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Energy Statement

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Document Revision History			Ref	210771 35-39 Friar Street Development		
Rev	Author	Verification By	Date	Suitability	Comments / Status	
A	TW	GC	11/03/2022	S3	For Planning	
B	TW	AK	19/05/2022	S3	Updated following Overheating Study	

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Energy Statement

1.0 Executive Summary

CPW LLP has undertaken an initial Part L compliance assessment of the proposed Friar Street development. This is to demonstrate through the use of accredited thermal modelling software, how the scheme will incorporate energy efficiency measures and Low and Zero Carbon (LZC) technology solutions to reduce the predicted regulated CO₂ emissions of the development in accordance with Reading Borough Council energy planning conditions.

Initial SAP calculations have been made to demonstrate how the scheme will incorporate energy efficiency measures and Low and Zero Carbon (LZC) technology solutions to reduce the predicted regulated CO₂ emissions of the development by at least 35% (CO₂ reduction on 2013 building regulations) for new build residential developments. The calculations have been performed with SAP2012 methodology in accordance with The Sustainable Design and Construction SPD adopted 2019.

CPW have also conducted initial BRUKL analysis to show the carbon efficiency performance of the commercial spaces in their assumed operation. From this we have also calculated the sitewide cumulative savings on Part L Building Regulations 2013.

The building emission rate is compared to a Target Emission rate below to demonstrate the savings achieved.

	Regulated carbon dioxide savings			
	Target Emission Rate	Building Emission Rate	Reduction (Tonnes CO ₂ per annum)	(%) improvement
Non-Domestic Buildings	38.8	34.7	4.1	11%
Domestic Buildings	167.4	92.4	75	45%
Total Cumulative Savings		127.1	79.1	38.4%

Note 1. CO₂ emission factors of 0.216 for Gas and 0.519 for Electricity have been used to calculate the above and are taken from Building Regulations Approved Documents.

These results demonstrate compliance with the planning requirement of achieving 35% betterment on Part L 2013 for residential developments. The Dwelling Emission Rate has been calculated at a 45% improvement upon the Target Emission Rate from the notional building as per Part L of the Building Regulations. To ensure a zero carbon building as per Reading Borough Sustainable Design and Construction SPD document, a cash in-lieu contribution payment of £166,320 will be required as part of the Section 106 calculation based on £60 per tonne for a period of 30 years.

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2.0 Introduction

CPW has undertaken an Energy Assessment for the proposed Friar Street Development in accordance with the Reading Borough Council planning requirements.

This document complies with the requirements at both national and local level, as set out in the National Planning Policy Framework (2021), The Reading Borough Local Plan (2018), The Reading Borough Council Sustainable Design and Construction SPD (2019).

This Energy assessment shall demonstrate how the scheme will incorporate energy efficiency measures, decentralised energy sources and Low and Zero Carbon (LZC) technology solutions to reduce the predicted regulated CO₂ emissions of the development in accordance Sustainable Design and Construction SPD strategy policy, specifically but not limited to:

- Policy CC2 Sustainable Design and Construction
- Policy CC3 Adaptation to Climate Change
- Policy CC4: Decentralised Energy

It should also be noted that the use of SAP2012 and SAP-10 Carbon Factors have been utilised for energy and carbon assessments.

The new-build mixed-use development has been benchmarked against Building Regulations Parts L1A and L2A of the Building Regulations in terms of baseline regulated energy demand and carbon. As a new-build development the residential element of the building is to be assessed under Part L1A. Similarly, as a non-domestic new-build development the commercial element of the development is to be assessed under Approved Document Part L2A.

In order to deliver an environmentally responsible development, an exemplar approach is being proposed based on low energy design principles. This approach involves energy demand minimisation through effective building form and orientation, good envelope design and proficient use of services before considering the use of off-site CHP-led district heating to decarbonise the energy supply – in line with a commonly used Energy Hierarchy utilised on GLA referable projects; Be Lean, Be Clean, Be Green, Be Seen.

The Energy and Sustainability Targets which were examined within the Energy assessment are the following:

- Compliance with Building regulations Part L 2013
 - Part L1A for Domestic buildings
 - Part L2A for non-Domestic buildings
- Local planning requirement to achieve 35% betterment on Part L 2013 targets for residential developments
- Achieve BREEAM rating of 'EXCELLENT' (applicable only to non-domestic buildings)
- Meet TM52 overheating criteria for all non-residential areas.
- Meet TM59 overheating criteria for all Residential accommodation.

The Energy and thermal modelling has been broken down into the following packages and analysed as follows:

- 3No. Retail units - BRUKL report generated using IES Virtual Environment 2021 software.
- Restaurant space - BRUKL report generated using IES Virtual Environment 2021 software.
- 103 Residential units – Simulated under SAP 2012 and SAP10 methodology

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3.0 Energy Benchmarking

3.1 BREEAM

BREEAM or Building Research Establishment's Environmental Assessment Method is a voluntary scheme that aims to quantify and reduce the environmental burdens of buildings by rewarding those designs that take positive steps to minimise their environmental impacts. Projects are assessed using a system of credits. The credits are grouped within the following categories:

- Management
- Health and Wellbeing
- Energy
- Transport
- Water
- Materials
- Waste
- Land Use and Ecology
- Pollution

The assessment process results in a report covering the issues assessed together with a formal certification giving a rating on a scale of UNCLASSIFIED, PASS, GOOD, VERY GOOD, EXCELLENT and OUTSTANDING.

The diagram and text below describes how BREEAM scores and rates an assessed building:

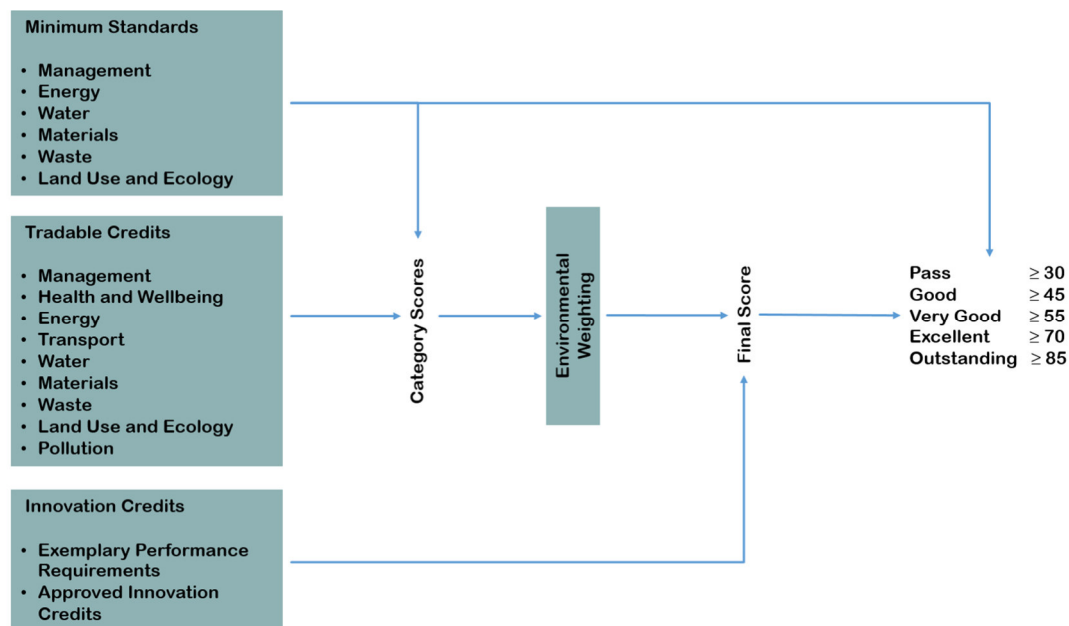


Figure 1 - Process for awarding a BREEAM rating

The BREEAM categories contain a number of environmental issues, which reflect the options available when designing, procuring and constructing a building.

Tradable Credits

Each environmental issue has a set number of 'credits' available and these credits are awarded where the building demonstrates that it complies with the requirements of that issue.

Minimum Standards

A number of issues within a category have set minimum standards, i.e. a minimum number of credits that must be achieved in order for a particular BREEAM rating level to be met.

Innovation Credits

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Innovation credits provide additional recognition for a building that innovates in the field of sustainable performance, above and beyond the level that is currently recognised and rewarded by standard BREEAM issues. Innovation credits are awarded for either complying with pre-defined BREEAM issue exemplary level requirements, or via application to BRE Global to have a particular building feature, system or process recognised as 'innovative'.

Within each of the BREEAM categories outlined above, there are a number of credit requirements that reflect the options available to designers and managers of buildings.

An environmental weighting is applied to the scores achieved under each category, as shown below, in order to calculate the final BREEAM score. The weighting factors have been derived from consensus-based research with various groups such as government, material suppliers and lobbyists. This research was carried out by BRE Global to establish the relative importance of each environmental issue.

The environmental weightings are as follows:

BREEAM Section	Weighting (%)	BREEAM Section	Weighting (%)
Management	12.0	Materials	12.5
Health and Wellbeing	15.0	Waste	7.5
Energy	19.0	Land Use and Ecology	10.0
Transport	8.0	Pollution	10.0
Water	6.0		

Figure 2 - BREEAM 2014 New Construction section weighting

The BREEAM rating bands are as follows:

BREEAM Rating	Score (%)
UNCLASSIFIED	<30
PASS	≥30
GOOD	≥45
VERY GOOD	≥55
EXCELLENT	≥70
OUTSTANDING	≥85

Table 1 - BREEAM rating bands

Although, at this stage, it is very difficult to predict exactly the number of BREEAM credits likely to be achieved by each LZC technology when applied to the current development, it is worth noting that these technologies have an influence over the following:

Ene 1 **Reduction of CO₂ Emissions** – Up to 12 (+5 Innovation) credits are available.

Ene 4 **Low Carbon Design** – One credit is available.

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Pol 2 **NO_x Emissions** – Up to 3 credits are available

BREEAM Pre-Assessment

A pre assessment meeting was held on the 15th of February where the BREEAM requirements were discussed to determine the possible score.

The assessment was produced using BREEAM 2018 Retail and based on a Shell Only basis as this was deemed to most appropriate based on the building to be delivered by the design team, and there are no services being installed in the building.

Incoming services will however be provided but be capped off in the building for future connection and the retail and restaurant MEP services will be installed as part of the tenant fit out.

The initial pre-assessment determined that a target score of 57.8% was achievable but a potential target of 58.6% was considered possible but additional work would need to be undertaken to determine whether these credits can be achieved and targeted.

The three incubator units of 59m², 50m² and 46m² have been excluded, due to the area is too small to assess, and they would need to be assessed separately. This would add additional cost to each unit development and the sustainable benefits would be negligible.

The BRE have stated that scale of the development (area or project budget: BREEAM does not lend itself to developments less than 1,000m² and with project budgets below £1,000,000 or EUR 1.2M as the scope for improvement in projects of this size is limited.

The cost of additional consultants, which may be required for a BREEAM rating alone, can often be disproportionate to the benefit of the development itself.

Despite the exclusion of the retail units, the commercial development area to be assess through BREEAM is still above the margin of 1000m² and therefore falls under a major non-residential development. Major non-residential developments require to meet a BREEAM score of 'Excellent' (70%) according Reading Borough Council Planning Policy adopted in 2019. This score is highly unlikely to be achieved given the restraints of the selected site.

However, the ground floor dining space of the commercial development area to be assess through BREEAM falls below the margin of 1000m² and therefore would fall under a minor non-residential development. Reading Borough Council Planning Policy states all minor non-residential developments or conversions to residential are required to meet the most up-to-date BREEAM 'Very Good' (score required 55%) standard as a minimum.

We believe that the Restaurant unit has the potential to achieve a BREEAM Rating of 'Very Good' and therefore should be considered for approval.

The BREEAM Pre-Assessment Tracker has been included within this report in Appendix C .

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3.2 Estimated Energy Demands and CO₂ Emissions

In order to benchmark the proposed new development, estimated energy demands and CO₂ emissions data have been calculated. These estimated energy consumptions are indicative only at this stage. They will, however, be used as a guideline to assess the percentage of the building's total energy consumption and CO₂ emissions that could be reduced or offset in accordance with the Energy Hierarchy.

In accordance with energy assessment guidance, it is prudent for this report to reflect the benchmark data derived from approved Dynamic Simulation Model (DSM) software which use government and industry agreed National Calculation Methodology (NCM) room templates containing standard operating conditions.

The modelling confirms the predicted notional regulated CO₂ emissions are as follows:

Building Regulations 2013 Part L Compliant Development	Notional Carbon Dioxide Emissions (Tonnes CO ₂ per annum)	
	Regulated	Unregulated*
Restaurant	32.9	61.61
Commercial / Retail units	5.87	60.78
Residential	119.9	-
Total	38.8	122.4

*unregulated load calculated using Part L software

Table 2 – Notional CO₂ Emissions

Note 1. CO₂ emission factors of 0.216 for Gas and 0.519 for Electricity have been used to calculate the above and are taken from Building Regulations Approved Documents.

It is CPWs recommendation that Reading Borough Council Planning Committee assess the proposed development based on updated SAP10 methodology, more commonly used and more inline with the updated Part L Building Regulations to be updated in June 2022. This ensures a more accurate carbon efficiency performance of the proposed development is reflected and the greater calculated carbon reductions can be fully acknowledged.

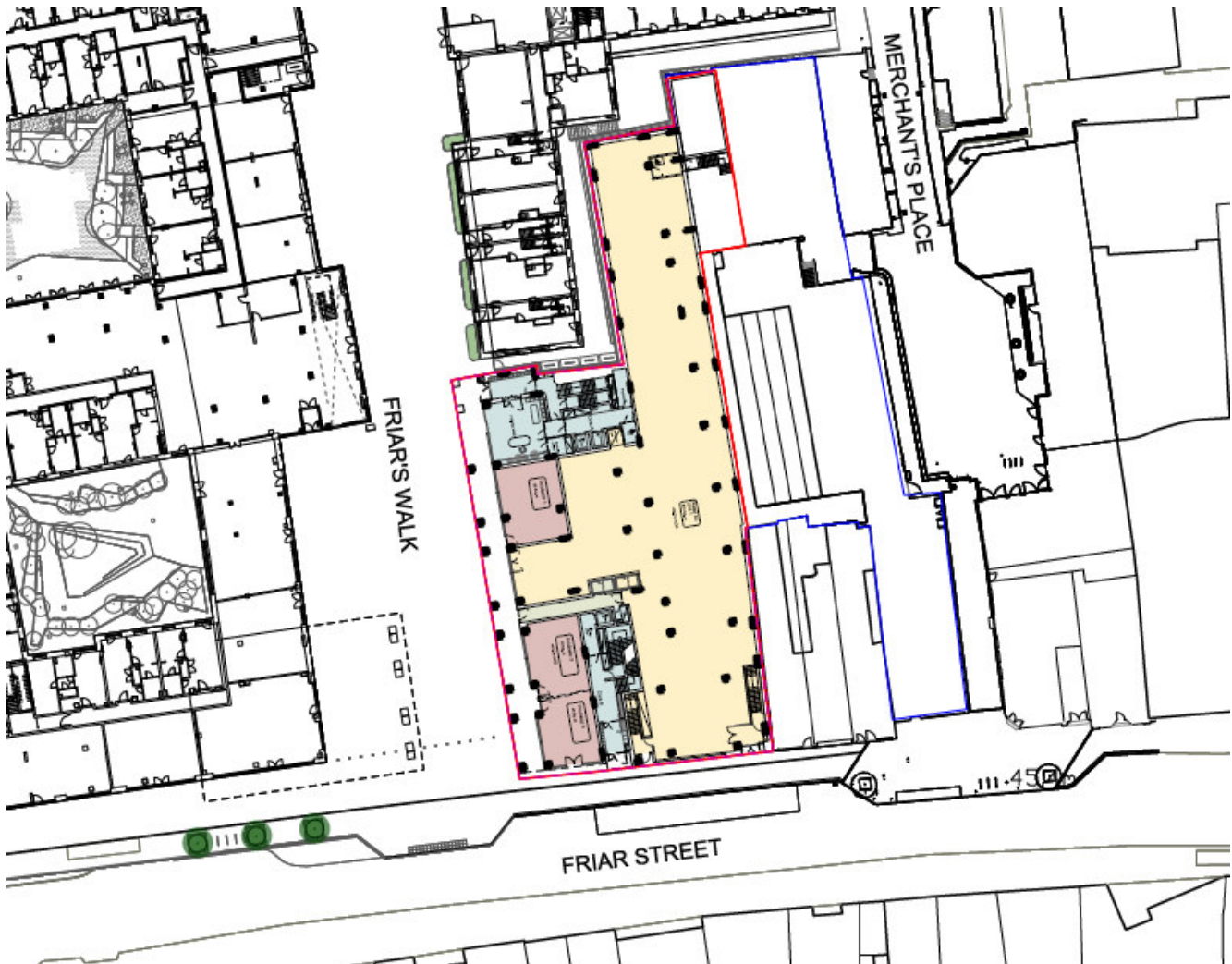
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4.0 Energy Efficiency – Be Lean

In order to deliver an environmentally responsible building, an exemplar approach is being proposed based on low energy design principles. In summary, this approach involves energy demand minimisation through effective building form and orientation, good envelope design and proficient use of services; such that the building itself is being used as the primary environmental modifier.

Long term energy benefits are best realised by reducing the inherent energy demand of the building in the first instance. These benefits are described and quantified in the following sections.

4.1 Site Location



The proposed site is located in the heart of Reading Town Centre, on Friar Street. A number of new developments building are currently being developed in the area. The majority of the surrounding buildings are generally quite low with the maximum height of the neighbouring properties to be around 10-12 storeys.

4.2 Site weather and microclimate

The local weather and any microclimate will influence energy usage. A development on the coast may have a maritime climate, experiencing milder winters and cooler summers than those further inland, particularly on the west coast where they are subject to the jet stream influence. Inland buildings will have a continental climate, suffering more extremes in temperature and therefore more likely to require heating and cooling.

The climate in Reading Town centre is warm and temperate with annual average temperatures of approx. 10.0C. Reading lies 33m above sea level and there is significant rainfall throughout the year. Maximum temperatures can reach up to 22C in July and August, and minimum temperatures are unlikely to drop below 0-1C in the winter months. The buildings in this area generally low rise to one side, but being a city centre with high rise buildings to the North-

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East, the area might suffer from any Urban Heat Island effects, which could generate temperatures of up to 25C in the summer months. The most accurate weather station is in Swindon Brize Norton (approx. 40 miles away), and this will be used for any thermal simulations.

The site's landscape also affects the energy demand of a building. Vegetation, land form and any existing buildings can provide shade to a new development. For example, 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, any tree used for energy conservation should be considered as part of a much larger landscape.

As part of the regeneration and pedestrianisation of Friar's Walk, the landscape strategy aims to see the planting many trees and green spaces around this are, which are expected to have a positive effect on the site's environmental conditions; providing shade, and a cooler environment.

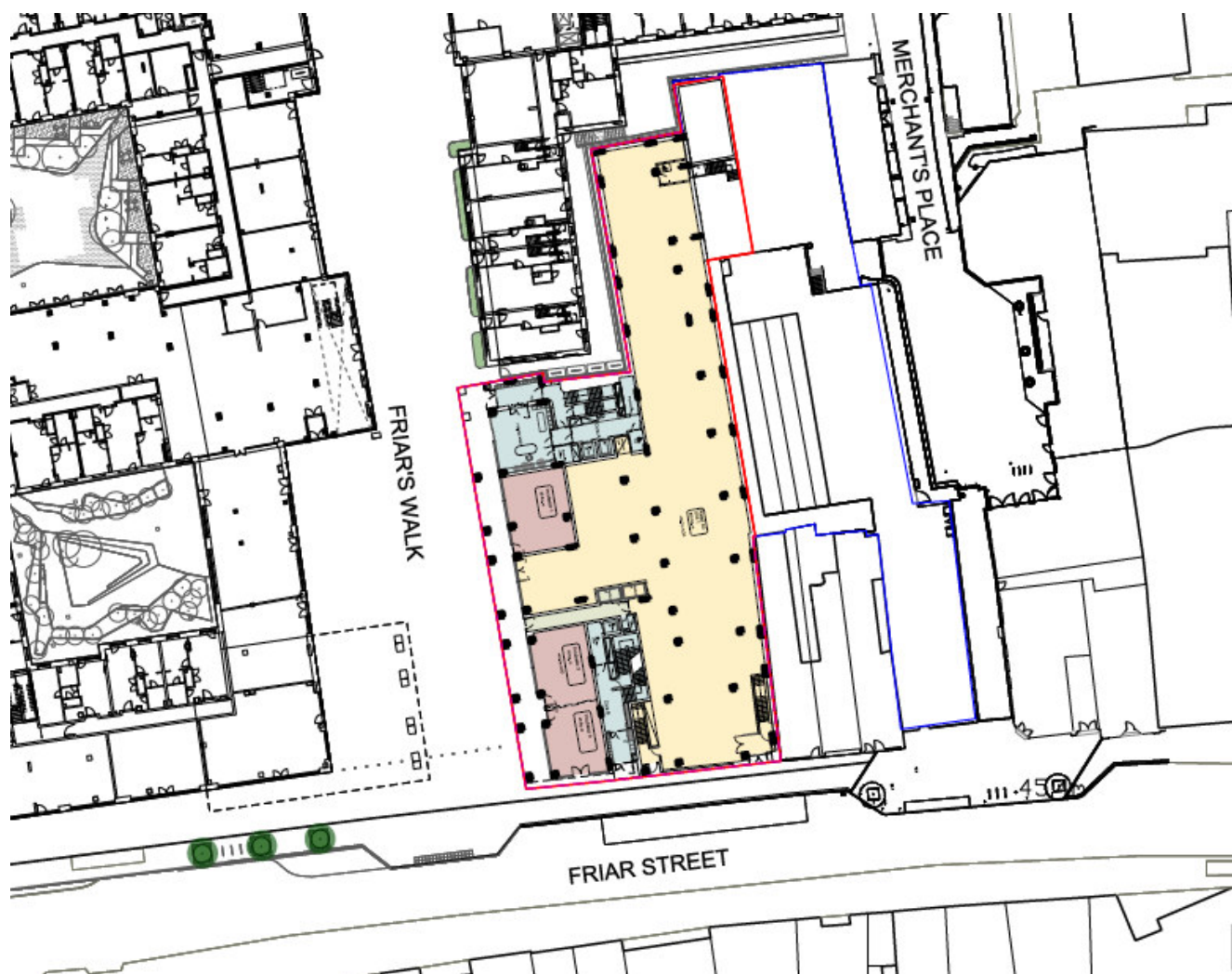
4.3 Building Orientation, Layout and Form

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.

By orientating the building, so that the long sides of the building face north and south, glare arising from the low early morning and evening sun is designed out. 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.

Solar heating or solar gain is often welcome in winter months, helping to heat up the building. However, careful design and attention to building orientation is essential to avoid summertime overheating, as on a clear day in summer an unshaded window in the UK can admit 3kWhr of energy per m² of glass. Overheating is likely to be more of a problem if the windows face the southern half of the sky (east or west facing windows can also be a problem in some types of building), there are horizontal or near-horizontal rooflights, the building has high internal heat gains or the building needs to be kept cooler than normal.

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Planning the internal layout of buildings and rooms to maximise the benefits of solar gain and minimise the disadvantages is essential. The majority of commercial spaces face South to South-West and are for the most part protected from the effects of extreme solar irradiation. All occupied spaces have access to the external envelope and hence access to a form of natural daylight and ventilation.

All retail accommodation is located on the ground floor of the development. The restaurant space is located on ground floor and basement level at the base of the residential accommodation. The tenant shared working space accommodation is located to the north-west section of the building, which should limit the ingress of solar gains to spaces where internal gains could be high, due to the taller buildings neighbouring the development.

The residential accommodation is contained within two cores from Levels 1 to Level 6 for core B, with core A climbing to level 10. Where balconies are provided recessed from the building facade, these provide solar shading to window openings into apartments. This is increasingly important in the case of the South and West facing apartments.

The building form factor is approximately 0.2 which means that we have good floor area to heat loss surface area ratio. This assists the commercial building element in minimising heat losses and improving the likelihood of achieving a good air tightness.

4.4 Building Design – Energy Efficiency

The general construction design standards to be adopted must exceed the requirements of the current (2013 Edition) Part L Building Regulations.

To this end, the proposed design shall promote reduced CO₂ emissions from delivered energy consumption by minimising operational energy demand through passive and best-practice measures. The LZC technology energy options presented herein will potentially provide a further CO₂ reduction over and above the measures included as an integral part of the project design.

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Be Lean – use less energy

Being lean is all about utilising passive, often simple measures to help reduce the energy consumption to a sensible minimum level. For this project we started with the thermal envelope. Using traditional construction methods, we have been able to engineer the building envelope to minimise heat loss in winter and minimise unwanted heat gain in summer. This has been achieved by:-

- Enhanced envelope U-values - to reduce the building's heating requirements;
- Providing a well-sealed envelope to minimise the infiltration of cold winter air - to reduce the building's heating requirement;
- Minimising thermal bridging by careful structural and architectural detailing - to reduce the building's heating requirement;
- Adopting a window design that optimises daylight but controls solar gain and glare – to reduce electric lighting energy consumption;
- Providing exposed thermal mass where possible to provide passive cooling – suppresses summertime overheating to acceptable levels without the need for high energy consuming and expensive to run and maintain mechanical cooling systems.
- Considering the layout and orientation of the building - to minimise summertime overheating and the need for high energy consuming and expensive to run and maintain mechanical cooling systems.

The following diagram illustrates the approach we have adopted:



The application of exposed thermal mass to provide passive cooling is well understood and is an excellent method of suppressing the fluctuations of internal temperature without resorting to mechanical cooling systems, which are both expensive to install, consume significant amounts of energy in summer and have high maintenance costs. In occupied spaces and where possible, this passive cooling will be provided by exposing the concrete floor. The exposed thermal mass will absorb room heat gains during the day allowing the spaces to remain comfortable and compliant with the overheating criteria. Stored heat will be released at night by means of the mixed mode ventilation philosophy. This will regenerate the exposed concrete's ability to absorb heat the following day. The process is described in more detail later in the report.

Ceilings will be finished with a high reflective coating to optimise daylight, especially towards the back corners of the rooms. It will also improve the artificial light uniformity and improve its energy efficiency. The window design has been carefully considered to enable optimum daylight transmission while still affording natural ventilation with or without

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the blinds down. Importantly the structural engineering solution for the building allows the window head height to be maximised so they finish immediately below the soffit. This, together with the generous ceiling height has allowed us to meet and exceed the daylighting criteria.

The development's thermal envelope performance will be better than that required by the Building Regulations to minimise heat loss and therefore minimise the heating energy consumed. This will be achieved by improving the U-Values and by having a very tight thermal envelope to minimise the opportunity for heat to escape. We propose to design the building envelope to deliver an air leakage rate better than 3m³/hr/m² at 50 Pa, considerably better than the Building Regulation minimum of 10m³/hr/m² at 50 Pa.

Fabric First Energy Strategy – Thermal Envelope

Aligned with our Energy Strategy we promote a thermally efficient building fabric specification in order to inherently reduce the energy consumption of the building. This strategy designs out the need for Renewables (LZC) solutions that are disproportionately expensive and ensures the construction budget is put into the building.

The table below shows the proposed building fabric thermal performance for the development:

Element	Criteria U-Value (W/m ² K)	Notes
General Glazing	U = 1.2	Glass to achieve a total light transmission of 0.71 G-Value of 0.4
Wall	U = 0.15	Thermal mass to inner leaf
Roof	U = 0.1	Light weight construction.
Ground/ Basement Floor	U = 0.12	-
Internal Glass Partitions	-	Glass to achieve a total light transmission of 0.69
Ceiling / Soffit	-	To achieve a minimum reflectance of 80%. Painted concrete and false ceilings.
Internal Wall	-	To achieve a minimum reflectance of 60%. Internal partitions and internal surfaces of external walls.
Floor	-	To achieve a minimum reflectance of 25 - 30%
Thermal Bridging Ψ value	0.01 w/mK or better	Thermal bridging elements will be either designed out completely or their specification will be carefully detailed to minimise heat transmission through the envelope.

The table below shows some of the 'Be Lean' active design measures incorporated within the design to demonstrate our approach.

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Item	Description
Heat recovery ventilation	As discussed, all ventilation systems utilise heat recovery ventilation as part of a mixed-mode ventilation strategy that is deployed to maximise energy efficiency.
On-demand control to communal spaces	Areas of the building that are intended to be intermittent use like retail units, and commercial spaces, have local demand controlled ventilation.
Zoned building services	The building energy systems will be zoned to ensure that energy is not lost when a certain area requires heat but another does not.
Automatic monitoring of all energy sub-metering	Out of range alarms shall be triggered when the energy consumption of the building exceeds the typical consumption levels to highlight to the facilities staff that excessive energy use has occurred.
Variable speed pumping	Variable speed pumping on all secondary circuits (see heating schematic) reduces energy consumption associated with distribution significantly.
Lighting Efficiency	LED's have been appraised for their suitability as part of the design development, and have been found to be a cost effective measure to reduce lighting electrical energy use.
On-demand control to communal spaces	The room by room ventilation, heating and lighting controls ensure that energy efficiency is maximised in every space where the amount of air delivered is variable to suit the space.

Solar Shading Strategy

The scheme benefits from the usage of solar performance glazing. The glazing specification is carefully selected to ensure the internal environment is pleasant on all orientations but varying the g-value. In addition, a number of locations contain internal blinds to limit daylight, reducing the effective g-value further still. The proposed G-value for the elevations of the development glazing shall be 0.4.

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5.0 Decentralised Energy – Be Clean

5.1 Existing Heat Networks

Opportunities to connect the planned development to existing or future decentralised heat distribution networks, including those featuring Combined Heat and Power (CHP) plant, have been investigated. Reading Borough Council policy encourages the design and implementation of decentralised heat networks.

Investigations have been carried out into the viability of connection into a local district heating network. It was found from conversations through the pre-app process that, currently, Reading Council have a proposed the implementation of a District Heating System that shall be created specifically to accommodate the central Reading district by supplying all required district heating requirements.

The District Heating Proposal is still at feasibility stage and not currently available for connection. The Friar Street development intends to provide the mechanical and spatial allowance for the proposed system to connect to a future District Heating system. This can be achieved by allowing for future connection to the base of the LTHW riser and space allowance for potential future plant within the basement residential bike store.

6.0 Appraisal of Renewable and Low Carbon Technology Energy Options – Be Green

In accordance with BREEAM requirements, 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.

A summary of the feasibility process is tabulated below and an overview of each viable technology is given subsequently.

Technology	Brief Description	Benefits	Issues/Limitations	Feasible for Site?
Solar Photovoltaic	Solar photovoltaic panels convert solar radiation into electrical energy through semiconductor cells. They are not to be confused with solar panels which use the sun's energy to heat water (or air) for water and space heating.	Low maintenance/no moving parts Easily integrated into building design No ongoing costs Income generated from Feed-in Tariff (FIT)	Any overshadowing reduces panel performance Panels ideally inclined at 30° to the horizontal facing a southerly direction	Yes, but limited to upper roof space
Solar Thermal	Solar thermal energy can be used to contribute towards space heating and hot water requirements. The two most common forms of collector are panel and evacuated tube.	Low maintenance Little/no ongoing costs Income generated from Renewable Heat Incentive (RHI) scheme	Must be sized for the building hot water requirements Panels ideally inclined at 30° to the horizontal facing a southerly direction	No, not suitable on this site. Limited available roof space to make this viable to serve full DHW demand
Ground Source Heat Pump (GSHP)	GSHP systems tap into the earth's considerable energy store to provide both heating and cooling to buildings. A number of installation methods are possible including horizontal trench, vertical boreholes, piled foundations (energy piles) or plates/pipe work submerged in a large body of water. The design, installation and operation of GSHPs is well established.	Minimal maintenance Unobtrusive technology Flexible installation options to meet available site footprint Income generated from Renewable Heat Incentive (RHI) scheme	Large area required for horizontal pipes Full ground survey required to determine geology More beneficial to the development if cooling is required Integration with piled foundations must be done at an early stage	No, not suitable on this site, expensive

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Technology	Brief Description	Benefits	Issues/Limitations	Feasible for Site?
Air Source Heat Pump	Electric or gas driven air source heat pumps extract thermal energy from the surrounding air and transfer it to the working fluid (air or water).	Efficient use of fuel Relatively low capital costs	Specialist maintenance More beneficial to the development if cooling is required Requires defrost cycle in extreme conditions Some additional plant space required	Yes
Wind Turbine (Stand-alone column mounted)	Wind generation equipment operates on the basis of wind turning a propeller, which is used to drive an alternator to generate electricity. Small scale (1kW – 15kW) wind turbines can be pole or roof mounted.	Low maintenance/ongoing costs Minimum wind speed available (www.bwea.com) Excess electricity can be exported to the grid Income generated from Feed-in Tariff (FIT)	Planning issues Aesthetic impact and background noise Space limitations on site Wind survey to be undertaken to verify 'local' viability	No, not suitable on this site
Wind Turbine (Roof Mounted)	As above	Low maintenance/ongoing costs Minimum wind speed available (www.bwea.com) Excess electricity can be exported to the grid Income generated from Feed-in Tariff (FIT)	Planning issues Aesthetic impact and background noise Structural/vibration impact on building to be assessed Proximity of other buildings raises issues with downstream turbulence Wind survey to be undertaken to verify 'local' viability	No, not suitable on this site
Bio-Renewable Energy Sources (Automated feed – wood-fuel boiler plant)	Modern wood-fuel boilers are highly efficient, clean and almost carbon neutral (the tree growing process effectively absorbs the CO ₂ that is emitted during combustion). Automated systems require mechanical fuel handling and a large storage silo.	Stable long term running costs Potential good CO ₂ saving Income generated from Renewable Heat Incentive (RHI) scheme	Large area needed for fuel delivery and storage Reliable fuel supply chain required Regular maintenance required Significant plant space required	No, not suitable on this site
Fuel Cells and Fuel Cell Combined Heat and Power	Fuel cells convert the energy of a controlled chemical reaction, typically involving hydrogen and oxygen, into electricity, heat and water vapour. Fuel cell stacks operate in the temperature range 65°C – 800°C providing co-generation opportunities in the form of Combined Heat and Power (CHP) solutions.	Zero CO ₂ emissions if fired on pure hydrogen and low CO ₂ emissions if fired on other hydrocarbon fuels Virtually silent operation since no moving parts High electrical efficiency Excess electricity can be exported back to the grid Benefits from being part of an energy centre/district heating scheme	Expensive Pure hydrogen fuel supply and distribution infrastructure limited in the UK Sufficient base thermal and electrical demand required Some additional plant space required Reforming process, used to extract hydrogen from alternative fuels, requires energy; lowering overall system efficiency	No, expensive, emerging technology

Table 3- Summary of Renewable and Low Carbon Technology Energy Options

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6.1 Heat Pump Technologies

Electric driven air source heat pumps extract thermal energy from the surrounding air and transfer it to the working fluid (air or water). ASHPs can provide both heating and cooling to buildings and have an associated Coefficient of Performance (COP), this is typically around 3 to 4 for heat pumps driven by compressors powered by electric motors and incorporating Variable Refrigerant Flow (VRF) technology. With VRF technology, there is an opportunity to heat and cool separate spaces and recover the heat between them. Care should be taken when mounting the units to avoid



any acoustic problems associated with operating the fans. The outdoor units normally operate with sound levels typically in the range 55 - 60dB(A). A downside of electric driven air source heat pumps is that they require a defrost cycle in extreme conditions which impacts on the system efficiency. Heating capacity also falls off as the ambient temperature drops below 5°C but still maintains 80% capacity at -5°C.

Units are either roof or ground mounted and coupled to a thermal buffer store with additional back-up electric immersion heaters in the cylinder, to make up any shortfall. Alternative heat pump solutions can be supplied for internal installation within a plant room.

Figure 3 - Air Source Heat Pumps

6.2 Solar Photovoltaic (PV) Panels

Solar photovoltaic panels convert solar radiation into electrical energy through semiconductor cells. They are not to be confused with solar panels which use the sun's energy to heat water (or air) for water and space heating.



Figure 4 - CPW Photovoltaic Installations: Project Epic (BREEAM Excellent Office – above left) and Castle Wood (BREEAM Excellent School – above right)

Photovoltaic panels are available in a number of forms including mono-crystalline, polycrystalline, amorphous silicon (thin film) or hybrid panels (discussed later). They are fixed or integrated into a building's un-shaded south facing façade or pitched roof ideally at an incline of 30° to the horizontal for maximum energy yield.

Energy Statement

It is essential that the panels remain un-shaded, as even a small shadow can significantly reduce output. The individual modules are connected to an inverter to convert their direct current (DC) into alternating current (AC) which is usable in buildings.



Figure 5 - Solar PV Louvres on the South Facade

Although sloping rooftops provide an ideal site for fixing PV panels using traditional mounting frames, there are a number of alternative solutions whereby PV panels can be incorporated into the actual building fabric of the development.

Solar louvres use PV panels to provide solar shading on the south façade of buildings as part of the brise soleil (see above), and this can be a highly effective way of controlling overheating and help reduce glare.

Solar glazing uses a combination of solar PV and glass, where the PV cells are laminated between two panes of specialised glazing (see above). The resulting glass laminate serves the dual function of creating energy and shade at the same time, reducing the risk of overheating.



Figure 6 - CPW Solar Glazing Installation, University of Warwick - Materials and Analytical Sciences Building

Solar glazing can be used wherever conventional glass would be specified, especially in atria. Bespoke designs allow for varying light penetration by changing the spacing between individual cells. Typically, a combination of 50% PV and 50% translucent glazing is used.

Vertical solar facades can be used to directly replace conventional rain screen cladding materials providing a smooth, flat facade surface for the building. Where circumstances allow, the PV panels can be tilted towards the sun to maximize the energy yield.

As mentioned earlier, there are a number of types of PV cell:

Mono-crystalline Silicon Cells: These are made using cells saw-cut from a single cylindrical crystal of silicon. The principle advantage of mono-crystalline cells is their high efficiency, typically around 15 – 20%, although the manufacturing process required to produce mono-crystalline silicon is complicated, resulting in slightly higher costs than other competing technologies.

Polycrystalline Silicon Cells: These are made from cells cut from an ingot of melted and re-crystallised silicon. In the manufacturing process, molten silicon is cast into ingots of polycrystalline silicon. The ingots are then saw-cut into very thin wafers and assembled into complete cells giving a granular textured finish. Polycrystalline cells are cheaper

Energy Statement

to produce than mono-crystalline types, due to the simpler manufacturing process but tend to be slightly less efficient, with average efficiencies of circa 12 – 15%.

Thick-Film Silicon: This is another polycrystalline technology where the silicon is deposited in a continuous process onto a base material giving a fine grained, sparkling appearance. Like all crystalline PV, this is encapsulated in a transparent insulating polymer with a tempered glass cover and usually bound into a strong aluminium frame.

Thin-Film Amorphous Silicon: Amorphous silicon cells are composed of silicon atoms in a thin homogenous layer rather than a crystalline structure. Amorphous silicon absorbs light more effectively than crystalline silicon, so the cells can be thinner. For this reason, amorphous silicon is also known as a 'thin film' PV technology. Amorphous silicon can be deposited on a wide range of substrates, both rigid and flexible, which makes it ideal for curved surfaces and 'fold-away' modules. Amorphous cells are, however, less efficient than crystalline based cells, with typical efficiencies of around 6%, but they are easier and, therefore, cheaper to produce.

Other Thin Films: A number of other promising materials such as cadmium telluride (CdTe) and copper indium diselenide (CIS) are now being used for PV modules. The attraction of these technologies is that they can be manufactured by relatively inexpensive industrial processes, certainly in comparison to crystalline silicon technologies, yet they typically offer higher module efficiencies than amorphous silicon. New technologies based on the photosynthesis process are at early stages of commercialisation.

6.3 Energy production from LZC

6.3.1 Solar Photovoltaic Panels

The use of Photovoltaic Panels has been implemented into the Friar Street development proposal.

The roof space allocation has been estimated to accommodate 34 panels with the following estimated output and carbon savings under both SAP2012 and SAP10 methodology:

SAP2012 Methodology

ENERGY & CARBON

THE ANNUAL PREDICTED ENERGY OUTPUT IS AROUND

11,272 kWh

THE ANNUAL SITE-GENERATED ELECTRICITY SAVES

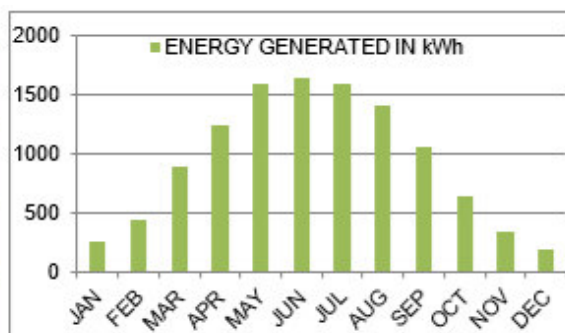
5,850 kg CO₂

THIS SAVING IS EQUAL TO DRIVING AN AVERAGE UK CAR AROUND

34,821 km

OR TAKING A RETURN FLIGHT FROM LONDON TO

HOUSTON
FOR 3 PERSON(S)



SAP10 methodology

ENERGY & CARBON

THE ANNUAL PREDICTED ENERGY OUTPUT IS AROUND

11,272 kWh

THE ANNUAL SITE-GENERATED ELECTRICITY SAVES

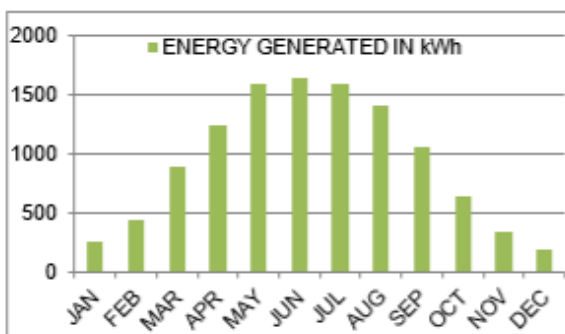
2,626 kg CO₂

THIS SAVING IS EQUAL TO DRIVING AN AVERAGE UK CAR AROUND

15,633 km

OR TAKING A RETURN FLIGHT FROM LONDON TO

HONOLULU
FOR 1 PERSON(S)



Energy Statement

6.3.2 Air Source Heat Pump

CPW's proposal is to provide the residential element of the development with Air Source Heat Pumps (ASHP). The network will run at approximately 55-35 degrees Celsius Flow and Return:

- Communal plant: The communal plants will comprise of a series of air source heat pumps, a 3-port valve arrangement and pipework circulation pumps that work to maintain the system temperature at approximately 55C.
- Space Heating and cooling: A Heat Interface Unit (HIU) will transfer heat from the communal system in order to serve the apartment heating system accordingly. Space heating will be provided via radiators to meet the thermal comfort requirements within each space of the apartments.
- Domestic Hot water: Hot water shall be transferred through the apartment Heat Interface Units from the communal heating system. This will minimise any DHWS network distribution losses.

ASHP's take full advantage of the improving carbon emission factors in the National Grid as they are powered by electricity, this technology has assisted the energy performance of the building and is required to comply with the Planning Policy set out by the Reading Borough Local Plan.

The ASHP's are expected to have a SCOP of 3 and an SEER of 4.

The noise levels associated with an ASHP installation should not be overlooked. Typically, acoustic buffer kits are employed to ensure noise levels don't exceed 65dBA when 1m from the unit.

The thermal buffer is important to allow the ASHP system to continue operating when heating/hot water load demand falls during the course of the day.



Air Source Heat Pump Unit

The following results demonstrate the output of the SAPs and GLA reporting spreadsheet values at the BE GREEN stage:

Energy Statement

Table 8: Regulated CO₂ Savings from Stage 3 – BE GREEN of the Energy Hierarchy for Domestic Buildings

7.0 Cooling and Overheating

7.1 The Cooling Hierarchy

CPW have proposed the current design strategies based on a good practice procedure, by implementing a cooling hierarchy to maximise the passive design measures prior to relying on the addition of comfort cooling and to minimise its use if implement. These have been included in the Friar Street development as follows:

1. Minimising Internal Heat Gains – DHW pipe work will be designed and insulated to minimise heat loss into the building. For residential accommodation, Danish standards DS439 have been used in order to provide a good level of diversification when sizing heating and hot water systems. In Commercial accommodation, kitchens and high heat spaces shall be situated away from areas of high solar gains.
2. Reducing Solar Gains – As stated in the Be Lean section, a low G-Value has been targeted in order to minimise solar gains. Solar shading will also be considered on the southern façade to combat overheating in certain rooms.
3. Thermal Mass – Thermal mass is being incorporated through the floor slabs and roof, which will comprise concrete planks. Suspended ceilings are likely to be required for acoustic reasons, however further investigation will be undertaken as to the design of these and the floor finishes to try to utilise and expose the thermal mass of the concrete floors wherever possible, so as to help regulate the internal temperature.
4. Passive Ventilation – Where natural ventilation is not applicable due to air quality and acoustic restrictions, mechanical ventilation will be carefully specified, to reduce energy demand to a minimum.
5. Mechanical Ventilation – Supply and extract systems will be specified with heat recovery and heater batteries to minimise energy use of the system.

Energy Statement

7.2 Overheating Analysis

A detailed analysis has been undertaken to determine whether or not rooms will overheat during the summer. The areas have been thermally modelled to comply with CIBSE TM52 (for non-residential spaces) and CIBSE TM59 (for residential accommodation) Overheating Criteria using CIBSE certified Level 5 approved Dynamic Simulation Modelling software.

The software conducts a Dynamic Thermal analysis of the space based upon a weather file derived from CIBSE calculations (Summer Design Year). The weather data files used by the modelling software are provided based on recorded data for the nearest geographical location, these provide details on temperature, solar irradiation, wind speed, wind direction etc. The data has been interpreted by the issuing authority such that it gives the anticipated maximum loads for a current design summer year. The results confirm the thermal comfort within a particular room throughout the summer months.

The TM52 Adaptive Comfort analysis tool within IES is capable of assessing overheating of buildings based on the criteria defined by BS EN15251 and BREEAM requirements.

Commercial accommodation: All commercial accommodation is proposed to be fully comfort cooled and hence is considered to be in compliance with all TM52 overheating limitations. This includes the following areas:

- Retail units
- Restaurant space

Residential accommodation

The residential spaces have been tested under TM59 for overheating compliance and the following critical assumptions have been made at this point in order to achieve the targets :

- The overheating strategy relies on mechanical ventilation within each room
- Windows are non-openable for mitigation of overheating
- Internal doors within apartments require to be opened at times to achieve overheating compliance.

The below weather files have been tested from the London Gatwick weather station data:

Weather File: Swindon_Brize_Norton _DYS1_2020 (50th Percentile Range)

As a result of the acoustic consultant's report it has been determined that there are high levels of noise pollution being generated towards the Southern side of the site. The effect of this means that a number of apartments predominantly located towards the South elevations, are unable to rely on opening windows to deal with the effects of overheating. This is due to the duration of window opening required throughout the year, and the levels of noise experienced within the apartments.

Further detailed assessments by the acoustician will confirm the precise extent of this within the Environmental Noise Survey and Acoustic Design Statement.

Additionally, the Air Quality consultant has advised that due to NO₂ levels being close to the limit on the southern façade the opening of windows is not advised for dwellings that are south facing.

Therefore, the TM59 overheating analysis has been conducted without the ability to open windows to mitigate overheating and shall rely solely on the passive design measures of the building and the mechanical ventilation to be provided to each dwelling.

Energy Statement

Initial TM 59 Results displayed below:

Homes that are predominantly mechanically ventilated because they have either no opportunity or extremely limited opportunities for opening windows/lowers should be assessed for overheating using the fixed temperature method based on CIBSE Guide A (2015a).

Criteria for homes 'predominantly mechanically ventilated'

For homes with restricted window openings, the CIBSE fixed temperature test must be followed, i.e. all occupied rooms should not exceed an operative temperature of 26°C for more than 3% of annual occupied annual hours.

Criteria For Spaces Predominantly 'Mechanically Ventilated'

Room Name	Annual Occupied Hours	No. of Hours over 26°C p.a	% of hours over 26°C p.a	CIBSE criteria met?	Room Name	Annual Occupied Hours	No. of Hours over 26°C p.a	% of hours over 26°C p.a	CIBSE criteria met?
SECOND FLOOR BEDROOM					SECOND FLOOR LIVING/KITCHEN				
L02 : DOUBLE BEDROOM 1 APT 08	8760	443.00	5.06	FAIL	L02 : LIVING KITCHEN APT 08	4745	301.00	6.34	FAIL
L02 : DOUBLE BEDROOM 2 APT 07	8760	1130.00	12.90	FAIL	L02 : LIVING KITCHEN APT 07	4745	939.00	19.79	FAIL
L02 : DOUBLE BEDROOM 1 APT 07	8760	1067.00	12.18	FAIL					
L02 : DOUBLE BEDROOM 2 APT 06	8760	1036.00	11.83	FAIL	L02 : LIVING KITCHEN APT 06	4745	813.00	17.13	FAIL
L02 : DOUBLE BEDROOM 1 APT 06	8760	872.00	9.95	FAIL					
L02 : DOUBLE BEDROOM 2 APT 05	8760	1167.00	13.32	FAIL	L02 : LIVING KITCHEN APT 05	4745	906.00	19.09	FAIL
L02 : DOUBLE BEDROOM 1 APT 05	8760	881.00	10.06	FAIL					
L02 : DOUBLE BEDROOM 1 APT 04	8760	1241.00	14.17	FAIL	L02 : LIVING KITCHEN APT 04	4745	1245.00	26.24	FAIL
L02 : DOUBLE BEDROOM 2 APT 04	8760	1446.00	16.51	FAIL					
L02 : DOUBLE BEDROOM 1 APT 03	8760	1201.00	13.71	FAIL	L02 : LIVING KITCHEN APT 03	4745	903.00	19.03	FAIL
L02 : DOUBLE BEDROOM 2 APT 02	8760	1054.00	12.03	FAIL	L02 : LIVING KITCHEN APT 02	4745	769.00	16.21	FAIL
L02 : SINGLE BEDROOM 2 APT 01	8760	707.00	8.07	FAIL	L02 : LIVING KITCHEN APT 01	4745	648.00	13.66	FAIL
L02 : DOUBLE BEDROOM 1 APT 01	8760	720.00	8.22	FAIL					

Room Name	Annual Occupied Hours	No. of Hours over 26°C p.a	% of hours over 26°C p.a	CIBSE criteria met?	Room Name	Annual Occupied Hours	No. of Hours over 26°C p.a	% of hours over 26°C p.a	CIBSE criteria met?
SIXTH FLOOR BEDROOM					SIXTH FLOOR LIVING/KITCHEN				
L06 : DOUBLE BEDROOM 1 APT 07	8760	851.00	9.71	FAIL	L06 : LIVING KITCHEN APT 07	4745	638.00	13.45	FAIL
L06 : DOUBLE BEDROOM 2 APT 07	8760	726.00	8.29	FAIL					
L06 : SINGLE BEDROOM 3 APT 07	8760	595.00	6.79	FAIL					
L06 : DOUBLE BEDROOM 2 APT 06	8760	1120.00	12.79	FAIL	L06 : LIVING KITCHEN APT 06	4745	933.00	19.66	FAIL
L06 : DOUBLE BEDROOM 1 APT 06	8760	1019.00	11.63	FAIL					
L06 : DOUBLE BEDROOM 2 APT 05	8760	1032.00	11.78	FAIL	L06 : LIVING KITCHEN APT 05	4745	806.00	16.99	FAIL
L06 : DOUBLE BEDROOM 1 APT 05	8760	855.00	9.76	FAIL					
L06 : DOUBLE BEDROOM 2 APT 04	8760	1176.00	13.42	FAIL	L06 : LIVING KITCHEN APT 04	4745	911.00	19.20	FAIL
L06 : DOUBLE BEDROOM 1 APT 04	8760	862.00	9.84	FAIL					
L06 : DOUBLE BEDROOM 2 APT 03	8760	1692.00	19.32	FAIL	L06 : LIVING KITCHEN APT 03	4745	1435.00	30.24	FAIL
L06 : DOUBLE BEDROOM 1 APT 03	8760	1289.00	14.71	FAIL					
L06 : DOUBLE BEDROOM 1 APT 02	8760	1307.00	14.92	FAIL	L06 : LIVING KITCHEN APT 02	4745	1122.00	23.65	FAIL
L06 : DOUBLE BEDROOM 1 APT 01	8760	1200.00	13.70	FAIL	L06 : LIVING KITCHEN APT 01	4745	1145.00	24.13	FAIL

Room Name	Annual Occupied Hours	No. of Hours over 26°C p.a	% of hours over 26°C p.a	CIBSE criteria met?	Room Name	Annual Occupied Hours	No. of Hours over 26°C p.a	% of hours over 26°C p.a	CIBSE criteria met?
NINTH FLOOR BEDROOM					NINTH FLOOR LIVING/KITCHEN				
L09 : DOUBLE BEDROOM 2 APT 04	8760	1439.00	16.43	FAIL	L09 : LIVING KITCHEN APT 04	4745	1216.00	25.63	FAIL
L09 : DOUBLE BEDROOM 1 APT 04	8760	1184.00	13.52	FAIL					
L09 : DOUBLE BEDROOM 1 APT 03	8760	1265.00	14.44	FAIL	L09 : LIVING KITCHEN APT 03	4745	1593.00	33.57	FAIL
L09 : DOUBLE BEDROOM 2 APT 03	8760	1671.00	21.36	FAIL					
L09 : SINGLE BEDROOM 3 APT 03	8760	2433.00	27.77	FAIL					
L09 : SINGLE BEDROOM 2 APT 02	8760	1370.00	15.64	FAIL	L09 : LIVING KITCHEN APT 02	4745	1295.00	27.29	FAIL
L09 : DOUBLE BEDROOM 1 APT 02	8760	1271.00	14.51	FAIL					
L09 : SINGLE BEDROOM 3 APT 01	8760	1559.00	17.80	FAIL	L09 : LIVING KITCHEN APT 01	4745	1270.00	26.77	FAIL
L09 : DOUBLE BEDROOM 2 APT 01	8760	1291.00	14.74	FAIL					
L09 : DOUBLE BEDROOM 1 APT 01	8760	1450.00	16.55	FAIL					

As detailed in the Daylighting consultants Report, 65% of the 124 rooms assessed at first to fourth floor satisfy BRE daylighting requirements. Therefore, with the above results indicating apartments failing the overheating criteria set out in CIBSE TM59, and the reduction of glazing level maximised whilst limiting the shortfall on internal daylighting levels it has been determined that in this instance, the units shall be provided with active cooling systems to achieve overheating compliance.

For purposes of BREEAM dwellings were also assessed against **Weather File: Swindon_Brize_Norton_DYS1_2050 (50th Percentile Range)** to assess the buildings performance in reaction to the affects of global warming. As with the 2020 year weather file, all spaces identified as high risk spaces failed to meet the criteria set out in CIBSE TM59.

Energy Statement

Overheating Study

An Overheating Study has been completed to mitigate the risk of overheating within the dwellings via passive measures. The implementation of passive measures to minimise solar gains to the spaces and provide passive ventilation are energy efficient methods to mitigate the risk of overheating with little to no reliability on additional energy consumption.

The Overheating Study investigated 5 worse case apartments from various levels of the building, from the apartments assessed in the initial overheating assessment. The progressive passive measure options investigated are as follows;

- Option 1 – Solid Panels
- Option 2 – Brise Soleil
- Option 3 – Solid Panels + Brise Soleil
- Option 4 – Acoustic Ventilation + Brise Soleil + Triple Glazed
- Option 5 – Acoustic Ventilation Panels + Triple Glazed + Mesh Screens



Acoustic Ventilation



Panels Solid Panels



Brise Soleil

The results of the Overheating Study can be found in Appendix D of this report.

Energy Statement

Considering the results of the Overheating Study, Option 5 has been incorporated and shall be progressed with into the next stage of design. The Residential development's overheating strategy shall incorporate the following:

- South facing Apartments directly adjacent to Friar Street between levels 1 and 5 shall incorporate Acoustic Ventilation Panels within the glazing fitting and a triple glazed window build-up.
- South facing Apartments directly adjacent to Friar Street on level 6 shall incorporate Acoustic Ventilation Panels within the glazing fitting and a triple glazed window build-up and Mesh screens.
- South facing Apartments directly adjacent to Friar Street between levels 7 and 10 shall incorporate Mesh Screens, a triple glazed window build-up, and openable windows.

The Overheating Assessment results for Option 5 are shown below:

OPTION-5 WITH ACOUSTIC VENTILATION PANELS AND BRISE SOLEIL + TRIPLE GLAZING + MESH

LEVEL	APT	Room Name	Annual Occupied Hours	No. of Hours over 26°C p.a	% of hours over 26°C p.a	CIBSE criteria met?
LEVEL 02	APT 03	L02:APT03_1B2P_DOUBLE BEDROOM01	8760	59	0.67	PASS
		L02:APT03_1B2P_LIVING/KITCHEN	4745	63	1.33	PASS
	APT 04	L02:APT04_2B4P_DOUBLE BEDROOM01	8760	170	1.94	PASS
		L02:APT04_2B4P_DOUBLE BEDROOM02	8760	68	0.78	PASS
		L02:APT04_2B4P_LIVING/KITCHEN	4745	103	2.17	PASS

LEVEL	APT	Room Name	Annual Occupied Hours	No. of Hours over 26°C p.a	% of hours over 26°C p.a	CIBSE criteria met?
LEVEL 06	APT 02	L06:APT02_1B2P_DOUBLE BEDROOM01	8760	298	3.40	FAIL
		L06:APT02_1B2P_LIVING/KITCHEN	4745	364	7.67	FAIL
	APT 03	L06:APT03_2B4P_DOUBLE BEDROOM01	8760	398	4.54	FAIL
		L06:APT03_2B4P_DOUBLE BEDROOM02	8760	124	1.42	PASS
		L06:APT03_2B4P_LIVING/KITCHEN	4745	217	4.57	FAIL

Criteria For Spaces Predominantly 'Naturally Ventilated'									
LEVEL	APT	Room Name	Criteria 1	Criteria 2		TM59 Criteria met ?	Room Name	Criteria 1	TM59 Criteria met ?
LEVEL 09	APT 03	BEDROOM (DOUBLE OCCUPANCY)		No. of Hours	% of Hours		LIVING ROOM AND KITCHEN		
		L09 : DOUBLE BEDROOM 1 APT 03	0.4	7.00	0.21	PASS	L09:APT03_3B5P_LIVING/KITCHEN	0.7	PASS
		L09 : DOUBLE BEDROOM 2 APT 03	0.5	1.00	0.03	PASS			
		L09 : SINGLE BEDROOM 3 APT 03	0.9	1.00	0.03	PASS			

The implementation of this overheating strategy shall result in the vast majority of dwellings passing the overheating criteria set out in CIBSE TM59 guidance. Those dwellings that do not pass experience shall experience a maximum simulated value of 364 of the total annual 4745 occupied hours over 26 degrees, approximately 7.7% of the time. Annual occupied hours assessed are detailed in TM59 guidance. Further enhancement of the passive measures would be detrimental to the daylighting levels which already do not meet BRE guidance.

Energy Statement

8.0 Carbon Emission Analysis Results

CPW LLP has undertaken an initial Part L compliance assessment of the proposed Friar Street development. This is to demonstrate through the use of accredited thermal modelling software, how the scheme will incorporate energy efficiency measures and Low and Zero Carbon (LZC) technology solutions to reduce the predicted regulated CO₂ emissions of the development in accordance with Reading Borough Council energy planning conditions.

Residential

Initial SAP calculations have been made to demonstrate how the scheme will incorporate energy efficiency measures and Low and Zero Carbon (LZC) technology solutions to reduce the predicted regulated CO₂ emissions of the development by at least 35% (CO₂ reduction on 2013 building regulations) for new build residential developments. The calculations have been performed with SAP2012 methodology in accordance with The Sustainable Design and Construction SPD adopted 2019.

SAP 2012 methodology:

	Total Regulated Emissions (Tonnes CO₂/year)	CO₂ Savings (Tonnes CO₂/year)	Percentage Savings (%)
Target Emission Rating	167.4	-	-
Dwelling Emission Rate	92.4	75	45
	Total Fabric Energy Efficiency (kWh/m²)	Energy Savings (kWh/m²)	Percentage Savings (%)
Target Fabric Energy Efficiency	47.91	-	-
Dwelling Fabric Energy Efficiency	28.09	19.82	41

These results demonstrate compliance with the planning requirement of achieving 35% betterment on Part L 2013 for residential developments. The Dwelling Emission Rate has been calculated at a 45% improvement upon the Target Emission Rate from the notional building as per Part L of the Building Regulations. To ensure a zero carbon building as per Reading Borough Sustainable Design and Construction SPD document, a cash in-lieu contribution payment of £166,320 will be required as part of the Section 106 calculation based on £60 per tonne for a period of 30 years.

SAP2012 methodology is very dated with updated SAP10 methodology more commonly used and more inline with the updated Part L Building Regulations to be updated in June 2022. When assessed against SAP10 methodology the proposed development has the following calculated CO₂ emission savings:

Energy Statement

SAP10 methodology:

	Regulated domestic carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Be lean: Savings from energy demand reduction	19.1	18%
Be clean: Savings from heat network	0.0	0%
Be green: Savings from renewable energy	50.0	47%
Cumulative on site savings	69.1	65%
Annual savings from off-set payment	37.4	-
	(Tonnes CO₂)	
Cumulative savings for off-set payment	1,122	-
Cash in-lieu contribution (£)	106,629	

The use of SAP10 methodology clearly shows the benefit of opting for an electrically driven heat generation plant such as Air Source Heat Pumps due to the more accurate Carbon Factors associated with the guidance.

We have shown the SAP10 methodology broken down into Be Lean, Be Clean and Be Green iterations as common with projects referable to the London Plan to indicate how the passive design measures of the building (Be Lean stage) are efficient in providing Carbon saving for the development against Part L of the Building Regulations at 18% savings.

SAP10 methodology calculates the Dwelling Emission Rate achieves a total 65% improvement upon the Target Emission Rate from the notional building as per Part L of the Building Regulations. Significantly above the 35% requirement set out by the Reading Borough Council Planning requirements.

Energy Statement

CPW have also conducted initial BRUKL analysis to show the carbon efficiency performance of the commercial spaces in their assumed operation. The BRUKLs show that the commercial spaces had the following improvements on Part L regulations, detailed in the table below. From this we have also calculated the sitewide cumulative savings on Part L Building Regulations 2013.

The building emission rate is compared to a Target Emission rate below to demonstrate the savings achieved.

	Regulated carbon dioxide savings			
	Target Emission Rate	Building Emission Rate	Reduction (Tonnes CO ₂ per annum)	(%) improvement
Non-Domestic Buildings	38.8	34.7	4.1	11%
Domestic Buildings	167.4	92.4	75	45%
Total Cumulative Savings		127.1	79.1	38.4%

Note 1. CO₂ emission factors of 0.216 for Gas and 0.519 for Electricity have been used to calculate the above and are taken from Building

These results demonstrate borderline compliance with the planning requirement of achieving 35% betterment on Part L 2013 for residential developments. This narrow margin of compliance is due to outdated electricity carbon efficiency factors embedded within SAP2012 methodology.

It is CPWs recommendation that Reading Borough Council Planning Committee assess the proposed development based on updated SAP10 methodology, more commonly used and more inline with the updated Part L Building Regulations to be updated in June 2022. This ensures a more accurate carbon efficiency performance of the proposed development is reflected and the greater calculated carbon reductions can be fully acknowledged.

Energy Statement

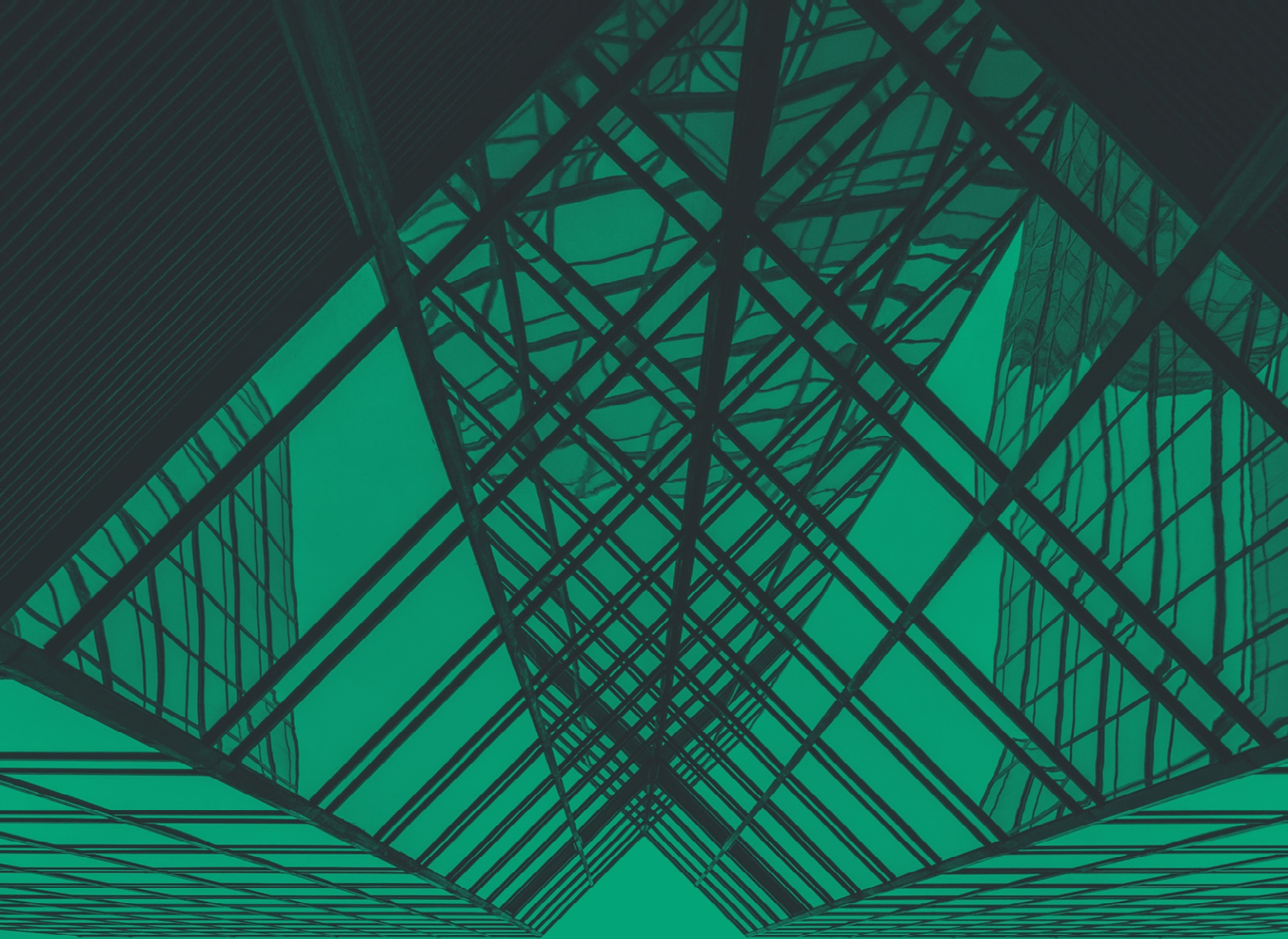
9.0 Appendices

9.1 Appendix A - BRUKL Documents

9.2 Appendix B – Sample SAP data sheets

9.3 Appendix C – BREEAM Pre-Assessment Tracker

9.4 Appendix D – Overheating Study



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Project name

FRIAR STREET RETAIL SPACE 1

As designed

Date: Thu Mar 10 14:22:06 2022

Administrative information

Building Details

Address: 35 FRIAR STREET, READING, RG1 1DX

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: CPW

Telephone number: 0121 709 6600

Address: INTERFACE 100, ARLESTON WAY, SOLIHULL,
SOLIHULL, B90 4LHCriterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	38.8
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	38.8
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	30
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.15	0.15	DJ00000F:Surf[2]
Floor	0.25	-	-	UNKNOWN
Roof	0.25	-	-	UNKNOWN
Windows***, roof windows, and rooflights	2.2	1.2	1.2	DJ00000F:Surf[0]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	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)]				
* There might be more than one surface where the maximum U-value occurs. ** 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. N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	3

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	>0.95

1- Retail | ASHP feeding Cassette unit AHU (HR85)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	4.5	0	0	0.85
Standard value	2.5*	2.6	N/A	N/A	0.65
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

1- Retail | Domestic hot water

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I	Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1		
L00 : INCUBATOR 1	-	-	-	1.9	-	-	-	-	-	-	N/A

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
Standard value	Luminaire	Lamp	Display lamp	
L00 : INCUBATOR 1	-	100	22	558

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
L00 : INCUBATOR 1	NO (-7.9%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of 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
Area [m ²]	50.6	50.6
External area [m ²]	36.1	36.1
Weather	SWI	SWI
Infiltration [m ³ /hm ² @ 50Pa]	3	5
Average conductance [W/K]	32.52	23.92
Average U-value [W/m ² K]	0.9	0.66
Alpha value* [%]	10	10

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

Building Use

% Area	Building Type
100	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 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	1.42	0.47
Cooling	11.42	11.93
Auxiliary	8.92	3.06
Lighting	35.74	60.08
Hot water	1.79	1.86
Equipment*	20.26	20.26
TOTAL **	59.28	77.41

* 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

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	151.78	167.11
Primary energy* [kWh/m ²]	177.44	228.17
Total emissions [kg/m ²]	30	38.8

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

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 SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	20.4	131.4	1.4	11.4	8.9	4	3.2	4	4.5
	Notional	4.3	162.8	0.5	11.9	3.1	2.56	3.79	----	----

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

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.15	DJ00000F:Surf[2]
Floor	0.2	-	UNKNOWN
Roof	0.15	-	UNKNOWN
Windows, roof windows, and rooflights	1.5	1.2	DJ00000F:Surf[0]
Personnel doors	1.5	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building
U _{i-Typ} = Typical individual element U-values [W/(m²K)]		U _{i-Min} = Minimum individual element U-values [W/(m²K)]	
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3

Project name

FRIAR STREET RETAIL SPACE 2

As designed

Date: Thu Mar 10 14:16:41 2022

Administrative information

Building Details

Address: 35 FRIAR STREET, READING, RG1 1DX

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: CPW

Telephone number: 0121 709 6600

Address: INTERFACE 100, ARLESTON WAY, SOLIHULL,
SOLIHULL, B90 4LHCriterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	36.1
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	36.1
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	27.2
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.15	0.15	DJ000011:Surf[2]
Floor	0.25	-	-	UNKNOWN
Roof	0.25	-	-	UNKNOWN
Windows***, roof windows, and rooflights	2.2	1.2	1.2	DJ000011:Surf[0]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	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)]				
* There might be more than one surface where the maximum U-value occurs.				
** 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.				
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	3

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	>0.95

1- Retail | ASHP feeding Cassette unit AHU (HR85)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	4.5	0	0	0.85
Standard value	2.5*	2.6	N/A	N/A	0.65
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

1- Retail | Domestic hot water

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I	Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1		
L00 : INCUBATOR 3	-	-	-	1.9	-	-	-	-	-	-	N/A

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
Standard value	Luminaire	Lamp	Display lamp	
L00 : INCUBATOR 3	-	100	22	592

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
L00 : INCUBATOR 3	NO (-60.2%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of 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
Area [m ²]	54.2	54.2
External area [m ²]	42.6	42.6
Weather	SWI	SWI
Infiltration [m ³ /hm ² @ 50Pa]	3	5
Average conductance [W/K]	34.54	28.19
Average U-value [W/m ² K]	0.81	0.66
Alpha value* [%]	10	10

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

Building Use

% Area	Building Type
100	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 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	2.46	2.27
Cooling	4.93	5.82
Auxiliary	8.92	3.06
Lighting	35.73	59.03
Hot water	1.79	1.87
Equipment*	20.26	20.26
TOTAL **	53.83	72.05

* 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

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	92.13	100.31
Primary energy* [kWh/m ²]	161.12	212.11
Total emissions [kg/m ²]	27.2	36.1

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

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 SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	35.4	56.8	2.5	4.9	8.9	4	3.2	4	4.5
	Notional	20.9	79.4	2.3	5.8	3.1	2.56	3.79	----	----

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

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.15	DJ000011:Surf[2]
Floor	0.2	-	UNKNOWN
Roof	0.15	-	UNKNOWN
Windows, roof windows, and rooflights	1.5	1.2	DJ000011:Surf[0]
Personnel doors	1.5	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building
U _{i-Typ} = Typical individual element U-values [W/(m²K)]		U _{i-Min} = Minimum individual element U-values [W/(m²K)]	
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3

Project name

FRIAR STREET RETAIL SPACE 3

As designed

Date: Thu Mar 10 14:06:47 2022

Administrative information

Building Details

Address: 35 FRIAR STREET, READING, RG1 1DX

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: CPW

Telephone number: 0121 709 6600

Address: INTERFACE 100, ARLESTON WAY, SOLIHULL,
SOLIHULL, B90 4LHCriterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	39.2
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	39.2
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	33.7
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.15	0.15	DJ000012:Surf[2]
Floor	0.25	-	-	UNKNOWN
Roof	0.25	-	-	UNKNOWN
Windows***, roof windows, and rooflights	2.2	1.2	1.2	DJ000012:Surf[0]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	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)]				
* There might be more than one surface where the maximum U-value occurs.				
** 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.				
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	3

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	>0.95

1- Retail | ASHP feeding Cassette unit AHU (HR85)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	4.5	0	0	0.85
Standard value	2.5*	2.6	N/A	N/A	0.65
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

1- Retail | Domestic hot water

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I	Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1		
L00 : INCUBATOR 4	-	-	-	1.9	-	-	-	-	-	-	N/A

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
Standard value	Luminaire	Lamp	Display lamp	
L00 : INCUBATOR 4	-	100	22	537

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
L00 : INCUBATOR 4	YES (+30.4%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of 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
Area [m ²]	48.2	48.2
External area [m ²]	68.8	68.8
Weather	SWI	SWI
Infiltration [m ³ /hm ² @ 50Pa]	3	5
Average conductance [W/K]	61.79	45.52
Average U-value [W/m ² K]	0.9	0.66
Alpha value* [%]	10	10

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

Building Use

% Area Building Type

100	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 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	3.54	3.58
Cooling	21.57	12.55
Auxiliary	8.92	3.06
Lighting	30.85	57.05
Hot water	1.79	1.86
Equipment*	20.26	20.26
TOTAL **	66.67	78.1

* 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

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	295.66	204.22
Primary energy* [kWh/m ²]	199.56	230.25
Total emissions [kg/m ²]	33.7	39.2

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

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 SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity									
Actual	47.5	248.1	3.5	21.6	8.9	3.73	3.2	4	4.5
Notional	33	171.2	3.6	12.6	3.1	2.56	3.79	----	----

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

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.15	DJ000012:Surf[2]
Floor	0.2	-	UNKNOWN
Roof	0.15	-	UNKNOWN
Windows, roof windows, and rooflights	1.5	1.2	DJ000012:Surf[0]
Personnel doors	1.5	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building
U _{i-Typ} = Typical individual element U-values [W/(m²K)]		U _{i-Min} = Minimum individual element U-values [W/(m²K)]	
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3

Project name

FRIAR STREET RESTAURANT

As designed

Date: Thu Mar 10 14:26:25 2022

Administrative information

Building Details

Address: 35 FRIAR STREET, READING, RG1 1DX

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: CPW

Telephone number: 0121 709 6600

Address: INTERFACE 100, ARLESTON WAY, SOLIHULL,
SOLIHULL, B90 4LHCriterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	35.8
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	35.8
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	32.5
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.15	0.15	L0000000:Surf[6]
Floor	0.25	-	-	UNKNOWN
Roof	0.25	0.12	0.12	L0000000:Surf[0]
Windows***, roof windows, and rooflights	2.2	1.2	1.2	L0000000:Surf[1]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	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)]				
* There might be more than one surface where the maximum U-value occurs. ** 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. N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	3

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	>0.95

1- Restaurant | ASHP feeding Cassette unit AHU (HR85)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	4.5	0	0	0.85
Standard value	2.5*	2.6	N/A	N/A	0.65
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

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

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]										HR efficiency	
	ID of system type	A	B	C	D	E	F	G	H	I		
	Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
L00 : RETAIL A3 UNIT 1		-	-	-	1.9	-	-	-	-	0	-	N/A

General lighting and display lighting

General lighting and display lighting		Luminous efficacy [lm/W]			
Zone name		Luminaire	Lamp	Display lamp	General lighting [W]
	Standard value	60	60	22	
L00 : RETAIL A3 UNIT 1		-	100	22	2032

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
L00 : RETAIL A3 UNIT 1	NO (-65%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of 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
Area [m ²]	896.2	896.2
External area [m ²]	874.8	874.8
Weather	SWI	SWI
Infiltration [m ³ /hm ² @ 50Pa]	3	3
Average conductance [W/K]	219.39	406.97
Average U-value [W/m ² K]	0.25	0.47
Alpha value* [%]	10	10

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

Building Use

% Area	Building Type
100	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 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	0.03	1.25
Cooling	6.09	5.86
Auxiliary	13.75	3.84
Lighting	10.95	12.63
Hot water	33.48	47.11
Equipment*	61.61	61.61
TOTAL **	64.31	70.69

* 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

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	70.58	91.5
Primary energy* [kWh/m ²]	192.49	211.63
Total emissions [kg/m ²]	32.5	35.8

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

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 SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	0.5	70.1	0	6.1	13.8	4	3.2	4	4.5
	Notional	11.6	79.9	1.3	5.9	3.8	2.56	3.79	----	----

Key to terms

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- Heat con [kWh/m2] = Heating energy consumption
- Cool con [kWh/m2] = Cooling energy consumption
- Aux con [kWh/m2] = Auxiliary energy consumption
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- 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

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
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Floor	0.2	-	UNKNOWN
Roof	0.15	0.12	L0000000:Surf[0]
Windows, roof windows, and rooflights	1.5	1.2	L0000000:Surf[1]
Personnel doors	1.5	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building
U _{i-Typ} = Typical individual element U-values [W/(m²K)]		U _{i-Min} = Minimum individual element U-values [W/(m²K)]	
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3

Property Ref	House Type	Total Floor Area	External Wall U Value	Corridor & Stairwell Wall U Values	Flat Roof U Value	Window U Value	Window G-Value	Front Door U Value	Y Value	Design Air Pressure	Heating System	Distribution Losses	Heating Controls	Cylinder Volume (L)	Cylinder Measured Heat Loss (kWh/24hrs)	Ventilation Reference	DER	TER	% Reduction	DfEE	TfEE	% Reduction
A1 - 1B2P	First Floor Flat	49.74	0.15	0.25		1.20	0.40	1.31	0.01	3.00	Communal Mains Gas Boilers, Efficiency 95.56%	>= 1991, pre-insulated, low temp, variable flow	Fiat Rate Charging, programmer & TRVs	180	1.85	Nuare MRXBOXAB-EC04	19.74	21.86	9.71	44.19	50.35	12.2228565
A2 - 2B4P	First Floor Flat	69.28	0.15	0.25		1.20	0.40	1.31	0.01	3.00	Communal Mains Gas Boilers, Efficiency 95.56%	>= 1991, pre-insulated, low temp, variable flow	Fiat Rate Charging, programmer & TRVs	180	1.85	Nuare MRXBOXAB-EC04	21.74	24.16	10.01	50.85	62.20	18.25424489
A3 - 1B2P	First Floor Flat	49.84	0.15	0.25		1.20	0.40	1.31	0.01	3.00	Communal Mains Gas Boilers, Efficiency 95.56%	>= 1991, pre-insulated, low temp, variable flow	Fiat Rate Charging, programmer & TRVs	180	1.85	Nuare MRXBOXAB-EC04	16.37	18.59	11.96	35.50	40.96	13.31630811
A4 - 1B1P	First Floor Flat	37.15	0.15	0.25		1.20	0.40	1.31	0.01	3.00	Communal Mains Gas Boilers, Efficiency 95.56%	>= 1991, pre-insulated, low temp, variable flow	Fiat Rate Charging, programmer & TRVs	180	1.85	Nuare MRXBOXAB-EC04	14.22	16.21	12.26	32.70	38.18	14.3386059
A5 - 2B3P	First Floor Flat	60.87	0.15	0.25		1.20	0.40	1.31	0.01	3.00	Communal Mains Gas Boilers, Efficiency 95.56%	>= 1991, pre-insulated, low temp, variable flow	Fiat Rate Charging, programmer & TRVs	180	1.85	Nuare MRXBOXAB-EC04	17.09	19.95	14.32	44.65	59.04	24.3765689
B1 - 1B1P	First Floor Flat	36.50	0.15	0.25		1.20	0.40	1.31	0.01	3.00	Communal Mains Gas Boilers, Efficiency 95.56%	>= 1991, pre-insulated, low temp, variable flow	Fiat Rate Charging, programmer & TRVs	180	1.85	Nuare MRXBOXAB-EC04	13.88	16.46	15.70	32.85	41.73	21.26493431
B2 - 2B4P	First Floor Flat	71.68	0.15	0.25		1.20	0.40	1.31	0.01	3.00	Communal Mains Gas Boilers, Efficiency 95.56%	>= 1991, pre-insulated, low temp, variable flow	Fiat Rate Charging, programmer & TRVs	180	1.85	Nuare MRXBOXAB-EC04	16.66	19.35	13.91	36.99	45.95	19.49582358
B3 - 2B4P	First Floor Flat	69.96	0.15	0.25		1.20	0.40	1.31	0.01	3.00	Communal Mains Gas Boilers, Efficiency 95.56%	>= 1991, pre-insulated, low temp, variable flow	Fiat Rate Charging, programmer & TRVs	180	1.85	Nuare MRXBOXAB-EC04	16.08	18.88	4.76	43.95	48.73	9.890923969
B4 - 1B2P	First Floor Flat	56.14	0.15	0.25		1.20	0.40	1.31	0.01	3.00	Communal Mains Gas Boilers, Efficiency 95.56%	>= 1991, pre-insulated, low temp, variable flow	Fiat Rate Charging, programmer & TRVs	180	1.85	Nuare MRXBOXAB-EC04	17.84	19.57	8.62	41.24	46.59	11.4763678
B5 - 1B2P	First Floor Flat	50.95	0.15	0.25		1.20	0.40	1.31	0.01	3.00	Communal Mains Gas Boilers, Efficiency 95.56%	>= 1991, pre-insulated, low temp, variable flow	Fiat Rate Charging, programmer & TRVs	180	1.85	Nuare MRXBOXAB-EC04	15.55	17.11	9.11	37.27	42.91	13.13382608
B6 - 2B3P	First Floor Flat	61.03	0.15	0.25		1.20	0.40	1.31	0.01	3.00	Communal Mains Gas Boilers, Efficiency 95.56%	>= 1991, pre-insulated, low temp, variable flow	Fiat Rate Charging, programmer & TRVs	180	1.85	Nuare MRXBOXAB-EC04	17.7	22.69	22.00	33.30	41.37	19.48988533
A6 - 2B3P - 6F	Ninth Floor Flat	67.38	0.15	0.25	0.15	1.20	0.40	1.31	0.01	3.00	Communal Mains Gas Boilers, Efficiency 95.56%	>= 1991, pre-insulated, low temp, variable flow	Fiat Rate Charging, programmer & TRVs	180	1.85	Nuare MRXBOXAB-EC04	19.6	25.40	22.05	46.83	53.46	23.62495106
A6 - 2B3P - 6F	Ninth Floor Flat	69.87	0.15	0.25		1.20	0.40	1.31	0.01	3.00	Communal Mains Gas Boilers, Efficiency 95.56%	>= 1991, pre-insulated, low temp, variable flow	Fiat Rate Charging, programmer & TRVs	180	1.85	Nuare MRXBOXAB-EC04	17.77	21.86	19.72	45.02	67.34	33.14363275
A5 - 3B5P - 9F	Ninth Floor Flat	88.55	0.15	0.25		1.20	0.40	1.31	0.01	3.00	Communal Mains Gas Boilers, Efficiency 95.56%	>= 1991, pre-insulated, low temp, variable flow	Fiat Rate Charging, programmer & TRVs	180	1.85	Nuare MRXBOXAB-EC04	15.74	16.95	7.14	37.89	42.15	10.10783953
A1 - 1B1P	Second Floor Flat	39.88	0.15	0.25		1.20	0.40	1.31	0.01	3.00	Communal Mains Gas Boilers, Efficiency 95.56%	>= 1991, pre-insulated, low temp, variable flow	Fiat Rate Charging, programmer & TRVs	180	1.85	Nuare MRXBOXAB-EC04	16.11	18.37	12.30	38.67	46.51	16.66696373
A2 - 2B4P - 2F	Second Floor Flat	71.20	0.15	0.25		1.20	0.40	1.31	0.01	3.00	Communal Mains Gas Boilers, Efficiency 95.56%	>= 1991, pre-insulated, low temp, variable flow	Fiat Rate Charging, programmer & TRVs	180	1.85	Nuare MRXBOXAB-EC04	16.19	18.44	12.23	38.92	46.89	17.05467022
A3 - 1B2P - 7F	Seventh Floor Flat	49.84	0.15	0.25		1.20	0.40	1.31	0.01	3.00	Communal Mains Gas Boilers, Efficiency 95.56%	>= 1991, pre-insulated, low temp, variable flow	Fiat Rate Charging, programmer & TRVs	180	1.85	Nuare MRXBOXAB-EC04	15.77	23.84	33.86	43.14	70.69	38.97541462
A4 - 2B3P - 7F	Seventh Floor Flat	67.38	0.15	0.25		1.20	0.40	1.31	0.01	3.00	Communal Mains Gas Boilers, Efficiency 95.56%	>= 1991, pre-insulated, low temp, variable flow	Fiat Rate Charging, programmer & TRVs	180	1.85	Nuare MRXBOXAB-EC04	13.7	17.98	23.82	35.65	45.41	21.50560345
A4 - 1B2P - 6F	Sixth Floor Flat	37.15	0.15	0.25	0.15	1.20	0.40	1.31	0.01	3.00	Communal Mains Gas Boilers, Efficiency 95.56%	>= 1991, pre-insulated, low temp, variable flow	Fiat Rate Charging, programmer & TRVs	180	1.85	Nuare MRXBOXAB-EC04	26.68	23.51	12.02	54.78	72.79	24.14926967
A5 - 2B3P - 6F	Sixth Floor Flat	60.87	0.15	0.25	0.15	1.20	0.40	1.31	0.01	3.00	Communal Mains Gas Boilers, Efficiency 95.56%	>= 1991, pre-insulated, low temp, variable flow	Fiat Rate Charging, programmer & TRVs	180	1.85	Nuare MRXBOXAB-EC04	18.29	18.55	1.42	47.39	47.45	0.11458872
B1 - 1B1P - 6F	Sixth Floor Flat	36.50	0.15	0.25	0.15	1.20	0.40	1.31	0.01	3.00	Communal Mains Gas Boilers, Efficiency 95.56%	>= 1991, pre-insulated, low temp, variable flow	Fiat Rate Charging, programmer & TRVs	180	1.85	Nuare MRXBOXAB-EC04	21.3	25.82	17.51	48.82	54.56	10.51793988
B2 - 2B4P - 6th	Sixth Floor Flat	71.68	0.15	0.25	0.15	1.20	0.40	1.31	0.01	3.00	Communal Mains Gas Boilers, Efficiency 95.56%	>= 1991, pre-insulated, low temp, variable flow	Fiat Rate Charging, programmer & TRVs	180	1.85	Nuare MRXBOXAB-EC04	23.5	28.91	18.72	55.06	68.25	19.2882177
B3 - 2B4P - 6th Floor	Sixth Floor Flat	69.96	0.15	0.25	0.15	1.20	0.40	1.31	0.01	3.00	Communal Mains Gas Boilers, Efficiency 95.56%	>= 1991, pre-insulated, low temp, variable flow	Fiat Rate Charging, programmer & TRVs	180	1.85	Nuare MRXBOXAB-EC04	13.83	16.42	15.75	32.77	41.62	21.26047641
B4 - 1B2P - 6F	Sixth Floor Flat	50.14	0.15	0.25	0.15	1.20	0.40	1.31	0.01	3.00	Communal Mains Gas Boilers, Efficiency 95.56%	>= 1991, pre-insulated, low temp, variable flow	Fiat Rate Charging, programmer & TRVs	180	1.85	Nuare MRXBOXAB-EC04	15.51	18.45	15.92	39.75	51.91	23.41957125
B5 - 1B2P - 6F	Sixth Floor Flat	50.95	0.15	0.25	0.15	1.20	0.40	1.31	0.01	3.00	Communal Mains Gas Boilers, Efficiency 95.56%	>= 1991, pre-insulated, low temp, variable flow	Fiat Rate Charging, programmer & TRVs	180	1.85	Nuare MRXBOXAB-EC04	17.47	20.91	16.45	45.22	51.89	12.8926543
B6 - 2B3P - 6F	Sixth Floor Flat	61.03	0.15	0.25	0.15	1.20	0.40	1.31	0.01	3.00	Communal Mains Gas Boilers, Efficiency 95.56%	>= 1991, pre-insulated, low temp, variable flow	Fiat Rate Charging, programmer & TRVs	180	1.85	Nuare MRXBOXAB-EC04	15.69	17.49	10.30	31.61	35.80	11.71665402
A1 - 1B1P - 10F	Tenth Floor Flat	39.88	0.15	0.25	0.15	1.20	0.40	1.31	0.01	3.00	Communal Mains Gas Boilers, Efficiency 95.56%	>= 1991, pre-insulated, low temp, variable flow	Fiat Rate Charging, programmer & TRVs	180	1.85	Nuare MRXBOXAB-EC04	17.8	19.54	8.90	39.45	46.43	15.0315768
A2 - 2B4P - 10F	Tenth Floor Flat	71.20	0.15	0.25	0.15	1.20	0.40	1.31	0.01	3.00	Communal Mains Gas Boilers, Efficiency 95.56%	>= 1991, pre-insulated, low temp, variable flow	Fiat Rate Charging, programmer & TRVs	180	1.85	Nuare MRXBOXAB-EC04	15.35	17.33	11.41	30.49	35.47	14.02104739
A3 - 1B2P - 10F	Tenth Floor Flat	49.84	0.15	0.25	0.15	1.20	0.40	1.31	0.01	3.00	Communal Mains Gas Boilers, Efficiency 95.56%	>= 1991, pre-insulated, low temp, variable flow	Fiat Rate Charging, programmer & TRVs	180	1.85	Nuare MRXBOXAB-EC04	17.42	19.26	9.56	38.41	45.51	15.61672994
A4 - 2B3P - 10F	Tenth Floor Flat	67.38	0.15	0.25	0.15	1.20	0.40	1.31	0.01	3.00	Communal Mains Gas Boilers, Efficiency 95.56%	>= 1991, pre-insulated, low temp, variable flow	Fiat Rate Charging, programmer & TRVs	180	1.85	Nuare MRXBOXAB-EC04	16.75	19.68	14.91	39.57	53.08	25.44288020
A5 - 3B5P - 10F	Tenth Floor Flat	88.55	0.15	0.25	0.15	1.20	0.40	1.31	0.01	3.00	Communal Mains Gas Boilers, Efficiency 95.56%	>= 1991, pre-insulated, low temp, variable flow	Fiat Rate Charging, programmer & TRVs	180	1.85	Nuare MRXBOXAB-EC04	14.65	17.56	16.56	32.36	42.16	23.4465312
A6 - 2B3P - 10F	Tenth Floor Flat	60.87	0.15	0.25	0.15	1.20	0.40	1.31	0.01	3.00	Communal Mains Gas Boilers, Efficiency 95.56%	>= 1991, pre-insulated, low temp, variable flow	Fiat Rate Charging, programmer & TRVs	180	1.85	Nuare MRXBOXAB-EC04	15.35	18.45	16.82	37.14	41.38	8.78664483

Multiplier	TFA*M	DER*TFA*M	TER*TFA*M	DfEE*TFA*A*M	TfEE*TFA*A*M
6	7.86	155.1564	171.83731	347.38176	395.73145
1	1.31	28.4794	31.848533	65.60825	81.482213
3	3.93	64.3416	73.072947	139.52391	160.95668
1	1.31	18.6282	21.23219	42.839775	50.01063
6	7.86	134.3274	156.77681	350.94633	464.07089
6	10.48	145.4624	172.54521	344.23914	437.28852
8	10.48	174.5968	202.81531	387.69338	481.5817
6	7.86	126.3888	132.69954	345.46995	393.0427
3	3.93	70.1112	76.89204	162.05901	183.08408
1	1.31	20.3705	22.412255	46.828433	56.208788
1	1.31	23.187	29.725953	43.629115	54.190917
5	6.55	129.69	166.36626	287.45898	350.19038
1	1.31	23.7287	26.640211	56.976657	68.213708
5	6.55	103.097	111.02339	248.18192	276.08789
3	3.93	63.3123	72.19172	151.95888	182.79001
1	1.31	21.2089	24.162283	50.984995	61.431751
1	1.31	20.6587	31.233707	56.513106	62.607112
5	6.55	89.735	117.79414	233.49382	297.46559
1	1.31	27.0908	30.792377	71.725566	85.355421
5	6.55	119.7995	121.52163	310.4247	310.78082
1	1.31	27.903	33.820098	63.956592	71.474206
3	3.93	92.355	113.6255	216.38229	268.22751
1	1.31	18.1173	21.50472	42.930558	54.521613
6	7.86	121.9086	144.98874	312.44374	407.99425
6	7.86	137.3142	164.34687	385.41274	407.86097
1	1.31	20.8539	22.914459	41.404194	46.896719
5	6.55	100.5425	113.4867	199.73474	232.30656
1	1.31	22.8012	25.234489	50.31986	59.621843
1	1.31	21.9425	25.788676	51.838543	69.528629
1	1.31	19.1915	23.000468	42.393694	55.233674
5	6.55	100.5425	120.81478	247.1957	271.10682
	134.93	2265.4223	2630.569	5404.7032	6508.0772

Block Compliance	
Block Compliance DER	10.78861165
Block Compliance DfEE	40.05560785
Block Compliance TfEE	48.23298887

13.88%

16.95%

Property Ref	House Type	External Wall U Value	Corridor & Stairwell Wall U	Flat Roof U Value	Window U Value	Window G-Value	Front Door U Value	Total Floor Area	Y Value	Design Air Pressure	Heating System	Distribution Losses	Heating Controls	Cylinder Volume (L)	Cylinder Measured Heat Loss (kWh/24hrs)	Ventilation Reference	DER	TER	% Reduction	DFEE	TTEE	% Reduction	Multiplier	TFA*M	DER*TFA	TER*TFA	DFEE*TF	TTEE*TF
A1 - 1B2P	First Floor Flat	0.15	0.25		1.20	0.40	1.31	49.74	0.01	3.00	Zeroth ASHP, Efficiency 300%	Calculated - 1.02	Flat Rate Charging, programmer & TRVs	180	1.85	Nuair MRXBOXAB-EC04	13.21	27.01	51.09	35.50	40.96	13.32	6	298.44	3942.3924	8050.8644	10594.62	12224.102
A2 - 2B4P	First Floor Flat	0.15	0.25		1.20	0.40	1.31	69.28	0.01	3.00	Zeroth ASHP, Efficiency 300%	Calculated - 1.02	Flat Rate Charging, programmer & TRVs	180	1.85	Nuair MRXBOXAB-EC04	11.58	23.48	50.69	32.70	38.18	14.34	1	69.28	802.2624	1626.6944	2265.456	2645.1104
A3 - 1B2P	First Floor Flat	0.15	0.25		1.20	0.40	1.31	49.84	0.01	3.00	Zeroth ASHP, Efficiency 300%	Calculated - 1.02	Flat Rate Charging, programmer & TRVs	180	1.85	Nuair MRXBOXAB-EC04	13.40	28.24	52.55	36.99	45.95	19.5	3	149.52	2003.568	4222.4448	5530.7448	6870.444
A4 - 1B1P	First Floor Flat	0.15	0.25		1.20	0.40	1.31	37.15	0.01	3.00	Zeroth ASHP, Efficiency 300%	Calculated - 1.02	Flat Rate Charging, programmer & TRVs	180	1.85	Nuair MRXBOXAB-EC04	14.21	33.13	37.1	33.30	41.37	19.49	1	37.15	527.0015	1236.7795	1237.095	1136.8965
A5 - 2B3P	First Floor Flat	0.15	0.25		1.20	0.40	1.31	60.87	0.01	3.00	Zeroth ASHP, Efficiency 300%	Calculated - 1.02	Flat Rate Charging, programmer & TRVs	180	1.85	Nuair MRXBOXAB-EC04	12.98	26.83	51.61	38.67	46.51	16.87	6	316.82	4740.5556	8798.8506	14123.057	16886.362
B1 - 1B1P	First Floor Flat	0.15	0.25		1.20	0.40	1.31	36.50	0.01	3.00	Zeroth ASHP, Efficiency 300%	Calculated - 1.02	Flat Rate Charging, programmer & TRVs	180	1.85	Nuair MRXBOXAB-EC04	16.90	37.96	55.48	48.82	54.56	10.52	8	292	4934.8	11084.32	14255.44	19331.52
B2 - 2B4P	First Floor Flat	0.15	0.25		1.20	0.40	1.31	71.68	0.01	3.00	Zeroth ASHP, Efficiency 300%	Calculated - 1.02	Flat Rate Charging, programmer & TRVs	180	1.85	Nuair MRXBOXAB-EC04	11.25	23.68	52.9	32.77	41.62	21.26	8	573.44	6451.2	13665.747	18761.629	23965.573
B4 - 1B2P	First Floor Flat	0.15	0.25		1.20	0.40	1.31	50.14	0.01	3.00	Zeroth ASHP, Efficiency 300%	Calculated - 1.02	Flat Rate Charging, programmer & TRVs	180	1.85	Nuair MRXBOXAB-EC04	13.98	30.80	54.61	45.22	51.89	12.86	6	300.84	4205.7432	9265.872	13603.985	15610.588
B5 - 1B2P	First Floor Flat	0.15	0.25		1.20	0.40	1.31	50.95	0.01	3.00	Zeroth ASHP, Efficiency 300%	Calculated - 1.02	Flat Rate Charging, programmer & TRVs	180	1.85	Nuair MRXBOXAB-EC04	14.25	28.53	50.05	39.45	46.43	15.03	3	152.85	2178.1125	4360.8105	6029.9325	7096.8255
B6 - 2B3P	First Floor Flat	0.15	0.25		1.20	0.40	1.31	61.03	0.01	3.00	Zeroth ASHP, Efficiency 300%	Calculated - 1.02	Flat Rate Charging, programmer & TRVs	180	1.85	Nuair MRXBOXAB-EC04	13.45	28.87	53.41	39.57	53.08	25.44	1	61.03	820.8335	1761.9351	2414.9571	2939.4724
B3 - 2B4P	First Floor Flat	0.15	0.25		1.20	0.40	1.31	69.96	0.01	3.00	Zeroth ASHP, Efficiency 300%	Calculated - 1.02	Flat Rate Charging, programmer & TRVs	180	1.85	Nuair MRXBOXAB-EC04	11.88	25.57	53.54	32.36	42.16	23.25	1	69.96	831.1248	1788.8772	2263.9056	2949.5156
A4 - 2B3P - 9F	Ninth Floor Flat	0.15	0.25	0.15	1.20	0.40	1.31	67.38	0.01	3.00	Zeroth ASHP, Efficiency 300%	Calculated - 1.02	Flat Rate Charging, programmer & TRVs	180	1.85	Nuair MRXBOXAB-EC04	12.55	24.93	49.65	37.27	42.91	13.13	5	336.9	4228.095	8398.917	12556.263	14456.379
A6 - 2B3P - 9F	Ninth Floor Flat	0.15	0.25		1.20	0.40	1.31	60.87	0.01	3.00	Zeroth ASHP, Efficiency 300%	Calculated - 1.02	Flat Rate Charging, programmer & TRVs	180	1.85	Nuair MRXBOXAB-EC04	14.81	27.11	48.11	47.39	47.45	0.11	1	60.87	889.3107	1686.1857	2884.6293	2888.2815
A5 - 3B5P - 9F	Ninth Floor Flat	0.15	0.25		1.20	0.40	1.31	88.55	0.01	3.00	Zeroth ASHP, Efficiency 300%	Calculated - 1.02	Flat Rate Charging, programmer & TRVs	180	1.85	Nuair MRXBOXAB-EC04	11.13	26.40	57.85	35.65	45.41	21.51	5	442.75	4927.8075	11688.8	15784.038	20105.278
A1 - 1B1P	Second Floor Flat	0.15	0.25		1.20	0.40	1.31	39.88	0.01	3.00	Zeroth ASHP, Efficiency 300%	Calculated - 1.02	Flat Rate Charging, programmer & TRVs	180	1.85	Nuair MRXBOXAB-EC04	15.73	31.97	50.8	44.19	50.35	12.22	3	119.64	1881.9372	3824.8908	5286.8916	6023.874
A2 - 2B4P - 2F	Second Floor Flat	0.15	0.25		1.20	0.40	1.31	71.20	0.01	3.00	Zeroth ASHP, Efficiency 300%	Calculated - 1.02	Flat Rate Charging, programmer & TRVs	180	1.85	Nuair MRXBOXAB-EC04	11.29	23.96	52.67	32.85	41.73	21.26	1	71.2	803.848	1705.952	2338.92	2971.176
A3 - 1B2P - 7F	Seventh Floor Flat	0.15	0.25		1.20	0.40	1.31	49.84	0.01	3.00	Zeroth ASHP, Efficiency 300%	Calculated - 1.02	Flat Rate Charging, programmer & TRVs	180	1.85	Nuair MRXBOXAB-EC04	14.28	28.67	50.02	41.24	46.59	11.48	1	49.84	711.7162	1423.9288	2055.4016	2322.0465
A4 - 2B3P - 7F	Seventh Floor Flat	0.15	0.25		1.20	0.40	1.31	67.38	0.01	3.00	Zeroth ASHP, Efficiency 300%	Calculated - 1.02	Flat Rate Charging, programmer & TRVs	180	1.85	Nuair MRXBOXAB-EC04	12.89	24.68	48.58	37.89	42.15	10.11	5	336.9	4275.261	8314.692	12765.141	14200.335
A4 - 1B2P - 6F	Sixth Floor Flat	0.15	0.25	0.15	1.20	0.40	1.31	37.15	0.01	3.00	Zeroth ASHP, Efficiency 300%	Calculated - 1.02	Flat Rate Charging, programmer & TRVs	180	1.85	Nuair MRXBOXAB-EC04	15.78	37.32	57.72	40.83	53.46	23.62	1	37.15	586.227	1386.438	1516.8345	1886.039
A5 - 2B3P - 6F	Sixth Floor Flat	0.15	0.25	0.15	1.20	0.40	1.31	60.87	0.01	3.00	Zeroth ASHP, Efficiency 300%	Calculated - 1.02	Flat Rate Charging, programmer & TRVs	180	1.85	Nuair MRXBOXAB-EC04	13.03	26.94	51.64	38.92	46.89	17.01	5	354.35	3965.6865	8198.189	11845.302	14270.972
B1 - 1B1P - 6F	Sixth Floor Flat	0.15	0.25	0.15	1.20	0.40	1.31	36.50	0.01	3.00	Zeroth ASHP, Efficiency 300%	Calculated - 1.02	Flat Rate Charging, programmer & TRVs	180	1.85	Nuair MRXBOXAB-EC04	18.55	42.75	56.61	55.06	68.25	19.33	1	36.5	677.075	1560.375	2009.69	2491.125
B2 - 2B4P - 6th	Sixth Floor Flat	0.15	0.25	0.15	1.20	0.40	1.31	71.68	0.01	3.00	Zeroth ASHP, Efficiency 300%	Calculated - 1.02	Flat Rate Charging, programmer & TRVs	180	1.85	Nuair MRXBOXAB-EC04	12.78	27.03	52.72	39.75	51.91	23.42	3	215.04	2748.2112	5812.5312	8547.84	11162.726
B3 - 2B4P - 6th	Sixth Floor Flat	0.15	0.25	0.15	1.20	0.40	1.31	69.96	0.01	3.00	Zeroth ASHP, Efficiency 300%	Calculated - 1.02	Flat Rate Charging, programmer & TRVs	180	1.85	Nuair MRXBOXAB-EC04	12.39	26.99	54.1	37.74	41.38	8.79	1	69.96	886.8044	1888.2204	2640.2604	2894.8448
B4 - 1B2P - 6F	Sixth Floor Flat	0.15	0.25	0.15	1.20	0.40	1.31	50.14	0.01	3.00	Zeroth ASHP, Efficiency 300%	Calculated - 1.02	Flat Rate Charging, programmer & TRVs	180	1.85	Nuair MRXBOXAB-EC04	12.88	25.96	50	31.81	35.80	11.72	6	309.84	3814.6512	7626.3024	9505.5504	10770.072
B5 - 1B2P - 6F	Sixth Floor Flat	0.15	0.25	0.15	1.20	0.40	1.31	50.95	0.01	3.00	Zeroth ASHP, Efficiency 300%	Calculated - 1.02	Flat Rate Charging, programmer & TRVs	180	1.85	Nuair MRXBOXAB-EC04	12.42	25.11	50.54	30.49	35.47	14.02	6	305.7	3796.794	7676.127	9320.793	10843.179
B6 - 2B3P - 6F	Sixth Floor Flat	0.15	0.25	0.15	1.20	0.40	1.31	61.03	0.01	3.00	Zeroth ASHP, Efficiency 300%	Calculated - 1.02	Flat Rate Charging, programmer & TRVs	180	1.85	Nuair MRXBOXAB-EC04	13.97	28.11	50.31	38.41	45.51	15.62	1	61.03	852.5891	1715.5533	2344.1623	2777.4753
A1 - 1B1P - 10F	Tenth Floor Flat	0.15	0.25	0.15	1.20	0.40	1.31	39.88	0.01	3.00	Zeroth ASHP, Efficiency 300%	Calculated - 1.02	Flat Rate Charging, programmer & TRVs	180	1.85	Nuair MRXBOXAB-EC04	17.22	35.53	51.54	50.85	62.20	19.25	1	39.88	586.7356	1416.9364	2027.898	2489.158
A2 - 2B4P - 10F	Tenth Floor Flat	0.15	0.25	0.15	1.20	0.40	1.31	71.20	0.01	3.00	Zeroth ASHP, Efficiency 300%	Calculated - 1.02	Flat Rate Charging, programmer & TRVs	180	1.85	Nuair MRXBOXAB-EC04	13.69	29.35	53.36	44.65	59.04	24.38	5	356	4873.64	10448.6	15895.4	21018.24
A3 - 1B2P - 10F	Tenth Floor Flat	0.15	0.25	0.15	1.20	0.40	1.31	87.98	0.01	3.00	Zeroth ASHP, Efficiency 300%	Calculated - 1.02	Flat Rate Charging, programmer & TRVs	180	1.85	Nuair MRXBOXAB-EC04	12.91	24.72	47.78	43.95	48.73	9.81	1	87.98	1135.8218	2174.8656	3866.366	4287.2654
A4 - 2B3P - 10F	Tenth Floor Flat	0.15	0.25	0.15	1.20	0.40	1.31	67.38	0.01	3.00	Zeroth ASHP, Efficiency 300%	Calculated - 1.02	Flat Rate Charging, programmer & TRVs	180	1.85	Nuair MRXBOXAB-EC04	14.21	32.29	56	45.02	67.34	33.14	1	67.38	957.4688	2175.7002	3033.4476	4537.3662
A5 - 3B5P - 10F	Tenth Floor Flat	0.15	0.25	0.15	1.20	0.40	1.31	88.55	0.01	3.00	Zeroth ASHP, Efficiency 300%	Calculated - 1.02	Flat Rate Charging, programmer & TRVs	180	1.85	Nuair MRXBOXAB-EC04	12.88	35.49	54.27	43.14	70.69	38.98	1	88.55	1122.814	3142.6395	3820.047	6259.5965
A6 - 2B3P - 10F	Tenth Floor Flat	0.15	0.25	0.15	1.20	0.40	1.31	60.87	0.01	3.00	Zeroth ASHP, Efficiency 300%	Calculated - 1.02	Flat Rate Charging, programmer & TRVs	180	1.85	Nuair MRXBOXAB-EC04	16.40	34.79	52.86	54.78	72.79	24.75	5	304.35	4991.34	10588.337	16672.293	22153.637
																6062.54	80232.34	169717.18	237832.38	289857.87								

Block Compliance

Block Compliance DER 13.2341131

Block Compliance TER 27.6840416

Block Compliance DFEE 39.228824

Block Compliance TTEE 47.8130022

52.73%

17.95%

Block Compliance		
Block Compliance DER	13.23411311	
Block Compliance TER	27.8944016	52.73%
Block Compliance DFEE	39.220524	
Block Compliance TTEE	47.81130922	17.95%

CPW Where buildings come alive			CPW Birmingham: 0121 709 6600 www.cpw-p.com				BREEAM SCORE %:				Targeted		Achieved		Potential					
			BREEAM-0000-0000				Score % and Minimum Standards met for Classification:				49.4		0.0		59.3					
			Last Updated: 00/00/2020								Unclassified		Unclassified		Unclassified					
			Initials: DF								-		-		Not Pursuing					
			Revision: - A								-		-		Pursuing					
			Date of issue: 15/2/22								-		-		Possible Target					
											-		-		Achieved					
Retail			BREEAM 2018 Tracker		Job Title: Friar Street Reading		New Build:		m²											
			Shell & Core		Job Number: 210771		Refurbishment:		m²											
Name	Item	Responsibility	Comment/Action				Potential Additional	Available Credits	Targeted Credits	Achieved Credits	Target Score %	Achieved Score %								
			Actions required to secure the points given in the assessment				9.90%	106	48	0	49.46	0.00								
Management			Weighting: 0.120				3.20%	15	11	0	8.80	0.00								
Man 01	Project Brief and Design																			
	Project Delivery Planning	Client/ PM	At Stage 1, Project Brief and project meeting minutes outlining roles/ responsibilities/ contributions and showing how each one of the following have been considered: end user requirements, aims of the design/ strategy, installation and construction requirements/ limitations, occupiers' budget and technical expertise in maintaining proposed systems, maintainability and adaptability of proposals, operational energy, requirements for the production of the project, end user documentation, requirements for commissioning, training and aftercare support. Show how the project delivery stakeholders contributions and their consultation has influenced: Initial Project Brief, Project Execution Plan, Communication Strategy, Concept Design.					1	1	-										
	Stakeholder Consultation (interested parties)	Client/ PM	Consultation plan showing scope and process Documentation (e.g. meeting minutes, responsibilities schedule) confirming: - Collaboration began prior to end of RIBA Stage 2 . - Roles and responsibilities have been defined, covering all points in Criterion 2. - Comments from consultations have influenced the initial project brief. Third party consultation required for education buildings					1	1	-										
	Pre-Requirement: BREEAM AP	Client/ PM	Evidence/Letter confirming a BREEAM Advisory Professional was appointed to formally agree strategic performance targets early in the design process					N/A	Y	N										
	BREEAM AP (Concept Design)	Client/ PM	Evidence/Letter confirming a BREEAM Advisory Professional was appointed for RIBA stage 2 . Meeting minutes / BREEAM trackers showing BREEAM AP contribution and feedback during Concept Design. Pre-assessment report showing targets and design advice to achieve targets					1	1	-										
	BREEAM AP (Developed Design)	Client/ PM	Previous credits must be achieved. Evidence confirming the sustainability champion has been appointed for RIBA Stages 2-4 . Meeting minutes / BREEAM trackers showing BREEAM AP contribution and feedback during Developed Design.					1	1	-										
Man 02	Life Cycle Cost (LCC) and Service Life Planning																			
	Elemental LCC Plan	QS	Elemental life cycle cost plan at Stage 2 .				2	2	-	-										
	Component Level LCC Plan	QS	Component level life cycle cost plan by the end of Stage 4 .				1	1	-	-										
	Capital Cost Reporting	QS	Confidential capital cost reporting to the BRE (data is anonymised by the BRE and used to inform performance benchmarking). Evidence showing the predicted capital cost for the building in £k/ m².					1	1	-										
Man 03	Responsible Construction Practices																			
	Pre-requisite: Legally Harvested and Traded Timber	Main Contractor	Letter/Supplier Certificates confirming all timber will comply with the UK Government Timber Procurement Policy.					N/A	y	N										
	Environmental Management	Main Contractor	Prerequisite for NHS Buildings. Copy of the contractor's ISO14001 Cert & compliance with PPG6 guidelines.					1	1	-										
	Pre-Requirement: BREEAM AP	Main Contractor	Client and main contractor to formally agree performance targets - letter or specification required					N/A	Y	N										
	BREEAM AP (Site)	Main Contractor	BREEAM Advisory Professional to be appointed for the construction period. Spec or letter confirming an AP has been appointed to monitor the project to ensure ongoing compliance with the criteria. Evidence confirming the sustainability champion has been appointed for RIBA Stage 4 onwards . Meeting minutes / BREEAM trackers showing BREEAM AP contribution and feedback during Construction.					1	1	-										
	Responsible Construction Management	Main Contractor	Main contractor to achieve items listed as required plus 6 additional items in Table 4.1 (categories are: vehicle movement, pollution management, tidiness, health and wellbeing, security processes, training, awareness and feedback, monitoring and reporting). CCS score will contribute towards this - item g also required 'ensure clear and safe access in and around the buildings at the point of handover					2	2	-										
	Monitoring of Construction Site Impacts: Utility Consumption	Main Contractor	Site monitoring and target setting for energy consumption and reporting on total CO2/ project value. Site monitoring and target setting for water consumption and reporting on total net water consumption m3.					1	1	-										
	Monitoring of Construction Site Impacts: Transportation	Main Contractor	Site monitoring and target setting for transportation movements and impacts from the delivery of the majority of construction materials to site and construction waste from site. Reporting in kg CO2 equivalent plus total distance travelled (km)					1	1	-										
Man 04	Commissioning and Handover																			
	Commissioning: Testing Schedule and Responsibilities	Main Contractor	Spec or letter confirming commissioning responsibilities, commissioning testing schedule, and relevant codes to be adhered to. A copy of the main contractors programme of works confirming commissioning has been accounted for.					0	0	-										
	Commissioning: Design and Preperation	Main Contractor	During the design stage, the client or main contractor needs to appoint a project team member (who is not involved in the general installation works for the building services systems) with responsibility for undertaking design reviews, commissioning management etc. For buildings with complex building services and systems this requires a specialist commissioning manager.					0	0	-										
	Commissioning: Testing and Inspecting Building Fabric	Main Contractor	Project programme of works to confirm thermographic survey, airtightness testing and inspection has been accounted for. Copy of appointment letter or similar for surveyor.				1	1	-	-										
	Pre-Requirement: Building User Guides	Main Contractor	Letter or Spec confirming commitment to produce Building User Guides and contents. One technical BUG required for Facilities Manager, one non-technical required BUG for building occupiers. Draft copy to be developed and discussed with users first where building occupants are known					N/A	N	N										
	Handover	Main Contractor	Two handover training schedules required: one non-technical (to include an introduction to the non-technical BUG), one technical (to include an introduction to the technical BUG). Letter/spec/programme confirming occupier training					0	0	-										
Health and Wellbeing			Weighting: 0.070				2.10%	10	3	0	2.10	0.00								
Hea 01	Visual Comfort																			
	Daylighting	Architect	Daylight calculations showing compliance with table 5.1 Building plans showing room uses					2	0	-										
	View Out	Architect	Floor plans of the building showing room uses, dimesions, and window locations. Elevations marked up to show dimensions of windows and walls. External/Site plans showing locations of nearby buildings.					1	0	-										
	Internal and External Lighting	M&E	Drawings showing external lighting. Confirmation road lighting has been specified in accordance with BS 5489-1:2013 Confirmation remaining lighting has been specified in accordance with BS EN 12464-2:2014					1	1	-										

CPW Where buildings come alive			CPW Birmingham: 0121 709 6600 www.cpwpc.com					BREEAM SCORE %: Score % and Minimum Standards met for Classification:		<table><tr><th>Targeted</th><th>Achieved</th></tr><tr><td>49.4</td><td>0.0</td></tr><tr><th>Unclassified</th><th>Unclassified</th></tr><tr><td>-</td><td>-</td></tr><tr><td>-</td><td>-</td></tr><tr><td>-</td><td>-</td></tr><tr><td>-</td><td>-</td></tr></table>	Targeted	Achieved	49.4	0.0	Unclassified	Unclassified	-	-	-	-	-	-	-	-	<table><tr><th>Potential</th></tr><tr><td>59.3</td></tr><tr><th>Unclassified</th></tr><tr><td>-</td></tr></table>	Potential	59.3	Unclassified	-
Targeted	Achieved																												
49.4	0.0																												
Unclassified	Unclassified																												
-	-																												
-	-																												
-	-																												
-	-																												
Potential																													
59.3																													
Unclassified																													
-																													
BREEAM-0000-0000 Last Updated: 00/00/2020 Initials: DF Revision: - A Date of issue: 15/2/22																													
Retail			BREEAM 2018 Tracker Shell & Core		Job Title: Friar Street Reading Job Number: 210771		New Build:		m²		%																		
							Refurbishment:		m²		%																		
Name	Item	Responsibility	Comment/Action					Potential Additional	Available Credits	Targeted Credits	Achieved Credits	Target Score %	Achieved Score %																
Hea 02	Indoor Air Quality																												
	Pre-requisite: Indoor Air Quality (IAQ) Plan	Contractor	Copy of the compliant indoor air quality plan.						N/A	y	N																		
	Ventilation	M&E	Mech vent buildings - confirmation fresh air rates meet the requirements of BS ISO 17772-1:2017 Nat vent buildings - confirmation fresh air rates meet the requirements of CIBSE AM10. Different codes for education buildings and clinical areas.						0	-	-																		
Hea 04	Thermal Comfort																												
	Thermal Modelling	M&E	Copy of the thermal modelling results Where relevant, including the PMV and PPD values						1	1	-																		
	Design for Future Thermal Comfort	M&E	Re-run of the thermal model with the 2030 weather file. Evidence confirming the building will or can be adapted to withstand effects of climate change Where relevant, the PMV and PPD values for the climate change scenario					1	1	-	-																		
Hea 05	Acoustic Performance																												
	Acoustic Performance	Acoustician	The building meets the listed performance requirements for sound insulation and indoor ambient noise level , including the testing regime required.					1	1	-	-																		
Hea 06	Security																												
	Security of Site and Building	Architect	Correspondence from Security Consultant e.g. police ALO Design drawings showing implementation of recommendations						1	-	-																		
Hea 07	Safe and Healthy Surroundings																												
	Safe Access	Landscape Architect	Site drawings showing paths, cycle lanes, and vehicle delivery routes.						1	1	-																		
	Outside Space	Architect	Design drawings showing an external amenity area for building users that is non-smoking, has seating and avoids areas that have disturbances from noise.					1	1	-	-																		
Energy	Weighting: 0.095													1.46%	13	2	0	1.46	0.00										
Ene 01	Reduction of Energy Use & Carbon Emissions																												
	Energy Performance	M&E	Copy of the design stage .inp file Output from assessor's calculator					2	9	-	-																		
	Prerequisite: Preliminary Design Workshop	M&E	Prior to Concept Design relevant members of the design team hold a preliminary design workshop focussing on operational energy performance. Meeting agenda/ minutes required.						N/A	N	N																		
	Prediction of Operational Energy Consumption	M&E	Undertake additional energy modelling during the design and post-construction stages to generate predicted operational energy consumption figures. Report predicted energy consumption targets by end use, design assumptions and input data. Carry out a risk assessment to highlight any significant design, technical and process risks that should be monitored and measured during construction and commissioning.						0	-	-																		
Ene 02	Energy monitoring																												
	Sub-metering of End-use Categories	M&E	Drawings showing location of meters. Copy of spec/metering schematics confirming what has been metered, and that meters are labelled and connected to BMS.						0	0	-																		
	Sub-metering of High Energy Load and Tenancy Areas	M&E	Drawings showing location of meters. Copy of spec/metering schematics confirming what has been metered, and that meters are labelled and connected to BMS						0	0	-																		
Ene 03	External lighting																												
	Luminous Efficiency and Lighting Control	M&E	External lighting drawings Confirmation of lights to be installed (could be on drawing) Confirmation of switching and PIR if necessary						1	1	-																		
Ene 04	Low Carbon Design																												
	Passive Design Analysis	M&E	Hea 04 first credit must be awarded. Copy of the analysis results and evidence confirming it is compliant, and was completed at RIBA Stage 2. Report needs to quantify the reduced total energy demand and CO2 emissions resulting from the passive design measures.						1	-	-																		
	Free Cooling	M&E	Not targeted due to mechanical cooling						1	-	-																		
	Low Zero Carbon Technologies	M&E	Copy of the feasibility report at RIBA Stage 2.						1	1	-																		
Ene 06	Energy Efficient Transportation Systems																												
	Energy Consumption	M&E	Copy of transport analysis including confirmation of whether a regenerative drive would be worthwhile. Letter/Evidence confirming lowest energy usage lift has been specified						0	-	-																		
	Energy Efficient Features	M&E	Criterion 1 is achieved. Manufacturer's details confirming standby, variable controls, and energy efficiency lighting.						0	-	-																		

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Transport		Weighting: 0.145					0.00%	12	6	0	7.25	0.00																			
Tra 01	Travel Plan																														
	Travel Assessment and Travel Plan	Client/ PM	Travel plan to be produced during the feasibility and design stages and be based on a site specific travel assessment or statement. Must cover disabled access. Client needs to be involved in the development of the travel plan.					2	2	-																					
Tra 02	Sustainable Transport Measures																														
	Pre-requisite: Tra 01 Achieved	Client/ PM	Copy of the travel plan and survey Must include AI figure, and disabled access					N/A	Y	N																					
	Transport Options Implementation	Architect	Public transport meaures, private transport measures (including electric recharging stations), active travel measures (including cycle racks), alternative transport measures, Public transport timetables. Specification and marked up drawings for private/ active/ alternative transport measures. Safe pedestrian route of less than 500m shown on a scale drawing for all relevant amenities.					10	4	-																					
Water		Weighting: 0.020					0.00%	2	2	0	2.00	0.00																			
Wat 01	Water Consumption																														
	Water Consumption Reduction	Architect/ M&E/ Main Contractor	Spec/Manufacturers details confirming cisterns, WCs, & taps to be installed or a letter confirming the specified flush/flow rates of each. More than 2 credits unlikely without rainwater harvesting.					0	-	-																					
Wat 02	Water Monitoring																														
	Prerequisite: Water Meter on the Mains Water Supply	M&E	A water meter on the mains supply to each building must be installed.					N/A	Y	N																					
	Appropriate Sub-Meters	M&E	Drawings showing location of meters. Copy of spec/metering schematics confirming what has been metered, and that meters are labelled and connected to BMS					1	1	-																					
Wat 03	Water Leak Detection																														
	Leak Detection System	M&E/ Main Contractor	Drawings and Spec confirming leak detection between site boundary and building entrance meter					1	1	-																					
	Flow Control Devices	M&E/ Main Contractor	Solenoid valves connected to PIRs to control cold water supply					0	-	-																					
Wat 04	Water Efficient Equipment																														
	Large water consuming systems are designed to minimise unregulated consumption	Architect	Confirmation that there will be no irrigation system on the site Water efficiency calculations.					0	-	-																					
Materials		Weighting: 0.220					3.14%	14	4	0	6.28	0.00																			
Mat 01	Environmental Impacts from Construction Products - Building Life Cycle Assessment (LCA)																														
	Superstructure	Architect/ LCA Specialist	Copy of building life cycle assessment at Concept Design . A copy of the Mat 01 Results submission tool needs to be submitted to the BRE at the end of Concept Design and before Planning permission is applied for. A copy of the Mat 01 Results submission tool needs to be submitted to the BRE at the end of Technical Design .				2	6	-	-																					
	Substructure and Hard Landscaping Options Appraisal during Concept Design	Architect/ LCA Specialist	Copy of options appraisal from Stage 1 / 2 .					1	-	-																					
Mat 02	Environmental Impacts from Construction Products - Environmental Product Declarations (EPDs)																														
	Specification of Products with a Recognised EPD	Architect	Copy of construction product EPDs. A total EPD points score of at least 20 is needed to achieve the credit.					1	-	-																					
Mat 03	Responsible Sourcing of Construction Products																														
	Pre-requisite: All timber used on the project is 'Legally harvested and traded t	Main Contractor	Letter/Supplier Certificates confirming all timber will comply with the UK Government Timber Procurement Policy					N/A	Y	N																					
	Enabling Sustainable Procurement	Main Contractor	A sustainable procurement plan must be used by the design team to guide specification towards sustainable construction products and needs to be in place before Concept Design . It should include sustainability aims, objectives and strategic targets, including a requirement for assessing the potential to procure construction products locally, and procedures to check and verify the effective implementation of the plan. If organisational or covering several sites then additional measures are required.					1	1	-																					
	Measuring Responsible Sourcing	Main Contractor	Applicable building materials to be responsibly sourced by main contractor. 1 credit for 10% superstructure. 2 credits also requires 20% internal finishes plus substructure and hard landscaping. 3 credits also requires 30% internal finishes plus substructure and hard landscaping. A copy of the Mat03 calculator Plan/spec/letter detailing the materials making up each building element A copy of the responsible sourcing scheme certificates for each material's manufacturer OR - if materials/manufacturers are not know - a letter of intent confirming the percentage of construction products will be sourced from responsible suppliers to achieve the above					3	2	-																					
Mat 05	Designing for Durability and Resilience																														
	Protecting from Degredation and Damage	Architect	Drawings showing areas where pedestrians and trolley movements occur. Design drawings/spec confirming durability measures which will be implemented. Evidence confirming how each applicable building element is protected from potential environmental degradation (including roof and facade) and how convenient access to the roof and facade is achieved. Marked up drawings/ specification and/ or written report required.					1	1	-																					
Mat 06	Material Efficiency																														
	Target, Report and Implement Material Efficiency Opportunities	Architect/ Main Contractor	Requires a report at each RIBA stage , plus letter/spec confirming designing for materials efficiency in accordance with BS 8895 &/or WRAP					1	-	-																					
Waste		Weighting: 0.080					0.00%	10	7	0	5.60	0.00																			
Wst 01	Construction Waste Management																														
	Pre-demolition Audit	Demolition Contractor	Copy of compliant demolition audit. Demolition contractor to be ISO 14001 certified.					1	1	-																					
	Construction Resource Efficiency	Main Contractor	1 credit targeted for a compliant site Resource Management Plan with target of less than 13.3m3 (actual not bulk volume) or 11.1 tonnes of non-hazardous waste (from on-site construction and dedicated off-site manufacture) excluding demolition and excavation waste, per 100m2 GIFA.					3	2	-																					
	Diversion of Resources from Landfill	Main Contractor	1 credit targeted for non-hazardous construction waste diverted from landfill: non-demolition waste 70% by volume/ 80% tonnage; demolition waste 80% by volume/ 90% tonnage. Excavation waste is excluded.					1	1	-																					

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Wst 02 Use of Recycled and Sustainably Sourced Aggregates																													
	Pre-requisite: Pre-demolition Audit	Demolition Contractor	Copy of compliant demolition audit. Demolition contractor to be ISO 14001 certified.					N/A	N	N																			
	Project Sustainable Aggregate Points	Main Contractor	Not targeted. Would require Sustainable Aggregate points to be determined					1	0	-																			
Wst 03 Operational Waste																													
	Operational Waste	Architect	Dedicated recyclable waste storage area to be provided at a rate of 2m2 per 1,000m2 of net floor area for buildings <5,000m NIFA. A minimum of 10m2 for buildings >5,000m2. Marked up to scale drawing to be provided showing recyclable waste storage area in m2 plus separate area for general waste storage. Recyclable waste stream labelling required - to be confirmed on drawing or by email. Water outlet to be provided for areas with organic waste storage.					1	1	-																			
Wst 04 Speculative Finishes																													
	Speculative Floor and Ceiling Finishes	Architect	For tenanted areas where the future occupant is not known - drawing showing show area of carpets or other floor or ceiling finishes to this area only. Where the end user is known, confirmation that the floor and ceiling finishes have been selected by the known occupant of the development. OR where no capets and only ceiling finishes have been installed, the building owner confirms that the first tenants will not be permitted to make substantial alterations to the ceiling finishes.					0	-	-																			
Wst 05 Adaptation to Climate Change																													
	Resilience of Structure, Fabric, Building Services, and Renewables Installation	Architect/ M&E	Climate change adaptation strategy appraisal, including building services and renewable systems, structural and fabric resilience aspects, during Concept Design. To be updated at Technical Design demonstrating how the recommendations/ solutions proposed have been implemented.					1	1	-																			
Wst 06 Design for Disassembly and Adaptability																													
	Recommendations	Architect	Study to explore the ease of disassembly and the functional adaptation potential of different design scenarios at Concept Design.					1	1	-																			
	Implementation	Architect	Update of study at Technical Design demonstrating how the recommendations/ solutions proposed have been implemented. Production of a building adaptability and disassembly guide for prospective tenants.					1	-	-																			
Land Use and Ecology		Weighting: 0.190					0.00%	13	8	0	11.69	0.00																	
LE 01 Site Selection																													
	Previously Occupied Land	Architect/ Client	Marked up to scale drawing showing before/ after are of development footprint on previously occupied land. 75% must be shown as previously occupied to achieve credit.					1	1	-																			
	Contaminated Land	Contaminated Land Professional	A copy of the remediation strategy and implementation plan. Land unlikely to be contaminated					1	-	-																			
LE 02 Identifying and Understanding the Risks and Opportunities for the Project																													
	Prerequisite: Statutory obligations	Ecologist/ Main Contractor	Client or main contractor must confirm compliance is monitored against all relevant UK legislation relating to the ecology of the site.					N/A	y	N																			
	Determining the Ecological Outcomes for the Site	Ecologist/ Main Contractor	1 credit for site survey and evaluation Route 1 - BREEAM Guidance Note GN34 BREEAM Ecological Risk Evaluation Checklist must be completed if targeting foundation route. Appoint a Suitably Qualified Ecologist/ provide a copy of the Ecological Survey and Evaluation document, for Route 2 & maximum credits. 1 credit for site survey and evaluation 1 credit for determining the ecological outcomes for the site.					2	1	-																			
LE 03 Managing Negative Impacts on Ecology																													
	Pre-requisite: LE02 is achieved	Ecologist/ Main Contractor	LE 02's 'Survey and evaluation and Determining ecological outcomes' criteria must be achieved Client or main contractor must confirm compliance is monitored against all relevant UK legislation relating to the ecology of the site.					N/A	Y	N																			
	Planning, Liaison, Implementation and Data	PM/ Ecologist/ Main Contractor	Roles and responsibilities must be clearly defined. Site preparation and construction works to have been planned for and implemented at an early project stage. Project team must have liaised and collaborated with relevant stakeholder and selected appropriate solutions, during site preparation and construction works.					1	1	-																			
	Managing Negative Impacts of the Project	Ecologist/ Main Contractor	Negative impacts from site preparation works must be managed accordingly and the loss of ecological value has been limited as far as possible (1 credit) no overall loss of ecological value has occurred (2 credits).					2	1	-																			
LE 04 Change and Enhancement of Ecological Value																													
	Pre-requisite: LE03 is achieved and additional requirements met	Ecologist/ Main Contractor	Criterion 6 (for Foundation route) or 8 (for Comprehensive route) in LE 03 must be achieved. Client or main contractor must confirm compliance is monitored against all relevant UK legislation relating to the ecology of the site. Roles and responsibilities must be clearly defined. Site preparation and construction works must be planned for and implemented at an early project stage.					N/A	y	N																			
	Ecological Enhancement	Ecologist/ Main Contractor	The project team liaising and collaborating with representative stakeholders must have implemented the solutions/ measure to enhance ecological value (a) on site (b) off site within the zone of influence.					1	1	-																			
	Change and Enhancement of Ecology	Ecologist/ Landscape Architect/ Main Contractor	Up to 3 credits are available based on the change in ecological value (1 credit targeted for no change in ecological value). Completed version of BREEAM Change in Ecological Value Calculator Tool must be included.					3	1	-																			

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LE 05 Long Term Ecology Management and Maintenance																					
	Pre-requisite: Statutory obligations, planning and site implementation	PM/ Ecologist/ Main Contractor	Client or main contractor must confirm compliance is monitored against all relevant UK legislation relating to the ecology of the site. Roles and responsibilities must be clearly defined. Site preparation and construction works must be planned for and implemented at an early project stage. (If achieving via Route 1: Criterion 6 in LE 03 must be achieved) (If achieving via Route 2: Criterion 8 in LE 03 must be achieved, and at least 1 credit under LE 04 for 'Change and Enhancement of Ecology'.)				N/A	Y	N												
	Planning, Liasion, Data, Monitoring and Review Management and Maintenance	PM/ Ecologist/ Main Contractor	The project team liaising and collaborating with representative stakeholders have (a) monitored and reviewed the implementation of the measures and their effectiveness (b) develop and review management and maintenance solutions, actions or measures. Inclusion of a section on Ecological and Biodiversity as part of the tenant/ building owner information.				1	1	-												
	Landscape and Ecology Management Plan Development	Ecologist	5 year landscape and ecology management plan, must include actions and responsibilities for relevant individuals. To be updated to support maintenance of the ecological value of the site.				1	1	-												
Pollution		Weighting:	0.060			0.00%	7	5	0	4.28	0.00										
Pol 01 Impact of Refrigerants																					
Pre-requisite: All systems comply with BS EN 378:2008 & Institute of Refrigeration Ammonia Refrigeration Systems Code of Practice.							N/A	N	N												
	Impact of Refrigerant	M&E/ Refrigeration Specialist	Refrigerants specified to have DELC of ≤100 CO ₂ -eq/kW. (2 credits), or ≤1000kgCO ₂ -eq/kW (1 credit).				0	-	-												
	Leak Detection	M&E/ Refrigeration Specialist	Requires hermetically sealed systems/benign refrigerants, or a refrigerant leak detection system with automatic isolation and containment.				0	-	-												
Pol 02 Local Air Quality																					
	NOx, PM10 and VOC Emission of Heating Fuels	M&E	Letter/spec/plans confirming heating source/s for space heating and water (e.g. boilers, CHP, POU etc.) Manufacturer's details detailing NOx emissions of installed systems Where relevant - calcs showing NOx conversions. Confirmation of whether the project is in a 'high pollution location' via DEFRA website.				0	-	-												
Pol 03 Flood and Surface Water Management																					
Pre-requisite: Appropriate Consultant Engaged		Flood Risk Consultant	Appropriately qualified consultant is appointed				N/A	y	N												
Flood Resilience		Flood Risk Consultant	Site is in FZ1. Two credits assumed available				2	2	-												
Pre-requisite: Priority Levels are Followed to Create Bespoke Run-Off Solutions		Flood Risk Consultant	Surface water run-off design solutions must be bespoke i.e. must take account of the specific site requirements				N/A	y	N												
Surface Water Run-Off: Rate		Flood Risk Consultant	Report/ letter/ micro drainage results should show that drainage measures are specified so that the peak rate of run-off from the site to the watercourses shows a 30% improvement for the developed site compared with the pre-developed site. This should comply with the 1 year and 100 year return periods. Calculations should include an allowance for climate change. Letter confirming that maintenance agreements for the ownership, long term operation and maintenance of all SUDS solutions are in place.				1	1	-												
Surface Water Run-Off: Volume		Flood Risk Consultant	Confirmation that flooding of property will not occur in the event of local drainage system failure AND drainage calcs for post-development run off volume				1	-	-												
Minimising Watercourse Pollution		Flood Risk Consultant	Confirmation that there will be no discharge from the developed site for rainfall up to 5mm, plus pollution prevention measures				1	-	-												
Pol 04 Reduction of Night Time Light Pollution																					
Reduction of Potential Light Pollution		M&E	External lighting drawings and specification, including confirmation regarding all external lighting switch off/ down level times.				1	1	-												
Pol 05 Reduction of Noise Pollution																					
Reduction of Potential Noise Pollution		Acoustician	Background noise assessment and report by acoustician. Noise to be no more than 5dB below existing background levels				1	1	-												
Innovation		Maximum:	10			0.00%	10	0	0	0	0										
Inn 01	Man 03 - Responsible Construction Practices - Responsible Construction Management	Main Contractor	Letter confirming participation in CCS and targeted exemplary score.				1	-	-												
	Hea 01 - Visual Comfort - Daylighting	M&E/ Main Contractor	Design drawings and daylight calculations showing compliance with exemplary level daylight factors.				1	-	-												
	Hea 06 - Security - Security Rating Scheme	Client/ Architect	Participation in a risk based security rating scheme, performance with the scheme verified by an independent party.				1	-	-												
	Ene 01 - Reduction of Energy Use & Carbon Emissions - Beyond Zero Net Regulated	M&E/ Main Contractor	Copy of design stage .inp file showing building achieves a zero net regulated CO ₂ -eq emissions				3	-	-												
	Ene 01 - Reduction of Energy Use & Carbon Emissions - Post-occupancy Stage	M&E/ Client	Achieve all Ene 02 credits. Client/ occupier commits funds for post occupancy energy modelling, to be submitted to the BRE. Assessor is appointed to report on actual consumption vs predicted.				2	-	-												
	Wat 01 - Water Consumption - Reduction of 65+%	M&E/Architect/Main Contractor	Completed Wat 01 calculator tool and details of flow rates of specified sanitary ware. (Unavaialbe without rainwater harvesting).				0	-	-												
	Mat 01 - Environmental Impacts - Core Building Services Option Appraisal	Architect/ LCA Specialist	Complete building LCA options appraisal of at least 3 significantly different core building services design options.				0	-	-												
	Mat 01 - Environmental Impacts - LCA and LCC Alignment	Architect/ LCA Specialist	Achieve Elemental LCC plan and Component Level LCC options appraisal credits. Include relevant design options in LCCs. Show LCA and LCCs option appraisals have been taken into account in design decisions.				1	-	-												
	Mat 01 - Environmental Impacts - Third Party Verification	Architect/ LCA Specialist	LCA is completed by an independent third party.				1	-	-												
	Mat 03 - Responsible Sourcing of Construction Products - Measuring Responsible Sourcing	Main Contractor	All responsible sourcing credits achieved, plus core building services.				1	-	-												
	Wst 01 - Construction Waste Management - Exceptional Resource Efficiency and Diversion	Main Contractor	Target for non-hazardous construction waste diverted from landfill: non-demolition waste 85% by volume/ 90% tonnage; demolition waste 85% by volume/ 95% tonnage; excavation waste 95% by volume or tonnage.				1	-	-												
	Wst 02 - Use of Recycled and Sustainably Sourced Aggregates - Project Sustainability	Main Contractor	The Project Sustainable Aggregate Points score meets or exceeds the exemplary level performance				1	-	-												
	Wst 05 - Adaptation to Climate Change - Responding to Climate Change	Client	TBC by other credits achieved: Hea 04 thermal comfort criterion 6; Ene 01 6 credits; Ene 04 passive design analysis; Wat 01 3 credits; Mat 05; Pol 03 flood resilience 1 credit, surface water run off 2 credits.				0	-	-												
	LE 02 - Identifying and Understanding the Risks and Opportunities for the Project	Ecologist/ Main Contractor	Ecology report shows wider sustainability benefits have been considered. Hea 07, Pol 03 (surface water run off and minimising water course pollution), and Pol 05 have been achieved.				1	-	-												
	LE 04 - Enhancement of Ecology	Client	Ecological value calculator confirms significant net gain has been achieved.				1	-	-												

FRIAR STREET OVERHEATING STUDY - TM59 Overheating Assessments

Weather File: Swindon_Brize_Norton_DSY1_2020High50_epw

Homes that are predominantly mechanically ventilated because they have either no opportunity or extremely limited opportunities for opening windows/louvers should be assessed for overheating using the fixed temperature method based on CIBSE Guide A (2015a).

Criteria for homes 'predominantly mechanically ventilated'

For homes with restricted window openings, the CIBSE fixed temperature test must be followed, i.e. all occupied rooms should not exceed an operative temperature of 26°C for more than 3% of annual occupied annual hours.

Criteria For Spaces Predominantly 'Mechanically Ventilated'

OPTION-1 WITH SOLID PANEL

LEVEL	APT	Room Name	Annual Occupied Hours	No. of Hours over 26°C p.a	% of hours over 26°C p.a	CIBSE criteria met?
LEVEL 02	APT 03	L02:APT03_1B2P_DOUBLE BEDROOM01	8760	1533	17.50	FAIL
		L02:APT03_1B2P_LIVING/KITCHEN	4745	810	17.07	FAIL
	APT 04	L02:APT04_2B4P_DOUBLE BEDROOM01	8760	2171	24.78	FAIL
		L02:APT04_2B4P_DOUBLE BEDROOM02	8760	1859	21.22	FAIL
		L02:APT04_2B4P_LIVING/KITCHEN	4745	1354	28.54	FAIL

OPTION-2 WITH BRISE SOLEIL

LEVEL	APT	Room Name	Annual Occupied Hours	No. of Hours over 26°C p.a	% of hours over 26°C p.a	CIBSE criteria met?
LEVEL 02	APT 03	L02:APT03_1B2P_DOUBLE BEDROOM01	8760	2158	24.63	FAIL
		L02:APT03_1B2P_LIVING/KITCHEN	4745	1112	23.44	FAIL
	APT 04	L02:APT04_2B4P_DOUBLE BEDROOM01	8760	2837	32.39	FAIL
		L02:APT04_2B4P_DOUBLE BEDROOM02	8760	2939	33.55	FAIL
		L02:APT04_2B4P_LIVING/KITCHEN	4745	1751	36.90	FAIL

OPTION-3 WITH SOLID PANELS AND BRISE SOLEIL

LEVEL	APT	Room Name	Annual Occupied Hours	No. of Hours over 26°C p.a	% of hours over 26°C p.a	CIBSE criteria met?
LEVEL 02	APT 03	L02:APT03_1B2P_DOUBLE BEDROOM01	8760	1490	17.01	FAIL
		L02:APT03_1B2P_LIVING/KITCHEN	4745	774	16.31	FAIL
	APT 04	L02:APT04_2B4P_DOUBLE BEDROOM01	8760	1812	20.68	FAIL
		L02:APT04_2B4P_DOUBLE BEDROOM02	8760	1548	17.67	FAIL
		L02:APT04_2B4P_LIVING/KITCHEN	4745	1023	21.56	FAIL

OPTION-4 WITH ACOUSTIC VENTILATION PANELS AND BRISE SOLEIL + TRIPLE GLAZING

LEVEL	APT	Room Name	Annual Occupied Hours	No. of Hours over 26°C p.a	% of hours over 26°C p.a	CIBSE criteria met?
LEVEL 02	APT 03	L02:APT03_1B2P_DOUBLE BEDROOM01	8760	59	0.67	PASS
		L02:APT03_1B2P_LIVING/KITCHEN	4745	63	1.33	PASS
	APT 04	L02:APT04_2B4P_DOUBLE BEDROOM01	8760	170	1.94	PASS
		L02:APT04_2B4P_DOUBLE BEDROOM02	8760	68	0.78	PASS
		L02:APT04_2B4P_LIVING/KITCHEN	4745	103	2.17	PASS

LEVEL	APT	Room Name	Annual Occupied Hours	No. of Hours over 26°C p.a	% of hours over 26°C p.a	CIBSE criteria met?
LEVEL 06	APT 02	L06:APT02_1B2P_DOUBLE BEDROOM01	8760	695	7.93	FAIL
		L06:APT02_1B2P_LIVING/KITCHEN	4745	563	11.87	FAIL
	APT 03	L06:APT03_2B4P_DOUBLE BEDROOM01	8760	754	8.61	FAIL
		L06:APT03_2B4P_DOUBLE BEDROOM02	8760	895	10.22	FAIL
		L06:APT03_2B4P_LIVING/KITCHEN	4745	608	12.81	FAIL

OPTION-5 WITH ACOUSTIC VENTILATION PANELS AND BRISE SOLEIL + TRIPLE GLAZING + MESH

LEVEL	APT	Room Name	Annual Occupied Hours	No. of Hours over 26°C p.a	% of hours over 26°C p.a	CIBSE criteria met?
LEVEL 02	APT 03	L02:APT03_1B2P_DOUBLE BEDROOM01	8760	59	0.67	PASS
		L02:APT03_1B2P_LIVING/KITCHEN	4745	63	1.33	PASS
	APT 04	L02:APT04_2B4P_DOUBLE BEDROOM01	8760	170	1.94	PASS
		L02:APT04_2B4P_DOUBLE BEDROOM02	8760	68	0.78	PASS
		L02:APT04_2B4P_LIVING/KITCHEN	4745	103	2.17	PASS

LEVEL	APT	Room Name	Annual Occupied Hours	No. of Hours over 26°C p.a	% of hours over 26°C p.a	CIBSE criteria met?
LEVEL 06	APT 02	L06:APT02_1B2P_DOUBLE BEDROOM01	8760	298	3.40	FAIL
		L06:APT02_1B2P_LIVING/KITCHEN	4745	364	7.67	FAIL
	APT 03	L06:APT03_2B4P_DOUBLE BEDROOM01	8760	398	4.54	FAIL
		L06:APT03_2B4P_DOUBLE BEDROOM02	8760	124	1.42	PASS
		L06:APT03_2B4P_LIVING/KITCHEN	4745	217	4.57	FAIL

Criteria For Spaces Predominantly 'Naturally Ventilated'

LEVEL	APT	Room Name	Criteria 1	Criteria 2	TM59 Criteria met ?	Room Name	Criteria 1	TM59 Criteria met ?
LEVEL 09				No. of Hours	% of Hours			
		BEDROOM (DOUBLE OCCUPANCY)				LIVING ROOM AND KITCHEN		
		L09 : DOUBLE BEDROOM 1 APT 03	0.4	7.00	0.21	L09:APT03_3B5P_LIVING/KITCHEN	0.7	PASS
	APT 03	L09 : DOUBLE BEDROOM 2 APT 03	0.5	1.00	0.03			
		L09 : SINGLE BEDROOM 3 APT 03	0.9	1.00	0.03			