



RIDGE

ENERGY STRATEGY REPORT
NEW HENRY STREET
BRISTOL
DOMINUS BRISTOL LIMITED
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NEW HENRY STREET
STUDENT ACCOMMODATION
DOMINUS BRISTOL LIMITED

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CONTENTS

1. INTRODUCTION

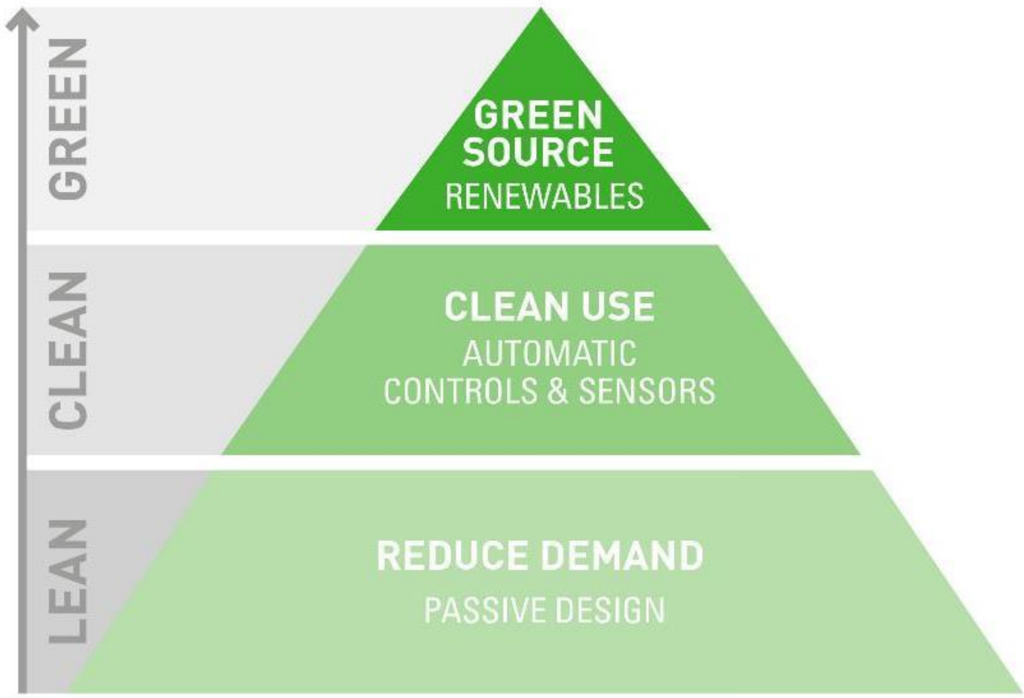
As Low Carbon Design Consultants Ridge and Partners have been appointed by DOMINUS Real Estate to provide a statement for the purposes of submitting a full planning application for a mixed use development comprising employment, commercial and student accommodation uses.

The purpose of the statement is to summarise the relevant policies both National and Local and demonstrate the ways Ridge & Partners have reviewed various options to promote policies set out in this report and subsequent design.

The document presented below outlines a preliminary low carbon design philosophy followed to develop an energy strategy for the proposed works. The "Energy Hierarchy" methodology provides a design framework which was used to develop the proposed low carbon energy strategy. The approach described by this methodology provides a staged process: LEAN, CLEAN and GREEN (Illustrated below) to assess design measures.

Each stage would focus on the following:

- Lean – Main aim is to reduce the buildings energy demand through "passive measures".
- Clean – Meet the reduced energy demand in the most efficient way possible using "active measures"
- Green – Assess the technical feasibility of incorporating a low or zero carbon technology to further reduce the CO_2 emissions.



2. DEVELOPMENT PROPOSALS

2.1 Description of Development Site

The Site is located within the administrative boundary of Bristol City Council. The site currently accommodates two buildings in industrial use. The buildings span almost the full width of the curtilage. They are located in the north sector of the site with a large forecourt area in the south that contains vehicle parking for the units. Both buildings comprise a two-storey form alongside a large yardage that would have traditionally facilitated servicing by HGVs. The southwest and southeast boundary (fronting Kingsland Road) is made up of a steel palisade fencing that is sited behind a large concrete apron. There are two gates within the fencing on Sussex Street that provide access to the site (shared pedestrian and vehicular).

The site is bounded to the north-east by Alfred Street. Here, The Redeemed Christian Church of God occupies a rudimentary single storey post war building with a small forecourt. Adjacent to this to the north is a disused railway line running northeast to north-west which could potentially form a vital link within Bristol's strategic cycle network in the future.

The overall character comprises industrial buildings and external storage for vehicles, gas cylinders, scrap metal and miscellaneous industrial operations. There is a relatively low employment density estimated between 20-25 FTE positions and the immediate area is generally lacking in visual amenity.

The surrounding area to the north, east and south of the site comprises industrial /employment uses. To the west of the site comprises The Dings residential area, which sits between the site and Temple Meads Train Station.

The main vehicular access road of Kingsland Road forms the western boundary of the site and links Old Market to the north with Silverthorne Lane to the south. The northern boundary abuts a shared cycle/footway, which currently ends to the north east of the site but provides a direct link to Temple Meads Train Station and central Bristol beyond.

The Site does not lie within a Conservation Area, however the Old Market Conservation Area is located approximately 300 metres to the north of the site and the Silverthorne Lane Conservation Area is located approximately 200metres to the south of the site.

The locally listed non-designated heritage assets in the vicinity of the site comprise;

1. Hannah More School, Kingsland Road
2. Shaftesbury Crusade, Kingsland Road
3. Shaftesbury House, Kingsland Road
4. Barton Hill Engine Sheds

In terms of archaeology, the site contains predominantly areas of hardstanding and buildings. Given the limited archaeological finds within relative proximity and the generally developed nature of the area, the likelihood of any archaeology is considered low.

The site is highly sustainable with good connections to local facilities, services and strong public transport provision. The proposed development would be 'car free', which should be supported given the sustainable location. The proposed development would result in a net reduction in vehicle movements associated with the site and would therefore not to have an adverse impact on the local highway network.

Figure 1 – View of the existing site and the surrounding area

2.2 Development Proposal

Demolition of existing structures and redevelopment of the site for two conjoined buildings comprising light industrial use (Class E(g)(iii)); flexible retail/light industrial use (Class E(a) / Class E(g)(iii)); flexible commercial use (Class E(b-g)); flexible industrial use (Class E(g)(iii) / Class B8 / Sui Generis; student accommodation use with ancillary community space (Sui Generis); public realm works and landscaping; cycle parking; ancillary plant and servicing; and other associated works.

Key Development Parameters

Table 1: Proposed Floorspace

Use	Use Class	GIA (SQ.M)
Student Accommodation	Sui Generis	19,980
Maker Space	Class E(g)(iii)	1,016
Flexible Industrial Use	Class E(g)(iii) / B8 / Sui Generis	114
Flexible Commercial Space	Class E (b-g)	146
Supermarket / Maker Space	Class E(a) / E(g)(iii)	468
Ancillary Community Space	Sui Generis	175
Back of House	-	1,062
TOTAL		22,961

Table 2: Proposed Cycle Parking Spaces

Cycle Parking	No. spaces
Student accommodation	364
All other uses	26
Total	390

Table 3: Proposed No. Units

Accommodation	No. units
Cluster (5-8 bed per LKD)	400
Townhouse cluster	80
Studios	225
Total	705 (2% accessible)

The proposed development comprises a mixed use development comprising employment, commercial and student accommodation uses. The proposed new development will provide:

i. 705 purpose-built student accommodation bed spaces
ii. Light Industrial Maker Space (Class E(g)(iii)) – 994sqm (Gross Internal Area, GIA)
iii. Flexible Supermarket / Maker Space (Class E(a) / Class E(g)(iii)) – 468sqm (GIA)
iv. Flexible Commercial Space (Class E(b-g)) – 146sqm (GIA)
v. A dedicated flexible community space (Ancillary Sui Generis) – 159sqm (GIA)

Figure 2 -Proposed North Elevation

Figure 3 - Ground Floor General Arrangement Layout

3. ENERGY HIERARCHY

In line with the draft definition of zero carbon an energy hierarchy has been created (see figure 3 below). Under Policy EN4, developers will initially be expected to secure high levels of energy efficiency and low energy demand. This is followed by the incorporation of on-site measures where these exist, such as low or zero carbon energy technologies and directly connected heat (not necessarily on-site).

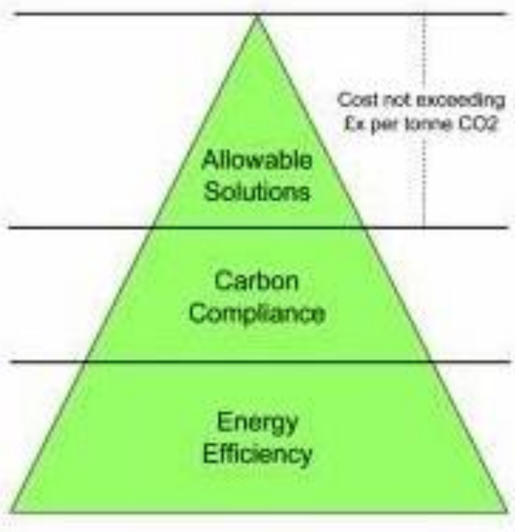


Figure 4 – Energy Hierarchy

However, in order to achieve the highest level of carbon reductions it is intended that developers will be able to contribute to or co-ordinate investment in near or off-site infrastructure. This could include, for example, the connection of buildings to district heating networks and investment in low or zero carbon technologies on buildings owned by the city or by public and community institutions. Further guidance on these 'allowable solutions', possibly in the form of a Supplementary Planning Document (SPD), will be given following further national guidance on this matter expected from the Local Planning Authority.

3.1. Decarbonisation of the Electricity Grid

The National Grid in the UK is decarbonising rapidly. This permits the electrification of heat and heralds the end to combustion of fossil fuels as the main source of heating. The attractive alternative to combustion is heat transfer using heat pumps linked to ground source or air source energy.

The carbon factor of grid electricity was 495 grams of CO_2 for each kWh of electricity generated in 2014 according to Defra. This fell by 6.5% to 462 grams in 2015, and by a further 10.8% to 412 grams in 2016.

The Department for Business, Energy and Industrial Strategy (BEIS) published its Energy and Emissions Projection (EEP) in October 2020 showing the projected Grid Carbon Factor falling dramatically from 156 grams in 2019 to just 67 grams in 2040.

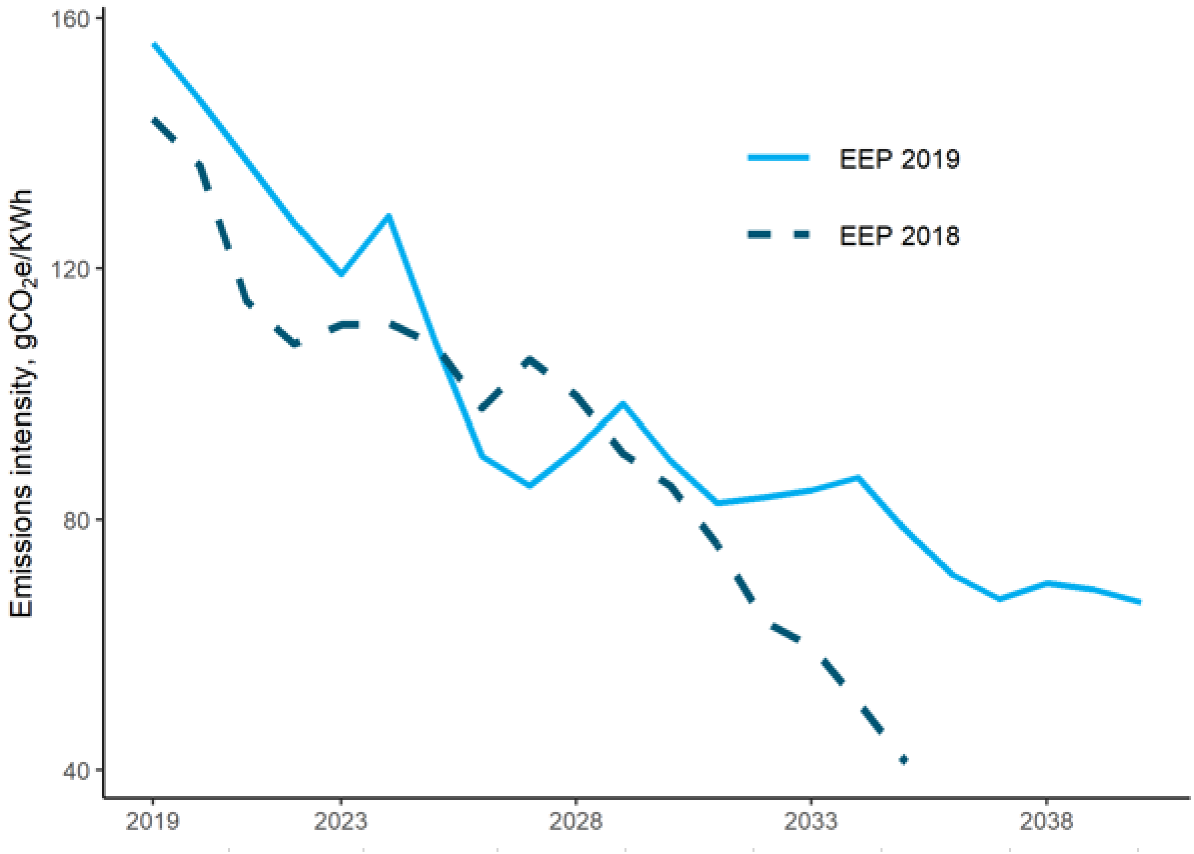


Figure 5 – Predicted Reduction in Grid Carbon Factor

Furthermore, the UK Government has passed laws that require the country to reduce all greenhouse gas emissions to net zero by 2050 and the phasing out of natural gas as a source of heating with gas heating to be banned from 2025.

4. GOVERNMENT POLICY REVIEW

4.1. National Policy Framework

A revised National Planning Policy Framework (NPPF) was updated and published in July 2021 which sets out the Government's planning policies for England and how they are expected to be applied. This framework replaces that published in February 2019. This framework states the purpose of Sustainable development that:

'The purpose of the planning system is to contribute to the achievement of sustainable development.'

This highlights sustainability as a critical issue that runs throughout all the planning policies. The National Planning Policy Framework (NPPF) defines sustainable development in agreement with the U.N. definition of "meeting the needs of the present without compromising the ability of future generations to meet their own needs." The NPPF outlines how three overarching objectives need to be pursued in mutually supportive ways to achieve sustainable development. These objectives are outlined below.

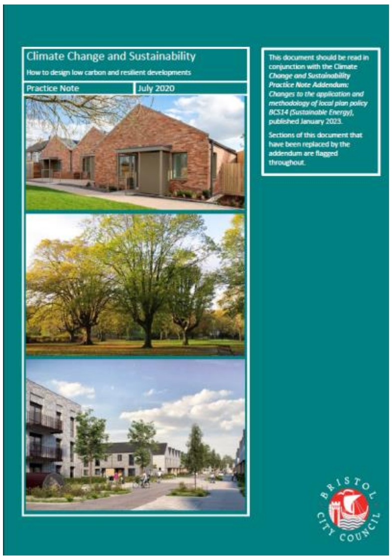
The environmental objective of this framework is to:

- Contribute to protecting and enhancing our natural, built, and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.

At the heart of the Framework is a 'presumption in favour of sustainable development.' Section 14 of the National Planning Policy Framework (NPPF) specifically addresses the challenge of climate change. It states that: 'New development should be planned for in ways that:

- Avoid increased vulnerability to the range of impacts arising from climate change. When new developments are brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure; and can help to reduce greenhouse gas emissions, such as through its location, orientation, and design. Any local requirements for the sustainability of buildings should reflect the government's policy for national technical standard Local Plan and supplementary guidance.'

4.2. Climate Change and Sustainability – Bristol City Council - 2020



This practice note provides advice on the implementation of Bristol Local Plan policies for sustainability, climate change and resilience. By following the guidance in this note, developers can ensure their proposals meet local plan requirements for delivering sustainable buildings.

The council has declared a climate emergency and Bristol has committed, in the One City Plan, to becoming carbon neutral and climate resilient by 2030. The council is implementing a range of measures, including this practice note, which will secure reduced emissions.

Developers should aim to exceed the requirements of the current local plan policies. Where development proposals go beyond the standards required by the current local plan, the benefits of such an approach can be taken into account as a material consideration when planning applications are decided.

- **Policy BCS13 – Climate Change**

Policy BCS13 states developments should contribute to both mitigating and adapting to climate change, and to meeting targets to reduce carbon dioxide emissions. Developments should mitigate climate change through measures including:

- High standards of energy efficiency including optimal levels of thermal insulation, passive ventilation and cooling, passive solar design, and the efficient use of natural resources in new buildings.
- The use of decentralised, renewable, and low-carbon energy supply systems.
- Developments should adapt to climate change through measures including:
    - Site layouts and approaches to design and construction which provide resilience to climate change.
    - Measures to conserve water supplies and minimise the risk and impact of flooding.
    - The use of green infrastructure to minimise and mitigate the heating of the urban environment.
    - Avoiding responses to climate impacts which lead to increases in energy use and carbon dioxide emissions.
    -

These measures should be integrated into the design of new developments. New development should demonstrate through Sustainability Statements how it would contribute to mitigating and adapting to climate change and to meeting targets to reduce carbon dioxide emissions by means of the above measures.

- **Policy BCS14 – Sustainable Energy**

Policy BCS14 requires a systematic approach whereby development reduces carbon emissions through the application of the following energy hierarchy:

1. Minimising energy requirements;
2. Incorporating renewable energy sources;
3. Incorporating low-carbon energy sources.

As such, the policy has four main strands:

- To encourage major freestanding renewable and low carbon energy installations;
- To reduce energy demsand through the use of energy efficiency and conservation measures, including improvements in fabric efficiency and air permeability and use of passive design principles in new development;

- To secure at least a 20% saving in CO_2 emissions from energy use in new development through on-site generation of renewable energy; and
- To ensure that heating and hot water systems are designed and specified in accordance with the heat hierarchy including, where appropriate, connection to a heat network.

Achieving high levels of energy performance beyond the requirements set by the Building Regulations should be viewed as a major priority in building design, particularly in light of the 'performance gap' between design and as-built energy performance that has been identified in recent years. Minimising energy use through design needs to be factored in from the beginning of the design process. Bristol City Council strongly encourages the use of fabric and other energy efficiency measures to reduce the requirement for heat and power in line with a 'fabric first' approach, and the application of the energy hierarchy.

Designing a shell and then considering how to meet the energy requirements means that opportunities will be lost - for example making use of the orientation of new buildings to take advantage of solar gain. Opportunities for energy efficiency should therefore be maximised at the planning stage. The Sustainability Statement, which is to be submitted with the planning application of new developments, should demonstrate how the orientation of buildings has been designed to optimise solar gain to support energy efficient design, whilst mitigating against overheating. The built form should also be designed to minimise the number of external heat loss walls.

Where site constraints allow, the application of passive design principles is recommended, as exemplified in the Passivhaus approach; this typically requires buildings to be orientated along an east/west principal axis so that the building faces within 30 degrees of due south. This allows the building to derive maximum benefit from useful solar gains.

Once the best possible building orientation has been identified, further measures to consider include:

- Substantial fabric insulation and/or wall thickness, and energy efficient glazing;
- The use and placement of internal thermal mass to create an internal energy buffer;
- Energy efficient building form;
- Appropriate levels of daylighting (e.g. through the use of an atrium or high level windows);
- Good levels of airtightness and appropriate ventilation provided mechanically with heat recovery or naturally;
- Minimising heat loss through thermal bridges;
- Solar shading on south facing glazing to avoid overheating during hotter weather; and
- Tree planting to provide summer shade, whilst allowing solar gain during the winter months.

Where mechanical ventilation is proposed, this should incorporate heat recovery with the facility for a summer bypass. Where local environmental conditions permit (e.g. noise, air quality), openable windows should be included as they allow building users the opportunity for natural ventilation at quieter times even where mechanical ventilation is also specified. Once energy demand for heating and cooling is reduced to a minimum through building fabric and design, consideration should be given to the efficient and low carbon building services and control systems to further reduce energy demand:

- Selection of heating and cooling systems in accordance with the BCS14 heat hierarchy (see below).
- Responsive heating controls;
- Building management systems linked to temperature, CO_2 and humidity sensors around the building; and
- Intelligent and energy efficient lighting design to incorporate LED lighting in combination with natural lighting.

Selection of Heating Systems

As mentioned above, heating and cooling systems should be selected in accordance with the heat hierarchy set out in policy BCS14. Applicants should note that the heat hierarchy intentionally excludes non-renewable electrical space and water heating and individual gas boilers.

The decarbonisation of mains electricity as a result of changes in the way electricity is generated and specifically a reduction in fossil fuel generation and increase in wind and solar PV generation has closed the gap between the carbon intensity of electricity and gas. The Government expects the carbon intensity of electricity to fall below that of gas by or before 2025. However, non-renewable electric heating remains excluded from the heat hierarchy for the following reasons:

- The continued decarbonisation of mains electricity is not guaranteed and is predicated on:
    - a significant increase in renewable power generating capacity in the UK, to displace fossil fuel generation; and
    - a shift from gas to renewable electric space and hot water heating, specifically heat pumps.

- Demand on the local electricity distribution network is expected to increase significantly over the next decade due to the transition to electric vehicles and the increased use of heat pumps in Bristol which, in combination with heat networks, will be necessary to decarbonise heat. The cumulative impact of developments across the city adopting a heating strategy based on electric resistive heating is to increase demand on the electricity distribution network. It makes the need for costly upgrades to the network more likely and could delay or make the transition to electric vehicles and renewable electric heat more difficult and more expensive.
- Electric resistive heating is relatively inefficient compared to heat pumps and is likely to increase running costs for the end user.
- An electric resistive heating system is also likely to mean that developments cannot easily connect to a heat network or heat pump based heating system in the future, as it would likely require the entire heating system to be replaced with a 'wet' system at a considerable cost. In most cases a wet heating system will, if designed correctly, allow for a future connection to a heat network.

For certified Passivhaus schemes electric resistive heating is allowable. This is because the space heating requirement is very small and to a large degree addressed through the ventilation system, which helps to avoid peaks in demand. The 'performance gap' between designed and actual energy usage has also been shown to be very small or non-existent in certified Passivhaus buildings. Applicants will be required to show that a scheme is capable of being certified as having met the Passivhaus standard and, in the event that it cannot, will be required to meet BCS14 in full by other means. This includes the selection of the heating and hot water system in accordance with the heat hierarchy.

- Combined heat and power

Combined heat and power (CHP) is an efficient way of generating energy, where waste heat from generating electricity is captured and used for space heating in buildings. This can also be combined with cooling for summer months to give combined cooling, heat and power (CCHP).

CHP requires substantial demand for heat and appropriate demand for power to be viable. Where CHP is proposed only for a single use development – e.g. a student accommodation building – the design should be future proofed to allow connection at a later stage to a larger heat network.

In energy strategies, the use of gas powered CHP is treated as an energy efficiency measure. If powered by renewable fuels, the use of CHP is treated both as an energy efficiency measure and as a renewable energy measure.

- District heating

Policy **BCS14** requires that within Heat Priority Areas (as identified in the Core Strategy), major developments connect to existing heat networks where available. Where a network is not available major developments within Heat Priority Areas should incorporate infrastructure to connect to district heating networks in the future where feasible. Within central Bristol these requirements are further emphasised by policy BCAP21.

Where the council cannot provide a connection to a heat network within one year, the development should instead be designed to meet one of the other options on the heat hierarchy set out in policy BCS14.

Renewable Energy Generation

The energy strategy should contain sufficient information to demonstrate that feasibility has been fully tested for a range of renewable energy technologies and that a 20% reduction in residual emissions has been achieved. A calculation of the likely energy generated from the renewable technology along with the resultant CO_2 emissions reduction should be provided in the energy strategy. Supporting information should be provided on the likely impacts – for example, in the case of biomass, details of the proposed arrangements for the supply, storage and delivery of fuel.

Recognising that the detailed design of the renewables scheme is generally carried out post planning consent, a condition will be imposed requiring the submission of a detailed specification to demonstrate that the proposed technologies have been fully incorporated within the detailed design and are capable of delivering the predicted emissions savings.

Allowable Solutions

Where it can be demonstrated that it is not possible to meet a 20% reduction in residual CO_2 emissions using renewable energy on site, in certain circumstances off-site solutions (Allowable Solutions) may be considered. Whilst no national framework for Allowable Solutions currently exists there are local solutions, for example in the form of either directly linked or near-site provision or through financial contribution to a city wide low carbon energy initiative.

Directly linked and near-site provision

'Directly linked' refers to the provision of renewable energy sources at other sites that are related to the application site. This could apply where, for example, renewable technology could be installed more effectively in terms of cost and / or output at a different site within the estate of the applicant.

'Near-site provision' refers to the provision of renewable energy sources outside but near to the application site. This could apply where, for example, solar panels could be installed on an existing building adjacent to the proposed development. This might be appropriate if, for example, the adjacent building is more favourable in terms of orientation or shading.

Financial contributions

Applicants should consult the local planning authority with regards to financial contributions as Allowable Solutions.

- **BCAP20: Sustainable Design Standards**

Policy BCS15 of the Core Strategy sets out requirements relating to sustainable design and construction and is applicable within the Central Area Plan area. This policy complements BCS15 by setting specific scaled standards against BREEAM and the Code for Sustainable Homes for development within Bristol City Centre.

Development in Bristol City Centre will be expected to meet sustainable design standards as set out in the table below:

Development type	2013 - 2015	2016 onwards
Residential 10+ dwellings	Code for Sustainable Homes level 4	Code for Sustainable Homes level 5
Residential 100+ dwellings	Code for Sustainable Homes level 4 and BREEAM for Communities "Excellent"	Code for Sustainable Homes level 5 and BREEAM for Communities "Excellent"
Non-residential 1,000m² or greater	BREEAM "Excellent"	BREEAM "Excellent"

The assessment of major development against national sustainability methodologies will ensure that development engages thoroughly with issues of sustainable design and construction. Assessments should be completed by a licensed assessor. The Code and BREEAM measures should be used unless they are replaced by an alternative national measure of sustainability as approved by the local planning authority.

5. REGULATORY FRAMEWORK

5.1. Building Regulations Part L 2021

Part L 2021 came into effect in June 2022 with a transitional period of 12 months and will act as an uplift to help the construction industry adapt to changing regulations and low carbon heating. Figure 7 shows the timeline for the new Part L regulations and displays that the new regulations will require a 31% and 27% reduction in CO_2 emissions compared to the previous 2013 regualtions for domestic buildings and non-domestic buildings respectively.

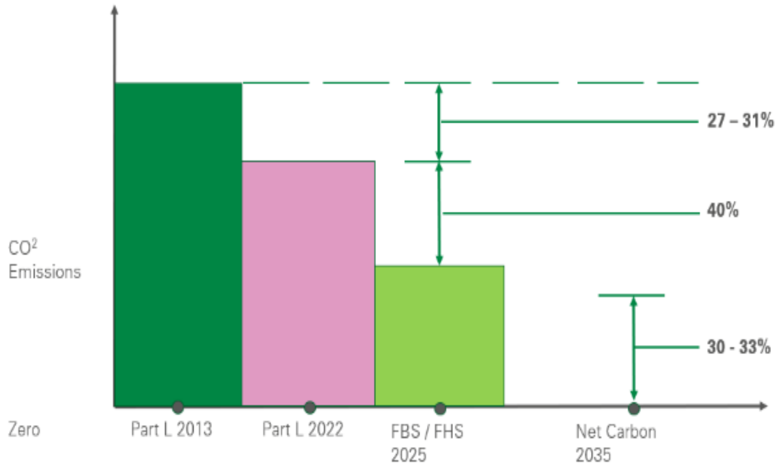


Figure 6 - Part L 2022 Changes

The future building standards which will come into effect in 2025 will require CO_2 emissions to be futher decreased by 40% in comparision to current figures. The timeline for the future buildings standards is displayed in figure 8:

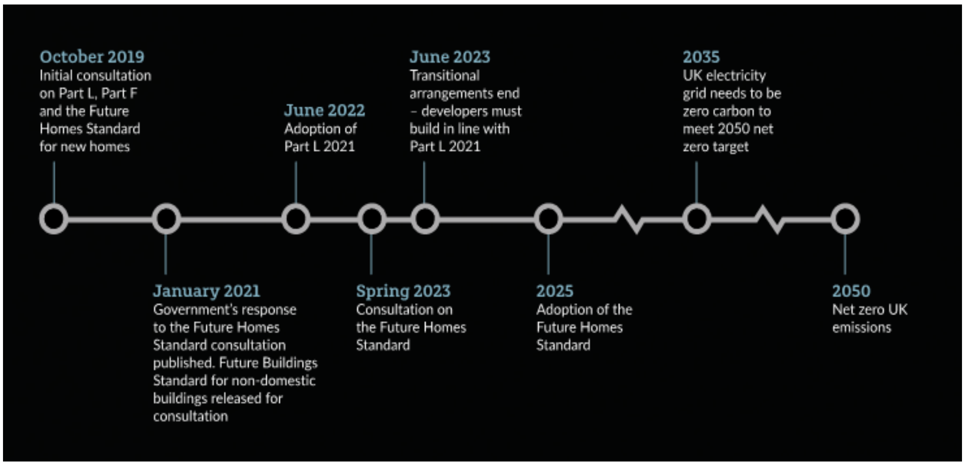


Figure 7 - Future Homes Standard

A new performance metric has also been ushered in, primary energy will become the principle measure replacing CO_2 emissions as the main metric. CO_2 emissions will become less effective as a measure of energy performance as the electricity grid becomes decarbonised. If not addressed, this could result in a dwelling with low CO_2 emissions complying with regulations, despite having excessively high energy consumption. Consequently, the Primary Energy metric has been introduced to ensure that energy efficiency is directly measured rather than assuming it is linked to CO_2 emissions. Any plans/notices submitted after June 2022 must adhere to the new Part L standards.

5.2. BREEAM

BREEAM (Building Establishment's Environmental Assessment Method) is the world's leading and most widely used environmental assessment method for commercial buildings.

BREEAM UK New Construction scheme is a performance based assessment method and certification scheme for new non-domestic buildings. The primary aim of BREEAM UK New Construction is to mitigate the life cycle impact of new buildings on the environment in a robust and cost effective manner. This is achieved through integration and the use of the scheme by clients and their project team at key stages in the design and construction process.

The building's performance is assessed under a number of categories, including:

- Energy
- Water
- Transport
- Materials
- Land use
- Pollution
- Health and wellbeing; and Management
- Waste

The assessment process provides in a report that covers the areas assessed, along with a formal certification on a scale of UNCLASSIFIED, PASS, GOOD, VERY GOOD, EXCELLENT and OUTSTANDING.

The assessment process provides in a report that covers the areas assessed, along with a formal certification on a scale of UNCLASSIFIED, PASS, GOOD, VERY GOOD, EXCELLENT and OUTSTANDING.

The diagram adjacent shows how the BREEAM assessment scores and rates a building:

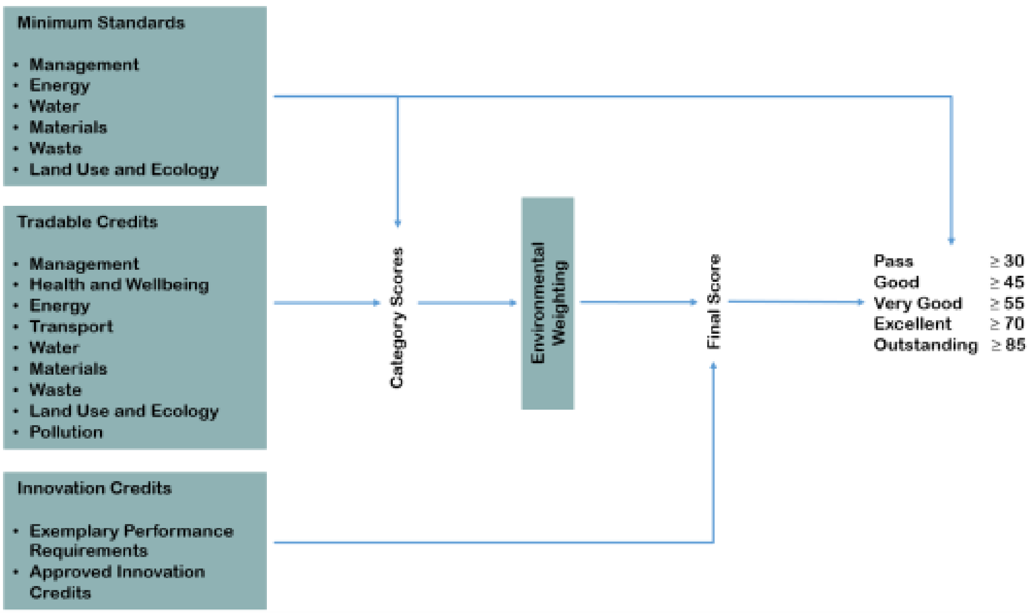


Figure 8 Process for Awarding BREEAM Ratings

The BREEAM categories include a number of environmental elements that reflect the different options available when designing, procuring and constructing a building. Each environmental element has credits available that are awarded when compliance has been demonstrated.

For the building to meet a specific BREEAM rating, there are a series of minimum standards that must be achieved for that rating to be awarded. In addition to the credits, there are also innovation credits available that provide additional recognition of sustainable performance that goes beyond what is currently recognised and rewarded by the standard BREEAM credits.

The innovation credits are awarded for either meeting the BREEAM exemplary level requirements or by an application to BRE to have a specific feature, system or process recognised as 'innovative'.

Each different BREEAM section has an environmental weighting applied to the scores which calculates the final BREEAM score. These factors have been derived from consensus based research with groups such as the government, suppliers and lobbyists.

The weightings are:

Environmental section	Weighting			
	Fully fitted out	Simple building	Shell and core only	Shell only
Management	11%	7.5%	11%	12%
Health and Wellbeing	14%	16.5%	8%	7%
Energy	16%	11.5%	14%	9.5%
Transport	10%	11.5%	11.5%	14.5%
Water	7%	7.5%	7%	2%
Materials	15%	17.5%	17.5%	22%
Waste	6%	7%	7%	8%
Land Use and Ecology	13%	15%	15%	19%
Pollution	8%	6%	9%	6%
Total	100%	100%	100%	100%
Innovation (additional)	10%	10%	10%	10%

Once the weightings have been applied, the score is then assigned a BREEAM rating as follows:

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

At this stage it is difficult to predict the exact number of BREEAM credits achievable by each Low and Zero Carbon Technology. These technologies will have an influence over the following:

- Ene 01 – Energy Performance – Up to 9 credits are available
- Ene 01 – Predicting Operation Energy use – Up to 4 credits are available
- Ene 04 – Low and Zero Carbon Technologies – Up to 3 (+1 innovation) credits are available
- Pol 02 – Local Air Quality – Up to 2 credits are available.

The BREEAM target for the New Henry Street development is BREEAM Excellent.

6. APPRAISAL OF SOLUTIONS

6.1. Summary

The strategic approach outlined, follows a specific appraisal of technologies at each stage of design and to achieve the overall goal of CO_2 reduction.

As on the whole it becomes more expensive to implement carbon reduction measures the further along the design process as the opportunities to reduce demand diminish.

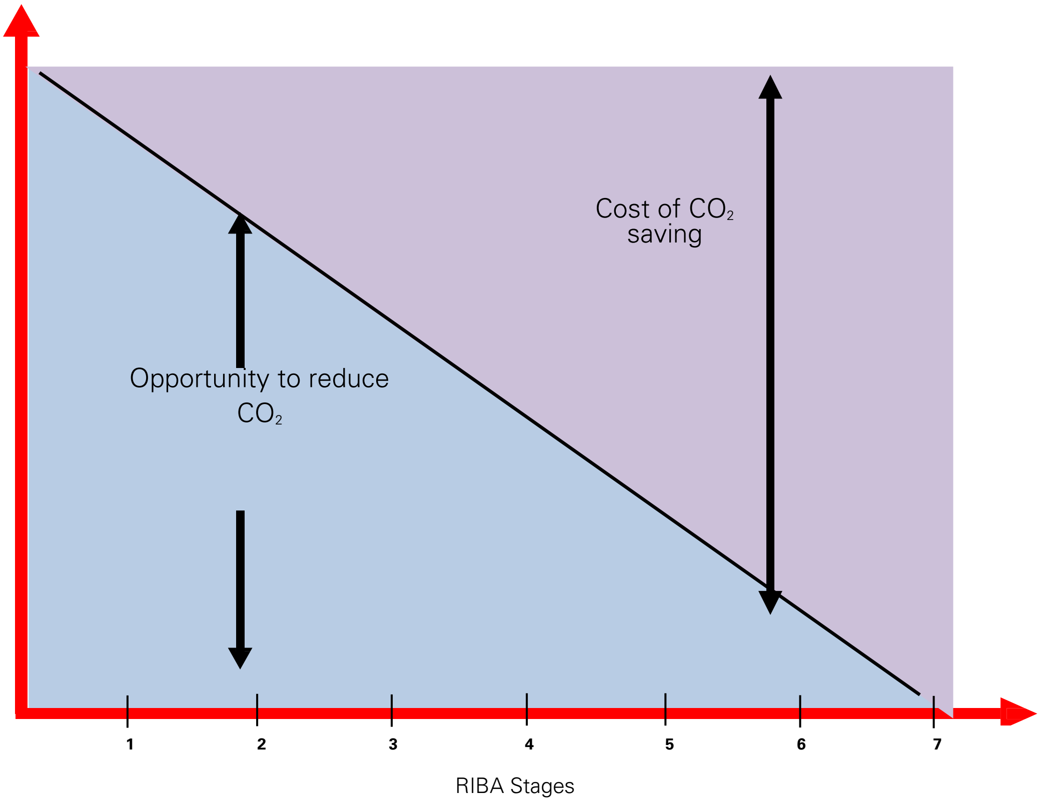


Figure 9 - Costs of implementing design measures at each RIBA Stage

In this first instance it is therefore essential that the buildings 'passive measures' are optimised and the design team work in close collaboration with the user team to consider the future fit out demands.

The next stage is to adopt 'efficient technologies' such as heat recovery and variable speed drives etc. to meet the demand efficiency with the final approach of assessing 'renewable and low carbon' technologies for implementation.

Our approach has followed the lean, mean, green approach shown below. Firstly, reduce the energy demand, secondly, meet the demand efficiently and finally, assess low and zero carbon technologies which are suitable for implementation:

Reduce Demand

Passive design:

- Thermal insulation
- Natural ventilation
- Natural daylight
- Thermal mass
- Air tightness
- Solar shading/Glass Specification

LEAN Reduce Energy Demand

Meet demand efficiently

Meet Demand Efficiently:

- Low energy fit out
- Heat recovery
- Mixed mode ventilation
- Low energy lighting (LED)
- Power management
- Variable speed drives
- Demand Operated Systems
- Low Specific Fan Power

MEAN Supply Energy Cleanly and Efficiently

Supply energy from low and zero carbon technology

Renewable and Low and Zero Carbon Technologies:

- Combined heat power/tri-generation
- Biomass/biofuels
- Solar thermal hot water
- Ground source heat pumps (GSHP)
  - Open loop
  - Closed loop
- Photovoltaics
- Fuel cells
- Air source heat pumps (ASHP)
- Wind
- Hydro

GREEN Incorporate Renewable Energy

6.2. Passive Design Measures - (Reduce Demand – Be Lean)

This section looks at the proposed measures that will ensure the initial demand for energy in the building is low from the outset using passive measures.

The **site location** is in central Bristol, with **weather** typical of the South-West. Summers are comfortable and partly cloudy and the winters are long, cold, windy, and mostly cloudy. Over the course of the year, the temperature typically varies from 3°C to 21°C and is rarely below -3°C or above 27°C. There are existing buildings on all the surrounding roads which will provide some level of shading. Overheating is likely to occur to spaces with windows facing south, in addition to southeast and southwest U-values surpassing the Minimum Building Regulations requirements will minimise the winter heat loss, while low g-value glazing will allow for optimal gain, without summertime overheating.

The **microclimate** in the centre of Bristol tends towards higher temperatures than typical in the South-West generally, due to the urban heat island effect.

In terms of expected **building occupancy**, these are expected to be typical of buildings of this type with variable usage in the purpose built student accommodation (PBSA) generally but high occupancy in the weekday evenings and weekends. For the commercial space of the building, it is unknown what the occupancy will be as they are speculative commercial units, but the usages could realistically be all day and evening (i.e. shop during day, bar / restaurant during the evening)

The following measures are assessed for suitability in the design:

- **Passive Design**
  - Thermal Insulation and Thermal Bridging
  - Natural Ventilation / Mixed mode
  - Natural Daylight
  - Thermal Mass
  - Air tightness
  - Solar Shading
  - Low Energy Fit Out
  - Sub-metering
  - Adaption to climate change

These measures promote the reduction of Energy use and carbon emission in the first instance.

The passive design features at New Henry Street, Bristol mean that the building is well adapted to these risks.

Firstly, the energy demand has been reduced and therefore the building will be less affected by the decreased availability of energy.

Secondly, the building will have a lower carbon footprint helping to stop the effects of climate change from increasing any further.

The expected increase in external temperatures could result in future overheating problems. Whilst the building cannot be relocated, by having low G-Value glass, there is less solar heat gain entering the rooms.

The demand for cooling has also been reduced through the adoption of efficient building services and by exceeding the u-values stated in the Building Regulations.

This combination of passive design measures act to stabilise the temperatures within the building and enable it to adapt to the likely extremes of both high and low temperatures.

Key:
Y – Yes could be incorporated
P – Possible
N – Not appropriate

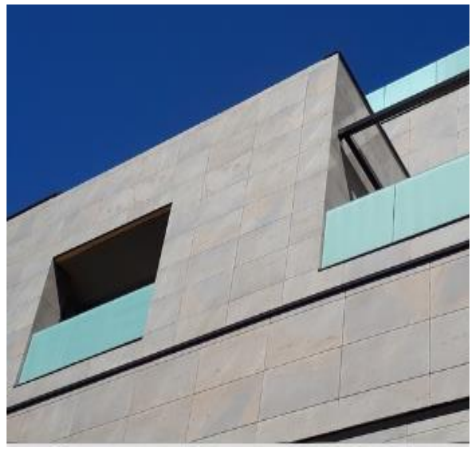
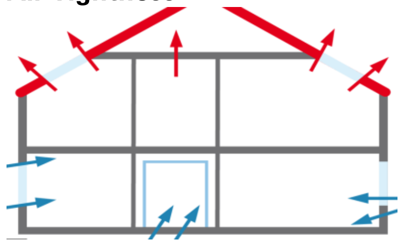
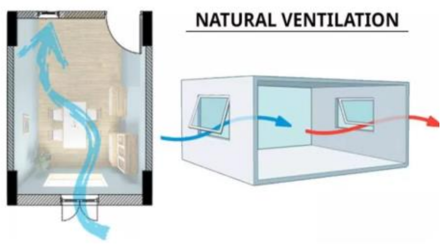
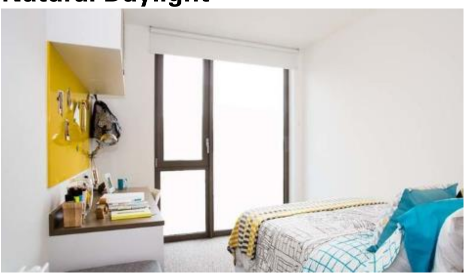
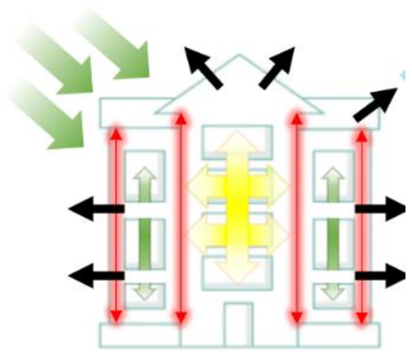
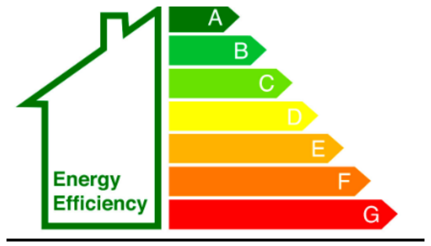
Measure	Description	Suitable For Consideration	Commentary
Thermal Insulation 	Thermal insulation is the reduction of heat transfer (i.e., the transfer of thermal energy between objects of differing temperature) between objects in thermal contact or in range of radiative influence.	Y	Insulation is central to low energy construction to reduce unnecessary heat loss. The Part L building regulations set out limiting efficiencies for thermal insulation which we intend to improve on shown in the table to the left. This will reduce the energy required to heat the spaces in the proposed new building. The future building standards will also need to be considered. This will come into effect in 2025 and will require CO_2 emissions to be further decreased by 40% in comparison to Part L 2021 current figures therefore careful consideration of thermal insulation must be made at design stage. The development will adapt a high level of thermal insulation to reduce heat loss and thus reduce overall energy demand. Thermal insulation is essential to minimise heat losses and minimum standards. Building Regulation U-Values will matched or exceeded.

Table 4.1 Limiting U-values for new or replacement elements in new and existing buildings and air permeability in new buildings

Element type	Maximum U-value[1] W/(m²·K) or air permeability
Roof (flat roof)[2]	0.18
Roof (pitched roof)[2]	0.16
Wall[2][3]	0.26
Floor[4][5]	0.18
Swimming pool basin[6]	0.25
Windows in buildings similar to dwellings[7][8]	1.6 or Window Energy Rating[9] Band B
All other windows,[8][10][11] roof windows, curtain walling	1.6
Rooflights[12][13]	2.2
Pedestrian doors (including glazed doors)[14]	1.6
Vehicle access and similar large doors	1.3
High-usage entrance doors	3.0
Roof ventilators (including smoke vents)	3.0
Air permeability (for new buildings)	$8.0m^3/(h \cdot m^2)$ @ 50Pa

Air Tightness 	Airtightness is the control of air leakage, i.e. the elimination of unwanted draughts through the external fabric of the building envelope. This may be achieved by the correct and proper installation of a vapour check or vapour barrier.	Y	The development will target an air tightness that exceed the minimum requirements of Part L 2021 building regulations to reduce air infiltration and unwanted draughts through the external fabric of the building envelope and so heating and cooling energy demand will be lowered. The development will target a air tightness of $3m^3/(h.m^2)$ at 50 Pa.
Natural Ventilation 	Natural ventilation is a method of supplying fresh air to a building or room by means of passive forces, typically by wind speed or differences in pressure internally and externally. During design, natural ventilation is first considered before mechanical ventilation because this reduces carbon emissions.	Y	An acoustics report has deemed natural ventilation unsuitable to meet the buildings ventilation demands alone. However, natural ventilation will be used in a mixed mode approach with mechanically powered ventilation using MVHR units to counter space overheating. The internal planning, building geometry and external topography will be optimised to take full advantage of natural ventilation. Careful attention to the placement of openable windows and interior partitions can greatly increase the natural flow of air through a building by capturing the prevailing winds.
Natural Daylight 	Natural light is light that is generated naturally, the common source of which is the Sun. This is as opposed to artificial light, which is typically produced by electrical appliances such as lamps.	Y	To reduce the energy used for artificial lighting the natural daylight entering occupied spaces will be maximised by optimising window size and orientation. Dimmable lighting with photocells will sense if the illuminance level of the space has been met and reduce lighting levels as required. North facing windows are particularly effective at providing useful daylight and will be incorporated on the building. The buildings orientation and fenestration strategy will take advantage of passive solar gains and natural daylight to reduce heating energy and the need for artificial lighting.
Solar Shading 	Solar shading is a method by which solar radiation in the form of heat and light can be mitigated in a building. While natural heat and light are essential in most buildings and modern architecture uses it more and more there are occasions when the levels are too high. This leads to overheating and too much light. Solar shading is a general term for a range of methods used to reduce the amount of solar gain.	Y	Whilst maximising daylight care must be taken to ensure that direct sunlight does not cause glare in the spaces and does not cause excessive solar gains in summer which will cause spaces to overheat. This is managed by solar shading on affected windows. Some examples of solar shading are: canopies, solar control glazing, balconies, internal blinds and curtains which could be adopted on this development. Solar shading by recessing of windows to be considered throughout the scheme

Thermal Mass 	Thermal mass describes a materials capacity to absorb, store and release heat. For example, water and concrete have a high capacity to store heat and are referred to as 'high thermal mass' materials. Insulation foam, by contrast, has very little heat storage capacity and is referred to as having 'low thermal mass'. A common analogy is thermal mass as a kind of thermal battery. Though thermal mass has always been an aspect of buildings, only in recent years has it evolved as a tool to be deployed in the conservation of energy. However thermal mass does not offer a 'one size fits all' concept.	**N**	Thermal mass such as concrete can absorb large amounts of heat energy which prevents spaces from overheating. The thermal mass can be cooled overnight when the space is not occupied to further reduce energy needed for cooling when the space is occupied. The New Henry Street development will be of medium lightweight structure with a concrete flat roof.
Low Energy Fit Out 	A low energy fit out is an interior development of a building that is low carbon in its design, operation, and entire lifecycle.	**Y**	All goods and appliances should be highly energy efficient to reduce energy demand.
Sub-metering 	Building submetering is a meter within your building or facility for specific energy measurements.	**N**	Power, lighting, major plant and separate tenancy areas will be metered to allow energy consumption to be pinpointed and reviewed if it is excessive. Baselines and targets will also be set to help reduce energy use. The individual rooms of the development will not be metered individually, the building as a whole will be metered.
Adaption to climate change 	Average temperatures for central England have risen by approximately 1°C since the 1970s and this has resulted in higher temperatures, changing rain patterns, rising sea levels, in addition to unpredictable extreme weather events such as floods, droughts and freezing winters. Risks of climate change include the increased likelihood of increased external temperatures which could lead to staff illness and therefore lower productivity, damage to equipment due to the high internal building temperatures in addition to increased cooling demand.	**Y**	An uplift in fabric improvements and solar shading on a development can maximise the retention of heat in winter and reduce solar gains in summer. These actions will help combat the extremes expected as a result of climate change.

6.2.1. Passive Design Measures Summary

In summary, section 6.3, has set out the passive design elements incorporated within the development of New Henry Street. Our approach has followed the recognised strategy of fabric first followed by energy efficiency measures. The team have maximised passive measures to reduce the initial load of the building in terms of heating, cooling, and anticipated lighting loads with the following measures: -

- U-values that exceed minimum Building Regulation Standards as below
- Air leakage rates that exceed minimum Building Regulations as below
- Low G-Value Glass (0.4) which will offer a level of solar shading

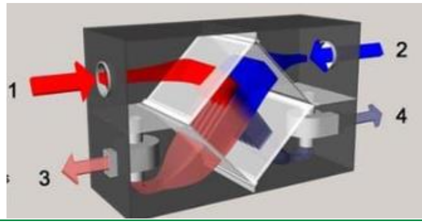
Element	Part L 2021 Building Regulations	New Henry Street Target U-Values
Flat Roof U-Value	0.18 W/m2K	0.11 W/m2K
External Wall U-Value	0.26 W/m2K	0.13 W/m2K
Ground Floor U-Value	0.18 W/m2K	0.13 W/m2K
External Glazing U-Value	1.60 W/m2K	1.60 W/m2K
Air-permeability	$8m^3/hour/m^2$ @ 50Pa	$3\ m^3/hour/m^2$ @ 50Pa

6.3. Meeting Demand Efficiently - (Be Clean)

This section looks at technologies that will be used to ensure that energy demand is further reduced and met efficiently

- Ventilation
- Heat recovery
- Demand Operated Systems
- Variable Speed Drives on fans and pumps
- Power Management
- LED Lighting
- Waste Water Heat Recovery
- BMS

Key:
Y – Yes could be incorporated
P – Possible
N – Not appropriate

Technology	Description	Suitable For Consideration	Commentary
Mechanical Ventilation Heat Recovery (MVHR) 	MVHR provides fresh filtered air into a building whilst retaining most of the energy that has already been used in heating the building. Heat Recovery Ventilation is the solution to the ventilation needs of energy efficient buildings.	Y	Where fresh air is supplied, and stale warm air extracted by mechanical ventilation, heat recovery will be used to recycle up to 85% of the heat from the extracted air to warm the incoming air. The re-use of waste heat in the mechanical ventilation systems could provide a significant step towards reducing CO_2 emissions. Local Mechanical Ventilation Heat Recovery (MVHR) units to incorporate heat recovery where provided.
Demand Operated Systems 	The control of the heating, cooling, ventilation, and lighting systems is fundamental to the energy efficiency of buildings. The use of the following measures can reduce energy consumption: Zoned thermostatic control; Time control; Variable flow control; BMS (Building Management System) automated control; Lighting PIR (Passive Infra-Red Sensor) control; Daylight linked lighting control; CO_2 detection; and Energy management control	Y	Where ventilation, heating and cooling is provided to a space that may not always be in use, occupancy sensors will be used, this will be fundamental to the energy efficiency of each building. These will shut down the systems serving the spaces when they are not required and turn them back on instantly when they are required. The use of the following measures will be encouraged: Zoned thermostatic control; Time control; Variable flow control; BMS (Building Management System) automated control; Lighting PIR (Passive Infra-Red Sensor) control; Daylight linked lighting control; CO_2 detection; and Energy management control. The use of passive infra-red (PIR) for lighting, heating, ventilation will be adopted where feasible
Variable Speed Drives 	Variable speed drives and controls allow an energy system to modulate during periods of low demand. Using variable speed drive pumps therefore uses less energy than traditional pumps, which run at a constant speed.	Y	All pumps and fans would be provided with variable speed motors which will speed up and slow down as the demand increases or reduces to conserve energy. These can be used in conjunction with the demand operated systems to reduce the speed of pumps and fan motors to a minimum to conserve energy. Variable speed drives can be adopted on all fan and pump motors where possible to reduce energy consumption (Central Plant).
Power Management 	Power management is a computing device feature that allows users to control the amount of electrical power consumed by an underlying device, with minimal impact on performance. It enables the switching of devices in various power modes, each with different power usage characteristics related to device performance.	Y	Power factor correction can be used on the electrical supplies of a building to improve energy efficiency and will be adopted on the New Henry Street development.

LED Lighting 	An LED lamp or LED light bulb is an electric light that produces light using light-emitting diodes. LED lamps are significantly more energy-efficient than equivalent incandescent lamps and can be significantly more efficient than most fluorescent lamps	**Y**	Extensively adopted LED fittings will be used throughout the scheme to limit the energy associated with internal and external lighting.
BMS Optimisation 	A building management system is a computer-based control system installed in buildings that controls and monitors the building's mechanical and electrical equipment such as ventilation, lighting, power systems, fire systems, and security systems.	**Y**	The building shall be provided with an intelligent building management system that will learn how the building operates and optimise the function of the ventilation, heating, and cooling systems to minimise energy use.

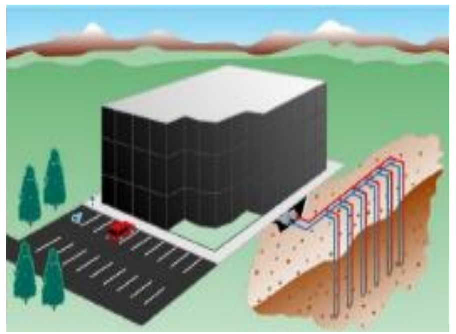
6.4. LZC Technology - (Be Green)

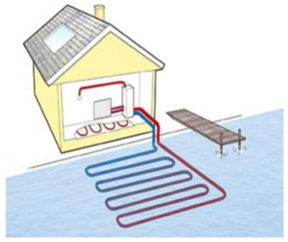
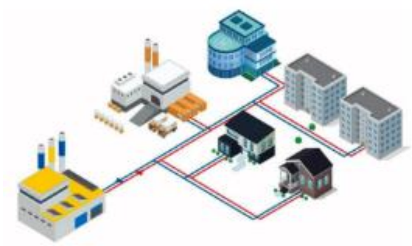
The following Low Zero Carbon (LZC) technologies have been identified and reviewed against their suitability on the New Henry Street, Bristol site:

- Solar Water Heating
- Ground Source Heat Pumps
- Water Source Heat Pumps
- District Heating
- Biomass
- Wind Power
- Photovoltaic Electricity Generation
- Combined Heat and Power
- Air Source Heat Pumps
- Battery Storage

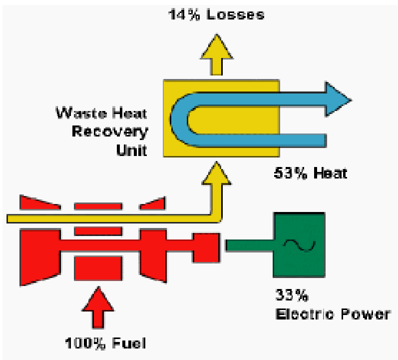
These services are described in more detail below and their suitability discussed.

Key:
Y – Yes could be incorporated
P – Possible
N – Not appropriate

Technology	Description	Suitable For Consideration	Commentary
Solar Thermal Water Heating 	Solar thermal water heating systems use heat from the sun to pre-heat domestic hot water. Solar thermal water heating systems are generally composed of solar thermal collectors and a fluid system to move the heat from the collector to a storage tank to store the heat for subsequent use. The system requires solar panels on the roof, ideally south facing, linked to hot water storage cylinders.	**P**	The solar energy collection and pipework distribution strategy would centre on collecting and storing thermal energy in cylinders or tanks in plant rooms. The roof space would be better utilised for PV panels and plant equipment as such there would be limited space to utilise this technology therefore not proposed for this development.
Ground Source Heat Pumps 	Ground Source Heat Pumps (GSHP) can be used to extract heat from the ground by circulating a fluid through a system of pipes buried underground to a heat exchanger which transfers the energy to the distribution network. This can provide space heating and/or domestic hot water. Ground source heat pumps have the advantage that they can act as a source of both heating and cooling for the buildings. Ground source heat pumps are either open-loop (abstracting and rejecting water to the aquifer below the site) or closed-loop. aquifer below the site) or closed-loop using boreholes and energy piles.	**N**	GSHP's have an average COP of 4.6 meaning that for every unit of electricity used to pump heat, 4-6 units of heat are produced making it an effective way of heating a building. However, the efficiency of the system is dependent on the low distribution temperatures from the low grade heat. There is limited land available for boreholes/pipework therefore it would be difficult for this system to be incorporated in the development. Financial constraints of this technology are also an issue and therefore discounted.

Water Source Heat Pumps 	Water Source Heat Pumps (WSHP) work in a similar way to GSHP, with the exception that the pipes are submerged into a river, stream, lake or the sea. The fluid is pumped through the system and absorbs energy from the surrounding water. WSHP can be either an open-loop or closed-loop system.	**N**	No suitable water courses nearby with enough volume.
District Heating 	Energy sources include heat from CHP and to a lesser extent, geothermal. Bristol City Council has a district heating scheme with the possibility of connection, however the feasibility and viability of connection to the district heating mains related to both the proximity of the network and the forecasted annual heat demand.	**N**	The Bristol District Heat Network is planned to be extended near to the site in the future with a view to adopt the New Henry Street development to the system. The scheme will have all the necessary infrastructure in place to allow for this future connection.
Biomass 	Biomass heating systems burn biomass material in a biomass boiler in order to heat water in the same way that gas boilers burn gas. Biomass materials include all land and water based vegetation, e.g. wood chips, wood pellets, wood waste and fast growing coppice trees such as willow. The carbon dioxide emitted from burning biomass is balanced by that absorbed during the fuel's production. Biomass heating therefore approaches a low carbon process. Biomass boilers require fuel storage for the fuel source.	**N**	Could be adopted to offset heating and hot water but high NOx levels are a concern. Sourcing of materials and transporting large volumes into the site would be an issue. Wood chips require a large storage area, usually equivalent to the plant room size, therefore this technology is discounted.
Wind Power 	Wind power is one of the cleanest and safest methods of generating electricity. Wind turbines use the wind's forces to turn a rotor which in turn generates electricity. Wind power is used in large scale wind farms for national electrical grids as well as in small individual turbines or building integrated turbine.	**N**	Wind Power is not deemed suitable on the roofs of the development.
Photovoltaic Electricity Generation 	Photovoltaic (PV) modules are devices or banks of devices that use the photovoltaic effect to generate electricity directly from sunlight. Until recently, their use has been limited due to high manufacturing costs. In buildings current applications include PV on the roof, PV curtain walling systems and PV louvred external shading devices. Typically, photovoltaics would be installed on a south facing roof.	**Y**	The development will have a significant electricity demand over a 24 hour period, therefore, no potential issues with utilisation, i.e. availability will match demand. The PV panels are used to generate electricity reducing CO_2 emissions. PV panels are considered attractive to generate renewable energy to the development.

Combined Heat and Power (CHP)



A CHP unit provides heating as well as electrical power. The electricity generated by the CHP plant can be distributed around a development and into the electrical network if needed. The use of this co-generation improves the overall efficiency of the primary energy delivered to the site with a corresponding reduction in the development's CO_2 emissions.

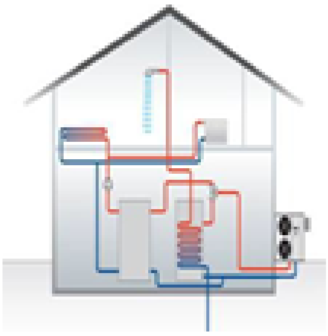
The amount of thermal energy provided by the CHP unit will be dependent on the calculated thermal base load for the buildings.

N

Relatively low cost of CHP unit if integrated into a gas boiler and domestic water cylinder strategy. High maintenance costs result in marginal returns on small to medium sized installations

Not considered as is not compatible with future de-carbonisation of the grid and reduction of use of fossil fuels

Air Source Heat Pump



Air source heat pumps work in a similar way to GSHPs but extract thermal energy from the surrounding air and transfer it into water. Air source heat pumps can be fitted on the façade or on the roof but care should be taken when mounting the units to avoid any acoustic problems associated with operating the fans as the outdoor units typically operate with sound levels in the range 55 - 60dB(A).

The efficiency of ASHP is measured by Coefficient of Performance (CoP); this is the ratio of units of heat output for each unit of electricity used to drive the system. Average CoP is around 2-4 although some systems may produce a greater rate of efficiency.

Y

The ASHP system does offer an attractive solution in terms of the de-carbonisation of the grid and the omission of natural gas to the site.

This technology is feasible to generate hot water & heating and is the favoured solution for the development.

6.4.1. LZC Technology Summary

Section 6.4 has set out the low and zero carbon technologies incorporated within the development of New Henry Street Development and has established the renewable and low carbon technologies that can be adopted is by using air source heat pumps (ASHP) to generate the heating, hot water and cooling to the development, combined with Photovoltaic Panels to offset a percentage of the developments electrical demand.

The ASHP solution will generate heating and hot water to the development with high an efficiency system where typically 1 kWh of electricity input will generate 3 kWh of heat output (known as the co-efficient of performance or COP).

To further supplement this system with renewable technology, rooftop photovoltaic panels will be provided to generate electricity for the development.

Photovoltaic Summary

The use of photovoltaic panels is considered attractive as this system offers an effective method of offsetting carbon emissions and has little/no maintenance or ongoing costs. The installations are scalable with size only restricted by façade and/or roof space.

PV panels mounted on the roof have been proposed on the development.

The following table summarises the capital costs, payback and both the energy and CO_2 savings by introducing the PV.

Capital cost	£60,480
Payback period	3.8 years
Energy generated by PV per annum	40,961 kWhr/yr
CO_2 saving	5.57 tonnes/CO2/yr

Capital cost based on £1,150/kWp

The table above summarises the approximate capital cost and estimated energy generated by PV.

Possibility of electricity export

Should the generation of electricity from the PV system exceed the requirement of the building at any point, it can be exported and sold to the grid. Utilities providers typically offer two different rates for the electricity based upon the predictability of electricity exported. Suitable measures and infrastructure to enable the system to export electricity are typically inexpensive and relatively simple for small systems, but co-ordination with the local district network operator is usually necessary. However, as the demand on site will be high, it's not deemed feasible to export electricity generated from PV.

Available Grants

A scheme that is currently open is the Smart Export Guarantee (SEG). The Smart Export Guarantee requires some electricity suppliers to pay small scale generators for low carbon electricity, which is exported to the National Grid, as long as certain conditions are met. The scheme covers up to 5MW of Solar photovoltaic (solar PV).

Air Source Heat Pump Summary

ASHPs would be a good choice to deliver both heating, hot water to the New Henry Street development.

An Air Source Heat Pump system is proposed to be installed on this development; the following table summarises the capital costs, payback and both the energy and CO_2 savings by introducing Air Source Heat Pumps in place of gas.

Capital cost	£378,000
Payback period	No Payback
Energy generated by ASHP per annum	313,410 kWhr/yr
CO2 saving	68.7 tonnes/CO2/yr

The table above summarises the approximate capital cost and estimated energy saving when carbon and energy offsets are considered.

Possibility of electricity export

No.

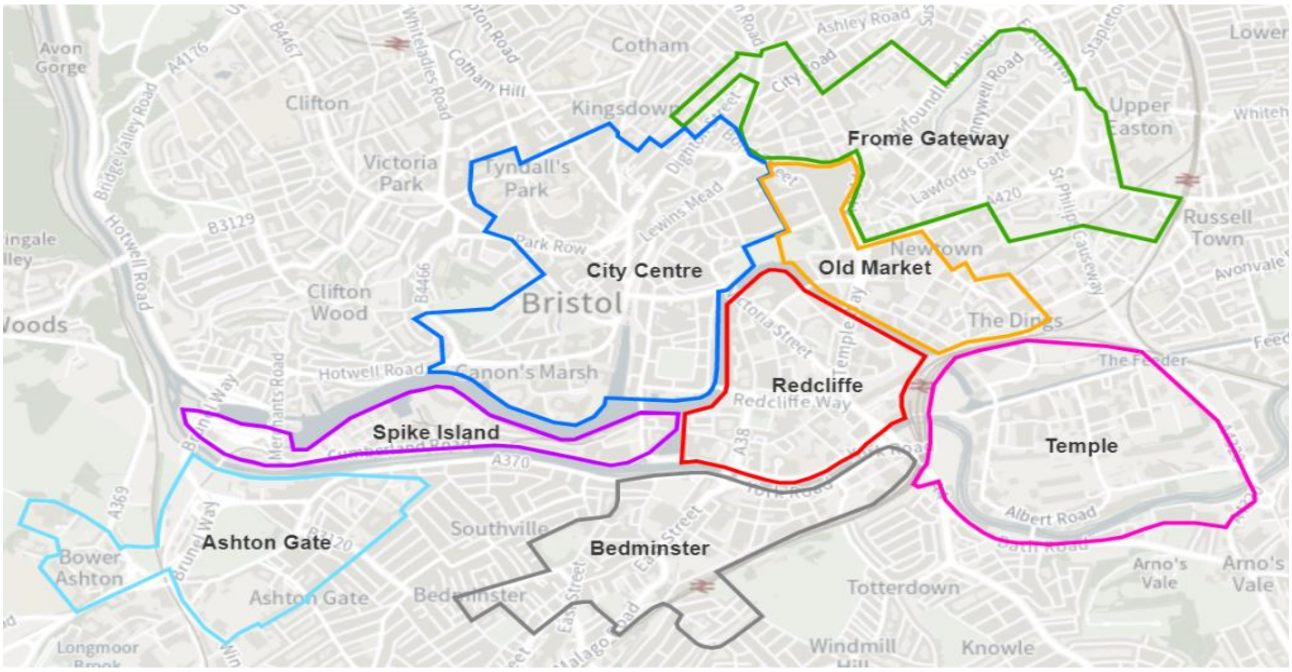
Available Grants

N.A

6.5. District Heating Network

This section outlines how consideration of energy supplied efficiently from a district heating network can be provided to the development in line with the Energy Hierarchy.

There are currently two city centre heat networks in Bristol that are in operation at Redcliffe and Old Market, with a third under construction in Bedminster. These networks supply over 15GWh of heat per year across 14 operational connections. Ultimately, the intention is to create a single interconnected, city-wide Bristol Heat Network. The map below shows showing areas for heat networks to be delivered and expanded up to the year 2027.



At this time, it is not possible to connect to the Bristol district heating network as it is still being extended. However, the view is to extend the network in the future and there will be an option to connect the New Henry Street development to the system. The development will have all the necessary infrastructure in place to allow for this future connection.

7. PREDICTED CARBON EMISSIONS

The following predicted carbon emissions relate to a RIBA Stage 2 design and have been subject to design development during the next RIBA Stage.

The energy consumption of the development has been reduced by including 'lean' measures such as reduced U-values, 'mean' measures such as high efficiency services, and 'green' measures ensuring the building meets the minimum part L2A (2021) Target Emission Rate.

Bristol City Council have set out in Policy 'BCS14 – Sustainable Energy' from the Climate Change and Sustainability Document, that new developments must secure at least a 20% saving in CO_2 emissions from energy use through on-site generation of renewable energy. Section 6.4 has assessed the feasibility of renewable energy technologies that could be implemented on the New Henry Street development. From investigation, the most feasible technologies for implementation are Air Source Heat Pumps and Photovoltaic Panels. These technologies demonstrate that a 20% saving in energy usage can been achieved.

The tables below are from the Climate Change and Sustainability 2023 document that is set out by the Bristol City Council, the tables have been populated with figures that have been used on the New Henry Street Development:

Table 1 - % CO2 Reduction (No District Heating Connection)

NO DISTRICT HEAT CONNECTION	Regulated Energy Demand (MWh/yr)	Regulated CO_2 emissions (tonnes/yr)	CO_2 saved (tonnes/yr)	% CO_2 reduction
Baseline - Part L TER	1731.06	253.79	-	-
Proposed scheme after energy efficiency measures	2143.26	319.49	-65.70	-25.89
<u>Residual emissions</u> Proposed scheme after energy efficiency measures and CHP (if using)	1924.50	277.88	41.61	13.02
Proposed scheme after on-site renewables	1209.11	112.91	164.98	59.37
Total CO_2 reduction beyond Part L TER			140.89	55.51

Table 2 - Energy Efficiency Table

Notional Building TER without PV ($kg/CO_2/m^2$)	Proposed Building BER before energy efficiency measures ($kg/CO_2/m^2$)	Emissions for the proposed building with energy efficiency alone ($kg/CO_2/m^2$)
10.43	13.13	11.42

Table 3 - Energy consumption by end use

	Notional building		Proposed building	
	Energy consumption	Fuel type	Energy consumption	Fuel type
Heating (MWh/year)	158.17	Electricity	124.59	Electricity
Hot water (MWh/year)	163.03	Electricity	166.44	Electricity
Cooling (MWh/year)	16.79	Electricity	22.39	Electricity
Auxiliary (MWh/year)	301.49	Electricity	357.70	Electricity
Lighting (MWh/year)	192.72	Electricity	182.01	Electricity
Total (MWh/year)*	832.19	-	853.12	-
Total per GIA (kWh/m2/year)*	831948.69	-	853118.49	-
***Not including equipment load**				

Table 4 - Development recommended U-Values

	(Part L Values 2021 or most current)		
Element or System Dwellings	**Non Dwellings Limiting**	**Non Dwellings Notional**	**Proposed**
Wall	0.26	0.18	0.13
Roof	0.18	0.15	0.11
Floor	0.18	0.15	0.13
Windows	1.6	1.4	1.6
Doors	1.6	1.6	1.4
Rooflights	2.2	2.1	-
Air permeability	8	3	3

Table 5 - On-site renewables installed capacity

Renewable electricity – enter the total installed capacity (kW)	50
Renewable electricity – enter the estimated annual yield (kWh) from renewable measures generating electricity (where available apply recognised standard methodologies such as the Microgeneration Certification Scheme (MCS) methodology for Solar PV)	61319.41
Renewable heat – enter the total installed capacity (kW)	764
Renewable heat – enter the estimated annual yield (kWh) from renewable measures generating heat	291023.88

8. CONCLUSIONS

This report has set out the passive design measures, energy efficiency measures and low and zero carbon technologies that have been incorporated within the development of New Henry Street, Bristol.

The development has been designed with U-values and air permeability that are lower than the minimum Building Regulations values which is essential in reducing the initial demand for energy of the building from the outset using passive measures. For the proposed development, U-values and air permeability values that exceeds Building Regulations have been used which will result in less energy required to maintain comfortable conditions inside the building as well as the building performing better as an insulator.

Passive design measures will allow the proposed development to maximise the use of natural sources of cooling and ventilation to maintain comfortable conditions within the internal spaces and will also allow the heating system to perform more efficiently. Utilising these passive measures will consequently reduce energy consumption and CO_2 emissions of the proposed development as less energy will be required for the space heating and space cooling requirements.

Energy efficiency measures have then been evaluated to assess which measures suit the produced development best. High efficiency LED lighting will be used throughout coupled with demand operated lighting where appropriate via daylight diming, absence detection which turns lights off when there is no occupancy detected. This reduces energy consumption and CO_2 emissions associated with lighting in the proposed development.

Heat recovery is proposed to the mechanical ventilation systems within proposed development. These units will provide fresh air and heat recovery to the individual bedrooms of the development as well as the cluster kitchens and the amenity spaces. This reduces the required cooling load which can reduce the CO_2 emissions that the development produces and will also assist in providing comfortable living conditions. Alongside this, the proposed ventilation units come with a summer bypass mode which will be used on the units during the summer periods which will reject heat instead of recovering. This will be used to avoid summer time overheating as during the warmer months of the year.

Various renewable and low zero carbon technologies have been assessed and this report has established the renewable and low carbon technologies that can be adopted is by using Air Source Heat Pumps (ASHP) to generate the heating, hot water and cooling to the development and Photovoltaic Panels to offset a percentage of the developments electrical demand.

This system was chosen to align with the government's policy on the phasing out of fossil fuels and the subsequent decarbonisation of the National Grid.

The ASHP solution will generate hot water, heating and cooling to the development with high efficiency system where typically 1 kWh of electricity input will generate 3 kWh of heat output (known as the co-efficient of performance or COP).

To further supplement this system with renewable technology, rooftop photovoltaic panels will be provided to generate electricity for the development.

8.1. Summary

In summary, by adopting the Low and Zero Carbon technologies identified in section 6.4, the developments building emission rate is lower than the target emissions rate and passes criterion 1 as follows:

The following BRUKL results relate to a RIBA Stage 2 design and will be subject to design development during the next RIBA stages. The results produced are from IES modelling software using the new Part L 2021 building regulations.

Target CO_2 emission rate (TER), $kgCO_2/m^2$. annum	4.75	
Building CO_2 emission rate (BER), $kgCO_2/m^2$. annum	4.64	
Target primary energy rate (TPER), kWh/m^2. annum	50.89	
Building primary energy rate (BPER), kWh/m^2. Annum	49.69	
Does the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

The proposed option provides an improvement over Part L2A 2021 baseline calculation.

The BRUKLS for the results are shown in the Appendix 1 of this report.

9. PART O NOTE

9.1. Building Regulations Part O: Overheating

The proposed development at New Henry Street Bristol will feature opening windows and mechanical ventilation units to provide fresh air and purge ventilation to the occupied rooms. A strategy will be implemented to satisfy the requirements under Building Regulations Part O: Overheating with use of CIBSE's TM59 Methodology for risk of overheating in dwellings.

The limits under TM59 mean that the development will adhere to the following:

When a room is occupied during the day (8am to 11pm), openings should be modelled to do all of the following.

a)

i. Start to open when the internal temperature exceeds 22°C.
ii. Be fully open when the internal temperature exceeds 26°C.
iii. Start to close when the internal temperature falls below 26°C.
iv. Be fully closed when the internal temperature falls below 22°C

b)

At night (11pm to 8am), openings should be modelled as fully open if both of the following apply.

i. The opening is on the first floor or above and not easily accessible.
ii. The internal temperature exceeds 23°C at 11pm.

C)

When a ground floor or easily accessible room is unoccupied, both of the following apply.

i. In the day, windows, patio doors and balcony doors should be modelled as open, if this can be done securely, following the guidance in paragraph 3.7 below.
ii. ii. At night, windows, patio doors and balcony doors should be modelled as closed. d. An entrance door should be included, which should be shut all the time.

Solutions will work to align with acoustic requirements and demands of Part F for ventilation and Part L conservation of fuel and power.

10. APPENDIX 1

BRUKL

The following BRUKL results relate to a RIBA Stage 2 design and have been subject to design development during the planning stage. The results produced are from IES modelling software using the new Part L 2021 building regulations.

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

New Henry Street — As designed

Date: Tue Dec 12 20:21:07 2023

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.20

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.20

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

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Foundation area [m²]: 3041.64

The CO_2 emission and primary energy rates of the building must not exceed the targets

Target CO_2 emission rate (TER), $kgCO_2/m^2annum$	4.75	
Building CO_2 emission rate (BER), $kgCO_2/m^2annum$	4.64	
Target primary energy rate (TPER), kWh_{PE}/m^2annum	50.89	
Building primary energy rate (BPER), kWh_{PE}/m^2annum	49.69	
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	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.13	0.19	000000B3:Surf[35]
Floors	0.18	0.13	0.13	SP000006:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.11	0.11	SP000034:Surf[19]
Windows** and roof windows	1.6	1.6	1.6	SP00000B:Surf[2]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	1.4	1.4	SP000006:Surf[1]
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]
$U_{i\text{-}Calc}$ = Calculated maximum individual element 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
m³/(h.m²) at 50 Pa	8	3

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m²]	24333.1	24333.1
External area [m²]	23053.1	29804.4
Weather	CAR	CAR
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	10499.1	11784.8
Average U-value [W/m²K]	0.46	0.4
Alpha value* [%]	25.17	10

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

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
99	**Residential Institutions: Universities and Colleges**
	Secure Residential Institutions
	Residential Spaces
	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
1	**Others: Miscellaneous 24hr Activities**
	Others: Car Parks 24 hrs
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	5.12	6.5
Cooling	0.92	0.69
Auxiliary	14.7	12.39
Lighting	7.48	7.92
Hot water	6.84	6.7
Equipment*	28.96	28.96
TOTAL**	**35.06**	**34.19**

* 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	2.52	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*2.52*	*0*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	74.27	76.52
Primary energy [kWh_{PE}/m^2]	49.69	50.89
Total emissions [kg/m²]	4.64	4.75

The analysis supporting this report was carried out by a competent person who is a Chartered Engineer with IMechE, Low Carbon Consultant (LCC) and Level 3,4 and 5 IES DSM qualified.

Name of Assessor: Adam Imrie

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