



BEYOND BUILDING

Energy Strategy

Land North of School Road, Arborfield Cross

On behalf of Croudace Homes

CR.AC.RG2

R01

Date: 16 April 2025

Revision History

Revision	Issue Date	Description	Issued by	Checked by
00	15/04/2025	Draft Report	DS	MK
01	16/04/2025	First Issue	DS	MK

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

08458 386 387

info@energistuk.co.uk

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EXECUTIVE SUMMARY

This Energy Strategy has been produced by Energist UK on behalf of Croudace Homes ('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 decarbonizes.

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

- i) The Climate Change Act (2008).
- ii) National Planning Policy Framework (NPPF, 2024).
- iii) Approved Document L Volume 1: Dwellings (2021).
- iv) Wokingham Borough Adopted Core Strategy Development Plan Document (2010): *Policy CP1 – Sustainable development.*
- v) Wokingham Borough Council Climate Change Interim Policy Position Statement, (2022):
 - **CC04: Sustainable Design and Construction**
 - *The full Future Homes Standard is expected to be introduced shortly (in 2025) and therefore development proposals are encouraged to aim towards this higher standard.*
 - *Wokingham Borough is situated within part of the country classified as an area of serious water stress. In order to address this issue, and contribute towards wider climate change adaptability, the higher optional standard for water efficiency of 110 litres per person per day is justified.*

▪ **CC05: Renewable energy and decentralised energy networks**

- Planning permission will only be granted for proposals that deliver a minimum 10% reduction in carbon emissions through renewable energy or low carbon technology

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, as listed in Table 1.

Table 1 - Measures incorporated to deliver the energy standard at Land North of School Road, Arborfield Cross.

Fabric First: demand-reduction measures	▪ Energy-efficient building fabric and insulation to all heat loss floors, walls and roofs. ▪ High-efficiency double -glazed windows throughout. ▪ Quality of build will be confirmed by achieving good air-tightness results throughout. ▪ Efficient-building services. ▪ Efficient MVHR system throughout. ▪ Low-energy lighting throughout the building.
Renewable and low-carbon energy technologies	▪ Individual air-source heat pumps (ASHPs) to provide space heating and hot water across the development.

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 development.

	CO ₂ emissions	
	t.CO ₂ per annum	% reduction
Target Emission Rate: compliant with AD L 2021	67.60	-
Fabric First: demand-reduction measures	43.43	35.8%
Renewable and low-carbon energy technologies	19.07	36.0%
Total cumulative savings	48.53	71.8%

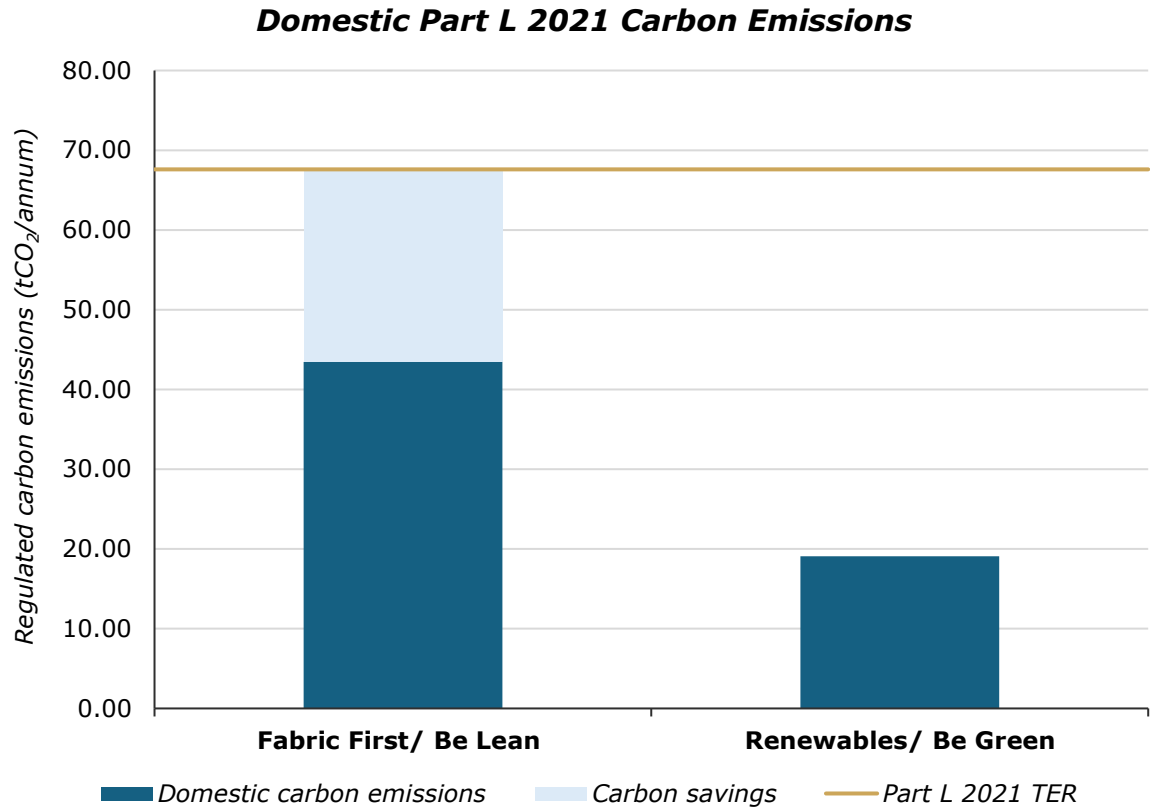


Figure 1 - How the development delivers the energy standard.

1. INTRODUCTION

1.1 Site Description

The proposed residential development is located at Land North of School Road, Arborfield Cross which falls within the jurisdiction of Wokingham Brough Council. The development is designed to comprise up to 70 dwellings, aiming to meet the housing needs of the local area while adhering to sustainability and energy efficiency standards.

The site layout, as shown in the accompanying drawing below, illustrates the proposed arrangement of residential units at the site.



Figure 2 – The illustrative outline layout of the site at Land North of School Road, Arborfield Cross.
[Source: Marrons, drawing reference: 2522477.4 / Rev G, March 2025]

1.2 Purpose of the Energy Strategy

This Energy Strategy has been prepared by Energist UK on behalf of Croudace Homes ('the Applicant'). It sets out the proposed climate change mitigation measures for the residential development at Land North of School Road, Arborfield Cross ('the Development'), and is submitted in support of the outline planning application to Wokingham Borough Council.

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) NPPF (2024).
- iii) AD L Volume 1: Dwellings (2021).
- vi) Wokingham Borough Adopted Core Strategy Development Plan Document (2010) – Policy CP1 – Sustainable development.
- vii) *Wokingham Borough Council Climate Change Interim Policy Position Statement, (2022):*

- **CC04: Sustainable Design and Construction**

- *The full Future Homes Standard is expected to be introduced shortly (in 2025) and therefore development proposals are encouraged to aim towards this higher standard.*
- *Wokingham Borough is situated within part of the country classified as an area of serious water stress. In order to address this issue, and contribute towards wider climate change adaptability, the higher optional standard for water efficiency of 110 litres per person per day is justified.*

- **CC05: Renewable energy and decentralised energy networks**

- *Planning permission will only be granted for proposals that deliver a minimum 10% reduction in carbon emissions through renewable energy or low carbon technology*

The way in which the Applicant meets the energy ,standard and CO₂ reduction target at Land North of School Road, Arborfield Cross 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):

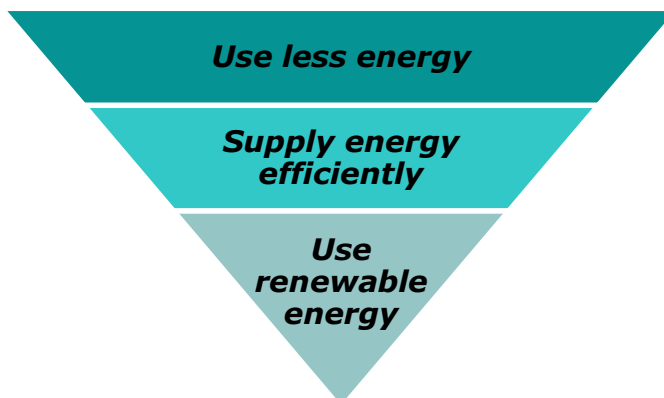


Figure 3 - Three-tier energy hierarchy

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 10 representative units within the development, based on Croudace house types. As the assessment was carried out at the outline stage, a carefully selected mix of Croudace house types was used to ensure that the energy performance predictions reflect the likely design characteristics of the proposed scheme.

The assessment covers a variety of unit types, including apartments and two-, three-, and four-bedroom houses. This sample size is considered appropriate for extrapolation purposes.

The modelled data was then used to estimate the overall CO₂ emissions and energy demand for all proposed dwellings within the development application. This approach provides a comprehensive analysis of the scheme's energy performance at the outline stage, ensuring alignment with current regulatory standards and offering 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. 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 (fully filled and sealed)
Roof (Flat) 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 (double-glazed units)
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

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 **67.60 t.CO₂ per annum**. To ensure compliance with AD L 2021, CO₂ emissions should not exceed this figure.

Table 4 - Development's Target Emission Rate for Land North of School Road, Arborfield Cross.

	CO ₂ emissions	
	t.CO ₂ per annum	% reduction
Target Emission Rate: compliant with AD L 2021	67.60	-

3. FABRIC FIRST: DEMAND-REDUCTION MEASURES

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 double-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 North of School Road, Arborfield Cross.

Element	Proposed 'Be Lean' Design Specification
Ground Floor (W/m ² .K)	0.11
External Wall U-Value (W/m ² .K)	0.17
Party Wall U-Value (W/m ² .K)	0 (fully filled and sealed)
Roof U-Value (W/m ² .K)	0.11
Roof Slope U-Value (W/m ² .K)	0.18

External Door U-Value (W/m ² .K)	1.00
Glazing U-Value (W/m ² .K)	1.3
Glazing G-Value	0.63
Design Air Permeability (m ³ /m ² hr @50 Pa)	3.5
Thermal Bridging	SAP 10 Appendix R values
Lighting (W/m ²)	100% of 80 lm/W
Ventilation	MVHR – Vectaire Midi/Maxi BY AT
Space Heating	92.3% efficient gas boiler*
Space Heating Controls	Zone controls, delayed start thermostat
Domestic Hot Water Heating	From main heating system

* *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 'Fabric First' stage results

The total calculated CO₂ emissions at the 'Fabric First' for the residential spaces at Land North of School Road, Arborfield Cross is **43.43 t.CO₂ per annum**, which is a reduction of 24.17 t.CO₂ per annum, or 35.8% over the Baseline. Please refer to Appendix 3 for SAP results.

Table 6 - Development's total calculated CO₂ emissions at the 'Fabric First' stage.

	CO ₂ emissions	
	t.CO ₂ per annum	% reduction
Target Emission Rate: compliant with AD L 2021	67.60	-
Fabric First: demand-reduction measures	43.43	35.8%

4. RENEWABLE AND LOW-CARBON ENERGY TECHNOLOGIES

4.1 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 North of School Road, Arborfield Cross.

Table 7 - Summary of feasibility for Land North of School Road, Arborfield Cross.

✓	Solar Thermal Solar PV Air Source Heat Pumps
X	Wind Turbines Biomass Boilers Ground Source Heat Pumps

AIR SOURCE HEAT PUMPS

Following the implementation of 'Fabric First' design measures to reduce energy demand, the strategy proposes individual ASHPs. This solution will ensure efficient, low-carbon space heating and hot water provision for all units.

This also brings the development in line with the anticipated FHS benchmarks and is a positive step towards zero carbon emissions with the decarbonisation of the grid electricity.

SOLAR THERMAL / SOLAR PV

Given the strong performance already achieved without renewables, and the additional considerations associated with PV installation (including orientation, shading, visual impact, and maintenance), it is considered proportionate and justified to exclude PVs at this outline stage. However, this position could be revisited at detailed design if necessary to further improve performance or address specific local requirements.

4.2 Development's 'LZC' stage results

The estimated site-wide CO₂ emissions after implementation of the suitable LZC technologies for the residential spaces at Land North of School Road, Arborfield Cross are **19.07 t.CO₂ per annum**, which is a reduction of further 24.36 t.CO₂ per annum, or 36% over the Baseline. This exceeds the 10% reduction target set out in *Policy CC05*. Please refer to Appendix 3 for the detailed SAP results.

Table 8 – The 'LZC' stage results for Land North of School Road, Arborfield Cross.

	CO ₂ emissions	
	t.CO ₂ per annum	% reduction
Target Emission Rate: Compliant with AD L 2021	67.60	-
Fabric First: demand-reduction measures	43.43	35.8%
Renewable and low-carbon energy technologies	19.07	36.0%

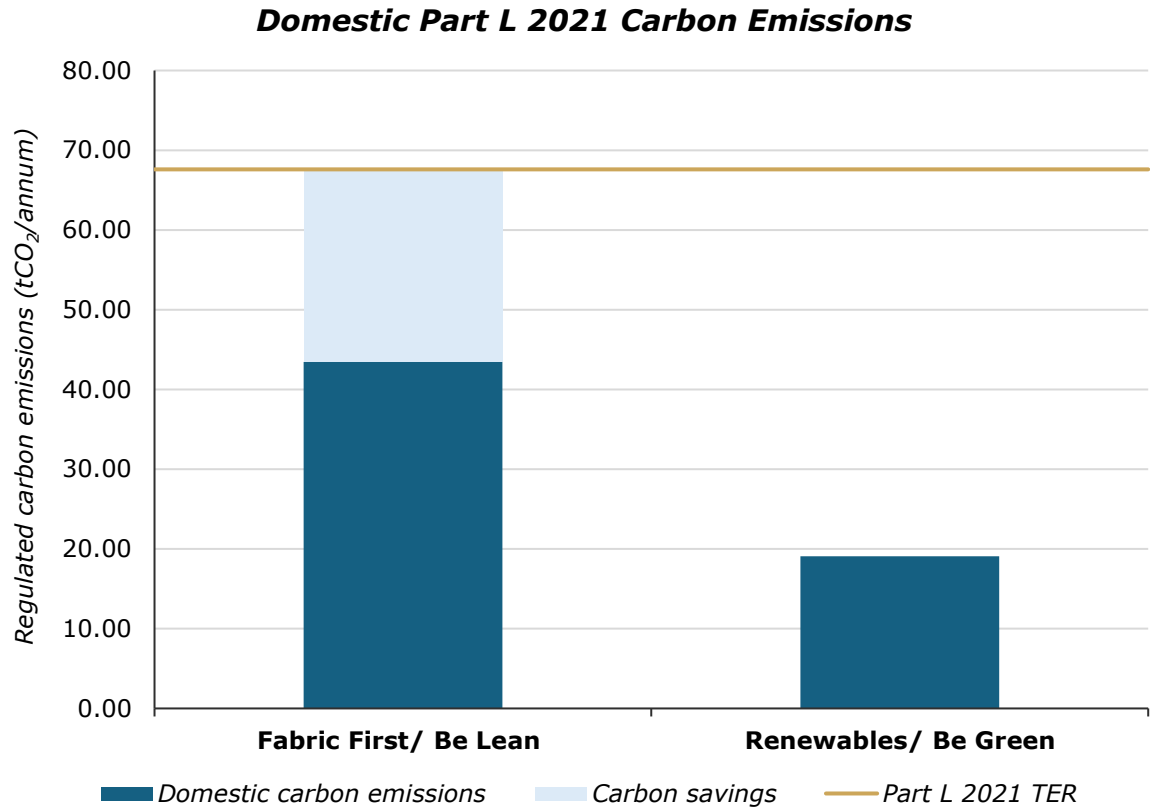


Figure 4 – TER, 'Fabric First' and 'LZC' CO₂ emissions summary

5. Reduced Water Demand

It is recognised that water consumption in residential dwellings has a significant impact not only on direct operational costs (e.g., water bills), but also indirectly through increased energy use associated with heating water for domestic purposes. This relationship is partly reflected in the SAP 10.2 methodology, which accounts for reduced energy demand where a dwelling complies with [Approved Document Part G](#).

The Applicant intends to reduce water demand across the site by incorporating water-efficient fixtures and fittings as standard in all new homes. A water consumption rate of 110 litres per person per day, including a 5-litre allowance for external water use, will be achieved in line with *Policy CC04*.

An interim water efficiency calculation has been undertaken to estimate the average daily water use, based on the flow rates of taps and showers and the capacity of appliances such as baths, dishwashers and washing machines. The calculation also incorporates assumptions on typical usage patterns. A detailed water efficiency assessment demonstrating compliance with this standard is provided in Appendix 5.

Table 9 - Water calculations for new dwellings at Land North of School Road, Arborfield Cross.

Element	Performance
Kitchen taps flow rate	6 Litres per minute
Other basin taps flow rate	5.4 Litres per minute
WCs flush volume (full/part)	4/2.6Litres
Shower flow rate	8 Litres per minute
Bath volume	155 Litres
Dishwasher water consumption	1.30 litres per place setting
Washing-machine water consumption	8.20 litres per kg

6. CONCLUSIONS AND RECOMMENDATIONS

The Applicant has committed to achieving substantial reductions in CO₂ emissions at the proposed development at Land North of School Road, Arborfield Cross.

The energy strategy follows the recognised three-tier energy hierarchy — *reduce energy demand, supply energy efficiently, and utilise renewable energy* — and aligns with key policy drivers, including:

- The Climate Change Act (2008),
- National Planning Policy Framework (2024),
- Approved Document L Volume 1: Dwellings (2021),
- the Wokingham Adopted Core Strategy Development Plan (2010), and
- the Wokingham Borough Council Climate Change Interim Policy Position Statement (2022).

The latter requires all residential developments of 10 or more dwellings to achieve at least a 10% reduction in CO₂ emissions through on-site renewable energy.

The strategy also anticipates the FHS, due to be implemented in 2025, which is expected to require a 75–80% reduction in emissions compared to dwellings built to the 2013 Building Regulations.

The current outline proposal delivers a 71.8% reduction over AD L 2021 — a significant step towards this target, achieved without reliance on PV installations.

Each tier of the energy hierarchy has been addressed in full. The development prioritises demand reduction through a series of ‘fabric-first’ measures, enhancing the thermal performance of the building envelope. In addition, the inclusion of individual ASHPs supports both efficient energy supply and low-carbon heating provision. ASHPs play a dual role in the strategy: they provide high-efficiency heating while significantly reducing emissions, making them integral to meeting the FHS ambition and displacing fossil fuel use.

PV panels have not been proposed at this stage, as the development achieves strong energy performance through passive design and ASHPs alone. The resulting 71.8% on-

site CO₂ reduction significantly exceeds current Building Regulations requirements and represents a pragmatic and effective approach at outline stage. PVs may be reconsidered at a later stage if further uplift is required.

A summary of the key design and technology measures adopted within this strategy is presented in the table below.

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

Table 10 - Measures incorporated to deliver the energy standard.

Fabric First: demand-reduction measures	▪ Energy-efficient building fabric and insulation to all heat loss floors, walls and roofs. ▪ High-efficiency double -glazed windows throughout. ▪ Quality of build will be confirmed by achieving good air-tightness results throughout. ▪ Efficient-building services ▪ Efficient MVHR system throughout. ▪ Low-energy lighting throughout the building.
Renewable and low-carbon energy technologies	▪ Individual ASHPs to provide space heating and hot water across the development.

Details of the CO₂ emissions and percentage savings are provided in Table 11, with Figure 5 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	
	t.CO ₂ per annum	% reduction
Target Emission Rate: compliant with AD L 2021	67.60	-
Fabric First: demand-reduction measures	44.43	35.8%
Renewable and low-carbon energy technologies	19.07	36.0%
Total cumulative savings	48.53	71.8%

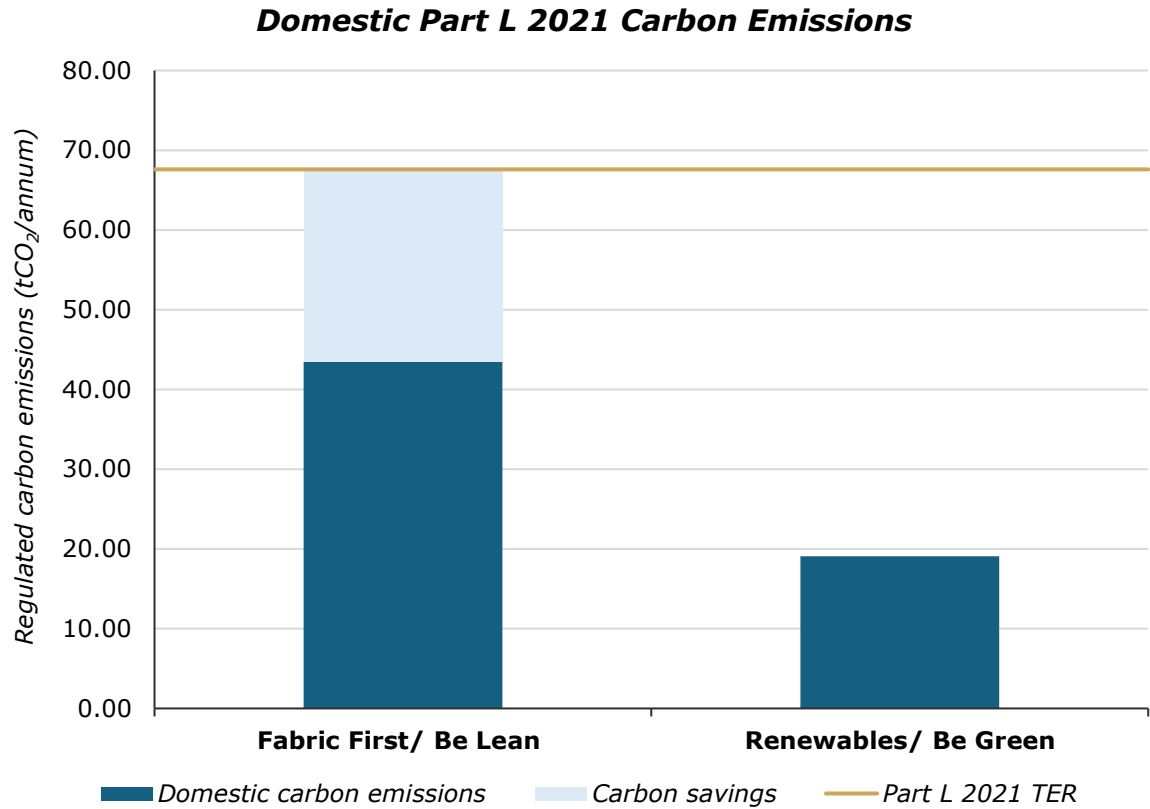


Figure 5 - How the Development delivers the energy standard

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 (2024)

The National Planning Policy Framework (NPPF) encourages Local Planning Authorities to 'support the transition to net zero by 2050 and take full account of all climate impacts including overheating, water scarcity, storm and flood risks and coastal change. I ' (NPPF paragraph 161), 'Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating and drought from rising temperatures '. (NPPF Paragraph 162).

Paragraph 165, 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, and their future re-powering and life extension, while ensuring that adverse impacts are addressed appropriately (including cumulative landscape and visual impacts);

b) consider identifying suitable areas for 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 locating potential heat customers and suppliers.

In paragraph 166, 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.'

Wokingham Brough Local Development Framework Adopted Core Strategy Development Plan Document (Jan 2010)

CP1 – Sustainable development

Planning permission will be granted for development proposals that:

- 1) Maintain or enhance the high quality of the environment;
- 2) Minimise the emission of pollutants into the wider environment;
- 3) Limit any adverse effects on water quality (including ground water);
- 4) Ensure the provision of adequate drainage;
- 5) Minimise the consumption and use of resources and provide for recycling;
- 6) Incorporate facilities for recycling of water and waste to help reduce per capita water consumption;
- 7) Avoid areas of best and most versatile agricultural land;
- 8) Avoid areas where pollution (including noise) may impact upon the amenity of future occupiers;
- 9) Avoid increasing (and where possible reduce) risks of or from all forms of flooding (including from groundwater);
- 10) Provide attractive, functional, accessible, safe, secure and adaptable schemes;
- 11) Demonstrate how they support opportunities for reducing the need to travel, particularly by private car in line with CP6; and
- 12) Contribute towards the goal of reaching zero-carbon developments⁴¹ 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 design to take account of microclimate so as to minimise carbon dioxide emissions through giving careful consideration to how all aspects of development form.

Climate Change Interim Policy Position Statement (December 2022)

Table 2 – Proposed Clarifications to existing Local Plan climate change related policies

Existing Local Plan Policy	Policy Application	Justification
CC04: Sustainable Design and Construction <i>Planning permission will only be granted for proposals that seek to deliver high quality sustainably designed and constructed developments by:</i> 1. In respect of all new homes: a) Seeking to achieve the 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).	Given the Code for Sustainable Homes has been withdrawn, applicants must meet the interim Future Homes Standard (as required by Building Regulations) of a minimum 31% reduction in emissions and are encouraged to work towards the full Future Homes Standard of 75-80% less carbon emissions. Any uplift to minimum Building Regulations requirements is a material planning consideration which will be taken into account. The expectation will be that developments meet the optional building regulations standard of 110 litres per person per day as a minimum given CfSH has been revoked. Delivery beyond these standards is a material planning consideration which will be taken into account.	From 15 June 2022 the interim Future Homes Standard has been introduced into Building Regulations Part L and is therefore mandatory for all new applications. The full Future Homes Standard is expected to be introduced shortly (in 2025) and therefore development proposals are encouraged to aim towards this higher standard. Wokingham Borough is situated within part of the country classified as an area of serious water stress. In order to address this issue, and contribute towards wider climate change adaptability, the higher optional standard for water efficiency of 110 litres per person per day is justified.
CC04: Sustainable Design and Construction 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	Non-residential schemes will be expected to meet the interim Future Buildings Standard (as required by Building Regulations) of a minimum 27% reduction in emissions, as a minimum. In practice, this means meeting BREEAM 'Excellent' standard or higher. Delivery beyond these standards is a material planning consideration which will be taken into account.	A mandatory BREEAM requirement has not been set at the national level, as was the expectation when the policy was introduced. Best practice standards have generally been recognised as at least BREEAM 'Very Good' or 'Excellent' as is reflected in WBC's Sustainable Design and Construction SPD (2014). However, the Future Buildings Standard, requiring new non-residential buildings to achieve a 27% reduction in carbon emissions, came into force on 15 June 2022. It is noted that the current BREEAM 'Very Good' classification does not achieve the minimum

		27% carbon reduction required. All schemes must comply with updated building regulations and achieve the interim Future Building Standard which means requiring BREEAM 'Excellent' is justified. Schemes that work to other standards (for example Passivhaus) will also be considered provided they deliver sustainability outcomes demonstrably equivalent to, or better than, BREEAM 'Excellent'.
CC05: Renewable energy and decentralised energy networks 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	For clarification, the policy requirement for 10% energy reduction through renewable / low carbon technologies is expected to be achieved in addition to the uplifted emissions improvements required through Building Regulations (as updated in June 2022). Renewable and low carbon energy schemes will be supported in appropriate locations and where consistent with other relevant policies. WBC will consider the climate change benefits of a proposal when assessing the acceptability of a renewable energy application and take a positive presumption, supporting schemes unless the harm is significant and not outweighed by the benefits.	CC05 supporting text is clear "The relevant standards in the assessment are those set by Building Regulations at the time of submission of a planning application." (paragraph 2.38). The uplifted building regulations introduced in June 2022 are the mandatory starting point. WBC expects fabric efficiency improvements, such as additional insulation, to be used to meet building regulations and for the additional 10% policy requirement to be sought in addition to these improvements. To accord with the NPPF, in particular paragraphs 152, 155, 156, and 158: "152. The planning system should support the transition to a low carbon future in a changing climate ... It should help to: shape places in ways that contribute to radical reductions in greenhouse gas emissions... and support renewable and low carbon energy and associated infrastructure." "155. 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); ..."

APPENDIX 3: SAP RESULTS

SAP 10.2 Compliance Sheets provided separately.

APPENDIX 4: PART G CALCULATIONS

ENERGIST
WATER EFFICIENCY CALCULATOR

Water efficiency calculator for 3 Bed , Land North Of School Road , Arborfield Cross, RG2

Our reference: CR.AC.RG2
 Regulation: Part G (2015) Enhanced

Assessor: Dominique Stockford
 Date issued: 9-4-2025. Revision:

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)	4.0	1.46	0	5.84
	Part flush volume (litres)	2.6	2.96	0	7.70
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)	5.4	1.58	1.58	10.16
Bath (where shower also present)	Capacity to overflow (litres)	155.0	0.11	0	17.05
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)	6.0	0.44	10.36	13.00
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					110.36
Contribution from greywater (litres/person/day) from Table 4.6					0.00
Contribution from rainwater (litres/person/day) from Table 5.5					0.00
Normalisation factor					0.91
Total water consumption					100.43
External water use					5.00
Total water consumption (litres/person/day)					105.43

APPENDIX 5: LZCT ASSESSMENT

Wind	<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>
Installation considerations	▪ 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 £3,000. A 2.5 kW pole-mounted system costs between £9,900 and £19,000. A 6 kW pole-mounted system costs between £21,000 and £30,000 (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	▪ 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	▪ 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	▪ 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 4.7 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	<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> Solar Photovoltaics convert solar radiation into electricity which can be used on site or exported to the national grid. Solar Thermal generates domestic hot water from the sun's radiation. Glycol circulates within either flat plate or

	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.
Installation considerations	▪ 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 £5,000 - £8,000 (including VAT at 5 per cent) - (taken from the Energy Saving Trust).
Advantages	▪ 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	▪ 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 ✓	▪ 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	<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> 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. They can feed either low-temperature radiators or underfloor heating and often have electric immersion heater back-up for the winter months.
Installation	▪ 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	temperatures. It is therefore vital that the dwelling has a low heating demand to ensure the system can provide appropriate space-heating capability. ▪ 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. ▪ £7,000-£11,000 per dwelling (taken from the Energy Saving Trust).
Advantages	▪ Air source systems are a good alternative solution to providing heating and hot water to well-insulated, low heat loss dwellings. ▪ 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	▪ 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. ▪ 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. ▪ 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	- 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. £11,000-£15,000 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	- 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	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	<i>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.</i> 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. ▪ £11,000-£15,000 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	▪ 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	▪ 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	<i>Providing a heating system fuelled by plant based materials such as wood, crops, or food waste.</i> 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.
Installation considerations	▪ 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.

	▪ 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. ▪ £9,000-£21,000 per dwelling dependent on size (taken from Energy Saving Trust).
Advantages	▪ Considerable reduction in CO₂ emissions.
Disadvantages	▪ 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	▪ 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.