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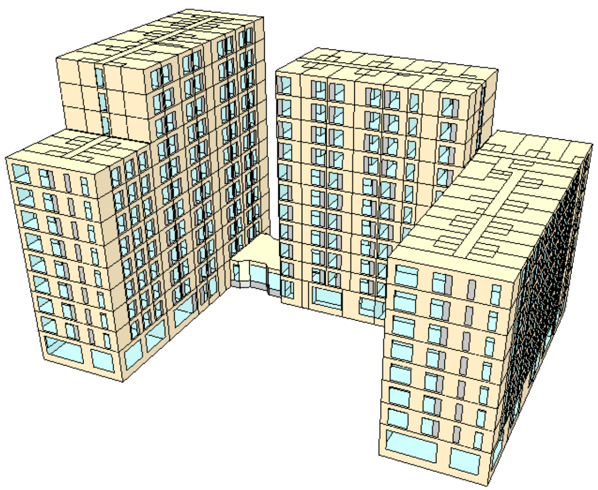
Avon Street
Bristol

Energy Statement Update - 27/11/2023



QA

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Contents

Section 1 – Executive Summary

This Energy Statement has been written to address the changes to the new building from an energy perspective to comply with the planning requirements of Bristol City Council as set out in the "Climate Change & Sustainability Practice Note", detailing policies BCS13-15.

This Energy Statement has been prepared to illustrate the environmental aspects of the proposed development highlighting the Energy/Carbon emission profile and, assess the options available for reducing energy consumption and associated CO_2 emissions in accordance with Bristol City Council's policies and guidelines.

A number of planning policies, both national and local that apply to the proposed development, have been reviewed together with the Building Regulations Approved document part L2 2021. Bristol's policy BCS14 advises that a carbon emissions reduction of 20% greater than Part L of the Building Regulations shall be achieved.

The baseline energy emissions have been developed, producing a preliminary Sbem calculation for the building. The fabric first approach has been prioritised with these passive measures being adopted across the building including vast improvements to the thermal performance and air tightness. The improvements made beyond current Building Regulations Part L2 are identified in the adjacent table indicating a 12-40% improvement on U-values and a 50% improvement on air permeability.

Construction Element	Building Regulation Specification	Development Specification
Floor	0.18 W/m²K	0.11 W/m²K
External Wall	0.26 W/m²K	0.15 W/m²K
Roof	0.16 W/m²K	0.10 W/m²K
Unitised Façade/ Curtain Walling	1.60 W/m²K	1.40 W/m²K
Window	1.60 W/m²K	1.40 W/m²K
Air Permeability	8.00 m³/h/m²	4.00 m³/h/m²

In addition to the fabric first passive design measures, active building services are to be designed to minimise direct energy consumption and CO_2 emissions, with particular emphasis on the following;

- Connection to Bristol's district heating network
- Reduced Standing Losses from Pipes and Cylinders
- Energy Efficient LED Lighting & improved Lighting Controls
- Low Energy Motors in Pumps and Fans
- Efficient Heat Recovery in relevant systems and with enhanced controls
- Installation of a photovoltaic panel array

The carbon emissions on this proposed development have been calculated to achieve 13.64% reduction below Part L 2021 via the energy and heat hierarchy using the lean, clean and green technologies.

Then in addition to the carbon calculations completed under the current Building Regulations 2021, the results indicate the development performs well and is achieving a 14.44% reduction in primary energy on day one. This will improve over time as the UK electricity grid continues to decarbonise in the future.

	Base scheme – Electric heating, no PV	District heating & no PV	District heating + PV included
TER (kgco2)	5.8	5.57	5.57
BER (kgco2)	7.14	5.86	4.81
Results over Part L2 2021	-23.1%	-5.2%	13.64 %
Result	Failed Part L	Still failed Part L, but Improved by 18%	Improved by another 18% & now passes Part L

Section 2 – Introduction

Futureserv Ltd have been appointed to produce an update to the Energy Statement to support the planning application for the proposed development at Avon Street. The proposed development shall consist of 447 student beds via a mixture of studios and clusters, alongside amenity provisions.

This Energy Statement addresses the planning requirements of Bristol City Council as set out in their planning policy BCS14.

The strategy proposed for this development is to use Bristol's off-site district heating network alongside onsite renewable and Low Carbon systems to meet Bristol City Council's desire for carbon reduction using Low or Zero Carbon Technology.

The strategy is essentially based on the reduction of energy consumption by use of passive construction measures, fabric first approach alongside active energy efficient equipment.

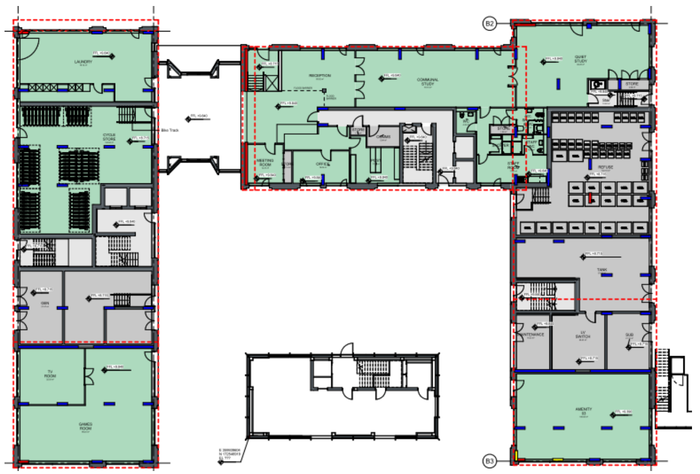


Figure 1 – Ground floor site plan showing building's location (Source; Chapman Taylors ground floor plan)

Section 3 – Development Proposals

Futureserv Ltd have been appointed to produce an Energy Statement in support of a planning application for the construction of a high-quality new student residential development at Avon Street, Bristol.

The development shall consist of approximately 447 beds. The building will also incorporate amenity space and communal spaces.

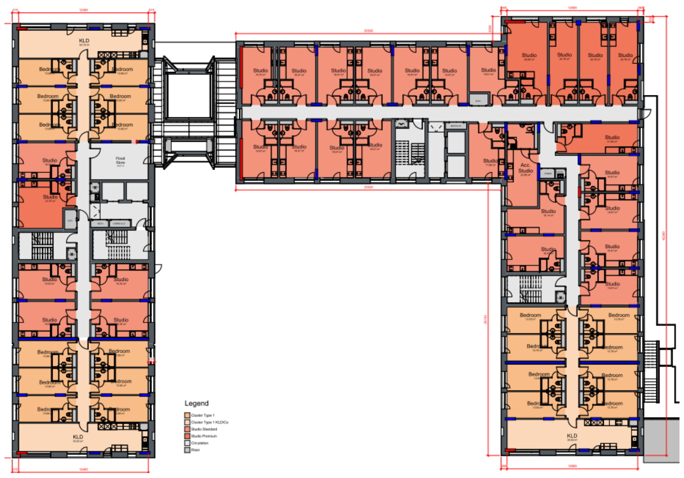


Figure 2 – Typical residential floor plan (Source; Chapman Taylor 1st floor plan)

This Energy Statement has been prepared to illustrate the environmental aspects of the proposed development highlighting the Energy/Carbon emission profile and assess the options available for reducing energy consumption and associated CO_2 emissions, in accordance with Bristol City Council's policies and guidelines.

Futureserv Consulting Engineers have collaborated with the design team in order to provide a holistic solution for the building that will provide an efficient envelope and contain intelligent building services reducing the environmental impact of the development whilst providing comfortable living accommodation.

Section 4 – Policy and Legislation

There are a number of planning policies both national and local that apply to the proposed development.

The National Planning Policy Framework (NPPF), offers specific guidance which highlights the UK's aspiration to support a transition to a Low Carbon future in a changing climate and in particular, to encourage the use of renewable resources such as Renewable Energy and states;

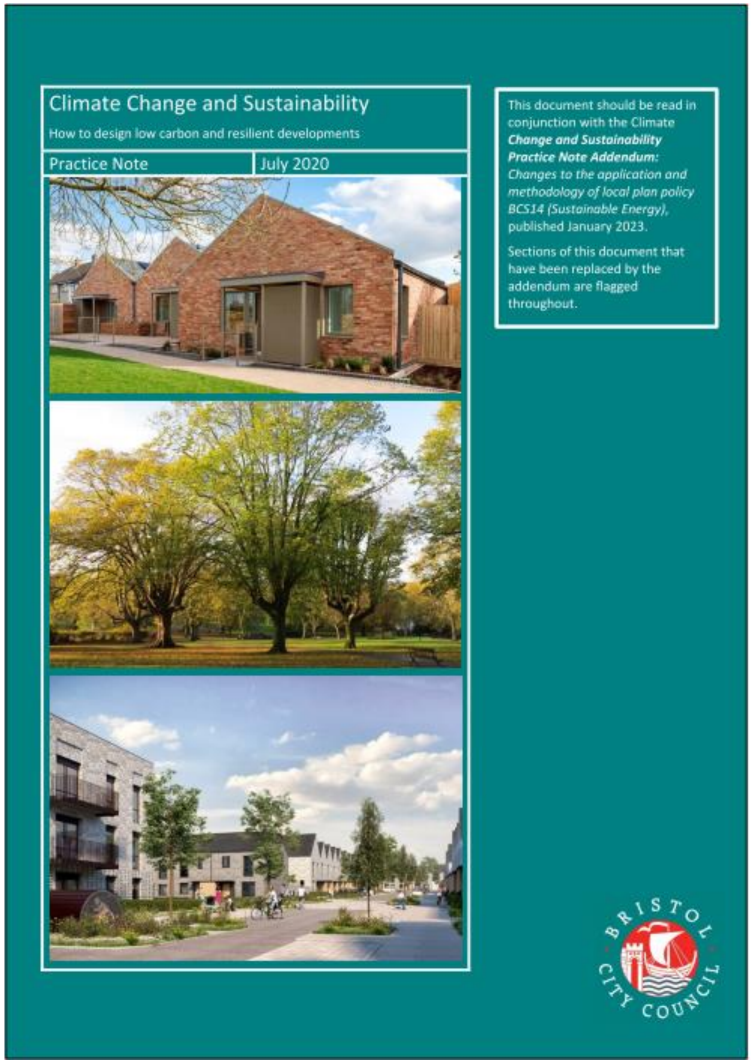
Planning authorities should ensure that development plans contribute to global sustainability by addressing the causes and effects of climate change through policies which reduce energy use and emissions, promote development of renewable energy resources, and take climate change impacts into account in the location and design of development.

Local Policies

In addition to Building Regulations compliance the performance of the building will provide additional carbon savings in line with policies of the Bristol Local Plan and Bristol's Climate Change Note.

This practice note offers advice on the implementation of Bristol Local Plan policies as they relate to sustainability, climate change and resilience. The relevant strategic policy is set out in policies BCS13-16 of the Bristol Core Strategy.

Within these documents, specific policies highlight carbon emissions reductions and the impacts of climate change. These are as follows.



Bristol Local Framework

Policy BCS14: Sustainable Energy

BCS14	Sustainable Energy Provides criteria for assessing new renewable energy schemes, with a presumption in favour of large-scale renewable energy installations. Requires new development to minimise its energy requirements and then incorporate an element of renewable energy to reduce its CO_2 emissions by a further 20%. Supports the delivery of a district heating network in Bristol.

The development will meet the strategy targets shown in the above table.

Development must follow the principles of the Energy Hierarchy, being designed:

- to reduce the need for energy through design features;
- to reduce the need for energy through energy efficient features; and
- to meet residual energy requirements through the use of low or zero carbon energy generating technologies.

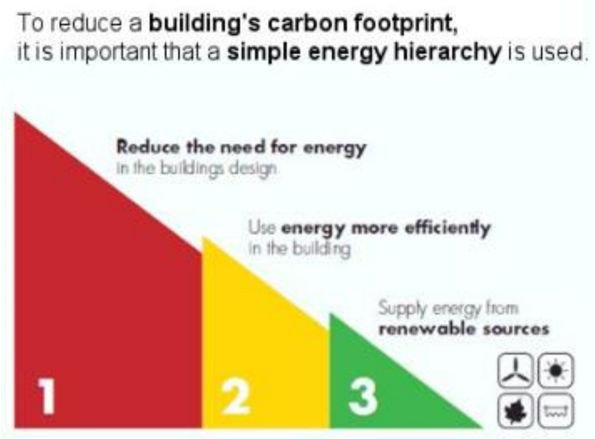
Building Standards

1. New development should be designed and constructed to meet the relevant Building Regulations, as a minimum, with a view to:

   a) Maximising energy efficiency and the use of low carbon energy

2. In meeting the carbon reduction targets set out in Building Regulations, the Council will expect development to be designed in accordance with the following energy hierarchy:

   a) Reduce energy demand through energy efficiency measures
   b) Supply energy through efficient means (i.e. low carbon technologies)
   c) Utilise renewable energy generation



Renewable Energy Generation

1. Proposals for the installation of renewable and low carbon energy technologies, including both building-integrated and standalone schemes will be promoted and encouraged, provided that:

   a) any significant adverse impacts can be mitigated.
   b) where biofuels are to be utilised, they should be obtained from sustainable sources and transportation distances are minimised.
   c) any energy centre is suitably located and designed to a high quality such that it is sympathetically integrated with its surroundings; and
   d) all proposals are consistent with any relevant Policies in this Plan.

Renewable energy can be supplied at a national level from sources such as large offshore wind farms, solar farms or hydroelectric schemes.

Locally, smaller and on-site renewable energy schemes include solar photovoltaic, solar thermal, ground source and air source heat pumps and, where fuelled by biomass or biogas, district energy schemes and combined heat and power plants (CHP). On-site renewable energy schemes are the most effective way for Bristol to contribute to renewable energy targets set out by the Government.

The indications from the evidence base identify there will be a greater need to encourage and support a wider spectrum of renewable energy technologies to help deliver the energy supply that would be placed on the grid as a result of the levels of growth planned for the city. Therefore, as part of the strategic approach, any proposed development schemes will be expected to consider and incorporate, where viable, renewable energy generation technologies as part of the overall suite of energy supply.

Building Regulations Part L (2021) Compliance

The proposed development is being designed to comply with the Building Regulations Approved Document Part L2, 2021 edition. These approved documents took effect from 15th June 2022.

The main changes in these approved documents from the previous revisions are that.

- The notional building used to determine carbon dioxide targets is the same size and shape as the actual building, constructed to a concurrent specification. The Part L2 2021 specifications have been strengthened to deliver a circa 30% carbon dioxide saving across the new non-domestic building mix relative to part L2a 2013.


ONLINE VERSION

HM Government

The Building Regulations 2010

Conservation of fuel and power

APPROVED DOCUMENT

L

Volume 2: Buildings other than dwellings

Requirement L1: Conservation of fuel and power

Requirement L2: Onsite generation of electricity

Regulations: 6, 22, 23, 24, 25, 25A, 25B, 26, 26C, 27, 27C, 28, 40, 40A, 43, 44 and 44ZA

2021 edition – for use in England

Section 5 – Energy Strategy

5.1 - Baseline Energy Assessment

Futureserv Ltd have conducted analysis for this stage of the development on the current design of the building, to show compliance with the Building Regulations Part L2: 2021, therefore setting a reference baseline.

This baseline energy assessment has been developed, producing a preliminary Simplified Building Energy Model (SBEM) calculation for the building. The baseline models have been created to provide Target Emission rates (TER). The calculations then in turn produce Building Emission rates (BER) which are equal to or lower than that of the TER.

SBEM is the standard assessment method for the carbon emission levels of a building. This considers the fabric properties of the building, the method of heating/cooling/ventilating/hot water etc and produces an estimate of carbon emissions.

If the building does not pass the Part L criteria, then it is an iterative process to add renewable/low carbon technologies, to lower the overall carbon emissions.

5.2 - Passive Design Improvements

On the completion of the model and establishment of the Target Emission Rates (TER), the building emissions have been reduced through judicious passive design. This has involved an assessment of non-energy consuming design decisions to create a fabric first approach to energy efficiency.

Passive fabric measures across all the building include improvements to the thermal performance and air tightness above Part L requirements of the Building Regulations and this effectively allows the building envelope to attenuate external conditions without recourse to active Building Services.

5.2.1 – Fabric First Approach

A **'fabric first'** approach to building design involves maximising the performance of the components and materials that make up the building fabric itself, before considering the use of mechanical or electrical building services systems. This can help reduce capital and operational costs, improve energy efficiency and reduce carbon emissions. A fabric first method can also reduce the need for maintenance during the building's life.

Buildings designed and constructed using the fabric first approach aim to minimise the need for energy consumption through methods such as:

- Maximising air-tightness.
- Using Super-high insulation.
- Optimising solar gain through the provision of openings and shading.
- Optimising natural ventilation.

Focussing on the building fabric first, is generally considered to be more sustainable than relying on energy saving technology, or renewable energy generation, which can be expensive, can have a high embodied energy and may or may not be used efficiently by the consumer.

Having energy efficiency integrated into the building envelope can mean occupants are required to do less to operate their building and not have to adjust their habits or learn about new technologies. This can result in less reliance on the end user regarding the buildings energy efficiency.

Fabric first building systems can be constructed off site, resulting in higher quality and so better performance, reduced labour costs and an increased speed of build.

5.2.2 - Fabric Values

The table below shows the proposed material specification that will be incorporated within the building design to limit heat losses and ensure efficient operation of the proposed development.

An air tightness of 4.0 $m^3/hr/m^2$ @50Pa is targeted for this development in order to minimise uncontrolled ventilation. An improved air tightness reduces heat losses and energy demand of the development.

Construction Element	Building Regulation Specification	Development Specification	Improvement over Part L2 Building Regulations
Floor	0.18 W/m^2K	0.11 W/m^2K	39% improved
External Wall	0.26 W/m^2K	0.15 W/m^2K	43% improved
Roof	0.16 W/m^2K	0.10 W/m^2K	37.5% improved
Unitised Façade/ Curtain Walling	1.60 W/m^2K	1.4 W/m^2K	12.5% improved
Window	1.60 W/m^2K	1.4 W/m^2K	12.5% improved
Air	8 $m^3/h/m^2$	4.00 $m^3/h/m^2$	50% improved

5.3 - Energy Efficiency Improvements

In addition to the Passive design measures described in the preceding Section to improve the building envelope performance, the Active Building Services are to be designed to minimise direct energy consumption and CO_2 emissions, with particular emphasis on the following;

- Connection to Bristol's district heating network
- Reduced Standing Losses from Pipes and Cylinders
- Energy Efficient LED Lighting
- Improved Lighting Controls
- Low Energy Motors in Pumps and Fans
- Efficient Heat Recovery in relevant systems and
- Enhanced heating controls

It is currently proposed that the heat energy for the domestic hot water will be generated using a connection to the Bristol district heat network.

The space heating will be generated via a connection to Bristol's district heating network in all accommodation areas of the building. These will be complete with thermostatic and time controllers.

The ventilation will be via whole dwelling Mechanical Heat Recovery Ventilation (MVHR) units in each studio & cluster. These will provide extract ventilation to kitchens and bathrooms, and balanced supply ventilation to all occupied rooms. Purge ventilation will be via openable windows, giving the occupants the final control over the environment in their homes.

Amenity areas of the building will be ventilated and cooled as required by detailed calculations, with dedicated mechanical ventilation heat recovery units and local comfort cooling systems.

All internal lighting installations will make use of low energy technologies combined with presence and absence detection in conjunction with timed setbacks. 100% low energy lighting provision will be included within the development. Photo switching and automatic dimming will be specified to the communal areas of the building in order to improve the efficiency of the lighting system.

All fans, motors and pumps shall be specified to incorporate ECA accredited technology and appropriate controls.

Construction Element	Specification
Ventilation	MVHR heat recovery ventilation
Lighting	100% low energy fittings
Space Heating	Low pressure hot water radiators fed from the off-site district heating network
Heating Control	Thermostatic and time controlled
Water Heating	Central domestic hot water cylinders fed from the low-pressure hot water system served by the offsite district heating network connection

To demonstrate that the design choices made have reduced the carbon emissions of the building two iterations of the building have been assessed.

The first of which uses Electric heaters to provide the space and water heating. This design fails Part L, Target emissions is 5.8 and the building emission rate of 7.14 this represents a 23% fail.

Then we replaced the electric space and water heating with the existing district heating system which the project plans to connect to. The design Target emissions rate is 5.57 and the building emissions rate is 5.86 this represents a 5.2% fail.

Using the district heating system shows an improved carbon emissions rate of 17.8% over the electric heating system.

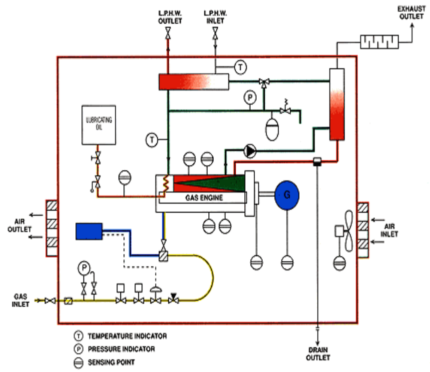
This is in compliance with Bristol city councils heat hierarchy as the project connects to an existing district heating system.

5.4 - Renewable Energy Improvements

In order to comply with Bristol's Local Plan, which aims to utilise renewable or low carbon technologies, there are a number of options to consider. All currently acknowledged and commercially available technologies have been considered and assessed with the conclusions summarised below.

Combined Heat and Power (CHP)

On-site generation of electricity and the utilisation of waste heat from this process within a building can create a beneficial arrangement whereby the transmission losses of grid supplied electricity can be omitted. The use of CHP tends to require a steady and continuous heat demand therefore the large quantities of domestic hot water associated with residential studio accommodation would satisfy this requirement.



Diagrammatic layout of CHP unit

However, the integration of Combined Heat and Power technology has been discounted due to the movement to utilise decarbonised grid electricity over traditional fossil fuel heating systems. This alongside the location and clean air act implications with the flue discharge have discounted this technology.

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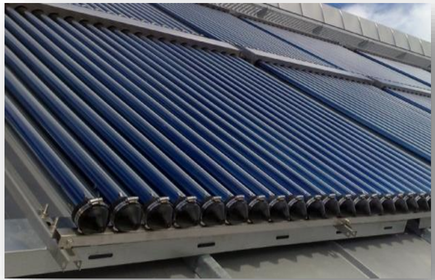
Solar Thermal Collectors

The use of flat plate & evacuated tube thermal panels has been identified as a potential method of harnessing renewable solar energy by pre-heating domestic hot water provision.

The introduction of the renewable Heat Incentive may further improve the financial viability for the technology.



Example of Solar Thermal unit

However, there is a conflict between the use of a central solar thermal collector array and connecting to the off-site district heating network. Furthermore, the restricted flat roof areas available (due to the PV inclusion) negate the inclusion of a panel system offering any significant contributions. Therefore, without being able to offer a good contribution of renewable energy alongside the logistic and strategy issues, the installation of solar thermal panels has been discounted for the development.

Solar Photovoltaic Panels

The option to utilise roof mounted Photovoltaic panels to generate electrical energy is a renewable energy method of generating Carbon free electrical power.

Due to the density in occupancy within the development, there is likely to be a fairly constant base electrical load prevalent on the building which may be mitigated in part by the use of Solar PV.

PV System components

The flat roof areas of the building could be used to accommodate a PV array which could support a reasonably sized system. The system would be able to offer a good contribution of renewable energy to the building and therefore the installation of photovoltaics has been included in the development.

Wind Turbines

Wind energy can be a cost-effective method of renewable power generation and turbines can produce Carbon neutral electricity with outputs ranging from watts to megawatts.

The most common design is for three blades mounted on a horizontal axis, which is free to rotate into the wind on a tall tower. The blades drive a generator either directly or via a gearbox (generally for larger machines) to produce electricity.

The electricity can either link to the grid or charge batteries. An inverter is required to convert the electricity from direct current (DC) to alternating current (AC) for feeding into the grid.

There are a variety of wind turbines on the market ranging from smaller turbines that can be attached directly to a buildings structure to larger stand-alone turbines.

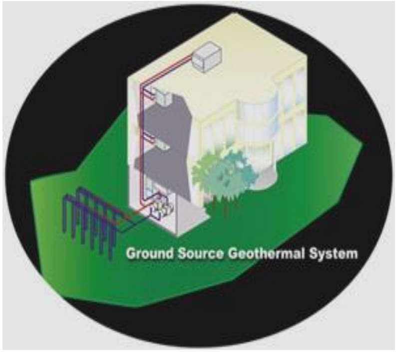
City centre and sub-urban locations generally experience poorer yields for electricity output from small and medium scale wind turbines, due to obstructions and variations in local topography.

Wind Turbine Installation

Also taking into account the visual impact and unwanted noise in an environment with sleeping accommodation the use of wind turbines is discounted from inclusion at this development.

Ground Source Heat Pumps

The ground below buildings remains at a constant temperature of around 10°C to 12°C offering the ability to extract energy in the winter and discharge energy in the summer from cooling with the energy exchange being achieved via open or closed loop systems linked to heat pumps.



Ground Source Heat Pump Installation

The footprint of the development and the surrounding site conditions do not have the potential to deliver an element of space available for closed loop heat exchange, due to this, the likely yield, peak load demand and cost feasibility, we have discounted Ground Source Heat Pumps at this development in favour of better performing suitable technologies.

Air Source Heat Pumps

Air source heat pumps provide an accepted solution for using renewable energy taken from ambient air to heat a building in the winter and discharge heat from cooling in the summer.

Typical External Condenser Unit

The use of air source heat pumps in order to provide heating to the development would conflict with the proposed servicing strategy for the building which utilises an off-site district heating connection to provide the buildings space heating and domestic hot water generation.

However, for the main ground floor amenity areas of the development, refrigerant based air source heat pump condensers will be utilised in the form of a VRF system to heat and cool the areas, due to the higher concentration of occupancy.

For this reason, we have not considered the use of water based air source heat pumps throughout this development.

Biomass

Some success on other projects has been made with the implementation of wood fuelled energy equipment forming a Carbon Neutral heat source however these projects have tended to be light density Sub-Urban or even rural in their location. The relatively constrained nature of this site, together with limited storage space and potential delivery issues, reduces the opportunity to take advantage of a Biomass solution for this development.

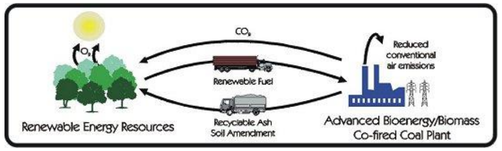
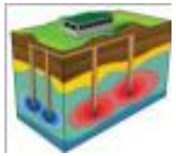
Plantroom Biomass Installation

In addition, flue emissions and the requirements the Clean Air Act has led to a dismissal of this technology for this particular scheme.

Summary of Systems

The following table provides an overview of the systems and their suitability for this project:

Proposed Technology	Image	Comments
Combined Heat and Power **DISCOUNTED**		The integration of Combined Heat and Power technology has been discounted due to the city centre location and clean air act implications with the flue discharge alongside the movement to utilise decarbonised grid electricity over traditional fossil fuel heating systems.
Solar Photovoltaic **INCLUDED**		The flat roof areas of the building could be used to accommodate a PV array which could support a reasonably sized system. The system would be able to offer a good contribution of renewable energy to the building and therefore the installation of photovoltaics has been included in the development.
Air Source Heat Pumps **DISCOUNTED**		Water based heat pumps are not compatible with the proposed standalone servicing strategy for the apartments utilising electric heating and domestic hot water. Refrigerant Air Source Heat Pumps will be utilised for the main ground floor commercial areas and amenity areas of the development, where cooling as well as heating will be required due to the higher occupancy concentration.
Solar Thermal **DISCOUNTED**		There is a conflict between the use of local independent water heaters within each apartment and a central solar thermal collector array. Interconnecting solar thermal panels with remote apartment cylinders is not conducive or efficient due to extended distribution losses. Furthermore, the restricted flat roof areas available negate the inclusion of a panel system offering any significant contributions.

Biomass Boilers **DISCOUNTED**		Biomass boiler solutions have been discounted at this location due to potential clean air issues, deliverability logistics and the lack of available storage space for the required quantity of fuel.
Wind Turbines **DISCOUNTED**		Wind turbines have been discounted due to the resulting visual/noise impact from the equipment, and relatively poor performance of the solution when used within Urban and Sub-Urban locations.
Ground Source Heat Pump **DISCOUNTED**		The inclusion of Ground Source Heat Pumps has been discounted within this development due to the conflict with the selected CHP technology, system cost viability and also the site constraints.

5.5 - Energy Generation and Distribution Systems

As a consultant, Futureserv has an over-arching philosophy delivering design of a truly sustainable nature, employing widely recognised methods.

- Be Lean – **Fabric First Approach -** Reduce demand wherever possible utilising passive measures.
- Be Clean – **Bristol District heating connection** - Where energy is used, then it should be optimised to operate at the highest efficiencies practical.
- Be Green – **Photovoltaic array installation** - Take advantage of renewable options to reduce fossil fuel energy sources.

The proposed development will be designed to be served by Bristol's off-site district heating connection throughout, utilising the ever-increasing clean electricity provided from the UK grid to generate the community hot water network.

All plant and equipment would be equipped with energy control measures incorporating variable speed drives, with low energy motors provided on ventilation fans and hydraulic pumps.

The development would be provided with an inverter driven boosted cold-water supply system located within the main plant room and all sanitary appliances are to be equipped with low water flow devices.

To further reduce the carbon emissions a PV system has been implemented this improves the development from a 5.2% fail to a 13.64% pass over Part L 2021.

Up to a total of 445sqm of photovoltaic panels shall be installed across the different roof levels to serve the development with onsite generation of electricity, providing up to 107mwh of electricity per year.

5.6 – Carbon & Energy Performance Calculations

To demonstrate the environmental benefits associated with the energy hierarchy, approved Sbem software has been used to generate the proposed carbon reductions for the development.

The table below indicates the baseline carbon emissions for the development in the form of Target Emission Rates and Building Emission Rates (Kg CO2/m²/annum).

Target Emissions Rate	**5.57 kg/CO2/m²**
Building Emission Rate	**4.81 kg/CO2/m²**
Carbon Reduction from Target Emission Rates Part L2 2021	**13.64% reduction**

Therefore, the CO_2 reduction due to utilising the energy hierarchy on this development has been calculated to be **13.64%** over Part L 2021.

The remaining shortfall to achieve the 20% reduction shall be agreed with the local authority via an offset payment to deliver the project requirements.

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Avon Street - District heating & PV — As designed

Date: Thu Nov 23 16:44:50 2023

Administrative information

Building Details

Address: Avon Street - District heating & PV,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.22

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.22

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

Certifier details

Name:

Telephone number:

Address: , ,

Foundation area [m²]: 1108.88

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

Target CO_2 emission rate (TER), $kgCO_2/m^2$annum	5.57	
Building CO_2 emission rate (BER), $kgCO_2/m^2$annum	4.81	
Target primary energy rate (TPER), kWh_{PE}/m^2annum	56.28	
Building primary energy rate (BPER), kWh_{PE}/m^2annum	48.12	
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	0.16	0.24	00000001:Surf[3]
Floors	0.18	0.11	0.11	00000001:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.1	0.1	0000001C:Surf[0]
Windows** and roof windows	1.6	1.2	1.2	00000001:Surf[1]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	1.2	1.2	00000005:Surf[2]
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building

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

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

** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position.

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

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

Air permeability	Limiting standard	This building
m³/(h.m²) at 50 Pa	8	4

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Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m²]	13306.6	13306.6
External area [m²]	11832.4	11832.4
Weather	CAR	CAR
Infiltration [m³/hm²@ 50Pa]	4	3
Average conductance [W/K]	4643.64	6412.72
Average U-value [W/m²K]	0.39	0.54
Alpha value* [%]	25.34	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
100	**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
	Others: Miscellaneous 24hr Activities
	Others: Car Parks 24 hrs
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	24.72	28.91
Cooling	0.47	0.15
Auxiliary	7.01	4.42
Lighting	6.48	7.06
Hot water	21.1	21.34
Equipment*	23.62	23.62
TOTAL**	**59.79**	**61.88**

* 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	8.05	2.79
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*8.05*	*2.79*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	92.56	99.7
Primary energy [kWh_{PE}/m^2]	48.12	56.28
Total emissions [kg/m²]	4.81	5.57

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Energy Performance Certificate

HM Government

Non-Domestic Building

Avon Street - District heating & PV

Certificate Reference Number:
1821-3565-4638-5799-5856

This certificate shows the energy rating of this building. It indicates the energy efficiency of the building fabric and the heating, ventilation, cooling and lighting systems. The rating is compared to two benchmarks for this type of building: one appropriate for new buildings and one appropriate for existing buildings. There is more advice on how to interpret this information in the guidance document *Energy Performance Certificates for the construction, sale and let of non-dwellings* available on the Government's website at www.gov.uk/government/collections/energy-performance-certificates.

Energy Performance Asset Rating

Technical information

Main heating fuel: District Heating

Building environment: Heating and Mechanical Ventilation

Total useful floor area (m²): 13306.602

Building complexity: Level 5

Building emission rate ($kgCO_2/m^2$ per year): 4.81

Primary energy use (kWh_{PE}/m^2 per year): 48.12

Benchmarks

Buildings similar to this one could have ratings as follows:

12 — If newly built

47 — If typical of the existing stock

Section 6 – Conclusions

This energy statement has summarised the energy hierarchy requirements for Avon Street, Bristol to respond to the emission reduction aspirations set out within the Bristol Core Strategy Plan, in particular policies BCS14, to implement the use of low carbon and/or renewable technologies.

The proposed development will incorporate a fabric first approach using passive energy techniques available in the construction industry to reduce its ongoing requirement to consume energy to heat, ventilate and light the building, this is achieved by improved highly efficient fabric design in excess of the thermal properties set out within the Building Regulations. The development will then incorporate energy efficiency measures within its Building Services to reduce the carbon footprint of the site below the passive improvement stage, using highly efficient heat generation plant, heat recovery systems and energy efficient and highly controllable lighting. Connecting to the district heating system brings the project in line with the council's heat hierarchy.

The approach adopted is to implement energy saving options which reduce the requirement for regulated energy, such as a more efficient building envelope, and utilising those high efficiency low carbon technologies which are feasible and appropriate for this type of building.

This is the "lean", "clean", "green" approach as mentioned earlier in the document. The measures adopted by this development follow this principle. The regulated energy sources are targeted for reduction by means of both passive and active measures.

The table below demonstrates the improvements achieved through the design process.

	Base – Electric heating	**District heating – No PV**	**District heating – PV included**
TER	5.8	5.57	5.57
BER	7.14	5.86	4.81
Results over 2021	-23.1%	-5.2%	13.64 %

Overall, the Carbon emissions from the proposed development show potential for a total reduction in emissions from the baseline set by current Building Regulations Part L2 2021, by 13.64%.

The strategy improves on the fundamental principles of the Building Regulations and will make a significant contribution to reducing the annual CO_2 emissions of the proposed development. The remaining shortfall to achieve the 20% reduction shall be agreed with the local authority via an offset payment to deliver the project requirements.