

Hexham Rd (The Willows) Redevelopment

Reading, RG2 7UQ

7. ENERGY EFFICIENCY STATEMENT

In Support of Planning Application

Project no: E05076

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7.1 Executive Summary

This Energy Efficiency Statement has been developed to assist the planning application stage to demonstrate how energy will be considered and incorporated as part of the proposed development and to show that the current policies and sustainability requirements set by the Client (Reading Borough Council) have been considered and how these will be met.

The following Assessments and reports show that the planning requirements related to the energy efficiency have been met.

SAP Calculation; this demonstrates that with the incorporation of PV the residential development exceeds a 100% carbon reduction requirement with individual flats achieving 121.57% carbon reduction (on average) over the baseline TER. See Appendix A for further details.

1. **Passivhaus PHPP calculation:** The proposed development at 2 Hexham Road in Reading have been modelling in PHPP and tested against the demanding Passivhaus Classic and Low Energy building standard and it shows that all block meet the requirements of the Passivhaus Classic and Low Energy Building Standards.
See Appendix C for further results.
2. **Part L2A (BRUKL) calculation;** demonstrates the non-residential PMLD Day Care Service achieves 35% carbon reduction. See Appendix B.

Refer also to the Sustainability Report.

7.2 Introduction

Pre-planning consultation with the Planners that the Passivhaus principles exceed the required BREEAM standard and therefore this approach can be considered as acceptable to achieve an improved outcome in terms of sustainability.

“It is agreed by officers that for the proposed mixed-use scheme that designing all the use types to Passivhaus principles, with the residential elements achieving a minimum 35% improvement in the dwelling emission rate, with planning contributions to offset the remaining carbon emission to zero, is acceptable.”

The development aim is to achieve a net zero carbon in operation by adopting Passivhaus principles and introducing the low carbon technologies which include the following:

- Very low U-values of all external elements by introducing high levels of insulation and high-quality triple glazed windows
- minimal thermal bridging
- high levels of air tightness
- mechanical ventilation with heat recovery (MVHR)
- On-site renewable energy generation and storage via photovoltaic panels and battery storage
- Combination exhaust air heat pumps (including heating, hot water and MVHR)

Refer to Appendices A and Band C for further details.

7.3 Proposed Development

The Hexham Road development will be constructed on the site of the former Willows Care Home site on Hexham Road and Northumberland Avenue in Reading.

The new multistorey development will include:

- a day care service for adults with learning disabilities providing social care services (Use Class E(f))
- sheltered housing for over 55s (Use Class C3)
- council housing flats for older people (Use Class C3)

The development will provide access to either private gardens, shared roof terraces or shared courtyard spaces to ensure the physical and mental wellbeing of tenants.

Please refer to architectural and landscape layout drawings which form part of the planning application for more details.

7.4 RBC Planning Policies and Energy Efficiency Requirements and Guidance

7.4.1 Policies Overview

Reading's existing Climate Change Strategy, entitled 'Reading Means Business on Climate Change – Reading's Climate Change Strategy 2013 – 2020' set a target of reducing the Borough's carbon footprint in 2020 by 34% compared with 2005 levels. This aim has been achieved, with CO₂ emissions in the Borough falling by 41% since 2005, within the top 5% of authorities in Great Britain.

Reading Borough Council has declared a Climate Emergency and sets out its commitment to working to achieve a carbon neutral Reading by 2030. However, it recognises that this aim can only be fully achieved with policy changes from local government.

Reading is also a signatory to UK100 'aiming to have 100% clean energy by 2050.

To help increase the use and supply of renewable and low carbon energy, RBC local planning authorities have a positive strategy to promote and maximise use of energy from renewable and low carbon sources, while ensuring that any adverse impacts (including visual impacts) are addressed satisfactorily.

The strategic priorities identified and relevant to planning policy are as follows:

- Energy supply – reduce electricity consumption, develop heat supply networks to deliver low carbon heat in Reading and increase the amount of energy generated locally using renewable technologies;
- Low carbon development – buildings in Reading to be built to high standards of energy efficiency incorporating on-site renewable energy where possible, retrofit energy efficiency measures into Reading's buildings, minimise the 'embodied carbon' incorporated in construction projects and continue to develop planning policies that support the reduction of greenhouse gas emissions directly and indirectly from the Borough and reduce the risks of climate change to the communities of Reading;
- Natural environment – improve the quality and connectivity of natural habitats;

- Water supply and flooding – Manage demand for and supply of water to reduce the expected impact of water shortages on consumers and on wildlife and reduce the risk of damage due to flooding;
- Transport – develop a transport infrastructure which supports more low carbon travel options for people in Reading and encourage non-car travel for all sectors of the population; and
- Purchasing, supply and consumption – reduce waste by supporting the re-use and repair of products and materials.

7.4.2 Energy Efficiency Planning Requirements

Major planning applications like Hexham Road Development are required to provide an Energy statement which demonstrate how the energy related aspects of the proposed development will meet requirements of Policies CC2, CC4 and H5 of the Reading Borough Local Plan (2019):

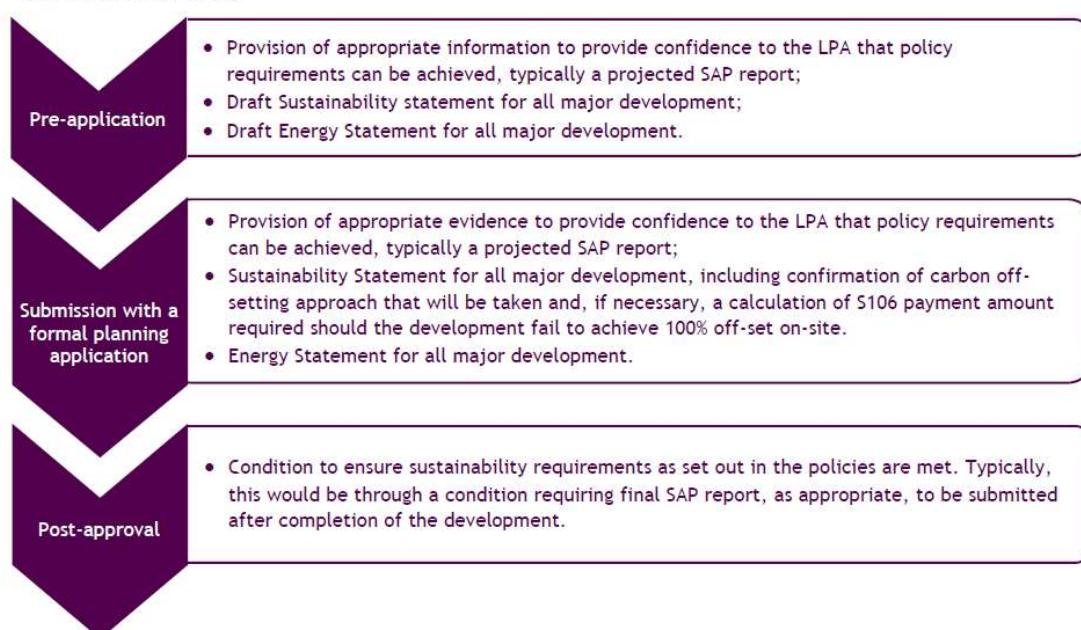
The Local Plan requires BREEAM Excellent standards to be achieved for all non-residential development with the floor area greater than 1000m².

For residential development of ten dwellings or more, the Local Plan requires ‘Zero Carbon’ development, unless it can be clearly demonstrated that this would render a development unviable.

Residential Development

- 3.9 For residential development of ten dwellings or more, the Local Plan requires ‘Zero Carbon’ development, unless it can be clearly demonstrated that this would render a development unviable. Zero carbon homes is an achievable standard that, until recently, was intended to be a national requirement in the Building Regulations. It is required through planning policy for major residential new build development, and the viability of this approach was tested through the Local Plan and was not found to place an unreasonable burden on development. The paragraphs below describe the requirements in more detail.

Table 3.3: Summary of Zero Carbon Homes submission requirements at each stage of the application process



In achieving Zero Carbon Homes for major residential developments, the preference is that new build residential of ten or more dwellings will achieve true carbon neutral development on-site. If this is not achievable, it must achieve a minimum of 35% improvement in regulated emissions over the Target Emissions Rate in the 2013 Building Regulations, plus a Section 106 contribution of £1,800 per remaining tonne towards carbon offsetting within the Borough (calculated as £60/tonne over a 30 year period). £60 per tonne of carbon is a nationally-recognised price of carbon and reflects the amount established by the Zero Carbon Hub¹⁵.

Energy Statements demonstrate how the energy related aspects of the proposed development meets the requirements of local planning policy and energy and emissions standards. An energy statement would typically include the following information:

- Energy efficiency of the building.
- Baseline annual predicted energy demand of the development (regulated and unregulated);
- Baseline annual predicted carbon emissions of the development (regulated and unregulated), the Target Emission Rate (TER);
- The contribution of each proposed renewable energy technology.
- Cost information of technically feasible low or zero carbon renewable technologies, including additional insulation, low carbon de-centralised energy, heat pumps etc;
- Feasibility of district or community heating;
- Summary of the benefits of various energy technologies;
- The total estimated reduction in the development's baseline carbon and/or energy emissions.

Please refer to Appendices A, B and C for details how these have been met.

7.4.2.1 CC2: Sustainable Design and Construction

Requirements:

This policy seeks improved sustainability performance of buildings by setting the requirement that all major non-residential developments or conversions to residential are required to meet the most up-to-date BREEAM 'Excellent' standards, where possible. All minor non-residential developments or conversions to residential must meet the most up-to-date BREEAM 'Very Good' standards as a minimum.

Proposal:

Although the BREEAM is part of the requirements for non-residential part of the development it has been agreed that by following the principles of BREEAM and Passivhaus the full BREEAM assessment will not be required.

During the pre-planning consultation It has been confirmed by the planners that the Passivhaus principles exceed the required BREEAM standard and therefore this approach can be considered as acceptable to achieve an improved outcome in terms of sustainability.

"It is agreed by officers that for the proposed mixed-use scheme that designing all the use types to Passivhaus principles, with the residential elements achieving a minimum 35% improvement in the dwelling emission rate, with planning contributions to offset the remaining carbon emission to zero, is acceptable."

For further details on overall sustainability measures related to Hexham Road development refer to separate Sustainability Report as well as to Appendices A, and B for details how these have been met.

7.4.2.2 CC4: Decentralised Energy

Requirements:

Policy CC4 requires that any development of more than 20 dwellings and/or non-residential development of over 1,000 sq m shall consider the inclusion of decentralised energy provision, within the site, unless it can be demonstrated that the scheme is not suitable, feasible or viable for this form of energy provision. Where there is existing decentralised energy provision present within the vicinity of the application site, further developments of 10 dwellings or more or non-residential development of 1,000 sq m or more will be expected to link into the existing decentralised energy network or demonstrate why this is not feasible.

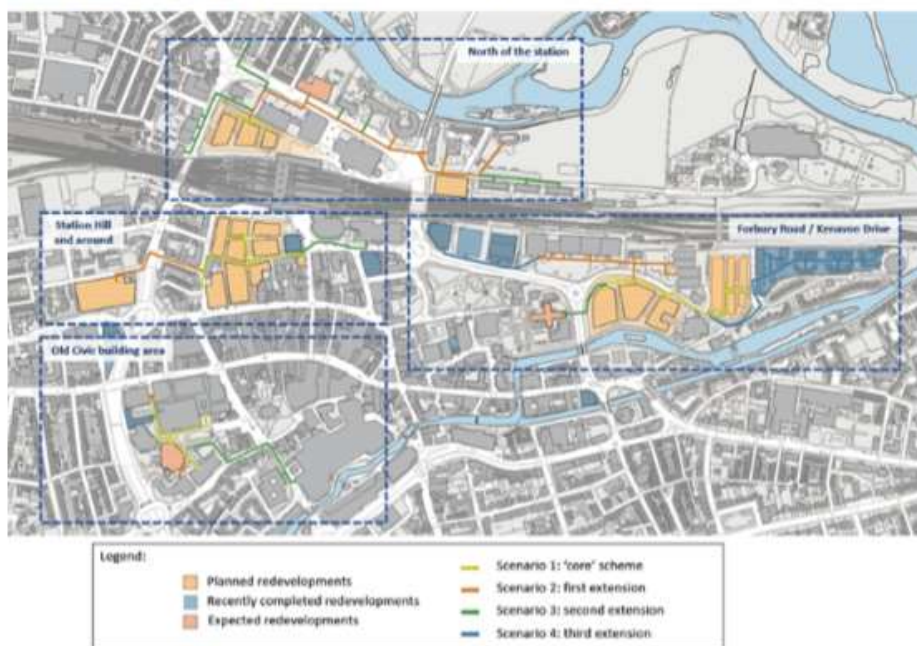
Proposal:

The following technologies have been reviewed and assessed at the feasibility stage:

Biomass boiler – assessed as not viable due to large biomass plant required as well as suitable storage and access for biomass fuel (wood chip/pallets etc.)

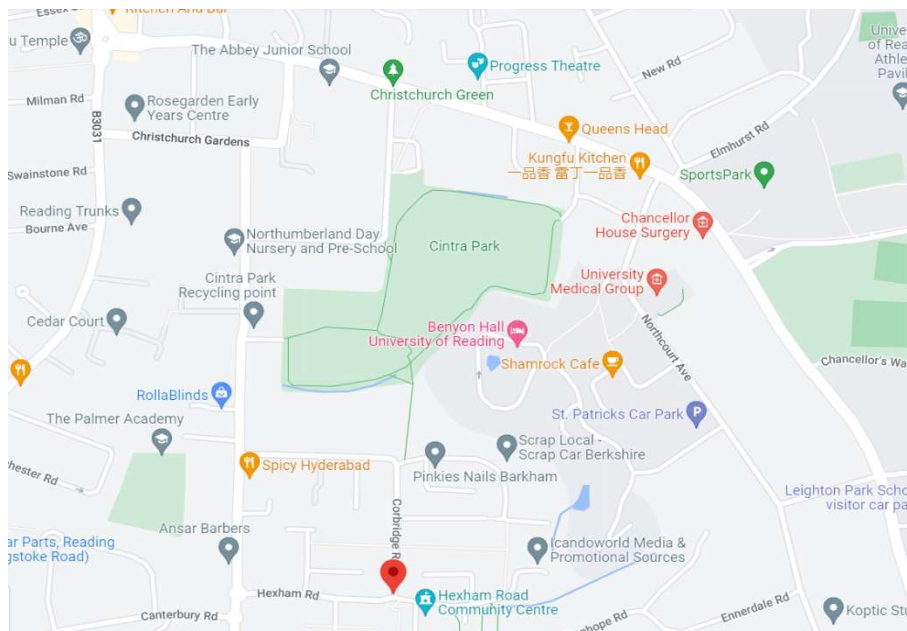
District Heating - not available in close proximity to the new development site and the general requirement is to not to use fossil fuels, so an all-electric approach has been adopted with ASHP and on-site PV panels providing a proportion of the annual energy demand.

Figure 8.1: Overview of the four identified clusters (Element Energy)



Based on the heat mapping and energy master planning study for reading town centre the four clusters highlighted on the above map have been identified as potentially suitable for heat network.

Hexham Road development lays outside of these cluster (approximately 1.2 miles away) and therefore is considered as not viable for connection to a planned Reading district heating network.



Wind Turbine – not suitable for installation in the proximity to site location

Solar thermal – Due to limited roof space and nature of the building and hot water strategy proposed for the building the thermal solar panel has been discounted and PV panels used instead to supplement the individual properties in reducing energy consumption.

PV panels – feasible and extensively used for the development to provide net zero carbon development. The PV panels will be supplemented by storage batteries to store unused electricity rather than sent to the grid.

GSHP (Ground Source Heat Pumps) – the technology has been discounted due to land constraints to accommodate horizontal arrays and proximity to the existing utility services which imposed constraints on works associated with vertical boreholes. An initial assessment of utilising GSHP's was carried out, which for a 80kW output would require in the order of 16No 85m deep boreholes (spaced 6m apart). The site is tight, and it considered the space was not available for these.

GSHP could be considered for the PMLD centre however for the relatively small load available it would be cost prohibitive

ASHP (Air Source Heat Pumps) - The proposed strategy is based on the individual electrically driven high efficiency exhaust heat pumps which will provide heating and hot water to each flat.

The alternative exhaust air source heat pumps have been selected based on the following;

- Very good seasonal efficiency

- Very low heating demands of each property due to improved building fabrics and building air tightness and applying Passivhaus standards.
- Provision of dedicated PV panels and battery storage to enable provision of zero carbon building with the aim of meeting 100% of operational energy via on-site generation. The proposed solution will provide net zero carbon strategy for each individual flat.

Please refer to SAP calculation reports for sample residential properties and BRUKL calculation for the non-residential PMLD Day Service for details of seasonal efficiencies and building carbon emissions of the Hexham Road development.

4.2.1 H5: Standards for New Housing

Requirements:

H5 - Policy H5 requires all major new build residential development to be designed to achieve 'zero carbon homes' as defined in the Sustainable Design and Construction SPD. All other new build housing will achieve at a minimum a 35% improvement on the dwelling emission rate over the target emission rate (TER) as defined in the 2013 Building Regulations.

Proposal:

The SAP calculation and Associated Energy Efficiency Report Appendix A confirms that the new domestic properties will achieve a 100% improvement with proposed centralised PV panels.

The summary Table from the SAP Report (Appendix A) indicates the estimated annual on-site energy generation from the proposed PV panel system will allow to achieve the 100% reduction in CO₂ emission with aim to achieve net zero carbon building.

BLOCK COMPLIANCE Calculation Type: New Build (As Designed)



Property-Assessment Reference	Multiplier	Floor Area (m ²)	DER (kgCO ₂ /m ²)	TER (kgCO ₂ /m ²)	% DER/TER
Flat 1-Flat 1	1	52.78	-5.49	25.54	121.50 %
Flat 2-Flat 2	1	52.78	-5.52	25.45	121.69 %
Flat 3-Flat 3	1	66.52	-2.64	23.35	111.31 %
Flat 6-Flat 6	1	52.78	-5.49	25.54	121.50 %
Flat 5-Flat 5	1	66.52	-2.92	22.03	113.26 %
Flat 4-Flat 4	1	52.78	-5.41	25.94	120.85 %
Flat 7-Flat 7	1	52.78	-5.49	25.54	121.50 %
Flat 8-Flat 8	1	52.78	-6.08	22.72	126.76 %
Flat 9-Flat 9	1	52.78	-6.08	22.67	126.82 %
Flat 11-Flat 11	1	52.78	-6.20	22.69	127.32 %
Flat 10-Flat 10	1	52.78	-6.07	22.67	126.77 %
Flat 12-Flat 12	1	52.78	-6.05	23.70	125.53 %
Flat 13-Flat 13	1	52.78	-6.16	21.59	128.54 %
Flat 14-Flat 14	1	52.78	-6.16	21.59	128.54 %
Flat 15-Flat 15	1	52.78	-6.16	21.59	128.54 %
Flat 16-Flat 16	1	52.78	-6.05	22.90	126.42 %
Flat 17-Flat 17	1	52.78	-5.88	23.54	124.98 %
Flat 18-Flat 18	1	52.78	-5.68	24.50	123.19 %
Flat 20-Flat 20	1	52.78	-4.77	30.01	115.89 %
Flat 19-Flat 19	1	52.78	-5.37	25.78	120.83 %
Flat 21-Flat 21	1	52.78	-4.95	29.41	116.83 %
Flat 22-Flat 22	1	52.78	-6.08	22.72	126.76 %
Flat 23-Flat 23	1	52.78	-5.62	24.75	122.71 %
Flat 24-Flat 24	1	52.78	-6.08	22.67	126.82 %
Flat 25-Flat 25	1	52.78	-6.07	22.67	126.77 %
Flat 26-Flat 26	1	52.78	-6.20	22.69	127.32 %
Flat 27-Flat 27	1	52.78	-6.05	23.70	125.53 %
Flat 28-Flat 28	1	52.78	-6.03	22.90	126.33 %
Flat 29-Flat 29	1	52.78	-6.04	22.90	126.37 %
Flat 30-Flat 30	1	52.78	-6.07	22.67	126.77 %
Flat 31-Flat 31	1	52.78	-6.05	22.90	126.42 %
Flat 32-Flat 32	1	52.78	-4.32	30.43	114.19 %
Flat 33-Flat 33	1	52.78	-4.31	30.38	114.19 %
Flat 34-Flat 34	1	52.78	-4.36	30.43	114.33 %
Flat 35-Flat 35	1	52.78	-4.66	29.47	115.81 %
Flat 36-Flat 36	1	52.78	-4.61	29.41	115.67 %
Flat 37-Flat 37	1	52.78	-5.40	26.74	120.19 %
Flat 38-Flat 38	1	52.78	-5.26	26.74	119.67 %
Flat 39-Flat 39	1	52.78	-5.28	28.01	118.85 %
Flat 40-Flat 40	1	52.78	-5.13	28.55	117.97 %
Flat 41-Flat 41	1	52.78	-5.37	26.74	120.08 %
Flat 42-Flat 42	1	52.78	-5.16	28.55	118.07 %
Totals:	42	2244.24	-228.77	1,054.78	
Average DER = -5.41 kgCO ₂ /m ²		% DER/TER	PASS		
Average TER = 25.08 kgCO ₂ /m ²		121.57 %			

Please refer to Appendices A for further details on how these have been met.

The BRUKL document provided for the PMLD Day Care Service show that the proposed development will achieve the 35% improvement over Part L2A 2021 building regulation. Refer to Appendix B for further details.

APPENDIX A

SAP CALCULATIONS AND ENERGY STRATEGY REPORT





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ENERGY STRATEGY

Hexham Road

REPORT STATUS: 2.0



Document Control Sheet

REPORT STATUS: 2.0

Client	Mace		
Development	Hexham Road		
Report Title:	Low and Zero Carbon Energy Strategy		
Author	Rachael Fleming	Reviewed by	Naomi Sadler
Date	21.02.2023	Version No.	V 2.0
Reason for version	For Approval		

Revision	Date	Description	Prepared by	Checked by
2.0	21.02.2022	Energy Strategy for PP	Rachael Fleming	Naomi Sadler

About Sadler Energy and Environmental Services Ltd.

Our team of technical specialists offer advanced levels of expertise and experience to our clients. We have a wide experience of the construction and development industry from the concept and planning stage through to the completion of the project.

Our emphasis is to provide innovative and cost-effective solutions that respond to increasing demands for energy efficiency, quality, and practical on-site applications.



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1. Summary

Energy strategy for submission to Reading Borough Council, for a day-centre for adults with learning difficulties, as well as sheltered and general needs accommodation, at 5 Hexham Road, Reading, RG2 7UQ. Project includes day centre, sheltered, general and supported living apartments, comprising 42 units.

Reading Local Plan states that large-build projects (10 or more dwellings) must aim for zero carbon development or at least 35% reduction on carbon emissions (measured in tonnes of CO₂ per year), meaning DER (dwelling emission rate) must be at least 35% less than TER (target emission rate) as modelled in SAP software. The project is designed to Passivhaus standards and so has low carbon emissions. This property has potential to reach carbon-zero or even “plus energy”.

Energy strategy includes use of MVHR, multi-split heating with air source heat pumps, along with PV apportioned from communal PV on roof. Baseline energy ratings and carbon emissions, as well as target ratings and emissions are calculated using SAP 2012 and designbuilder V7.

2. Information and Background

This Energy Strategy has been produced to identify the measures and technologies necessary to exceed the requirements of Reading Borough Council as well as ensure the homes meet the need to reduce reliance on fossil fuels, while reducing carbon emissions arising from new developments, to slow the rate of climate change the measures and technologies necessary to exceed the carbon emission requirements of the Reading Borough Council Local Plan.

The property comprises forty-two one-bedroom flats; two with an area of 66.52 square meters, and the rest having a floor area of 56 square meters. The site is located at 5 Hexham Road, Reading, RG2 7UQ, and is oriented to the North. The previous property at this address, Willows Care Home, has been demolished.

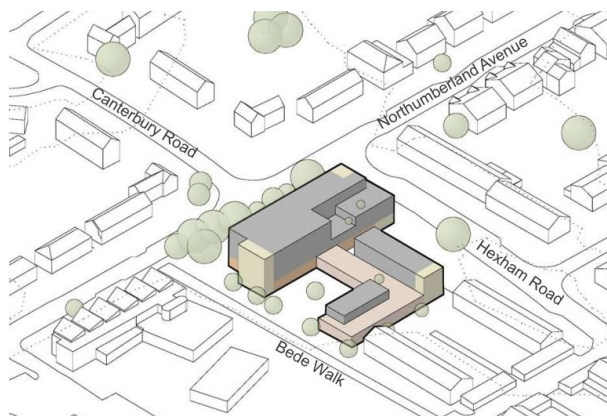


Figure 1 Figure 1 Site layout of the site at Hexham Road

The ground floor includes six flats, day-care services, shared services, storage areas and various activity



rooms. The building has 4 floors total, with garden areas and solar PV on the roof. This building contains commercial and non-commercial spaces and so this report demonstrates compliance with Building Regulations Part L1 and L2, using SAP10 calculations for dwellings.

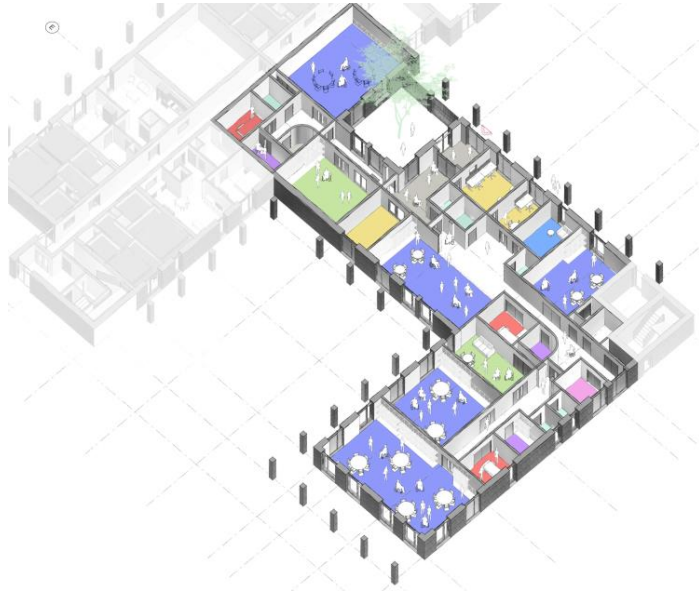


Figure 2 Figure 2 Ground floor of Hexham Road showing non-domestic space

Total dwelling floor area: 2219.68 m2.

Non-dwelling area: 1232.93 m2

This dwelling in project has the potential to exceed the Reading 35% carbon reduction target, using air source heat pumps and solar photovoltaic panels to achieve net-zero dwelling emission rates when modelled in SAP2012 against a notional dwelling.

2.1 Planning targets

The Reading Borough Council Local Plan was adopted in November 2019 and sets measures to respond to the declared climate emergency. A supporting Sustainable Design and Construction SPD was subsequently adopted in December 2019. Policy H5 details the required standard for new housing, as detailed below.

H5: STANDARDS FOR NEW HOUSING

New build housing should be built to the following standards, unless it can be clearly demonstrated that this would render a development unviable:

- a. All new build housing outside the Central Area as defined on the Proposals Map will comply with the nationally-described space standard.*
- b. All new build housing will be built to the higher water efficiency standard under Regulation 36(3) of the Building Regulations79.*
- c. All major new-build residential development should be designed to achieve zero carbon homes.*
- d. All other new build housing will achieve at a minimum a 19% improvement in the dwelling emission rate over the target emission rate, as defined in the 2013 Building f. On developments of 20 or more new build dwellings, at least 5% of dwellings will be wheelchair user dwellings in*



line with M4(3) of the Building Regulations. Any market homes provided to meet this requirement will be 'wheelchair adaptable' as defined in part M, whilst homes where the Council is responsible for allocating or nominating an individual may be 'wheelchair accessible'.

Reading Local Plan 2019, General Policies, section 4.4.46 further states,

"where homes are not designed to be carbon neutral, this will mean as a minimum a 35% improvement in the dwelling emission rate over the 2013 Building Regulations."

This report will demonstrate workings towards Reading's zero-carbon ambition and 35% reduction on TER in SAP 2012 calculations, with aim to achieve zero-carbon. This development should achieve zero carbon onsite, however the absolute minimum of 35% carbon reduction over the minimum building fabric targets set out in the Building Regulations Part L (2021) must be achieved. The Energy Strategy will demonstrate how to meet the 0% carbon dioxide emissions target in line with the Local Plan.

SAP2012 calculations will be used to measure carbon emission reduction and building fabric efficiency as currently designed, as well as model options for low zero carbon technology.

2.2 Key Policy Targets

Key policy targets are summarized below:

-  To provide a water usage rate of under 110 Litres per person per day
-  Achieve a minimum of 35% improvement in regulated emissions over the Target Emissions Rate in the 2013 Building Regulations.

The buildings have also been designed to Passivhaus standard, with the latest Passivhaus design report carried out in January 2023.

3. Energy Efficiency – Demand Reduction

The developer aims to provide homes with as close to zero carbon emissions resulting from regulated energy usage (heating, hot water, ventilation and lighting) as possible. This is achieved by applying the energy hierarchy detailed below.

3.1 Methodology

This report uses the energy hierarchy to minimise onsite carbon emissions, the stages are:

-  Use Renewable Energy – assess the feasibility of renewable energy systems
-  Supply Energy Efficiently – Use low-carbon technology to significantly reduce energy consumption
-  Use less Energy – the incorporation of low energy design and passive measures to promise the reduction of energy use



3.2 Building Energy Modelling

Indicative calculations have been carried out using SAP2012, which calculates a range of metrics used for Building Regulations compliance, based on the predicted annual energy use per square metre of a floor area for a dwelling. The metrics used in this report are:

- ✈ Dwelling Emissions Rate (DER): the predicted carbon dioxide emissions based on the fuels used to eat, light, cool and ventilate a dwelling, expressed in $\text{kg}/\text{CO}_2/\text{m}^2/\text{yr}$.
- ✈ Dwelling Fabric Energy Efficiency: the predicted energy used to heat and cool a dwelling expressed in $\text{kWh}/\text{m}^2/\text{yr}$.

For each metric a “target” is calculated by SAP2012 based on a notional dwelling specification set in the Building Regulations. The dwelling energy metrics must be lower than these targets to achieve Building regulation Part L compliance. Each energy strategy option will be modelled in SAP and produce:

- ✈ Dwelling emission rates (DER) for both properties vs target emission rates (TER) in $\text{kgCO}_2/\text{m}^2/\text{yr}$.
- ✈ Dwelling fabric energy efficiency (DFEE) for both properties vs target dwelling fabric energy efficiency(TFEE), measured in $\text{kWh}/\text{m}^2/\text{yr}$.

TER is considered the baseline emissions for the buildings in this energy strategy report.



4. Energy Efficiency - Measures

In this chapter we have detailed the most effective energy efficient measures to achieve a fabric efficient and low carbon dwelling. A fabric-first approach is used to minimize energy demand as much as practical. Energy efficiency features include built form and insulation standards (thermal envelope and glazing); thermal bridging; air permeability; ventilation; lighting and controls; appliances; water use; heating and hot water systems.

4.1 Thermal Envelope

The built elements of this property achieve u-values that meet the Building Regulations (BR) 2021 Part L standards. Table 1 summarizes the design u-values of the thermal envelope as well as the limiting values in BR and the percentage improvement.

Thermal Element	BR U-value (Part L 2013) W/m ² K	Design u-values W/m ² K
Ground Floor	0.18	0.09
External Cavity wall	0.26	0.11
Block cavity wall to corridor	0.26	0.00
Flat Roof	0.16	0.09
External Doors	1.60	0.85
Windows & Glazed Doors	1.20	0.85

Table 1 - Proposed Fabric Standard

It should be noted that this development will feature heated corridors and so the walls to corridors will act as party walls.

4.2 Thermal Bridging

Thermal bridging occurs at the junction between fabric elements, where the continuous insulation line is broken. The quantity which describes the heat loss associated with a thermal bridge is its linear thermal transmittance, Ψ . This is a property of a thermal bridge and is the rate of heat flow per degree per unit length of the bridge, that is not accounted for in the U-values of the plane building elements containing the thermal bridge.

Through careful detailing of junctions, and approved schemes, it is possible to mitigate the impact of thermal bridges. This property aims for minimal thermal bridging, with Psi values for both houses well below the default values as calculated by BRE Group, see Table 2. Calculated thermal bridging values will be achieved through established construction details, so that the building fabric should be continuous over the whole building envelope and constructed so that there are no reasonably avoidable thermal bridges in the insulation layers caused by gaps in the various elements.



Thermal bridge	Psi value (W/m ² K)	BRE Default Psi Value
E2 lintels	0.234	1.000
E3 sill	0.014	0.080
E4 Jamb	0.022	0.100
E5 Ground floor	0.073	0.320
E6 Intermediate floor within dwelling	0.010	0.140
E15 Flat roof with parapet	0.100	0.560
E16 Corner	0.050	0.180

Table 2 - Thermal bridging values

4.3 Air Permeability

As buildings become more insulated, uncontrolled air leakage represents an increasing proportion of dwelling heat loss. As such, it is necessary to ensure that any unwanted leakage is minimized. These properties will ensure air permeability rate of 0.6m³/hm²@50Pa.

4.4 Mechanical Ventilation Heat Recovery

With this level of airtightness, additional controlled ventilation is required to provide fresh air and to remove stale, moist air. The dwellings will be mechanically ventilated with heat recovery (MVHR), via (PKOM4) compact units located within each dwelling.

The Pichler PKOM4 heat pump combination unit is a Passivhaus certified ventilation unit which not only provides ventilation, heating, and cooling of low-energy houses, but also warm water treatment. For the Adult Day Care Centre, ventilation will be provided by a series of Passivhaus-certified MVHR units. The MVHR will extract warm moist air from kitchens and bathrooms and supplies fresh air to bedrooms and living rooms via a balanced system. Purge ventilation can be provided by the system when operating in 'boost' mode.

To assist in the management of overheating risk, the MVHR units will have a summer bypass mode, which switches off heat recovery when temperatures outside increase. Thorough commissioning of the MVHR units is part of the quality assurance process, to ensure the units are operating with the correct flow rates for each room. MVHR units do require additional maintenance with filters needing to be replaced annually. Units to be located as close to an outside wall as possible to maintain efficiency with rigid ducting to reduce friction and noise, plus sound attenuators between rooms.

4.5



4.6 Lighting

Low energy fittings are defined as fittings that can only be used with lamps having a luminous efficacy greater than 105 lumens per circuit watt. All buildings will have 100% low energy lights fitted internally. Externally, property will have low energy light fitting with light and motion sensors.

4.7 Appliances

Where supplied, any white goods will achieve the following ratings (or better) under the EU Energy Efficiency Labelling Scheme: fridges, fridge-freezers: A+ rating; washing machines: A++ rating; dishwashers: A+ rating; washer-dryers: A rating; tumble-dryers: A rating. When possible, external drying lines will be included to reduce the need for tumble dryers.

4.8 Water Efficiency

Dwellings will achieve a minimum water efficiency standard of 105 Litres/person/day. The water fittings and maximum consumption rates are summarized in Table 3 below.

Water Fitting	Maximum Consumption
WC	4/2.6 Litres (L) dual flush
Shower	8 L/min
Bath	170 L
Basin Taps	5 L/min
Sink Taps	6 L/min
Dishwasher	1.25 L/place setting
Washing Machine	8.17 L/kilogram dry load

Table 3 - (Part G2 Table 2.2) Maximum fittings & consumption rates



4.9 Primary Heating

Space heating and hot water will both be provided by an energy efficient air source heat pump. The PKOM heat pump combi provides ventilation, heating, cooling and hot water. living rooms will constantly ensure fresh and filtered out-side air in the rooms and ensure hygienic exchange of air. The highly efficient heat recovery system is also optionally available as a design with recovery of waste air humidity. To prevent overly high summer temperatures in the living rooms, heat recovery may also be bypassed during cooler night hours by means of a bypass flap.

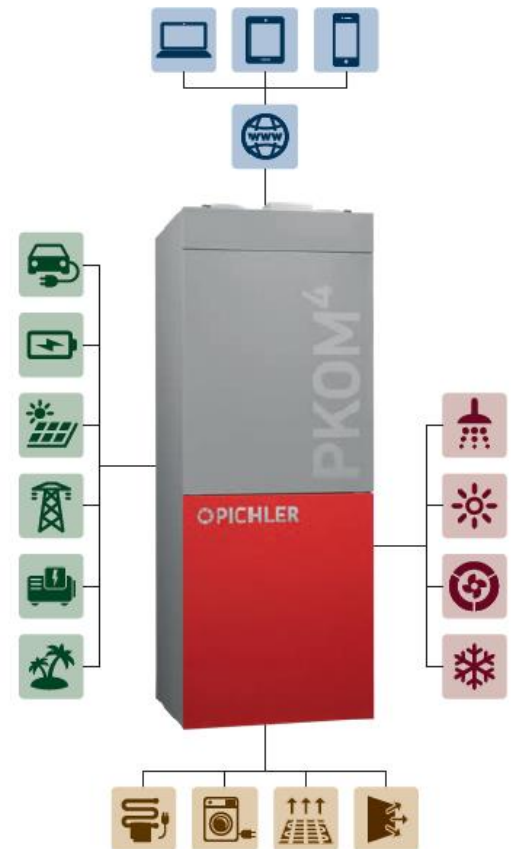
Pichler PKOM4 are excellent air to air heat pumps that provide heating and hot water while saving on space. The outdoor and work at temperatures as low as -25°C. The indoor integrated unit comes with a 212L water tank and a small installation footprint. Heating may be supplied by radiators, underfloor or fancoils.

Pros:

- ✎ Reduce energy demand and carbon emissions
- ✎ Touch screen and app
- ✎ Space saving (<0.75m²)
- ✎ Low running cost
- ✎ Significantly lower emissions when calculated using updated SAP 10.1 emissions factors

Cons:

- ✎ Higher capital costs
- ✎ Maintenance



4.10 Renewables

This property will install solar PV on the roof, as it conveniently faces south with little to no shading. Ample roof space allows for plenty of communal areas as well as space for solar panels. The developer has consulted with a project assessment with a local solar PV company and estimated that the development can apportion 2.5kWp per flat based on an even split between communal PV.



5. Supply Energy Efficiently

In recent years, the electricity grid has undergone de-carbonization with coal power stations decommissioned and electricity generation moving to cleaner fuel sources and renewable energy such as wind and solar. This project has been designed in accordance with SAP10 regulations and so includes energy efficient MVHR, and an air source heat pump to provide heating and hot water, all powered by electricity.

6. Options for Low and Zero Carbon (LZC) Dwellings

This energy strategy investigates the best options for low and zero carbon dwellings. A baseline emission and energy efficiency rate is modelled as the target emission rate (TER) and target fabric energy efficiency (TFEE) that is achieved when the properties are modelled as notional buildings, without any installed renewable energy sources such as wind turbine or solar PV.

The heating and hot water for this property will combine air source heat pumps with PV panels, apportioned to achieve carbon-zero.

6.2 Dwelling Energy Demand and Emissions

The table below shows the block compliance for this development. The full SAP calculations are submitted with this report and demonstrate a full breakdown of each flat.

	BASELINE TFEE Energy Demand (kWh/m²/year)	Predicted Energy Demand DFEE (kWh/ m²/year)	Energy Demand Reduction (%)	
Block Compliance	34.93	20.13	42.37	
	BASELINE TER Emissions (tonnes.CO₂/year)	Predicted CO₂ Emissions DER (tonnes.CO₂/year)	CO₂ Emissions Reduction (%)	SAP Rating
Block Compliance	25.08	-5.41	121.57	94A

The results table shows that through using the air source heat pump, as well as PV, the dwellings in this project will achieve on average **121.57% carbon reduction on the baseline TER** and so would meet the zero carbon target. The energy demand per square meter due to fabric efficiency would yield **42.37% reduction on baseline target fabric energy efficiency**.



7. Conclusion

The objective of this energy strategy is to demonstrate compliance with Reading Borough Council reduction ambitions, which specifies at least 35% reduction on TER in SAP2012 calculations, and zero carbon for large developments. These properties follow a fabric-first, energy efficient design, with a focus on low carbon and renewable energy for use in hot water and heating, as well as generous renewables, and exceeds net zero carbon emission targets.

The developer is proposing to install a Pichler PKOM4 air source heat pump with integrated domestic hot water tank, plus 2.5kWp apportioned solar PV per flat





BLOCK COMPLIANCE

Calculation Type: New Build (As Designed)

Block Reference	Hexham Apartments	Issued on Date	21/02/2023
Block Name	Flats 1-42		
Assessor Details	Mrs. Rachael Fleming, Rachael Fleming, Tel: 07731 625 776, rachael.fleming@sees.co.uk		Assessor ID AP48-0001
Client	MACE, 1459 Hexham		

Block Compliance Report - DER

Block Reference: Hexham Apartments	Block Name: Flats 1-42
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BLOCK COMPLIANCE

Calculation Type: New Build (As Designed)

Property-Assessment Reference	Multiplier	Floor Area (m ²)	DER (kgCO ₂ /m ²)	TER (kgCO ₂ /m ²)	% DER/TER
Flat 1-001	1	52.78	-5.49	25.54	121.50 %
Flat 2-Flat 2	1	52.78	-5.52	25.45	121.69 %
Flat 3-Flat 3	1	66.52	-2.64	23.35	111.31 %
Flat 6-Flat 6	1	52.78	-5.49	25.54	121.50 %
Flat 5-Flat 5	1	66.52	-2.92	22.03	113.26 %
Flat 4-Flat 4	1	52.78	-5.41	25.94	120.85 %
Flat 7-Flat 7	1	52.78	-5.49	25.54	121.50 %
Flat 8-Flat 8	1	52.78	-6.08	22.72	126.76 %
Flat 9-Flat 9	1	52.78	-6.08	22.67	126.82 %
Flat 11-Flat 11	1	52.78	-6.20	22.69	127.32 %
Flat 10-Flat 10	1	52.78	-6.07	22.67	126.77 %
Flat 12-Flat 12	1	52.78	-6.05	23.70	125.53 %
Flat 13-Flat 13	1	52.78	-6.16	21.59	128.54 %
Flat 14-Flat 14	1	52.78	-6.16	21.59	128.54 %
Flat 15-Flat 15	1	52.78	-6.16	21.59	128.54 %
Flat 16-Flat 16	1	52.78	-6.05	22.90	126.42 %
Flat 17-Flat 17	1	52.78	-5.88	23.54	124.98 %
Flat 18-Flat 18	1	52.78	-5.68	24.50	123.19 %
Flat 20-Flat 20	1	52.78	-4.77	30.01	115.89 %
Flat 19-Flat 19	1	52.78	-5.37	25.78	120.83 %
Flat 21-Flat 21	1	52.78	-4.95	29.41	116.83 %
Flat 22-Flat 22	1	52.78	-6.08	22.72	126.76 %
Flat 23-Flat 23	1	52.78	-5.62	24.75	122.71 %
Flat 24-Flat 24	1	52.78	-6.08	22.67	126.82 %
Flat 25-Flat 25	1	52.78	-6.07	22.67	126.77 %
Flat 26-Flat 26	1	52.78	-6.20	22.69	127.32 %
Flat 27-Flat 27	1	52.78	-6.05	23.70	125.53 %
Flat 28-Flat 28	1	52.78	-6.03	22.90	126.33 %
Flat 29-Flat 29	1	52.78	-6.04	22.90	126.37 %
Flat 30-Flat 30	1	52.78	-6.07	22.67	126.77 %
Flat 31-Flat 31	1	52.78	-6.05	22.90	126.42 %
Flat 32-Flat 32	1	52.78	-4.32	30.43	114.19 %
Flat 33-Flat 33	1	52.78	-4.31	30.38	114.19 %
Flat 34-Flat 34	1	52.78	-4.36	30.43	114.33 %
Flat 35-Flat 35	1	52.78	-4.66	29.47	115.81 %
Flat 36-Flat 36	1	52.78	-4.61	29.41	115.67 %
Flat 37-Flat 37	1	52.78	-5.40	26.74	120.19 %
Flat 38-Flat 38	1	52.78	-5.26	26.74	119.67 %
Flat 39-Flat 39	1	52.78	-5.28	28.01	118.85 %
Flat 40-Flat 40	1	52.78	-5.13	28.55	117.97 %
Flat 41-Flat 41	1	52.78	-5.37	26.74	120.08 %
Flat 42-Flat 42	1	52.78	-5.16	28.55	118.07 %
Totals:	42	2244.24	-228.77	1,054.78	
Average DER = -5.41 kgCO ₂ /m ²		% DER/TER	PASS		
Average TER = 25.08 kgCO ₂ /m ²		121.57 %			

BLOCK COMPLIANCE

Calculation Type: New Build (As Designed)

Block Compliance Report - DFEE

Block Reference: Hexham Apartments

Block Name: Flats 1-42

BLOCK COMPLIANCE

Calculation Type: New Build (As Designed)

Property-Assessment Reference	Multiplier	Floor Area (m²)	DFEE (kWh/m²/yr)	TFEE (kWh/m²/yr)	% DFEE/TFEE
Flat 1-Flat 1	1	52.78	21.22	36.17	41.34 %
Flat 2-Flat 2	1	52.78	21.04	35.86	41.34 %
Flat 3-Flat 3	1	66.52	20.73	35.18	41.08 %
Flat 6-Flat 6	1	52.78	21.22	36.17	41.34 %
Flat 5-Flat 5	1	66.52	18.94	30.75	38.41 %
Flat 4-Flat 4	1	52.78	21.67	37.55	42.30 %
Flat 7-Flat 7	1	52.78	21.22	36.17	41.34 %
Flat 8-Flat 8	1	52.78	16.37	26.42	38.06 %
Flat 9-Flat 9	1	52.78	16.41	26.24	37.46 %
Flat 11-Flat 11	1	52.78	17.45	27.51	36.58 %
Flat 10-Flat 10	1	52.78	16.58	26.24	36.81 %
Flat 12-Flat 12	1	52.78	19.43	31.20	37.73 %
Flat 13-Flat 13	1	52.78	14.79	20.36	27.36 %
Flat 14-Flat 14	1	52.78	14.79	20.36	27.36 %
Flat 15-Flat 15	1	52.78	14.79	20.36	27.36 %
Flat 16-Flat 16	1	52.78	16.89	27.06	37.59 %
Flat 17-Flat 17	1	52.78	19.12	29.18	34.45 %
Flat 18-Flat 18	1	52.78	20.55	32.48	36.74 %
Flat 20-Flat 20	1	52.78	24.72	51.34	51.85 %
Flat 19-Flat 19	1	52.78	22.35	36.86	39.37 %
Flat 21-Flat 21	1	52.78	24.58	50.44	51.26 %
Flat 22-Flat 22	1	52.78	16.37	26.42	38.06 %
Flat 23-Flat 23	1	52.78	20.45	33.47	38.89 %
Flat 24-Flat 24	1	52.78	16.41	26.24	37.46 %
Flat 25-Flat 25	1	52.78	16.58	26.24	36.81 %
Flat 26-Flat 26	1	52.78	17.45	27.51	36.58 %
Flat 27-Flat 27	1	52.78	19.43	31.20	37.73 %
Flat 28-Flat 28	1	52.78	17.04	27.06	37.03 %
Flat 29-Flat 29	1	52.78	17.00	27.06	37.19 %
Flat 30-Flat 30	1	52.78	16.58	26.24	36.81 %
Flat 31-Flat 31	1	52.78	16.89	27.06	37.59 %
Flat 32-Flat 32	1	52.78	26.93	52.64	48.83 %
Flat 33-Flat 33	1	52.78	26.98	52.45	48.56 %
Flat 34-Flat 34	1	52.78	26.77	52.64	49.14 %
Flat 35-Flat 35	1	52.78	25.22	49.49	49.04 %
Flat 36-Flat 36	1	52.78	25.43	49.30	48.43 %
Flat 37-Flat 37	1	52.78	21.75	40.28	45.99 %
Flat 38-Flat 38	1	52.78	22.48	40.28	44.19 %
Flat 39-Flat 39	1	52.78	23.07	45.70	49.52 %
Flat 40-Flat 40	1	52.78	23.10	46.39	50.20 %
Flat 41-Flat 41	1	52.78	21.91	40.28	45.61 %
Flat 42-Flat 42	1	52.78	22.95	46.39	50.54 %
Totals:	42	2244.24	845.62	1,468.25	
Average DFEE = 20.13 kWh/m²/yr		% DFEE/TFEE	PASS		
Average TFEE = 34.93 kWh/m²/yr		42.37 %			



Project name

Hexham Road

As designed

Date: Tue Feb 21 21:54:47 2023

Administrative information

Building Details

Address: Hexham Road, Reading, RG2 7UQ

Certifier details

Name: Rachael Fleming

Telephone number:

Address: , ,

Certification tool

Calculation engine: SBEM

Calculation engine version: v6.1.d.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v7.1.3

BRUKL compliance module version: v6.1.d.0

Foundation area [m²]: 318.32The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m ² annum	1.88
Building CO ₂ emission rate (BER), kgCO ₂ /m ² annum	1.17
Target primary energy rate (TPER), kWh/m ² annum	19.9
Building primary energy rate (BPER), kWh/m ² annum	12.39
Do the building's emission and primary energy rates exceed the targets?	BER =< TER BPER =< TPER

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

Fabric element	U _{a-Limit}	U _{a-Calc}	U _{i-Calc}	First surface with maximum value
Walls*	0.26	0.17	0.35	Ground floor - Accomodation Entry_P_10
Floors	0.18	0.12	0.12	Ground floor - Accomodation Entry_S_3
Pitched roofs	0.16	-	-	No heat loss pitched roofs
Flat roofs	0.18	0.1	0.1	Ground floor - Accomodation Entry_R_4
Windows** and roof windows	1.6	0.85	0.85	Ground floor - Accomodation Entry_G_9
Rooflights***	2.2	-	-	No external rooflights
Personnel doors^	1.6	-	-	No external personnel doors
Vehicle access & similar large doors	1.3	-	-	No external vehicle access doors
High usage entrance doors	3	-	-	No external high usage entrance doors

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

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

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

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

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

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

Air permeability	Limiting standard	This building
m ³ /(h.m ²) at 50 Pa	8	1

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	0.9 to 0.95

1- Mitsubishi PURY-P450YLM-A1

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.75	2	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

1- Instantaneous

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	0.028
Standard value	1	N/A

Zone-level mechanical ventilation, exhaust, and terminal units

ID	System type in the Approved Documents
A	Local supply or extract ventilation units
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 balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter
NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.	

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	2.3	2	0.5	0.5	0.4	1		
Ground floor - NW Stairwell		-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Bin Store		-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Lift		-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Scooter Store		-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - ELE Intake		-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - NE Stairwell		-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - SW Stairwell		-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Plant Room		-	-	-	-	0.4	-	-	-	-	0.95	N/A
FF NE STAIRWELL - Zone 1		-	-	-	-	0.4	-	-	-	-	0.95	N/A
FF - NW Stairwell		-	-	-	-	0.4	-	-	-	-	0.95	N/A
FF - South stairwell		-	-	-	-	0.4	-	-	-	-	0.95	N/A
SF NE STAIRWELL - Zone 1		-	-	-	-	0.4	-	-	-	-	0.95	N/A
TF South stairwell - Stairwell		-	-	-	-	0.4	-	-	-	-	0.95	N/A
SF Riser - Zone 1		-	-	-	-	0.4	-	-	-	-	0.95	N/A

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	2.3	2	0.5	0.5	0.4	1		
SF NW Stairwell - Stairwell	-	-	-	-	0.4	-	-	-	-	0.95	N/A
SF SOUTH stairwell - Stairwell	-	-	-	-	0.4	-	-	-	-	0.95	N/A
TF NW Stairwell - Zone 1	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Accomodation Entry	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Residential Corridor	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - General Need Entrance	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Multifunction	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Corridor and Waiting Room	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Reception	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Office	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Quiet Room	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Multifunction 1	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Acc WC	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Laundry	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Medical	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Art Room and Corridor	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Study	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Assisted WC 1	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Tea Room	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Assisted WC	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Dark Room	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - East residential corridor	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Store Room 1	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Sensory Room	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Acc WC 1	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Life Skills	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Assisted WC 2	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Store Room	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Acc WC 5	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - IT Comms	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Acc WC 4	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Acc WC 3	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Lobby	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Acc WC 2	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Large Multifunction	-	-	-	-	0.4	-	-	-	-	0.95	N/A
FF - FF Corridor	-	-	-	-	0.4	-	-	-	-	0.95	N/A
FF - Acc WC	-	-	-	-	0.4	-	-	-	-	0.95	N/A
FF - Community Room	-	-	-	-	0.4	-	-	-	-	0.95	N/A
TF Riser - Zone 1	-	-	-	-	0.4	-	-	-	-	0.95	N/A
TF South stairwell - Corridor	-	-	-	-	0.4	-	-	-	-	0.95	N/A
SF NW Stairwell - Corridor	-	-	-	-	0.4	-	-	-	-	0.95	N/A
SF SOUTH stairwell - Corridor	-	-	-	-	0.4	-	-	-	-	0.95	N/A

"LENI calculation for lighting energy provided in a separate submission."

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

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
FF - NW Stairwell	NO (-58.8%)	YES
FF - South stairwell	NO (-53.9%)	YES
Ground floor - Accomodation Entry	NO (-43.7%)	YES
Ground floor - Residential Corridor	YES (+45.7%)	YES
Ground floor - General Need Entrance	NO (-0.7%)	YES
Ground floor - Multifunction	NO (-28.3%)	YES
Ground floor - Corridor and Waiting Room	NO (-25.7%)	YES
Ground floor - Reception	NO (-69.8%)	YES
Ground floor - Office	NO (-53.9%)	YES
Ground floor - Quiet Room	NO (-63.3%)	YES
Ground floor - Multifunction 1	NO (-56%)	YES
Ground floor - Acc WC	N/A	N/A
Ground floor - Laundry	N/A	N/A
Ground floor - Medical	N/A	N/A
Ground floor - Art Room and Corridor	NO (-12.9%)	YES
Ground floor - Study	NO (-15.3%)	YES
Ground floor - Assisted WC 1	N/A	N/A
Ground floor - Tea Room	NO (-93.5%)	YES
Ground floor - Assisted WC	N/A	N/A
Ground floor - Dark Room	N/A	N/A
Ground floor - East residential corridor	N/A	N/A
Ground floor - Store Room 1	N/A	N/A
Ground floor - Sensory Room	NO (-10.5%)	YES
Ground floor - Acc WC 1	NO (-19.6%)	YES
Ground floor - Life Skills	NO (-4.8%)	YES
Ground floor - Assisted WC 2	NO (-61.3%)	YES
Ground floor - Store Room	N/A	N/A
Ground floor - Acc WC 5	NO (-20.7%)	YES
Ground floor - IT Comms	N/A	N/A
Ground floor - Acc WC 4	N/A	N/A
Ground floor - Acc WC 3	N/A	N/A
Ground floor - Lobby	NO (-16.1%)	YES
Ground floor - Acc WC 2	N/A	N/A
Ground floor - Large Multifunction	NO (-14.3%)	YES
FF - FF Corridor	NO (-22.1%)	YES
FF - Acc WC	N/A	N/A
FF - Community Room	NO (-17.9%)	YES
TF Riser - Zone 1	NO (-44.6%)	YES
TF South stairwell - Corridor	YES (+31%)	YES
SF NW Stairwell - Corridor	NO (-16.3%)	YES
SF SOUTH stairwell - Corridor	NO (-18.2%)	YES

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m ²]	1986.1	1986.1
External area [m ²]	4563.7	4563.7
Weather	SWI	SWI
Infiltration [m ³ /hm ² @ 50Pa]	1	3
Average conductance [W/K]	826.76	1399.59
Average U-value [W/m ² K]	0.18	0.31
Alpha value* [%]	36.43	23.74

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

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
8	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
92	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger Terminals
	Others: Emergency Services
	Others: Miscellaneous 24hr Activities
	Others: Car Parks 24 hrs
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	1.1	4.99
Cooling	3.66	1.37
Auxiliary	1.68	2.51
Lighting	4.99	5.58
Hot water	4.82	1.75
Equipment*	20.54	20.54
TOTAL **	16.26	16.21

* 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	8.07	2.88
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
<i>Displaced electricity</i>	<i>8.07</i>	<i>2.88</i>

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	101.64	150.85
Primary energy [kWh/m ²]	12.39	19.9
Total emissions [kg/m ²]	1.17	1.88

HVAC Systems Performance										
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] No Heating or Cooling										
	Actual	48.7	138.9	0	0	1.6	0	0	0	0
	Notional	114.1	136.8	0	0	2.3	0	0	----	----
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	22.8	30.7	1.7	5.7	1.7	3.68	1.5	3.75	2
	Notional	74	20.8	7.8	2.1	2.6	2.64	2.7	----	----

Key to terms

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

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APPENDIX B

PART L2A CALCULATION (BRUKL) FOR DAY CARE SERVICE & NON-RESIDENTIAL AREAS

Project name

Hexham Road

As designed

Date: Tue Feb 21 21:54:47 2023

Administrative information

Building Details

Address: Hexham Road, Reading, RG2 7UQ

Certifier details

Name: Rachael Fleming

Telephone number:

Address: , ,

Certification tool

Calculation engine: SBEM

Calculation engine version: v6.1.d.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v7.1.3

BRUKL compliance module version: v6.1.d.0

Foundation area [m²]: 318.32The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m ² annum	1.88
Building CO ₂ emission rate (BER), kgCO ₂ /m ² annum	1.17
Target primary energy rate (TPER), kWh/m ² annum	19.9
Building primary energy rate (BPER), kWh/m ² annum	12.39
Do the building's emission and primary energy rates exceed the targets?	BER ≤ TER BPER ≤ TPER

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

Fabric element	U _{a-Limit}	U _{a-Calc}	U _{i-Calc}	First surface with maximum value
Walls*	0.26	0.17	0.35	Ground floor - Accommodation Entry_P_10
Floors	0.18	0.12	0.12	Ground floor - Accommodation Entry_S_3
Pitched roofs	0.16	-	-	No heat loss pitched roofs
Flat roofs	0.18	0.1	0.1	Ground floor - Accommodation Entry_R_4
Windows** and roof windows	1.6	0.85	0.85	Ground floor - Accommodation Entry_G_9
Rooflights***	2.2	-	-	No external rooflights
Personnel doors^	1.6	-	-	No external personnel doors
Vehicle access & similar large doors	1.3	-	-	No external vehicle access doors
High usage entrance doors	3	-	-	No external high usage entrance doors

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

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

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

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

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

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

Air permeability	Limiting standard	This building
m ³ /(h.m ²) at 50 Pa	8	1

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	0.9 to 0.95

1- Mitsubishi PURY-P450YLM-A1

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.75	2	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

1- Instantaneous

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	0.028
Standard value	1	N/A

Zone-level mechanical ventilation, exhaust, and terminal units

ID	System type in the Approved Documents
A	Local supply or extract ventilation units
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 balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter
NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.	

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	2.3	2	0.5	0.5	0.4	1		
Ground floor - NW Stairwell		-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Bin Store		-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Lift		-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Scooter Store		-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - ELE Intake		-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - NE Stairwell		-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - SW Stairwell		-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Plant Room		-	-	-	-	0.4	-	-	-	-	0.95	N/A
FF NE STAIRWELL - Zone 1		-	-	-	-	0.4	-	-	-	-	0.95	N/A
FF - NW Stairwell		-	-	-	-	0.4	-	-	-	-	0.95	N/A
FF - South stairwell		-	-	-	-	0.4	-	-	-	-	0.95	N/A
SF NE STAIRWELL - Zone 1		-	-	-	-	0.4	-	-	-	-	0.95	N/A
TF South stairwell - Stairwell		-	-	-	-	0.4	-	-	-	-	0.95	N/A
SF Riser - Zone 1		-	-	-	-	0.4	-	-	-	-	0.95	N/A

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	2.3	2	0.5	0.5	0.4	1		
SF NW Stairwell - Stairwell	-	-	-	-	0.4	-	-	-	-	0.95	N/A
SF SOUTH stairwell - Stairwell	-	-	-	-	0.4	-	-	-	-	0.95	N/A
TF NW Stairwell - Zone 1	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Accomodation Entry	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Residential Corridor	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - General Need Entrance	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Multifunction	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Corridor and Waiting Room	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Reception	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Office	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Quiet Room	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Multifunction 1	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Acc WC	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Laundry	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Medical	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Art Room and Corridor	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Study	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Assisted WC 1	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Tea Room	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Assisted WC	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Dark Room	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - East residential corridor	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Store Room 1	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Sensory Room	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Acc WC 1	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Life Skills	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Assisted WC 2	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Store Room	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Acc WC 5	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - IT Comms	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Acc WC 4	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Acc WC 3	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Lobby	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Acc WC 2	-	-	-	-	0.4	-	-	-	-	0.95	N/A
Ground floor - Large Multifunction	-	-	-	-	0.4	-	-	-	-	0.95	N/A
FF - FF Corridor	-	-	-	-	0.4	-	-	-	-	0.95	N/A
FF - Acc WC	-	-	-	-	0.4	-	-	-	-	0.95	N/A
FF - Community Room	-	-	-	-	0.4	-	-	-	-	0.95	N/A
TF Riser - Zone 1	-	-	-	-	0.4	-	-	-	-	0.95	N/A
TF South stairwell - Corridor	-	-	-	-	0.4	-	-	-	-	0.95	N/A
SF NW Stairwell - Corridor	-	-	-	-	0.4	-	-	-	-	0.95	N/A
SF SOUTH stairwell - Corridor	-	-	-	-	0.4	-	-	-	-	0.95	N/A

"LENI calculation for lighting energy provided in a separate submission."

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

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
FF - NW Stairwell	NO (-58.8%)	YES
FF - South stairwell	NO (-53.9%)	YES
Ground floor - Accomodation Entry	NO (-43.7%)	YES
Ground floor - Residential Corridor	YES (+45.7%)	YES
Ground floor - General Need Entrance	NO (-0.7%)	YES
Ground floor - Multifunction	NO (-28.3%)	YES
Ground floor - Corridor and Waiting Room	NO (-25.7%)	YES
Ground floor - Reception	NO (-69.8%)	YES
Ground floor - Office	NO (-53.9%)	YES
Ground floor - Quiet Room	NO (-63.3%)	YES
Ground floor - Multifunction 1	NO (-56%)	YES
Ground floor - Acc WC	N/A	N/A
Ground floor - Laundry	N/A	N/A
Ground floor - Medical	N/A	N/A
Ground floor - Art Room and Corridor	NO (-12.9%)	YES
Ground floor - Study	NO (-15.3%)	YES
Ground floor - Assisted WC 1	N/A	N/A
Ground floor - Tea Room	NO (-93.5%)	YES
Ground floor - Assisted WC	N/A	N/A
Ground floor - Dark Room	N/A	N/A
Ground floor - East residential corridor	N/A	N/A
Ground floor - Store Room 1	N/A	N/A
Ground floor - Sensory Room	NO (-10.5%)	YES
Ground floor - Acc WC 1	NO (-19.6%)	YES
Ground floor - Life Skills	NO (-4.8%)	YES
Ground floor - Assisted WC 2	NO (-61.3%)	YES
Ground floor - Store Room	N/A	N/A
Ground floor - Acc WC 5	NO (-20.7%)	YES
Ground floor - IT Comms	N/A	N/A
Ground floor - Acc WC 4	N/A	N/A
Ground floor - Acc WC 3	N/A	N/A
Ground floor - Lobby	NO (-16.1%)	YES
Ground floor - Acc WC 2	N/A	N/A
Ground floor - Large Multifunction	NO (-14.3%)	YES
FF - FF Corridor	NO (-22.1%)	YES
FF - Acc WC	N/A	N/A
FF - Community Room	NO (-17.9%)	YES
TF Riser - Zone 1	NO (-44.6%)	YES
TF South stairwell - Corridor	YES (+31%)	YES
SF NW Stairwell - Corridor	NO (-16.3%)	YES
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Is evidence of such assessment available as a separate submission?	YES
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* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

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	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
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Equipment*	20.54	20.54
TOTAL **	16.26	16.21

* 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	8.07	2.88
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
<i>Displaced electricity</i>	<i>8.07</i>	<i>2.88</i>

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	101.64	150.85
Primary energy [kWh/m ²]	12.39	19.9
Total emissions [kg/m ²]	1.17	1.88

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System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] No Heating or Cooling										
	Actual	48.7	138.9	0	0	1.6	0	0	0	0
	Notional	114.1	136.8	0	0	2.3	0	0	----	----
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	22.8	30.7	1.7	5.7	1.7	3.68	1.5	3.75	2
	Notional	74	20.8	7.8	2.1	2.6	2.64	2.7	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
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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

APPENDIX C

PHPP CALCULATION AND ASSESSMENT



**Proposed Development Hexham Road
Reading
Passivhaus Design
February 2023**

GREENBOX ASSOCIATES CONTACT DETAILS

This report was prepared by Rachel Mitchell of Greenbox Associates Ltd, an architectural engineering consultancy which specialises in building modelling and energy demand reduction. Rachel Mitchell is a Passivhaus Designer, Elmhurst Energy SAP assessor and thermal bridge modeller.

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Status: FINAL

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INTRODUCTION

Greenbox Associates Ltd has been appointed by Hampshire County Council, on behalf of Reading Borough Council, to review the proposed design at Hexham Road Reading, and model the building, which contains both domestic and non-domestic elements, in Passive House Planning Package (PHPP) and evaluate against the demanding Passivhaus Classic Standard.

This high-density development, located in the center of Reading, will deliver supporting living housing and an adult day care center.

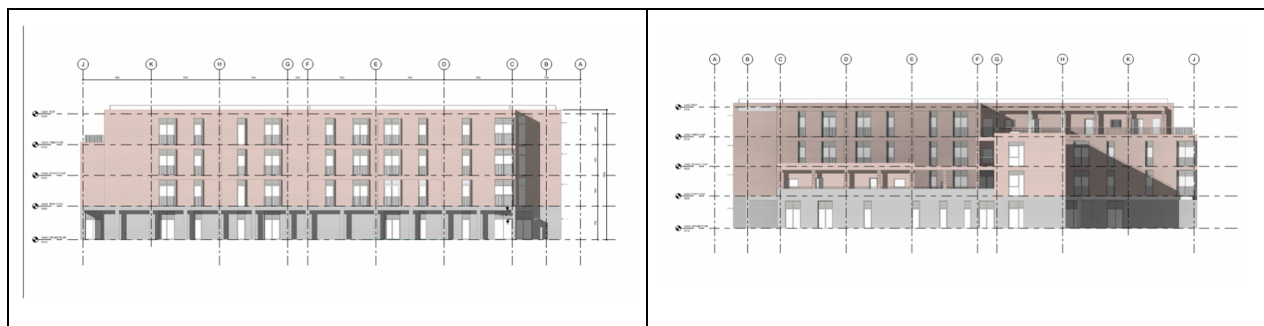


Figure 1. Proposed West and East facing façade at Hexham Road

Decarbonisation of the built environment is a critical element on the path to net zero carbon in 2050, and whilst decarbonising the National Grid supply is a key part of that strategy, it is cheaper and easier to save energy than to produce it. Driving down energy demand in buildings is the most efficient way to reduce both carbon emissions and peak demand on the electricity grid.

Reducing demand also protects its occupants against rising fuel costs, as homes need less much energy to maintain comfortable and healthy internal temperatures, which means bills remain affordable. Well insulated and affectively ventilated homes also reduce the risk of condensation and mould, and ensure good indoor air quality.

The building has been designed using the design principles of Passivhaus, a standard which consistently delivers energy efficient, comfortable, and affordable homes. The building has been modelled in Passive House Planning Package (PHPP) to show how it compares with the standard and summary of the outputs from these assessments can be found in Appendix one.

The specification provided within this document will form part of the Employees Requirements and the appointed contractor will be required to meet both the Passivhaus Criteria outlined and the results generated by Passivhaus Planning Package (PHPP) software.

PHPP MODELLING

The following buildings were modelling in Passivhaus Planning Package (PHPP). The main building was split between the Adult Day Care Centre and the residential units, as these would operate in a separate way and be serviced by different heating and ventilation systems. Therefore, the result of this building will be reported separately.

HEXHAM ROAD PHPP MODELLING	
Block A non-residential	PLMD Adult Day Care Centre (31 Place)
Block A residential	42 x 1 bed flats

Table 1 - Summary of buildings modelled in PHPP

PASSIVHAUS STANDARD

Passivhaus buildings provide a high level of occupant comfort while using little energy for heating and cooling. Typically, a Passivhaus built in the UK will use half the energy compared to a home built to meet current building regulations. They are built with meticulous attention to detail and rigorous design and construction according to principles developed by the Passivhaus Institute in Germany and can only be certified through an exacting quality assurance process on site.

Evidence shows that UK Passivhaus buildings are performing in use to their design energy standard, which is crucial, given that the discrepancy between design aspiration and as-built performance (the performance gap) for many new buildings in the UK can be as much as 50-100%. This means many non-Passivhaus homes are using much more energy than predicted, which is a problem for developers, occupants and government as bills are higher and energy and carbon targets are being missed. With no performance gap, Passivhaus buildings consistently perform in-use as predicted at the design stage.

A Passivhaus is designed to deliver super insulated and airtight comfortable buildings, that have a low space heating demand. There are minimum requirements for U-values, thermal bridges, air permeability, primary energy use and overheating risk as shown in Table 2 below.

PASSIVHAUS CLASSIC DESIGN ELEMENTS	
Low space heating demand	Less than 15 kWh/m ² /year (as measured in PHPP)
Low U Values	Less than 0.15 W/m ² K
High levels of air tightness	Less than 0.6 ach _{n50}
Triple glazed windows	Whole window U value less than 0.85W/m ² K
Reduced thermal bridges	Less than 0.01W/mK
Overheating risk	Less than 10% of hours above 25°C UK guidance 5% of hours Best practice 0% of hours
Primary energy targets	Less than 85 kWh/m ² /year
Primary energy renewable	Less than 60 kWh/m ² /year (this target may vary with dwelling type)
Quality assurance	Evidence of construction and commissioning to be given before certification

Table 1 - Summary of the Passivhaus Classic Standard

The key design elements of a Passivhaus are:

- High levels of insulation
- Minimal thermal bridges
- High levels of air tightness
- Mechanical ventilation with heat recovery (MVHR)
- Protection from overheating risk.

These elements provide the following benefits:

- Lower space heating bills
- Good internal air quality and a healthy internal environment
- Comfortable internal temperatures all year
- Protection against fuel poverty and cold homes
- Meeting zero carbon targets
- Reduce the requirements for renewable energy
- Durable homes with longer lasting components

The Passivhaus standard therefore gives a robust method to help achieve the government's net zero carbon targets for 2050, protect against rising fuel prices and provide a comfortable healthy home.

FABRIC FIRST

The better way to get to zero carbon is to save energy rather than generate it. By investing in the fabric of the structure, the carbon and energy benefits are locked in for the lifetime of the building, while bolted on technologies can fail and need to be replaced. Increasing insulation levels and reducing air tightness lowers heat loss from the building and therefore space heating demand, which in turn reduces energy bills. In addition, attention to detail to the building fabric, through insulation and reduced thermal bridges, increases internal surface temperatures, which if kept above 17°C, will eliminate condensation risk and mould growth. This provides a healthy indoor environment and protects the structure, which prolongs the life of the building.

The proposed building will have a much-improved fabric compared to current building regulations and is better than the proposed Future Homes Standard 2025.

PASSIVHAUS EMPLOYEES' REQUIREMENTS – BUILDING MODELLING

Contractors should note that:

- Passive House Planning Package (PHPP) calculations should be undertaken to show compliance with the two building standards

Table 2 below, shows the proposed U values at Hexham Road compared the maximum allowable under Part L1A 2021. All the blocks will be constructed using the same specification, except for the floor in Block A which reflects the size of the building.

FABRIC FIRST - TABLE OF PROPOSED U VALUES HEXHAM ROAD		
	Hexham Road	Minimum Standards for Part L1A 2021
Ground Floor	0.12 W/m ² K	0.18 W/m ² K
External Walls	0.16 W/m ² K	0.26 W/m ² K
Roofs	0.11 W/m ² K	0.16 W/m ² K
Windows	0.85 W/m ² K	1.6 W/m ² K
External Doors	0.85 W/m ² K	1.6 W/m ² K
Thermal Bridges	0.02 W/m ² K	0.08 W/mK

Table 2 - Summary of Passivhaus U values at Hexham Road compared to Part L1A 2021

PASSIVHAUS REQUIREMENTS – FABRIC

- External Wall U values above are calculated based on a 280mm full fill cavity insulation with a thermal conductivity of 0.035 W(m/k) or less.
- U value calculations must take into account wall ties – which are assumed to be Ancon Teplo ultra-low thermal conductivity wall ties
- All non-repeating thermal bridges must be calculated as part of the PHPP assessment. Typically, these will be bespoke for this project. The PHPP method is to use external (not internal) measurements for psi value calculations

AIR PERMEABILITY AND VENTILATION

Once insulation levels have been increased, the heat losses from uncontrolled ventilation and infiltration can be considerable. Under current Building Regulations a dwelling must have an infiltration rate of less than 8.0 m³/hm²@50Pa. The air permeability targets will vary for each building type will be much lower than this and the targets are shown in the table below

With this level of airtightness, additional controlled ventilation is required to provide both fresh air and to removed stale and moist air. The dwellings will be mechanically ventilated with heat recovery (MVHR), via the PKOM 4 compact units located within each dwelling (see section on heating and hot water). For the Adult Day Care Centre, ventilation will be provided by a Passivhaus certified MVHR unit (specific unit to be decided)

MVHR extracts warm moist air from kitchens and bathrooms and supplies fresh air to bedrooms and living rooms via a balanced system. Purge ventilation can be provided by the system when operating in 'boost' mode.

The Passivhaus standard sets maximum limits for the energy required to run the fans in the unit and good practice minimum standards for the efficiency of the heat exchanger within the unit. This ensures that energy consumption is reduced, and the maximum amount of heat is recovered. By setting these standards it also means the fans are better quality and designed to operate at optimum speeds, and therefore will be quieter.

To assist in the management of overheating risk, the MVHR units will have a summer bypass mode, which switches off heat recovery when temperatures outside increase. Thorough commissioning of the MVHR units is part of the quality assurance process, to ensure the units are operating with the correct flow rates for each room.

Table 3 below outlines the design stage ventilation strategy at Hexham Road.

VENTILATION AT HEXHAM ROAD		
Building	Residential Units	Non- residential unit
Air tightness	0.6 Ach _{n50}	0.6 Ach _{n50}
Air permeability	1.05 m ³ /hm ² 50Pa	0.84 m ³ /hm ² 50Pa
Design infiltration rate	0.057 1/h	0.042 1/h
Design air flow rate	0.44 1/h	0.40 1/h
MVHR units	PKOM4 compact unit	Passivhaus Certified MVHR unit
Summer bypass	Yes	Yes

Table 3 - Summary of ventilation rates at Hexham Road

It is advisable to engage an air testing company at an early stage, as the building is complex, to agree the air testing regime as Passivhaus will test the whole building rather than individual units. This may require a bespoke approach as the building may have to be compartmentalised, to allow for the building to be pressurised correctly.

The following elements should be incorporated into the MVHR design to optimise the efficiency and effective running of the system:

- Select a Certified Passivhaus component
- Locate the MVHR unit as close to an outside wall as possible to maintain efficiency
- Use rigid ducting to reduce friction and noise
- Place sound attenuators between rooms
- Have a simple interface with the user and a clear boost setting
- Replace filters regularly as specified by the manufacturer

It is a common assumption that windows cannot be opening in a Passivhaus. This is incorrect and there will be opening windows in all habitable rooms. These will provide additional day time ventilation and more importantly, night-time cooling in summer (subject to any acoustician reports) to assist in reducing overheating risk.

PASSIVHAUS REQUIREMENTS – AIRTESTING AND MVHR

- Air testing large buildings can be complex, and the services of a suitably experienced air testing company should be engaged at an early stage.
- Air testing needs to be undertaken at critical stages, typically these are
 - Once the building is airtight, but before the airtight layer is covered
 - After second fix
 - Final air test at completion
- Location of the MVHR units is critical and should be located as close as possible to an external wall.

SPACE HEATING AND HOT WATER

As the building is designed to meet the Passivhaus Classic Standard, the space heating demand will be low, and the greater energy demand will be for hot water. In line with the phasing out of gas as the main form of energy for heating and hot water and the Decarbonisation of the National Grid, electricity will be used for space and hot water.

Within the domestic units, space heating and hot water will be provided by a PKOM 4 compact unit. This is a heat pump, which combines an MVHR with hot water, space heating and if needed cooling. Heating and cooling will be provided within the PKOM4 unit and distributed via the internal supply air ducting. This is a certified Passivhaus component, which means it meets minimum standards for energy use and noise and well as the efficiency of the heat exchange. A PKOM 4 unit is designed to be used in dwellings with a low space heating demand. There will be an electric towel rail in the bathrooms to provide additional heating if needed. For the adult day care center, heating and hot water will be provided by an Air Source Heat Pump (ASHP)

The heating and hot water strategy for each building type is outlined in Table 4.

SPACE HEATING AND HOT WATER DELIVERY AT HEXHAM ROAD		
Building	Residential Units	Non- residential unit
Space heating and hot water	PKOM 4 unit to flats and ASHP to day care center	PKOM 4 unit
Heat emitter	Supply air and electric radiators	Supply air and electric radiators
Hot water tank	Within PKOM unit separate tank for day care center	Within PKOM unit

Table 4 - Summary of heating and hot water strategy Hexham Road.

By providing individual heating and hot water heating systems to each dwelling, this eliminates the need for a heat distribution network within the buildings. Distribution of hot water, especially in the summer and in larger buildings, can contribute to overheating risk. This is one of several strategies to reduce overheating, which is discussed in more detail in the next section.

OVERHEATING RISK ASSESSMENT

Many new and existing homes are at risk of overheating. This can be because of building design, e.g., large areas of glass, building services, e.g., poorly insulated hot water pipes or low ventilation rates, e.g., lack opening windows. User behaviour such as not opening windows at night, can also exacerbate overheating

As homes become more insulated and airtight, there is a concern this risk could increase, as once warm air becomes trapped in a building, it can be more difficult to purge. Therefore, considering overheating and reducing risk is critical at the design stage. The Good Homes Alliance have produced overheating risk guidance, which identifies the following factors as contributing to overheating risk:

- Location in the UK (Southeast is a high risk).
- Urban location (Heat Island effect).
- Lack of openable windows (security, noise, design).
- Community heating schemes (heat losses from the distribution pipes).
- Large areas of glazing especially to the west.
- Single aspect dwellings (no cross ventilation).

Overheating risk can be reduced by

- The proximity to areas of trees and/or water.
- Light coloured surrounding surfaces.
- Shading from trees and buildings.
- High exposed thermal mass.
- Higher ceilings to allow the retrofit of ceiling fans.
- External shading devices.
- Opening windows preferably with cross ventilation.
- Reducing the areas of glazing, without compromising daylighting (especially roof lights)

The health implications of summer overheating in our homes are significant. It is estimated that there are currently around 2000 heat-related deaths in the UK every year and that this could rise to more than 7000 by 2050 as summer temperatures are predicted to rise.

PHPP requires designers to model the impact of glazing areas, window openings, shading, internal gains, and ventilation options so they can minimise the risk of overheating. New guidance developed by the Passivhaus Trust now also requires Passivhaus designers to “stress test” design in future climates and situations where, for example, occupants fail to open windows or deploy shading.

Whilst PHPP can measure overheating risk, for a large and complex building such as this building, there should be a more comprehensive CIBSE TM59 assessment.

An overheating risk assessment has been made for the two parts of the building and the result are described on the following page. These assessments may be subject to further revision following the completion of the CIBSE TM59 overheating risk calculations.

HEXHAM ROAD – RESIDENTIAL

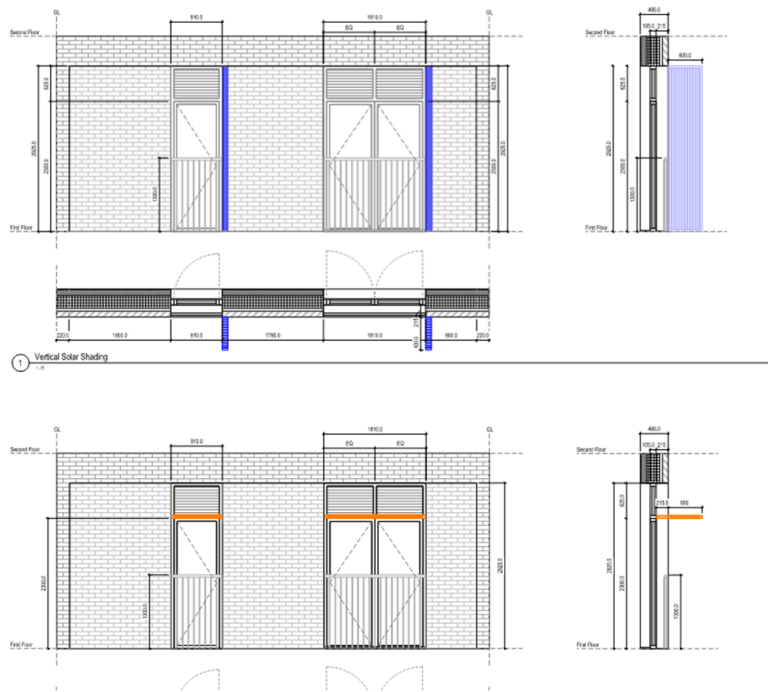


Figure 1. Hexham Road shading strategy window details

For the residential Units the following measures have been modelled to reduce overheating risk:

- Solar glass to all facades with lower g values 0.34 (except the north)
- Shading from balconies on the south facade
- Juliette balconies will provide some shading to the residential units
- 1000mm brise soleil to the south elevation to all windows without overhangs
- Vertical fin shading to the east and west façades
- Increase ventilation rates via the MVHR system
- Secure window opening both day and night (restrictors on the ground floor)

HEXHAM ROAD – NON-RESIDENTIAL



Figure 2- Hexham Road shading strategy balconies and overhangs on the south facade

The following measures have been modelled to reduce overheating risk on the non-residential part of the building.

- Solar glass to all facades with lower g values 0.34 (except the north)
- Upper floor balcony providing shading to the south façade
- Secure window opening both day and night (restrictors on the ground floor)

PASSIVHAUS REQUIREMENTS – OVERHEATING RISK

- Predicted overheating risk must be modelled at +2°C to ensure climate resilience.
- Building should meet both the Passivhaus good practice standard and TM59 for overheating risk

PRIMARY ENERGY VALUES

In addition to meeting the space heating demand element of Passivhaus design, there are also limits to the total primary energy demand of the building. Primary energy calculations consider not only regulated energy use (space heating, hot water and building services) but also unregulated energy use (household electricity demand, cooking etc). To meet the Primary Energy targets, it is proposed to provide hot water and heat the dwellings using individual PKOM compact units and an Air Source Heat Pump (ASHP) system for the adult day care services. This means the projects meet the Primary Energy Renewable (PER) requirement, which has a target of 60 kWh/m²/year.

The PER value will be directly affected by the efficiency of the final choices of the ASHP unit(s) and the design of the total system. In addition, assumptions about potential consumer appliances and the equipment provided in the Adult Day Care Centre, need to be refined. These metrics will be further update as these details emerge.

MAIN OUTPUTS FROM PHPP

The table on the following page give a summary of the main outputs from PHPP. To take into account rising summer temperature because of climate change, the buildings have been modelling using current climate data plus 2°C. Both parts of the building are meeting the overheating risk standard for Passivhaus at this higher temperature.

To meet the Passivhaus classic standard either space heating demand must be less than or equal to 15 kWh/m²/year or space heating load must be less than or equal to 10 W/m²K. For both parts of the building at Hexham Road, the space heating demand and the space heating load have been assessed.

PHPP outputs for Hexham Road Adult Day Care Centre			
	PHPP output	Target	Target met?
Space heating demand	13 kWh/m ² /year	≤15 kWh/m ² /year	Yes
Space heating load	9 W/m ² /year	≤10 W/m ² /year	YES
Frequency of overheating +2C	2 % of hours	≤10% of hours	YES
PER demand	55 kWh/m ² /year*	60 kWh/m ² /year	YES

*Estimated

Table 5 - Summary of PHPP outputs Block A1 Passivhaus Classic Standard

PHPP outputs for Hexham Road Residential flats			
	PHPP output	Target	Target met?
Space heating demand	14 kWh/m ² /year	≤15 kWh/m ² /year	YES
Space heating load	10 W/m ² /year	≤10 W/m ² /year	YES
Frequency of overheating + 2C	6 % of hours	≤10% of hours	YES
PER demand	44 kWh/m ² /year*	60 kWh/m ² /year	YES

*Estimated

Table 6- Summary of PHPP out puts Block A2 Passivhaus Classic Standard

MOVING TO DETAILED DESIGN STAGE

As the design develops and moves forward the following are recommended for more detailed consideration

- Clear mark-up of the insulation layer for all thermal elements of the building
- Detailed build ups of all external elements and detailed U value calculations
- Identification of potential thermal bridges and working with the structural engineer on columns and masonry supports
- Thermal bridge calculations for a selection of the most important/ worst performing junctions including the window installations
- Clear definition of the airtight layer on all plans and sections
- MVHR location and layouts for sample dwellings
- Hot water and heating pipe layouts where applicable
- Choice of ASHP units
- Definition of the air tightness strategy in conjunction with the air testing company and define the air testing regime
- TM59 overheating risk assessment and refinement of the overheating strategy for block A
- Detailed calculation of primary energy for all blocks.

SUMMARY AND CONCLUSION

The proposed development at Hexham Road in Reading has been separated into two sections and modelling in PHPP and tested against the demanding Passivhaus Classic with the following results:

- Both parts of the building meet the Passivhaus Classic Standard using either space heating demand or heat load calculation
- Based on the shading strategy, the building is not showing an overheating risk, even when modelled against a +2C temperature increase in the summer
- If there are peaks of summer temperatures, the PKOM unit can provide some limited cooling to the flats

These are early PHPP assessment and will be refined as the design develop and recommendations for further work have been made as the project moves forward.

APPENDIX ONE PHPP OUTPUTS

HEXHAM ROAD – RESIDENTIAL UNITS

Passive House-Verification				10.4a EN	
Photo or drawing				Building: Hexham Road Domestic Housing	
				Street: Postcode/City: Reading Province/Country: GB-United Kingdom/ Britain Building type: Climate data set: GB0002a-Silsoe, Altitude corrected, +0K summer correction Climate zone: 3: Cool-temperate Altitude of location: 61 m	
Home owner / Client: Street: Postcode/City: Province/Country:				Mechanical engineer: Street: Postcode/City: Province/Country:	
Architecture: Street: Postcode/City: Province/Country:				Certification: Street: Postcode/City: Province/Country:	
Energy consultancy: Greenbox Associates Ltd Street: Bristol Road Postcode/City: Southsea Province/Country: Hampshire GB-United Kingdom/ Britain				Interior temperature winter [°C]: 20.0 Interior temp. summer [°C]: 25.0 Internal heat gains (IHG) winter [W/m²]: 2.9 IHG summer [W/m²]: 2.9 Specific heat capacity [Wh/K per m² TFA]: 204 Mechanical cooling:	
Year of construction: 2023 No. of dwelling units: 43 No. of occupants: 69.7					
Specific building characteristics with reference to the treated floor area					
1 error message(s) in 'Check' worksheet					
Treated floor area m²		2532.8			
Space heating	Heating demand kWh/(m²a)	14.38	≤	15	Fulfilled?²
	Heating load W/m²	9.84	≤	-	
Space cooling	Cooling & dehum. demand kWh/(m²a)	-	≤	-	-
	Frequency of overheating (> 25 °C) %	0.01	≤	10	Yes
	Frequency of excessively high humidity (> 12 g/kg) %	0	≤	20	Yes
Airtightness	Pressurisation test result n ₅₀ 1/h	0.6	≤	0.6	Yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	54	≤	-	-
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	44	≤	60	Yes
	Renew. energy generation (in rel. to projected building footprint area) kWh/(m²a)	0	≥	-	
I confirm that the values given here have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.					
Task: First name: Surname: Certificate-ID: Issued on: City:				Passive house Classic? Yes Signature:	

HEXHAM ROAD – NON-RESIDENTIAL UNIT

Passive House-Verification				10.4a EN		
Photo or drawing				Building: Hexham Road Non-domestic building		
				Street: Postcode/City: Reading Province/Country: GB-United Kingdom/ Britain Building type: Climate data set: GB0002a-Silsoe, Altitude corrected, +0K summer correction Climate zone: 3: Cool-temperate Altitude of location: 61 m		
Home owner / Client: Street: Postcode/City: Province/Country:				Mechanical engineer: Street: Postcode/City: Province/Country:		
Architecture: Street: Postcode/City: Province/Country:				Certification: Street: Postcode/City: Province/Country:		
Energy consultancy: Greenbox Associates Ltd Street: Bristol Road Postcode/City: Southsea Province/Country: Hampshire GB-United Kingdom/ Britain				Interior temperature winter [°C]: 20.0 Interior temp. summer [°C]: 25.0 Internal heat gains (IHG) winter [W/m²]: 2.5 IHG summer [W/m²]: 3.0 Specific heat capacity [Wh/K per m² TFA]: 204 Mechanical cooling:		
Year of construction: 2023 No. of dwelling units: 1 No. of occupants: 50.0						
Specific building characteristics with reference to the treated floor area						
4 error message(s) in 'Check' worksheet						
Space heating	Treated floor area m²	675.0		Criteria	Alternative criteria	Fulfilled?²
	Heating demand kWh/(m²a)	13.10	≤	15	-	Yes
	Heating load W/m²	8.58	≤	-	10	
Space cooling	Cooling & dehum. demand kWh/(m²a)	-	≤	-	-	-
	Frequency of overheating (> 25 °C) %	0.00	≤	10	-	Yes
	Frequency of excessively high humidity (> 12 g/kg) %	13	≤	20	-	Yes
Airtightness	Pressurisation test result n ₅₀ 1/h	0.6	≤	0.6	-	Yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	42	≤	-	-	-
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	34	≤	60	60	Yes
	Renew. energy generation (in rel. to projected building footprint area) kWh/(m²a)	0	≥	-	-	
I confirm that the values given here have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.						
Passive house Classic? Yes						
Task: First name: Surname: Signature: Certificate-ID Issued on: City:						