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ENERGY STRATEGY REPORT

Spencers Wood Primary School

Report Title: Energy Strategy Report for SPENCERS WOOD PRIMARY SCHOOL

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Should you have any queries relating to this report, please contact

JOMAS ASSOCIATES LTD

www.jomasassociates.com

0333 305 9054

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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.

<i>Revision</i>	-
Date	15/07/2024
Prepared by	W.Delos Angeles
Checked by	N.Suaiso
Authorised by	E.Hucker

Note

The advice which we have prepared and provided within this report is in accordance with the CIEEM Code of Professional Conduct. We confirm that the opinions expressed are our true and professional opinions. Opinions and information provided in the report are based on Jomas Associates using reasonable skill, care and diligence in the preparation of the report in compliance with the CIEEM Code of Professional Conduct.

Validity of Data

The findings of the site survey are valid for a period of 24 months from the date of the survey. If approved works have not commenced by this date, then an updated site survey could be required to inform any changes to the habitats present on site in order to inform any updated mitigation and or precautionary measures required on site.

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The methodology adopted and the sources of information used by JA in providing its services are outlined in this report. The work described in this report was undertaken in **2021** and is based on the conditions encountered and the information available during the said period of time. The scope of this report and the services are accordingly factually limited by these circumstances.

Where assessments of works or costs identified in this report are made, such assessments are based upon the information available at the time and where appropriate are subject to further investigations or information which may become available.

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No allowance has been made for changes in prices or exchange rates or changes in any other conditions which may result in price fluctuations in the future. Where assessments of works or costs necessary to achieve compliance have been made, these are based upon measures which, in JA’s experience, could normally be negotiated with the relevant authorities under present legislation and enforcement practice, assuming a pro-active and reasonable approach by site management.

Forecast cost estimates do not include such costs associated with any negotiations, appeals or other non-technical actions associated with the agreement on measures to meet the requirements of the authorities, nor are potential business loss and interruption costs considered that may be incurred as part of any technical measures.

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1. Executive Summary

This Energy Strategy Report demonstrates the predicted energy performance and carbon emissions of the proposed development located at the **Land at Church Lane, Hyde End Lane and Hyde End Road, Three Mile Cross, RG7 1EW**. The presented figures in this study are based on the most updated information provided by the design team. The overall analysis took into consideration the national building regulations (i.e. **Part L2A**. Based on the study assumptions, the project shall comply with the council local polices and buildings regulations.)

1.1 Buildings Policy Requirements

The national building regulations require buildings to comply with the relevant energy efficiency requirements. This shall be accomplished through capping the project carbon emissions below the regulated target. The Wokingham Borough Local Development Framework recommends further reductions in the carbon emissions than the Building Regulations. The table below summarises the best practice 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 2A 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 new-build non-domestic development will be able to achieve all criteria through the implementation of measures like improved thermal performance of building fabric and efficient building services.
Wokingham Borough Local Plan	Planning permission will be granted for development proposals that contribute towards the goal of reaching zero-carbon developments as soon as possible by Including appropriate on-site renewable energy features.	In order to achieve the reductions, Solar PV is proposed as a renewable measure in the final stage i.e. Be Green which allows to achieve approximately 49% carbon reduction.
	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.	The development has used passive strategies such as orientation, internal layout and the size and location of the windows to reduce emissions. It also considers contextual climatic conditions as mentioned in the Be Lean stage.

Assessment Methodology and Strategies

The adopted methodology to mitigate the project's CO₂ emissions is in alignment with the industry accepted Energy Hierarchy. Compliance with the energy hierarchy suggestions automatically demonstrates Part L compliance. Models and simulation assumptions have been carried out using

Apache SBEM calculation method which complies with the National Calculation Methodologies (NCM). Table 2 below explains the Energy Hierarchy stages and the suggested strategies to help the proposed development achieve the required carbon targets.

Table 2: Energy Hierarchy stages to achieve 35% reductions over Part L requirement.

Stages	Strategies
<u>BE LEAN</u> Carbon Efficient Design (Minimising energy demand)	- Improved fabric U-values beyond Part L2A requirements. - Enhanced thermal bridging performance. - Energy efficient lighting fittings (i.e., LED). Further information can be found in the Be Lean Section.
<u>BE GREEN</u> On-site renewable technologies (i.e. ASHP, PVs, etc)	- Provision of efficient building services using ASHP. - Use of Solar PV to further offset the reduced emissions. Further information will be presented in the Be Green section below.
<u>BE SEEN</u> In-use monitoring	Installation of Smart Meters is recommended to monitor the actual operational energy use, manage it effectively and mitigate the performance gap.

Table 3: Analysis stages (as per energy hierarchy) and their corresponding carbon emissions

Analysis Stage	Building Emission Rate (BER) (KgCO ₂ /m ² .annum)
Notional TER	4.76
Baseline	5.0
Be-Lean	4.57
Be-Clean	4.57
Be-Green	2.46

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

1.3 Assessment Results

The non-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 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. Be Lean). The third stage of simulation assesses the feasibility of adopting local low-carbon energy sources like District heating / Air source heat pump (i.e. Be Clean stage). The fourth

simulation analyses the carbon reductions after considering renewable technologies as a strategy to achieve 35% reductions beyond Part L requirements (i.e. Be Green).



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

Results of the simulations show that the development is able to meet the overall criteria of the national and local policies i.e. >35% reductions over **Part L** through the implementation of better performing thermal envelop as well as high efficiency building services.

2. Introduction

This Energy Strategy Report (ESR) 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 in **Wokingham Borough** in the South-East of England having total built up area of approximately **1880 m²**. The proposed school will have multiple classrooms, a main hall, different types of play areas and other ancillary and staff spaces which is located at the **Land at Church Lane, Hyde End Lane and Hyde End Road, Three Mile Cross, RG7 1EW**.

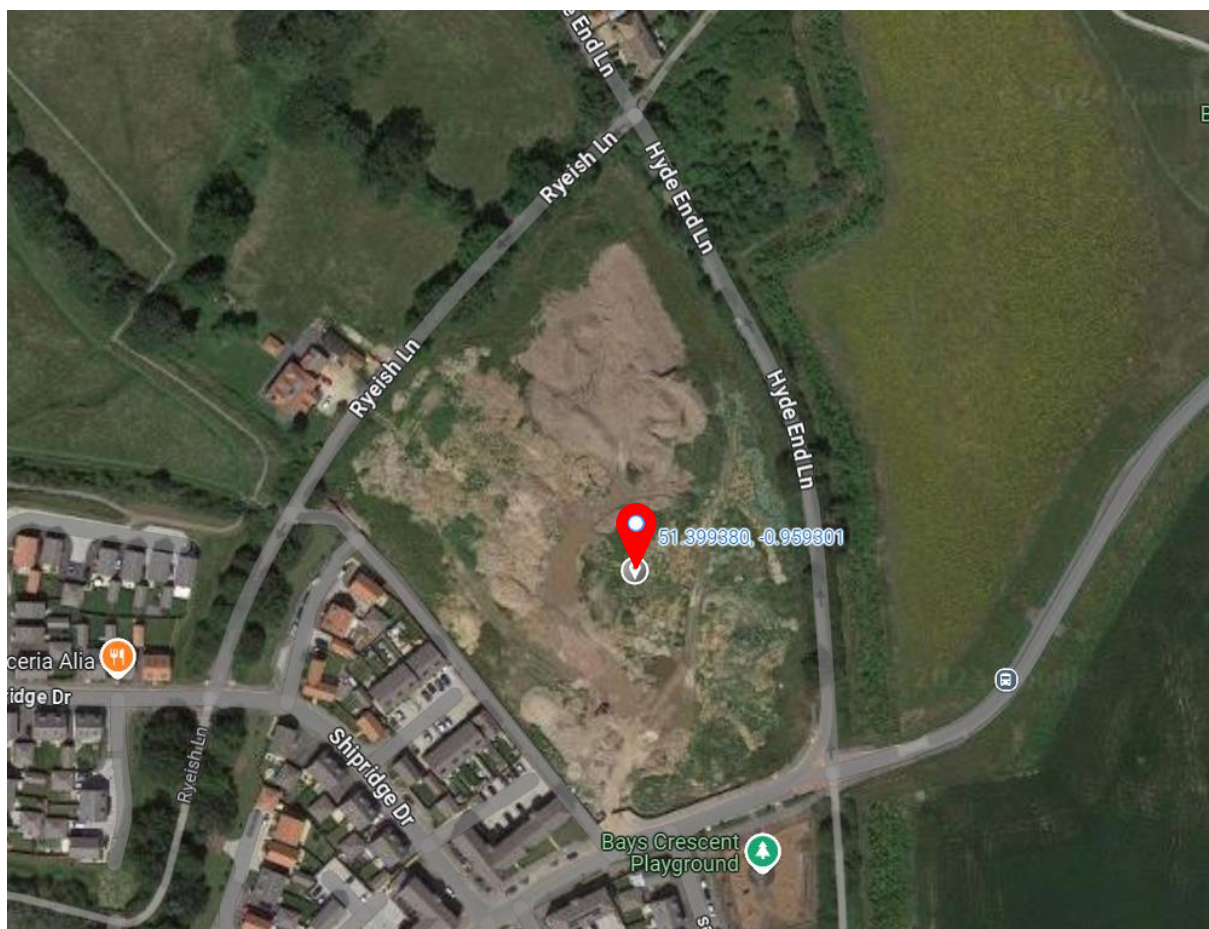


Figure 2: Site Location.(Source-Google Maps)

The domestic and non-domestic sectors play an important role in the UK economy, both as employer and generator of output. This ESR report analyses the domestic project using research and policies as 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, February 2021)

The National Planning Policy Framework is a key part of our reforms to make the planning system less complex and more accessible. These actions 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 (January 2010)

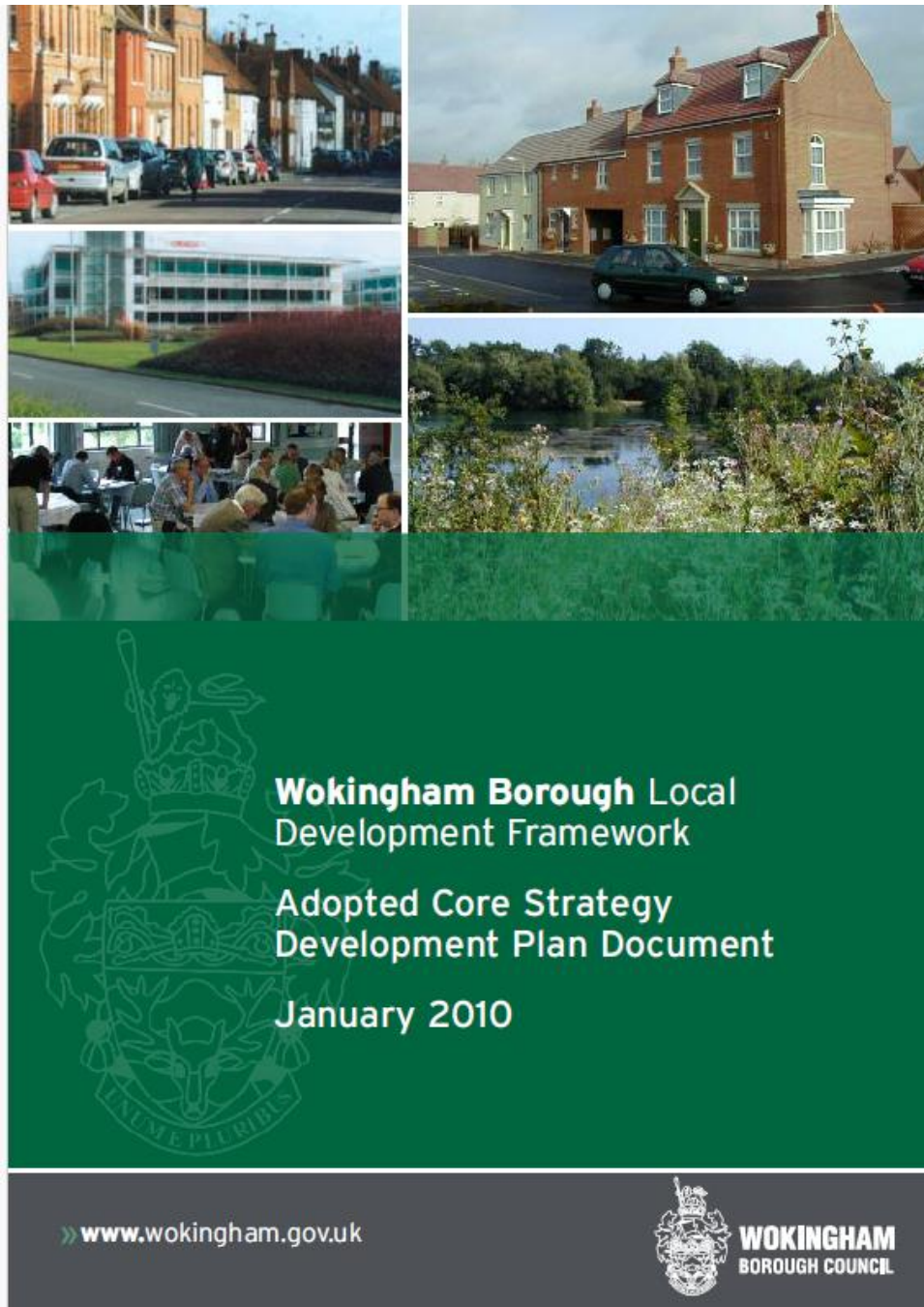


Figure 3: Wokingham Borough Local Plan

4 Core Strategy Policies

4.1 This Core Strategy includes a number of high-level policies in order to achieve the objectives and vision set out in the earlier sections. It also includes a number of policies relating to specific strategic proposals e.g. SDL in policies CP18-21. Proposals would therefore need to comply with relevant policies, together with other parts of the Development Plan. The policies are arranged into broad themes applying to the whole borough before more specific issues are considered.

Delivering a sustainable borough:

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 developments as soon as possible by:**
 - a. Including appropriate on-site renewable energy features; and**
 - b. Minimising energy and water consumption by measures including the**
- 13. 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.**

4.2 Development within the borough should enhance the overall sustainability of the area through minimising impact on the environment, including access to facilities as detailed under CP9. As is recognised in both the Community Strategy and the Spatial Objectives, the community values the high quality of the environment within the borough. It is therefore important that any proposals for development do not harm this or adversely affect the quality of life of residents, workers and visitors. The Council's Landscape Character Assessment highlights the areas of the borough with landscapes which should be protected or enhanced by development. The Council's Borough Design Guide SPD (July 2007) provides guidance on how schemes can reflect the quality of the borough's character. Village Design Statements provide similar guidance for smaller areas.

4.3 Proposals that enhance the quality of the environment of the borough could include those that improve the openness of the areas outside of development limits defined under Policy CP9.

Landowners and developers have the primary responsibility for protecting their land against the risk of flooding. They are also responsible for managing the drainage of their land such that they do not adversely affect adjoining properties. It is essential that future development is planned carefully, in accordance with PP25 (and the accompanying Good Practice Guide), the Flood Direction 2007 and the Wokingham Borough Strategic Flood Risk Assessment, steering it away from areas that are most at risk from flooding and ensuring that it does not exacerbate existing flooding problems. A planning solution to flood risk management should be sought wherever possible. At the planning application stage, the developer/ applicant is responsible for preparing a detailed site based Flood Risk Assessment or Drainage Impact Assessment depending upon the location and scale of development. It is essential that the developer/ applicant consider the possible change in flood risk over the lifetime of the development because of climate change. Sustainable Urban Drainage Systems can be used to minimise the risk and impact of flooding. Developers will be expected to provide and fund effective SUDS maintenance regimes. New development should be designed to be resilient to flooding as appropriate.

4.4 The completed Wokingham Borough SFRA highlights where the impacts of flooding (including from groundwater) and surface water runoff (both on and off site) will need to be addressed. The SFRA is a strategic document which identifies zones of risk to help in the allocation of land for development, for Development Management decision making purposes, to develop emergency plans and highlight possible requirements that may be needed in a more detailed FRA. Proposals need to include measures to reduce water consumption so that the impacts of water abstraction upon Natura 2000 sites as explained in the Appropriate Assessment are avoided. The minimisation of impacts on air quality will also help address the impacts of development on Natura 2000 sites as highlighted in the Appropriate Assessment.

4.5 Further guidance on flooding, drainage and water supply for development proposals will be included in the future Sustainable Development SPD.

4.6 Proposals for new development, including the construction of new buildings and the redevelopment and refurbishment of existing building stock, will be acceptable where the design of buildings and site layouts use energy, water, minerals, materials and other natural resources appropriately, efficiently and effectively and take account of the effects of climate change. Delivering on sustainable energy can bring significant social, environmental and economic benefits to Wokingham Borough.

4.7 As a result of the rapidly changing situation the Council is taking a flexible approach to the provision of on-site renewables and other sustainable forms of development dealt with in CP1. Wokingham Borough Core Strategy (Adopted 29 January 2010)

4.8 The Council will expect developers to use the Buildings Regulations, the Code for Sustainable Homes and other national guidance (at the time of application) to demonstrate that in order to achieve reductions in carbon emissions, a percentage of energy used in developments be provided by on site renewable energy installations. The Council will seek over and above the minimum national and regional targets (SEP Policy NRM11) through the Managing Development Delivery DPD.

4.9 Development for the generation of energy from renewable resources will be permitted unless there are unacceptable locational or other impacts that could not be outweighed by wider environmental, social and economic or other benefits. Overall, the Council wants to achieve zero-

carbon development as soon as possible. The Government target for new homes is to do so by 2016. The regional target for reducing carbon dioxide emissions is detailed in SEP Policy CC2.

4.10 It is recognised that small-scale projects make a valuable contribution to the overall outputs of renewable energy and therefore help meet renewable energy targets both locally and nationally. Only where a developer can satisfy the Council why the higher target cannot be achieved will a lower target be provided.

4.11 The Council will need to make provision for implementing the renewable energy generation targets and strategy set out in the SEP (Policies NRM11- NRM16).

4.12 The speed of progress towards these aims will be kept under review in future local development documents, having regard to Government and regional policy, developments in technology and science, and the impact of viability of development. Technology is changing and new guidance is coming forward from various sources, Government policy is still emerging.

4.13 The policy will be delivered through:

- a. Preparation of the Managing Development Delivery DPD and a SPD on Sustainable Development;
- b. Development control and building control;
- c. Private and public sector development – particularly through implementation of emerging good practice;
- d. Close working with other agencies and utilities including the Environment Agency and water utilities, particularly in relation to pollution control, flooding and water conservation, efficiency and recycling measures.

4.14 The community, Government and regional policy (PPG24 & SEP Policy NRM10 respectively) recognise the need for proposals to avoid areas of noise. Within the borough, noise issues arise in a variety of locations including alongside the major roads (M4 & A329(M)/A3290) and the railway lines within the Strategic Transport Network (see paragraph 4.56). Proposals should have regard to the advice in PPG24 concerning the suitability of different locations (based on noise exposure levels) for a variety of activities and the Air Quality Management Areas of the borough. The LAA includes targets for dealing with local concerns about anti-social behaviours and crime. Initiatives such as 'Secured by Design' can make a contribution to this.

4. Assessment Methodology

4.1 The Energy Hierarchy

The energy hierarchy is a classification 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 should be used to assess applications:

- **BE LEAN** – By using less energy and considering the further energy efficiency measure in comparison to the baseline building.
- **BE CLEAN** – 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 decentralise energy (e.g. CHP, District Heat Networks).
- **BE GREEN** – By integrating renewable energy into the scheme which can further reduce the carbon dioxide emission rate.
- **BE SEEN** – By monitoring, verifying, and reporting on energy performance to use energy mode effectively.

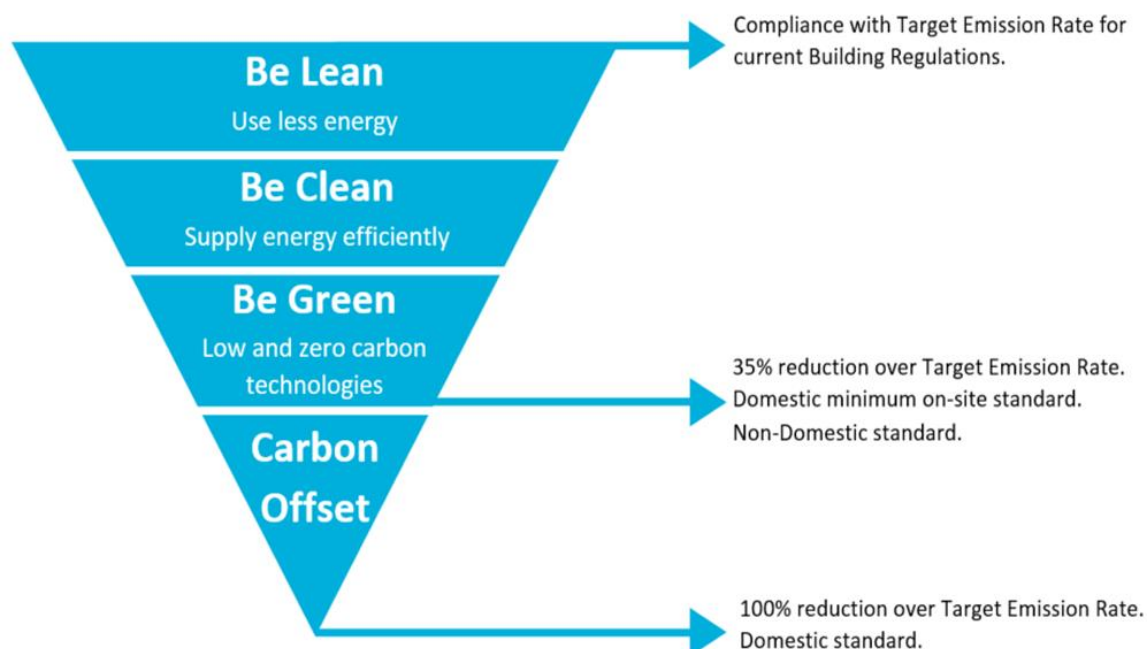


Figure 3: GLA Energy Hierarchy

4.2 Modelling strategy

The Government approved software, IES-VE have been utilised to carry out the project compliance simulations (i.e., SBEM) 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, HVAC, 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.

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 4: Reference documents list, as used for energy analysis.

No.	Document Name	Format	Received Date
1	240107 PROP block plan	dwg	10-07-2024
2	240107 PROP PLAN 00	dwg	10-07-2024
3	240107 PROP PLAN 01	dwg	10-07-2024
4	240107 PROP PLAN RF	dwg	10-07-2024
5	240107 PROP SECTIONS AND ELEVATIONS	dwg	10-07-2024

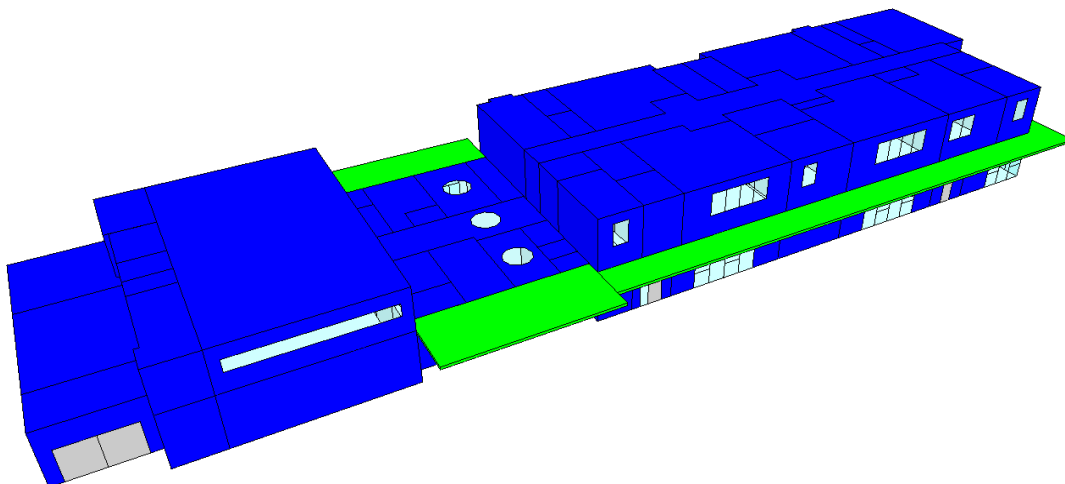


Figure 5: IES-VE simulation model

5. BASELINE - Target Emission Rate (TER) & Actual Building Rate (DER)

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 L2 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 (IES-VE).

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 (SBEM).

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

Table 5: Regulated Energy Use and Carbon Emissions TER at Baseline

Energy Hierarchy Stage	BER (kgCO ₂ /m ² . year)	BPER (KWh _{PE} /m ² . year)
Notional	4.76	49.89
Baseline	4.95	51.96

The results of the first run showed that the Baseline BER for the flats exceeds the regulated target emissions rate (TER) as depicted in figure 6 below. Further improvements to the model assumptions are carried out in the following section (i.e. Be-lean) to try and achieve reductions via passive measures.

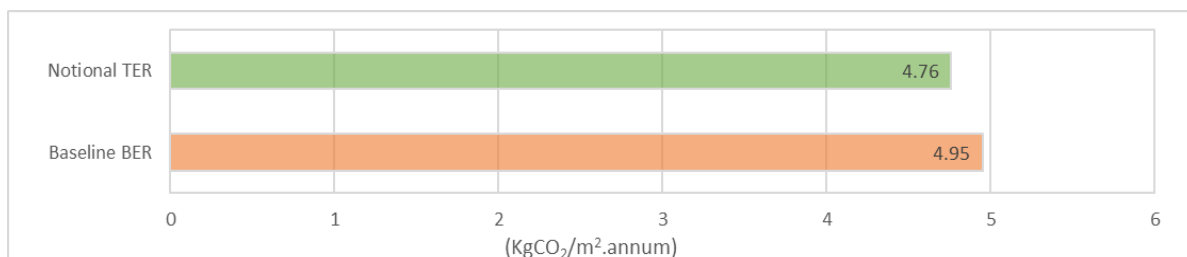


Figure 6: Notional Building TER and Baseline BER for the proposed scheme.

6. BE LEAN - Energy Efficient 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 Baseline benchmark on the path to achieving TER compliance (Building Regulations 2021 Part L1).

6.1 Site location



Figure 7: 3D view of the site and surroundings

The proposed project site is located at **Land at Church Lane, Hyde End Lane and Hyde End Road, Three Mile Cross RG7 1EW** in the Wokingham Borough. It is a greenfield site surrounded by largely low-rise residential. The site is accessed from the north via Ryeish Lane and Fullbrook Avenue, which connects to Hyde End Lane.

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.

Local weather data has been used for thermal and energy simulations. Figure 8 below represents the annual dry bulb temperature in the locality. 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. However, in this case, the context is largely urban and no dense vegetation exists in the immediate vicinity of the site.

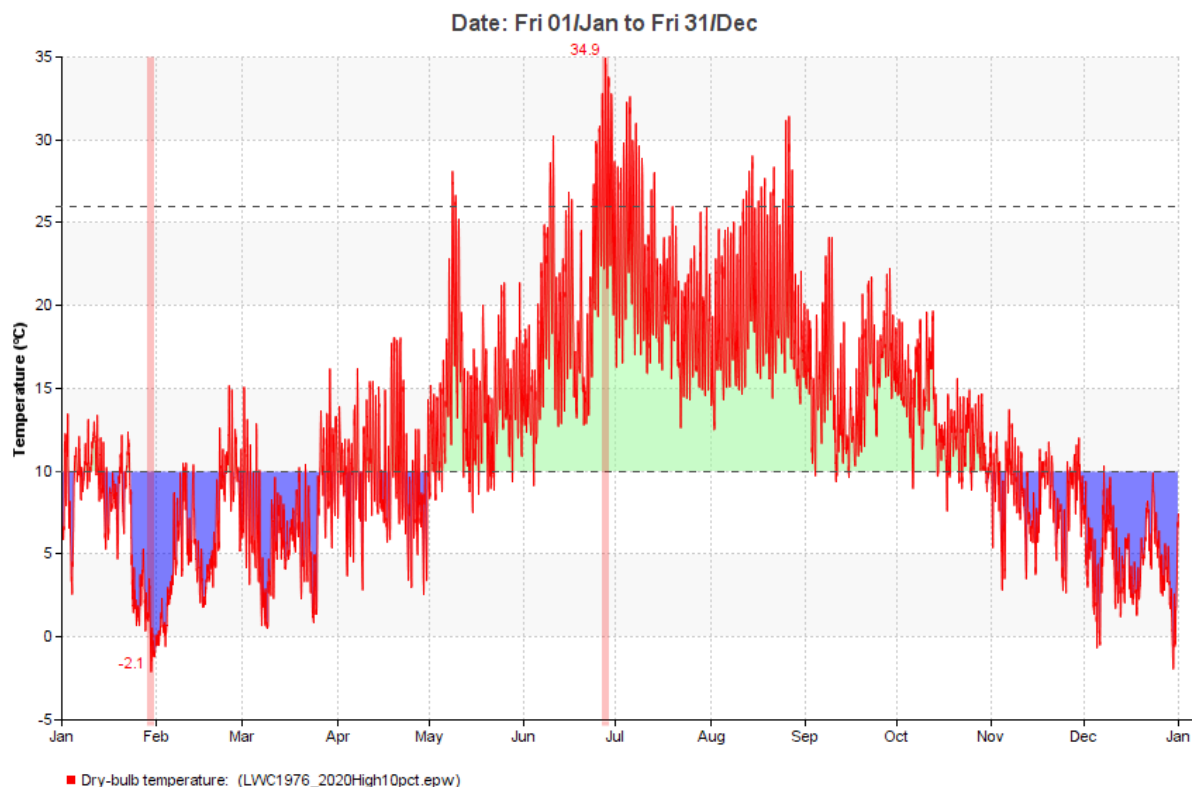


Figure 8: IES Annual Dry Bulb Temperature according to the weather file

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 appealing 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 school building has been planned such that the regularly occupied spaces such as classrooms have ample openings to allow daylight and sunlight in. The primary axis of the

building runs roughly from **North-East** to **South-West**; with the windows opening primarily on the sides.



Figure 9: Proposed development: Site plan

6.4 Building Design – Energy Efficiency Design Measures

At the 'BE LEAN' stage 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 L2A 2021** have been suggested in this stage of assessment process.

Table 6 below presents the improved U-values used for the dwellings against the **Part L2 2021** figures as used for the Baseline. The Be Lean 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 6: Proposed thermal performance for construction material.

Category Specification		Part L2 Notional (Existing Building)	Be Lean Improved values
U-value (W/m ² K)	Wall	0.26	0.18
	Roof	0.18	0.12
	Floor	0.18	0.12
	Windows	1.6	1.2
	Sky Lights	2.2	2.2
	Doors	1.6	1.6
Air Permeability (m ³ /h.m ² at 50 Pa)		10.00	3.0

The 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 minimize the infiltration of cold winter air and warm air in summer.
- Minimizing thermal bridging by using accredited construction details to avoid heat losses.
- Adopting a window to wall ratio that prioritizes 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.

6.5 Building occupancy type

The building occupancy type is dependent on the NCM building type. **D1 Primary or Secondary School** building type has been identified for the building. The occupancy and internal gains have been input accordingly.

Space Name	NCM Building Area Type (Actual)	NCM Activity (Actual)
Acc/staff	D1: Primary or Secondary school (Primary)	NCM D1Edu: Toilet
Acc/staff	D1: Primary or Secondary school (Primary)	NCM D1Edu: Swimming pool
bin store	D1: Primary or Secondary school (Primary)	NCM D1Edu: Cupboard
cl st	D1: Primary or Secondary school (Primary)	NCM D1Edu: Cupboard
classroom	D1: Primary or Secondary school (Primary)	NCM D1Edu: Teaching areas
classroom	D1: Primary or Secondary school (Primary)	NCM D1Edu: Teaching areas
classroom	D1: Primary or Secondary school (Primary)	NCM D1Edu: Teaching areas
cloakroom	D1: Primary or Secondary school (Primary)	NCM D1Edu: Cupboard
coat	D1: Primary or Secondary school (Primary)	NCM D1Edu: Cupboard

coat	D1: Primary or Secondary school (Primary)	NCM D1Edu: Cupboard
coat	D1: Primary or Secondary school (Primary)	NCM D1Edu: Cupboard
coat	D1: Primary or Secondary school (Primary)	NCM D1Edu: Cupboard
corridor	D1: Primary or Secondary school (Primary)	NCM D1Edu: Circulation area
dry store	D1: Primary or Secondary school (Primary)	NCM D1Edu: Cupboard
Extensive Y1 classroom	D1: Primary or Secondary school (Primary)	NCM D1Edu: Teaching areas
Extensive Y2 classroom	D1: Primary or Secondary school (Primary)	NCM D1Edu: Teaching areas
external store	D1: Primary or Secondary school (Primary)	NCM D1Edu: Cupboard
gen store	D1: Primary or Secondary school (Primary)	NCM D1Edu: Cupboard
gen store	D1: Primary or Secondary school (Primary)	NCM D1Edu: Cupboard
Head office	D1: Primary or Secondary school (Primary)	NCM D1Edu: Office
hygeine room	D1: Primary or Secondary school (Primary)	NCM D1Edu: Changing facilities
interview	D1: Primary or Secondary school (Primary)	NCM D1Edu: Office (PrmSchl: Meeting)
kit ch/wc	D1: Primary or Secondary school (Primary)	NCM D1Edu: Toilet
kitchen-	D1: Primary or Secondary school (Primary)	NCM D1Edu: Food preparation area
kitchen /	D1: Primary or Secondary school (Primary)	NCM D1Edu: Food preparation area
Library	D1: Primary or Secondary school (Primary)	NCM D1Edu: Teaching areas
lift	-	-
lift	-	-
lobby	D1: Primary or Secondary school (Primary)	NCM D1Edu: Circulation area
mainhall	D1: Primary or Secondary school (Primary)	NCM D1Edu: Dry sports hall
Nursery	D1: Primary or Secondary school (Primary)	NCM D1Edu: Dry sports hall
nursery	D1: Primary or Secondary school (Primary)	NCM D1Edu: Cupboard
office	D1: Primary or Secondary school (Primary)	NCM D1Edu: Office
PE	D1: Primary or Secondary school (Primary)	NCM D1Edu: Cupboard
plant	D1: Primary or Secondary school (Primary)	NCM D1Edu: Light plant room
plant	D1: Primary or Secondary school (Primary)	NCM D1Edu: Light plant room
Primary	D1: Primary or Secondary school (Primary)	NCM D1Edu: Teaching areas
Primary	D1: Primary or Secondary school (Primary)	NCM D1Edu: Teaching areas
recep st	D1: Primary or Secondary school (Primary)	NCM D1Edu: Cupboard
Reception	D1: Primary or Secondary school (Primary)	NCM D1Edu: Reception
repro-	D1: Primary or Secondary school (Primary)	NCM D1Edu: Light plant room
roof access	D1: Primary or Secondary school (Primary)	NCM D1Edu: Teaching areas
SEN	D1: Primary or Secondary school (Primary)	NCM D1Edu: Teaching areas
SEN	D1: Primary or Secondary school (Primary)	NCM D1Edu: Teaching areas
SEN MI	D1: Primary or Secondary school (Primary)	NCM D1Edu: Teaching areas
SEN MI	D1: Primary or Secondary school (Primary)	NCM D1Edu: Teaching areas
SEN WC	D1: Primary or Secondary school (Primary)	NCM D1Edu: Toilet
SEN wc	D1: Primary or Secondary school (Primary)	NCM D1Edu: Toilet

serv.	-	-
server	D1: Primary or Secondary school (Primary)	NCM D1Edu: Light plant room
sick bay	D1: Primary or Secondary school (Primary)	NCM D1Edu: Circulation area
small	D1: Primary or Secondary school (Primary)	NCM D1Edu: Teaching areas
small	D1: Primary or Secondary school (Primary)	NCM D1Edu: Teaching areas
spec	D1: Primary or Secondary school (Primary)	NCM D1Edu: Cupboard
Spec Store	D1: Primary or Secondary school (Primary)	NCM D1Edu: Cupboard
Specialist	D1: Primary or Secondary school (Primary)	NCM D1Edu: Teaching areas
st	D1: Primary or Secondary school (Primary)	NCM D1Edu: Cupboard
wc	D1: Primary or Secondary school (Primary)	NCM D1Edu: Toilet
wc	D1: Primary or Secondary school (Primary)	NCM D1Edu: Toilet
wc	D1: Primary or Secondary school (Primary)	NCM D1Edu: Toilet
wc	D1: Primary or Secondary school (Primary)	NCM D1Edu: Toilet
Staff	D1: Primary or Secondary school (Primary)	NCM D1Edu: Office (PrmSchl: Common)
staff wc	D1: Primary or Secondary school (Primary)	NCM D1Edu: Toilet
staff work	D1: Primary or Secondary school (Primary)	NCM D1Edu: Office (PrmSchl: Cellular)
staff work room	D1: Primary or Secondary school (Primary)	NCM D1Edu: Office (PrmSchl: Cellular)
stairs	D1: Primary or Secondary school (Primary)	NCM D1Edu: Circulation area
stairs	D1: Primary or Secondary school (Primary)	NCM D1Edu: Circulation area
stairs	D1: Primary or Secondary school (Primary)	NCM D1Edu: Circulation area
stairs	D1: Primary or Secondary school (Primary)	NCM D1Edu: Circulation area
toilet	D1: Primary or Secondary school (Primary)	NCM D1Edu: Toilet
void	-	-
void	-	-
void	-	-
void	-	-
wc	D1: Primary or Secondary school (Primary)	NCM D1Edu: Toilet
wh ap	D1: Primary or Secondary school (Primary)	NCM D1Edu: Cupboard
classroom	D1: Primary or Secondary school (Primary)	NCM D1Edu: Teaching areas

6.6 Daylighting and Solar Shading Strategy

The glazing specification has been suggested to ensure that the internal environment is pleasant on all orientations. This will help reduce the overheating risk, and subsequently the cooling demand. The glazing specifications assumed for the energy model are summarized in the table below:

Table 9: Glazing specifications

	U-value (Including frame)	G-value	VLT
Commercial	1.2	0.4	0.7

6.7 Be-Lean - Active Measures

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

Table 10: Active Design Measures adopted at Be Lean Stage

Measure	Explanation
Ventilation System	Extract ventilation system as per the appendix
Heating & Cooling	Electric powered Air source heat pump
Low energy lights	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.
Occupancy control	Yes

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

Table 11: Regulated Carbon Emissions (BER) at Be Lean Stage

Energy Hierarchy Stage	BER (kgCO ₂ /m ² . year)	BPER (KWh _{PE} /m ² . year)
Notional	4.76	48.03
Be Lean	4.57	49.89

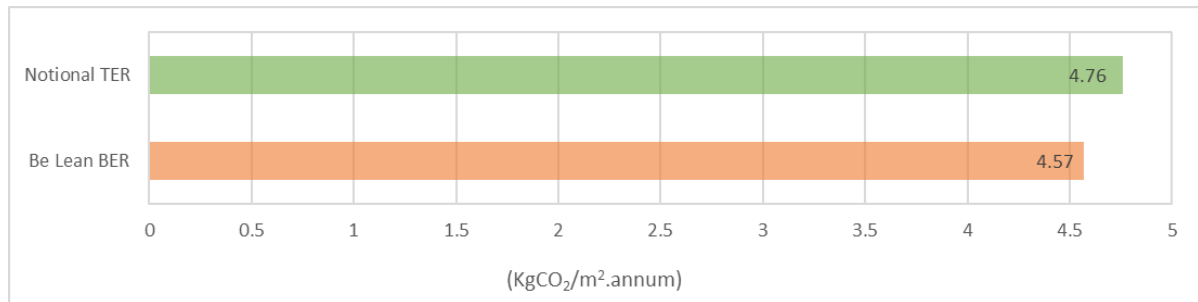


Figure 10: Notional Building TER and Be Lean BER for the proposed scheme.

At the 'BE LEAN' stage of the energy hierarchy, high performance construction material and energy efficient building systems have been incorporated into the model, as summarized in Table 7, Table 9 and Table 10 above.

The output from the energy assessment at this stage confirms that implementing the above-mentioned measures will result in significant reductions in the energy consumption of the building. In fact, it achieves BER<TER, by registering **3.99%** saving from energy efficiency measures alone. Further measures to bring about enhanced reductions have been discussed in the next stage of the analysis i.e. Be Green.

7. BE CLEAN – CHP & Decentralised Energy Networks

The Energy Hierarchy encourages the use of local CHP system and connection to District Heating systems to reduce CO₂ emissions further.

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. Wokingham Borough Local Development 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 Energy Hierarchy 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. The need to run the CHP plant continuously as far as possible 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 at a later time.

Generally, developments consisting 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 of this development.** In case the design team considers installing this technology, further information regarding the local system storage space will be needed.

Table 12: Regulated Carbon Emissions at Be Clean Stage

Energy Hierarchy Stage	BER (kgCO ₂ /m ² . year)	BPER (KWh _{PE} /m ² . year)
Notional	4.76	48.03
Be Lean	4.57	49.89

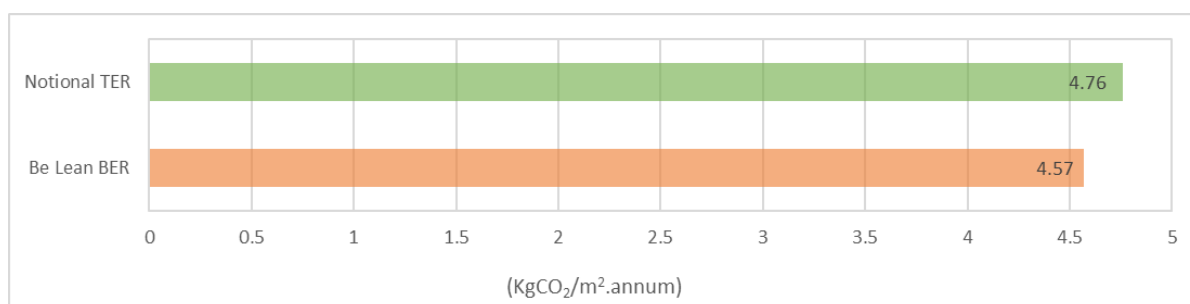


Figure 10: Notional Building TER and Be Clean BER for the proposed scheme.

8. BE GREEN – Renewable Energy Appraisal

In this section, 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 the LZC technology on the site.
- Implementation with regards the overall M&E design strategy for building type.
- Capital, operating and maintenance cost 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 we have identified that **Air Source Heat Pumps (ASHP) and Photovoltaic (PV)** would be the most appropriate option in this development.

The Government has outlined its ambitions for residential and non-domestic developments to be delivered to a zero-carbon standard. It is anticipated that zero carbon development will be realised predominantly through energy efficiency measures and the use of on-site low or zero carbon energy and connected heat. However, it is recognised that it will be difficult to deliver all the carbon savings necessary to meet zero carbon standards on site through these measures alone.

Table 13: Feasibility Study of LZC 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	MEDIUM
Ground Source Heat Pumps (GSHP)	High	LOW

8.1 Non-feasible Technology

- **Ground Source Heat Pumps (GSHP)**

Ground source heat pumps would be a feasible option to meet the space heating requirements at sites with ample ground space for bore holes to extract the ground heat. However, the current development is located next to conservation areas with potential Tree Protection Orders. Therefore, the option has not been considered in this case.

- **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.

- **Wind Power**

Wind turbines need extensive planning requirements, and they are only feasible at consistent wind speed. Moreover, there is no available wind grid located near the project location (<https://www.rensmart.com/Maps#NOABL>). Hence this option has been discounted.

Information

Location

- Latitude: 51.39943023492677
- Longitude: -0.959492524910667
- Height above sea level: 78 m

Wind Speeds

estimates from NOABL data

- At 10m above ground level 4.7 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. If the installation of a wind turbine is considered, windspeed measurements using an anemometer need to be performed to determine what the actual figures are.

- **Biomass**

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

- The burning of wood pellets releases substantially more NO_x 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>).

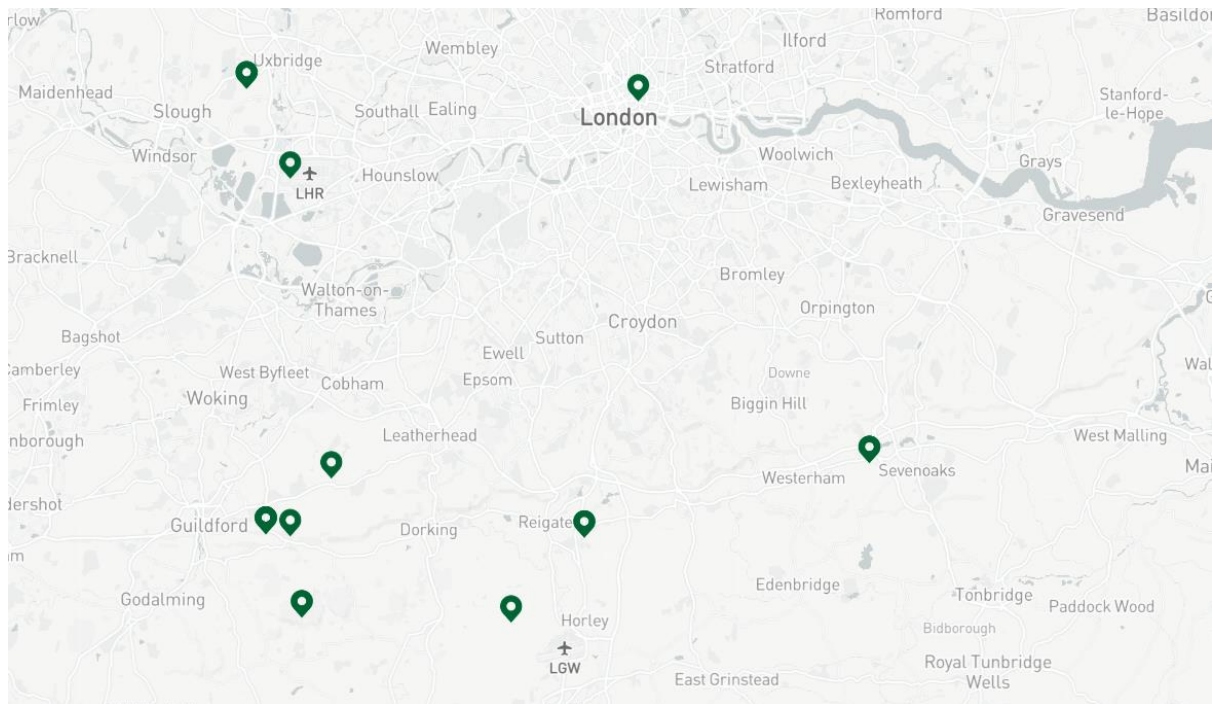


Figure 12: Biomass suppliers locations proximity to the project location.

8.2 Proposed Technology

- **Air Source Heat Pumps (ASHP)**

An ASHP can meet the space heating demands on site 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, it has been suggested for the space heating and hot water for this project.

Another advantage to 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.

ASHP Air Distribution system recommended minimum standards:

In order to limit air leakage, ventilation ductwork should be made and assembled so as to be reasonably airtight. Ways of meeting this requirement would be to comply with the specifications given in:

- B&ES DW/144⁴³. Membership of the B&ES specialist ductwork group or the Association of Ductwork Contractors and Allied Services is one way of demonstrating suitable qualifications, or
- British Standards such as BS EN 1507:2006⁴⁴, BS EN 12237:2003⁴⁵ and BS EN 13403:2003⁴⁶.

In order to limit air leakage, air handling units should be made and assembled so as to be reasonably airtight. Ways of meeting this requirement would be to comply with Class L2 air leakage given in BS EN 1886:2007⁴⁷.

The specific fan power of air distribution systems at the design air flow rate should be no worse than in Table 35 for new and existing buildings. Specific fan power is a function of the system resistance that the fan has to overcome to provide the required flow rate. BS EN 13779 Table A8 provides guidance on system pressure drop. To minimise specific fan power it is recommended that the 'low range' is used as a design target.

Where the primary air and cooling is provided by central plant and by an air distribution system that includes the additional components listed in Table 36, the allowed specific fan powers may be increased by the amounts shown in Table 36 to account for the additional resistance.

A minimum controls package should be provided in new and existing buildings as in Table 37.

Ventilation fans driven by electric motors should comply with European Commission Regulation No 327/2011 implementing Directive 2009/125/EC with regard to ecodesign requirements for fans driven by motors with an electric input power between 125 W and 500 kW.

(Source: Non-Domestic Building Services Compliance Guide)

Table 14: ASHP system specs, as assumed for energy modelling.

Systems	General Specification	Control
Heating and Cooling	Air Source Heat Pumps with Split or Multi Split (Heating – SCOP 3.5)	- As per Ventilation specification (See appendix) - Pump type – variable speed with differential sensor in the system
Hot Water	Same as space heating system	No Storage losses

- 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 within an urban area are less visually intrusive when compared to wind turbines.

Table 15: Suggested solar PV specifications.

Property	General specification
Orientation	South-West
Inclination	15°
Plant size	34.97 kWp
Total PV area	174 m ²
Overshading	None or little

In summary, a 34.97 kWp solar PV plant is recommended in order to maximise the PV capacity for installation over the preferred area of the development. PV type panels spread over 174 m² of roof space 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).

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 7: Regulated Carbon Reduction at Be-Green Stage

Energy Hierarchy Stage	BER (kgCO ₂ /m ² . year)	BPER (KWh _{PE} /m ² . year)
Notional	4.76	49.89
Be Green	2.46	23.77

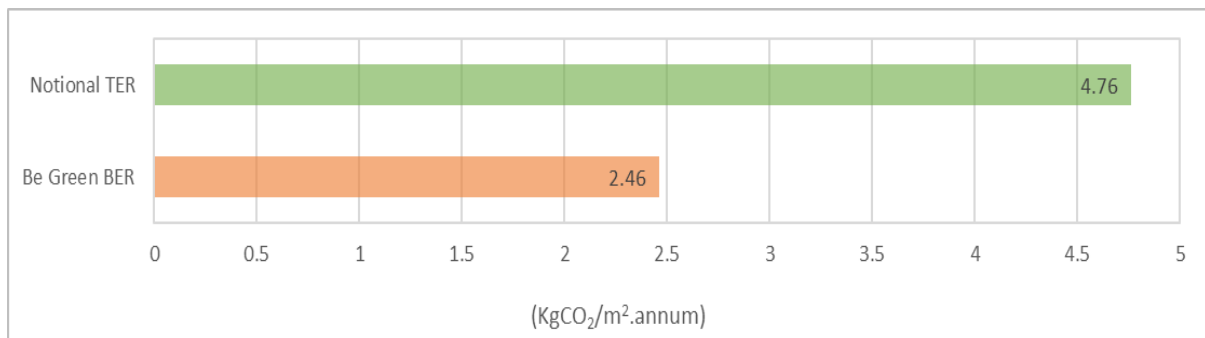


Figure 13: Notional Building TER and Be Green BER for the proposed scheme.

9. Conclusion

This report assesses the predicted energy performance and carbon dioxide emissions of the proposed non-domestic development **at the Land at Church lane, Hyde End lane and Hyde End road RG7 1EW**. The study results show that **high thermal performance building fabric and efficient heating systems** are keys to achieve building regulations compliance. Moreover, ASHP technology solar PV proved to be a major measure to achieve the **>35%** reductions beyond **Part L** requirements. The carbon savings from each stage are shown in the charts below. Given the total cumulative carbon savings, the proposed development shall meet the planning requirements.



Figure 14: Carbon Emissions Reductions after each stage of the Energy Hierarchy

Table 8: Overall Regulated Carbon Reduction

Analysis stage	BER (KgCO ₂ /m ² .annum)	% Reductions from Baseline
Notional	4.76	-
Baseline	5.0	-
Be Lean	4.57	3.99
Be Clean	4.57	3.99
Be Green	2.46	48.32

10. Appendix – SBEM Reports

Project name

Land at Church Lane_Base Model_V00

As designed

Date: Thu Jul 11 21:40:35 2024

Administrative information

Building Details

Address: Spencers Wood Primary School, Reading, RG7 1TL

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.22

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.22

BRUKL compliance module version: v6.1.e.1

Foundation area [m²]: 1038.79The CO₂ emission and primary energy rates of the building must not exceed the targets

The building does not comply with England Building Regulations Part L 2021

Target CO ₂ emission rate (TER), kgCO ₂ /m ² annum	4.76
Building CO ₂ emission rate (BER), kgCO ₂ /m ² annum	4.95
Target primary energy rate (TPER), kWh _{PE} /m ² annum	49.89
Building primary energy rate (BPER), kWh _{PE} /m ² annum	51.96
Do the building's emission and primary energy rates exceed the targets?	BER > TER BPER > TPER

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	U _{a-Limit}	U _{a-Calc}	U _{i-Calc}	First surface with maximum value
Walls*	0.26	0.26	0.26	BN000000:Surf[2]
Floors	0.18	0.18	0.18	CC000000:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.18	0.18	CC000000:Surf[1]
Windows** and roof windows	1.6	1.6	1.6	55000000:Surf[1]
Rooflights***	2.2	2.2	2.2	DB000000:Surf[1]
Personnel doors^	1.6	1.6	1.6	BN000000:Surf[3]
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building
U _{a-Limit} = Limiting area-weighted average U-values [W/(m ² K)] U _{a-Calc} = Calculated area-weighted average U-values [W/(m ² K)] U _{i-Calc} = Calculated maximum individual element U-values [W/(m ² K)] * Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. ** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position. ^ For fire doors, limiting U-value is 1.8 W/m ² K NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air permeability	Limiting standard	This building
m ³ /(h.m ²) at 50 Pa	8	3.38

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- Main system

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	-	0.2	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

"No HWS in project, or hot water is provided by HVAC system"

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
Acc/staff	174	-	-
Acc/staff	157	-	-
bin store	58	-	-
cl st	121	-	-
classroom	45	-	-
classroom	45	-	-
classroom	45	-	-
cloakroom	64	-	-
coat	84	-	-
coat	77	-	-
coat	55	-	-
coat	84	-	-
corridor	79	-	-
dry store	121	-	-
Extensive Y1 classroom	44	-	-
Extensive Y2 classroom	44	-	-
external store	91	-	-
gen store	91	-	-
gen store	86	-	-
Head office	61	-	-
hygeine room	104	-	-
interview	94	-	-
kit ch/wc	143	-	-
kitchen-	139	-	-
kitchen /	67	-	-
Library	53	-	-
lobby	86	-	-

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
	Standard value	95	80	0.3
mainhall		64	-	-
Nursery		63	-	-
nursery		78	-	-
office		58	-	-
PE		61	-	-
plant		55	-	-
plant		47	-	-
Primary		46	-	-
Primary		46	-	-
recep st		110	-	-
Reception		63	15	9
repro-		79	-	-
roof access		79	-	-
SEN		60	-	-
SEN		66	-	-
SEN MI		57	-	-
SEN MI		55	-	-
SEN WC		162	-	-
SEN wc		157	-	-
server		73	-	-
sick bay		169	-	-
small		71	-	-
small		68	-	-
spec		110	-	-
Spec Store		94	-	-
Specialist		46	-	-
st		121	-	-
wc		90	-	-
wc		90	-	-
wc		101	-	-
wc		101	-	-
Staff		48	-	-
staff wc		89	-	-
staff work		76	-	-
staff work room		60	-	-
stairs		69	-	-
stairs		70	-	-
stairs		77	-	-
stairs		80	-	-
toilet		124	-	-
wc		77	-	-
wh ap		121	-	-
classroom		45	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Acc/staff	N/A	N/A
classroom	NO (-29.1%)	NO
classroom	NO (-54%)	NO
classroom	NO (-25.7%)	NO
Extensive Y1 classroom	NO (-41.3%)	NO
Extensive Y2 classroom	NO (-42.3%)	NO
Head office	NO (-64.9%)	NO
interview	N/A	N/A
Library	YES (+96.2%)	NO
mainhall	NO (-36.5%)	NO
Nursery	NO (-21.4%)	NO
office	NO (-57%)	NO
Primary	NO (-29.3%)	NO
Primary	NO (-45.1%)	NO
Reception	NO (-20.6%)	NO
roof access	N/A	N/A
SEN	NO (-81.3%)	NO
SEN	N/A	N/A
SEN MI	N/A	N/A
SEN MI	NO (-70.1%)	NO
small	N/A	N/A
small	NO (-63.2%)	NO
Specialist	NO (-51.7%)	NO
Staff	NO (-46.8%)	NO
staff work	N/A	N/A
staff work room	NO (-80.6%)	NO
classroom	NO (-54.1%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m ²]	1881.9	1881.9
External area [m ²]	3845.7	3845.7
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	3	3
Average conductance [W/K]	1137.52	1157.68
Average U-value [W/m ² K]	0.3	0.3
Alpha value* [%]	25.2	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area Building Type

Retail/Financial and Professional Services
 Restaurants and Cafes/Drinking Establishments/Takeaways
 Offices and Workshop Businesses
 General Industrial and Special Industrial Groups
 Storage or Distribution
 Hotels
 Residential Institutions: Hospitals and Care Homes
 Residential Institutions: Residential Schools
 Residential Institutions: Universities and Colleges
 Secure Residential Institutions
 Residential Spaces
 Non-residential Institutions: Community/Day Centre
 Non-residential Institutions: Libraries, Museums, and Galleries

100

Non-residential Institutions: Education

Non-residential Institutions: Primary Health Care Building
 Non-residential Institutions: Crown and County Courts
 General Assembly and Leisure, Night Clubs, and Theatres
 Others: Passenger Terminals
 Others: Emergency Services
 Others: Miscellaneous 24hr Activities
 Others: Car Parks 24 hrs
 Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	14.61	16.95
Cooling	0	0
Auxiliary	0.84	1.48
Lighting	13.56	7.24
Hot water	4.63	7.43
Equipment*	23.83	23.83
TOTAL **	33.65	33.1

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	172.92	169.6
Primary energy [kWh _{PE} /m ²]	51.96	49.89
Total emissions [kg/m ²]	4.95	4.76

HVAC Systems Performance										
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Central heating using water: radiators, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	172.9	0	14.6	0	0.8	3.29	0	3.5	0
	Notional	169.6	0	17	0	0.8	2.78	0	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

- Heat dem [MJ/m2] = Heating energy demand
- Cool dem [MJ/m2] = Cooling energy demand
- Heat con [kWh/m2] = Heating energy consumption
- Cool con [kWh/m2] = Cooling energy consumption
- Aux con [kWh/m2] = Auxiliary energy consumption
- Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
- Cool SSEER = Cooling system seasonal energy efficiency ratio
- Heat gen SSEFF = Heating generator seasonal efficiency
- Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
- ST = System type
- HS = Heat source
- HFT = Heating fuel type
- CFT = Cooling fuel type

Project name

Land at Church Lane_Be Lean_V00

As designed

Date: Thu Jul 11 21:52:11 2024

Administrative information

Building Details

Address: Spencers Wood Primary School, Reading, RG7 1TL

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.22

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.22

BRUKL compliance module version: v6.1.e.1

Foundation area [m²]: 1038.79The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m ² annum	4.76
Building CO ₂ emission rate (BER), kgCO ₂ /m ² annum	4.57
Target primary energy rate (TPER), kWh _{PE} /m ² annum	49.89
Building primary energy rate (BPER), kWh _{PE} /m ² annum	48.03
Do the building's emission and primary energy rates exceed the targets?	BER ≤ TER BPER ≤ TPER

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	U _{a-Limit}	U _{a-Calc}	U _{i-Calc}	First surface with maximum value
Walls*	0.26	0.18	0.18	BN000000:Surf[2]
Floors	0.18	0.12	0.12	CC000000:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.12	0.12	CC000000:Surf[1]
Windows** and roof windows	1.6	1.2	1.2	55000000:Surf[1]
Rooflights***	2.2	2.2	2.2	DB000000:Surf[1]
Personnel doors^	1.6	1.6	1.6	BN000000:Surf[3]
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building

U_{a-Limit} = Limiting area-weighted average U-values [W/(m²K)]U_{i-Calc} = Calculated maximum individual element U-values [W/(m²K)]U_{a-Calc} = Calculated area-weighted average U-values [W/(m²K)]

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

** Display windows and similar glazing are excluded from the U-value check.

*** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m²K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
m ³ /(h.m ²) at 50 Pa	8	3.38

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- Main system

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	-	0.2	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

"No HWS in project, or hot water is provided by HVAC system"

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
	Standard value	95	80	0.3
Acc/staff		174	-	-
Acc/staff		157	-	-
bin store		58	-	-
cl st		121	-	-
classroom		45	-	-
classroom		45	-	-
classroom		45	-	-
cloakroom		64	-	-
coat		84	-	-
coat		77	-	-
coat		55	-	-
coat		84	-	-
corridor		79	-	-
dry store		121	-	-
Extensive Y1 classroom		44	-	-
Extensive Y2 classroom		44	-	-
external store		91	-	-
gen store		91	-	-
gen store		86	-	-
Head office		61	-	-
hygeine room		104	-	-
interview		94	-	-
kit ch/wc		143	-	-
kitchen-		139	-	-
kitchen /		67	-	-
Library		53	-	-
lobby		86	-	-

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
	Standard value	95	80	0.3
mainhall		64	-	-
Nursery		63	-	-
nursery		78	-	-
office		58	-	-
PE		61	-	-
plant		55	-	-
plant		47	-	-
Primary		46	-	-
Primary		46	-	-
recep st		110	-	-
Reception		63	15	9
repro-		79	-	-
roof access		79	-	-
SEN		60	-	-
SEN		66	-	-
SEN MI		57	-	-
SEN MI		55	-	-
SEN WC		162	-	-
SEN wc		157	-	-
server		73	-	-
sick bay		169	-	-
small		71	-	-
small		68	-	-
spec		110	-	-
Spec Store		94	-	-
Specialist		46	-	-
st		121	-	-
wc		90	-	-
wc		90	-	-
wc		101	-	-
wc		101	-	-
Staff		48	-	-
staff wc		89	-	-
staff work		76	-	-
staff work room		60	-	-
stairs		69	-	-
stairs		70	-	-
stairs		77	-	-
stairs		80	-	-
toilet		124	-	-
wc		77	-	-
wh ap		121	-	-
classroom		45	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Acc/staff	N/A	N/A
classroom	NO (-29.2%)	NO
classroom	NO (-54%)	NO
classroom	NO (-25.8%)	NO
Extensive Y1 classroom	NO (-41.4%)	NO
Extensive Y2 classroom	NO (-42.3%)	NO
Head office	NO (-65%)	NO
interview	N/A	N/A
Library	YES (+96.1%)	NO
mainhall	NO (-36.6%)	NO
Nursery	NO (-21.5%)	NO
office	NO (-57.1%)	NO
Primary	NO (-29.4%)	NO
Primary	NO (-45.1%)	NO
Reception	NO (-20.7%)	NO
roof access	N/A	N/A
SEN	NO (-81.3%)	NO
SEN	N/A	N/A
SEN MI	N/A	N/A
SEN MI	NO (-70.1%)	NO
small	N/A	N/A
small	NO (-63.3%)	NO
Specialist	NO (-51.8%)	NO
Staff	NO (-46.9%)	NO
staff work	N/A	N/A
staff work room	NO (-80.6%)	NO
classroom	NO (-54.1%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m ²]	1881.9	1881.9
External area [m ²]	3845.7	3845.7
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	3	3
Average conductance [W/K]	823.6	1157.68
Average U-value [W/m ² K]	0.21	0.3
Alpha value* [%]	25.24	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area Building Type

Retail/Financial and Professional Services
 Restaurants and Cafes/Drinking Establishments/Takeaways
 Offices and Workshop Businesses
 General Industrial and Special Industrial Groups
 Storage or Distribution
 Hotels
 Residential Institutions: Hospitals and Care Homes
 Residential Institutions: Residential Schools
 Residential Institutions: Universities and Colleges
 Secure Residential Institutions
 Residential Spaces
 Non-residential Institutions: Community/Day Centre
 Non-residential Institutions: Libraries, Museums, and Galleries

100 Non-residential Institutions: Education

Non-residential Institutions: Primary Health Care Building
 Non-residential Institutions: Crown and County Courts
 General Assembly and Leisure, Night Clubs, and Theatres
 Others: Passenger Terminals
 Others: Emergency Services
 Others: Miscellaneous 24hr Activities
 Others: Car Parks 24 hrs
 Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	12.11	16.95
Cooling	0	0
Auxiliary	0.84	1.48
Lighting	13.56	7.24
Hot water	4.63	7.43
Equipment*	23.83	23.83
TOTAL **	31.14	33.1

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
<i>Displaced electricity</i>	<i>0</i>	<i>0</i>

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	143.26	169.6
Primary energy [kWh _{PE} /m ²]	48.03	49.89
Total emissions [kg/m ²]	4.57	4.76

HVAC Systems Performance										
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Central heating using water: radiators, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	143.3	0	12.1	0	0.8	3.29	0	3.5	0
	Notional	169.6	0	17	0	0.8	2.78	0	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Project name

Land at Church Lane_Be Green_V01

As designed

Date: Thu Jul 11 21:59:13 2024

Administrative information

Building Details

Address: Spencers Wood Primary School, Reading, RG7 1TL

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.22

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.22

BRUKL compliance module version: v6.1.e.1

Foundation area [m²]: 1038.79The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m ² annum	4.76
Building CO ₂ emission rate (BER), kgCO ₂ /m ² annum	2.46
Target primary energy rate (TPER), kWh _{PE} /m ² annum	49.89
Building primary energy rate (BPER), kWh _{PE} /m ² annum	23.77
Do the building's emission and primary energy rates exceed the targets?	BER ≤ TER BPER ≤ TPER

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	U _{a-Limit}	U _{a-Calc}	U _{i-Calc}	First surface with maximum value
Walls*	0.26	0.18	0.18	BN000000:Surf[2]
Floors	0.18	0.12	0.12	CC000000:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.12	0.12	CC000000:Surf[1]
Windows** and roof windows	1.6	1.2	1.2	55000000:Surf[1]
Rooflights***	2.2	2.2	2.2	DB000000:Surf[1]
Personnel doors^	1.6	1.6	1.6	BN000000:Surf[3]
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building

U_{a-Limit} = Limiting area-weighted average U-values [W/(m²K)]U_{i-Calc} = Calculated maximum individual element U-values [W/(m²K)]U_{a-Calc} = Calculated area-weighted average U-values [W/(m²K)]

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

** Display windows and similar glazing are excluded from the U-value check.

*** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m²K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
m ³ /(h.m ²) at 50 Pa	8	3.38

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- Main system

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	-	0.2	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

"No HWS in project, or hot water is provided by HVAC system"

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
	Standard value	95	80	0.3
Acc/staff		174	-	-
Acc/staff		157	-	-
bin store		58	-	-
cl st		121	-	-
classroom		45	-	-
classroom		45	-	-
classroom		45	-	-
cloakroom		64	-	-
coat		84	-	-
coat		77	-	-
coat		55	-	-
coat		84	-	-
corridor		79	-	-
dry store		121	-	-
Extensive Y1 classroom		44	-	-
Extensive Y2 classroom		44	-	-
external store		91	-	-
gen store		91	-	-
gen store		86	-	-
Head office		61	-	-
hygeine room		104	-	-
interview		94	-	-
kit ch/wc		143	-	-
kitchen-		139	-	-
kitchen /		67	-	-
Library		53	-	-
lobby		86	-	-

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
	Standard value	95	80	0.3
mainhall		64	-	-
Nursery		63	-	-
nursery		78	-	-
office		58	-	-
PE		61	-	-
plant		55	-	-
plant		47	-	-
Primary		46	-	-
Primary		46	-	-
recep st		110	-	-
Reception		63	15	9
repro-		79	-	-
roof access		79	-	-
SEN		60	-	-
SEN		66	-	-
SEN MI		57	-	-
SEN MI		55	-	-
SEN WC		162	-	-
SEN wc		157	-	-
server		73	-	-
sick bay		169	-	-
small		71	-	-
small		68	-	-
spec		110	-	-
Spec Store		94	-	-
Specialist		46	-	-
st		121	-	-
wc		90	-	-
wc		90	-	-
wc		101	-	-
wc		101	-	-
Staff		48	-	-
staff wc		89	-	-
staff work		76	-	-
staff work room		60	-	-
stairs		69	-	-
stairs		70	-	-
stairs		77	-	-
stairs		80	-	-
toilet		124	-	-
wc		77	-	-
wh ap		121	-	-
classroom		45	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Acc/staff	N/A	N/A
classroom	NO (-29.2%)	NO
classroom	NO (-54%)	NO
classroom	NO (-25.8%)	NO
Extensive Y1 classroom	NO (-41.4%)	NO
Extensive Y2 classroom	NO (-42.3%)	NO
Head office	NO (-65%)	NO
interview	N/A	N/A
Library	YES (+96.1%)	NO
mainhall	NO (-36.6%)	NO
Nursery	NO (-21.5%)	NO
office	NO (-57.1%)	NO
Primary	NO (-29.4%)	NO
Primary	NO (-45.1%)	NO
Reception	NO (-20.7%)	NO
roof access	N/A	N/A
SEN	NO (-81.3%)	NO
SEN	N/A	N/A
SEN MI	N/A	N/A
SEN MI	NO (-70.1%)	NO
small	N/A	N/A
small	NO (-63.3%)	NO
Specialist	NO (-51.8%)	NO
Staff	NO (-46.9%)	NO
staff work	N/A	N/A
staff work room	NO (-80.6%)	NO
classroom	NO (-54.1%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m ²]	1881.9	1881.9
External area [m ²]	3845.7	3845.7
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	3	3
Average conductance [W/K]	823.6	1157.68
Average U-value [W/m ² K]	0.21	0.3
Alpha value* [%]	25.24	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area Building Type

Retail/Financial and Professional Services
 Restaurants and Cafes/Drinking Establishments/Takeaways
 Offices and Workshop Businesses
 General Industrial and Special Industrial Groups
 Storage or Distribution
 Hotels
 Residential Institutions: Hospitals and Care Homes
 Residential Institutions: Residential Schools
 Residential Institutions: Universities and Colleges
 Secure Residential Institutions
 Residential Spaces
 Non-residential Institutions: Community/Day Centre
 Non-residential Institutions: Libraries, Museums, and Galleries

100

Non-residential Institutions: Education

Non-residential Institutions: Primary Health Care Building
 Non-residential Institutions: Crown and County Courts
 General Assembly and Leisure, Night Clubs, and Theatres
 Others: Passenger Terminals
 Others: Emergency Services
 Others: Miscellaneous 24hr Activities
 Others: Car Parks 24 hrs
 Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	12.11	16.95
Cooling	0	0
Auxiliary	0.84	1.48
Lighting	13.56	7.24
Hot water	4.63	7.43
Equipment*	23.83	23.83
TOTAL **	31.14	33.1

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	16.52	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
<i>Displaced electricity</i>	<i>16.52</i>	<i>0</i>

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	143.26	169.6
Primary energy [kWh _{PE} /m ²]	23.77	49.89
Total emissions [kg/m ²]	2.46	4.76

HVAC Systems Performance										
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Central heating using water: radiators, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	143.3	0	12.1	0	0.8	3.29	0	3.5	0
	Notional	169.6	0	17	0	0.8	2.78	0	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

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Unit 24 Sarum Complex

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Uxbridge

UB8 2RZ

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Website: www.jomasassociates.com

Tel: 0333 305 9054

Email: info@jomasassociates.com