



Energy Strategy

Land to the West of Bines Road, Partridge Green

On behalf of Croudace Homes Limited

ST.H.RH13-0

R01

Date: 24 October 2024

Revision History

Revision	Issue Date	Description	Issued by	Checked by
00	03/10/24	Draft Report	MK	DS
01	24/10/24	Final Report	MK	MW

This report has been produced by Energist for the private use of the client and solely in relation to the named project. It should neither be reproduced in part or in whole nor distributed to third parties, without the express written permission of both Energist and the Client.

All advice provided by Energist regarding the performance of materials is limited solely to the purposes of demonstrating compliance with the services Energist has been appointed to deliver. The performance of materials under other criteria, including but not limited to fire, structural or acoustics, are not considered in our advice and it is the responsibility of the Client to ensure the wider suitability of materials specified in our assessments.

Calculations contained within this report have been produced based on information supplied to Energist by the Client and the Design Team. Any alterations to the technical specification on which this report is based will invalidate its findings.

Energist, Suite 210, Watermoor Point, Cirencester, GL7 1LF

08458 386 387

info@energistuk.co.uk

Contents

EXECUTIVE SUMMARY.....	4
1. INTRODUCTION.....	7
2. BASELINE ENERGY DEMAND.....	11
3. BE LEAN – REDUCED ENERGY DEMAND.....	13
4. BE CLEAN – SUPPLY ENERGY EFFICIENTLY.....	16
5. BE GREEN – LOW-CARBON AND RENEWABLE ENERGY.....	18
6. MAINS WATER CONSUMPTION	21
7. CONCLUSIONS AND RECOMMENDATIONS.....	22
APPENDICES.....	25
APPENDIX 1: LIST OF ABBREVIATIONS	25
APPENDIX 2: PLANNING POLICY AND DESIGN GUIDANCE	26
APPENDIX 3: SAP RESULTS.....	30
APPENDIX 4: LZCT ASSESSMENT	31
APPENDIX 5: WATER CALCULATIONS	41

EXECUTIVE SUMMARY

This Energy Strategy has been produced by Energist UK on behalf of Croudace Homes Limited ('the Applicant').

The Applicant seeks to make this a sustainable development that complements the character of the surrounding area and sets a high benchmark for future development. The Applicant will seek to go above and beyond many of the standards expected, including aligning with the Future Homes Standard (FHS), expected to be introduced in 2025. This standard is part of the UK government's broader strategy to improve the energy efficiency of new homes. It will set out requirements for new homes to produce 75-80% less carbon emissions compared to those built to the Approved Document L (AD L) 2013. The aim is for all new homes to be "zero carbon ready," meaning they will not require retrofitting to become zero carbon as the electricity grid decarbonises.

This statement will set out the measures planned by the Applicant to achieve significant CO₂ emission reductions at the proposed development site: Land to the West of Bines Road, Partridge Green ('the Development') demonstrating compliance with:

- i) The Climate Change Act (2008).
- ii) National Planning Policy Framework (NPPF, 2023).
- iii) Approved Document L Volume 1: Dwellings (2021).
- iv) Horsham District Planning Framework (2015):
 - Policy 35, Strategic Policy: Climate Change.
 - Policy 36, Strategic Policy: Appropriate Energy Use.
 - Policy 37, Sustainable Construction.

The development has optimised every opportunity to reduce on-site emissions by integrating efficient building fabric, innovative design, and advanced heating systems, resulting in substantial CO₂ emission reductions compared to the baseline. The applicant decided to commit to a design approach that aligns with the principles of the energy hierarchy. The development is anticipated to achieve a total reduction in regulated CO₂ emissions of **80%** over the Target Emission Rate (TER) Approved Document Part L (AD L) 2021 through the following measures: 'Be Lean', 'Be Clean' and 'Be Green'.

Table 1 - Measures incorporated to deliver the energy standard at Land to the West of Bines Road, Partridge Green

Be Lean	<ul style="list-style-type: none"> Energy-efficient building fabric: High-performance insulation applied to all heat loss areas, including floors, walls, and roofs. High-efficiency glazing: Triple-glazed windows throughout the development to minimise heat loss. Airtightness: Quality of construction will be ensured through achieving excellent air-tightness results across the building. Efficient building services: Efficient building services including high-efficiency heating systems, will be implemented. Ventilation: Efficient MVHR systems installed in the apartments. Low-energy lighting: Energy-saving lighting solutions will be installed throughout the development.
Be Clean	<ul style="list-style-type: none"> No CO₂ or energy demand reductions from 'Be Clean' at this stage.
Be Green	<ul style="list-style-type: none"> Space heating and domestic hot water systems: Individual ASHPs to provide space heating and hot water across the development. Solar photovoltaics (PV): A total of 241.6 kWP of solar PV panels will be installed to optimise energy generation.

In line with the strategy outlined above, the effectiveness of the design measures, along with the low-carbon and renewable energy solutions, in fulfilling the Applicant's commitment to the energy standard, is demonstrated in Table 2 and Figure 1 below.

Table 2 – CO₂ emissions at each stage of the energy hierarchy for the residential element

	CO ₂ emissions	
	kgCO ₂ per annum	% reduction
Target Emission Rate: Compliant with AD L 2021	102,211	-
Be Lean: <i>After demand-reduction measures</i>	78,122	23.6%
Be Clean: <i>Viability of heat networks</i>	78,122	0%
Be Green: <i>Low-carbon and renewable energy</i>	20,455	56.4%
Total savings	81,755	80.0%

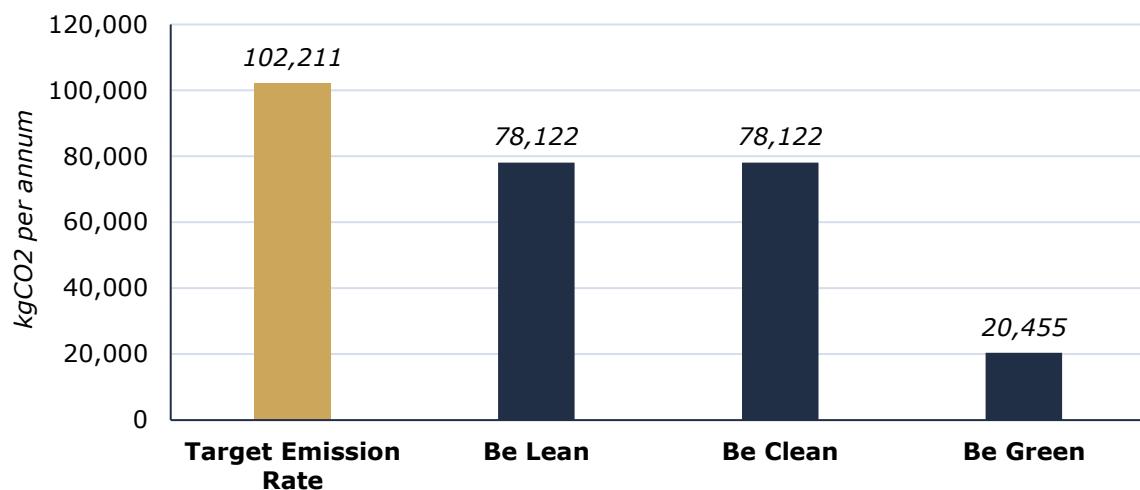


Figure 1 - How the Development delivers the energy standard

1. INTRODUCTION

1.1 Site Description

This Energy Strategy has been developed for the proposed residential development at Land to the West of Bines Road, Partridge Green, under the jurisdiction of Horsham District Council, England. The project will consist of 101 residential units, including 46 affordable homes (ranging from 1- to 4-bed units) and 55 open-market dwellings (ranging from 1- to 5-bed units). The housing types will vary from apartments to terraced, semi-detached, and detached homes. The development is designed to address local housing demand while complying with stringent sustainability and energy efficiency standards, striking a balance between meeting community needs and promoting environmentally responsible construction practices.

The site spans approximately 6.3 hectares, providing ample space not only for housing but also for the incorporation of green spaces. The design strategy maximises the available land to optimise energy performance, enhance biodiversity, and improve the overall environmental quality of the development.



Figure 2 – The illustrative layout of the site at Land to the West of Bines Road, Partridge Green
[Source: ECE Architecture, drawing number: PL-02]

1.2 Purpose of the Energy Strategy

This Energy Strategy has been produced by Energist UK on behalf of Croudace Homes Limited ('the Applicant'). It outlines climate change mitigation measures for the development at Land to the West of Bines Road, Partridge Green. This report supports an outline planning application for residential development at Land to the West of Bines Road, Partridge Green.

The Applicant will seek to go above and beyond many of the standards expected, including aligning with the FHS. It will set out requirements for new homes to produce 75-80% less carbon emissions compared to those built to the Approved Document L (AD L) 2013.

This Energy Strategy will demonstrate the approach adopted by the applicant to comply with:

- i) The Climate Change Act (2008).
- ii) National Planning Policy Framework (NPPF, 2023).
- iii) Approved Document L Volume 1: Dwellings (2021).
- iv) Horsham District Planning Framework (2015):
 - Policy 35, Strategic Policy: Climate Change,
 - *on enhancing development's Energy Efficiency:*
Development should reduce energy use during construction and improve energy efficiency, with a focus on influencing occupants' behaviour to reduce energy consumption;
 - *on implementing Low-Carbon Energy:*
Encourage the use of decentralised, renewable, and low-carbon energy supply systems.
 - Policy 36, Strategic Policy: Appropriate Energy Use,
 - *on following the below energy hierarchy:*
 - 1) *Lean – use less energy – e.g. through demand reduction*
 - 2) *Clean – supply energy efficiently – e.g. through heat networks*
 - 3) *Green – use renewable energy sources*
 - *on evaluating the viability of heat networks in accordance with the following hierarchy:*
 - 1) *Connection to existing (C)CHP distribution networks*
 - 2) *Site wide renewable (C)CHP*

- 3) Site wide gas-fired (C)CHP
- 4) Site wide renewable community heating/cooling
- 5) Site wide gas-fired community heating/cooling
- 6) Individual building renewable heating
- 7) Individual building heating, with the exception of electric heating

- Policy 37, Sustainable Construction,
 - *on enhancing development's Energy Efficiency:*
Maximise energy efficiency and integrate renewable or low-carbon energy;
 - *on Domestic Hot Water usage:*
Limit water usage to 110 litres/person/day.

The way in which the Applicant meets the energy standard and CO₂ reduction target at Land to the West of Bines Road, Partridge Green will be explained in further sections of this report.

1.3 Methodology

ENERGY HIERARCHY

This Energy Strategy is assessed against, and presented, to align with the following steps (please refer to the figure below):

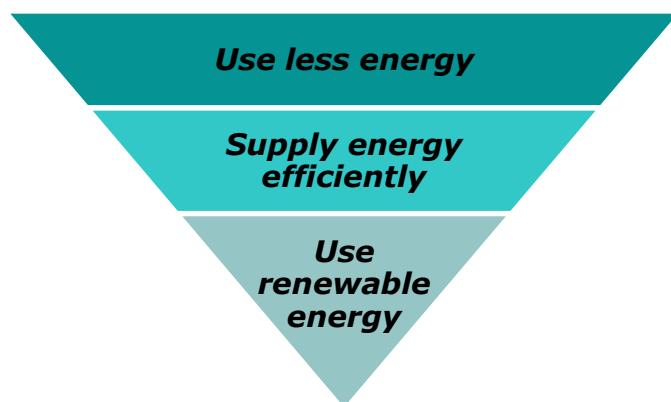


Figure 3 - Three-tier energy hierarchy

This three-tier energy hierarchy is based on widely recognised sustainable energy planning principles, consistent with UK national policy frameworks such as the NPPF and

the guidance from the Department for Energy Security and Net Zero (DESNZ). This approach prioritises energy demand reduction ('use less energy'), followed by efficient energy supply ('supply energy efficiently'), and the integration of renewable energy technologies ('use renewable energy').

SAP

Energist UK employed the SAP 10.2 methodology to calculate the energy demand for 11 representative units within the development. This sample data was carefully modelled and subsequently extrapolated to estimate the overall CO₂ emissions and energy demand for all the proposed homes included in the development application. The assessment was conducted using the available architectural drawings of the standard house types provided by Croudace Homes Limited, ensuring that the energy performance predictions are tailored to the specific design characteristics of the development. This approach allows for a comprehensive analysis of the development's energy efficiency, ensuring compliance with current regulatory standards and providing a robust foundation for future energy strategy decisions.

2. BASELINE ENERGY DEMAND

2.1 Introduction

At each stage of the energy hierarchy, the estimated energy performance of the development has been calculated using the SAP 10.2 methodology to calculate representative dwellings consisting of each unit type configuration for one and two bed apartments. This sample size is considered appropriate for the purposes of extrapolation.

SAP calculates the regulated energy demands associated with hot water, space heating and fixed electrical items. Part L is used for the purposes of the new build energy assessment.

The design specifications for the Baseline (compliant with AD L 2021) are listed in the table below.

Table 3 – Design specification for the Baseline

Element	Design specification for the Baseline
Ground Floor (W/m ² .K)	0.13
External Wall U-Value (W/m ² .K)	0.18
Party Wall U-Value (W/m ² .K)	0 (<i>fully filled and sealed</i>)
Roof U-Value (W/m ² .K)	0.11
External Door U-Value (W/m ² .K)	1.00
Glazing U-Value (W/m ² .K)	1.20 (<i>double-glazed units</i>)
Glazing G-Value	0.63
Design Air Permeability (m ³ /m ² hr @50 Pa)	5.0
Thermal Bridging	SAP 10 Appendix R values
Lighting (W/m ²)	100% of 80 lm/W
Ventilation	Natural ventilation with intermittent extract fans

Space Heating	92.3% efficient gas boiler
Space Heating Controls	Standard controls (<i>time and temperature zone control, thermostatic radiator valves</i>)
Domestic Hot Water Heating	From main heating system
PV system	For houses: kWp = 40% of ground floor area, including unheated spaces / 6.5 For flats: kWp = 40% of dwelling floor area / (6.5 ' number of storeys in block)

The cumulative floor areas for representative, sample dwellings have been used to estimate the Target Emission Rate (TER) and Dwelling Emission Rate (DER) for new dwellings, within the development proposals.

2.2 Development's Baseline

The resulting TER, representing the total maximum CO₂ emissions permitted for the development has been calculated as **102,211 kgCO₂ per annum**. To ensure compliance with AD L 2021, CO₂ emissions should not exceed this figure.

Table 4 - Development's Target Emission Rate for Residential Element

	CO ₂ emissions	
	kgCO ₂ per annum	% reduction
Target Emission Rate: Compliant with AD L 2021	102,211	-

3. BE LEAN – REDUCED ENERGY DEMAND

3.1 Introduction

The development achieves a high quality, sustainable design by integrating the following passive and active design measures to reduce energy demand:

- Energy-efficient building fabric and insulation to all heat loss floors, walls and roofs
- High-efficiency triple-glazed windows throughout
- Quality of build will be confirmed by achieving good air-tightness results throughout
- Efficient-building services including high-efficiency heating systems
- Low-energy lighting throughout the building

Designing an efficient thermal envelope significantly reduces the need for space heating by minimising heat transmittance through the building's thermal elements. Additionally, achieving low air permeability further lowers heating demand by limiting the amount of air that can infiltrate the building, effectively reducing heat loss during winter and minimising heat gain in summer.

Energist UK has considered a fabric-first approach as the priority solution for this Development with exemplary passive design features to align with the FHS.

Table 5 – 'Fabric First' design specification for Land to the West of Bines Road, Partridge Green

Element	Proposed 'Be Lean' Design Specification
Ground Floor (W/m ² .K)	0.12
External Wall U-Value (W/m ² .K)	0.15
Party Wall U-Value (W/m ² .K)	0 (<i>fully filled and sealed</i>)
Roof U-Value (W/m ² .K):	
▪ Main Roof	0.11
▪ Bay Roof	0.14
▪ Dormer Roof	0.14

External Door U-Value (W/m ² .K)	1.00
Glazing U-Value (W/m ² .K)	0.80 (triple-glazed units)
Glazing G-Value	0.50
Design Air Permeability (m ³ /m ² hr @50 Pa)	4.0
Thermal Bridging	SAP 10 Appendix R values
Lighting (W/m ²)	100% of 80 lm/W
Ventilation	Highly efficient MVHR (model used for SAP calculations: Vent-Axia Sentinel Kinetic Plus B)
Space Heating	92.3% efficient gas boiler*
Space Heating Controls	Zone controls, delayed start thermostat
Domestic Hot Water Heating	From main heating system
PV system	For houses: kWp = 40% of ground floor area, including unheated spaces / 6.5 For flats: kWp = 40% of dwelling floor area / (6.5 ' number of storeys in block)

* *Note: By using a standard system like gas boilers in the 'Fabric First' stage, a consistent baseline is established to measure the energy savings achieved solely through improvements in the building's fabric. This approach ensures that any reductions in energy demand are due to the efficiency of the building design itself, rather than the heating system. This standardisation allows for a like-for-like comparison of energy performance across different buildings or design options. Additionally, ventilation and lighting are assessed in this stage as they significantly impact the building's overall energy efficiency. The actual heating system, along with renewable technologies, is introduced in later stages to enhance these foundational efficiencies.*

3.2 Development's 'Be Lean' stage results

The total calculated CO₂ emissions at the 'Be lean' for the residential spaces at Land to the West of Bines Road, Partridge Green is **78,122 kgCO₂ per annum**, which is a reduction of 24,089 kgCO₂ per annum, or 23.6% over the Baseline. Please refer to Appendix 3 for SAP results.

Table 6 - Development's 'Fabric First' for Residential Element

	<i>CO₂ emissions</i>	
	<i>kgCO₂ per annum</i>	<i>% reduction</i>
Target Emission Rate: Compliant with AD L 2021	102,211	-
Be Lean: <i>After demand-reduction measures</i>	78,122	23.6%

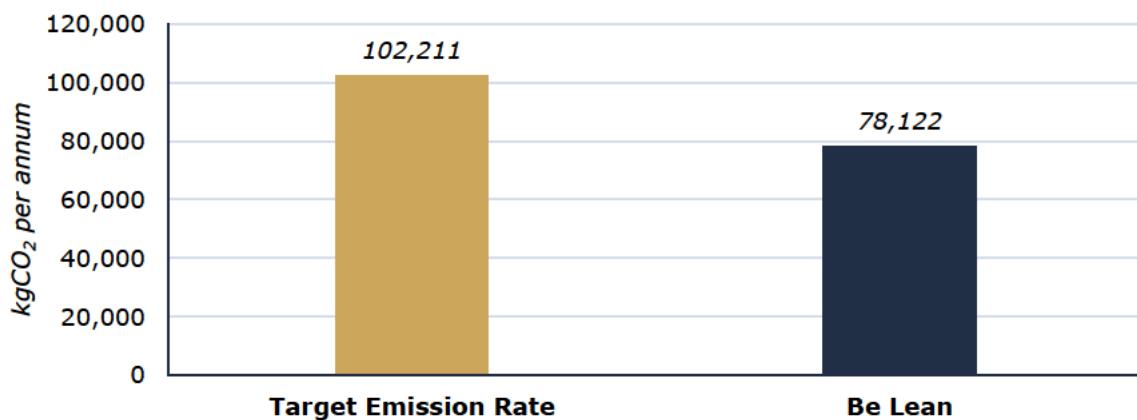


Figure 4 - TER and 'Be Lean' CO₂ emissions summary

4. BE CLEAN – SUPPLY ENERGY EFFICIENTLY

4.1 Introduction

The next step in the energy hierarchy is to assess how the remaining energy demand can be met, exploring the potential for integration with an existing or planned District Heat Network (DHN). This assessment is conducted in accordance with *Strategic Policy 36: Appropriate Energy Use*, which encourages developments to consider sustainable, low-carbon heating solutions through district heating where feasible.

To ensure compliance with the energy hierarchy, the potential to supply energy efficiently to the development and further reduce regulated CO₂ emissions through 'Be clean' measures, has been evaluated. This has been done with attention to the following hierarchy for selecting an energy system:

1. Connection to an area wide heat network.
2. Communal heating system:
 - Site-wide heat network
 - Building-level heating system
3. Individual heating system.

4.2 District Heat Network viability

DHN, also referred to as either district energy systems or district heating schemes, produce steam, hot water or chilled water at a central energy centre. The steam or water is distributed in pre-insulated pipework, to individual buildings for space heating, domestic hot water and air conditioning. As a result, individual buildings served by a DHN do not require their own boilers or chillers (source: UK District Energy Association).

Currently, there are no established district heat networks in Land to the West of Bines Road, Partridge Green. However, for developments in the area, especially in Heat Priority Areas, local planning policy encourages the installation of infrastructure that would allow for future connections to district heating networks if and when they become available.

This is part of the wider strategic energy goals outlined in Horsham District Council's policies.

4.3 Development's 'Be Clean'

As Land to the West of Bines Road, Partridge Green does not lie within any proximity to the heat network priority area. Therefore, **no improvements will be made in the 'Be Clean' section of the assessment** at this time.

5. BE GREEN – LOW-CARBON AND RENEWABLE ENERGY

5.1 Introduction

The applicant has also committed to maximising the integration of Low and Zero-Carbon (LZC) technologies within their energy strategy for the development.

Viability of the following low-carbon and renewable energy technologies have been considered:

- Wind
- Solar
- Aerothermal
- Geothermal
- Biomass

The above LZC technologies have been assessed for their viability as a component of a complementary heating strategy for the development. A detailed review of the LZC technologies is provided in Appendix 4, including wind, solar thermal, biomass, and other heat pump technologies. The Applicant's adopted strategy for LZC technologies is compatible with the 'Fabric First' design specification.

The following low-carbon and renewable energy technologies, summarised here in Table 7, are considered potentially viable options for the mixed-use development scheme at Land to the West of Bines Road, Partridge Green.

Table 7 - Summary of Feasibility for Land to the West of Bines Road, Partridge Green

✓	<i>Solar Thermal</i> <i>Solar PV</i> <i>Air Source Heat Pumps</i>
✗	<i>Wind Turbines</i> <i>Biomass Boilers</i> <i>Ground Source Heat Pumps</i>

AIR SOURCE HEAT PUMPS

Following the implementation of 'Be Lean' design measures to reduce energy demand, the strategy proposes the use of individual air-source heat pumps (ASHPs). For the purposes of this analysis, the Mitsubishi Ecodan unit, which uses R32 refrigerant, has been selected. This solution ensures efficient, low-carbon space heating and hot water provision for all units, contributing to the overall sustainability and energy performance of the development.

SOLAR THERMAL / SOLAR PV

The renewable energy contribution will be maximised through the installation of PV panels, each rated at 400 W. For this assessment, 604 solar PV panels have been assumed, based on the modelled samples:

- Plot 004 B2009M: 2.0 kWp
- Plot 012 S4029M: 3.6 kWp
- Plot 014 GF Flat: 1.4 kWp
- Plot 017 FF Flat: 1.4 kWp
- Plot 021 A4714: 2.0 kWp
- Plot 030 A2708M: 2.0 kWp
- Plot 062 B3016: 2.8 kWp
- Plot 064 G4032: 3.2 kWp
- Plot 066 G5037: 4.4 kWp
- Plot 072 B3017M: 2.2 kWp
- Plot 092 A3710M: 2.2 kWp

This configuration results in a **total capacity of 241.6 kWp**. The panels will be strategically positioned across **all suitable roof spaces** and are currently assumed to be oriented towards the south, east, or west (or a combination of these), based on a worst-case scenario.

Due to the limited information provided at this stage of the detailed application, these figures may be subject to change as the project progresses through further stages of development.

Both proposed technologies meet the 'Be Green' criteria and are designed to bring the development in line with the anticipated FHS benchmarks.

5.2 Development's 'Be Green' stage results

The estimated site-wide CO₂ emissions after implementation of the suitable LZC technologies for the residential spaces at Land to the West of Bines Road, Partridge Green are **20,455 kgCO₂ per annum**, which is a reduction of further 57,666 kgCO₂ per annum, or 56.4% over the Baseline. Please refer to Appendix 3 for SAP results.

Table 8 – Development's 'Be Green' for Land to the West of Bines Road, Partridge Green

	CO ₂ emissions	
	kgCO ₂ per annum	% reduction
Target Emission Rate: Compliant with AD L 2021	102,211	-
Be Lean: <i>After demand-reduction measures</i>	78,122	23.6%
Be Clean: <i>Viability of heat networks</i>	78,122	0%
Be Green: <i>Low-carbon and renewable energy</i>	20,455	56.4%
Total savings	81,755	80.0%

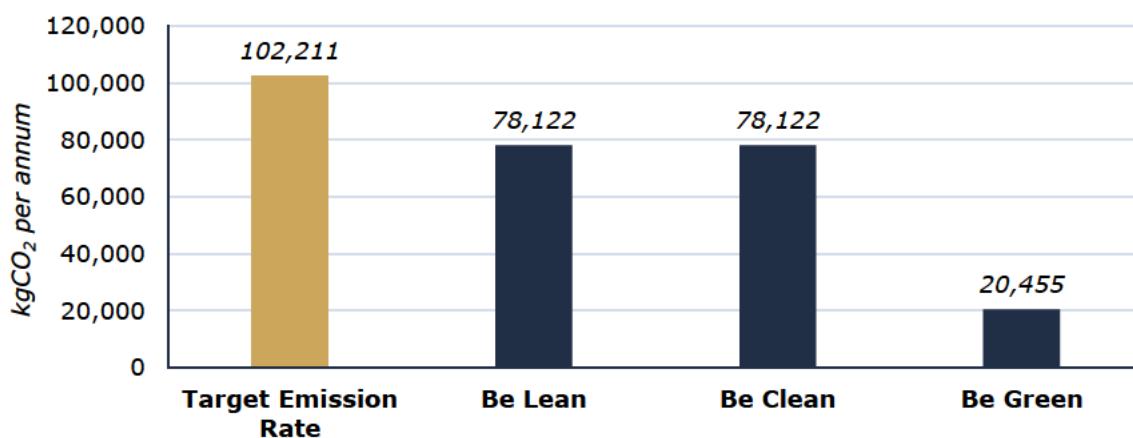


Figure 5 – TER, 'Be Lean', 'Be Clean', and 'Be Green' CO₂ emissions summary

6. MAINS WATER CONSUMPTION

6.1 Introduction

The water consumption of a dwelling has a significant impact on not only direct operational running costs (i.e. water consumption charges), but also indirectly through additional energy usage and the heating of water for domestic use. This is, in part, reflected in SAP 10.2 methodology which assumes reduced energy consumption should a dwelling be compliant with Approved Document Part G 2015 (incorporating May 2024 amendments).

The standard of 105 litres of water per person per day can be met using the following specification as set out in Table 9 below. Detailed water-efficiency calculations, demonstrating how compliance with this standard will be met, can be found in Appendix 5.

Table 9 - Water calculations for new dwellings at Land to the West of Bines Road, Partridge Green

Element	Performance
Kitchen Taps flow rate	5 Litres per minute
Other basin Taps flow rate	4 Litres per minute
WCs Flush Volume	6/3 Litres
Shower Flow rate	8 Litres per minute
Bath Volume	150 Litres
Dishwasher water consumption	1.25 litres per place setting
Washing-machine water consumption	8.17 litres per Kg

7. CONCLUSIONS AND RECOMMENDATIONS

The applicant is committed to achieving substantial reductions in CO₂ emissions at the proposed development site, Land to the West of Bines Road, Partridge Green. The energy strategy follows the three-tier hierarchy of 'use less energy, supply energy efficiently, and use renewable energy', aligning with key policies such as the Climate Change Act (2008), the National Planning Policy Framework (NPPF, 2023), Approved Document L, Volume 1: Dwellings (2021), and Policies 35, 36, and 37 of the Horsham District Planning Framework (2015). The applicant is also preparing to meet the Future Homes Standard (FHS), anticipated in 2025, which is expected to require a 75-80% improvement over the AD L 2013 standards.

BE LEAN: Energy-efficient measures, including high-performance building fabric, insulation, low-g-value triple-glazed windows (in line with Part O recommendations), low-energy lighting, and efficient ventilation systems, deliver a 23.6% reduction in regulated CO₂ emissions over AD L 2021 standards across the site.

As Land to the West of Bines Road, Partridge Green does not lie within any proximity to the heat network priority area. Therefore, no improvements will be made in the 'Be Clean' section of the assessment at this time.

BE GREEN: In addition to energy-efficient fabric, the development will incorporate individual ASHPs to provide space heating and domestic hot water.

In addition to the ASHPs, a 241.6 kWp PV system, consisting of 400 W panels, will be installed across all suitable roof spaces. These panels will be strategically oriented to maximise energy generation based on the building orientations. This results in a further 56.4% reduction in regulated CO₂ emissions across the site.

A summary of these measures is listed in the table below.

Table 10 - Measures incorporated to deliver the energy standard

Be Lean	<ul style="list-style-type: none">Energy-efficient building fabric: High-performance insulation applied to all heat loss areas, including floors, walls, and roofs.High-efficiency glazing: Triple-glazed windows throughout the development to minimise heat loss.
----------------	--

	<ul style="list-style-type: none"> ▪ Airtightness: Quality of construction will be ensured through achieving excellent air-tightness results across the building. ▪ Efficient building services: Efficient building services including high-efficiency heating systems, will be implemented. ▪ Ventilation: Efficient MVHR systems installed in the apartments. ▪ Low-energy lighting: Energy-saving lighting solutions will be installed throughout the development.
Be Clean	<ul style="list-style-type: none"> ▪ No CO₂ or energy demand reductions from 'Be Clean' at this stage.
Be Green	<ul style="list-style-type: none"> ▪ Space heating and domestic hot water systems: Individual ASHPs to provide space heating and hot water across the development. ▪ Solar PV: A total of 241.6 kWp of solar PV panels will be installed to optimise energy generation.

This comprehensive approach ensures that the development at Land to the West of Bines Road, Partridge Green, will achieve an **80%** reduction in regulated CO₂ emissions over AD L 2021 using SAP 10.2 methodology. It will also meet the Future Homes Standard, that will set out requirements for new homes to produce 75-80% less carbon emissions compared to those built to the 2013 standards.

Each stage of the energy hierarchy has been meticulously followed, ensuring that the development not only complies with but exceeds the requirements of the relevant policies. By reducing energy demand, supplying energy efficiently, and maximizing the use of renewable energy, the development delivers significant environmental benefits and supports the broader goals of sustainable development.

Details of the CO₂ emissions and percentage savings are provided in Table 11, with Figure 6 illustrating the impact of these design measures and low-carbon solutions in achieving compliance with the energy hierarchy.

Table 11 – CO₂ emissions at each stage of the energy hierarchy

	CO ₂ emissions	
	kgCO ₂ per annum	% reduction
Target Emission Rate: Compliant with AD L 2021	102,211	-

Be Lean: <i>After demand-reduction measures</i>	78,122	23.6%
Be Clean: <i>Viability of heat networks</i>	78,122	0%
Be Green: <i>Low-carbon and renewable energy</i>	20,455	56.4%
Total savings	81,755	80.0%

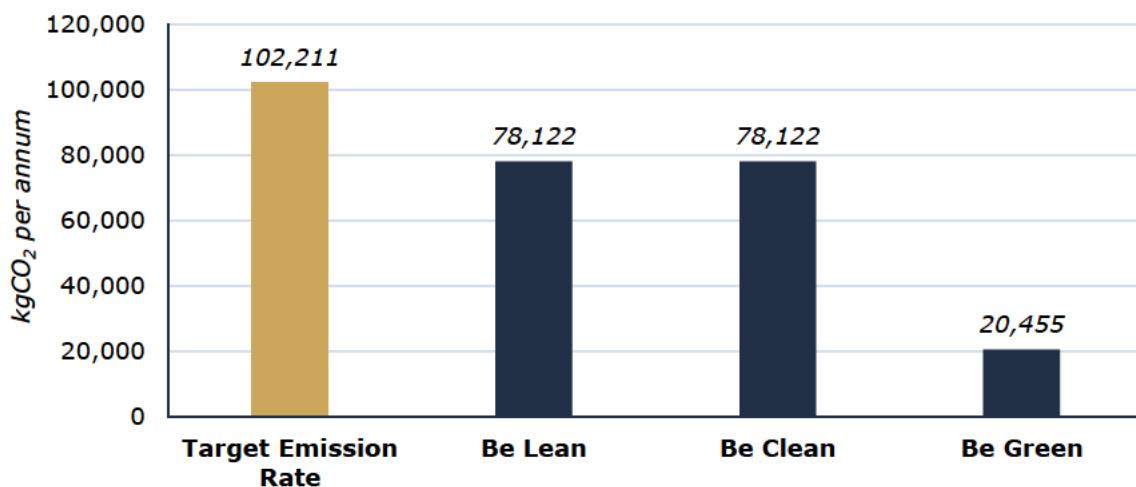


Figure 6 - How the Development delivers the energy standard

APPENDICES

APPENDIX 1: LIST OF ABBREVIATIONS

AD L 2021	<i>Approved Document Part L of Buildings Regulations 2021</i>
ASHP	<i>Air Source Heat Pump</i>
BER	<i>Building Emission Rate</i>
BRE	<i>Building Research Establishment</i>
CIBSE	<i>Chartered Institution of Building Services Engineers</i>
COP	<i>Coefficient of Performance</i>
DER	<i>Dwelling Emission Rate</i>
DHN	<i>District Heat Network</i>
DHW	<i>Domestic Hot Water</i>
EAHP	<i>Exhaust Air Heat Pump</i>
EVC	<i>Electric Vehicle Charging</i>
FEES	<i>Fabric Energy Efficiency Standard</i>
FHS	<i>Future Homes Standard</i>
GLA	<i>Greater London Authority</i>
LZC	<i>Low and Zero-Carbon technologies</i>
NCM	<i>National Calculation Methodology</i>
PV	<i>Photovoltaics</i>
SAP	<i>Standard Assessment Procedure</i>
SBEM	<i>Simplified Building Energy Model</i>
TER	<i>Target Emission Rate</i>
TFEE	<i>Target Fabric Energy Efficiency</i>
VRF	<i>Variable Refrigerant Flow</i>

APPENDIX 2: PLANNING POLICY AND DESIGN GUIDANCE

The Climate Change Act (2008)

Passed in November 2008, the Climate Change Act mandated that the UK would reduce emissions of six key greenhouse gases, including Carbon Dioxide, by 80% by 2050.

As a consequence, the reduction of carbon dioxide emissions is at the forefront of National, Regional and Local Planning Policy, along with continuing step changes in performance introduced by the Building Regulations Approved Document L (2021).

Approved Document L (2021)

This development is subject to the requirements of Approved Document L (2021). ADL 2013 represented an approximate reduction of 6% in the Target Emission Rate (kgCO₂/sqm per annum) over the requirements of Approved Document L (2010) for residential development and an aggregate 9% reduction for non-residential development. ADL (2021) has seen a further 31% improvement over these targets. It also sees the introduction of a Primary Energy Target, a measure of heating demand (kW hrs/sqm per annum) to ensure new-build dwellings with low-carbon heating systems still meet satisfactory energy-efficiency standards.

National Planning Policy Framework (2023)

The National Planning Policy Framework (NPPF) encourages Local Planning Authorities to 'support the transition to a low carbon future in a changing climate, taking full account of flood risk and costal change' (NPPF paragraph 157), 'whilst taking a proactive approach to mitigating and adapting to climate change, taking into account the long-term implication for flood risk, costal change, water supply, biodiversity and landscapes, and the risk of over shading from rising temperatures'. (NPPF Paragraph 158).

Paragraph 160, upholds the requirement for Local Plans to: 'To help increase the use and supply of renewable and low carbon energy and heat, plans should:

- a) provide a positive strategy for energy from these sources, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts);*
- b) consider identifying suitable areas of renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and*

c) identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for collocating potential heat customers and suppliers.'

In paragraph 162, NPPF stipulates that local planning authorities should take account of the benefits of decentralised energy and passive design measures as a means of energy efficiency in new development: 'In determining planning applications, local planning authorities should expect new development to:

- a) comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and
- b) take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.'

Horsham District Planning Framework (2015)

Policy 35

Strategic Policy: Climate Change

Development will be supported where it makes a clear contribution to mitigating and adapting to the impacts of climate change and to meeting the district's carbon reduction targets as set out in the Council's Acting Together on Climate Change Strategy, 2009.

Measures which should be used to mitigate the effects of climate change include;

1. Reduced energy use in construction;
2. Improved energy efficiency in new developments, including influencing the behaviour of occupants to reduce energy use;
3. The use of decentralised, renewable and low carbon energy supply systems;
4. The use of patterns of development which reduce the need to travel, encourage walking and cycling and include good accessibility to public transport and other forms of sustainable transport; and
5. Measures which reduce the amount of biodegradable waste sent to landfill.

Development must be designed so that it can adapt to the impacts of climate change, reducing vulnerability, particularly in terms of flood risk, water supply and changes to the district's landscape. Developments should adapt to climate change using the following measures:

1. Provision of appropriate flood storage capacity in new building development;
2. Use of green infrastructure and dual use SuDS to help absorb heat, reduce surface water runoff, provide flood storage capacity and assist habitat migration;
3. Use of measures which promote the conservation of water and/or grey water recycling; and
4. Use of site layout, design measures and construction techniques that provide resilience to climate change (opportunities for natural ventilation and solar gain). If it is not possible to incorporate the adaption and mitigation measures proposed, an explanation should be provided as to why this is the case.

Policy 36

Strategic Policy: Appropriate Energy Use

Energy hierarchy

All development will be required to contribute to clean, efficient energy in Horsham based on the following hierarchy:

1. *Lean – use less energy – e.g. through demand reduction*
2. *Clean – supply energy efficiently – e.g. through heat networks*
3. *Green – use renewable energy sources*

District Heating and Cooling

Commercial and residential developments in Heat Priority Areas or the strategic development locations will be expected to connect to district heating networks where they exist using the following hierarchy, or incorporate the necessary infrastructure for connection to future network.

Development should demonstrate that the heating and cooling systems have been selected in accordance with the following heating and cooling hierarchy;

1. *Connection to existing (C)CHP distribution networks*
2. *Site wide renewable (C)CHP*
3. *Site wide gas-fired (C)CHP*
4. *Site wide renewable community heating/cooling*
5. *Site wide gas-fired community heating/cooling*
6. *Individual building renewable heating*
7. *Individual building heating, with the exception of electric heating*

All (C)CHP must be of a scale and operated to maximise the potential for carbon reduction. Where site-wide (C)CHP is proposed, consideration must be given to extending the network to adjacent sites.

Energy Statements

All applications for residential or commercial development must include an Energy Statement demonstrating and quantifying how the development will comply with the Energy Hierarchy.

Developments in Heat Priority Areas and strategic developments should demonstrate and quantify how the development will comply with the heating and cooling hierarchy. Horsham District Council will work proactively with applicants on major developments to ensure these requirements are met.

Renewable energy schemes

The Council will permit schemes for renewable energy (e.g. solar) where they do not have a significant adverse effect on landscape and townscape character, biodiversity, heritage or cultural assets or amenity value. Community initiatives which seek to deliver renewable and low carbon energy will be encouraged.

Policy 37
Sustainable Construction

Proposals must seek to improve the sustainability of development. To deliver sustainable design, development should incorporate the following measures where appropriate according to the type of development and location:

1. *Maximise energy efficiency and integrate the use of decentralised, renewable and low carbon energy;*
2. *Limit water use to 110 litres/person/day;*
3. *Use design measures to minimise vulnerability to flooding and heatwave events;*
4. *Be designed to encourage the use of natural lighting and ventilation;*
5. *Be designed to encourage walking, cycling, cycle storage and accessibility to sustainable forms of transport;*
6. *Minimise construction and demolition waste and utilise recycled and low-impact materials;*
7. *Be flexible to allow future modification of use or layout, facilitating future adaptation, refurbishment and retrofitting;*
8. *Incorporate measures which enhance the biodiversity value of development.*

All new development will be required to provide satisfactory arrangements for the storage of refuse and recyclable materials as an integral part of design.

New homes and workplaces should include the provision of high-speed broadband access and enable provision of future technologies where available.

APPENDIX 3: SAP RESULTS

SAP 10.2 Compliance Sheets provided separately.

APPENDIX 4: LZCT ASSESSMENT

Wind	<p><i>The ability to generate electricity via a turbine or similar device which harnesses natural wind energy. This could be considered as an onsite solution to reducing carbon emissions (turbines included within the development), or offsite (investing financially into a nearby wind farm).</i></p>
Installation considerations	<ul style="list-style-type: none">▪ Wind turbines come in a variety of sizes and shapes. Turbines of 1 Kw can be installed to single house and large-scale turbines of 1-2 MW can be installed on a development to generate electricity to multiple dwellings and other buildings. In both instances the electricity generated can be used on site or exported to the grid. Vertical- or horizontal-axis turbines are available.▪ A roof-mounted 1 kW micro wind system costs up to [REDACTED]. A 2.5 kW pole-mounted system costs between [REDACTED] and [REDACTED]. A 6 kW pole-mounted system costs between [REDACTED] and [REDACTED] (taken from the Energy Saving Trust, TBC by supplier)▪ Local average wind speed is a determining factor. A minimum average wind speed of 6 m/s is required.▪ Noise considerations can be an issue dependent on density and build-up of the surrounding area.▪ Buildings in the immediate area can disrupt wind speed and reduce performance of the system.▪ Planning permission will be required along with suitable space to site the turbine, whether ground installed, or roof mounted.
Advantages	<ul style="list-style-type: none">▪ Generation of clean electricity which can be exported to the grid or used onsite.▪ Can benefit from the Feed in Tariff, reducing payback costs.

Disadvantages	<ul style="list-style-type: none"> ▪ Planning restrictions and local climate often limit installation opportunities. ▪ Annual maintenance required. ▪ High initial capital cost. It is usual for an investor to consider a series of turbines to make the investment financially sound.
Development feasibility x	<ul style="list-style-type: none"> ▪ Installing a large turbine in an area such as this is not considered to be appropriate due to its appearance and physical impact on the built-up environment. Residents' and neighbours' concerns may include the look of the turbine, the hum of the generator and the possibility of stroboscopic shadowing from the blades on homes. ▪ Wind speed has been checked for the development scheme using the NOABL wind map: ▪ http://www.rensmart.com/Weather/BERR. The wind speed at ten metres for the development scheme is 4.8 metres per second (m/s) which is below the minimum of 5 m/s and threshold for technical viability. ▪ Typical payback times for a single turbine are expected to be greater than 15 years which means that the cost of installing and maintaining a single wind turbine is not considered a commercially-viable option.
Solar PV Solar Thermal	<p><i>The ability to generate energy (either electricity, hot water or a combination of the two) through harnessing natural solar energy. This could include the use of solar thermal panels, photovoltaic (PV) panels, or a combined solution. PV panels, similarly, to turbines, can be considered both on and offsite.</i></p> <p>Solar Photovoltaics convert solar radiation into electricity which can be used on site or exported to the national grid.</p> <p>Solar Thermal generates domestic hot water from the sun's radiation. Glycol circulates within either flat plate or</p>

	<p>evacuated tube panels, absorbing heat from the sun, and transferring this energy to a water cylinder. A well-designed solar thermal system will account for 50-60% of a dwelling's annual hot water demand. Sizing the system to meet a higher demand will lead to excess heat generation in the summer months and overheating of the system.</p>
Installation considerations	<ul style="list-style-type: none"> ▪ Operate most efficiently on a south-facing sloping roof (between 30- and 45-degree pitch.) ▪ Shading must be minimal (one shaded panel can impact the output of the rest of the array.) ▪ Panels must not be laid horizontally on a flat roof as they will not self-clean. Panels will therefore need to be installed at an angle and with appropriate space between them, to avoid over-shading. ▪ Large arrays may require upgrades to substations if exporting electricity to the grid. ▪ Local planning requirements may restrict installation of panels on certain elevations. ▪ Installation must take into account pitch and fall of the roof, along with any additional plant on the roof to ensure there is sufficient room. ▪ The average domestic solar PV system is 4kWp and costs [REDACTED] - [REDACTED] (including VAT at 5 per cent) - (taken from the Energy Saving Trust).
Advantages	<ul style="list-style-type: none"> ▪ Relatively straightforward installation, connection to landlord's supply and metering. ▪ Linear improvement in performance as more panels are installed. ▪ Installation costs are continually reducing. ▪ Can benefit from the Feed in Tariff to improve financial payback.

Disadvantages	<ul style="list-style-type: none"> ▪ Less appropriate for high-rise developments, due to lack of roof space in relation to total floor area. ▪ With Solar Thermal, performance is limited by the hot water demand of the building – system oversizing will lead to overheating.
Development feasibility ✓	<ul style="list-style-type: none"> ▪ The suitability of Solar panels has been considered for this Development and are concluded as a technically-viable option. ▪ There are potential areas of roof space suitable for the positioning of unshaded Solar PV arrays. ▪ The Development is not on land, which is protected or listed, so it is considered that Solar panels would not have a negative impact on the local historical environment or the aesthetics of the area.
Aerothermal	<p><i>The transfer of latent heat in the atmosphere to a compressed refrigerant gas to warm the water in a heating system. This includes air to water heat pumps and air conditioning systems.</i></p> <p>Air Source Heat Pumps (ASHPs) extract heat from the external air and condense this energy to heat a smaller space within a dwelling or non-domestic building. A pump circulates a refrigerant through a coil to absorb energy from the air. This refrigerant is then compressed to raise its temperature which can then be used for space heating and domestic hot water.</p> <p>They can feed either low-temperature radiators or underfloor heating and often have electric immersion heater back-up for the winter months.</p>
Installation	<ul style="list-style-type: none"> ▪ ASHPs operate effectively in buildings with a low energy demand, as they emit low levels of energy suitable for maintaining rather than dramatically increasing internal

considerations	<p>temperatures. It is therefore vital that the dwelling has a low heating demand to ensure the system can provide appropriate space-heating capability.</p> <ul style="list-style-type: none"> ▪ Underfloor heating will give the best performance, but oversized radiators can also be used. ▪ Immersion heater back-up required to ensure appropriate Domestic Hot Water (DHW) temperature in winter months. ▪ Noise from the external unit can limit areas for installation. ▪ ██████████ per dwelling (taken from the Energy Saving Trust).
Advantages	<ul style="list-style-type: none"> ▪ Air source systems are a good alternative solution to providing heating and hot water to well-insulated, low heat loss dwellings. ▪ They require additional space when compared to a gas boiler. Space for an external unit is needed, as is space for the hot water cylinder and internal pump. ▪ Heat pumps are generally quiet to run, however if a collection of pumps were used, this could generate a noticeable hum while in operation. ▪ Running costs between heat pumps and modern gas boilers are comparable.
Disadvantages	<ul style="list-style-type: none"> ▪ Residents need to be made aware of the most efficient way of using a heat pump as the low flow rates used by such a system means that room temperature cannot be changed as reactively as a conventional gas or oil boiler system. ▪ Will not perform well in homes that are left unoccupied and unheated for a long period of time. ▪ Back-up immersion heating can drastically increase running costs. ▪ Noise and aesthetic considerations limit installation opportunities.

Development feasibility

- ASHPs are considered a viable option for this development scheme and shall be utilised as part of an individual heat pump strategy for dwellings. This works well with the reduced energy demand, as achieved through passive design principles.
- This presents a zero carbon ready energy strategy for the development, as the national grid continues to decarbonise.
- ASHPs are aligned with the FHS which seeks to move towards high efficiency all electric systems and away from on-site combustion associated with fossil fuels.

Geothermal

The transfer of latent heat from the ground to a compressed refrigerant gas to warm the water in a heating system. This includes ground source heat pumps. Heat can be collected through the use of either horizontally laid or vertically installed coils.

Ground Source Heat Pumps (GSHPs) operate on the same principle as an Air Source Heat Pump (ASHP) in that they extract heat from a source (in this instance the ground) and compress this energy to increase temperature for space heating and hot water. Pipework is installed into the ground, either through coils or in bore holes and piles, circulating a mix of water and antifreeze to extract energy from the ground, where the year-round temperature is relatively consistent (approx. 10 °C at 4 metres depth). This leads to a reliable source of heat for the building.

Again, an electrically powered pump circulates the liquid and powers the compressor, however annual efficiencies for GSHPs tend to be higher than those of ASHPs.

Installation considerations	<ul style="list-style-type: none"> ▪ Require appropriate ground conditions to sink piles/bore holes or excavate for coils (which also require a large area of land.) ▪ Decision between coils or piles can lead to significant extra cost. ▪ Need to consider whether low temperature output is fed through underfloor heating (most efficient) or oversized radiators. ▪ Similar to ASHPs, perform best in well-insulated buildings with a low heating demand. ▪ Electric immersion heater required for winter use. ▪ [REDACTED] per dwelling dependent on the size of the system (taken from the Energy Saving Trust).
Advantages	<ul style="list-style-type: none"> ▪ Perform well in well-insulated buildings, with limited heating demand. ▪ More efficient than ASHPs.
Disadvantages	<ul style="list-style-type: none"> ▪ The coils can be damaged by natural earthworks and by intensive gardening practices – occupants would need to be aware of the location of the coils for this system, and how to operate the system efficiently. Coils may also be damaged within the dwelling where the circuit is connected to the internal unit. ▪ Will not perform well in buildings that are left unoccupied and unheated for a long period of time. ▪ Back up immersion heating can drastically increase running costs. ▪ Large area of ground needed for coil installation.
Development feasibility x	<ul style="list-style-type: none"> ▪ GSHPs are not considered a viable option for this development scheme as they conflict with the preferred option of ASHP electric heating which works well with the reduced energy demand, as achieved through passive design principles.

Water Source Heat Pumps

The transfer of latent heat from a local water source to a compressed refrigerant gas to warm the water in a heating system. This includes water source heat pumps. Heat can be collected through the use of either horizontally laid or vertically installed coils.

Water Source Heat Pumps (WSHPs) operate on the same principle as an Air Source Heat Pump (ASHP) in that they extract heat from a source (in this instance the water) and compress this energy to increase temperature for space heating and hot water. Pipework is installed into the water source, circulating a mix of water and antifreeze to extract energy from the water, where the year-round temperature is relatively consistent (approx. 10 °C below surface). This leads to a reliable source of heat for the building.

Again, an electrically powered pump circulates the liquid and powers the compressor, however annual efficiencies for WSHPs tend to be higher than those of ASHPs.

Installation considerations

- Require a reliable water source near to the site.
- Need to consider affect on the water course.
- Need to consider whether low temperature output is fed through underfloor heating (most efficient) or oversized radiators.
- Similar to ASHPs, perform best in well-insulated buildings with a low heating demand.
- Electric immersion heater required for winter use.
- [REDACTED] per dwelling dependent on the size of the system (taken from the Energy Saving Trust).

Advantages

- Perform well in well-insulated buildings, with limited heating demand.
- More efficient than ASHPs.

Disadvantages	<ul style="list-style-type: none"> ▪ The coils can be damaged by high water flow or low water levels- occupants would need to be aware of the location of the coils for this system, and how to operate the system efficiently. Coils may also be damaged within the dwelling where the circuit is connected to the internal unit. ▪ Will not perform well in buildings that are left unoccupied and unheated for a long period of time. ▪ Back up immersion heating can drastically increase running costs. ▪ Large area of water needed for coil installation.
Development feasibility x	<ul style="list-style-type: none"> ▪ WSHPs are not considered a viable option for this development scheme as they conflict with the preferred option of ASHP electric heating which works well with the reduced energy demand, as achieved through passive design principles.
Biomass	<p><i>Providing a heating system fuelled by plant based materials such as wood, crops, or food waste.</i></p> <p>Biomass boilers generate heat for space heating and domestic hot water through the combustion of biofuels, such as woodchip, wood pellets or potentially biofuel or bio diesel. Biomass is considered to be virtually zero carbon. They can be used on an individual scale or for multiple dwellings as part of a district-heating network. A back-up heat source should be provided as consistent delivery of fuel is necessary for continued operation.</p>
Installation considerations	<ul style="list-style-type: none"> ▪ Biomass boilers are larger than conventional gas-fired boilers and also require what can be significant storage space for the fuel source. This needs to be considered at planning stage to ensure an appropriate plant room can be provided.

	<ul style="list-style-type: none"> ▪ Flue required to expel exhaust gases – design needs to be in line with the requirements of the Building Regulations. ▪ Need to consider whether fuel deliveries will be reliable and consistent to the location of the site (especially relevant in rural areas) and whether the plant room can be easily accessed by the delivery vehicle. ▪ [REDACTED] per dwelling dependent on size (taken from Energy Saving Trust).
Advantages	<ul style="list-style-type: none"> ▪ Considerable reduction in CO₂ emissions.
Disadvantages	<ul style="list-style-type: none"> ▪ Limited reduction in running costs compared to A-rated gas boilers, but at a substantially higher up-front cost. ▪ Plant room space required for boiler and storage. ▪ Dependent on consistent delivery of fuel. ▪ Ongoing maintenance costs (need to be cleaned regularly to remove ash.)
Development feasibility x	<ul style="list-style-type: none"> ▪ Biomass is not considered a technically viable option for the development scheme. The primary reason for this is down to the development's location within the context of London and the negative environmental impact of high levels of NO_x gases that are emitted from biomass boilers and the subsequent impact on local air quality. This is contrary to planning policies for air quality in London. ▪ There are also concerns regarding a sustainable supply of biomass to the site. ▪ The capital installation cost would be high which leads us to the conclusion that biomass would not be a commercially viable option for this development scheme. ▪ The on-site combustion associated with biomass is not aligned with the FHS and would contribute negatively to air quality issues.

APPENDIX 5: WATER CALCULATIONS

Please refer to the following page for the detailed water-efficiency calculations.

These calculations are based on a 2-bed semi-detached unit (specifically Unit A2708).

ENERGIST
WATER EFFICIENCY CALCULATOR

Water efficiency calculator for Land to the West of Bines Road, Partridge Green

Our reference: ST.H.RH13-0
Regulation: Part G (2015) Enhanced

Assessor: MK Date issued: 2-10-2024. Revision: 0

This Compliance Checklist follows the methodology as listed in Appendix A of UK Building Regulations Approved Document AD G (2016). The targets comply with requirements of Part G (2015) Enhanced as used in England.

Table A1: The water efficiency calculator

Installation type	Unit of measure	Capacity / Flow rate	Use factor	Fixed use litres/person/day	Litres per person per day
WC (single flush)	Flush volume (litres)	0.0	4.42	0	0.00
WC (dual flush)	Full flush volume (litres)	6.0	1.46	0	8.76
	Part flush volume (litres)	3.0	2.96	0	8.88
WCs (multiple fittings)	Average effective flushing volume (litres)	0.0	4.42	0	0.00
Taps (excluding kitchen / utility room taps)	Flow rate (litres per minute)	4.0	1.58	1.58	7.90
Bath (where shower also present)	Capacity to overflow (litres)	150.0	0.11	0	16.50
Shower (where bath also present)	Flow rate (litres per minute)	8.0	4.37	0	34.96
Bath only	Capacity to overflow (litres)	0.0	0.50	0	0.00
Shower only	Flow rate (litres per minute)	0.0	5.60	0	0.00
Kitchen / utility room sink taps	Flow rate (litres per minute)	5.0	0.44	10.36	12.56
Washing machine	Litres/kg of dry load	8.2	2.10	0	17.16
Dishwasher	Litres/place setting	1.3	3.60	0	4.50
Waste disposal unit	Litres/use	0.0	3.08	0	0.00
Water softener	Litres/person/day	0.0	1.00	0	0.00
Total calculated use					111.22
					0.00
					0.00
					0.91
					101.21
					0.00
Total water consumption (litres/person/day)					101.21
Maximum target					105.00