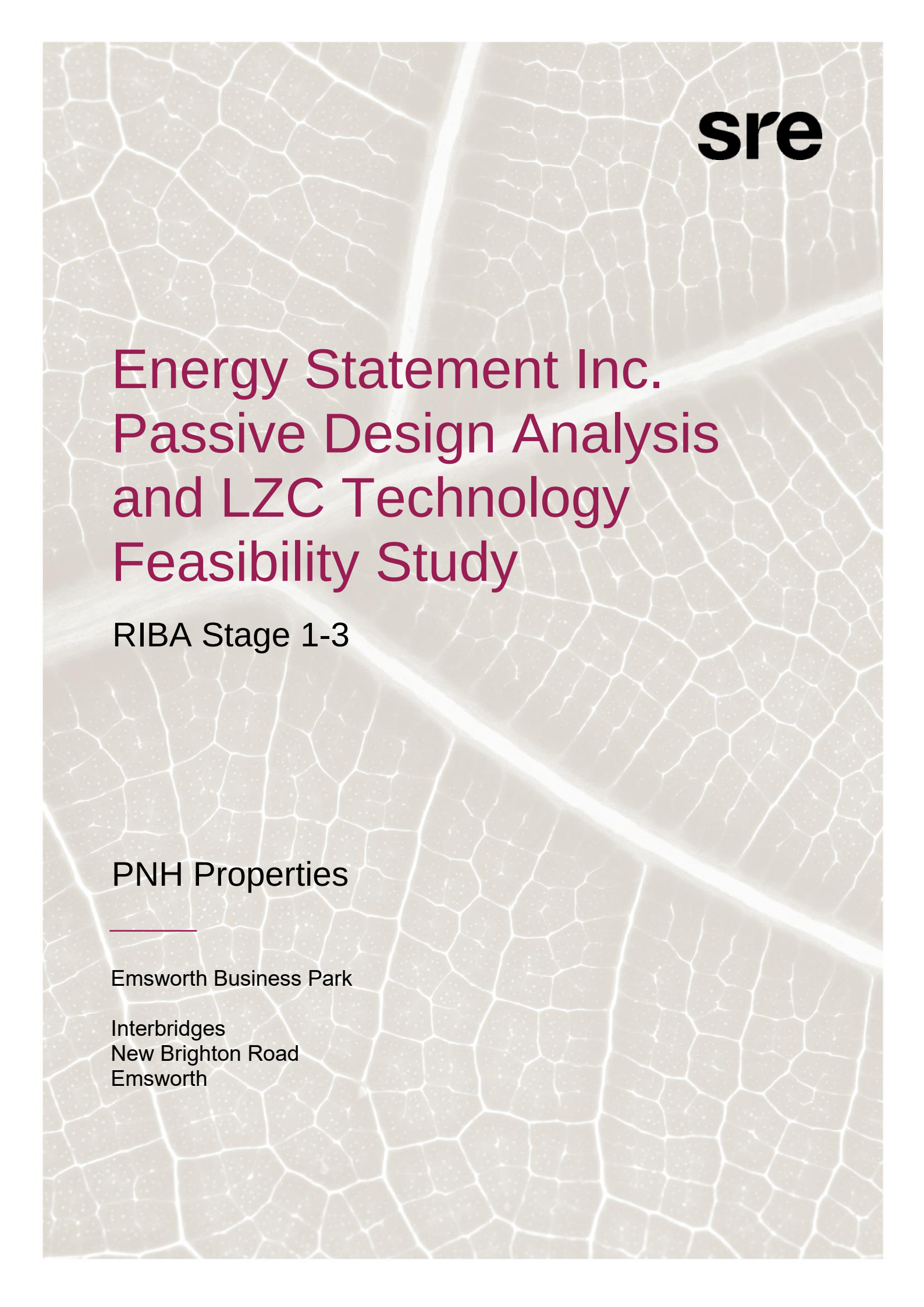




sre

Energy Statement Inc. Passive Design Analysis and LZC Technology Feasibility Study

RIBA Stage 1-3

PNH Properties

Emsworth Business Park

Interbridges
New Brighton Road
Emsworth

Version	Revision	Date	Author	Reviewer	Project Manager
1	A	06.12.2024	Alisha Pinheiro/ Honeyksha Waghela	Nikolaos Protogeros/ Sophie Hopwood/ Elsa Withnell	Adam Tucker

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Executive Summary

This Energy Statement including Passive Design and Low and Zero Carbon (LZC) Feasibility Study has been written to demonstrate the measures incorporated into the design of the Proposed Development at Emsworth Business Park. This will deliver lower energy and water use, lower global warming potential (GWP), carbon dioxide equivalent (CO₂e) emissions and operational costs, than a 2021 Building Regulations compliant design, in line with local policy requirements.

The Proposed Development at Emsworth Business Park, Emsworth includes an employment development with associated access, parking, yards, landscaping and substation.

The energy strategy has been developed by following the Policy CS14: Efficient Use of Resources which requires new developments to maximise their renewable energy production and contribute to the PUSH target of 100MW of renewable energy. The new developments should prioritise reducing energy use following the principles of – Lean: reduce energy consumption; Clean: generate energy using low carbon technologies and Green: generate energy using renewable sources.

The chosen energy strategy includes Lean passive and active design measures and Green Low and Zero Carbon (LZC) technologies to reduce the GWP and CO₂e emissions as far as practical and viable in line with Building Regulations 2021 Part L V2 and the local planning policy.

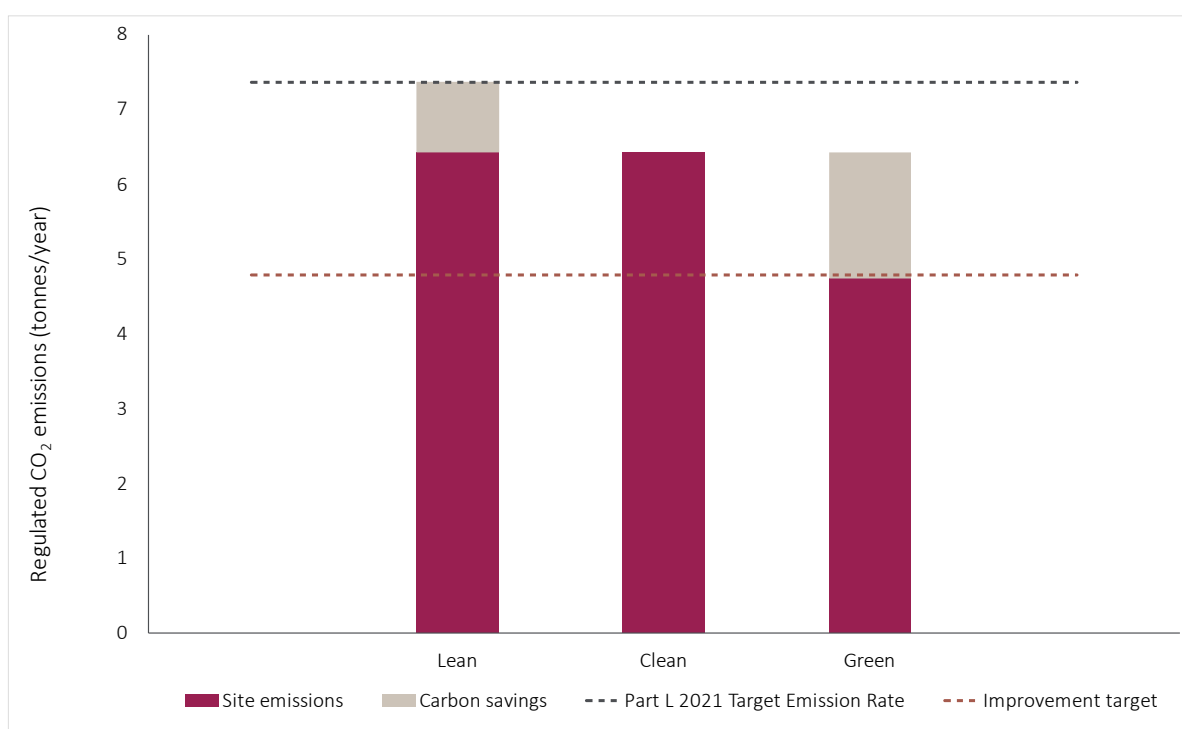
The statement also addresses the Building Research Establishment Environmental Assessment Method (BREEAM) New Construction Version 6.1 LZC Feasibility Study and Passive Design Analysis in support of BREEAM ENE04 assessment criteria.

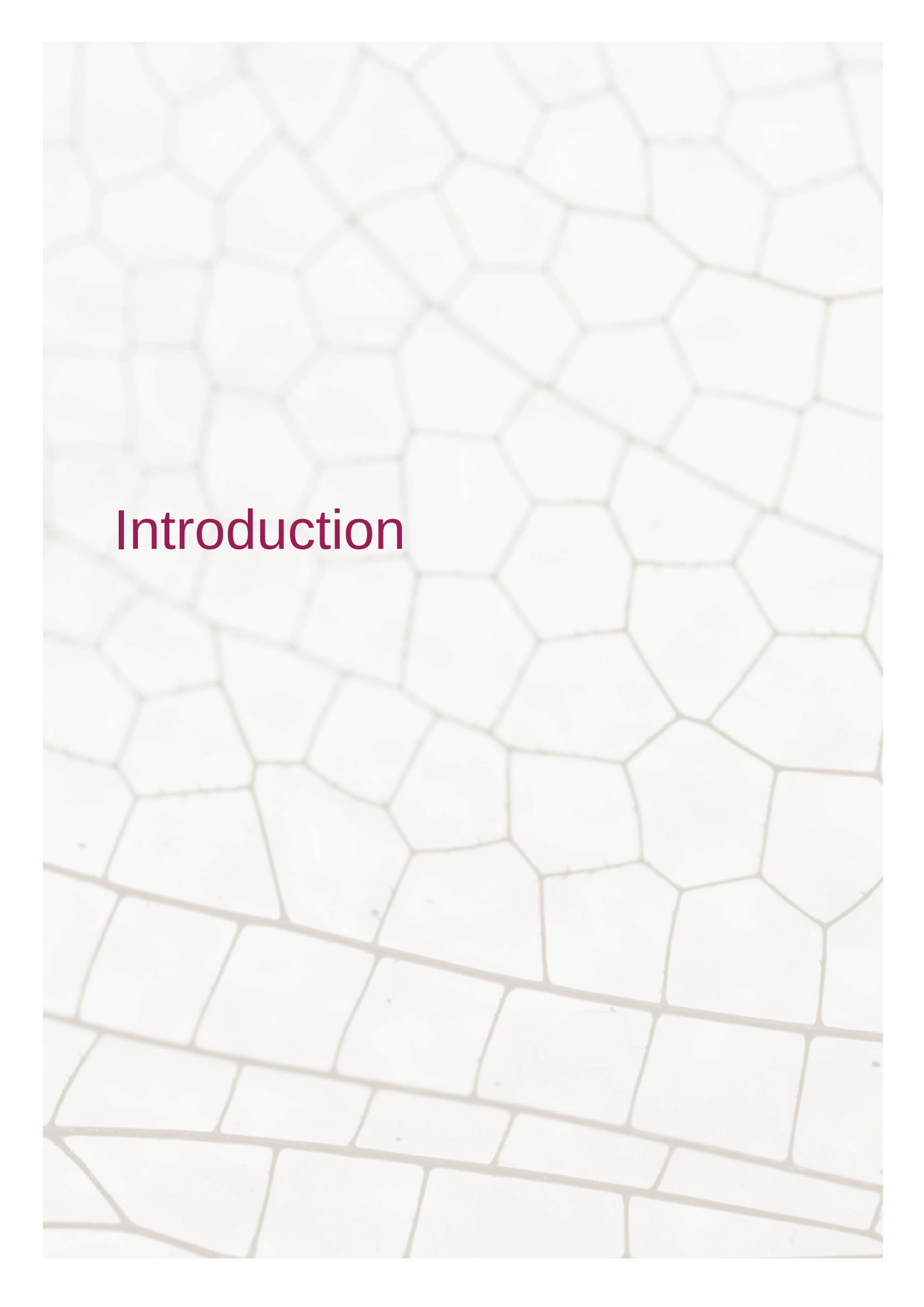
The proposed energy strategy is summarised below:

- Enhanced building fabric in line with Building Regulations 2021 Part L V2.
- High-efficiency light-emitting diode (LED) lighting. Passive Infrared (PIR) automatic on-off controls and dimming sensors in the mezzanine.
- Local extracts within the WCs.
- High-efficiency variable refrigerant flow (VRF) system (air-to-air heat pumps) to provide heating and cooling to all occupied areas and circulation spaces.
- Electric point-of-use for Domestic Hot Water (DHW).
- 10.53 kWp roof-mounted photovoltaic (PV) array.

Table 1 and Figure 1 summarise the CO₂e savings that can be achieved by applying the Energy Hierarchy. The Proposed Development can achieve a 13% improvement in annual CO₂e emissions through energy efficiency measures alone, with a site-wide 36% improvement over a Building Regulations Part L V2 compliant design. This meets Havant Borough Council planning policy requirements and contributes towards the PUSH target of 100MW from renewable energy.

Energy Hierarchy Category	CO ₂ e emissions (t/yr)	Cumulative Improvement (%)	Improvement over Baseline (%)
Baseline	7.37		
Lean	6.43	13	13
Clean	6.43	0	13
Green	4.74	26	36

Table 1 - Summary of regulated CO₂e savings for the Proposed DevelopmentFigure 1 - Energy Hierarchy CO₂e emissions reduction graph

The background of the slide is a microscopic image of plant tissue, showing a network of cells with thick, brownish cell walls. The cells are mostly polygonal in shape and are arranged in a somewhat regular pattern, though some areas show more elongated cells. The overall color is a light beige or off-white.

Introduction

1.0 Introduction

This Energy, Passive Design and Low and Zero Carbon (LZC) Feasibility Study has been written by SRE for PNH Properties (the Client). This statement demonstrates the measures incorporated at Emsworth Business Park, New Brighton Road, Emsworth (the Proposed Development) to deliver lower energy, water use and associated global warming potential (GWP) and carbon dioxide equivalent (CO₂e) emissions than the Building Regulations Part L V2 compliant design.

The statement compares the predicted actual building energy requirement with the Building Regulations Part L V2 compliant design, outlining Lean passive and active design measures, and assessing the suitability of Green LZC technologies specific to the project site, to address the relevant planning policy requirements.

1.1 The Site and the Proposed Development

The Proposed Development at Emsworth Business Park, Emsworth includes an employment development with associated access, parking, yards, landscaping and substation. Figure 2 shows the site plan of the Proposed Development.

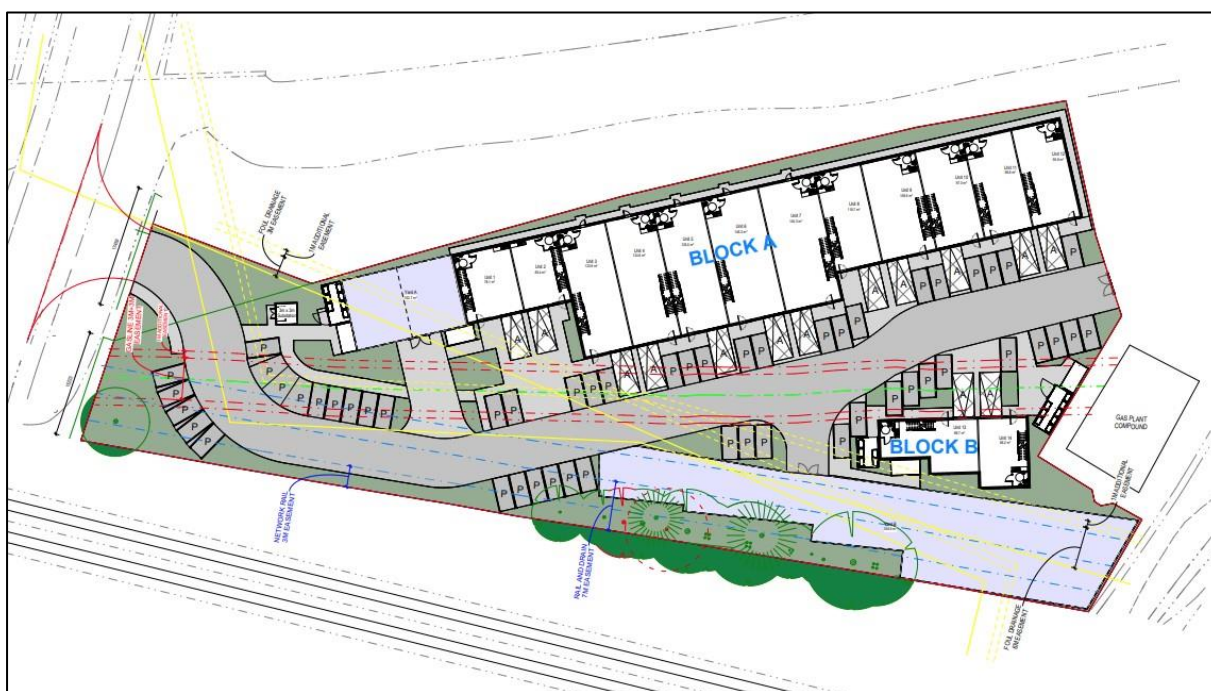


Figure 2 – Site Plan of the Proposed Development (Hyphen)

Please refer to Appendix A for the site plan of the Proposed Development.

1.2 Planning Policies

The energy and sustainability planning policy requirements relevant to the Proposed Development are summarised in Table 2.

Planning Policy	Requirement
Havant Borough Council	<u>Policy CS14 Efficient Use of Resources</u> Planning permission will be granted for development that: 1. Provides adequate land or funding for waste management infrastructure. 2. Locally contributes to the delivery of the PUSH target of 100MW of renewable energy by 2020 for the whole of the PUSH area. Major areas of development must ensure that their on-site renewable energy production is maximised, and resource efficiency is maximised. 3. On completion, unless proven to be financially or technically unviable, meets the following standards: • Residential development – Level 3 of the Code for Sustainable Homes. • Multi occupation homes and non-residential development over 500sqm - BREEAM standard 'very good'. • Improvements to these standards throughout the plan period will be encouraged. • Particular attention should be paid to water efficiency measures. 4. Allowable Solutions' may be used to achieve higher levels of carbon reduction where on-site proposals are not feasible or viable.
Havant Borough Council	<u>Policy CS16 High Quality Design</u> Planning permission will be granted for developments that are designed to high standards and demonstrate that its design: 1. Responds to, draws inspiration from and respects local context and: • Identifies and responds positively to existing features of natural, historic or local character within or close to the proposed development site; • Integrates with existing local landscape features, promotes wildlife and biodiversity and/or applies characteristics of the local area into the design of a scheme wherever possible to create variety and interest; • Uses the characteristics of the locality to help inform the design of the new development including heights, massing, existing buildings lines, plot widths and depths, materials and proportions of windows and doors; • Is well connected to and integrates with the immediate local area and the wider area by linking to existing pedestrian and cycle routes and encouraging people to use public transport where possible; and e) The development does not cause

- unacceptable harm to the amenity of neighbours through smell, the loss of privacy, outlook, noise and overlooking.
2. Produces a positive relationship between buildings, street and spaces both existing and proposed, where:
 - The layout of the development reduces opportunities for crime and antisocial behaviour; contributes to improving community safety; and makes provision for the management and maintenance of the development;
 - New streets are not dominated by vehicular traffic;
 - The layout of the development is legible, meaning it is easy to orientate oneself and move through.
 3. Contributes to the improvement of the public realm close to the development, particularly sites close to town, district and local centres and other priority regeneration areas by using high quality hard and soft landscape material and street furniture; and where development is of a significant scale or prominence makes provision for public art.
 4. Is inclusive by considering the needs of those with disabilities, ensuring safe and convenient access for all; and integrating affordable and supported housing with market housing through tenure blind design to minimise social exclusion and promote social integration.
 5. Maximises opportunities for mixed use developments, particularly in town and district centres; and encourage higher densities (50+ dwellings per hectare) where appropriate.
 6. Mitigates negative environmental impacts through sustainable design and construction methods, resource efficiencies, particularly water and the provision of facilities for waste recycling.
 7. Adapts to the changing needs of the users and the changing climate over the lifespan of the building.

Table 2 - Summary of local planning policy requirements

1.2.1 Applicability to Proposed Development

The Proposed Development is deemed to be a Major Development as it is over 1000 m² in area. Therefore, in accordance with the Havant Borough Core Strategy, the following standards are proposed to be met:

- Utilise the Energy Hierarchy to derive the energy strategy
- Review and assess the development under the cooling hierarchy
- Maximise carbon savings using energy efficiency measures before implementing LZC technologies
- Maximise their renewable energy production

1.3 BREEAM Assessment

This statement is accompanied by a BREEAM UK New Construction Version 6.1 to demonstrate the targeted measures for this development.

The pre-assessment has demonstrated that Emsworth Business Park has the potential to achieve a BREEAM 'Very Good' (a score of > 55%) rating based on the assumptions and information agreed to date. The minimum standards for a 'Very Good' rating have been

targeted by the Proposed Development, and the resulting overall target score for the assessment is currently 58.36%, which will deliver a robust 'Very Good' rating. The credits targeted are considered by SRE and the Project Team to be realistic and deliverable on-site.

As well as targeted credits, the pre-assessment also highlights 'Potential' credits – those which could be adopted to improve the current score and provide a sufficient 'buffer' against the loss of credits throughout the construction phase. These credits are more challenging to achieve and will therefore require additional input from the Project Team. The 'Potential' score for the project currently sits at 62.69%, demonstrating that the Proposed Development is on track to achieve the targeted 'Very Good' rating.

BREEAM standards can be challenging to achieve, and the pre-assessment should be carefully reviewed by the design and construction teams to ensure all targeted credits are delivered as the project is progressed.

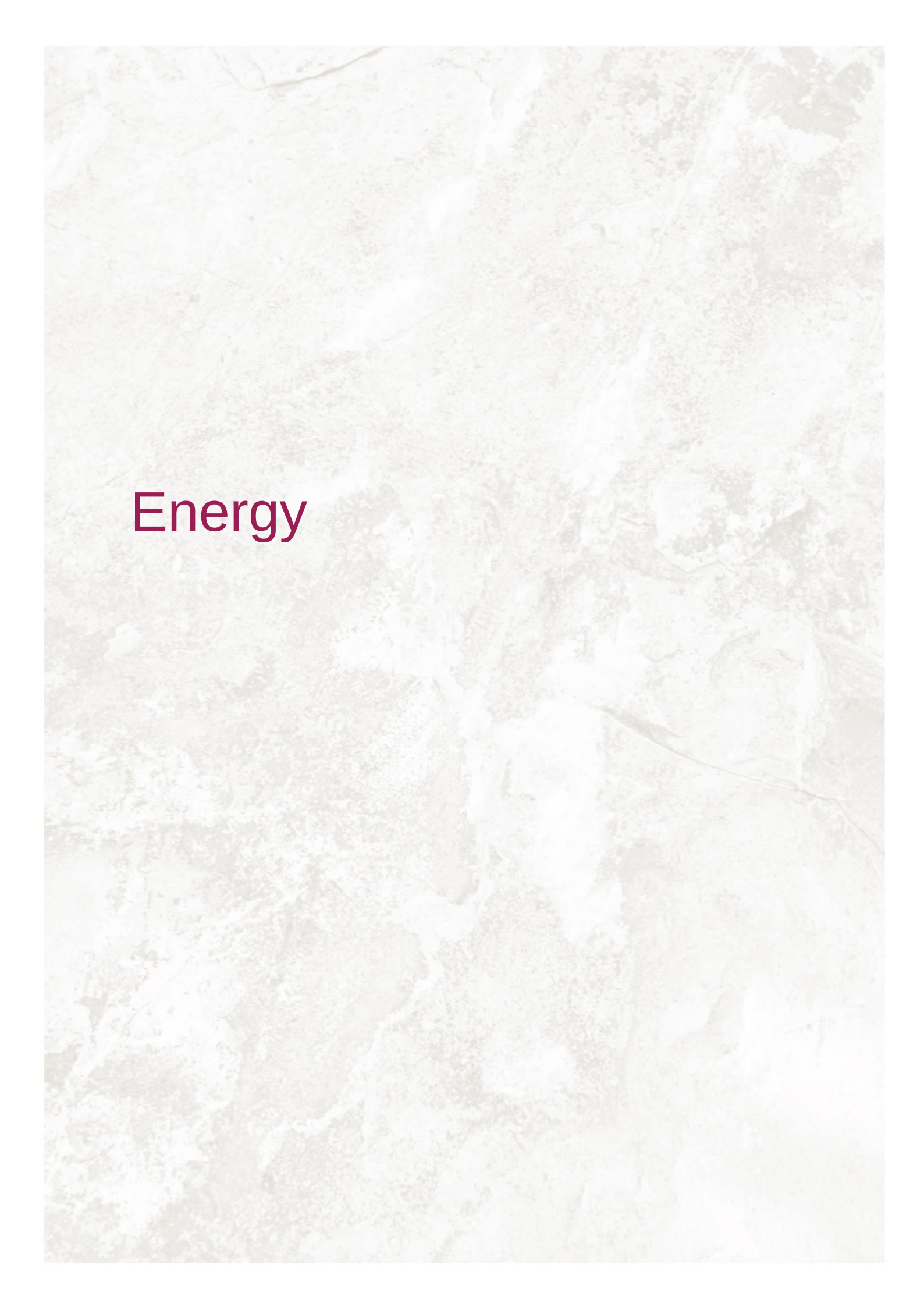
1.4 Available Grants

The main available low and zero-carbon (LZC) funding programs in Emsworth:

- **Green Heat Network Fund (GHNF)** - This fund offers financial support to organisations in England that want to develop new and existing low and zero-carbon heat networks. It covers the costs of building new heat networks and upgrading or expanding existing ones. However, individuals, households, and sole traders are not eligible for this grant¹.
- **Community Energy Fund** - The Department for Energy Security and Net Zero supports communities in England to develop clean energy projects up to the point of construction².

¹ <https://www.gov.uk/government/publications/green-heat-network-fund-ghnf>

² <https://www.gsenetzerohub.org.uk/financing-local-net-zero/funding/>

The background of the entire page is a light-colored, marbled paper with a complex, organic pattern of swirling, vein-like shapes in shades of cream, off-white, and pale beige. The texture appears slightly grainy and aged.

Energy

2.0 Energy

2.1 Method

The energy strategy design follows national policy guidance³ and seeks to be Lean, Clean, Green and Seen, as shown in Figure 3.

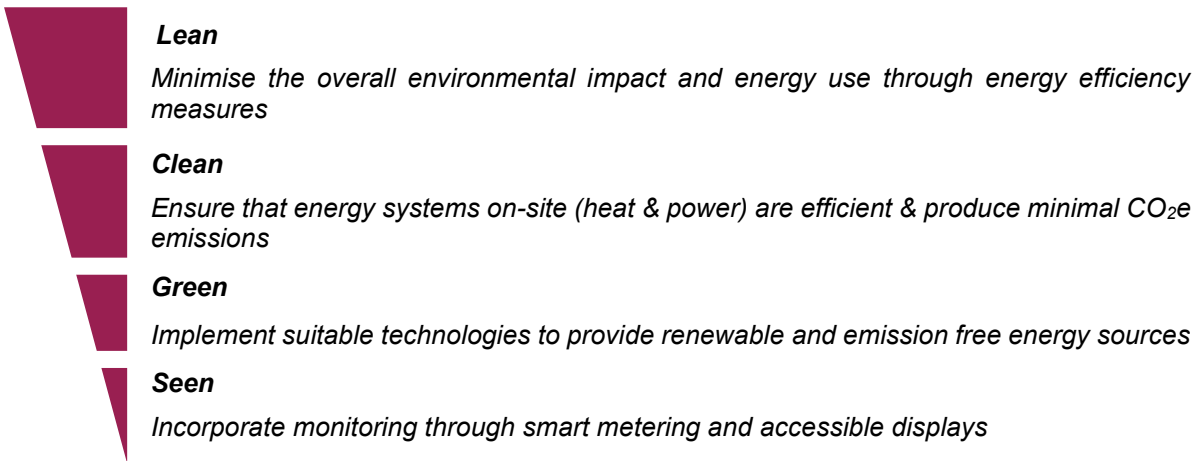


Figure 3 - The Energy Hierarchy

CO₂e Conversion Factors in Table 3 below have been taken from the 2021 Building Regulations. However, within Integrated Environmental Solutions Virtual Environment (IES VE) 2023 software, the CO₂e conversion factor for electricity varies over the course of the year due to the changing mix of inputs to the electricity grid, i.e., increased Photovoltaic (PV) generation in the summer months.

Energy Source	CO ₂ e Conversion Factor (kgCO ₂ e/kWh)
Electricity (mains)	0.136 ⁴
Electricity (offset)	-0.136 ⁴
Gas (mains)	0.210

Table 3 - CO₂e conversion factors by energy source

³ The London Plan <https://www.london.gov.uk/what-we-do/planning/london-plan/new-london-plan>

⁴ This value is not directly used, but rather represents the average of the month-to-month values used.

Emsworth Business Park is to be assessed under Building Regulations 2021 Part L V2 using a Dynamic Simulation Model (IES VE 2023 VE Compliance) - building use class B8: Storage or Distribution.

The Target Emission Rate (TER) from the Lean scenario provides the energy baseline and is the exact size and shape of the Proposed Development. The Baseline uses notional U-values and heating specifications outlined in 2021 Building Regulations Approved Document Part L. The Baseline CO₂e emissions are shown in Table 4.

Energy Hierarchy Category	CO ₂ e emissions (t/yr)
Baseline	7.37

Table 4 - Baseline values for CO₂e emissions

2.2 LEAN – Demand Reduction

The Lean scenario includes passive and active design measures to reduce CO₂e emissions, with results shown in Table 5.

Energy Hierarchy Category	Average CO ₂ e emissions (t/yr)	Improvement (%)
Baseline	7.37	
Lean	6.43	13

Table 5 - Lean CO₂e emissions and fabric improvement over Baseline

Emsworth Business Park is expected to achieve a 13% improvement in Lean energy efficiency measures alone.

2.2.1 Passive Design Measures

Passive design measures have been enhanced where possible throughout the site to maximise building efficiency within the confines of the site constraints and budget requirements. The building has been positioned within the site to maximise the usable space and provide suitable access and parking for loading vehicles and visitors. The Proposed Development will maximise positive solar gains where possible within the confines of the site. The unit will have double low emissivity (Low-E) glazing to control the solar gains to balance the risk of overheating.

The exact construction method is yet to be determined but is likely to be a steel frame with metal-clad insulated panelling or brick slip cladding to the external walls. The building will be very well insulated through all external elements and have a low infiltration rate. The U-values

will meet and exceed Building Regulations Part L V2 requirements, as shown in Table 6, with further details outlined in the summary specification sheet in Appendix B.

Element	Proposed U-value (W/m ² K)
External Wall - Blockwork	0.18
External Wall - Cladding	0.18
Ground Floor	0.12
Pitched Roof	0.12
Vehicle Access Door	1.30
Pedestrian Door	1.60
Rooflights	U-value - 1.6, G-value (glazing) - 0.4
Windows and Glazed Doors	U-value - 1.4, G-value (glazing) - 0.4
Additional Elements	
Air Tightness @50 Pa	5

Table 6 - Fabric energy efficiencies

2.2.2 Active Design Measures

The Proposed Development will utilise 100% light-emitting diode (LED) lighting in excess of Building Regulation requirements. External lighting, where installed, will also be energy efficient and will be positioned to avoid excessive light pollution and be supported by Passive Infrared (PIR) and/or daylight sensors and time controls to reduce operation times and subsequent energy use and emissions. Internal lighting in the mezzanine floor will have PIR auto-on-off and dimming sensors.

Following on from Section 2.0, the Proposed Development has been modelled using the notional building system type and performance values⁵. A notional Variable Refrigerant Flow (VRF) system has been modelled to provide space heating and cooling, and a notional instantaneous hot water system to supply hot water as part of the Lean scenario.

In modern air-tight buildings, careful consideration needs to be given to the specification of ventilation systems to ensure moisture is removed from the building, ventilation standards are met, and a healthy standard of internal air is maintained.

⁵ National Calculation Methodology Modelling Guide

https://www.uk-ncm.org.uk/filelibrary/NCM_Modelling_Guide_2021_Edition_England_15Dec2021.pdf

Local extracts are proposed in the WCs. Details of the systems used in the modelling are covered in the specification sheet in Appendix B.

2.2.3 Cooling

The cooling hierarchy has been used to ensure that passive building design has been optimised to reduce the potential for overheating within the Proposed Development. The design measures proposed are outlined in Table 7, with active cooling proposed to supply all occupied spaces and circulation space.

Cooling Hierarchy	Potential Design Measures
Minimising internal heat generation through energy efficient design	Heat distribution infrastructure should be designed to minimise pipe lengths and provide adequate insulation to minimise heat losses. High-efficacy LED lighting throughout with minimal heat output. Electric point-of-use hot water system.
Reducing the amount of heat entering the building in summer	All windows to have a low solar control glazing g-value of 0.40. All new external walls are to be well insulated with a high level of air tightness to reduce heat entering the building.
Use of thermal mass and high ceilings to manage the heat within the building	Thermal mass is anticipated to be medium-low.
Passive Ventilation	No openable windows are proposed.
Mechanical Ventilation	Standard extract fans are to be provided to all wet rooms.

Table 7 - Design measures following the Cooling Hierarchy

2.3 CLEAN – Heating Infrastructure

A centralised VRF and electric point-of-use hot water systems are proposed as part of the heating, cooling and hot water strategy. As heat pumps are considered a Green technology, the associated reduction in CO₂e emissions will be discussed in the 'Green' section of the report – under Section 2.4. Therefore, no further improvements over the 'Lean' scenario have been recorded.

2.3.1 District Heating

Connection to a district heating network has been discounted for the Proposed Development as there are no district heating networks in Emsworth at present. A feasibility study has been conducted by the Havant Borough Council on a potential district heating network connecting nine Civic Campus buildings including Havant College, NHS buildings and other public sector office buildings. Refer to Figure 4 for the proposed route of the potential district heating network.

As the network is more than 2.5 miles away from the Proposed Development and as a district heating network relies on connection to a wet system (since a VRF system is the favoured strategy to reduce operational CO₂e emissions) connection to such a network would not be suitable.

Therefore, no further improvement over the 'Clean' scenario has been recorded.

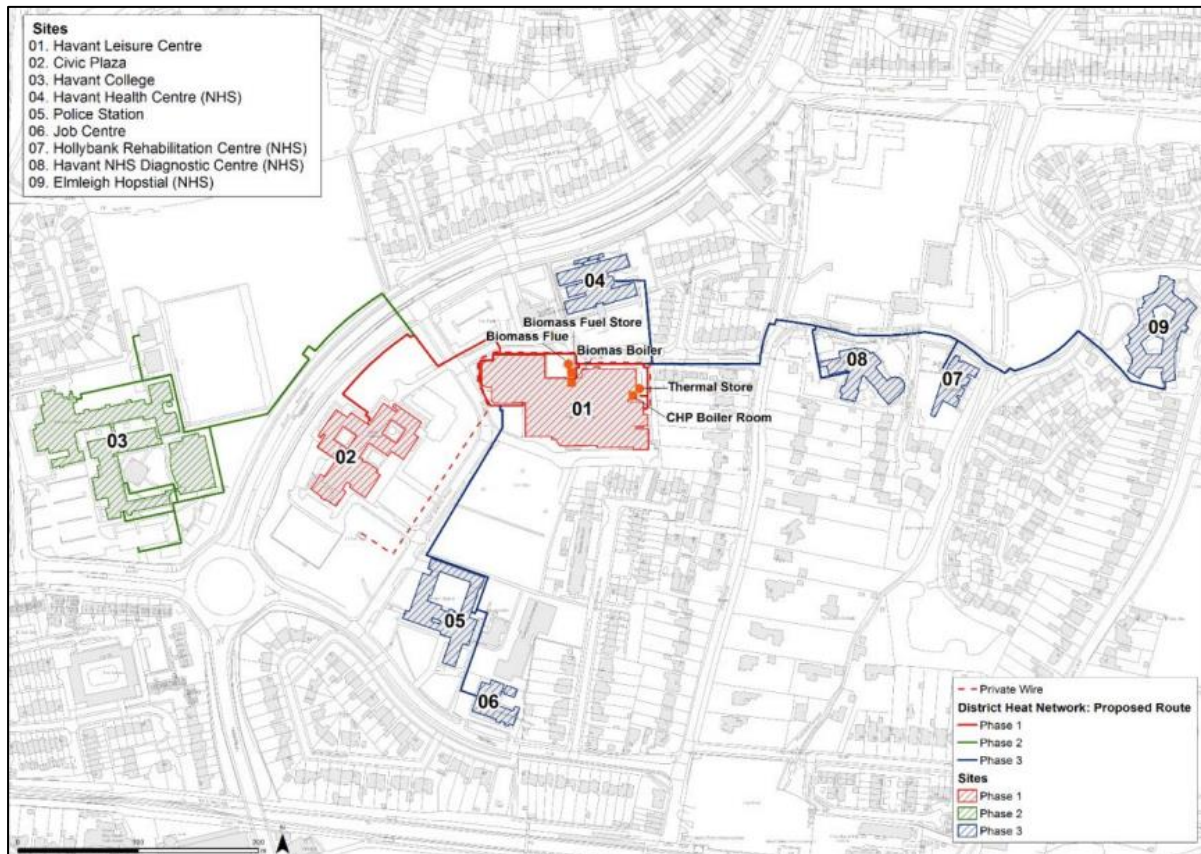


Figure 4 – Potential District Heating Networks (<https://www.havant.gov.uk/media/7893/download?inline>)

2.4 GREEN – Low Carbon and Renewable Energy

The addition of 'Green' technologies can provide a significant reduction in CO₂e emissions and enable the Proposed Development to achieve a 36% improvement over Baseline emissions. The proposed strategy includes VRF and electric point-of-use hot water systems with a 52m² PV array on the roof. The improvements in CO₂e and primary energy rate (PER) over the Baseline are shown in Table 8 and Table 9.

Energy Hierarchy Category	Average CO ₂ e emissions (t/yr)	Improvement over Baseline(%)
Baseline	7.37	
Green	4.74	36

Table 8 - Green CO₂e emissions and improvement over Baseline

Energy Hierarchy Category	Primary Energy Rate (kWh/m ² /yr)	Improvement over Baseline(%)
Baseline	35.79	
Green	22.86	36

Table 9 - Primary Energy Rate of the Proposed Development

A number of LZC technologies have been reviewed and assessed in support of the energy strategy and the BREEAM assessment. Please refer to Section 4.0 for a detailed LZC feasibility Study. The following viable LZC technologies are being proposed:

2.4.1 Heat Pumps

All heat pump systems consume electricity to operate – the Coefficient of Performance (CoP) of the system is the ratio of electrical energy consumed, to heat energy emitted. Generally, a CoP of 3 or 4 can be achieved, meaning 3 or 4 units of thermal energy are produced for each unit of electricity consumed.

Air-source Heat Pumps (ASHPs) efficiently extract energy from the external air and transfer it to internal air/water for heating. ASHPs will be located in a concealed area to minimise visual impact and potential noise to the building's occupants and neighbors. The final ASHP units chosen will comply with the minimum standards outlined in the Enhanced Capital Allowances (ECA) product criteria and other relevant issues as outlined in the Microgeneration Certification Heat Pump Product Certification Requirements documents⁶.

The use of a centralised VRF system has been proposed as a Green LZC technology to provide space heating and cooling via an air-to-air heat pump system to serve occupied areas and circulation spaces.

VRF systems are advanced, energy-efficient heating and air conditioning units specifically designed for commercial and large residential applications. They are particularly well-suited for occupied spaces and circulation areas within buildings. By utilising a network of indoor and outdoor units connected via refrigerant piping, VRF systems provide precise temperature control and allow for independent management of individual zones. This flexibility makes them

⁶ <http://www.microgenerationcertification.org>

especially effective in environments where different areas may have varying cooling and heating requirements.

2.5 Photovoltaics

PV panels convert energy from daylight into direct electrical current (DC), which is then converted to alternating electrical current (AC) via an inverter, or a series of inverters subject to the size of the array. The panels are generally roof mounted and provide electrical generation which can either be utilised directly on-site (or nearby) by HPs, lighting and other electrical equipment, stored in batteries, or exported back to the National Grid using export meters.

Noise will not be an issue since a PV array does not feature moving parts and is silent during operation.

The installation of PV is proposed in order to further reduce the on-site carbon emissions and offset some of the electrical demand within the Proposed Development with any excess being fed back into the National Grid.

The south-facing pitched roof is proposed to be a solar roof. The current proposal is to install a solar PV array of 26 no. 405W monocrystalline panels (~2m² in area) per panel, equivalent to a 10.53 kWp array with a pitch angle of 10°. Details of the proposed PV installation are detailed in Table 10.

Proposed Array (kWp)	Approximate no. Panels @405W	Active area (m ²)	Pitch (degrees)	Orientation	Estimated Annual Generation (kWh/yr)
10.53	26	52	10	South-east (164° azimuth)	9539.55

Table 10 - Proposed PV Array Summary

2.6 SEEN – In-use Monitoring

The Proposed Development will be supplied with Smart Meters (where available from the utility supplier) and PV generation meters along with the associated internal energy displays. This will further improve energy efficiency by allowing building users to observe their energy use in 'real time' and manage it more effectively.

2.7 Energy Conclusion

The Proposed Development has considered energy efficiency at every stage of the design and will deliver energy demand reduction measures along with L2C technologies in order to reduce energy demand and associated CO₂e emissions resulting from the Proposed Development's operation.

The calculations undertaken demonstrate that the Proposed Development will successfully exceed the Building Regulations Part L V2 compliance and align with Local Authority policies.

The following inputs and specifications will be provided to deliver the Part L and Planning Policy standards as a minimum:

- Enhanced building fabric in line with Building Regulations 2021 Part L V2.
- High-efficiency LED lighting. PIR automatic on-off controls and dimming sensors in the mezzanine.
- Local extracts for the WCs.
- High-efficiency VRF system to provide heating and cooling to all occupied areas and circulation spaces.
- Electric point-of-use for DHW.
- 10.53 kWp roof-mounted PV array.

The Proposed Development will achieve a site-wide improvement of 36% over the Baseline and a 13% improvement through Lean energy efficiency measures alone, as shown in Table 11 and Figure 5.

Energy Hierarchy Category	CO ₂ e emissions (t/yr)	Cumulative Improvement (%)	Improvement over Baseline (%)
Baseline	7.37		
Lean	6.43	13	13
Clean	6.43	0	13
Green	4.74	26	36

Table 11 - Summary of regulated CO₂e savings and cumulative improvements

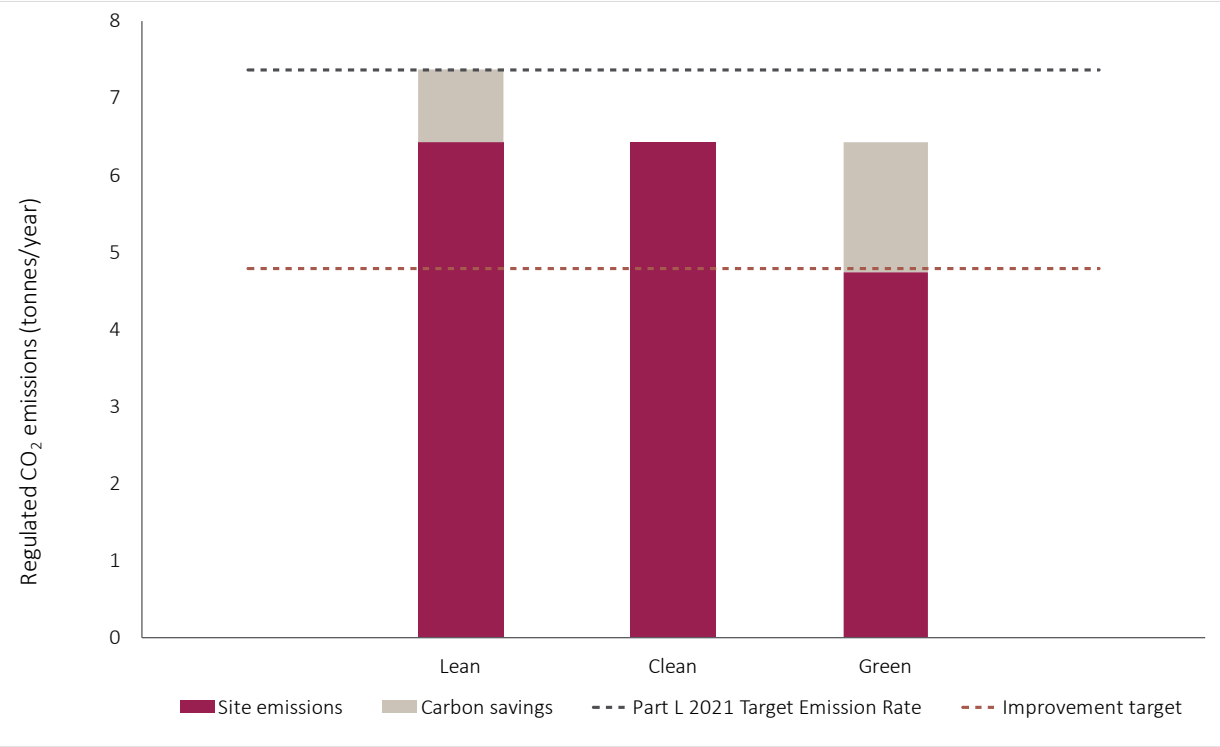


Figure 5 - Energy Hierarchy CO₂e emissions reduction graph



Passive Design Analysis

3.0 Passive Design Analysis

A Passive Design Analysis has been carried out for the Proposed Development. To achieve a high-performance building, a range of passive design measures have been incorporated in the design of the Proposed Development which is detailed in Section 2.2.1. These include the building layout and orientation with regard to site constraints, well-insulated envelope, glazing layout, size and thermal performance and solar control glass. These passive design measures, when used in combination with active design measures including energy-efficient lighting, will aim to deliver low energy, low CO₂e emissions and low operational costs.

3.1 Site Location

The Site is located in Emsworth, Hampshire. The new development will be built on the current greenfield bordered by the A27 to the north, the railway to the south, the B2148 New Brighton Road to the west, and the greenfield to the east. Figure 6 shows the location of the proposed site.



Figure 6 - Location of the Proposed Development (Google Earth)

3.2 Site Weather

The climate in Emsworth, Hampshire is classified as temperate (C), without a dry season (f), with a warm summer (b) – ‘Cfb’ - by the Köppen climate classification scheme. This temperate oceanic region has the coldest months averaging between 0°C and 18°C and at least one month averaging above 10°C.

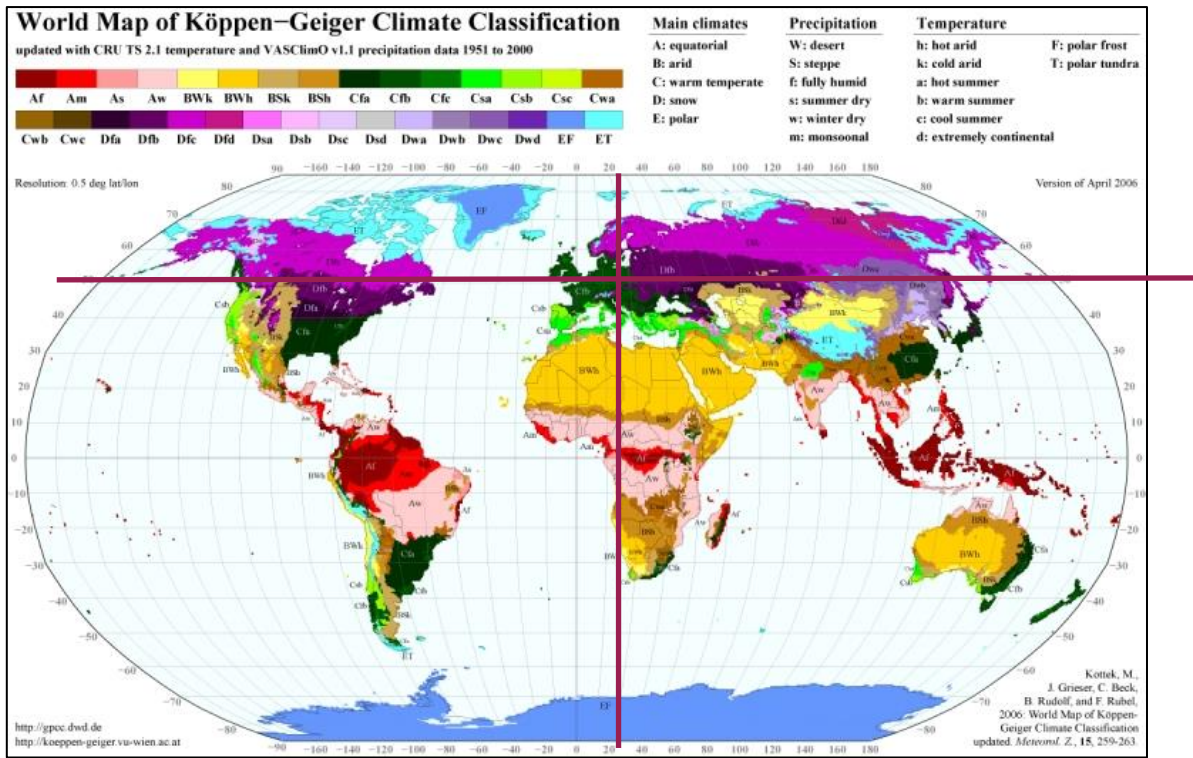


Figure 7 - Location of Site on Köppen Climate Classification Map with a description of Cfb⁷

The weather file used for the climate analysis is from Southampton TRY (CIBSE 2016) which is the closest, allowable weather station to the site. The warmest months on average are July and August, which see the highest daily maximum and minimum temperatures, while December, January and February are the coldest months with the lowest maximum and minimum temperatures, as shown in Figure 8. Given that there is no distinctive dry season, the relative humidity for the site is higher than the comfort band⁸ of 40%-70% throughout the year as shown in Figure 9, indicating a requirement for moisture control.

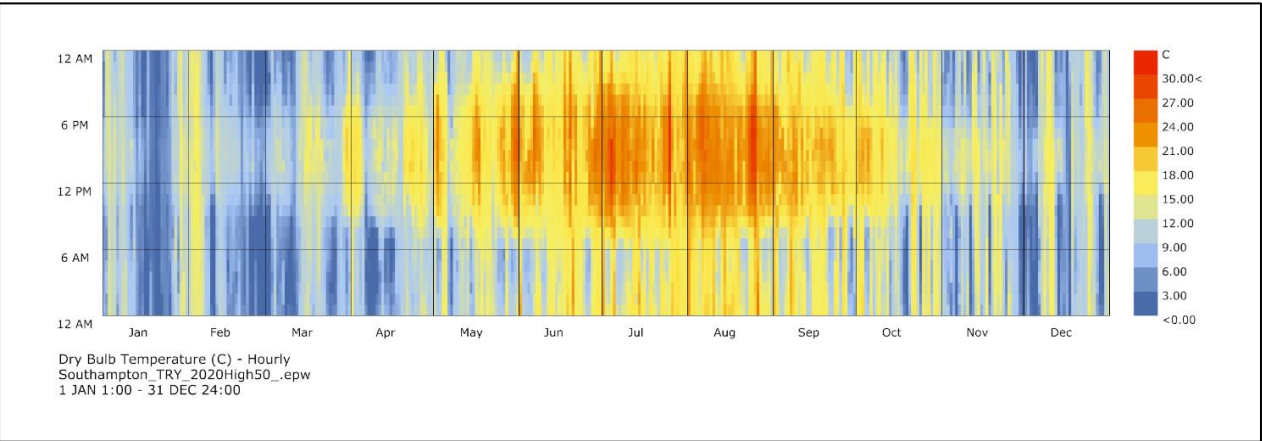


Figure 8 – Hourly Dry Bulb Temperature⁹

⁷ <https://koeppen-geiger.vu-wien.ac.at/present.htm>

⁸ CIBSE Guide A, Page 1-5

⁹ Weather file processed through Ladybug tools

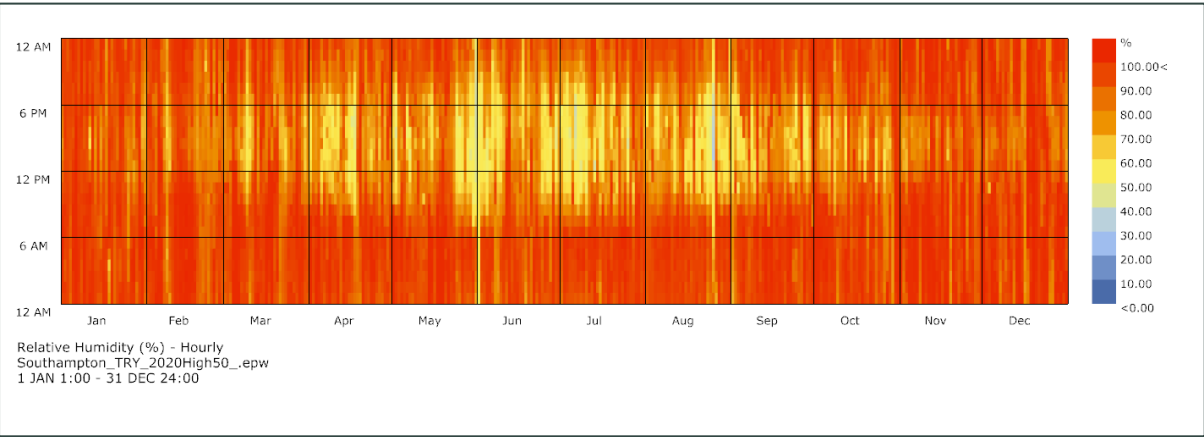


Figure 9 – Hourly Relative Humidity¹⁰

A Bioclimatic chart¹¹ has been plotted using the weather file for which Dry bulb temperatures and relative humidity during occupied hours¹² for the four seasons using a representative month for each season have been plotted, as shown in Figure 10, Figure 11, Figure 12 and Figure 13.

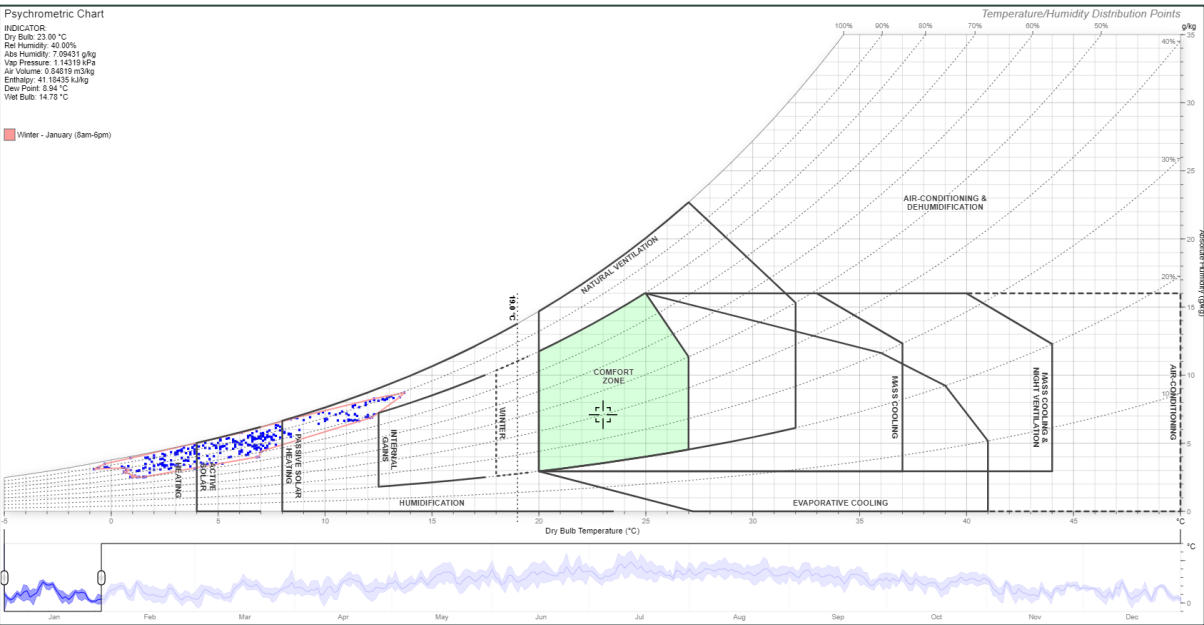


Figure 10 – Bioclimatic chart for January representing winter

¹⁰ Weather file processed through Ladybug tools

¹¹ The bioclimatic chart enables design teams to understand what the design needs to overcome or provide in order to achieve thermal comfort through passive means. Givoni Bioclimatic Chart, Online access - <http://andrewmarsh.com/software/psychro-chart-web/>

¹² Assumed to be 8:00am to 6:00pm

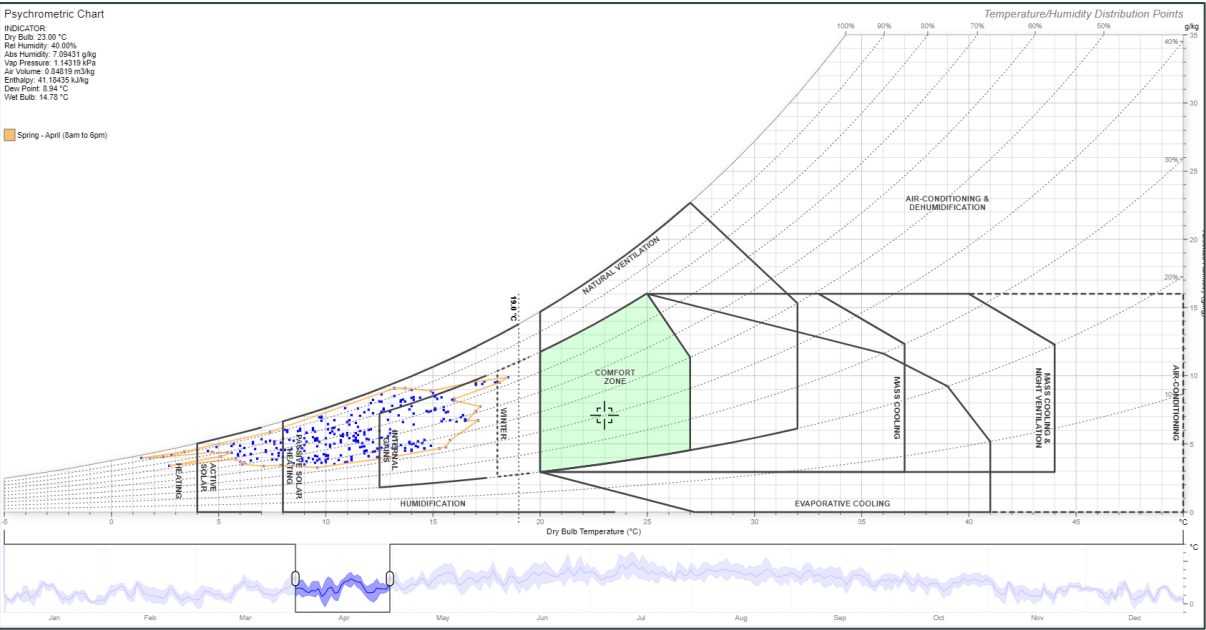


Figure 11 – Bioclimatic chart for April representing spring

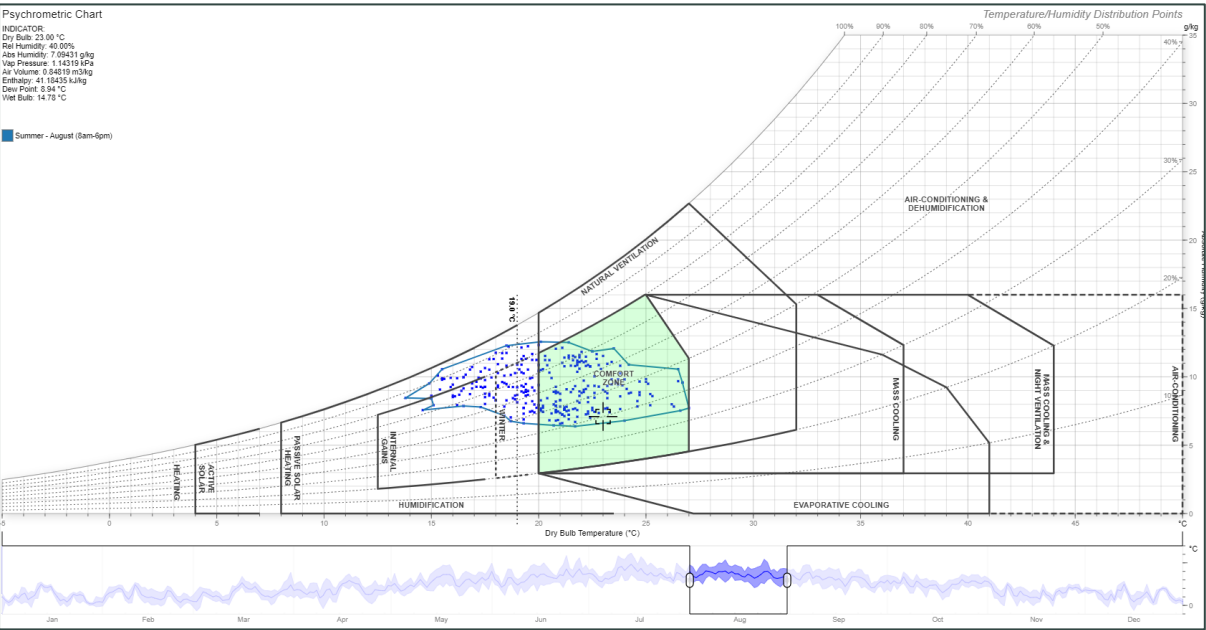


Figure 12 – Bioclimatic chart for August representing summer

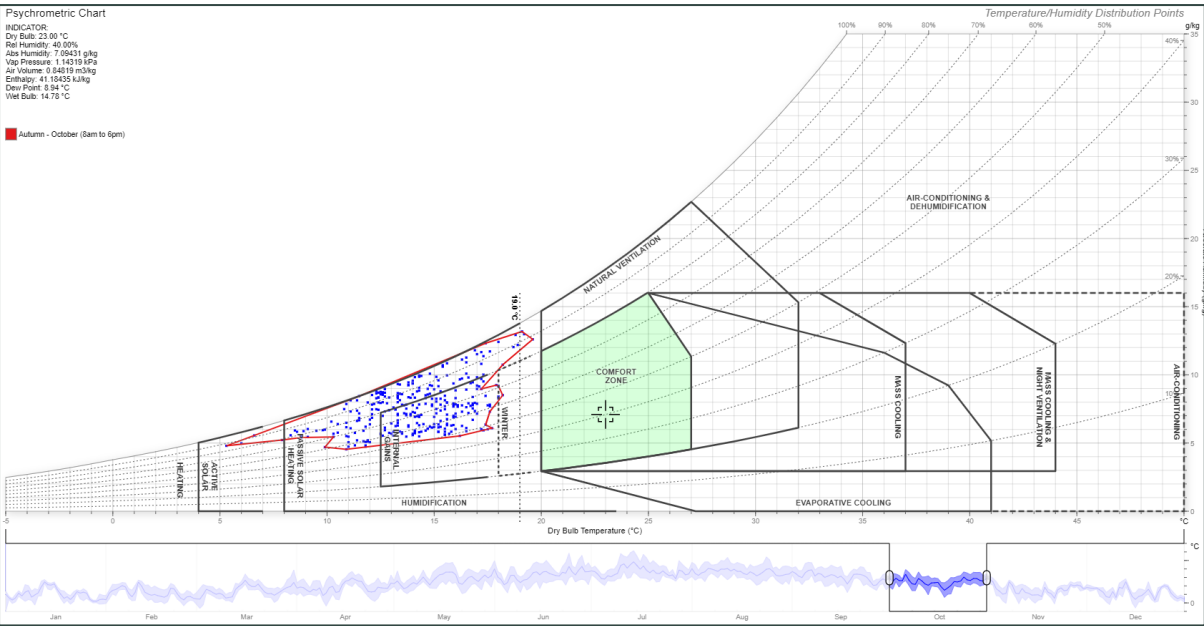


Figure 13 – Bioclimatic chart for October representing autumn

The results indicate that the provision of passive solar heat gain and the utilisation of internal heat gains is of high importance to achieving comfortable conditions. Through the implementation of a well-insulated airtight envelope, internal heat gains from people, light fittings and small power devices can be stored for prolonged periods of time in winter.

Sunshine hours provide an indication of cloudiness vs sunshine hours. Figure 14 shows the sunshine hours across the UK in 2023 and based on this information, the Proposed Development will receive a yearly average of greater than 1,650 hours of sunshine each year. This is higher than the UK average of 1,530 hours. 2022 was the UK's warmest year since 1884 for maximum and mean temperatures, the second warmest minimum temperature recorded since 2014.

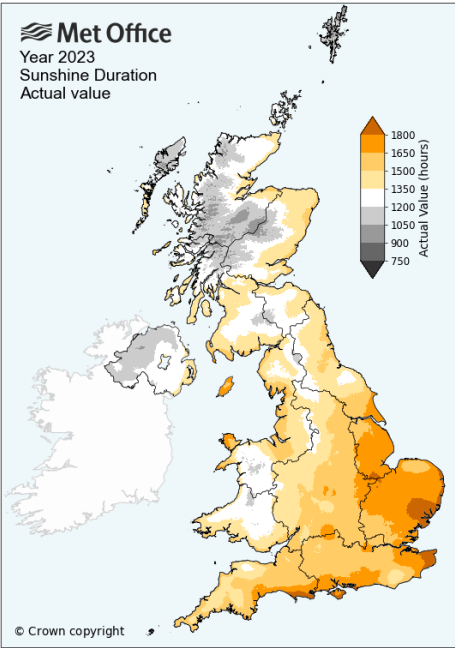


Figure 14 - Average sunshine hours - South East and Central South, England
(<https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-actual-and-anomaly-maps>)

For passive solar heating the design should aim to orient most of the glazing area toward conditioned spaces, from the south-east to the south-west as indicated by the solar rose diagrams (Figure 15). Since the Proposed Development has rooflights and the majority of the spaces have south-east facing glazing, the development will benefit from passive solar gains. Prior to the consideration of an air conditioning (AC) system, the Proposed Development has aimed to maximise winter sun exposure with south-east facing glazing in 12 no. out of 14 no. units. The G- value has been limited to 0.40 to balance with the intensity of the sun outside the winter time and to help mitigate overheating in the peak summer months.

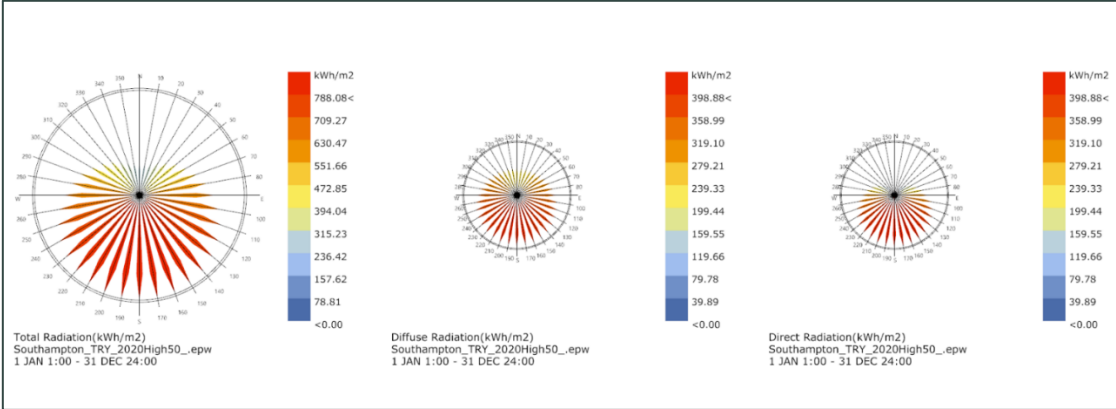


Figure 15 – Solar rose diagram¹³

The Met Office data from 2023 (Figure 16) shows that the Proposed Development received a yearly rainfall of circa 1000 to 1500 mm. The design team could consider ways to capture and store rainwater, however, considering the current climate, this passive design strategy is of less importance.

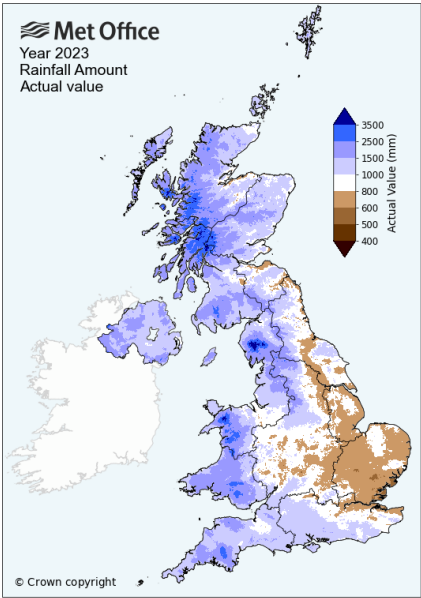


Figure 16 - Average rainfall - South East and Central South, England (<https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-actual-and-anomaly-maps>)

¹³ Weather file processed through Ladybug tools

3.3 Microclimate

An understanding of the characteristics of the site microclimate allows Architects and Developers to make informed strategic design decisions with respect to not only the climatic impacts of their buildings, but also the effect of the resulting microclimatic variables on the performance of buildings. Particularly, the site microclimates that will affect passive and low energy designs and the use of renewable technologies within the site.

The sun path diagram¹⁴ (Figure 17) plots the sun's elevation angle and azimuth angle over a day from a given location which can be used to roughly account for shading from surrounding objects of a site including trees by incorporating shading masks. By doing so in the required location, shading masks are useful to check if beneficial direct solar radiation is obstructed for any given point within the site.

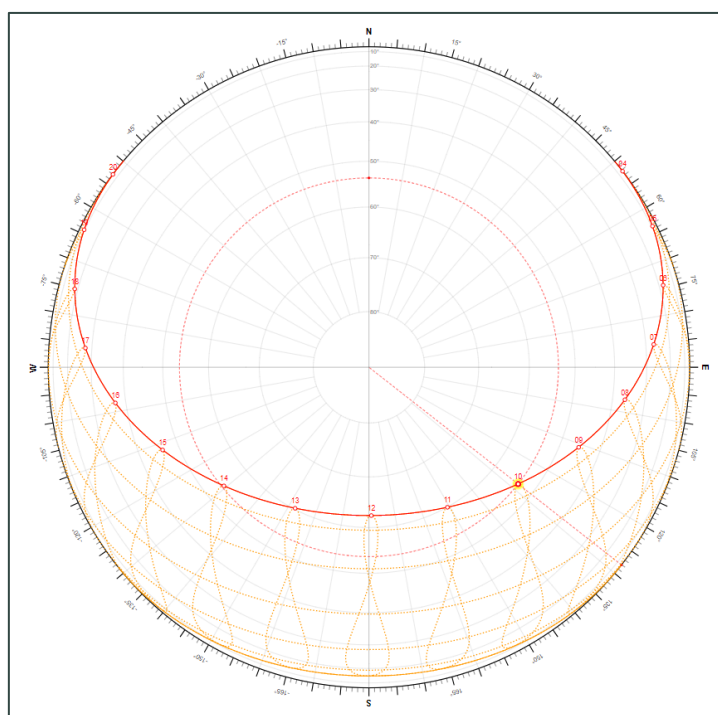


Figure 17 - Sun path diagram (Whole Year)¹⁵

3.4 Building Mass and Envelope

The building design will maximise natural daylight and positive solar gains to all shell and core units within the site constraints with 12 no. out of the 14 no. units having south-east facing glazing. Solar gains will be beneficial in winter and will be controlled through Low E glazing with low g-values in the summer.

In general, the building has been massed within the site to maximise the usable space, both for the building and the external hard landscaping areas. Windows on the north-east and south-east elevations will provide natural daylight and positive solar gains to the reception and work pods.

¹⁴ For a detailed explanation on how to read sun path chart - <http://solardat.uoregon.edu/AboutSunCharts.html>

¹⁵ Plotted for June 21st 10:00am - <https://drajmarsh.bitbucket.io/sunpath2d.html>

The construction method will most likely be a steel frame system (SFS) system. External walls will be cladding on an insulated carrier system. Internal partitions are assumed to be blockwork with plasterboard lining. The overall building will therefore have a low to medium thermal mass. All elements of the thermal envelope will have some form of insulation fitted to reduce the heating requirement throughout the year while maintaining the required constant temperature for the users. A design infiltration rate of 5 m³/hr/m² has been targeted for the building to help reduce the building's heating requirement but a lower target could further reduce the heating load.

3.5 Building Occupancy Type

The Proposed Development is designed to function as a shell and core storage or distribution facility comprising 14 no. 2-storey individual units.

3.6 Passive Design Modelling – Principles, Measures and Results

The implemented demand reduction measures and results of the simulation are summarised in the Table 12.

The passive design analysis has been calculated using IES VE 2023 DSM Level 5 software. To enable a baseline for comparison, a 'notional building' was modelled to be compared with the proposed design i.e., the 'proposed building'. The 'notional building' was modelled with fabric performance, glazing area, internal gains exactly as per an equivalent Part L 'notional building'. The table below lists the similarities and differences between the modelled 'notional building' and 'proposed building'.

Element	Notional Building ¹⁶	Proposed Building
External Walls – Side Lit (U-value)	0.18	0.18
External Walls – Top Lit (U-value)	0.26	
Ground Floor (U-value)	0.15	0.12
Roof – Side Lit (U-value)	0.15	0.12
Roof – Top Lit (U-value)	0.18	
Windows and Glazed doors (U-value)	1.40 (g-value 0.29)	1.40 (g-value 0.40)
Rooflights (U-value)	2.1 (g-value 0.40)	1.60 (g-value 0.40)
Loading Bay Doors (U-value)	1.30	1.30
Personnel Doors (U-value)	1.90	1.60

¹⁶ https://www.uk-ncm.org.uk/filelibrary/NCM_Modelling_Guide_2021_Edition_England_15Dec2021.pdf

Element	Notional Building ¹⁶	Proposed Building
Air Tightness @ 50 Pa – Side Lit	3 (m ³ /hr/m ²)	5 (m ³ /hr/m ²)
Air Tightness @ 50 Pa – Top Lit	5 (m ³ /hr/m ²)	
Thermal Mass	Classed as Lightweight (below 137.5 kJ/m ² K)	Classed as Lightweight (below 137.5 kJ/m ² K)
Internal Gains	Occupancy, equipment and lighting heat gains as per notional building for building type B8 Storage or distribution.	Occupancy, equipment and lighting heat gains as per notional building for building type B8 Storage or distribution.
Glazing area	40% of the exposed façade area	As per the proposed design

Table 12 – Notional Building vs Proposed Building inputs¹⁷

3.6.1 Daylighting & Ventilation Strategy

As previously discussed in Section 2.2.1 to 2.2.2, local extract system will be linked to the wet spaces to provide adequate ventilation to the development in line with Building Regulations Part L. The details of the daylight and ventilation strategy are shown in Table 13.

Design Measures	Notional Building	Proposed Building
External shading devices	None based on notional building	None
Fabric Performance	As per the notional building	As per Table 6 and Table 12
Window size and location	As per the notional building	Small amounts of glazing on the South-East and north façade.
Thermal mass	Lightweight construction below 137.5 kJ/m ² K	Lightweight construction below 137.5 kJ/m ² K
Daylighting strategy	Daylighting sensors in areas with glazing along with PIR sensors for applicable spaces	PIR and daylight sensors in the mezzanine

¹⁷ NCM modelling guide and Technical Guidance Document L 2021

Design Measures	Notional Building	Proposed Building
Ventilation strategy	Natural ventilation with standard extracts	Standard extracts in WCs

Table 13 – Notional Building vs Proposed Building implemented passive design measures

The ‘proposed building’ design with passive design measures as listed in the above table has a heating, cooling, auxiliary, DHW and lighting demand of 20.41 kWh/m² compared to the ‘notional building’ of 23.95 kWh/m². Thereby the reduced CO₂e emissions incorporating the passive design measures discussed is 2.93 kgCO₂e / year. The annual energy demand of the proposed building versus the notional building is shown in Figure 18.

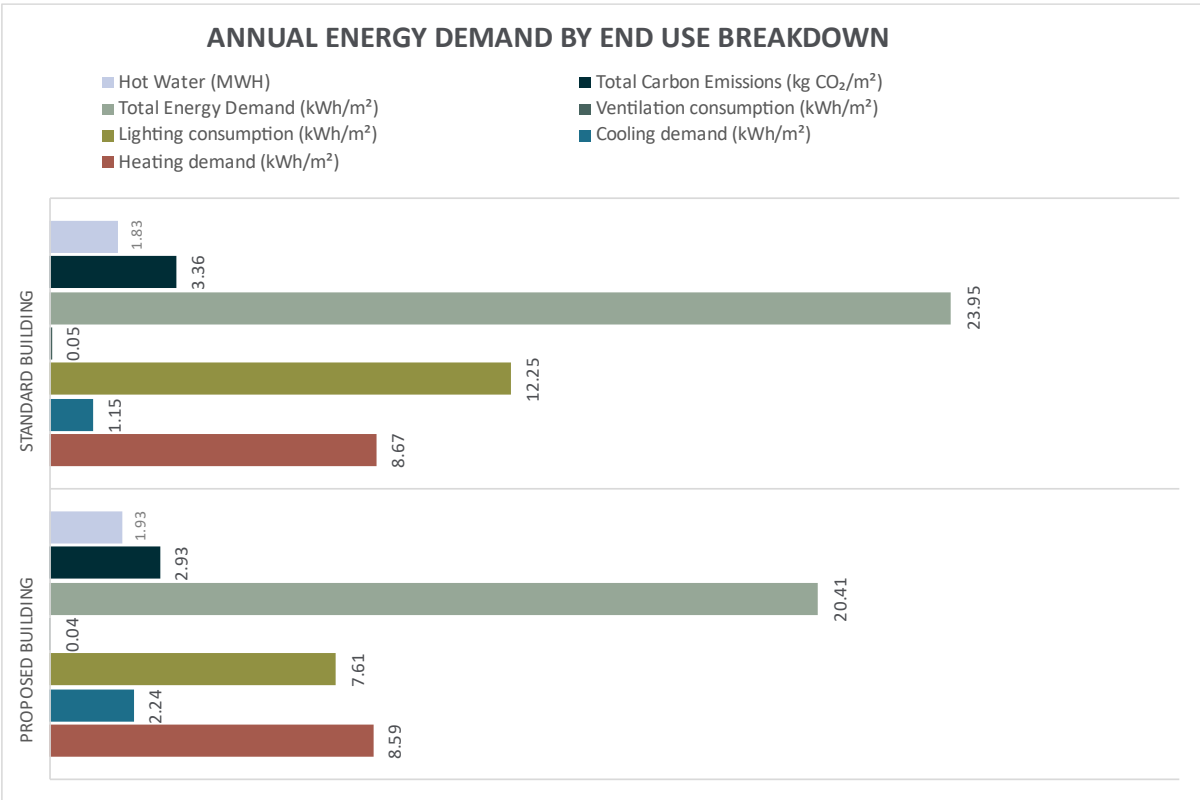


Figure 18 – Annual Energy Demand – Notional Building vs Proposed Building

3.7 Adaptation To Climate Change

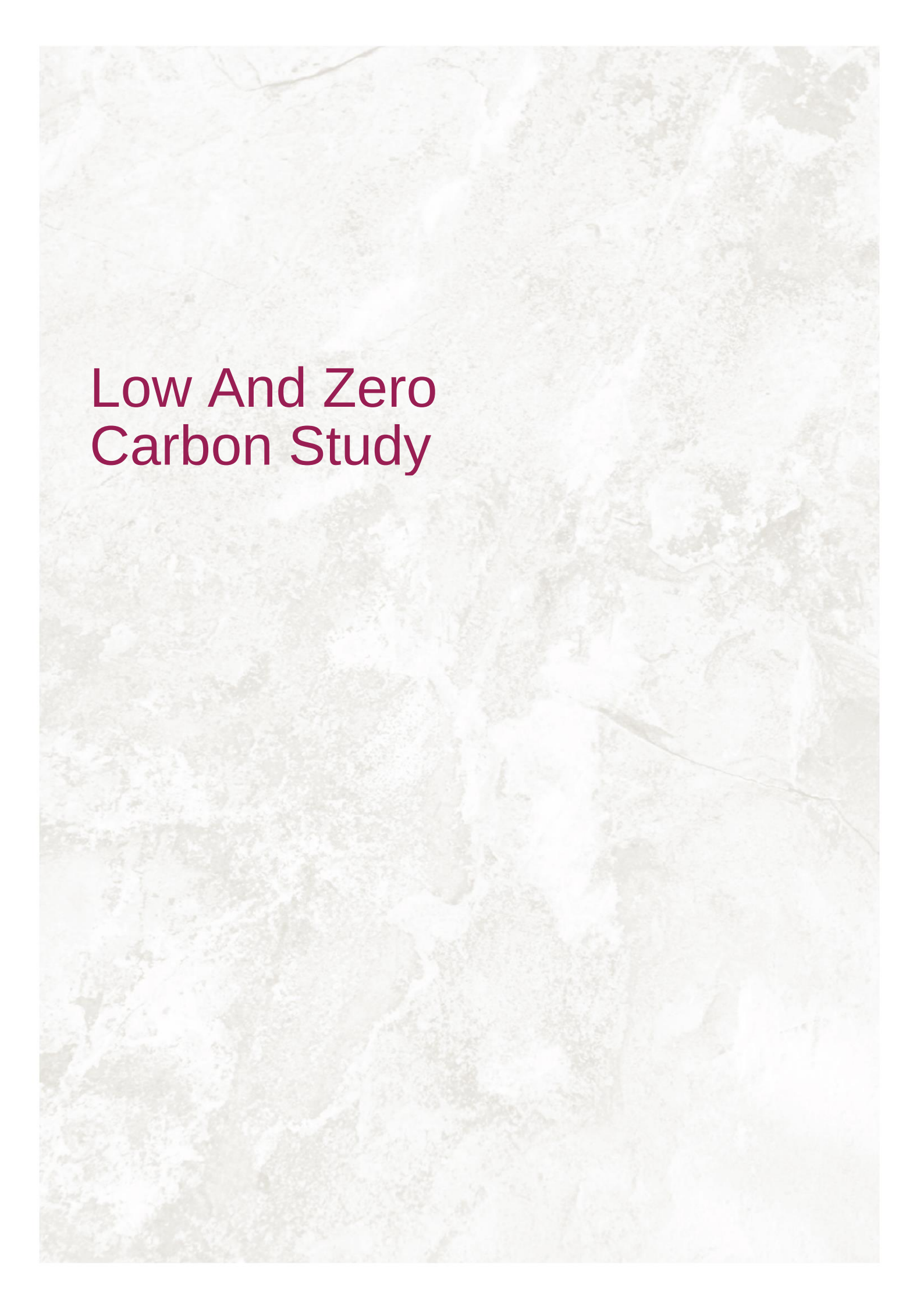
The proposed low to medium thermal mass and highly insulated thermal envelope will provide little protection from fluctuations in predicted short-term outside temperature, including extreme weather events. The provision of cooling during fit-out stage will provide efficient control of the indoor thermal environment which is important for health and wellbeing.

A Thermal Comfort Analysis (TM59 and TM52) has been undertaken which will further inform the details of the heating and cooling strategy at the Technical Design stage.

The BREEAM compliant flood risk assessment will detail the site's approach to flood risk and drainage strategies for 1-year and 100-year return period events, accounting for any projected changes in precipitation and future flood risk as a result of climate change.

3.8 Passive Design Analysis Conclusion

The Proposed Development has addressed a variety of elements relating to its passive design, maximising opportunities to reduce energy demand and CO₂ emissions through the use of passive design measures. These measures are demonstrated in Section 2.2 as 'Lean' improvements over the Baseline. The BREEAM Ene04 credit for Passive Design has therefore been achieved.

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Low And Zero Carbon Study

4.0 Low and Zero Carbon Study

To provide energy in a resource efficient manner, various low and zero carbon technologies have been assessed to determine suitability for the Proposed Development. The feasibility of each system along with reasons for inclusion and exclusion are discussed in this Section of the report. Table 14 summarises the various technologies assessed.

Air Source Heat Pumps and PV have been selected as the best suited technologies to provide heating, cooling and electricity for the Proposed Development.

Technology	Technically Feasible	Visual Implications	Noise Implications	Benefits	Weaknesses
District Heating	✗	✗	✗	Allows a mix of fuel sources to be utilised. Reduces space required in individual units for boilers and cylinders.	No existing or future proposed networks within the immediate area.
Combined Heat & Power	✗	✗	✗	Electrical generation alongside heat production creating CO ₂ offset.	Required large heat demand to operate effectively – and requires large plant room for CHP and back-up boilers.
Communal gas fired boiler system	✗	✗	✗	Responsive, reliable and well-established system.	On-site NO _x emissions. Uses gas which is a fossil fuel.
Ground source heat pump	✗	✗	✗	Can achieves SCOP of up to 5.00.	External space required for extensive pipework. Ground conditions dependant, borehole drilling costs. High capital costs.
Air source heat pump	✓	✓	✓	Provides space heating and hot water.	Background noise.

Technology	Technically Feasible	Visual Implications	Noise Implications	Benefits	Weaknesses
				Low CO ₂ emissions with High Coefficient of Performance.	
Biomass	✗	✗	✗	Low CO ₂ emissions.	Fuel storage space, cost and security of supply. Air quality implications due to NO ₂ and particulate matter emissions.
PV	✓	✓	✓	High CO ₂ offset and proven technology.	Susceptible to shading.
Solar water heating	✗	✓	✓	Efficient and integrates with a domestic heat pump or boiler. High energy offset.	Susceptible to shading and seasonable fluctuations during periods of inoccupation.
Wind Turbines	✗	✗	✗	High CO ₂ offset. Ability to generate energy for grid export.	Prone to turbulent air flows within built-up locations. Vibrations can affect structural integrity. High capital costs.

Table 14 - Reference Building vs Notional Building implemented passive design measures

4.1 District Heat Networks

District Heat Networks use a combination of excess heat generated from large-scale commercial, industrial or medical processes and heat generated from a local centralised source to heat buildings connected to that network.

A feasibility study has been conducted by the Havant Borough Council on a potential district heat network connecting nine Civic Campus buildings including Havant College, NHS buildings and other public sector office buildings. Refer to Section 2.3.1 for the proposed route of the potential district heating network.

As the network is more than 2.5 miles away from the Proposed Development and as a district heating network relies on connection to a wet system (whereas a VRV system and electric panel heaters are the favoured strategy to reduce operational CO₂e emissions) connection to such a network is not considered to be suitable.

4.2 Combined Heat and Power (CHP)

A CHP system can be an efficient way of generating electricity on-site with the benefit of reduced fuel costs (gas being cheaper than electricity) and reduced carbon emissions. Heat generated from the gas engine is used to produce hot water or steam for heating and hot water.

CHP systems often rely on natural gas or other fossil fuels to generate heat and electricity which further decreases the potential for CO₂ offset. Additionally, CHP systems are more complex than traditional heating or power systems which means they require regular maintenance to operate efficiently. The need for a centralised plant room, and extended subterranean pipe runs also work to decrease the efficiency and increase the complexity of the proposed system and as CHP systems are more complex than traditional heating or power systems this means they require regular maintenance to operate efficiently which can increase operational costs. CHP systems are most efficient when there is a consistent energy demand.

Given the buildings are currently shell and core and hence their final energy loads are unknown at this stage, the use of CHP has not been deemed feasible or appropriate for this site and therefore has been discounted.

4.3 Air Source Heat Pumps

The use of Air Source Heat Pumps (ASHP) has the potential to supply the Proposed Development with the heating, cooling and hot water requirements, subject to the provision of oversized/low temperature radiators or VRV/VRF system.

As with all Heat Pump systems ASHP consume electricity to operate - the Coefficient of Performance (CoP) of the system is the ratio of electrical energy consumed, to heat energy emitted. Generally, a CoP of 3 or 4 can be achieved, meaning 3 or 4 units of thermal energy are produced for each unit of electricity consumed. The CoP is affected by several factors, including system design, outside air temperatures (solar irradiation) and patterns of use.

ASHPs tend to generate an increased amount of noise and therefore the space in which the pump is positioned would need to be adequately sound insulated to prevent disturbances to the building's occupants.

Due to the heating, cooling requirements within the Proposed Development, the use of an ASHP is proposed through a VRF system, delivering heating and cooling, via ceiling cassettes from external condensers.

With the use of ASHP, the site will be utilising electricity – rather than gas – as the primary heating fuel, which generates lower levels of CO₂ and the CO₂ emission factor for electricity should continue to decrease as the grid decarbonises.

ASHP are deemed to be feasible for the Proposed Development and the specification is detailed in Appendix B.

4.4 Ground Source Heat Pumps

A Ground Source Heat Pump incorporates a buried network of pipes/coils continuously circulating a 'transfer liquid' (glycol) to extract heat from the ground to provide a source of space and or water heating. The ground maintains a temperature of ~11°C at 1m depth, which

warms the 'transfer liquid' before passing through a compressor to raise the temperature but can achieve high CoPs averaging at ~4.

The use of a Ground Source Heat Pump would have the potential to supply the space heating for the Proposed Development, subject to the provision of underfloor heating or oversized radiators (wet system) to maximise the GSHP system performance.

GSHPs requires extensive groundworks needed to install horizontal ground loops or vertical boreholes. The horizontal ground loops typically require an area around 2-3 times the floor area of the building whilst the vertical boreholes involve drilling around 15 to 30m boreholes and both options are dependent on the ground conditions at the site which would need to be assessed.

As the Proposed Development is currently shell and core the final building loads are unknown at this stage. The design and installation of the GHSP relies on the loads to be known in order to ensure sufficient horizontal ground loops or vertical boreholes. . Therefore, although a GSHP can provide a greater efficiency performance than an ASHP, a GSHP has not been considered further at this site.

4.5 Biomass Boiler

Biomass is a form of heating fuel characterised by the burning of organic matter (i.e. logs, wood pellets, wood chips, or man-made logs from agricultural waste). The use of biomass is deemed as a renewable resource as the CO₂ released during its combustion is equal to the CO₂ absorbed by the plant during its lifetime, and the resource can be re-grown in a relatively short timeframe.

Biomass boilers require large stocks of fuel to be kept and would require a communal based heating system. Further, biomass boilers emit high levels of particulates including both particulate matter and NO_x, as a byproduct of the combustion of organic material which could negatively impact the air quality of the surrounding area. Furthermore, the particulates mean biomass boilers require frequent maintenance and servicing to avoid breakdowns. For these reasons, biomass solutions have not been considered further at this site.

4.6 Photovoltaics

Photovoltaic (PV) panels convert energy from sunlight into direct (DC) electrical current. These are generally roof mounted, and provide electrical generation which can either be utilised directly on site, or exported back to the grid through an inverter to convert current from DC to AC.

The installation of PV could be used to offset electrical demand within the Proposed Development. The PV array would be connected into the electrical system via an inverter or series of inverters, depending on system size and setup.

Noise will not be an issue – A PV system does not feature moving parts and is silent during operation.

The Proposed Development has some areas of roof to allow a PV installation with initial conservative measurements showing that there is approximately 44 m² of roof space available on south facing pitched roof in Block A and 8m² on Block B of the roof that would be suitable for PV.

4.7 Solar Water Heating

Solar Water Heating (SWH), like PV above, is a roof mounted solar array system. However, SWH uses energy from the sun to heat water, rather than produce electricity. A carrier solution (commonly glycol) is heated within the panel and is then pumped to a hot water storage tank, where this is used to heat domestic hot water. A supplementary heating system is then used, to heat the water when needed (i.e. when sunlight is low, or water demand is particularly high).

The installation of Solar Water Heating (SWH) could be used to offset a proportion of the domestic hot water demand (DHW), subject to the installation of an appropriate hot water cylinder (dual coil) within each unit, and space allowed within the design for the required insulated flow and return pipework.

Noise will not be an issue with SWH – the only moving part is the circulation pump, which is inside the property and should not be noticeable.

Unlike PV, where the overall performance is generally limited by available roof space and finances, the CO₂ offset achievable with SWH is limited by the occupancy and estimated hot water load of the unit – too large a system can overheat an individual hot water tank at peak solar insolation. Furthermore, as SWH uses energy from the sun, the efficiency from SWH can drop in colder months when hot water demand is highest, which may require backup heating, unlikely PV which generates electricity from daylight not just direct sunlight. Although warehouses have low hot water demand compared to dwellings. In this case, it will be more beneficial for lighting and heating.

Whilst technically feasible, PV has been chosen over SWH due to the amount of CO₂ savings that can be made and as the DHW of the Proposed Development is expected to be low.

4.8 Wind Power

Wind turbines utilise the wind to turn a generator, which produces electricity which can be either utilised on site or exported to the Grid. Generally, turbines require smooth, fast wind speeds to allow adequate rotation to occur, and power produced. Due to this, they are broadly unsuited to urban environments.

Due to the urban environment surrounding the site, it is not likely to lend itself to the efficient operation of wind turbines and face strong opposition for aesthetic reasons.

Air flow within town is often turbulent due to the number and varying heights of neighbouring buildings which would reduce the efficiency of any turbine installed.

Therefore, by taking these factors into consideration, it has been deemed technically unfeasible to install a wind turbine at the Proposed Development.

4.9 Energy Storage

There are several different energy storage technologies on the market which are becoming more commercially viable that can provide storage of heat or electricity. Heat storage can be provided through inter-seasonal heat stores, which provide storage facilities for the heat removed from the internal spaces during cooling periods, the stored heat can then provide a proportion of the heating load during heating periods or phase change materials which utilise the changing state of a material (sometimes water from a liquid to solid) to capture or release energy.

Electrical storage can be provided through batteries which can store energy from renewable technology generation (PV or CHP) during peak energy production to be utilised during times of peak energy demand or used to run the baseload systems during night-time operation.

While energy storage could be feasible at this site, due to the Proposed Development's stage of design (a detailed energy demand consumption analysis is required to correctly size batteries), the use of energy storage has not been considered in detail at this stage. However, this could be something which can be easily incorporated within the final fitout should this be required or desired by the future end tenants.

4.10 Energy and Carbon Results

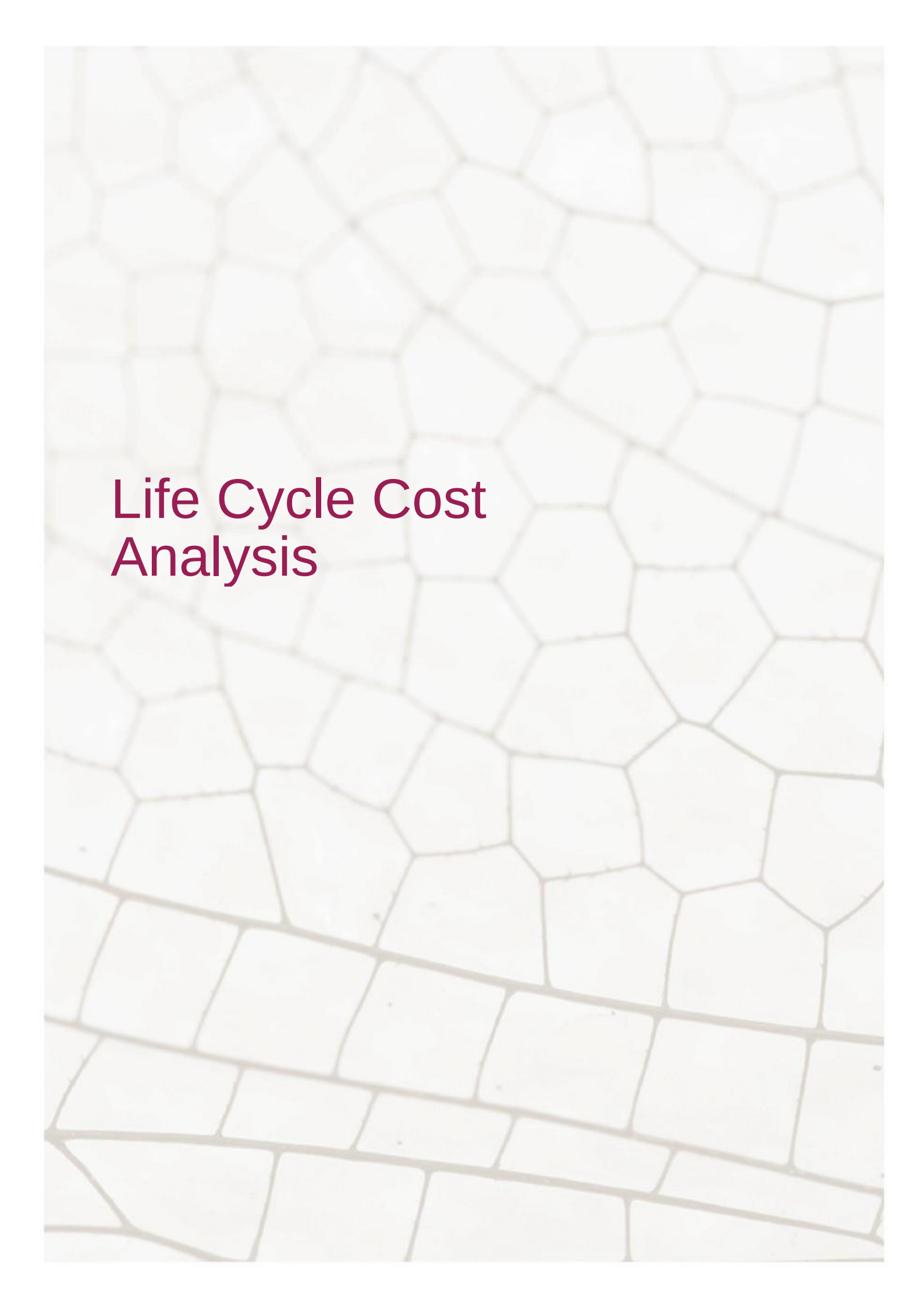
Table 15 and Table 16 below compares energy generated and carbon dioxide savings from PV by comparing a baseline with PV excluded and the proposed scenario with 52m² PV panels. The results show the Proposed Development will generate 9539.55 kWh/yr of electricity from PV resulting in a 1.22 tCO₂ saved per year. As heat pumps are now a standard technology and not considered to be an LZC technology under BREEAM Ene 04, the energy generated and CO₂ savings from the ASHPs have not been considered in these results.

	Energy Generated (kWh/yr)
Baseline (No PV)	-
Proposed Development	9539.55

Table 15 – Energy Results

	CO ₂ e emissions (t/yr)	Improvement (%)
Baseline (No PV)	5.96	
Proposed Development	4.74	20.5

Table 16 - CO₂e savings and improvements

The background of the slide is a microscopic image of plant tissue, showing a network of polygonal cells with thick, brownish cell walls. The cells are arranged in a somewhat regular pattern, typical of epidermal or mesophyll tissue. The overall color is a light beige or off-white.

Life Cycle Cost Analysis

5.0 Life Cycle Cost Analysis of Photovoltaics

5.1. Construction

The installation of Solar Photovoltaics (PV) does not incur high costs when incorporated into the construction phase of the development, it requires 'specialist installers' in the form of qualified solar installers, there are many companies who can supply these services across the UK, ensuring that prices remain competitive.

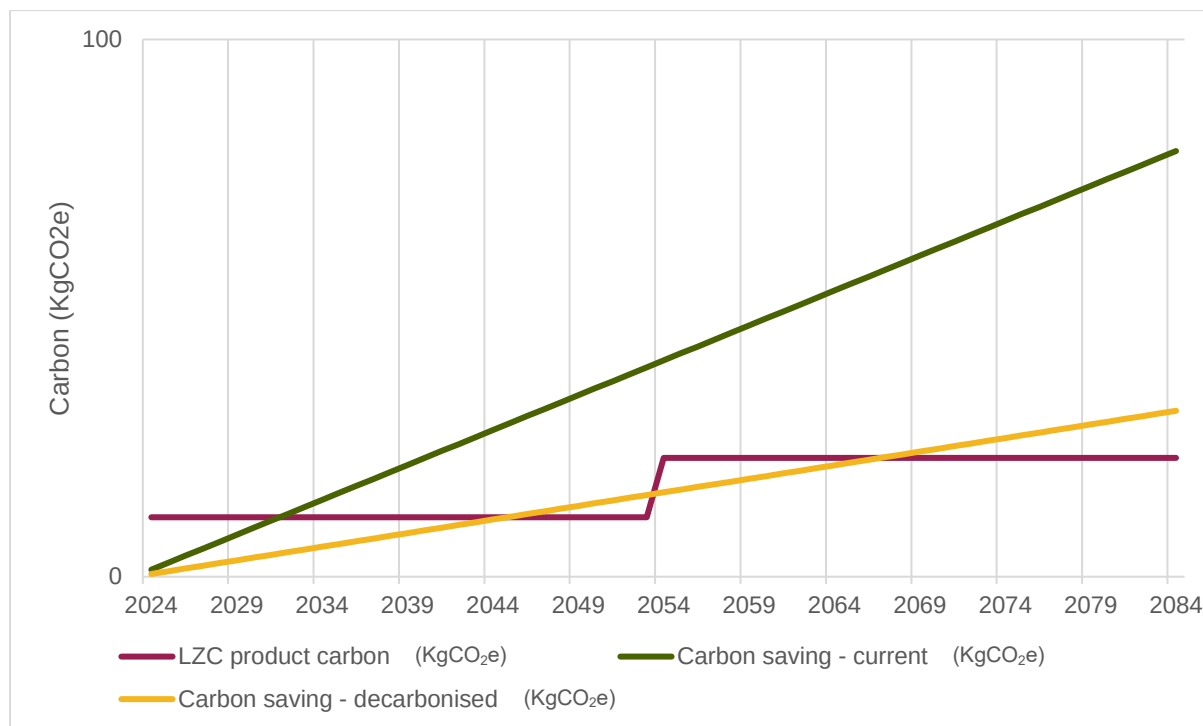


Figure 19- Carbon Payback

5.2. Operation

PV requires no management once they have been installed. The only requirement would be to check the levels of energy production on a clear, fine day to ensure that the expected production is being achieved. This could be carried out routinely by a member of staff to avoid additional management costs.

5.3. Maintenance

PV panels situated beyond 15 degrees tend to be self-cleaned by rain, however heavy, sticky dust such as brake dust or pollution particles may not be fully washed off through this method alone. Therefore, based on the site's location; situated within a high density, urban environment; the arrays will require an annual service to clean each panel. Costs of upkeep will therefore be minimal over the life of the system.

The Figure 20 demonstrates the energy cost payback over time, comparing the initial and ongoing costs of the product with the potential savings from reduced energy consumption very slightly.

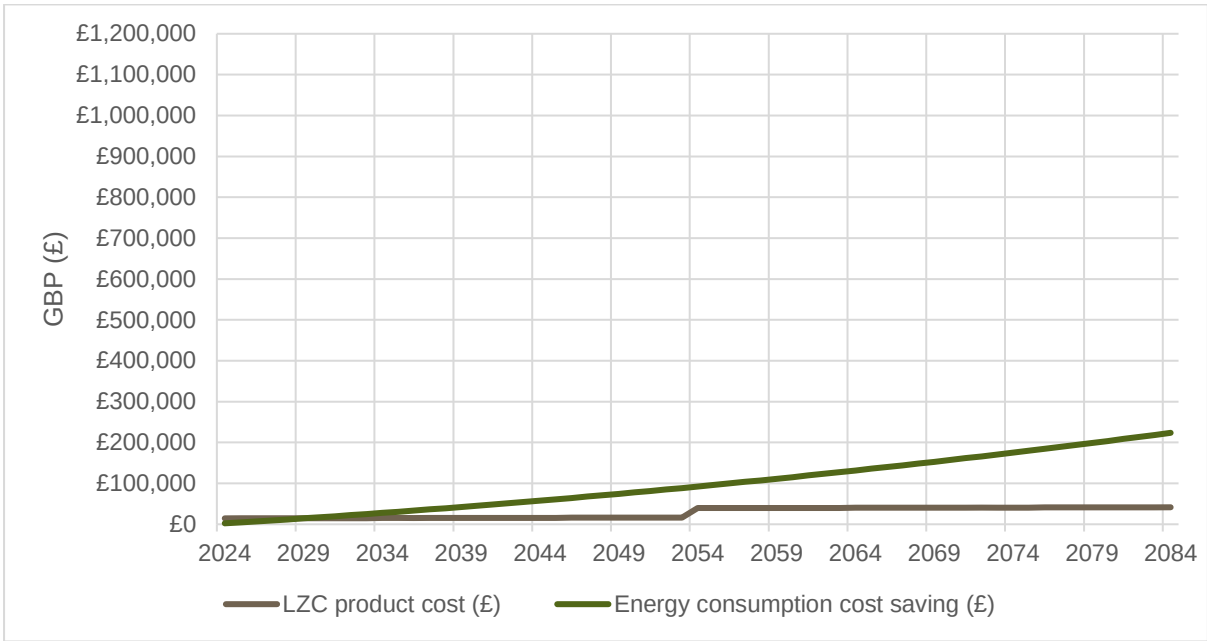
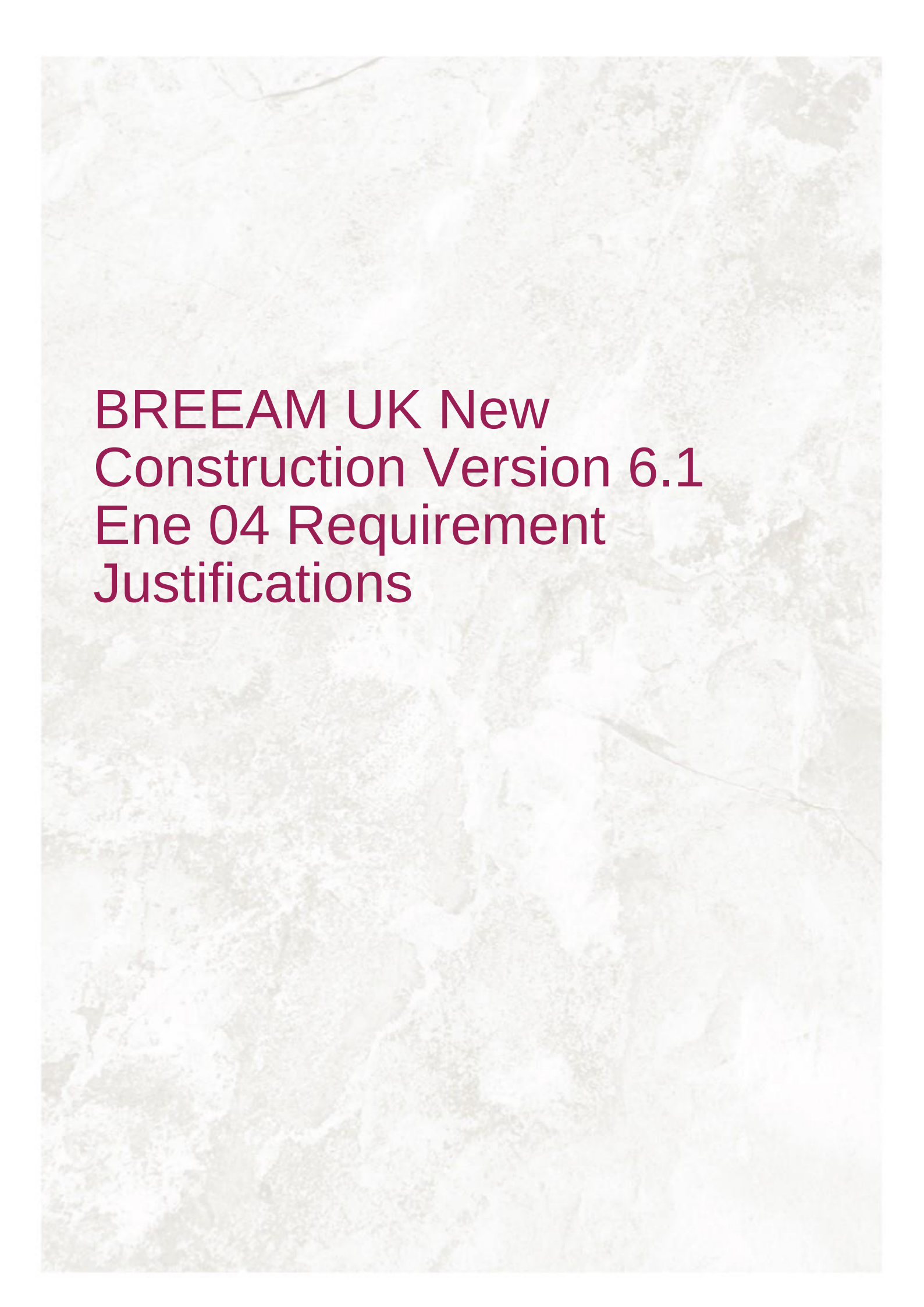


Figure 20 – Energy Cost Payback

The Figure 19 focuses on carbon payback, highlighting the reduction in carbon emissions over time compared to the product's carbon footprint. Both figures provide a long-term outlook, showing cumulative financial and environmental benefits as the product is utilized over several decades.

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BREEAM UK New Construction Version 6.1 Ene 04 Requirement Justifications

6.0 BREEAM UK New Construction Version 6.1 (Ene 04) - Requirement Justifications

This section illustrates compliance with the requirements of BREEAM UK NC V6.1 Passive Design Analysis and LZC Feasibility Study (Ene 04) in relation to this analysis and confirms achievable credits. The feasibility study was conducted during RIBA Stages 1-3 and has been validated by Elsa Withnell, a qualified energy assessor who has been undertaking Passive Design Analysis and LZC Feasibility Study for the last 3 years, Alisha Pinheiro and Honeyksha Waghela.

One Credit – Passive Design Analysis

The report addresses all the criteria required for Passive Design Analysis as per Section CN4 of the BREEAM UK NC V6.1 Ene 04. Refer to Table 17 for the minimum required criteria for the passive design analysis.

Criteria	Referenced Location
Site location	Section 3.1
Site weather	Section 3.2
Microclimate	Section 3.3
Building layout	Section 3.4
Building orientation	Section 3.4
Building form	Section 3.4
Building fabric	Section 3.4
Thermal mass or other fabric thermal storage	Section 3.4
Building occupancy type	Section 3.5
Daylighting strategy	Section 3.6
Ventilation strategy	Section 3.6
Adaptation to climate change	Section 3.7

Table 17 – LZC feasibility study minimum required criteria

A Thermal Comfort Analysis (TM59 and TM52) has been undertaken which will further inform the details of the heating and cooling strategy at the Technical Design stage.

The 'proposed building' design with passive design measures as listed in the above table has a heating, cooling, auxiliary, DHW and lighting demand of 20.41 kWh/m² compared to the 'notional building' of 23.95 kWh/m². Thereby the reduced CO₂e emissions incorporating the passive design measures discussed is 2.93 kgCO₂e / year.

The Proposed Development has addressed a variety of elements relating to its passive design, maximising opportunities to reduce energy demand and CO₂ emissions through the use of passive design measures. These measures are demonstrated in Section 2.2 as 'Lean' improvements over the Baseline. The BREEAM Ene04 credit for Passive Design has therefore been achieved.

One Credit - Low Zero Carbon Technologies Feasibility Study and Implementation

The report addresses all the criteria as per Section CN10 of the BREEAM UK and Fit-out 2014 Ene 04. Refer to Table 18 for an overview.

Criteria	Referenced Location
Energy generated from LZC energy source per year.	Section 4.10
Carbon dioxide savings from LZC energy source per year.	Section 4.10
Life cycle cost of the potential specification, accounting for payback.	Section 5.0
Local planning criteria, including land use and noise.	Section 1.2
Feasibility of exporting heat or electricity or both from the system.	Section 4.1
Identification of any available grants.	Section 1.4
All technologies appropriate to the site and energy demand of the development.	Section 4.0
Reasons for excluding other technologies.	Section 4.0
Where appropriate, connecting the building to an existing low carbon community energy scheme.	Section 4.1

Table 18 – LZC feasibility study minimum required criteria

The study proposes the use of photovoltaics along with energy storage as a local LZC technology that can be implemented on site. Please refer to the SBEM specification sheet in Appendix B for more details on the PV specifications.

In relation to BREEAM International NC Version 6.0 Ene 04 (Low and Zero Carbon Technologies) requirements, 1 no credit can be awarded to the Proposed Development.

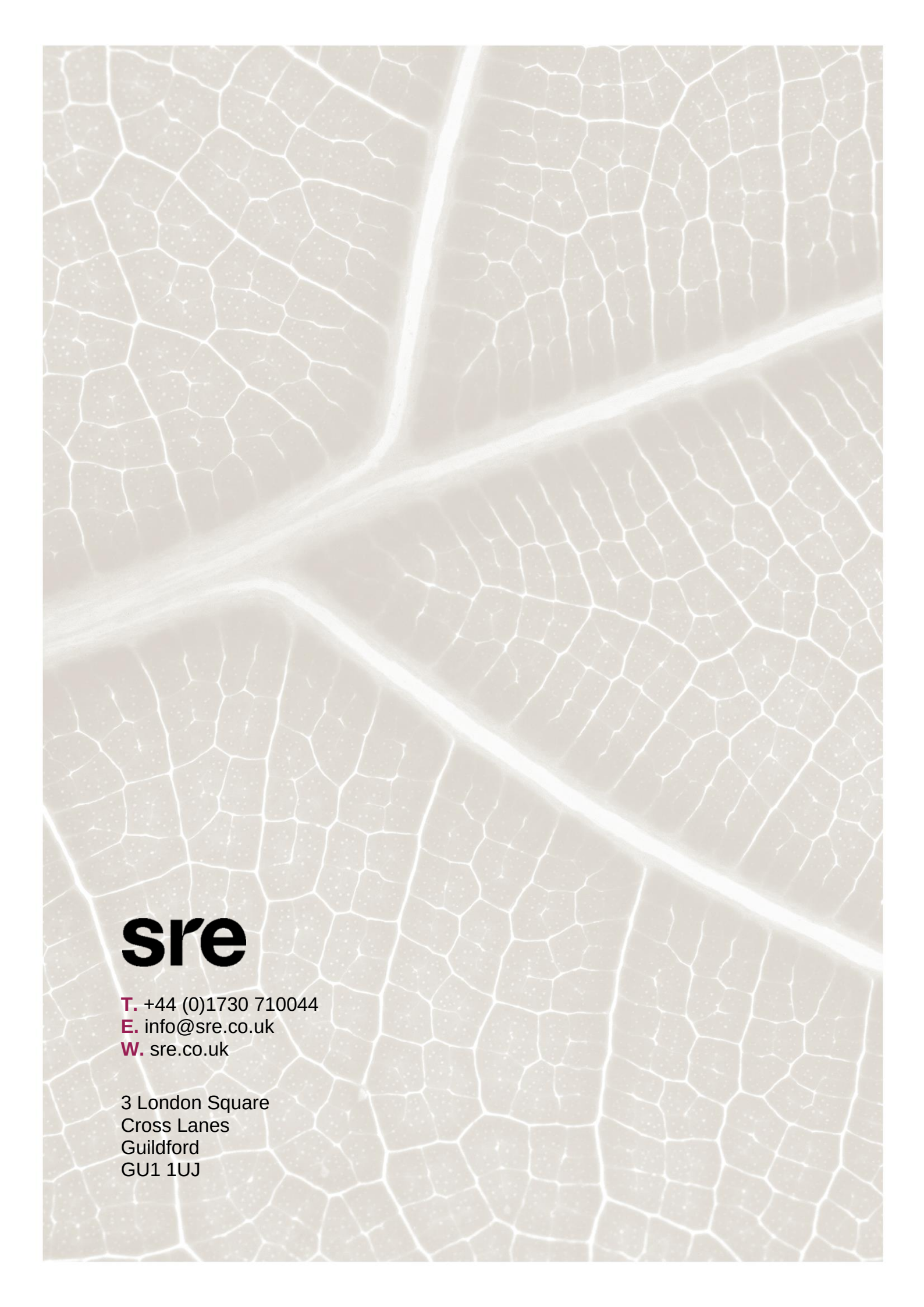
Appendices

Appendix A – Site Plan



Appendix B – SBEM Summary Sheets

Interbridges Site										sre	
Building Regulations 2021 Part L V2											
Building Type	Address			As-Designed/ As-Built Drawings	SBEM Level	Asset Rating (A-G) (0-100)	Green BER	TER	CO ₂ e Emission Rate Improvement (%)		
Misc. B8 Storage or Distribution	Interbridges, New Brighton Road, Emsworth			As Designed (Stage 2)	6	A 9	2.18	3.38	36.71%		
Construction Element	U-Value	Description									
Ground Floor	0.12	500mm Reinforced Concrete Slab, 150mm PIR Insulation (0.030 W/mK), 50mm Screed - Assumed by SRE									
External Walls - Blockwork	0.18	Blockwork (Inner - 100mm & Outer - 102.5mm), 100mm PIR Insulation board (0.022 W/mK) - Assumed by SRE									
External Walls - Cladding	0.18	100mm Composite Panels/ Metal Cladding (0.018 W/mK) - Assumed by SRE									
Pitched Roof	0.12	150mm Composite Panels/ Metal Cladding (0.018 W/mK) - Assumed by SRE									
Internal Partitions	-	Blockwork construction - Assumed by SRE									
Construction Element	U-Value	G Value	Frame Factor	Description (manufacturer, make and model)							
Vehicles access door	1.30	-	-	To be confirmed at Detailed design stage							
Rooflights	1.80	0.4	16%	Assumed to be Kingspan Daylight Trapezoidal Rooflights Clear							
Windows and Glazed doors	1.40	0.4	16%	To be confirmed at Detailed design stage							
Construction Notes	Description (manufacturer, make and model)										
Air-permeability	5 m ³ /(m ² s) at 50 Pa - EPC Conversion										
Heating and Cooling	System Details				Location		Emitter		Controls		
Heating/Cooling system 1	Split VRF System by air source heat pumps (SCOP 3.8, SEER 5.1, EER 5.1 - or equivalent)				Occupied spaces and circulation areas		Wall/Ceiling Cassettes		Local Time and Temperature		
Hot Water	System Details				Secondary Circulation		Circulation Losses (W/m)		Pump Power (kW)		
Domestic Hot Water System 1	Instantaneous electric water heater				-		-		-		
Ventilation	System Details				SFP (W/s)		Leakage tested ductwork CEN Classification		AHU CEN leakage standards class		
Mechanical Ventilation - Extract	Local extract - WCs				0.3		-		-		
Electrical Flow Control	Description										
Power Correction Factor	N	<0.80									
Separate Metering	Y	Separate metering for the heating, cooling, lighting and domestic hot water (TBC)									
Renewables	Description										
PV	44m ² Block A & 8m ² Block B (Pitch - <10 Degrees and Nominal efficiency of 20%)										
Solar Water Heating	N										
Wind Turbine	N										
Lighting	Description										
Lighting	Efficient LED fittings throughout Warehouse area - 150lm/W; Office area - 120 lm/W										
Lighting Controls	PIR Sensors in WC and auto-dimming in Mezzanine										
Parasitic Power	0.1 W/m ² assumed for stand-alone/combined sensors - no information otherwise										
Sign Off of details	Name	Manas Bane	Date	06.12.2024	By signing this document, I declare that the aforementioned details are all correct as per the final "as build" specifications:				Name		
									Sign		



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