development, this should take the form of an energy statement.

2.2. The Guildford Borough Local Plan: Development Management Policies (Adopted, March 2023) contains Policy D16. Policy D2 criteria (5), (6), (7) and (9) of the LPSS have been superseded by LPDMP Policy D16.

Policy D16: Carbon Emissions from Buildings

1) The development of low and zero carbon and decentralised energy, including low carbon heat distribution networks, is strongly supported and encouraged.

2) Where low carbon heat distribution networks already exist, new developments are required to connect to them or be connection-ready unless it can be clearly demonstrated that utilizing a different energy supply would be more sustainable or connection is not feasible.

Policy D16: Continued…

3) Proposals for development within Heat Priority Areas as shown on the Policies Map and all sufficiently large or intensive developments must demonstrate that low carbon heat networks have been given adequate consideration as the primary source of heat.

4) New buildings must achieve an emission rate no higher than the relevant Target Emission Rate (TER) set out in the Building Regulations (Part L).

5) Development proposals are strongly encouraged to improve upon the standards in paragraph 4.

2.3. Other key policies contained within the Guildford Borough Local Plan: Development Management Policies are as follows:

Policy D14: Sustainable and Low Impact Development

Fabric first

1) Development proposals are required to demonstrate how they have followed a 'fabric first' approach in line with the energy hierarchy.

Embodied carbon

2) Development proposals are required to demonstrate that embodied carbon emissions have been minimised by:

a) sourcing materials locally where possible; and

b) taking into account the embodied carbon emissions of materials based on information provided in a respected materials rating database.

3) Proposals for major development are required to demonstrate how they have considered the lifecycle of buildings and public spaces and the materials used to construct them to reduce lifetime carbon emissions.

Policy D14: continued…

Energy improvements

4) Proposals for major development are required to demonstrate how they have considered the lifecycle of buildings and public spaces and the materials used to construct them to reduce lifetime carbon emissions.

Waste

5) Proposals for major development, and development proposals that involve the demolition of at least one building and/or engineering works that involve the importation or excavation of hard core, soils, sand and other material, are required to submit a Site Waste Management Plan.

Water efficiency

6) New developments are expected to incorporate measures to harvest rainwater and conserve water resources and, where possible, water recycling/reuse systems.

Policy D15: Climate Change Adaptation

1) Development proposals are required to demonstrate how new buildings will:

a) be designed and constructed to provide for the comfort, health, and wellbeing of current and future occupiers over the lifetime of the development, covering the full range of expected climate impacts and with particular regard to overheating; and

b) incorporate passive heat control measures, and the exclusion of conventional air conditioning, in line with the cooling hierarchy.

2) New buildings likely to accommodate vulnerable people should demonstrate that their specific vulnerabilities have been taken into account with a focus on overheating.

Policy D15: Continued...

3) Major development proposals within the urban areas shown on the Policies Map are required to demonstrate how the urban heat island effect will be addressed through:

   a) choice of materials;

   b) layout, landform, massing, orientation and landscaping; and

   c) retention and incorporation of green and blue infrastructure as far as possible.

4) Development proposals are required to demonstrate adaptation for more frequent and severe rainfall events through measures including:

   a) retaining existing and incorporating new water bodies;

   b) designing planting and landscaping schemes to absorb and slow down surface water; and

   c) the use of permeable ground surfaces wherever possible.

5) Development proposals in and around areas of high risk of wildfire are required to be designed and managed to prevent the ignition and spread of fire, taking into account the risk to health and potential damage to significant habitats.

Policy D17: Renewable and Low Carbon Energy Generation and Storage

1) Proposals for renewable and low carbon energy generation and energy storage development, covering both power and heat, will be supported, with strong support for community-led initiatives.

2) Where such development is proposed in the Green Belt, climate change mitigation and other benefits will be taken into account when considering whether very special circumstances exist.

3) Proposals are required to demonstrate that the design of the scheme has sought to minimise visual impacts and that the management of the site will maximise opportunities for biodiversity while avoiding practices that are harmful to biodiversity.

4) For temporary permissions, provision must be made for the decommissioning of the infrastructure and associated works and the full restoration of the site once operation has ceased.

National Planning Policy Framework

2.4. 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.

2.5. 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.

2.6. 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

2.7. 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

2.8. The government introduced the next revision in Building Regulations, known as Part L 2021 in December 2021, to come into effect for buildings where construction is commenced after 15th June 2023. The new standards will require a 31% reduction in CO_2 emissions compared with the current Building Regulations standard.

Proposed Strategy

2.9. This statement is intended to establish the proposed approach to sustainable construction, energy, and water demand reduction to be delivered at the development.

2.10. Following review of government policy, it is considered that the Building Regulations standards for energy efficiency are the appropriate baseline energy performance requirements. The development will be designed to meet national standards with respect to Part L 2021 requirements as a minimum, and deliver carbon reductions in line with local adopted policy.

2.11. It is proposed that the development will be constructed following a fabric first approach to meet, and exceed where possible, the current Building Regulations, with insulation standards, thermal bridging and air leakage all improved beyond the minimum compliance levels.

2.12. In addition, consideration will be given to building design, passive solar design and energy efficient site-layouts where possible.

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 water use and the environmental impacts of materials, construction and household waste.

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

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

3. Climate Change Resilience

3.1. 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 resilient to future climate change impacts such as increases in temperature, rainfall, wind and sea level. Climate resilience is important to homeowners against a backdrop of increasingly extraordinary weather events.

Rising Temperatures and Overheating

3.2. With the risk of potentially higher summer temperatures and longer hot spells in the future, it is important to consider the thermal comfort of the dwelling. Passive design measures are proposed in order to mitigate future overheating.

3.3. 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

3.4. 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

3.5. 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

3.6. 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 at night.

Addressing overheating risk

3.7. 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 night-time hours, effectively smoothing out temperature fluctuations within the property.

3.8. 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.

3.9. 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

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

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

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

4. Energy Consumption and CO_2 Emissions

4.1. 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.

4.2. 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.

4.3. 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.

4.4. 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 improvements preceding regulations
L1A 2006	-
L1A 2010	25%
L1A 2013	6%
L1A 2021	31%

Energy Reduction Strategy – Fabric First

4.5. 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.

4.6. 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.

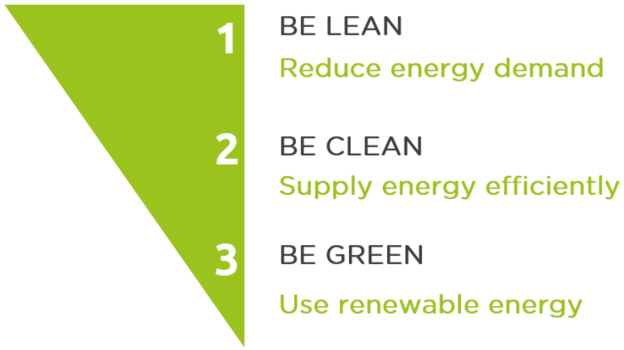

Figure 2. The Energy Hierarchy

Be Lean – reduce energy demand

4.7. 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

4.8. The design and specification of building services to utilise energy efficiently is the next stage of the hierarchy, considering:

- 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

4.9. 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

4.10. 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.

4.11. This approach has been widely supported by industry and government for some time, particularly in the residential sector, with the Zero Carbon Hub2 and the Energy Savings Trust3 having both stressed the importance of prioritising energy demand as a key factor in delivering resilient, low energy buildings.

4.12. 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

4.13. 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/m^2/year.

4.14. 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.

4.15. The TFEE is calculated based on the specific dwelling being assessed with reference values for the fabric elements contained within Approved Document L1A. 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.

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

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

Proposed Fabric Specification

4.16. 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 proposed 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 delivered.

Table 3. Proposed construction specification – main elements

	Part L1 Limiting Fabric Parameters	Proposed 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
Plane roof – u-value	0.16 W/m²K	0.09 W/m²K
Ground floor – u-value	0.18 W/m²K	≤ 0.12 W/m²K
Windows – u-value	1.6 W/m²K	1.30 W/m²K
Doors – u-value	1.6 W/m²K	0.64 - 1.00 W/m²K
Air Permeability	8.00 m³/h.m² at 50 Pa	4.00 m³/h.m² at 50 Pa
Thermal Bridging	Y = 0.20 (default)	Y = ≤ 0.035 (calculated)

Thermal bridging

4.17. 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.

4.18. 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

4.19. 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

4.20. 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

	Design Fabric Energy Efficiency (kWh/m²/year)	Target Fabric Energy Efficiency (kWh/m²/year)	Improvement %
2 Bed End-terraced	35.63	36.22	**1.63**
3 Bed Semi-detached	36.27	37.14	**2.33**
4 Bed Detached	39.22	39.41	**0.48**
5 Bed Detached	41.31	41.68	**0.88**
GF Maisonette	32.79	33.67	**2.61**
1F Maisonette	27.04	29.28	**7.65**

Provisions for Energy-Efficient Operation of the Dwelling

4.21. 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 modern gas-fired heating systems, fully insulated primary pipework, and controls including programmers, thermostats and Thermostatic Radiator Valves to avoid unnecessary heating of spaces when not required.

5. Baseline CO_2 Emissions

5.1. 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.

5.2. 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.

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

Table 5. Part L compliant CO_2 emissions by house type

House type	CO_2 emissions ($kgCO_2/yr$)
2 Bed End-terraced	1,188
3 Bed Semi-detached	1,058
4 Bed Detached	950
5 Bed Detached	918
GF Maisonette	1,246
1F Maisonette	1,287

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

Table 6. Part L compliant baseline CO2 emissions for the site

	Part L Compliant CO_2 emissions ($kgCO_2/year$)
Site-wide emissions baseline	52,025

6. Low Carbon and Renewable Energy Systems

6.1. 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

6.2. A CHP unit can generate 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.

6.3. 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 considered unfeasible for this development.

6.4. 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

6.5. Locating wind turbines adjacent to areas with buildings presents several 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.

6.6. A preliminary examination of the BERR wind speed database indicates that average wind speeds at 10m above ground level are around 5.2m/s [4]. Wind turbines at this site are therefore unlikely to generate enough electrical energy to be cost effective[5]. For these reasons wind power is not considered feasible.

Building Scale Systems

6.7. 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)

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

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

[5] 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 £2,000 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	
• Cost £2,000 - 5,000 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.	

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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 • 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 • Feed in Tariff support mechanism has been discontinued • 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 £1,300 upwards (1kWp+) and scalable • Ongoing offset of electricity fuel costs, 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% • 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 £5,000 - £7,000 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% • 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 £10,000+ • 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

6.9. Following this feasibility assessment, it is considered that there are a range of technically feasible low carbon or renewable energy systems, however a number of these may be discounted on the grounds of increased running costs for residents or other adverse effects:

- Biomass heating systems would require significant storage space for fuel as well as regular deliveries at different times to all dwellings. Local NO_x and particulate pollution is also an increasing concern, and therefore they are not appropriate for this development.

- Ground source heat pump systems may be technically feasible; however, the ground conditions are unknown, and the capital cost is likely to be prohibitive.

- Air source heat pumps may be technically feasible for the houses, however the potential increase in running costs, compared with a gas and solar PV approach, means that it is not a preferred option at this stage.

6.10. Therefore, solar photovoltaic systems are considered the option with the most significant potential for the development.

6.11. It is currently proposed that the whole site will incorporate gas heating systems supplemented with solar PV to meet Part L 2021 standards and reduce running costs.

6.12. It is provisionally assessed that all dwellings will be specified with solar PV systems of between around 0.67 – 4.36 kWp, depending on the specific characteristics of the homes. Full PV system designs will be developed once full SAP calculations can be completed.

7. As-Designed Performance

7.1. 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.

7.2. Table 12 demonstrates the CO_2 reductions achieved through the proposed fabric measures and the addition of PV.

Table 12. CO_2 emissions of sample dwellings

House type	CO_2 emissions ($kgCO_2/yr$)
2 Bed End-terraced	924.11
3 Bed Semi-detached	1003.04
4 Bed Detached	1276.5
5 Bed Detached	1566.25
GF Maisonette	757.12
1F Maisonette	612.5

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

Table 13. Estimated site-wide CO_2 emissions

	CO_2 emissions ($kgCO_2/yr$)	
Part L compliant	52,025	
After fabric measures and PV	50,495	
	$kgCO_2/yr$	%
Total savings	1,530	2.94

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8. Resource Efficiency

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.

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 strategy in terms of waste and recycling to ensure that the new dwellings are provided with adequate storage facilities for both waste and recyclable materials.

8.6. Guildford Borough Council currently operate a household collection service through which households are able to recycle materials including paper and cardboard, plastic bottles, tins, glasses and metal foils, along with a separate collection for garden waste. Future occupiers of the dwellings will be provided with an information pack detailing the Council's current collection arrangements for waste and recycling and advising of the nearest recycling centres to the Application site.

Construction Waste

8.7. The development will additionally be designed 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. A target to divert 85% by weight/volume of non-hazardous construction waste will be applied.

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. The development will comply with Part S of Building Regulations 2021 and provide each dwelling/ allocated parking space a vehicle charging point. EV charging units will be installed to meet the technical requirements of Approved Document S: Infrastructure for the charging of electric vehicles.

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9. Water Conservation

9.1. In line with Part G of Building Regulations 2021, water use will be managed effectively throughout the development through the incorporation of appropriate efficiency measures.

9.2. 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.

9.3. Table 14 shows a typical water demand calculation, and shows how the development will achieve a result less than the 'optional' 110 litres/occupier/day calculated in accordance with Building Regulations 17.K methodology and in accordance with Policy D2 of the Guildford Borough Local Plan: Strategy and Sites 2015-2034.

Table 14. Typical Water Demand Calculation

Installation Type	Unit of measure	Capacity/ flow rate	Litres/occupier/ day
WC (dual flush)	Full flush (l)	4	5.84
	Part flush (l)	2.6	7.70
Taps (excluding kitchen taps)	flow rate (l/min)	5	9.48
Bath	Capacity to overflow (l)	181	19.91
Shower	Flow rate (l/min)	8	34.96
Kitchen sink taps	Flow rate (l/min)	10	14.76
Washing Machine	Litres/kg dry load	8.17	17.16
Dishwasher	Litres/place setting	1.25	4.50
Calculated Use			114.3
Normalisation Factor			0.91
Total Internal Consumption (L)			104
External Use			5.0
Building Regulations 17.K			109

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10. Conclusions

10.1. This Energy and Sustainability Statement has been prepared by AES Sustainability Consultants on behalf of Bellway Homes Limited, South London to detail the proposed approach to sustainable construction to be employed at Harpers Road, Ash.

10.2. The development site is located on the eastern edge of the town of Aldershot, Hampshire, adjacent to Harpers Road to the east and the railway line to the south.

10.3. The proposal would deliver 51 dwellings across a mix of two to five bed detached, semi-detached and terraced houses and one to two bed maisonettes.

10.4. The statement is intended to demonstrate that, following a fabric first approach to demand reduction, the proposed development will deliver a level of energy performance beyond the current Building Regulation standards whilst addressing a range of additional sustainable design considerations.

10.5. A review of National policy including the NPPF and relevant recent Government statements has established that the Building Regulations are considered the appropriate method for setting standards relating to energy use and CO_2 emissions, considering building design and site-layout to further reduce energy consumption.

10.6. This strategy focuses on a 'Fabric First' approach which prioritises improvements to the fabric of the dwellings to avoid unnecessary energy demand and consequent CO_2 production.

10.7. Improvements in insulation specification, efficient building services, a reduction in thermal bridging and unwanted air leakage paths and further passive design measures will enable the relevant standards to be met, whilst building in low energy design and future climate resilience to the design and construction of the dwellings.

10.8. Calculations undertaken on the proposed dwellings under the approved Standard Assessment Procedure demonstrate that, through following the energy efficiency approach described, the calculated as-designed emissions are reduced by 2.94% over Part L 2021 requirements.

10.9. It has also been determined that the calculated water consumption equates to a maximum water consumption of 109 litres/occupier/day, and therefore offers an improvement on the 'optional' 110 litres/occupier/day allowable by Building Regulations 2021.

10.10. With the need to adapt to a shift in personal transportation to electric vehicles, the development will ensure the provision of EV charging points, in accordance with Approved Document S of Building Regulations.