

Land North of Arborfield Road, Shinfield

Bellway Homes (Thames Valley)

Energy Statement

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This statement has been commissioned by Bellway Homes Thames Valley to detail the proposed approach to sustainable construction in the development of The Land North of Arborfield Road, Shinfield. 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. This Energy & Sustainability Statement has been prepared on behalf of Bellway Homes (Thames Valley), in support of the application for development of the site known as Land North of Arborfield Road, Shinfield.

Development Description

- 1.2. Full planning application for the erection of new dwellings, open space, landscaping, supporting infrastructure and associated works.
- 1.3. The development site is located in the village of Shinfield, approximately 3.8 miles South East of Reading City Centre and 4.5 miles West of Wokingham, within the boundary of Wokingham Borough Council.
- 1.4. The proposed development addressed within this statement comprises of 191 dwellings across a mix of one to four bed dwellings, including affordable and private houses and apartments. The proposed site layouts is shown in Figure 1.

Purpose and Scope of the Statement

- 1.5. This statement details the proposed strategy to energy and CO₂ reduction to be employed at the development. It demonstrates that by following a fabric first approach and with the implementation of low carbon heating systems and renewable technology, the development will reduce carbon emissions significantly in excess of current regulatory standards, while according with relevant policies contained within the Wokingham Borough Local Plan, adopted January 2010.
- 1.6. This statement demonstrates that following a fabric first approach, the development will reduce CO₂ emissions through an improved fabric specification, a reduction in air leakage and thermal bridging.
- 1.7. Future changes to national guidance affecting the application of these policies have been reviewed, together with an examination of how the proposed strategy aligns with the future direction of government policy relating to carbon reductions and the Building Regulations.
- 1.8. This statement demonstrates that the development will be designed and constructed to meet the Part L 2021 standards, equating to a circa 31% improvement over previous regulatory standards and Future Home Standard, providing a 75-80% CO₂ reduction compared with Part L1a 2013 regulatory standards.



Figure 1. Land North of Arborfield Road Proposed Site Plan

2. Planning Policy

Local Planning Policy

- 2.1. This Energy Statement addresses local planning policy relating to sustainable design and construction, principally contained within the Wokingham Borough Local Development Framework Core Strategy, adopted in January 2010 and the associated Design and Sustainability Supplementary Planning Document (SPD). The relevant extracts from these documents are included below.

LOCAL PLAN - POLICY CP1

12. Contribute towards the goal of reaching zero-carbon developments as soon as possible by:

- a) Including appropriate on-site renewable energy features; and
- b) Minimising energy and water consumption by measures including the use of appropriate layout and orientation, building form, design and construction, and to design to take account of microclimate so as to minimise carbon dioxide emissions through giving careful consideration to how all aspects of development form.

Design and Sustainability SPD

7.5 The Council therefore encourages all residential development schemes should seek to be built to full Code Level 4 or whatever the mandatory Code Level is higher. However, this is an aspirational (non-mandatory) target. Developments will need to be built in line with mandatory Code timetable. Local mandatory requirements for developments to exceed statutory requirements for sustainable buildings may be included within the emerging MDD DPD, as indicated in paragraph 4.8 of the adopted Core Strategy. Policy CP1 (Sustainable Development) of the Core Strategy requires development proposals to contribute towards the goal of reaching zero carbon developments as soon as possible.

7.6 The 10% renewable or low carbon energy requirement of Policy NRM11 of the South East Plan is required for major development. However, the Council considers that renewable energy/low carbon technology can be used as part of reaching the Code Levels. Zero Carbon Homes will be legally required by 2016.

POLICY CC05: RENEWABLE ENERGY AND DECENTRALISED ENERGY NETWORKS

1. Local opportunities to contribute towards decentralised energy supply from renewable and low-carbon technologies will be encouraged
2. Planning permission will only be granted for proposals that deliver a minimum 10% reduction in carbon emissions through renewable energy or low carbon technology where the development is for:
 - a. Schemes of more than 10 dwellings (gross), or
 - b. Non-residential proposals of more than 1,000 sq m gross floorspace.
3. Proposals for renewable energy and decentralised energy works, including wind turbines, must demonstrate that:
 - a. They are appropriate in scale, location and technology type;
 - b. Are compatible with the surrounding area, including the impact of noise and odour;
 - c. Do not have a damaging impact on the local topography and landscape;
 - d. There is no significant impact upon heritage assets, including views important to their setting;
 - e. In the case of wind turbines, take account of their cumulative effect and properly reflect their increasing impact on the landscape and on local amenity

- 2.2. This Energy Statement addresses local planning policy relating to sustainable design and construction, contained within the Managing Development Delivery Development Plan Document (Local Plan) Proposed Submission, adopted in June 2012.

Policy CC05: Renewable energy and decentralised energy networks

1. Local opportunities to contribute towards decentralised energy supply from renewable and low-carbon technologies will be encouraged
2. Planning permission will only be granted for proposals that deliver a minimum 10% reduction in carbon emissions where the development is for:
 - a) Schemes of more than 10 dwellings (gross), or
 - b) Non-residential proposals of more than 1,000 sq m gross floorspace.
3. Any proposals for renewable energy and decentralised energy works, including wind turbines must demonstrate that:
 - a) It is appropriate in scale, location and technology type
 - b) It is compatible with the surrounding area, including the impact of noise and odour
 - c) There is no negative cumulative visual impact

Policy CC04: Sustainable Design and Construction

Planning permission will only be granted for proposals that demonstrate the following:

1. All new homes shall at least:
 - a) Meet requirements of the full Code for Sustainable Homes Level 4
 - b) Meet internal potable water consumption targets of 105 litres or less per person per day (as part of the requirement to meet full Code for Sustainable Homes Level 4).
2. All new non-residential proposals of more than 100 sq m gross non-residential floorspace shall at least:
 - a) Achieve the necessary mandatory Building Research Establishment Assessment Method (BREEAM) requirements or any future national equivalent
 - b) Meet or exceed statutory requirements for water resource management.
3. All development, including conversions, alterations and extensions shall incorporate suitable waste management facilities, including on-site recycling.

National Planning Policy Framework

- 2.3. In December 2023, 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.
- 2.4. 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.
- 2.5. Paragraph 159 sets out what is expected from new developments when considering strategies to mitigate and adapt to climate change:

159. New development should be planned for in ways that:

- a) 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
- b) 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

- 2.6. 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
- 2.7. 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 CO₂ emissions compared with the current Building Regulations standard.

Future Homes Standard

- 2.8. The government has indicated that the next step change in energy standards is likely to be introduced as the Future Homes Standard in 2025. This standard will be subject to consultation over the next few years to define the fabric and services standards that will be required, however it has been indicated that carbon reduction standards of 75-80% better than Part L 2013 will be introduced.
- 2.9. At this stage it is not clear on whether similar transitional arrangements will apply and when the regulations may be introduced, however it is expected that these standards will affect a significant proportion of the proposed development.

Proposed Strategy

- 2.10. This statement is intended to establish the proposed approach to sustainable construction and energy demand reduction to be delivered at the development.
- 2.11. It is proposed that the building will be constructed following a fabric first approach to meet, and exceed where possible, Building Regulations 2021 standards, with insulation, thermal bridging and air leakage all improved beyond the minimum compliance levels and low carbon or renewable energy systems integrated. The development will be built under Future Home Standard, providing a 75-80% CO₂ reduction compared with Part L 2013 regulatory standards.
- 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. 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.
- 2.14. In addition, consideration will be given to building design, passive solar design and additional sustainability measures.

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.
- 3.2. Passive design measures will be considered and incorporated to enhance resilience to climate change impacts throughout the lifetime of the development.

Rising Temperatures and Overheating

- 3.3. 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.

Approved Document O

- 3.4. In order to address overheating risk more robustly, the Government has introduced a new Approved Document, 'Part O', into the Building Regulations.
- 3.5. 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.
- 3.6. This assessment will be undertaken at the start of detailed design and any mitigation measures that may be required will be built in.

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 nighttime 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. When possible 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.

4. Energy Consumption and CO₂ 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 CO₂ standards contained within Part L were increased in 2010 and 2013, reducing the 'Target Emission Rate' (TER) by approximately 25% and a further 6% (9% for non-residential) respectively, requiring substantial improvements to thermal insulation and heating services, or a significant increase in on-site renewable energy provision.
- 4.4. The 2021 uplift to the regulations will require a further 31% reduction in emissions, delivering dwellings with emissions levels less than half of homes built to L1A 2006 standards.

Table 1. CO₂ Emissions improvements from successive Part L editions

Building Regulations	CO ₂ emissions improvements
L1A 2006	-
L1A 2010	25%
L1A 2013	6%
L1 2021	31%

Energy Reduction Strategy – Fabric First

- 4.5. 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 3).

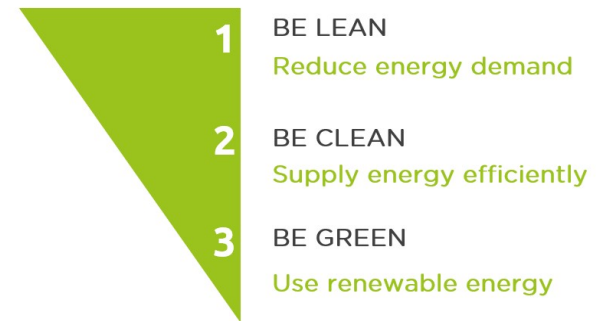


Figure 3. The Energy Hierarchy

Be Lean – reduce energy demand

- 4.6. 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 overshadowing 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

4.7. 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

4.8. 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

4.9. 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.

4.10. 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.

4.11. 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

4.12. In addition to the CO₂ 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), expressed in kWh/m²/year.

4.13. This standard enables the decoupling of energy use from CO₂ emissions and serves as an acknowledgement of the importance of reducing demand, rather than simply offsetting CO₂ emissions through low carbon or renewable energy technologies.

4.1. 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. These standards have been tightened under Part L 2021, The proposed approach and 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

Fabric Standards

- 4.2. In order to ensure that the energy demand of the development is reduced, the dwellings have been 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 2021 limiting fabric parameters in order to demonstrate the potential improvements.

Table 3. Proposed Construction Specification – Main Elements

	Part L1 2021 Limiting Fabric Parameters	Proposed Specification
External wall – u-value	0.26 W/m ² K	0.18 W/m ² K
Party wall – u-value	0.20 W/m ² K	0.00 W/m ² K
Plane roof – u-value	0.16 W/m ² K	0.09 W/m ² K
Ground floor – u-value	0.18 W/m ² K	<0.12 W/m ² K
Windows – u-value	1.60 W/m ² K	1.30 W/m ² K
Doors – u-value	1.60 W/m ² K	1.4 W/m ² K
Air Permeability	8.00 m ³ /h.m ² at 50 Pa	4.00 – 5.01 m ³ /h.m ² at 50 Pa

Thermal Bridging

- 4.3. 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 CO₂ reduction targets.
- 4.4. The specification seeks 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

- 4.5. 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 $\leq 4.00 - 5.01$ m³/h.m² at 50Pa, with pressure testing of all dwellings to be undertaken on completion to confirm that the design figure has been met.

Provisions for Energy-Efficient Operation of the Dwelling

- 4.6. 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 Air Source Heat Pumps, with controls enabling different temperature profiles in a minimum of two defined zones, a measure which services to avoid unnecessary heating of spaces when not required – for example, bedrooms and living rooms with differing hours of occupancy.

5. Low Carbon and Renewable Energy

- 5.1. A range of technologies have been assessed for potential incorporation into the scheme with the intent of delivering compliance with the carbon reduction targets contained within Part L 2021 and FHS.

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. However, the reduced emissions from the national grid due now means that CHP systems will not deliver CO₂ savings.
- 5.3. In addition, 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.
- 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.

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 4.9m/s⁴. Wind turbines at this site are therefore unlikely to generate sufficient quantities of electrical energy to be cost effective⁵. For these reasons wind power is not considered feasible.

⁴ NOABL Wind Map (<http://www.rensmart.com/Weather/BERR>)

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 4-9.

⁵ CIBSE TM38:2006. Renewable energy sources for buildings.

Table 4. Individual biomass heating feasibility appraisal

Potential Advantages	Risks & Disadvantages
- Potential to significantly reduce CO₂ 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 however air quality concerns mean that it is not considered appropriate.	

Table 5. Solar thermal systems feasibility appraisal

Potential Advantages	Risks & Disadvantages
- Mature and reliable technology offsetting the fuel required for heating water (typically gas) - 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.	

Table 6. Solar photovoltaic systems feasibility appraisal

Potential Advantages	Risks & Disadvantages
- The technology offsets the high carbon content of 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 (mansafe 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 £1,500 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, carbon saving potential and limited additional impacts mean that PV is considered a feasible option for this development.	

Table 7. 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 - With grid decarbonisation will be a low carbon heating source in future	- Air source heat pumps are powered by electricity, with a significantly higher unit price than gas, leading to potentially increased running costs - 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
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..	

Table 8. 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 - With grid decarbonisation will be a low carbon heating source in future	- 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 - Ground source heat pumps are powered by electricity with a significantly higher unit price than gas, leading to potentially increased running costs - 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+ - Running cost linked to COP of heat pump, however, likely to be higher than mains gas.	
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.	

Table 9. Hot Water Heat Pump Feasibility Appraisal

Potential Advantages	Risks & Disadvantages
- Hot water demand met through grid electricity with low effective emissions factor - Heat pump element increases efficiency over immersion heater, circa 200%+ - No external heat exchanger requirement, only intake and exhaust duct runs - Low noise levels - Compact solution in same footprint as hot water cylinder	- Maximum length of duct runs means that cylinder positioning needs to be considered within the dwelling - Less appropriate for larger dwellings with higher hot water demands due to potentially slower recharge rate - Some noise, however likely to be easily suppressed with appropriate cylinder location - Space heating must be met through separate system
Conclusions	
Hot water heat pumps are considered feasible for dwellings with a relatively low number of wet rooms and appropriate cylinder location to allow for duct runs to building façade.	

Summary

5.9. 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.

Low carbon heating systems

- 5.10. In order to take full advantage of the low carbon opportunities that electrification of heat provides; the energy must be used efficiently.
- 5.11. It is proposed that the development will supply heat through air source heat pump systems, taking advantage of 'free' environmental heat to boost system efficiencies to 250% or above.
- 5.12. These measures alone will deliver carbon reductions of circa 60-70% over Part L 2021 standards.

Renewable Energy

- 5.13. Any shortfall from the FHS carbon reduction requirements will be met through on-plot generation of renewable energy.
- 5.14. It is considered that solar PV systems are most appropriate in meeting a significant proportion of energy demand without introducing additional energy loss through larger hot water cylinders.
- 5.15. PV system designs will be worked up at the Design stage to meet the targets for primary energy and carbon within the part L 2021. Full PV system designs will be developed once the calculations can be completed.

6. Site Wide Carbon savings

- 6.1. Through following the strategy described, the dwellings will significantly reduce energy demand and consequent CO₂ emissions beyond a Part L 2021 compliant level of performance through the dwelling fabric, the use of Air Source Heat Pumps (ASHP) and the incorporation of solar PV systems.
- 6.2. Using SAP 10 software, dwellings have been assessed under Part L 2021 to establish the CO₂ emissions of the development, with the proposed fabric strategy applied to provide an overview of the as-designed CO₂ emissions.
- 6.3. Table 10 demonstrates the site-wide savings over and above the Part L 2021 compliant baseline that will be delivered.

Table 10. Site-wide CO₂ emission reductions achieved

	CO ₂ Emissions (kgCO ₂ /yr)	
Part L 2021 compliant baseline	199,961	
Part L 2021 calculated emissions	55,008	
	kgCO ₂ /yr	%
Total site-wide savings	144,953	72.49

- 6.4. It will be ensured as design progresses that revised calculations will be undertaken on a plot-by-plot basis to accurately represent the final CO₂ emissions of the development.
- 6.5. All dwellings constructed beyond the implementation of the Future Homes Standard, which is expected to be introduced in 2025, will meet a 75-80% reduction in CO₂ emissions compared with Part L 2013. It will be ensured as design progresses that revised calculations will be undertaken on a plot-by-plot basis under the relevant Part L to accurately represent the final CO₂ emissions of the development.
- 6.6. It is therefore considered that the emissions reductions presented in this statement are expected to be significantly exceeded once the Future Homes Standard is defined and comes into force.

Table 11. dwelling performance – CO₂ emissions

House type	Part L compliant emissions (kgCO ₂ /m ² /year)	As-designed emissions (kgCO ₂ /m ² /year)	Improvement %
Arkwright Detached	9.55	2.78	70.89
Baker Semi/End Terrace	11.68	2.62	77.57
Cartographer Semi	10.48	2.83	73.00
Harper Semi/End Terrace	10.46	2.38	77.25
Hooper Semi/End Terrace	11.37	2.21	79.79
Pargeter Detached	10.61	3.07	71.07
Parkman Semi	10.11	3.45	65.88
Ploughwright Semi	11.07	2.81	74.62
Reedmaker Detached	10.15	2.92	71.23
Scrivener Detached	10.88	2.93	73.07

7. Sustainable Design

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

Materials

- 7.2. 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.
- 7.3. 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

- 7.4. 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

- 7.5. 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.

- 7.6. Wokingham Borough 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

- 7.7. The construction process will be managed to effectively and appropriately monitor and manage construction site waste. Target benchmarks for resource efficiency will be set in accordance with best practice – e.g., 5m³ of waste per 100m² / tonnes waste per m².
- 7.8. 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.

Water Conservation

- 7.9. In line with current Building Regulations, water use will be managed effectively throughout the development through the incorporation of appropriate efficiency measures.
- 7.10. 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 to limit the use of water during the operation of the development to limit water use.
- 7.11. Table 12 shows how the development could achieve a water efficiency of under 110 litres/person/day calculated in accordance with Building Regulations 17.K methodology.
- 7.12. The calculation results in a total water consumption of 106.8 Litres/Person/Day for the intended specification, below the maximum of 110 Litres/Person/Day required by Building Regulations.

Table 12. Example Water Demand Calculation – Subject to specification adjustments

Installation Type	Unit of measure	Capacity/ flow rate	Litres/Person/Day
WC (dual flush)	Full flush (l)	6	8.76
	Part flush (l)	3	8.88
Taps (excluding kitchen taps)	flow rate (l/min)	3.80	7.58
Bath	Capacity to overflow (l)	155	17.05
Shower	Flow rate (l/min)	8	34.96
Kitchen sink taps	Flow rate (l/min)	6	13.00
Calculated Use			111.89
Normalisation Factor			0.91
Total Internal Consumption (L)			101.82
External Use			5.0
Building Regulations 17.K			106.8

Electric Vehicle Charging

7.13. It is recognized 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.

7.14. The development will therefore provide EVC infrastructure to all dwellings.

8. Conclusions

- 8.1. This Energy Statement has been prepared by AES Sustainability Consultants on behalf of Bellway Homes (Thames valley) to detail the proposed approach to sustainable construction to be employed at the Land North of Arborfield Road, Shinfield development.
- 8.2. The development site is located on the parcel of land North of Arborfield Road, within the administrative boundary of Wokingham Borough Council. The proposed development addressed within this statement comprises of 191 dwellings across a mix of one to four bed dwellings, including affordable and private houses and apartments.
- 8.3. 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.
- 8.4. This strategy sets out how the proposed development addresses relevant policies contained within the Wokingham Borough Council Local Development framework. 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. LPA is also working at the moment on a new local plan – the Local Plan Update – which will put in place a new planning strategy for the period to 20130. At the moment no more details have been released to the public.
- 8.5. It is expected that all dwellings will be constructed beyond the implementation of the Future Homes Standard, which is expected to be enforced in 2025, therefore will meet a 75-80% reduction in CO₂ emissions compared with current regulatory standards.
- 8.6. Calculations undertaken under the approved Standard Assessment Procedure demonstrate that Part L 2021 compliant emissions would equate to an estimated 199,961 kgCO₂/year. Through following the energy efficiency approach described, the calculated as-designed emissions are reduced by 144,953 kgCO₂/yr, a saving of 72.49 % over Part L 2021 requirements. This equates to a saving of circa 81.02 % when compared to 2013 requirements.
- 8.7. A range of additional sustainability measures have been given consideration including reduction of both construction and household waste.
- 8.8. A typical water calculation shows how the development could achieve a total water consumption of 106.8 /Person/Day for the intended specification, below the maximum of 110Litres/Person/Day required by Condition 29.

- 8.9. All dwellings will have Electric Vehicle charging (EVC) infrastructure to ensure the development is adaptable in accommodating a future shift to electric vehicles for personal transportation.