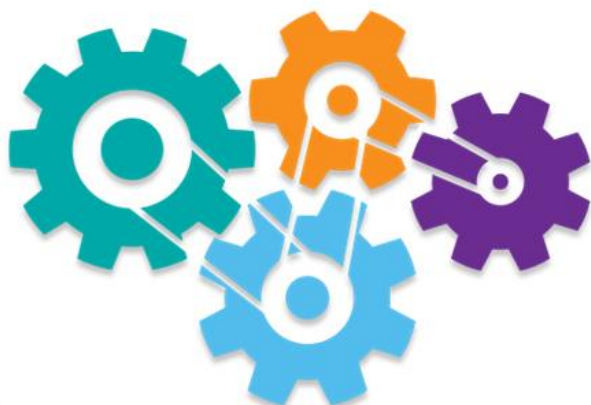


Land Adjacent
1 Ilbury Close
Shinfield
Reading
RG2 9DE

Energy Strategy Report

September
2026



Ref:
26-16860

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Quality Standards Control

The signatories below verify that this document has been prepared in accordance with our quality control requirements. These procedures do not affect the content and views expressed by the originator.

This document must only be treated as a draft unless it has been signed by the originators and approved by a director.

Revision	Initial	Rev A	Rev B	Rev C
Date	29/09/26			
Prepared by	R. Jadhav			
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Authorised by	A. King			

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Abbreviations

ASHP:	Air Source Heat Pump
BER:	Building Emission Rate
CO ₂ :	Carbon Dioxide
CHP:	Combined Heat and Power
CSH:	Code for Sustainable Homes
DWE:	Dwelling Emission Rate
DHW:	Domestic Hot Water
ESR:	Energy Strategy Report
GHG:	Green House Gas
GSHP:	Ground Source Heat Pump
GLA:	Great London Authority
HVAC:	Heating, Ventilation, and Air Conditioning
IES VE:	Integrated Environmental Solutions Virtual Environment
KWp:	Kilo Watt Power
KWh:	Kilo Watt Hour
LZC:	Low Zero Carbon
MVHR:	Mechanical Ventilation Heat Recovery
MCS:	Microgeneration Certification Scheme
NPPF:	National Planning Policy Framework
NCM:	National Calculation Methodology
OSM:	Open Street Map
PV:	Photovoltaic
SBEM:	Simplified Building Energy Modelling
SFP:	Specific Fan Power
TER:	Target Emission Rate

1. Executive Summary

This Energy Strategy Report demonstrates the predicted energy performance and carbon emissions of the proposed residential development located at **Land Adjacent 1 Ilbury Close, Shinfield, Reading, RG2 9DE**. The figures presented in this study are based on the most up to date information provided by the design team. The development will comprise of **2 semi-detached, 3-bedroom** dwellings. The overall analysis took into consideration the national building regulations (i.e. **Part L 2021**) and the local policy requirements (i.e. **Wokingham Borough Local Development Framework**). Based on the study assumptions, the project shall comply with the council local policies and building regulations.

1.1 Building Policy Requirements

The national building regulations require buildings to comply with certain objectives aimed at energy efficiency. This shall be accomplished through capping the project carbon emissions below the regulated target. In addition to the above, **Wokingham Borough Council** requires new developments to incorporate sustainable design and construction measures. The table below summarises the building regulations and local policy requirements the assessment adopted for the development.

Table 1: National and Local Policy Requirements

Policy:	Requirement	Compliance Check
Part L 2021	The building primary energy rate (BPER) and building emission rate (BER) must not exceed the target primary energy rate (TPER) and target emission rate (TER) respectively.	The development will be able to achieve all criteria through the implementation of several measures proposed as part of the energy strategy laid out within this report.
Wokingham Borough Local Plan (Adopted January 2010)	New development should minimise energy demand through sustainable design and construction measures, following the energy hierarchy and adopting a fabric-first approach to achieve high levels of energy efficiency.	Energy demand associated with the proposed development has been minimised through a fabric-first strategy. Enhanced thermal performance, airtightness and insulation standards reduce regulated energy consumption and associated carbon emissions.
	Development should incorporate passive design principles, including appropriate orientation, building form, solar gain control, natural daylighting and ventilation, to reduce reliance on mechanical heating and cooling systems.	The development has incorporated passive design measures through building orientation, glazing specification and window placement to maximise daylight while limiting unwanted heat losses and gains.

	Development should maximise opportunities for renewable and low-carbon energy generation through the integration of suitable technologies.	The proposal incorporates ASHP and PV panels to provide low-carbon heating and onsite renewable electricity generation. Together, these measures achieve 64.70% carbon reduction as measured against Building Regulation Part L 2021 TER.
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1.2 Assessment Methodologies and Strategies

The adopted methodology to mitigate the project's CO₂ emissions is in alignment with the *Wokingham Borough Council* policies. Models and simulation assumptions have been carried out using **SAP** calculation methods which comply with the National Calculation Methodologies (NCM).

Error! Reference source not found. below explains the various stages of the energy assessment and the suggested strategies to help the proposed development achieve the required carbon targets.

Table 2: Energy Assessment Stages

Stages	Strategies
1. <u>BE LEAN</u> Carbon Efficient Design (Minimising energy demand)	- Improved fabric U-values beyond Part L requirements. - Enhanced thermal bridging performance. - Energy efficient lighting fittings (i.e., LED). Further information can be found in the Be Lean Section.
2. <u>BE CLEAN</u> (Availability of CHP and communal heating systems)	Analysis for local CHPs and communal heating systems has been assessed. Further information can be found in the Be Clean Section.
3. <u>BE GREEN</u> On-site renewable technologies (e.g. solar, wind etc.)	Provision of efficient building services by way of ASHP as well as solar PV. Further information will be presented in the Be Green section below.

Table 3: Analysis stages and their corresponding carbon emissions

Analysis Stage	Average Building Emission Rate (BER) (KgCO ₂ /m ² .annum)
Notional TER	10.98
Stage 1 (Be Lean)	15.79
Stage 2 (Be Clean)	15.79
Stage 3 (Be Green)	3.83

The table above enlists the carbon emissions for each stage of the assessment, following the implementation of various environmental strategies relevant to each stage.

1.3 Assessment Results

The domestic development has been simulated under four conditions to analyse the improvements hierarchy. The first simulation assesses the building under the notional building specifications defined by Part L 2021. The function of this first simulation is to generate the regulated carbon target (TER) and the actual Building Emission Rate (BER). The second calculation analyses the carbon reductions achieved after improving the building fabric thermal performance by adopting improved thermal U-values and airtightness (i.e. **Stage 1**). The third stage of simulation assesses the feasibility of adopting local low-carbon energy sources like CHPs (i.e. **Stage 2**). The fourth simulation analyses the carbon reductions after considering renewable technologies as a strategy to achieve carbon reductions beyond **Part L** requirements (i.e. **Stage 3**).

The development comprises of two semi-detached dwellings that are mirror images of one another. While the side elevations are oriented in opposite directions, the only variation is the location of a half-glazed external door. SAP calculations produced identical performance results for both dwellings. Therefore, the results presented below are representative of both houses.

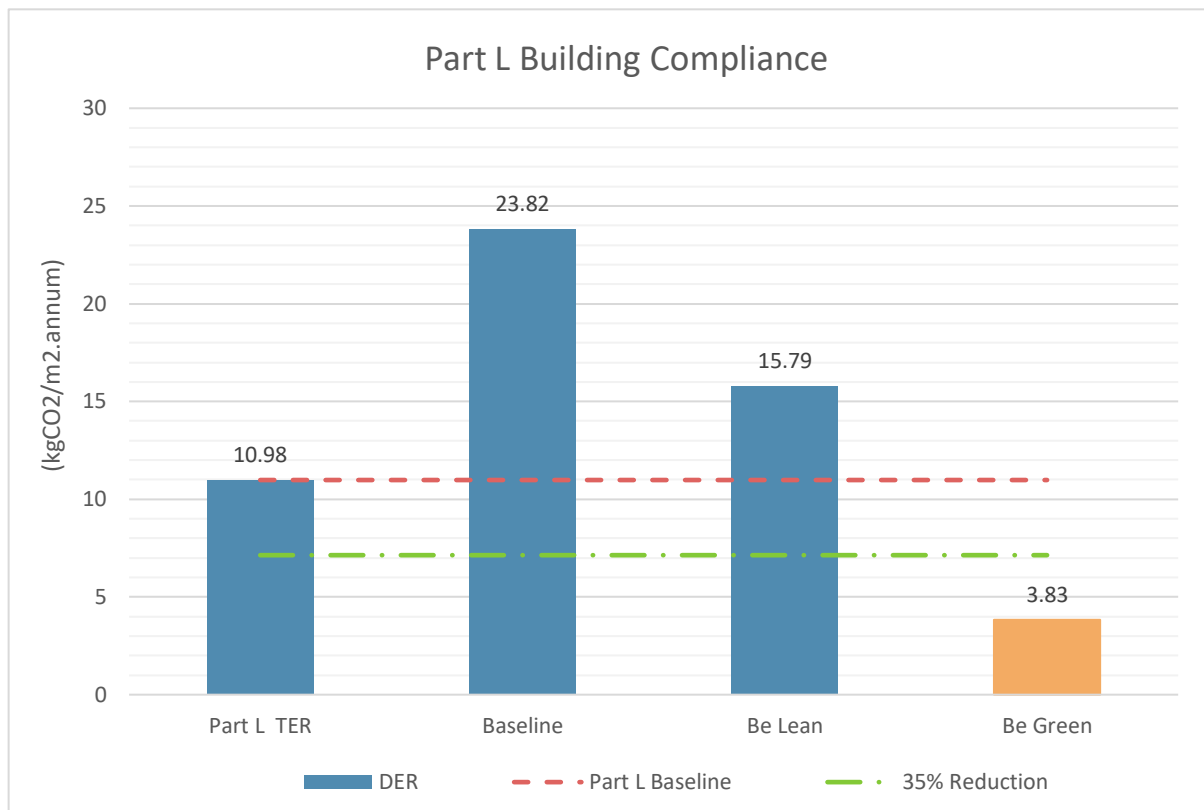


Figure 1: Impact on Building Emission Rate (BER) of the dwellings after every stage of the proposed strategy

Results of the simulations above show that the development is able to meet the criteria of the national and local policies i.e. reduction in carbon emissions when compared against the targeted emission rate (TER). Table 4 below, indicates the carbon emissions at each stage of energy hierarchy.

Table 4: Carbon Reduction Calculation

Analysis Stage	Average BER (KgCO ₂ /m ² .annum)	Total Carbon (Tonnes CO ₂ /annum)	% Reduction from TER
Notional TER	10.98	1.02	-
Be-Lean BER	15.79	2.22	-
Be-Clean BER	15.79	1.47	-
Be-Green BER	3.83	0.36	64.70

2. Introduction

Syntegra Consulting Ltd was instructed in September 2026 by Belle Housing Ltd to undertake an Energy Strategy Report (ESR). This Energy Strategy Report focuses on the energy strategies explored for the proposed scheme in order to make it comply with national and local policy requirements. The report presents how the annual energy consumption and related carbon emissions will be minimised to meet the regulated targeted carbon emissions (i.e. **Part L TER**). Furthermore, the report explains how to reach the required energy targets to achieve carbon reductions for the development.

The proposed development is located at **Land Adjacent 1 Ilbury Close, Shinfield, Reading, RG2 9DE**, within the administrative boundary of **Wokingham Borough Council** in the **South-Eastern** region of England. The development proposal has a total built up area of approx. **186m²** (please see calculation



Figure 2: Site Location (marked in Red)

reports in Appendix A).

The domestic and non-domestic sectors play an important role in the UK economy, both as employer and generator of output and in providing other sectors such as retail, finance and business with a critical factor of production, the physical location from which to do business. This ESR report analyses the domestic project using research and policies guidance to make sure this development is built up to achieve positive economic, social and environmental impacts.

3. Planning Policy

3.1 National Planning Policy Framework (NPPF, August 2026)

The National Planning Policy Framework is a key part of the reforms to make the planning system less complex and more accessible. These actions have been taken for the purpose of protecting the environment and promoting a sustainable growth of the built environment.

3.2 Wokingham Borough Local Development Framework (Adopted January 2010)

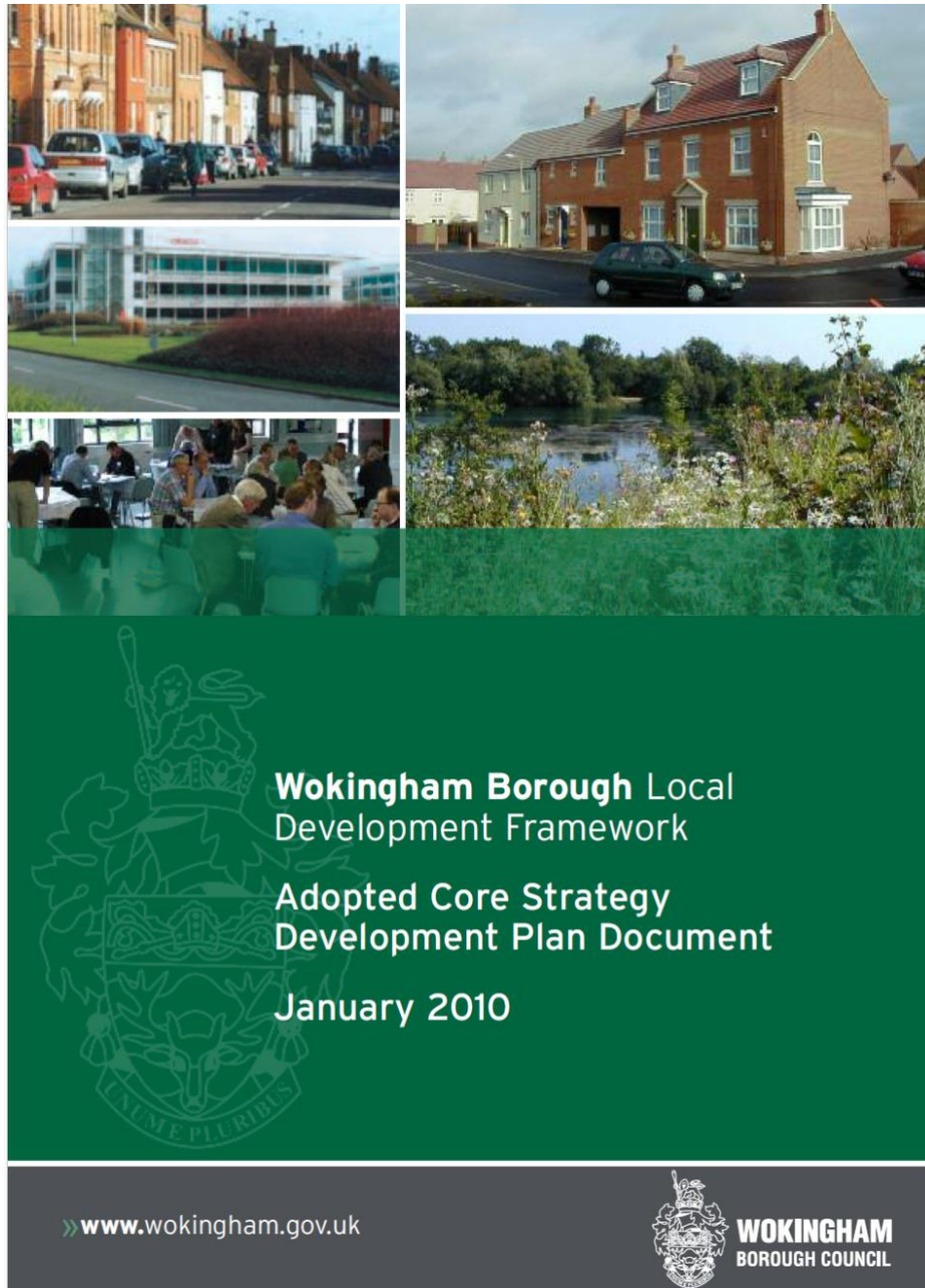


Figure 3: Wokingham Local Development Framework (January 2010)

Policy 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 (like 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
12. Contribute towards the goal of reaching zero-carbon developments as soon as possible by:
 - a. Including appropriate on-site renewable energy features
 - 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 considering how all aspects of the development form.

4. Assessment Methodology

4.1 Energy Hierarchy

The energy strategy adopted by this assessment is a set of different methods to improve energy performance in a parallel sequence. This includes primarily a focus on reducing energy use by avoiding unnecessary consumption, to then improving the efficiency of energy systems to minimise loss. This is followed by exploiting renewable energy sources and low carbon energy solutions for energy needs. Finally, any remaining demand can be catered for by conventional fuel sources and carbon offsetting solutions.

The Energy Strategy adopts a set of principles to guide design development and decisions regarding energy, balanced with the need to optimise environmental and economic benefits. The following hierarchy has been used to assess applications:

- **Stage 1** – By using less energy and considering the further energy efficiency measure in comparison to the baseline building.
- **Stage 2** – By supplying energy efficiently. Clean energy use looks at further carbon dioxide emission savings over the lean building by taking into consideration the use of decentralised energy (e.g. CHP, District Heat Networks).
- **Stage 3** – By integrating renewable energy into the scheme which can further reduce the carbon dioxide emission rate.

The methodology provides an appropriate framework for energy assessments while also being in line with the *Wokingham Borough Council* policies. It has therefore been appointed within this report as a step-by-step approach to ensuring compliance.

4.2 Modelling strategy

The Government approved software, **SAP 10.2** has been utilised to carry out the project compliance simulations (i.e., SAP) according to the National Calculation Methodology (NCM). Simulated Models are built to assess the actual building BER against the notional building TER. The notional building used to determine carbon dioxide targets (TER) is the same size and shape as the actual buildings, constructed to concurrent regulated specifications (i.e. **Part L 2021**).

The actual building has been modelled entirely to the notional building specifications in order to meet the carbon targets and the limiting fabric and buildings services parameters. However, for differences in fabric design and glazing areas, actual buildings sometimes are expected to exceed the notional TER. Therefore, further improvements to the actual building parameters (e.g. fabric, lightings, renewables) are made to meet the required compliance targets.

The approved document (i.e. **Part L 2021**) however, encourages developers to vary the specification provided the same overall level of carbon dioxide emissions is achieved or bettered. It is important to note that SAP is not intended to be used as a building design tool but to inform the designers' design decisions.

Information received from the project team has been used to undertake the energy assessments and supporting the modelling assumptions. The document references are listed in the table below.

Table 5: Reference documents list, as used for energy analysis

No.	Document Name	Format	Received Date
1	KICR - 200 - Planning	dwg	22-09-2026
2	KICR - 100 - Location And Block Plan	pdf	15-09-2026
3	KICR - 200 - Ground Floor Plan	pdf	15-09-2026
4	KICR - 201 - First And Roof Plan	pdf	15-09-2026
5	KICR - 400 - Front Elevations	pdf	15-09-2026
6	KICR - 401 - Rear Elevations	pdf	15-09-2026
7	KICR - 402 - Side Elevations	pdf	15-09-2026

5. BASELINE – Target Emission Rate (TER) & Building Emission Rate (BER)

The notional target (known as Target Emission Rate), as calculated in line with the Building Regulation 2021, is the maximum amount of carbon dioxide a development is allowed to emit. The Target Emission Rate (TER) includes carbon dioxide emissions which are covered by Part L of the Building Regulations, known as regulated emissions (space and water heating, ventilation, lighting, pumps, fans & controls). The baseline energy uses, and resultant CO₂ emissions rates of the development have been assessed using government-approved software (Elmhurst Energy).

This first run of simulation assesses the models under the notional building specifications defined under Part L to limit the fabric thermal heat losses. The assessment results in the regulated target values for energy consumption and carbon emissions i.e. the TER and TPER, by using the Government approved methodology (SAP).

The baseline regulated CO₂ emissions for the development are presented in the tables below:

Table 6: Regulated Energy Use and Carbon Emission Rate TER at Baseline

Energy Assessment Stage	BER (kgCO ₂ /m ² . year)	BPER (KWh _{PE} /m ² . year)
Notional	10.98	57.28
Baseline	23.82	131.05

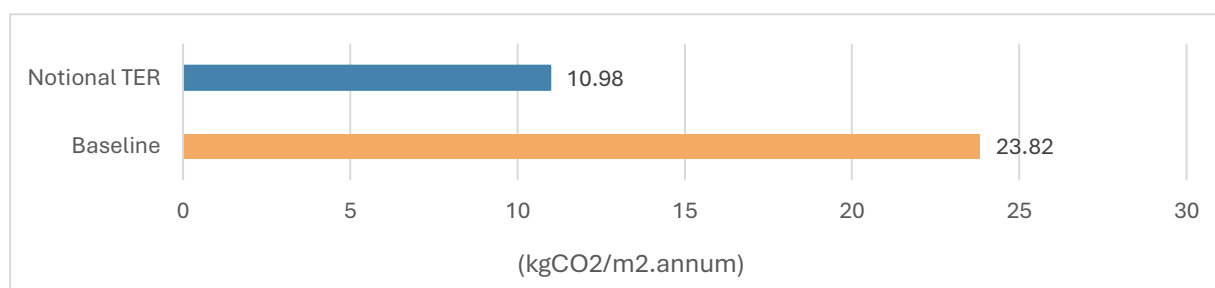


Figure 4: Notional Building TER and Existing BER for the proposed scheme

The results of the first run showed that the performance of the existing buildings is greater than the notional target (TER). Further improvements to the model mentioned, as per *Wokingham Borough Council's* local plan, are carried out in the following sections of the report (i.e. Stage 1 and Stage 2) to try and achieve reductions over the targeted performance.

6. STAGE 1 – BE LEAN – Passive Design

This section outlines the project location, orientation and climatic conditions taken into account to determine the most feasible energy efficient measures taken in order to minimise the building's energy demand. The analysis helps reduce the energy use and CO2 emissions beyond the Target benchmark on the path to achieving compliance (**Building Regulations 2021 Part L**).

6.1 Site location

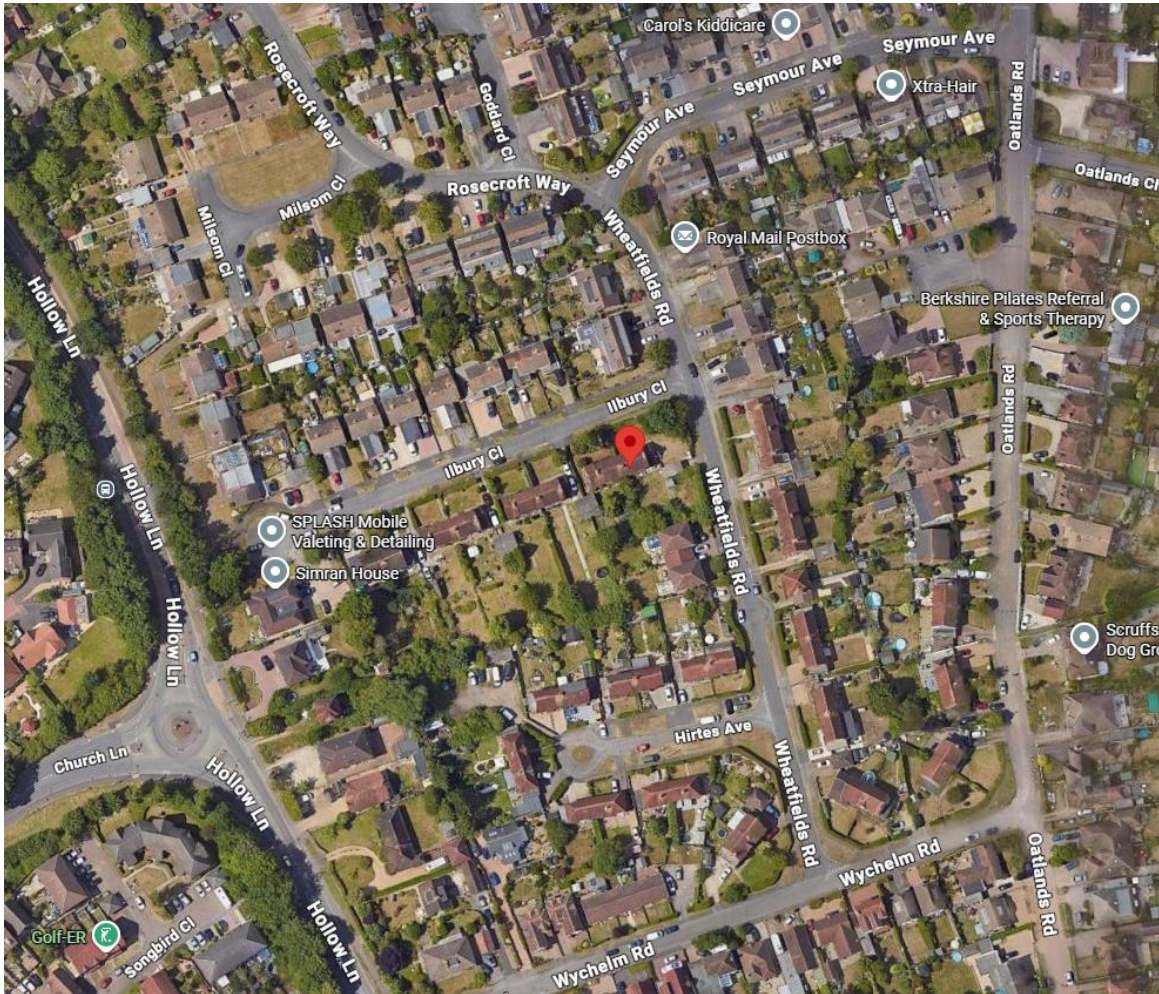


Figure 5: Urban view of the site surroundings (source: Google Earth)

The proposed project site is situated in Shinfield, just south of Reading. It is in an area predominantly characterised by low rise residential dwellings, with green spaces and areas of countryside within the wider setting. The site benefits from good connectivity to the local road network, including access to the M4 motorway. However, access to public transport is moderate. The nearest train station, Reading Green Park, is approximately 3.7 miles away and provides local rail services, while larger stations offering a wider range of destinations, such as Reading Station, are over 4 miles away. There are five bus stops approximately within 1-mile of the site, although services generally operate along similar routes and offer limited network coverage.

6.2 Site weather and Microclimate

The local weather and microclimate usually influence a building's energy performance. Urban design has a significant impact on microclimate and outdoor thermal comfort. Several studies in different climate regions have concluded that ventilation and shade are crucial to improve urban thermal comfort. Often the thermal conditions are improved as a consequence of good urban design including exist of proper shade and sufficient ventilation. This in turn leads to decreased occurrence of heat stress and heat-related diseases as well as grown performance of both mental and physical tasks.

London weather data has been used for thermal and energy simulations. Figure 7 represents the annual dry bulb temperature in London City. Maximum temperatures can reach up to 34.9°C in late Jun, and minimum temperatures can reach down to -2.1°C in late Feb. The buildings in this location are generally low rise, and the site is not expected to suffer from the Urban Heat Island effects.

The site's landscape also affects the energy demand of a building. Vegetation, landform, and any existing buildings can provide shade to a new development. For instance, if located to the south of the building, deciduous trees can be advantageous, providing shade in the summer but allowing sunshine through in the winter when they lose their leaves.

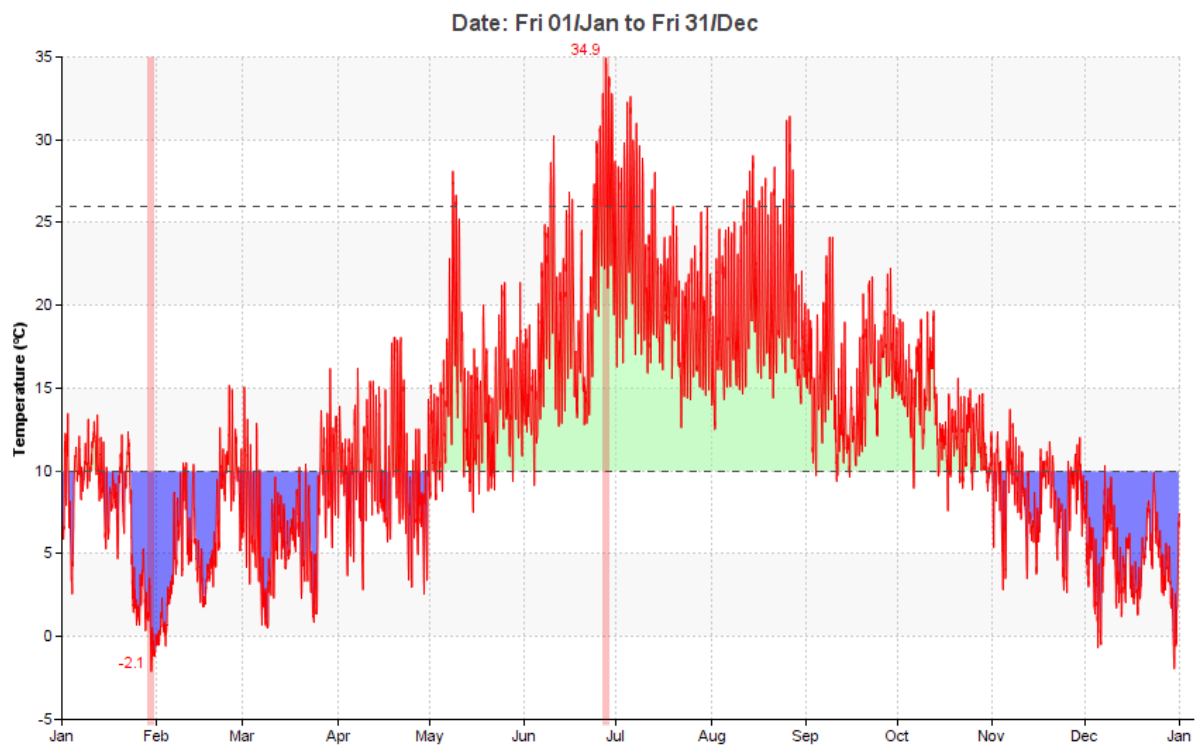


Figure 3: IES Annual Dry Bulb Temperature according to London weather data

6.3 Building Orientation, layout, and form

Building layout, orientation and form can influence many key features of the development. The design should provide for an effective use of space and layout, with opportunities to benefit from natural daylight balanced with achieving solar gain without overheating. In general, a higher thermal

performance can be achieved by limiting the surface area to volume ratio as this minimises heat loss through the wall area.

It should be noted that where the building footprint is extremely tight, for example in a city centre location, then the building form and orientation may have to be dictated by the available space and not by implementation of best practice measures. Invariably, planning constraints and/or the functional relationships of specific areas will result in some measure of deep planning, thus reducing the opportunity for natural ventilation and/or daylight.

In the current scenario, the dwelling has been planned such that the regularly occupied spaces (i.e. living rooms, bedrooms, kitchen etc.) have ample openings to allow daylight and sunlight in as the Window openings are a characteristic feature of the proposed development. The primary axis of the building runs roughly from the **North-West to South-East**.



Figure 4: Proposed roof plan

6.4 Building Design – Energy Efficiency Design Measures

At Stage 1 of the energy hierarchy, energy efficient building elements have been incorporated into the model. The heat loss of different building element is dependent upon their U-value, air permeability, and thermal bridging Y-values. Therefore, better U-values and air permeability figures than the minimum values set in **Part L1 2021** have been suggested in this stage of assessment process.

Table 7 below presents the improved U-values used for the building against the Part L1 2021 figures as used for the Baseline. The proposed U-values promote a thermally efficient building fabric in order to reduce energy consumption through passive measures. The overall figures mentioned in the table below are the assumptions for the second run of simulation.

Table 7: Proposed thermal performance for construction material

Category Specification		Part L1 Limiting values for existing buildings	Be Lean Improved values
U-value (W/m ² K)	External wall	0.26	0.18
	Heatloss floor	0.18	0.11
	Roof	0.16	0.11
	Door	1.6	1.0
	Window	1.6	1.2
Thermal Bridging (W/mK)	Lintel (E2)	0.1	0.02
	Sill (E3)	0.1	0.02
	Jamb (E4)	0.1	0.02
	Ground Floor (E5)	0.32	0.05
	Intermediate Floor (E6)	0.32	0.05
	Party Wall - Ground Floor (P1)	0.24	0.05
	Party Wall - Intermediate floor (P2)	0.24	0.05
	Party Wall - Roof (P4)	0.24	0.05
Air Permeability (m ³ /h.m ² at 50 Pa)		8.00	5.00

The proposed development will be adopting the following measures for enhanced fabric thermal performance:

- Enhanced envelope U-values to reduce the building's heat losses and demand.
- Providing a well-sealed envelope to minimise the infiltration of cold winter air and warm air in summer.
- Minimising thermal bridging by using accredited construction details to avoid heat losses.
- Adopting a window to wall ratio that prioritises daylight but controls solar gain and glare – to reduce electric lighting energy consumption while mitigating overheating.
- Providing exposed thermal mass to provide passive cooling – suppresses summertime overheating to acceptable levels without the need for high energy consuming mechanical cooling systems.

With the introduction of stricter benchmarks under Part L 2021, thermal performance of the building envelope has become crucial for compliance. As such, it has been proposed that U-values shall be reduced beyond the Part L requirements, particularly for glazing areas, to achieve the compliance criteria.

6.5 Building occupancy type

The building occupancy type is dependent on the NCM building type. The proposed dwelling has been identified as C3 Residential. The occupancy and internal gains have been input accordingly.

6.6 Daylighting and Solar Shading Strategy

The glazing specification is carefully selected to ensure the internal environment is pleasant on all orientations by providing high insulation levels with optimized solar gain. Additionally, selected spaces (i.e. Living room, Kitchen and corridor) having larger openings have been proposed with blinds to achieve better indoor thermal comfort.

6.7 Ventilation Strategy

Background ventilation will be provided via trickle ventilators incorporated within windows, together with local mechanical extract fans serving rooms requiring extraction, such as kitchens, bathrooms and WCs. No active cooling system is proposed, helping to avoid the unnecessary energy consumption associated with mechanical air-conditioning while maintaining adequate indoor air quality through natural ventilation, background trickle ventilation and targeted mechanical extraction.

6.8 Cooling Hierarchy

The building regulations outline a hierarchy of measures which should be followed in order to reduce the demand for cooling within the development. Multiple strategies have been considered for this development to reduce the cooling demand and the overheating risks, as described below:

- Reducing Solar Gains – Minimal glazing with low G-Values have been targeted in order to minimise solar gains.
- Minimising Internal Heat Gains – Heat distribution infrastructure within buildings is to be designed to minimise pipe lengths and adopt pipe configurations which minimise heat loss (e.g., twin pipes). All hot water pipes are to be insulated to reduce heat escaping into occupied spaces.
- Thermal Mass – Increasing the amount of exposed thermal mass can help to absorb excess heat within the building. Further investigation needs to be undertaken to try to capitalise on the thermal massing wherever possible, to help regulate the internal temperature.
- Optimised ventilation – Mechanical extraction strategies will be adopted with extract fans in wet rooms (e.g., toilets) to remove the hot, humid air.

6.9 Be Lean – Active Design Measures

The table below shows the applied 'Be Lean' active design measures incorporated within the design to demonstrate the energy strategy approach.

Table 8: Active Design Measures adopted at Be Lean Stage

Measure	Explanation
On-demand control	The room by room heating and lighting controls ensure that energy efficiency is maximised in almost all spaces where the amount of air or heat delivered is variable to suit the space.
Lighting Efficiency	The proposed light fittings shall be 100% energy efficient fittings i.e., LED lighting. These have been found to be a cost-effective measure to reduce electrical energy use associated with artificial lighting.

The impact of the measures implemented at this stage is summarized below:

Table 9: Regulated Carbon Emission Rate (BER) at Stage 1- Be Lean

Energy Hierarchy Stage	BER (kgCO ₂ /m ² . year)	BPER (KWh _{PE} /m ² . year)
Notional	10.98	57.28
Stage 1	15.79	87.87

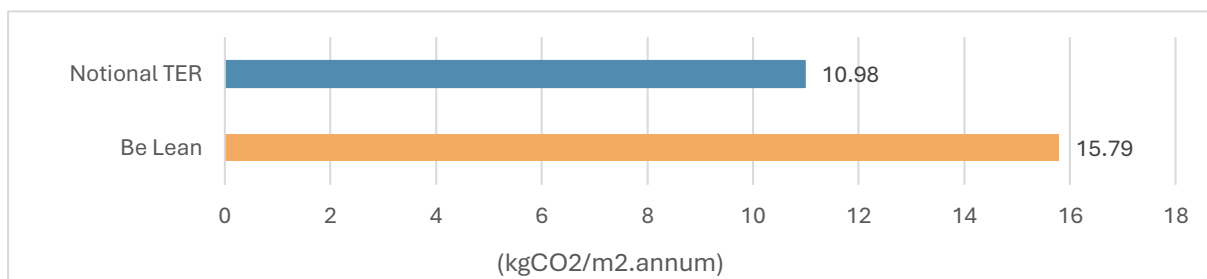


Figure 5: Notional Building TER and Stage 1 BER for the proposed scheme

At Stage 1 of the energy hierarchy, high-performance construction material and energy efficient building systems have been incorporated into the model, as summarized in Tables 7 and Table 8 above.

The output from the energy assessment at this stage confirms that implementing the above-mentioned measures will result in reductions in the energy consumption of the building when compared against the baseline building performance. However, these reductions are not enough to bring the carbon emissions under the notional target. This may be attributed to the fact that a gas boiler has been appointed for the development at this stage, in keeping with Building Regulations guidance on energy assessments. Further measures to ensure compliance have been recommended in the following sections of the report.

7. STAGE 2 – BE CLEAN – CHP & Decentralised Energy Networks

The *Wokingham Borough Council* policies encourage the use of local CHP systems and connection to District Heating systems to further reduce CO₂ emissions.

7.1 Decentralised Energy Network

District and community heating systems are favoured because they offer:

- Potential economies of scale in respect of efficiency and therefore reduced carbon emissions
- Greater potential for future replacement with Low or Zero Carbon (LZC) technologies

The feasibility of connecting into an existing heating network or providing the building with its own combined heat and power plant has been assessed as part of this stage. The national government data identifies that the site is not located near any existing or proposed district heat networks. In case heat networks are present in the area, their exact location, capacity and status of completion cannot be ascertained.

On the basis of the above findings, it is suggested that the building include provisions for future adaptability to connect to the district heat network. However, for the current analysis, it is proposed for this development to implement Air source heat pumps which enable a low temperature heating network to be set up within the building for heating and hot water systems. This makes the proposed system compatible for future connectivity with any heat networks, should the opportunity present itself.

7.2 Combined Heat and Power (CHP)

The assessment identifies the combined heat and power (CHP) as a method of producing heat and electricity with much lower emissions than separate heat and power. Also, it encourages the creation of district heating systems supplied by CHP. The implementation of a CHP strategy should be decided according to good practice design. Key factors for the efficient implementation of the CHP system are:

- Development with high heating load for most of the year.
- CHP operation based on maximum heat load for minimum 10 hours per day.
- CHP operation at maximum capacity of 90% of its operating period.

To ensure that CHP is financially viable it is essential that the unit is selected to meet the base heat load and that this load is maintained over a large proportion of the day (a figure of 14 – 17 hours per day is often quoted subject to the load profiles and gas and electricity prices) to ensure that the additional costs (maintenance) associated with running a CHP unit can be recovered. This needs to run the CHP plant, as far as possible continuously makes the building load profile of prime importance when reviewing the viability of such solutions and in particular the summertime heat load profile. To enable the CHP plant to run continuously when it is operating, a thermal store is often used so that excess CHP capacity can be used.

Generally, developments consist of at least 50 residential units would obtain the benefits of the micro-CHP system. As such, **the implementation of a CHP has not been considered for this development.** In case the design team considers installing this technology, further information regarding the local system storage space will be needed.

Therefore, the status of the assessment after Stage 2 is summarized below:

Table 10: Regulated Carbon Emission Rate (BER) at Stage 2- Be Clean

Energy Hierarchy Stage	BER (kgCO ₂ /m ² . year)	BPER (KWh _{PE} /m ² . year)
Notional	10.98	57.28
Stage 2	15.79	87.87

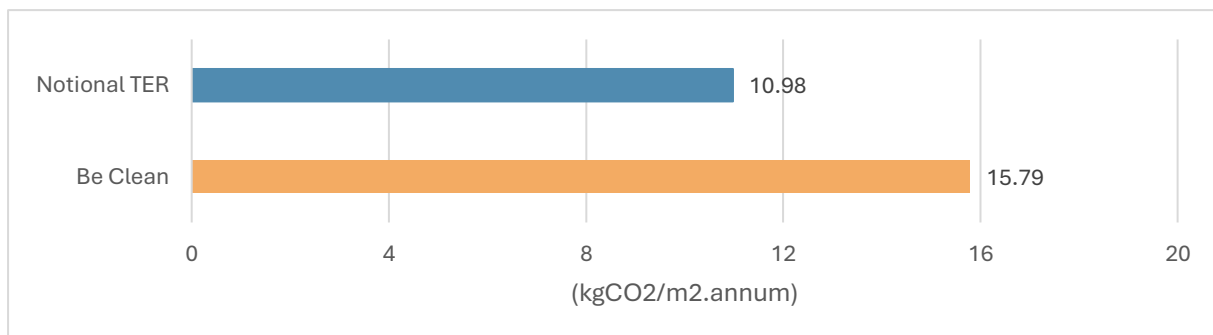


Figure 6: Notional Building TER and Stage 2 BER for the proposed scheme

8. STAGE 3 – BE GREEN – Renewable Energy Appraisal

In this section the viable renewable energy technologies that could reduce the development's CO₂ emissions are examined. The technical feasibility and economic viability of installing each LZC technology at the development have been assessed, so as to discount any unsuitable options at an early stage.

In determining the appropriate renewable technology for the site, the following factors are considered:

- Renewable energy resources or fuel availability of low or zero carbon technology on the site
- Implementation with regards the overall M&E design strategy for building type
- Capital, operating and maintenance costs available for the project
- Planning Permission from the local council.
- Available Grants

The table below summarises the various low zero carbon technologies considered for the projects, and **Air Source Heat Pumps (ASHP)** as well as **Photovoltaic (PV)** have been identified as the most appropriate option for this development.

Table 11: Feasibility study of low and zero carbon technologies

Technology Name:	Carbon Payback	Feasibility
Photovoltaic (PV)	High	HIGH
Air Source Heat Pumps (ASHP)	High	HIGH
Biomass	High	LOW
Wind Power	Low	LOW
Hydro Power	None	LOW
Solar Thermal	Low	LOW
Ground Source Heat Pumps (GSHP)	Low	LOW

8.1 Non-feasible Technology

• Ground Source Heat Pumps (GSHP)

Ground source heat pump would not be a feasible option to meet the space heating requirements. In this case, an ASHP system has been preferred. Therefore, GSHP will not be explored further.

• Solar Thermal

The use of solar thermal for this development would be limited to domestic hot water only. The use of solar thermal for space heating would not be practical as it is not required when solar thermal is at

its most effective during the summer months. Moreover, according to the scheme scale the expected carbon offset from the system is generally lower compared to other LZC technologies.

- **Hydro power**

The project site is not close to natural water resources. Therefore, small scale hydro-electric will not be studied any further because of the location and the spatial limitations of the development.

- **Biomass**

A biomass system designed for this development would be fuelled by wood pellets which have a high energy content. However, a biomass system would not be the appropriate technology for this site due to the following reasons:

- The burning of wood pellets releases substantially more NOx emissions when compared to similar gas boilers. As the development is situated within an urban area, the installation of a biomass boiler would further impact on the air quality in this area.
- Pellets would need to be transported from local pellet suppliers, which causes carbon emissions into the air.
- The project will need to consider the impacts on site layout and logistics arrangements.

However, if a biomass system is considered at further detailed design stage, local suppliers can be found near the site as shown in the map below (<http://biomass-suppliers-list.service.gov.uk>).

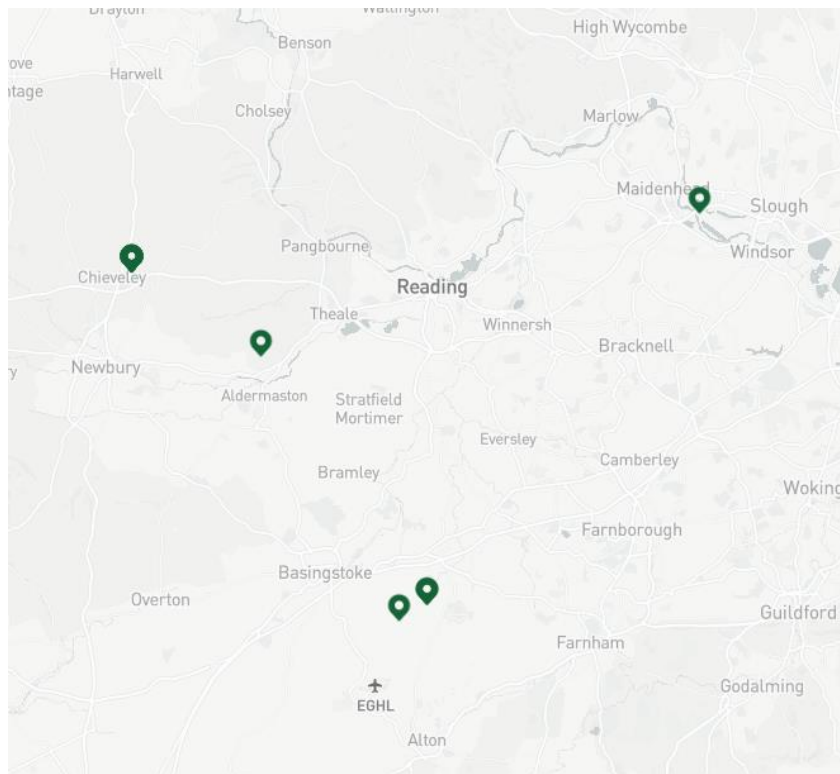


Figure 7: Biomass suppliers' locations in proximity to the project location

• Wind Power

Wind turbines need extensive planning requirements, and they are only feasible at consistent wind speed. All proposals for new wind turbine development must clearly demonstrate that any impacts in terms of noise, shadow flicker, vibration, air traffic safety, radar and telecommunications have been mitigated adequately to comply with other policies within the Local Plan. Hence this option has been discounted for now.

(source: <https://www.rensmart.com/Maps#NOABL>).

Information

Location

- Latitude: 51.408972
- Longitude: -0.945639
- Height above sea level: 137 m

Wind Speeds

estimates from NOABL data

- At 10m above ground level 4.8 m/s
- At 25m above ground level 5.5 m/s
- At 45m above ground level 6 m/s

Solar

falling on a optimally oriented panel

- Annual Energy per m² 1147 kWh
- Daily Energy per m² 3142 Wh

However, please note that the NOABL windspeed dataset is a model of windspeeds across the country, assuming completely flat terrain. It isn't a database of measured windspeeds. Other factors such as hills, houses, trees and other obstructions in the vicinity of the site need to be considered as well, as they can have a significant effect. In case the installation of a wind turbine is being considered, measurements using an anemometer need to be carried out to determine what the actual figures are.

• Photovoltaic (PV)

Solar PV could be one of the suitable renewable technologies for the project due to the following reasons:

- The installation of PV is much simpler when compared to other renewable technologies.
- There is sufficient roof space available to install enough PV modules to have a significant impact on carbon emissions of the development.
- PV panels sited on the roof are less visually intrusive when compared to wind turbines.

Table 12: Suggested solar PV specifications per dwelling

Property	General specification
Orientation	South-East
Inclination	30°
Plant size	1.5 kWp
Array size	6 panels @ 250 W per panel
Total PV area	Approx. 9.6 m ² (assuming 1.6 m ² /panel)
Overshading	None or little

In summary, a 1.5 kWp solar PV plant is recommended per dwelling in order to maximise the PV capacity for installation over the roof area of the development. Monocrystalline silicon panels (250 W per panel) spread over approx. 9.6 m² of roof space facing south-east should be able to provide the required output. However, the proposed PV panels are subject to further consideration at detailed design stages. In order to qualify both the installer and the equipment, the system must be certified under the Microgeneration Certification Scheme (MCS).

8.2 Proposed Technology

• Air Source Heat Pumps (ASHP)

An ASHP can meet the space heating demands more efficiently in comparison to gas boilers. Although this low carbon technology consumes electricity to operate, the heat output is much greater due to higher efficiency. Therefore, ASHP is suggested for the space heating and hot water of this project.

Another advantage of the use of ASHP technology is that it has no impact on the Air Quality credentials i.e. NO_x, Particulate Matter etc. Emissions associated with building operations, specifically those resulting from space conditioning of the building are minimized.

The design stage specifications used for energy calculations are in the table below. However, the ASHP was proposed only for simulation, detailed ASHP specifications should be provided by a mechanical engineer during the design development. The system must be certified under the Microgeneration Certification Scheme (MCS) and ideally, the Enhanced Capital Allowances criteria.

Table 13: ASHP system specs, as assumed for energy modelling

Systems	Type	General Specification
Heating	Air Source Heat Pump	- Pump type – variable speed, multiple pressure sensors. - Winter efficiency: 170% - Summer efficiency: 170%
Hot Water	100% demand being met by ASHP	

Given the proposed LZC technologies on the site (i.e., **ASHP and PV**), the overall CO₂ reduction at BE GREEN stage can be calculated as shown below.

Table 14: Regulated Carbon Reduction at stage 3 – Be Green

Energy Hierarchy Stage	BER (kgCO ₂ /m ² . year)	BPER (KWh _{PE} /m ² . year)
Notional	10.98	57.28
Be Green (Stage 3)	3.83	38.94

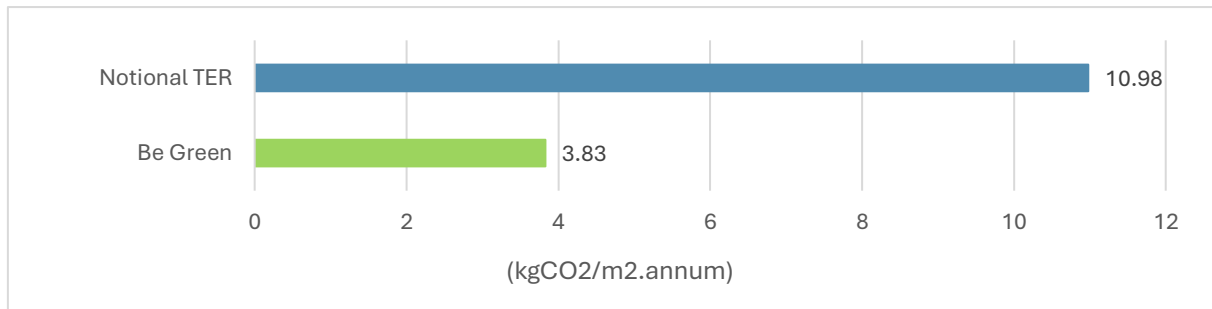


Figure 8: Notional Building TER and Stage 3 BER for the proposed scheme

9. Conclusion

This report assesses the predicted energy performance and carbon dioxide emissions of the proposed development at **Land Adjacent 1 Ilbury Close, Shinfield, Reading, RG2 9DE**.

Based on the information provided by the design team, the study has been done **on two semi-detached houses**. The study results show that **efficient building fabric and building services** proposed for the development are key to achieve building regulations compliance. Moreover, **ASHP** and **PV** prove to be an important measure to achieve further reductions. The combined carbon savings from each stage are shown in the charts below.

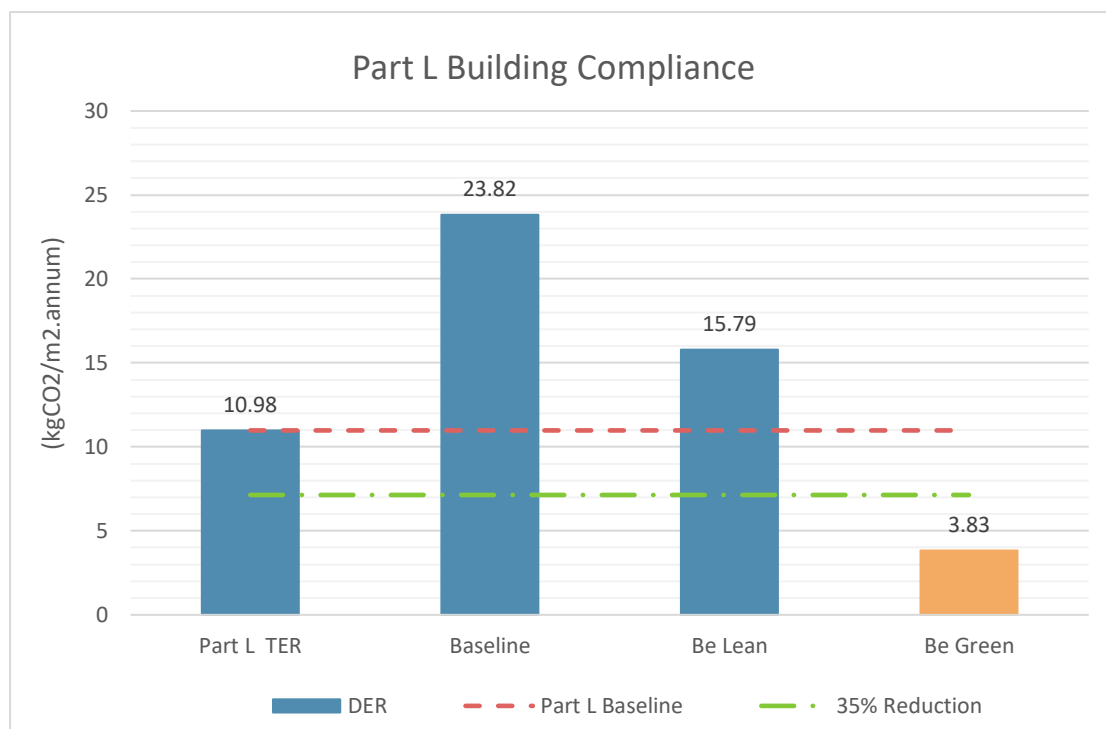


Figure 9: Total Carbon Emissions Reductions after each stage of the Energy Hierarchy

Table 15: Overall Regulated Carbon Reduction

Analysis Stage	DER (kgCO ₂ /m ² .annum)	Carbon Emissions (Tonnes/annum)	% Reductions from TER
Notional	10.98	1.02	-
Be Lean	15.79	2.22	-
Be Clean	15.79	1.47	-
Be Green	3.83	0.36	64.7

Please refer to the appendix for further SAP calculations.

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Tue 29 Sep 2026 11:08:19

Project Information			
Assessed By	Rahi Jadhav	Building Type	House, Semi-detached
OCDEA Registration	EES/035291	Assessment Date	2026-09-29

Dwelling Details			
Assessment Type	As designed	Total Floor Area	93 m ²
Site Reference	1A - Be Lean	Plot Reference	Be Lean
Address	1 Land Adjacent Ilbury Close, Shinfield, RG29DE		

Client Details	
Name	Array
Company	Array
Address	

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Mains gas		
Target carbon dioxide emission rate	10.98 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	15.79 kgCO ₂ /m ²		FAIL
1b Target primary energy rate and dwelling primary energy			
Target primary energy	57.28 kWh _{PE} /m ²		
Dwelling primary energy	87.87 kWh _{PE} /m ²		FAIL
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	35.5 kWh/m ²		
Dwelling fabric energy efficiency	34.6 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.18	Walls (1) (0.18)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	0.11	GF-Heatloss-Floor (0.11)	OK
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	1.16	Front-Openings (1.2)	OK
Rooflights	2.2	N/A	N/A	N/A

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	Net area [m ²]	U-Value [W/m ² K]
Exposed wall: Walls (1)	74.2183	0.18
Party wall: Party Wall (1)	42.86	0 (!)
Ground floor: GF-Heatloss-Floor, GF-Heatloss-Floor	46.5	0.11
Exposed roof: Roof (1)	46.5	0.11

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
Front-Door, Half-Glazed	2.193	North West	N/A	1 (!)
Front-Openings, Fully-Glazed	1.749	North West	0.7	1.2
Front-Openings, Fully-Glazed	0.759	North West	0.7	1.2
Front-Openings, Fully-Glazed	1.908	North West	0.7	1.2
Front-Openings, Fully-Glazed	1.3125	North West	0.7	1.2
Side-Door, Half-Glazed	1.9565	West	N/A	1 (!)
Rear-Openings, Fully-Glazed	1.9875	South East	0.7	1.2
Rear-Openings, Fully-Glazed	1.6695	South East	0.7	1.2
Rear-Openings, Fully-Glazed	1.6695	South East	0.7	1.2
Rear-Openings, Fully-Glazed	3.3572	South East	0.7	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))	
Building part 1: Thermal bridging calculated from linear thermal transmittances for each junction	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.02 (!)	
External wall	E3: Sill	Calculated by person with suitable expertise	0.02 (!)	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.02 (!)	
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.05	
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.05	
External wall	E10: Eaves (insulation at ceiling level)	SAP table default	0.12	
External wall	E12: Gable (insulation at ceiling level)	SAP table default	0.25	
External wall	E16: Corner (normal)	SAP table default	0.18	
External wall	E18: Party wall between dwellings	SAP table default	0.24	
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.05	
Party wall	P2: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.05	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.05	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))				
Maximum permitted air permeability at 50Pa		8 m ³ /hm ²		
Dwelling air permeability at 50Pa		5 m ³ /hm ² , Design value		OK
Air permeability test certificate reference				

4 Space heating	
Main heating system 1: Boiler with radiators or underfloor heating - Mains gas	
Efficiency	79.0%
Emitter type	Radiators
Flow temperature	35°C
System type	Condensing combi
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: N/A	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	80 lm/W	OK
External lights control	N/A	
8 Mechanical ventilation		
System type: N/A		
Maximum permitted specific fan power	N/A	
Specific fan power	N/A	N/A
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model		
Commissioning		
9 Local generation		
N/A		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
b. Client Declaration		
N/A		

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Tue 29 Sep 2026 11:08:38

Project Information			
Assessed By	Rahi Jadhav	Building Type	House, Semi-detached
OCDEA Registration	EES/035291	Assessment Date	2026-09-29

Dwelling Details			
Assessment Type	As designed	Total Floor Area	93 m ²
Site Reference	1B - Be Lean	Plot Reference	Be Lean
Address	1 Land Adjacent Ilbury Close, Shinfield, RG29DE		

Client Details	
Name	Array
Company	Array
Address	

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Mains gas		
Target carbon dioxide emission rate	10.98 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	15.79 kgCO ₂ /m ²		FAIL
1b Target primary energy rate and dwelling primary energy			
Target primary energy	57.28 kWh _{PE} /m ²		
Dwelling primary energy	87.87 kWh _{PE} /m ²		FAIL
1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	35.5 kWh/m ²		
Dwelling fabric energy efficiency	34.6 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.18	Walls (1) (0.18)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	0.11	GF-Heatloss-Floor (0.11)	OK
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	1.16	Front-Openings (1.2)	OK
Rooflights	2.2	N/A	N/A	N/A

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	Net area [m ²]	U-Value [W/m ² K]
Exposed wall: Walls (1)	74.2183	0.18
Party wall: Party Wall (1)	42.86	0 (!)
Ground floor: GF-Heatloss-Floor, GF-Heatloss-Floor	46.5	0.11
Exposed roof: Roof (1)	46.5	0.11

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
Front-Door, Half-Glazed	2.193	North West	N/A	1 (!)
Front-Openings, Fully-Glazed	1.749	North West	0.7	1.2
Front-Openings, Fully-Glazed	0.759	North West	0.7	1.2
Front-Openings, Fully-Glazed	1.908	North West	0.7	1.2
Front-Openings, Fully-Glazed	1.3125	North West	0.7	1.2
Side-Door, Half-Glazed	1.9565	East	N/A	1 (!)
Rear-Openings, Fully-Glazed	1.9875	South East	0.7	1.2
Rear-Openings, Fully-Glazed	1.6695	South East	0.7	1.2
Rear-Openings, Fully-Glazed	1.6695	South East	0.7	1.2
Rear-Openings, Fully-Glazed	3.3572	South East	0.7	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))	
Building part 1: Thermal bridging calculated from linear thermal transmittances for each junction	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.02 (!)	
External wall	E3: Sill	Calculated by person with suitable expertise	0.02 (!)	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.02 (!)	
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.05	
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.05	
External wall	E10: Eaves (insulation at ceiling level)	SAP table default	0.12	
External wall	E12: Gable (insulation at ceiling level)	SAP table default	0.25	
External wall	E16: Corner (normal)	SAP table default	0.18	
External wall	E18: Party wall between dwellings	SAP table default	0.24	
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.05	
Party wall	P2: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.05	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.05	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))				
Maximum permitted air permeability at 50Pa		8 m ³ /hm ²		
Dwelling air permeability at 50Pa		5 m ³ /hm ² , Design value		OK
Air permeability test certificate reference				

4 Space heating	
Main heating system 1: Boiler with radiators or underfloor heating - Mains gas	
Efficiency	79.0%
Emitter type	Radiators
Flow temperature	35°C
System type	Condensing combi
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: N/A	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	80 lm/W	OK
External lights control	N/A	
8 Mechanical ventilation		
System type: N/A		
Maximum permitted specific fan power	N/A	
Specific fan power	N/A	N/A
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model		
Commissioning		
9 Local generation		
N/A		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:	Date:	
b. Client Declaration		
N/A		

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Tue 29 Sep 2026 11:08:56

Project Information			
Assessed By	Rahi Jadhav	Building Type	House, Semi-detached
OCDEA Registration	EES/035291	Assessment Date	2026-09-29

Dwelling Details			
Assessment Type	As designed	Total Floor Area	93 m ²
Site Reference	1A - Be Green	Plot Reference	Be Green
Address	1 Land Adjacent Ilbury Close, Shinfield, RG29DE		

Client Details	
Name	Array
Company	Array
Address	

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate			
Fuel for main heating system	Electricity		
Target carbon dioxide emission rate	10.57 kgCO ₂ /m ²		
Dwelling carbon dioxide emission rate	3.83 kgCO ₂ /m ²		OK

1b Target primary energy rate and dwelling primary energy			
Target primary energy	55.08 kWh _{PE} /m ²		
Dwelling primary energy	38.94 kWh _{PE} /m ²		OK

1c Target fabric energy efficiency and dwelling fabric energy efficiency			
Target fabric energy efficiency	35.5 kWh/m ²		
Dwelling fabric energy efficiency	34.6 kWh/m ²		OK

2a Fabric U-values				
Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.18	Walls (1) (0.18)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	0.11	GF-Heatloss-Floor (0.11)	OK
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	1.16	Front-Openings (1.2)	OK
Rooflights	2.2	N/A	N/A	N/A

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))			
Name	Net area [m ²]	U-Value [W/m ² K]	
Exposed wall: Walls (1)	74.2183	0.18	
Party wall: Party Wall (1)	42.86	0 (!)	
Ground floor: GF-Heatloss-Floor, GF-Heatloss-Floor	46.5	0.11	
Exposed roof: Roof (1)	46.5	0.11	

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
Front-Door, Half-Glazed	2.193	North West	N/A	1 (!)
Front-Openings, Fully-Glazed	1.749	North West	0.7	1.2
Front-Openings, Fully-Glazed	0.759	North West	0.7	1.2
Front-Openings, Fully-Glazed	1.908	North West	0.7	1.2
Front-Openings, Fully-Glazed	1.3125	North West	0.7	1.2
Side-Door, Half-Glazed	1.9565	West	N/A	1 (!)
Rear-Openings, Fully-Glazed	3.3572	South East	0.7	1.2
Rear-Openings, Fully-Glazed	1.9875	South East	0.7	1.2
Rear-Openings, Fully-Glazed	1.6695	South East	0.7	1.2
Rear-Openings, Fully-Glazed	1.6695	South East	0.7	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))	
Building part 1: Thermal bridging calculated from linear thermal transmittances for each junction	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.02 (!)	
External wall	E3: Sill	Calculated by person with suitable expertise	0.02 (!)	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.02 (!)	
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.05	
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.05	
External wall	E10: Eaves (insulation at ceiling level)	SAP table default	0.12	
External wall	E12: Gable (insulation at ceiling level)	SAP table default	0.25	
External wall	E16: Corner (normal)	SAP table default	0.18	
External wall	E18: Party wall between dwellings	SAP table default	0.24	
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.05	
Party wall	P2: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.05	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.05	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))				
Maximum permitted air permeability at 50Pa		8 m ³ /hm ²		
Dwelling air permeability at 50Pa		5 m ³ /hm ² , Design value		OK
Air permeability test certificate reference				

4 Space heating	
Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	170.0%
Emitter type	Radiators
Flow temperature	35°C
System type	Air source heat pump
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: N/A	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	80 lm/W	OK
External lights control	N/A	
8 Mechanical ventilation		
System type: N/A		
Maximum permitted specific fan power	N/A	
Specific fan power	N/A	N/A
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model		
Commissioning		
9 Local generation		
Technology type: Photovoltaic system (1)		
Peak power	1.5 kWp	
Orientation	South	
Pitch	30°	
Overshading	None or very little	
Manufacturer		
MCS certificate		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed:	Assessor ID:	
Name:		
	Date:	
b. Client Declaration		
N/A		

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Tue 29 Sep 2026 11:09:08

Project Information			
Assessed By	Rahi Jadhav	Building Type	House, Semi-detached
OCDEA Registration	EES/035291	Assessment Date	2026-09-29

Dwelling Details			
Assessment Type	As designed	Total Floor Area	93 m ²
Site Reference	1B - Be Green	Plot Reference	Be Green
Address	1 Land Adjacent Ilbury Close, Shinfield, RG29DE		

Client Details	
Name	Array
Company	Array
Address	

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate

Fuel for main heating system	Electricity
Target carbon dioxide emission rate	10.57 kgCO ₂ /m ²
Dwelling carbon dioxide emission rate	3.83 kgCO ₂ /m ² OK

1b Target primary energy rate and dwelling primary energy

Target primary energy	55.08 kWh _{PE} /m ²
Dwelling primary energy	38.94 kWh _{PE} /m ² OK

1c Target fabric energy efficiency and dwelling fabric energy efficiency

Target fabric energy efficiency	35.5 kWh/m ²
Dwelling fabric energy efficiency	34.6 kWh/m ² OK

2a Fabric U-values

Element	Maximum permitted average U-Value [W/m ² K]	Dwelling average U-Value [W/m ² K]	Element with highest individual U-Value	
External walls	0.26	0.18	Walls (1) (0.18)	OK
Party walls	0.2	0	Party Wall (1) (0)	N/A
Curtain walls	1.6	0	N/A	N/A
Floors	0.18	0.11	GF-Heatloss-Floor (0.11)	OK
Roofs	0.16	0.11	Roof (1) (0.11)	OK
Windows, doors, and roof windows	1.6	1.16	Front-Openings (1.2)	OK
Rooflights	2.2	N/A	N/A	N/A

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))

Name	Net area [m ²]	U-Value [W/m ² K]
Exposed wall: Walls (1)	74.2183	0.18
Party wall: Party Wall (1)	42.86	0 (!)
Ground floor: GF-Heatloss-Floor, GF-Heatloss-Floor	46.5	0.11
Exposed roof: Roof (1)	46.5	0.11

2c Openings (better than typically expected values are flagged with a subsequent (!))

Name	Area [m ²]	Orientation	Frame factor	U-Value [W/m ² K]
Front-Door, Half-Glazed	2.193	North West	N/A	1 (!)
Front-Openings, Fully-Glazed	1.749	North West	0.7	1.2
Front-Openings, Fully-Glazed	0.759	North West	0.7	1.2
Front-Openings, Fully-Glazed	1.908	North West	0.7	1.2
Front-Openings, Fully-Glazed	1.3125	North West	0.7	1.2
Side-Door, Half-Glazed	1.9565	East	N/A	1 (!)
Rear-Openings, Fully-Glazed	3.3572	South East	0.7	1.2
Rear-Openings, Fully-Glazed	1.9875	South East	0.7	1.2
Rear-Openings, Fully-Glazed	1.6695	South East	0.7	1.2
Rear-Openings, Fully-Glazed	1.6695	South East	0.7	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part 1: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.02 (!)	
External wall	E3: Sill	Calculated by person with suitable expertise	0.02 (!)	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.02 (!)	
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.05	
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Secondary heating system: N/A	
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Efficiency	N/A
Commissioning	

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Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: N/A	
Manufacturer	
Model	

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Minimum permitted light source efficacy	75 lm/W	
Lowest light source efficacy	80 lm/W	OK
External lights control	N/A	
8 Mechanical ventilation		
System type: N/A		
Maximum permitted specific fan power	N/A	
Specific fan power	N/A	N/A
Minimum permitted heat recovery efficiency	N/A	
Heat recovery efficiency	N/A	N/A
Manufacturer/Model		
Commissioning		
9 Local generation		
Technology type: Photovoltaic system (1)		
Peak power	1.5 kWp	
Orientation	South	
Pitch	30°	
Overshading	None or very little	
Manufacturer		
MCS certificate		
10 Heat networks		
N/A		
11 Supporting documentary evidence		
N/A		
12 Declarations		
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Signed:	Assessor ID:	
Name:		
	Date:	
b. Client Declaration		
N/A		